Released

easYgen-3000XT Series

Manual | Genset Control

easYgen-3400XT-P1/3500XT-P1/3500XT-P1-LT

Release 1.14

37580C

This is no translation but the original Technical Manual in English.

Designed in Germany and Poland

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Brief Overview

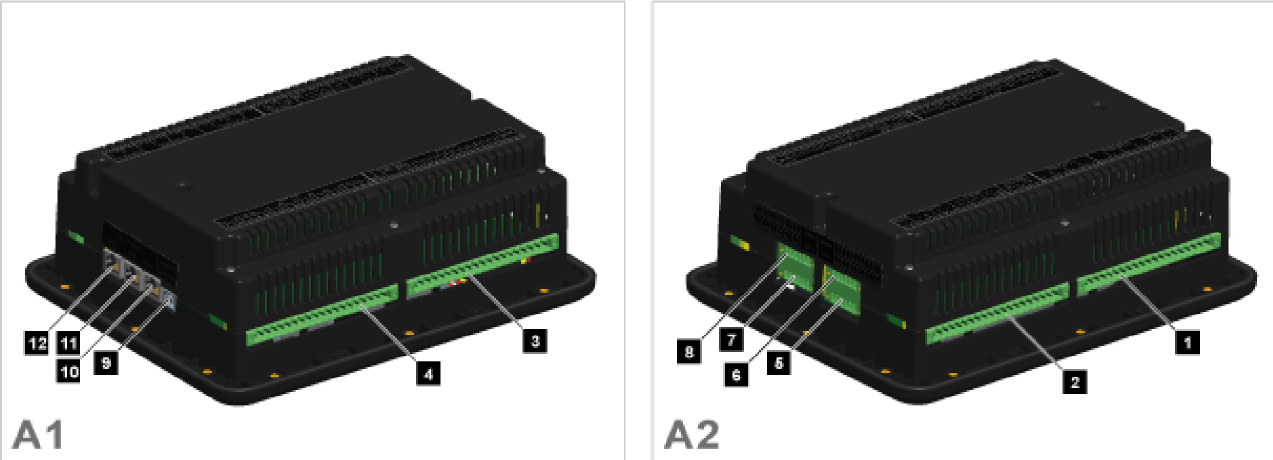

Fig. 1: easYgen-3500XT-P1 Series

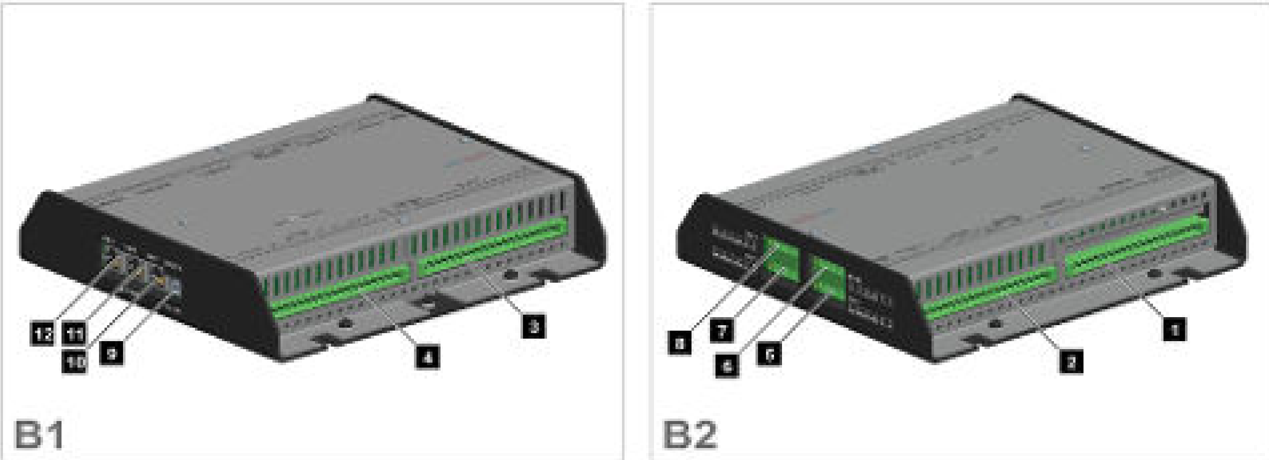

Fig. 2: easYgen-3400XT-P1 Series

A easYgen-3500XT-P1(-LT) (plastic housing with display)
B easYgen-3400XT-P1 (sheet metal housing)
1 Mains/generator/busbar PT terminal
2 Analog inputs/outputs, generator CT, and mains/GND current terminal
3 Discrete inputs, MPU, power supply, and D+ terminal
4 Relay outputs terminal
5 CAN bus interface connector CAN #2
6 RS-485 interface connector RS-485 #1
7 CAN bus interface connector CAN #1
8 CAN bus interface connector CAN #3
9 USB interface connector (2.0, slave) SERVICE port
10 ETHERNET interface connector (RJ-45) LAN C
11 ETHERNET interface connector (RJ-45) LAN B
12 ETHERNET interface connector (RJ-45) LAN A

The easYgen-3000XT series are control units for engine-generator system management applications.

The control units can be used in applications such as: co-generation, stand-by, AMF, peak shaving, import/export or distributed generation.

The easYgen-3000XT series is also applicable for islanded, island parallel, mains parallel and multiple unit mains parallel operations.

Scope of delivery

The following parts are included in the scope of delivery. Please check prior to the installation that all parts are present.

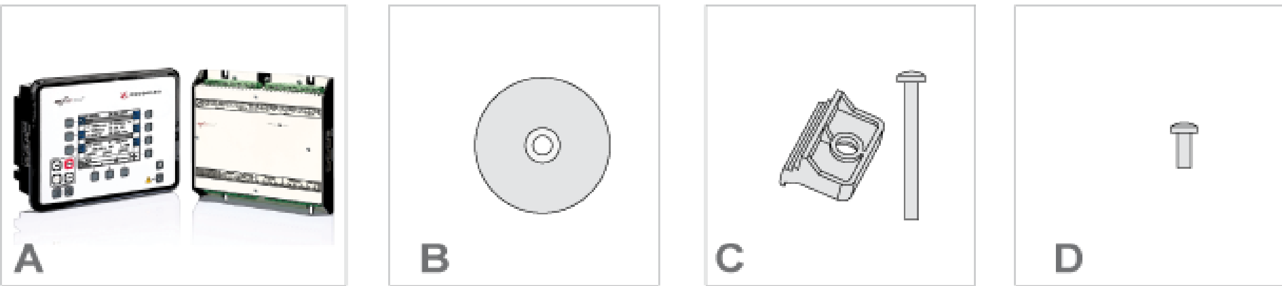

Fig. 3: Scope of delivery - schematic

A Device easYgen-3400XT-P1 (sheet metal housing) or easYgen-3500XT-P1(-LT) genset control (plastic housing). All screwable terminal connectors are delivered with plug and jack.
B Product CD (configuration software and manual)

C and D with plastic housing easYgen-3500XT-P1(-LT) only:
C Clamp fastener installation material - 4 x
D Screw kit installation material - 12 x

Configuration files and Technical Manual are available at the CD-ROM and additionally on device internal memory. Opening USB connection to the easYgen-XT offers read access to the files listed below but with status "delivery" -- please be aware that this files are not updated. The latest versions are available at the Woodward web site.

Files stored at easYgen-XT device:

- *Configuration*
  - *msi-file (installing application files and ToolKit)*
  - *eds-file (zipped)*
- *Documentation*
  - *Technical Manual (PDF)*

Sample application setup

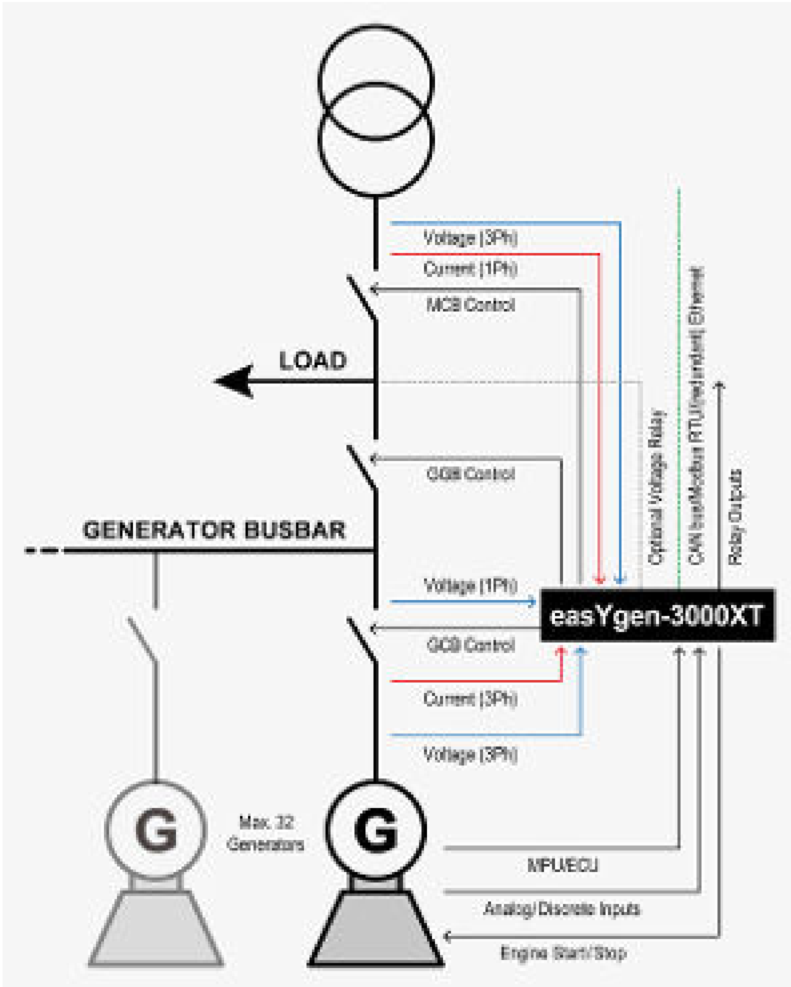

Fig. 4: Sample application setup

A typical application mode for the control unit is the use for mains parallel operation in a multi genset application.

- In this case, the easYgens-XT will function as an engine control with generator, mains and engine protection.
- The control unit can open and close the generator circuit breaker (GCB), group generator breaker (GGB), and the mains circuit breaker (MCB).
- The easYgens-XT are well prepared for system control and management, "talking" with other easYgens-3100XT/3200XT, easYgens-3400XT/3500XT, and/or LS-5s.

For a listing of all available application modes please refer to chapter *➪ Chapter 2.2 “Application Modes Overview” on page 35.*

Table of contents

1 General Information

1.1 About This Manual

1.1.1 Revision History

Rev.	Date	Editor	Changes
1.14	2017-09	GG	**NEW Software Revision Release 1.14-4 or higher** **NEW features & functions** ■ The devices are CSA certified. For details see ⇘ *Chapter 8.1.8 "Approvals" on page 667.* ■ The device provides now the capability to create an own Modbus address point list, beginning with address 50,000. For this purpose WW provides a TelegramMapper software tool to create customer specific DataTelegrams. This self created DataTelegrams can be used with easYgen-XT revision 1.14 or higher. For details see ⇘ *Chapter 4.7.3 "Modbus Protocol" on page 440*. ■ The device offers the capability to disable the password protection for the individual interface communication channels. If the password level is disabled the access level is set on code level 5. For details see 9126 ⇘ p. 446, 9127 ⇘ p. 466, 9128 ⇘ p. 440, and 9129 ⇘ p. 473. ■ For running the Remote Panel RP-3000XT with the easYgen-XT, the user can dynamically switch the Remote Panel into an Full mode, Annunciator mode or Off mode. See menu *"Parameter ➔ Configuration/Configure HMI ➔ Configure Remote Panel"* . **Corrections/Repairs** ■ Issue #19 described in the ERRATA sheet is solved: Indication of red and amber alarm lamps of ADEC ECU7 in easYgen did not work (ADEC ECU 7 is transmitting only one byte of DM1, eight are expected). ■ Issue #18 described in the ERRATA sheet is solved: Restricted to application mode GCB/L-GGB and GCB/L-GGB/L-MCB only: The feedback of the LS-5 installed over the GGB was always recognized as closed. ■ Issue #17 described in the ERRATA sheet is solved: Application mode GCB/MCB together with "GCB auto unlock": If emergency run was active, "GCB auto unlock" could have caused simultaneous dead bus closure of GCB and MCB if mains returned during the "GCB open pulse". This could only happen in parallel logic if the "GCB open time pulse" (5708) was configured higher or same than 2 s. (This was because the mains settling time - which is shortened to 2 s in emergency case - and the "GCB open time pulse" were mismatched.) ■ Issue #16 described in the ERRATA sheet is solved: Generator power factor monitoring works now even if generator measurement is configured to 3PH3W. ■ Issue #15 described in the ERRATA sheet is solved: All visualization values of ADEC ECU7 are indicated now. ■ Issue #13 described in the ERRATA sheet is solved: MCB plausibility alarm works fine now: If MCB was not enabled (12923 = FALSE) and start without load was active and emergency run was active, the GCB no longer will be frequently closed and opened. ■ The active power setpoint can be changed now even in island mode and with load control enabled. ■ The event logger stores from now, when the engine has stopped. Until now only the starting information was stored. ■ Sequencer does catch messages reliably at high bus load ■ Dead bus closure is not blocked on breaker close failure ■ GCB no longer opens and closes permanently if emergency and start without load ■ Setpoint Ramp active power 2 is executed in island parallel operation, too ■ Busbar display and voltage of busbar is correct now (HMI and ToolKit), even if "Generator/Busbar" is configured for HOME screen, and measurement for 1 Phase measurement is set to "Phase-Neutral". The Busbar voltage on HOME screen is no longer always Zero (000 V) when there is actually voltage measured. ■ Mains decoupling screen: Text "Overfreq." is changed to "Overfreq.2" and text "Underfreq." is changed to "Underfreq.2" ■ Screens "Configure Breaker", "Monitor Breaker": Corrected hide/unhide of links and buttons for GGB ■ The buttons had no function and this is now corrected: – "Test ON"/"Test OFF" under *"Next Page ➔ Diagnostic ➔ Mains decoupling ➔ Mains decoupling thresholds"* – "Execute" under *"Next Page ➔ Diagnostic ➔ Mains decoupling ➔ Mains decoupling test"* – *"Measured values ➔ Busbar"*: Corrected jump at arrow down for non configurable busbar with breaker mode with LS5 – *"Measured values ➔ BusbarMainsByLS5"*: corrected jump at arrow up for non configurable busbar with breaker mode with LS5

Rev.	Date	Editor	Changes
			■ MANual operation mode: – The power factor setpoint is now adjustable, if the device runs power factor control. – In island- or mains parallel operation and when switching the device into operation mode STOP, the unloading of the generator now is executed before opening the GCB. – If an analog output is configured to a discrete +/- setpoint (e.g. 05.64), the value will be updated now. ■ If emergency run is active (no mains) AND operating mode is fixed to AUTOmatic via LogicsManager AND an alarm of class C .. F occurs, the Command Variable *"Emergency run"* (04.09) no longer toggles for 2 s and so does not generate lot of entries in the event history. ■ CAN J1939 address claiming: Device did not answer on address claiming request. ■ CAN: The baud rate handling in all CAN communication ports has been optimized. ■ During cranking: Crank relay could have toggled if speed (measured via MPU) jittered around firing speed. **Technical Manual updated** ■ Description, images, and tables updated according to the new features, functions, and corrections listed above. ■ The Ethernet port is named Ethernet #1 or Ethernet A which means the same. ■ Two symbols "generator Add-on/Add-off" explained (see *Chapter 4.1.5.4 "Sequencing" on page 105*). ■ Load Control example updated (see *"Example 3: Islanded Parallel Operation (IOP)" on page 282*). ■ NOTE added: Use Pin 61 or (metal housing) protective earth, see *Chapter 6.3.8 "Wiring Self Powered Discrete Inputs" on page 558*. ■ More user-friendly description of remotely changing setpoints (see *Chapter 6.4.1.7 "Remotely Changing The Setpoint" on page 608* and *Chapter 6.5.1.3 "Remotely Changing The Setpoint" on page 621*). ■ Settings proposal for J1939 communication with Cummins ECU (see *Chapter 7.6.2 "Supported J1939 ECUs & Remote Control Messages" on page 649*). ■ Product label with Unom (see *Chapter 8.1 "Technical Data" on page 661*). ■ Data Protocols updated: – 5003, start addr. 450066, ID 10149 – 5003, start addr. 450120, ID 10298 – 5010, start addr. 450111, ID8009 – 5014, start addr. 450066, ID 4087 – 5014, start addr. 450136, ID 4090 ■ LogicsManager References update: – 07.xx: IDs changed – 09.xx: IDs changed – 10.xx: IDs changed – 11.xx: IDs changed – 13.xx: IDs changed – 15.xx: IDs changed ■ Layout optimizations and typo corrections.
B	2016-11-21	GG	**NEW Software Revision Release 1.13 or higher** **NEW features & functions** ■ A new application mode is available: GCB/L-GGBMCB. In this application mode, the easYgen-XT controls the connected LS-5 device (version V2.0002 and higher) at the interchange point. For details refer to *Chapter 6.1.12 "Application Mode A12 (GCB/L-GGBMCB)" on page 531* (and *Chapter 2.2 "Application Modes Overview" on page 35* for overview). ■ A customer specific device name can be entered and will be used e.g. as device name in Ethernet network. Refer to for *Chapter 4.3.5 "System Management" on page 158* more details. ■ Run-up synchronization is possible even without connected speed sensor, if in a single application the genset shall magnetize a power transformer. For details refer to *Chapter 4.4.1.5.1 "Run-Up Synchronization w/o Speed" on page 178.* ■ easYgen-XT in conjunction with the LS-5 (version V2.0002 and higher) can synchronize even with negative slipping frequency: LS-5 is switching the easYgen to a special slip frequency offset.

Rev.	Date	Editor	Changes

For details refer to description of parameter 6676 p. 222 in this document and parameter 5709 in the LS-5 (Technical Manuals 37649/37650).

- The frequency measurements based on phase-phase and phase-neutral voltages are monitored on plausibility. For details refer to *Chapter 4.5.1.3.1 "Plausibility Check of Voltages' AC Wiring" on page 321*.
- All monitoring functions in the device are from now on expanded with an additional functionality:
  - Each monitor can be individually enabled by an internal LogicsManager flag.

    (For example refer to parameter *"Enabled"* *Chapter 4.5.1.3.2 "Generator Overfrequency (Level 1 & 2) ANSI# 81O" on page 322*).
- Both alarm class configuration parameters 2601 p. 396 for GCB and 2621 p. 400 for MCB now additionally offer the possibility to select "Control".
- The Node-ID of the device in a CAN bus network can be automatically pre-set with the device number. Parameter 1894 p. 445 *"Align device no. with Node-ID"* must be configured to "Yes". This will avoid same-number-mismatch.
- AnalogManager became even more flexible:
  - 16 free configurable and accessible constants enable pre-sets to be used as AnalogManager input. For details refer to *Chapter 4.9.2 "AnalogManager Constants" on page 494* and *Chapter 4.9.1 "Operations" on page 484*.
- Fuel level monitoring offers two further SPN available via J1939 interface (refer to *"Standard visualization messages" on page 646*) and *Chapter 9.2.13 "Protocol 5016 (Basic Visualization)" on page 820*:
  - SPN 96: Fuel level 1
  - SPN 38: Fuel level 2
- Load sharing interface can be switched between CAN and Ethernet. Refer to parameter *"Load share interface"* 9924 p. 254/ p. 658 for details.
- Power factor values display (generator and mains) enhanced: Three instead two decimal places. Refer to *Chapter 8.3 "Accuracy" on page 668* for details.
- *"Generator Total AC Power"* PGN 65029 p. 653 is send to Scania S6 ECU via J1939 protocol. For details refer to *Chapter 7.6.3 "Device Type Standard" on page 652*.
- The "Protection Lamp DM1" status of the J1939 communication is from now on available as LM 03.44 command variable. Refer to *Chapter 9.3.2.3 "Group 03: Engine Control" on page 888* for details.
- Max number of logged events enhanced: 1000 events saved now instead of 300 before. Refer to *Chapter 9.5.4 "Event History" on page 970* for details.
- Device identification via settings file: Serial number will be part of the .wset file generated and saved via ToolKit. Device identification, file management, and support request become much easier.
- The readme.txt file in the device additionally informs, that the Technical Manual saved in the device will not be updated when executing a firmware update.

Corrections/Repairs

- Issue #6 described in the ERRATA sheet is solved:

  PC/laptop with operating system Windows 8.1 and ToolKit running:
  - USB connection handling is improved.
- Issue #7 described in the ERRATA sheet is resolved:

  Island mode:
  - If - during warm-up - the genset becomes the single engine (by unexpected drop-out of parallel genset), the warm-up is interrupted immediately to avoid dead busbar.
- Issue #9 described in the ERRATA sheet is solved:

  An additional PHOENIX CAN coupler device is supported:
  - PHOENIX 27 02 23 0 (with firmware 101 or higher).
- Issue #10 described in the ERRATA sheet is solved:

  The easYgen-XT is not making a reboot procedure if a Modbus TCP write order is executed on a password protected parameter just at that moment the password level expires.
- The issue #11 described in the ERRATA sheet is solved:

  If the easYgen-XT executes a GGB dead busbar closure and the breaker closure failure alarm occurs, the GGB dead busbar closure is not stopped, even if there are other devices existing and willing to do a dead busbar closure.
- The issue #12 described in the ERRATA sheet is solved:

  The *"Operating range failure"* errors 6 to 10 are not detected or indicated wrongly.
- Issue #13 described in the ERRATA sheet is solved:

  SPN 189 "Engine rated speed" is transmitted in time, so "Easygen 3000 communication timeout" J1939 E3 communication will not occur even if ECU Device type (parameter 15102) is configured to "EGS Woodward".

<table>
<tr><th>Rev.</th><th>Date</th><th>Editor</th><th>Changes</th></tr>
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Issue #14 described in the ERRATA sheet is solved:
If ECU Device type (parameter 15102) is configured to "EGS Woodward", it can happen, that the easYgen is transmitting SPN 189 too slowly. This would cause an "Easygen 3000 communication timeout" in the E3 and twinkling of the SPN 189 indication at the E3.
Phase rotation (mismatch) measurement changed: Based now on phase-phase voltages instead of phase-neutral voltages.
Complete HMI/display text translated: English text fragments replaced by local wording.
GCB/MCB mode:
The closed transition time of the breaker matches the duration time of <100 ms. Refer to " Breaker logic "CLOSED TRANSIT."" on page 217 for details.

Technical Manual

Description, images, and tables updated according to the new features and functions listed above.
Small corrections:

Chapters eliminated that described Busbar 2, because they are part of package "...-P2" only.
Chapter 3.3.11.1 "Connecting 24 V Relays" on page 79 re-arranged:
Moved below Chapter 3.3.11 "Relay Outputs (LogicsManager)" on page 77.
Cable recommendations updated:
General note instead of repeating separately with sub-chapters (see Chapter 3.3.2 "Wiring Diagram" on page 47 ff)
Cable length recommended (see Chapter 3.4.1 "Interfaces overview" on page 83)
A_{max} added (see Chapter 3.4.2 "RS-485 Interface" on page 84 and Chapter 3.4.4 "CAN Bus Interfaces" on page 85)

Terminal assignment corrected. For details refer to Chapter 3.3.5.2.3 " Parameter Setting '1Ph 3W' (1-phase, 3-wire)" on page 63 and Chapter 3.3.5.2.4.2 "'1Ph 2W' Phase-Phase Measuring" on page 65.
Home screen values of Busbar are voltage, power, and frequency. For details refer to Chapter 4.1.2 "The HOME Screen" on page 98.
Wrench button (softkey) explained. For details refer to Chapter 4.1.4.3 "Status/Monitoring Screens" on page 102.
"Main" screen renamed to "Home" screen. Refer to Chapter 4.1.5.1 "HOME Screen Voltage Display" on page 103 for details.
Further WAGO devices expand I/O via CAN 2. For details refer to Chapter 6.3.10 "Setup Expansion Modules at CAN 2" on page 559.
Relation between "Monitoring delay time" and "Engine monitoring delay time" explained in more detail. Refer to Chapter 6.3.15 "Run-Up Synchronization" on page 580.
Explained in more detail:

Chapter 6.5.1.3 "Remotely Changing The Setpoint" on page 621
Chapter 6.4.1.7 "Remotely Changing The Setpoint" on page 608

Technical Data of display added. For details refer to Chapter 8.1.6 "Display (plastic housing variant, only)" on page 666.
Marine approvals updated - no longer pending. For details refer to Chapter 8.1.8 "Approvals" on page 667.

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</table>

Rev.	Date	Editor	Changes
A	2016-08-31	GG	**NEW Software Revision Release 1.12-2 or higher** **NO NEW features & functions** **Corrections/Repairs** ■ Internal bugfixing. **Technical Manual** ■ Revision number updated to fit display/label. In future the published revision number will be reduced to less details: "X.YY" but without "-ZZ" e.g., "1.13". ■ *Chapter 3.3.11.1 "Connecting 24 V Relays" on page 79* re-arranged: Moved below *Chapter 3.3.11 "Relay Outputs (LogicsManager)" on page 77.* ■ Cable recommendations updated: – General note instead of repeating separately with sub-chapters (see *Chapter 3.3.2 "Wiring Diagram" on page 47* ff) – Cable length recommended (see *Chapter 3.4.1 "Interfaces overview" on page 83*) – A_{max} added (see *Chapter 3.4.2 "RS-485 Interface" on page 84* and *Chapter 3.4.4 "CAN Bus Interfaces" on page 85*) ■ ToolKit system requirements updated for latest version 5.2 (see *Chapter 4.2.1 "Install ToolKit" on page 121*) ■ Application Note explaining how to handle complete/partial setting recommended (see *Table on page 123*).
NEW	2016-06	GG	**Technical Manual - 1st issue** ■ Describing device software release 1.12-0 **Notes** New device features & updates in comparison to easYgen-3000 series will be found in the transition manual #37625. Please check availability at Woodward web site www.woodward.com.

Up to date documentation?

Please check Woodward web site for latest revision of this Technical Manual (search for "37580") and if there is an Errata Sheet with latest information (search for: "37619").

1.1.2 Depiction Of Notes And Instructions

Safety instructions

Safety instructions are marked with symbols in these instructions. The safety instructions are always introduced by signal words that express the extent of the danger.

DANGER!
This combination of symbol and signal word indicates an immediately-dangerous situation that could cause death or severe injuries if not avoided.

WARNING!
This combination of symbol and signal word indicates a possibly-dangerous situation that could cause death or severe injuries if it is not avoided.

CAUTION!
This combination of symbol and signal word indicates a possibly-dangerous situation that could cause slight injuries if it is not avoided.

NOTICE!
This combination of symbol and signal word indicates a possibly-dangerous situation that could cause property and environmental damage if it is not avoided.

Tips and recommendations

This symbol indicates useful tips and recommendations as well as information for efficient and trouble-free operation.

Additional markings

To emphasize instructions, results, lists, references, and other elements, the following markings are used in these instructions:

Marking	Explanation
⟶	Step-by-step instructions
⇨	Results of action steps
☞	References to sections of these instructions and to other relevant documents
■	Listing without fixed sequence
[Buttons]	Operating elements (e.g. buttons, switches), display elements (e.g. signal lamps)
"Display"	Screen elements (e.g. buttons, programming of function keys)

Marking	Explanation
"Screen xx ➔ Screen xy ➔ Screen xz" ...	Menu path. The following information and setting refer to a page on HMI screen or ToolKit located as described here.
TKit HMI	Some parameters/settings/screens are available only either in ToolKit **or** in HMI/display.

Dimensions in Figures

All dimensions shown with no units specified are in ***mm****.*

1.2 Copyright And Disclaimer

Disclaimer

All information and instructions in this manual have been provided under due consideration of applicable guidelines and regulations, the current and known state of the art, as well as our many years of in-house experience. Woodward assumes no liability for damages due to:

- Failure to comply with the instructions in this manual
- Improper use / misuse
- Willful operation by non-authorized persons
- Unauthorized conversions or non-approved technical modifications
- Use of non-approved spare parts

The originator is solely liable to the full extent for damages caused by such conduct. The agreed upon obligations in the delivery contract, the general terms and conditions, the manufacturer's delivery conditions, and the statutory regulations valid at the time the contract was concluded, apply.

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Actions to the contrary will entitle us to claim compensation for damages. We expressly reserve the right to raise any further accessory claims.

1.3 Service And Warranty

Our Customer Service is available for technical information.

For regional support, please refer to: *http://www.woodward.com/Support_pgd.aspx*.

In addition, our employees are constantly interested in new information and experiences that arise from usage and could be valuable for the improvement of our products.

Warranty terms

Please enquire about the terms of warranty from your nearest Woodward representative.

For our contact search webpage please go to: http://www.woodward.com/Directory.aspx

1.4 Safety

1.4.1 Intended Use

The genset control unit has been designed and constructed solely for the intended use described in this manual.

The easYgen-... devices are available in two different enclosures. They are designed to be installed either on the back plate of a switch gear cabinet (e.g. easYgen-x100.../...-x400...) or on the front plate of a switch gear panel (e.g. easYgen-x200.../...-x500...).The terminals are always located on the inner side of the housing.

The genset control unit must be used exclusively for engine-generator system management applications.

- Intended use requires operation of the control unit within the specifications listed in *Chapter 8.1 "Technical Data" on page 661*.
- All permissible applications are outlined in *Chapter 2.2 "Application Modes Overview" on page 35*.
- Intended use also includes compliance with all instructions and safety notes presented in this manual.
- Any use which exceeds or differs from the intended use shall be considered improper use!
- No claims of any kind for damage will be entertained if such claims result from improper use.

NOTICE!

Damage due to improper use!

Improper use of the genset control unit may cause damage to the control unit as well as connected components.

Improper use includes, but is not limited to:

– Storage, transport, and operation outside the specified conditions.

1.4.2 Personnel

WARNING!

Hazards due to insufficiently qualified personnel!

If unqualified personnel perform work on or with the control unit hazards may arise which can cause serious injury and substantial damage to property.

– Therefore, all work must only be carried out by appropriately qualified personnel.

This manual specifies the personnel qualifications required for the different areas of work, listed below:

- Well trained for electrical installations.
- Skilled and competent to be aware especially of the local safety regulations.
- Experienced in working on electronic measuring and control devices.
- Allowed to manage the controlled (engine/generator) system.

The workforce must only consist of persons who can be expected to carry out their work reliably. Persons with impaired reactions due to, for example, the consumption of drugs, alcohol, or medication are prohibited.

When selecting personnel, the age-related and occupation-related regulations governing the usage location must be observed.

1.4.3 General Safety Notes

Electrical hazards

> **DANGER!**
>
> **Life-threatening hazard from electric shock!**
>
> There is an imminent life-threatening hazard from electric shocks from live parts. Damage to insulation or to specific components can pose a life-threatening hazard.
>
> – Only a qualified electrician should perform work on the electrical equipment.
> – Immediately switch off the power supply and have it repaired if there is damage to the insulation.
> – Before beginning work at live parts of electrical systems and resources, cut the electricity and ensure it remains off for the duration of the work. Comply with the five safety rules in the process:
>   – cut electricity;
>   – safeguard against restart;
>   – ensure electricity is not flowing;
>   – earth and short-circuit; and
>   – cover or shield neighboring live parts.
> – Never bypass a fuse or render it inoperable. Always use the correct amperage when changing a fuse.
> – Keep moisture away from live parts. Moisture can cause short circuits.

Prime mover safety

> **WARNING!**
>
> **Hazards due to insufficient prime mover protection**
>
> The engine, turbine, or other type of prime mover should be equipped with an overspeed (over-temperature, or over-pressure, where applicable) shutdown device(s), that operates totally independently of the prime mover control device(s) to protect against runaway or damage to the engine, turbine, or other type of prime mover with possible personal injury or loss of life should the mechanical-hydraulic governor(s) or electric control(s), the actuator(s), fuel control(s), the driving mechanism(s), the linkage(s), or the controlled device(s) fail.

Device implemented self test

this Woodward device has a self test check implemented. Permanently under control are:

- processor function and
- supply voltage.

The internal signal "self check" is aligned in series with the inverse signal *"Ready for op. OFF"* parameter 12580 ↳ p. 190/↳ p. 190/↳ p. 928/↳ p. 968. Per default (factory settings) discrete output R01 is energized/closed if device itself is OK.

LogicsManager (LM) equation parameter 12580 ➪ p. 190/ ➪ p. 190/➪ p. 928/➪ p. 968 allows to customize this safety relay. You can use the result of this equation: LM command variable 99.01 .

Be careful in changing safety relevant settings!

CAUTION!

Uncontrolled operation due to faulty configuration

The discrete output "Ready for operation" must be wired in series with an emergency stop function.

This means that it must be ensured that the generator circuit breaker is opened and the engine is stopped if this discrete output is de-energized.

If the availability of the plant is important, this fault must be signaled independently from the unit.

Modifications

WARNING!

Hazards due to unauthorized modifications

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment.

Any unauthorized modifications:

– constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage
– invalidate product certifications or listings.

Use of batteries/alternators

NOTICE!

Damage to the control system due to improper handling

Disconnecting a battery from a control system that uses an alternator or battery-charging device whilst the charging device is still connected causes damage to the control system.

– Make sure the charging device is turned off before disconnecting the battery from the system.

Unit includes a lithium backup battery for Real Time Clock. Field replacement of the battery is not allowed.

In case of battery replacement please contact your Woodward service partner.

Electrostatic discharge

Protective equipment:
- ESD wrist band

NOTICE!
Damage from electrostatic discharge
All electronic equipment sensitive to damage from electrostatic discharge, which can cause the control unit to malfunction or fail.

– To protect electronic components from static damage, take the precautions listed below.

1. Avoid build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as easily as synthetics.

2. Before working on terminals on the control unit, ground yourself by touching and holding a grounded metal object (pipes, cabinets, equipment, etc.) to discharge any static electricity.

   Alternatively wear an ESD wrist band connected to ground.

3. Before any maintenance work on the control unit, ground yourself by touching and holding a grounded metal object (pipes, cabinets, equipment, etc.) to discharge any static electricity.

   Alternatively wear an ESD wrist band connected to ground.

4. Keep plastic, vinyl, and Styrofoam materials (such as plastic or Styrofoam cups, cigarette packages, cellophane wrappers, vinyl books or folders, plastic bottles, etc.) away from the control unit, modules and work area.

5. Opening the control cover may void the unit warranty. Do not remove the printed circuit board (PCB) from the control cabinet unless instructed by this manual.

> *If instructed by this manual to remove the PCB from the control cabinet, follow these precautions:*
>
> – *Ensure that the device is completely voltage-free (all connectors have to be disconnected).*
> – *Do not touch any part of the PCB except the edges.*
> – *Do not touch the electrical conductors, connectors, or components with conductive devices or with bare hands.*
> – *When replacing a PCB, keep the new PCB in the plastic antistatic protective bag it comes in until you are ready to install it. Immediately after removing the old PCB from the control cabinet, place it in the antistatic protective bag.*

> *For additional information on how to prevent damage to electronic components caused by improper handling, read and observe the precautions in:*
>
> – *"Woodward manual 82715, Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules".*

Notes on marine usage

Marine usage of the easYgen genset control requires additional precautions as listed below:

> *The specified marine approvals are initially only valid for metal housing units. They are only valid for plastic housing units, if they are installed using the screw kit .*
>
> – *Use all 12 screws and tighten accordingly.*

- The easYgen-3000(XT) Series has an internally isolated power supply.

> *Some additional, independent safety and protection devices are necessary to meet safety requirements of Rules and Regulations of marine Classification Societies.*
>
> – *Please refer to the corresponding documents issued by marine Classification Societies for the applicable requirements.*

The easYgen is type approved by LR Lloyd's Register.

– *Please consider for final functional arrangements to comply with appropriate Lloyd's Register Rules as subject of the Plan Approval process.*

1.4.4 Protective Equipment And Tools

Protective gear

Personal protective equipment serves to protect risks to the safety and health of persons as well as to protect delicate components during work.

Certain tasks presented in this manual require the personnel to wear protective equipment. Specific required equipment is listed in each individual set of instructions.

The cumulative required personal protective equipment is detailed below:

ESD wrist band
The ESD (**e**lectro**s**tatic **d**ischarge) wrist band keeps the user's body set to ground potential. This measure protects sensitive electronic components from damage due to electrostatic discharge.

Tools

Use of the proper tools ensures successful and safe execution of tasks presented in this manual.

Specific required tools are listed in each individual set of instructions.

The cumulative required tools are detailed below:

Torque screwdriver
A torque-screwdriver allow fastening of screws to a precisely specified torque.

- Note the required torque range individually specified in the tasks listed in this manual.

2 System Overview

2.1 Display And Status Indicators

HMI and ToolKit are aligned for the same sequence and structure of functions and parameters.

Restrictions
Full access to all parameters and settings with ToolKit only!

2.2 Application Modes Overview

The genset control provides the following basic functions via the application modes listed below.

For detailed information on the application modes and special applications refer to *“Device status” on page 507.*

Application mode	Symbol	Function
None	A01	No breaker control. This application mode provides the following functions: ■ Measuring of engine/generator parameters (i.e. voltage, frequency, current, power, coolant temperature, oil pressure, etc.) ■ Engine start/stop
GCB open	A02	GCB control (open) This application mode provides the following functions: ■ Measuring of engine/generator parameters (i.e. voltage, frequency, current, power, coolant temperature, oil pressure, etc.) ■ Engine start/stop ■ Engine/generator protection (relay output to open GCB) ■ Mains failure detection with mains decoupling (GCB)
GCB	A03	GCB control (open/close) This application mode provides the following functions: ■ Measuring of engine/generator parameters (i.e. voltage, frequency, current, power, coolant temperature, oil pressure, etc.) ■ Engine start/stop ■ Engine/generator protection (relay output to open GCB) ■ GCB operation (relay output to close GCB) ■ Mains failure detection with mains decoupling (GCB)

Application mode	Symbol	Function
GCB/MCB	A04	GCB/MCB control (open/close) This application mode provides the following functions: ■ Measuring of engine/generator parameters (i.e. voltage, frequency, current, power, coolant temperature, oil pressure, etc.) ■ Engine start/stop ■ Engine/generator protection (relay output to open GCB) ■ GCB operation (relay output to close GCB) ■ MCB operation (relay outputs to open and close MCB) ■ Mains failure detection with mains decoupling (GCB and/or MCB) ■ Auto mains failure operation (AMF)
GCB/GGB	A05	GCB/GGB control (open/close) This application mode provides the following functions: ■ Measuring of engine/generator parameters (i.e. voltage, frequency, current, power, coolant temperature, oil pressure, etc.) ■ Engine start/stop ■ Engine/generator protection (relay output to open GCB) ■ GCB operation (relay output to close GCB) ■ GGB operation (relay output to open and close the GGB) ■ Mains failure detection with mains decoupling (GCB)
GCB/GGB/MCB	A06	GCB/GGB/MCB control (open/close) This application mode provides the following functions: ■ Measuring of engine/generator parameters (i.e. voltage, frequency, current, power, coolant temperature, oil pressure, etc.) ■ Engine start/stop ■ Engine/generator protection (relay output to open GCB) ■ GCB operation (relay output to close GCB) ■ GGB operation (relay output to open and close the GGB) ■ MCB operation (relay outputs to open and close the MCB) ■ Mains failure detection with mains decoupling (GCB/MCB) ■ Auto mains failure operation (AMF)
GCB/LS5	A07	GCB/LS5 control (open/close) This application mode provides the following functions: ■ Measuring of engine/generator parameters (i.e. voltage, frequency, current, power, coolant temperature, oil pressure, etc.) ■ Engine start/stop ■ Engine/generator protection (relay output to open GCB) ■ GCB operation (relay output to close GCB) ■ Connection to LS-5 system, LS5 runs as independent unit (Mode “LS5”) ■ Auto mains failure operation (AMF) guided by LS-5 system
GCB/L-MCB	A08	GCB/L-MCB control (open/close) This application mode provides the following functions: ■ Measuring of engine/generator parameters (i.e. voltage, frequency, current, power, coolant temperature, oil pressure, etc.) ■ Engine start/stop ■ Engine/generator protection (relay output to open GCB) ■ GCB operation (relay output to close GCB) ■ MCB operation via LS-5, LS-5 runs as slave unit (Mode “L-MCB”) ■ Mains failure detection with mains decoupling via GLS or LS-5 (MCB) ■ Auto mains failure operation (AMF)

Application mode	Symbol	Function
GCB/GGB/L-MCB	A09	GCB/GGB/L-MCB control (open/close) This application mode provides the following functions: ■ Measuring of engine/generator parameters (i.e. voltage, frequency, current, power, coolant temperature, oil pressure, etc.) ■ Engine start/stop ■ Engine/generator protection (relay output to open GCB) ■ GCB operation (relay output to close GCB) ■ GGB operation (relay output to open and close the GGB) ■ MCB operation via LS-5, LS-5 runs as slave unit (Mode “L-MCB”) ■ Mains failure detection with mains decoupling via GLS or LS-5 (MCB) ■ Auto mains failure operation (AMF)
GCB/L-GGB	A10	GCB/GGB/L-MCB control (open/close) This application mode provides the following functions: ■ Measuring of engine/generator parameters (i.e. voltage, frequency, current, power, coolant temperature, oil pressure, etc.) ■ Engine start/stop ■ Engine/generator protection (relay output to open GCB) ■ GCB operation (relay output to close GCB) ■ GGB operation (relay output to open and close the GGB) ■ Mains failure detection with mains decoupling via GLS or LS-5 (MCB) ■ Auto mains failure operation (AMF)
GCB/L-GGB/L-MCB	A11	GCB/L-GGB/L-MCB control (open/close) This application mode provides the following functions: ■ Measuring of engine/generator parameters (i.e. voltage, frequency, current, power, coolant temperature, oil pressure, etc.) ■ Engine start/stop ■ Engine/generator protection (relay output to open GCB) ■ GCB operation (relay output to close GCB) ■ GGB operation via LS-5, LS-5 runs as slave unit (Mode “L-GGB”) ■ MCB operation via LS-5, LS-5 runs as slave unit (Mode “L-MCB”) ■ Mains failure detection with mains decoupling via GLS or LS-5 (MCB) ■ Auto mains failure operation (AMF)
GCB/L-GGBMCB	A12	GCB/L-GGBMCB control (open/close) This application mode provides the following functions: ■ Measuring of engine/generator parameters (i.e. voltage, frequency, current, power, coolant temperature, oil pressure, etc.) ■ Engine start/stop ■ Engine/generator protection (relay output to open GCB) ■ GCB operation (relay output to close GCB) ■ GGB and MCB operation via LS-5x2, LS-5 runs as slave unit (Mode “L-GGBMCB”) ■ Mains failure detection with mains decoupling via GLS or LS-5x2 (GGB or MCB) ■ Auto mains failure operation (AMF)

2.3 Operation Modes

The easYgen-3000XT offers four operation modes:

- AUTO
- MANUAL (MAN)
- TEST

- STOP
- ... and an internal (non) operating phase during starting the device itself

The plastic housing (HMI) version of the easYgen-3000XT enables to select an operation mode by pressing the according button at the front panel - if current settings allow this function.

For more information about the operation modes please see *Chapter 5.2 “Change Operating Modes” on page 500*.

3 Installation

> **NOTICE!**
> **Avoid electrostatic discharge!**
> Before working with terminals please read and follow the instructions of chapter ↬ *"Electrostatic discharge" on page 31*.
>
> For CAN and RS485 shielded cabling, no more than 25 mm wiring exposed without shield coverage are allowed at terminal plug side.

3.1 Mount Unit (Sheet Metal Housing)

Dimensions

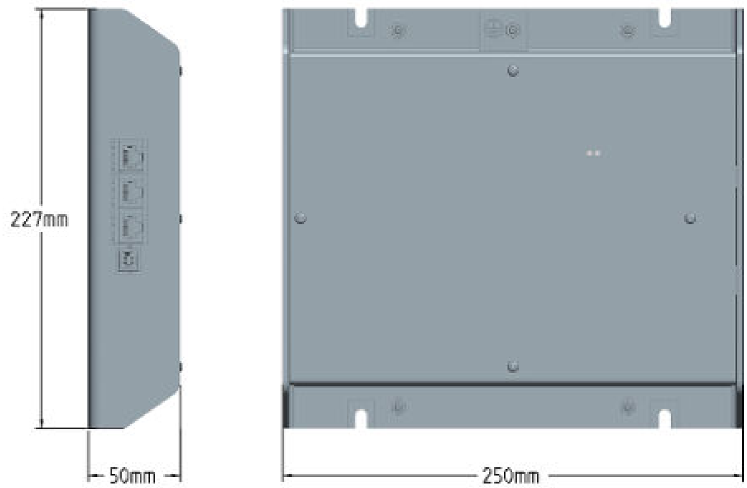


Fig. 5: Sheet metal housing - dimensions

Mounting into a cabinet

Special tool:
- Torque screwdriver

Proceed as follows to install the unit using the screw kit:

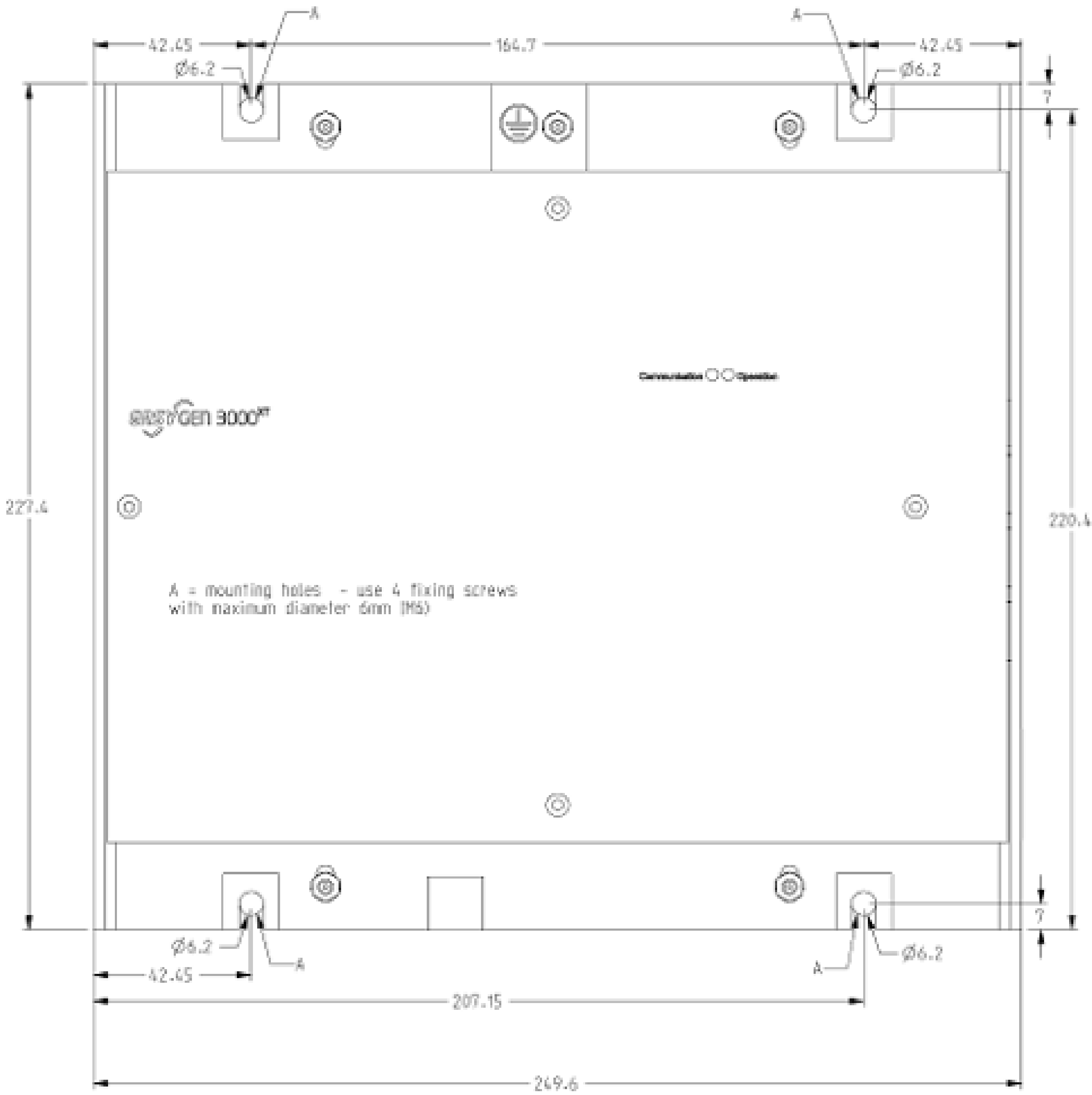


Fig. 6: Sheet metal housing - drill plan

1. Drill the holes according to the dimensions in Fig. 6 (dimensions shown in mm).

> *Ensure sufficient clearance for access to the terminals (top and bottom) and connectors located at the sides.*

2. Mount the unit to the back panel and insert the screws.

3. Tighten the screws to a torque according to the quality class of the used screws.

> *Tighten the screws with a crosswise pattern to ensure even pressure distribution.*

3.2 Mount Unit (Plastic Housing)

Mount the unit **either** using the clamp fasteners (*Chapter 3.2.1 "Clamp Fastener Installation" on page 42*) **or** the screw kit (*Chapter 3.2.2 "Screw Kit Installation" on page 43*).

> – *Don't drill holes if you want to use the clamp fasteners. If the holes are drilled into the panel, the clamp fasteners cannot be used anymore.*
> – *In order to enhance the protection to IP 66, fasten the unit with the screw kit instead of the clamp fastener hardware.*

Dimensions

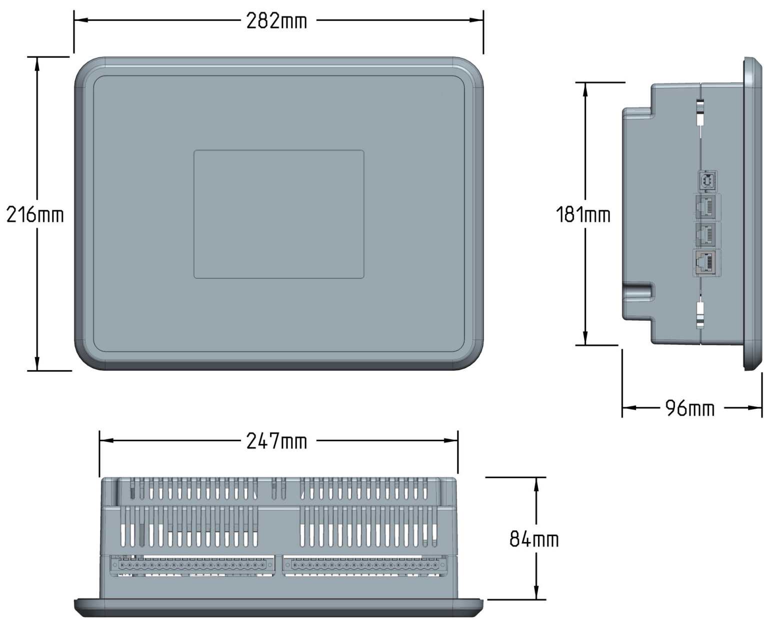


Fig. 7: Plastic housing - dimensions

Panel cutout

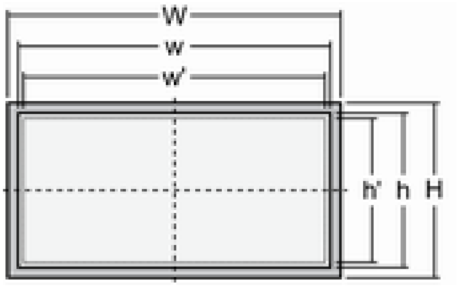


Fig. 8: Cutout schematic

Measure	Description			Tolerance
H	Height	Total	216 mm	—
h		Panel cutout	183 mm	+ 1.0 mm
h'		Housing dimension	181 mm	
W	Width	Total	282 mm	—
w		Panel cutout	249 mm	+ 1.1 mm
w'		Housing dimension	247 mm	
	Depth	Total	96.3 mm	—

The maximum permissible corner radius is 4 mm.

3.2.1 Clamp Fastener Installation

For installation into a door panel with the fastening clamps, proceed as follows:

1. Cut out the panel according to the dimensions in Fig. 8.

Don't drill the holes if you want to use the clamp fasteners. If the holes are drilled into the panel, the clamp fasteners cannot be used anymore!

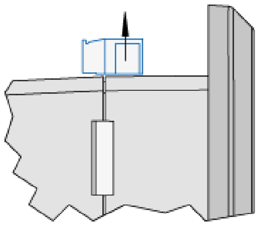


Fig. 9: Remove terminals

2. Loosen the wire connection terminal screws on the back of the unit and remove the wire connection terminal strip if required.

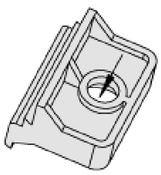


Fig. 10: Insert screws in clamps

3. Insert the four clamping screws into the clamp inserts from the shown side (Fig. 10; opposite the nut insert) until they are almost flush. Do not completely insert the screws into the clamp inserts.
4. Insert the unit into the panel cutout. Verify that the unit fits correctly in the cutout. If the panel cutout is not big enough, enlarge it accordingly.

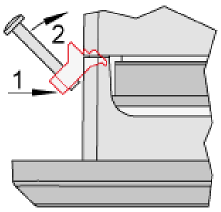


Fig. 11: Attach clamp inserts

5. Re-install the clamp inserts by tilting the insert to a 45° angle. (Fig. 11/1) Insert the nose of the insert into the slot on the side of the housing. (Fig. 11/2) Raise the clamp insert so that it is parallel to the control panel.

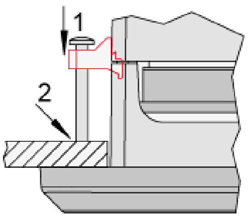


Fig. 12: Tighten clamping screws

6. Tighten the clamping screws (Fig. 12/1) until the control unit is secured to the control panel (Fig. 12/2). Over tightening of these screws may result in the clamp inserts or the housing breaking. Do not exceed the recommended tightening torque of 0.1 Nm.

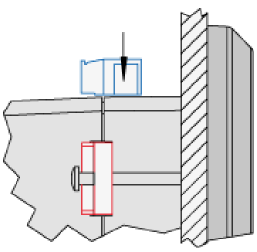


Fig. 13: Reattach terminals

7. Reattach the wire connection terminal strip (Fig. 13) and secure them with the side screws.

3.2.2 Screw Kit Installation

The housing is equipped with 12 nut inserts (Fig. 14), which must all be tightened properly to achieve the required degree of protection.

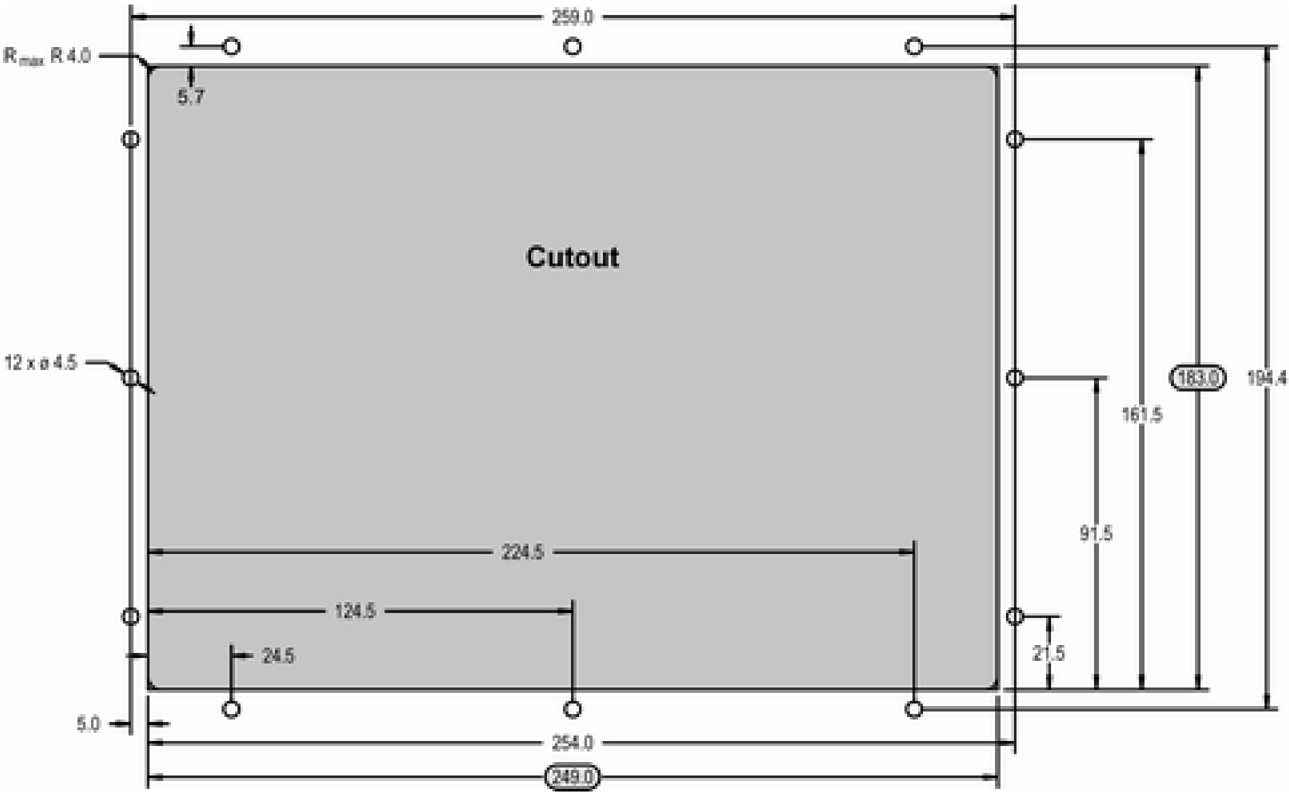


Fig. 14: Plastic housing - drill plan

Special tool:
- Torque screwdriver

Proceed as follows to install the unit using the screw kit:

1. Cut out the panel and drill the holes according to the dimensions in Fig. 14 (dimensions shown in mm).
2. Insert the unit into the panel cutout. Verify that the unit fits correctly in the cutout. If the panel cutout is not big enough, enlarge it accordingly.
3. Insert the screws and tighten to 0.6 Nm (5.3 pound inches) of torque.

> *Tighten the screws with a crosswise pattern to ensure even pressure distribution.*

> *If the thickness of the panel sheet exceeds 2.5 mm, be sure to use screws with a length exceeding the panel sheet thickness by 4 mm.*

3.3 Setup Connections

NOTICE!

Avoid electrostatic discharge!

Before working with terminals please read and follow the instructions of chapter *"Electrostatic discharge" on page 31*.

For CAN and RS485 shielded cabling, no more than 25 mm wiring exposed without shield coverage are allowed at terminal plug side.

General notes

NOTICE!

Malfunctions due to literal use of example values

All technical data and ratings indicated in this chapter are merely listed as examples. Literal use of these values does not take into account all actual specifications of the control unit as delivered.

– For definite values please refer to chapter *Chapter 8.1 "Technical Data" on page 661*.

Wire sizes

Field wiring shall be made with use of cables which have temperature rating not less than 90 °C.

AWG	mm²	AWG	mm²	AWG	mm²	AWG	mm²	AWG	mm²	AWG	mm²
30	0.05	21	0.38	14	2.5	4	25	3/0	95	600MCM	300
28	0.08	20	0.5	12	4	2	35	4/0	120	750MCM	400
26	0.14	18	0.75	10	6	1	50	300MCM	150	1000MCM	500
24	0.25	17	1.0	8	10	1/0	55	350MCM	185		
22	0.34	16	1.5	6	16	2/0	70	500MCM	240		

Table 1: Conversion chart - wire sizes

3.3.1 Terminal Allocation

NOTICE!

Avoid electrostatic discharge!

Before working with terminals please read and follow the instructions of chapter *"Electrostatic discharge" on page 31*.

For CAN and RS485 shielded cabling, no more than 25 mm wiring exposed without shield coverage are allowed at terminal plug side.

The device terminals are allocated (similarly for all housing variants) as follows:

- Plastic housing - for easYgen-3500XT-P1 and easYgen-3500XT-P1-LT
- Sheet metal housing - for easYgen-3400XT-P1

The max. possible conductor cross-section of the terminals used is A_{max} = 2.5 mm²!

LT Variant description

The temperature range is the only difference between standard plastic housing and LT variant.

The manual is describing plastic housing and metal housing variant. Describing the plastic housing means both standard and LT variant - if not, it is mentioned!

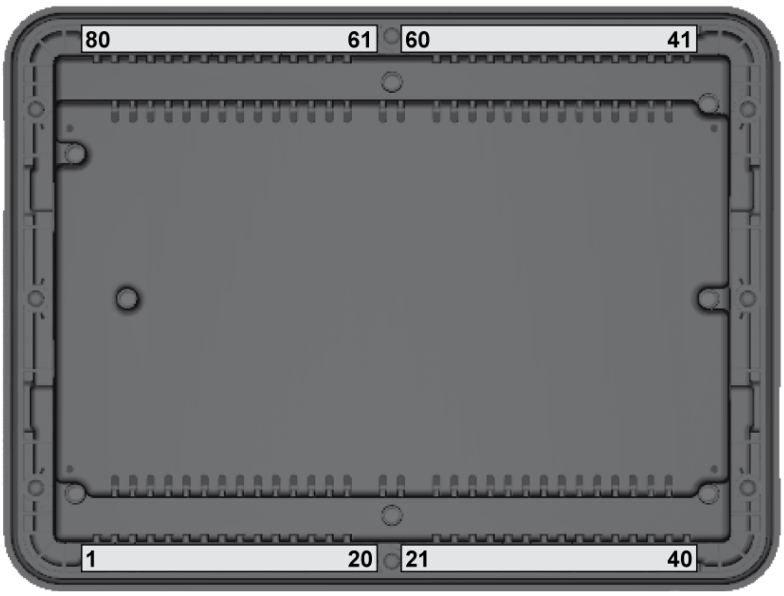


Fig. 15: Terminals easYgen-3000XT-P1(-LT) plastic housing

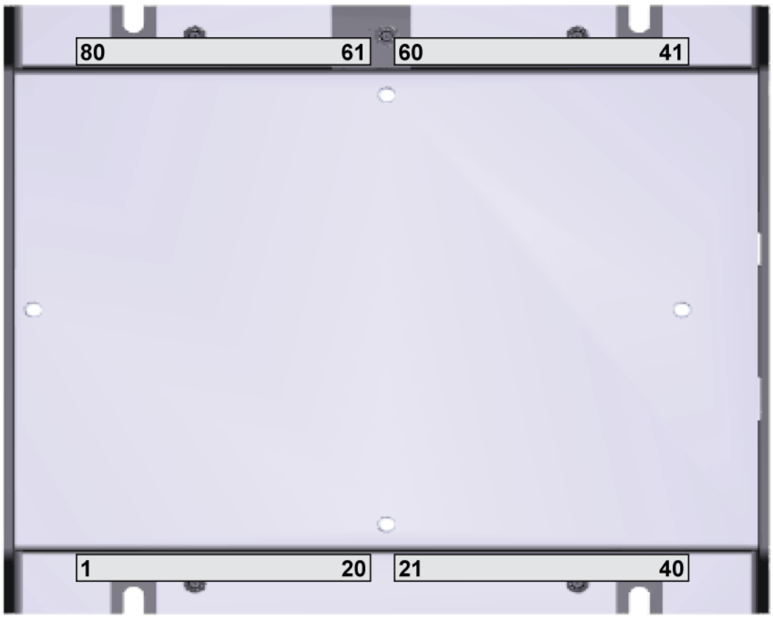


Fig. 16: Terminals easYgen-3000XT-P1 sheet metal housing

3.3.2 Wiring Diagram

The Protective Earth terminal 61 is not connected on the sheet metal housing.

– *Use the protective earth (PE) connector located at the bottom center of the sheet metal housing instead.*

Common terminal for AC measurement voltages

Mains, generator, and busbar voltage measuring terminals no longer differentiate with separate terminals for each voltage range.

Please be aware that former (easYgen) 100/120 V terminals are no longer available.

General recommendations

Ensure appropriate cable cross sections following the local standards and restrictions.

The maximum cable cross section of the terminal blocks is 2.5 mm^2.

For every type of signal lines like power supply, DI, DO, AI, AO, MPU:

- *Return line has to be close to forward signal line.*
- *Use cables instead of single wires.*
  - *In case of using single wires please do at least one twist per meter to keep wires together closely.*

Plastic housing variants:

- *Rout all cables connected to terminal blocks **away** from back cover.*

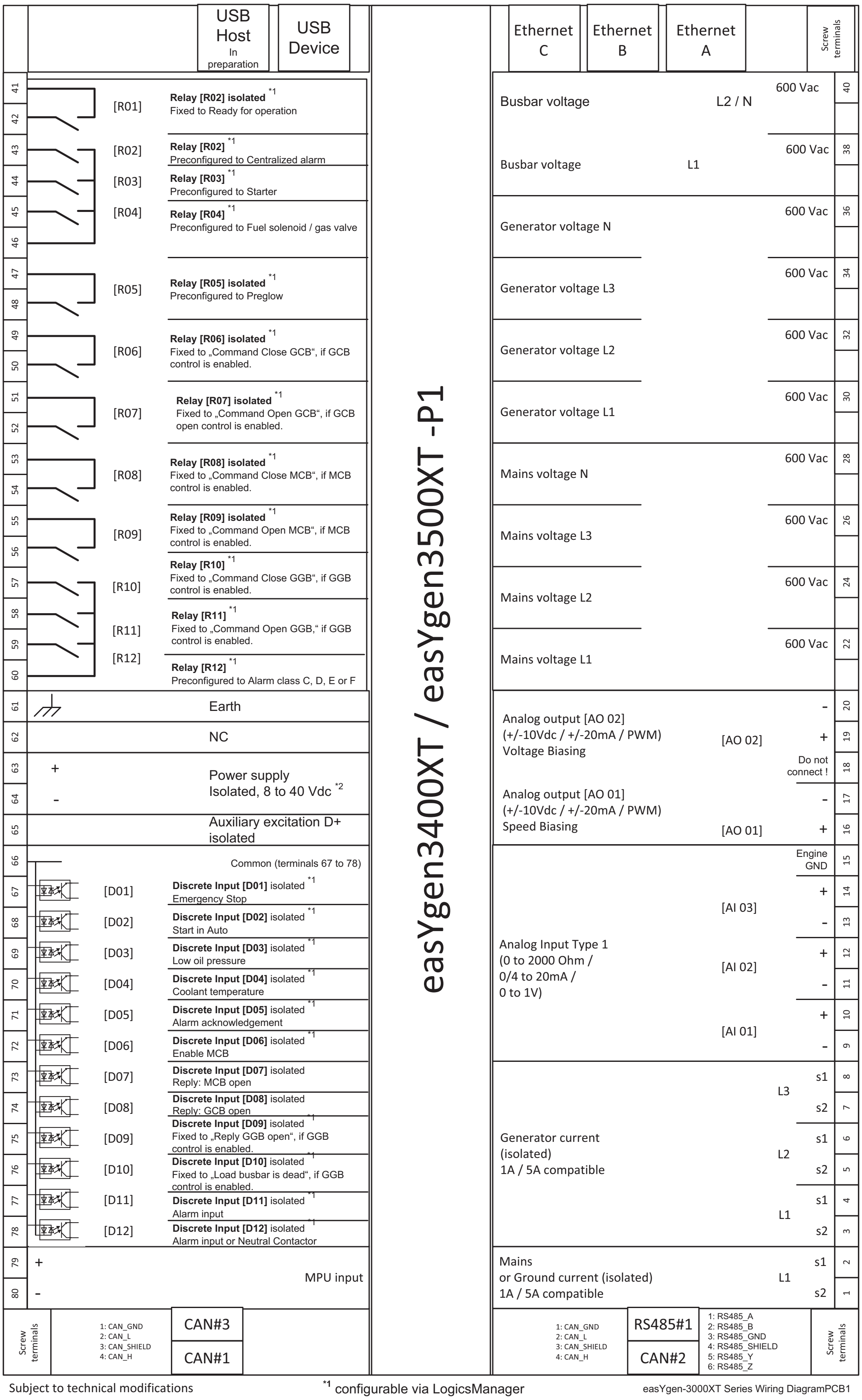


Fig. 17: Wiring diagram easYgen-3400XT/3500XT-P1(-LT)

1) Configurable by LogicsManager
2) V_{nom} = 12/24 V SELV

3) Pin 61: Metal housing: don't use
   Plastic housing with HMI/display: Earth/ground

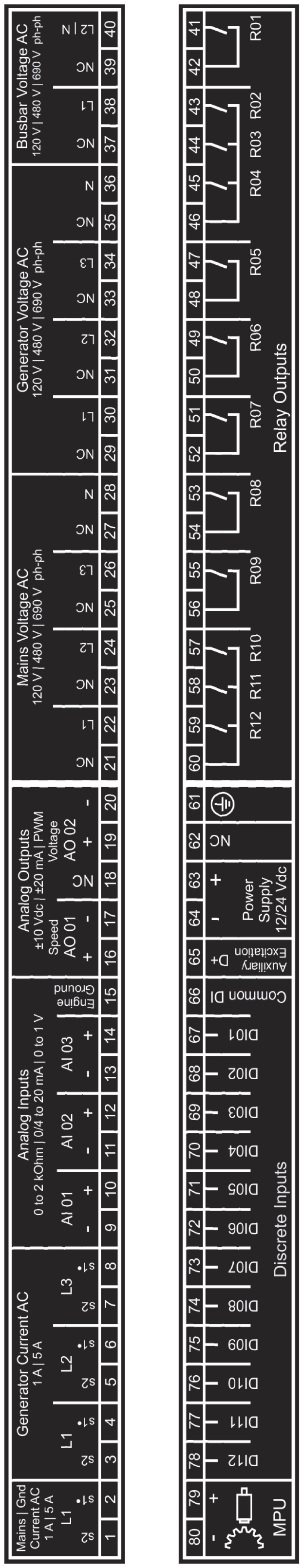


Fig. 18: Label/print easYgen-3400XT/3500XT-P1(-LT) wiring

3.3.3 Power Supply

General notes

WARNING!

Risk of electric shock - plastic housing

– Connect Protective Earth (PE) to the unit to avoid the risk of electric shock.
  Setup the connection using screw-plug-terminal 61.
– The conductor providing the connection must have a wire larger than or equal to 2.5 mm² (14 AWG). The connection must be performed properly.

WARNING!

Risk of electric shock - sheet metal housing

– Connect Protective Earth (PE) to the unit to avoid the risk of electric shock.
  Use the protective earth (PE) connector located at the bottom center of the sheet metal housing.
– The conductor providing the connection must have a wire larger than or equal to 2.5 mm² (14 AWG). The cable length should be as short as possible.
– The connection must be performed properly.

WARNING!

Permissible differential voltage

The maximum permissible differential voltage between terminal 64 (B-) and terminal 61 (PE) is 100 V_{RMS}. On engines where a direct connection between battery minus and PE is not possible, it is recommended to use an isolated external power supply if the differential voltage between battery minus and PE exceeds 100 V_{RMS}.

Woodward strictly recommends to use a power supply that is fulfilling the SELV restrictions (SELV = separated or safety extra-low voltage, see IEC)

Woodward recommends to use one of the following slow-acting protective devices in the supply line to terminal 63:

– *Fuse NEOZED D01 6A or equivalent* ***or***
– *Miniature Circuit Breaker 6A / Type C*
  (for example: ABB type: S271C6 or equivalent)

> ***Power ON***
> *With power ON the easYgen-3000XT device is monitoring self preparation by some display on screen and button illumination. HOME screen shows the device is working.*

Schematic and terminals

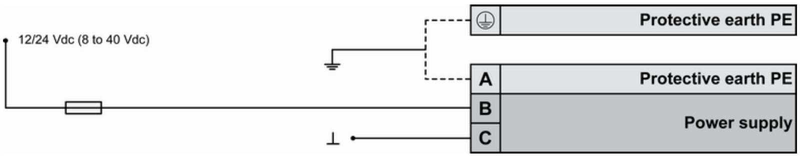


Fig. 19: Power supply - wiring

Terminal		Description
A	61	PE (protective earth) - plastic housing ONLY
B	63	12/24Vdc (8 to 40.0 Vdc)
C	64	0 Vdc

Table 2: Power supply - terminal assignment

Characteristics

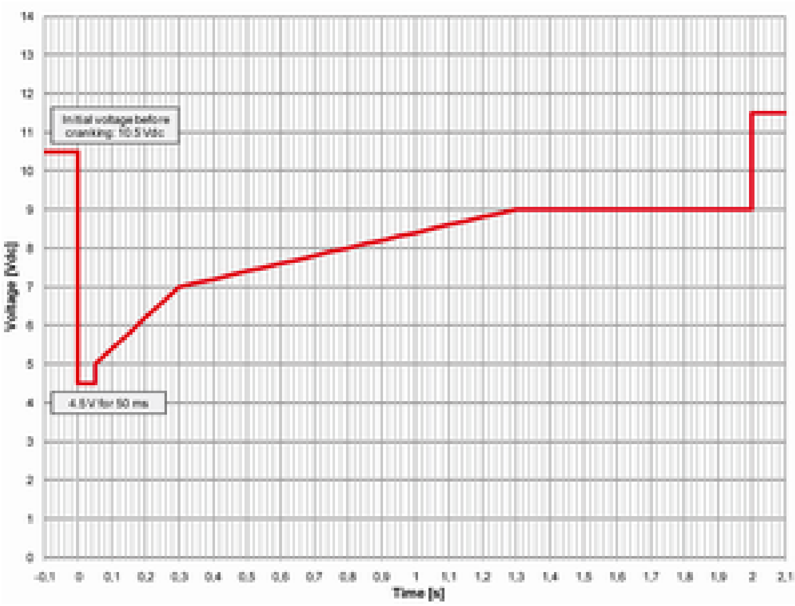


Fig. 20: Power supply - crank waveform

3.3.4 Charging Alternator

General notes

> *The charging alternator D+ acts as an pre-exciting output during the engine start-up.*
>
> *During regular operation, it acts as an input for monitoring the charging voltage.*

Schematic and terminals

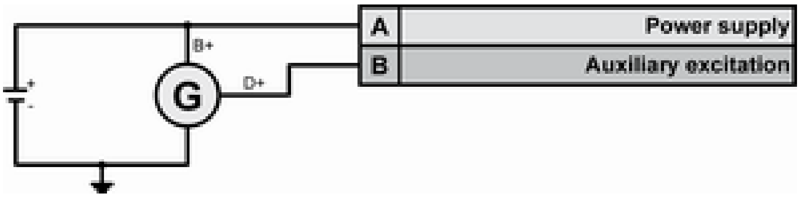


Fig. 21: Charging alternator - wiring

Terminal		Description
A	63	Battery B+ (8 to 40.0 Vdc SELV)
B	65	Auxiliary excitation (D+) output

Table 3: Charging alternator - terminal assignment

3.3.5 Voltage Measuring

General notes

Woodward recommends protecting the voltage measuring inputs with slow-acting fuses rated for 2 to 6 A.

The wide range terminals allow several voltages. The current voltage (range) of the application must be "told" to the genset controller device. Settings are described in chapter *Chapter 4.6 "Configure Measurement" on page 429.*

3.3.5.1 Generator Voltage

General notes

The voltage measuring inputs for 120 V, 480 V, and 690 V are using the same terminals 30 to 36. The current voltage range must be selected by the corresponding settings via HMI and/or ToolKit.

Parameter 1800 *p. 433* *("Gen. PT secondary rated volt.") must be configured to the correct value to ensure proper measurement.*

Schematic and terminals

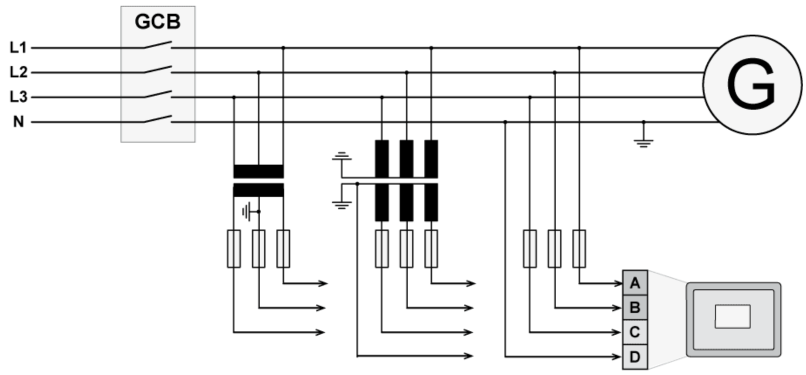


Fig. 22: Voltage measuring - generator - wiring

Measuring input / Phase	Terminal	
Generator voltage - L1	A	30
Generator voltage - L2	B	32
Generator voltage - L3	C	34
Generator voltage - N	D	36

Table 4: Voltage measuring - generator - terminal assignment

3.3.5.1.1 Parameter Setting '3Ph 4W OD' (3-phase, 4-wire, Open delta)

Generator windings

A generator system that is connected to the load through a 3-phase, 4-wire connection but have the device wired for a 3-phase, 3-wire installation may have the L2 phase grounded on the secondary side. In this application the device will be configured for 3-phase, 4-wire OD for correct power measurement.

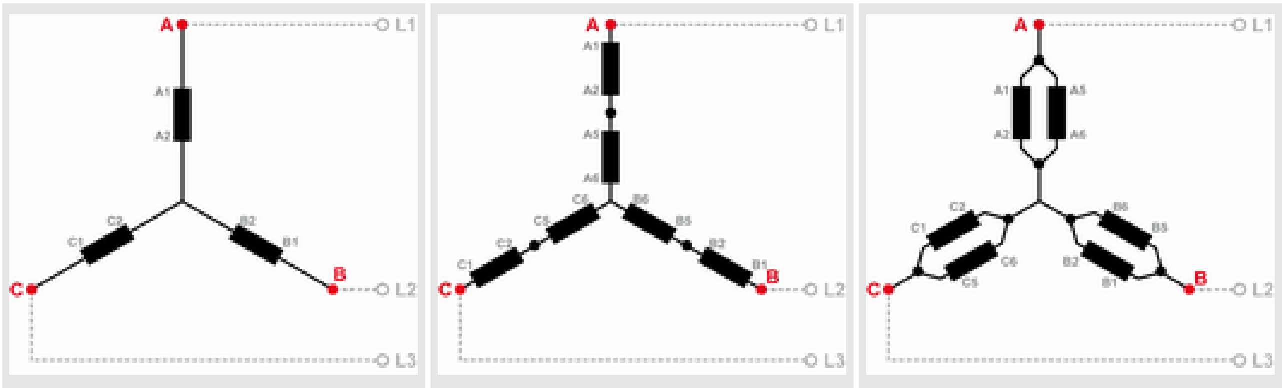


Table 5: Generator windings - 3Ph 4W OD

Measuring inputs

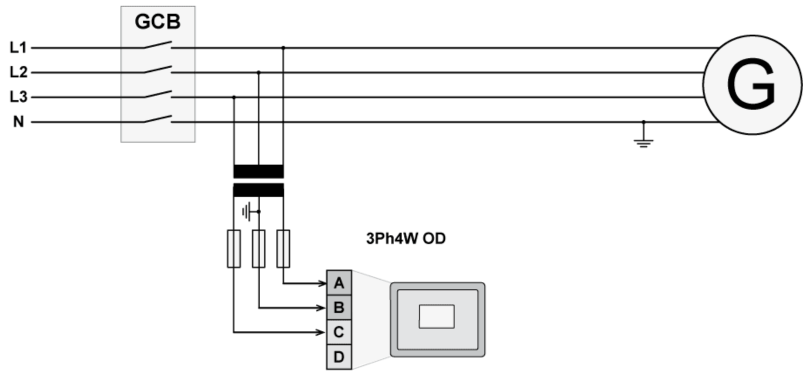


Fig. 23: Measuring inputs - 3Ph 4W OD

Terminal assignment

Measuring input / Phase	Terminal	
Generator voltage - L1	A	30
Generator voltage - L2	B	32
Generator voltage - L3	C	34
Generator voltage - N	-/-	

Table 6: Generator terminal assignment 3Ph 4W OD

3.3.5.1.2 Parameter Setting '3Ph 4W' (3-phase, 4-wire)

Generator windings

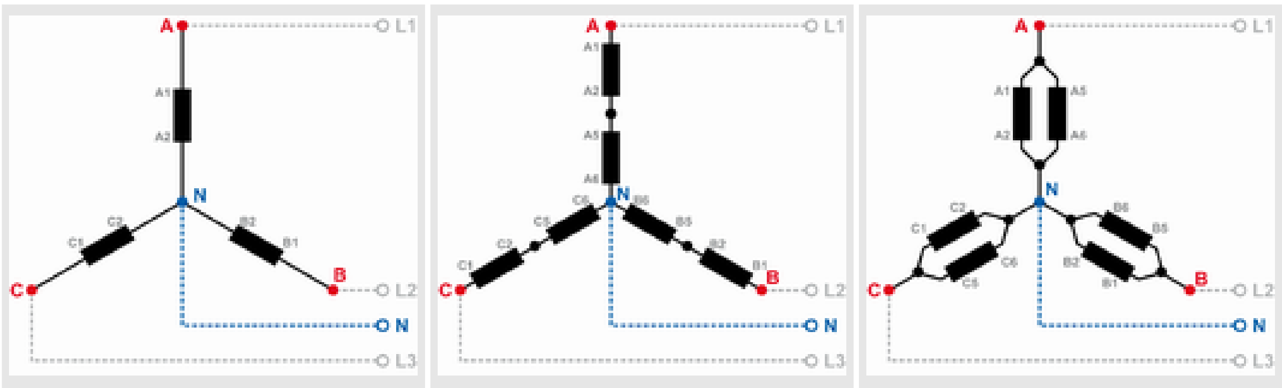


Table 7: Generator windings - 3Ph 4W

Measuring inputs

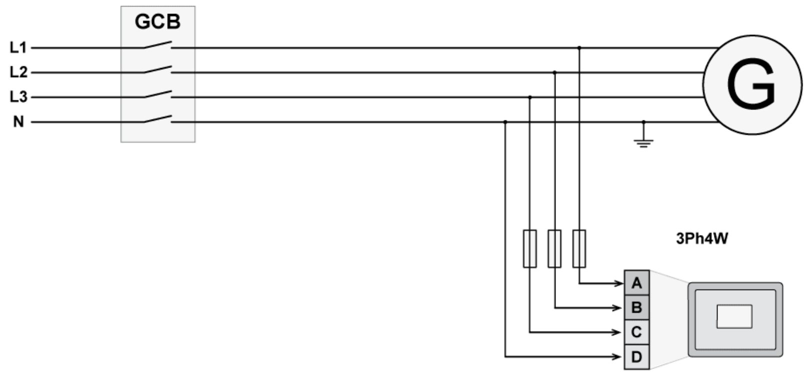


Fig. 24: Measuring inputs - 3Ph 4W

Terminal assignment

Measuring input / Phase	Terminal	
Generator voltage - L1	A	30
Generator voltage - L2	B	32
Generator voltage - L3	C	34
Generator voltage - N	D	36

Table 8: Generator terminal assignment 3Ph 4W

3.3.5.1.3 Parameter Setting '3Ph 3W' (3-phase, 3-wire)

Generator windings

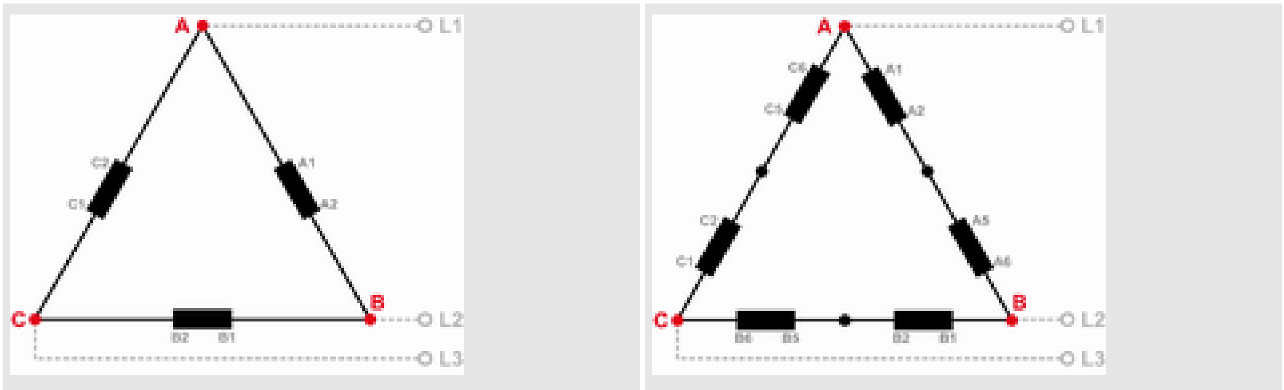


Table 9: Generator windings - 3Ph 3W

Measuring inputs

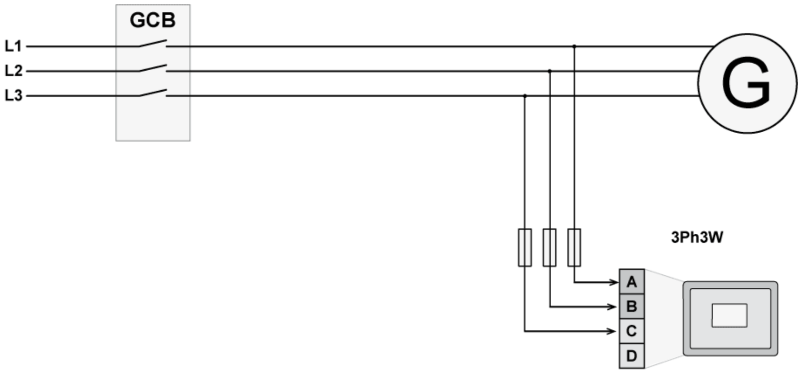


Fig. 25: Measuring inputs - 3Ph 3W

Terminal assignment

Measuring input / Phase	Terminal	
Generator voltage - L1	A	30
Generator voltage - L2	B	32
Generator voltage - L3	C	34
-/-	-/-	36

Table 10: Generator terminal assignment 3Ph 3W

3.3.5.1.4 Parameter Setting '1Ph 3W' (1-phase, 3-wire)

Generator windings

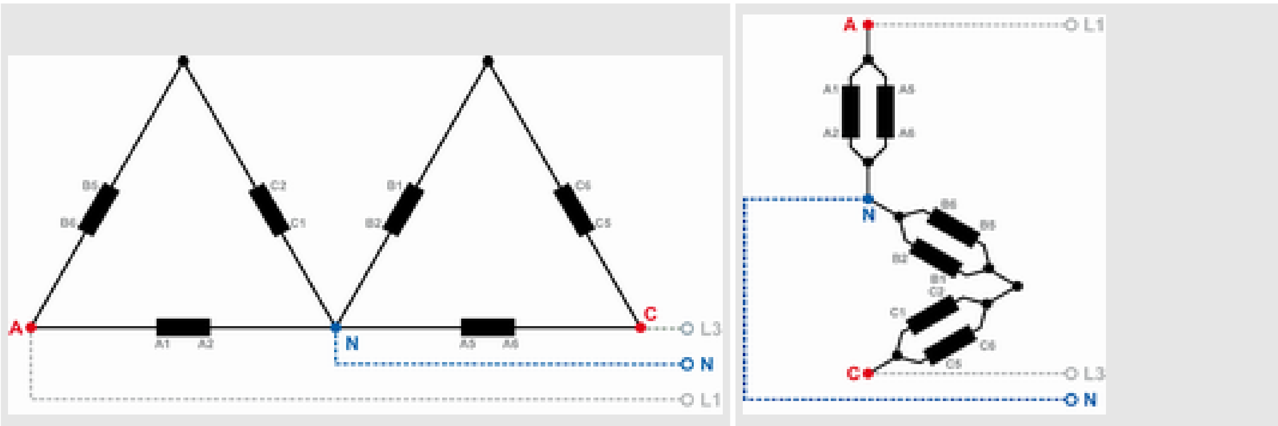


Table 11: Generator windings - 1Ph 3W

Measuring inputs

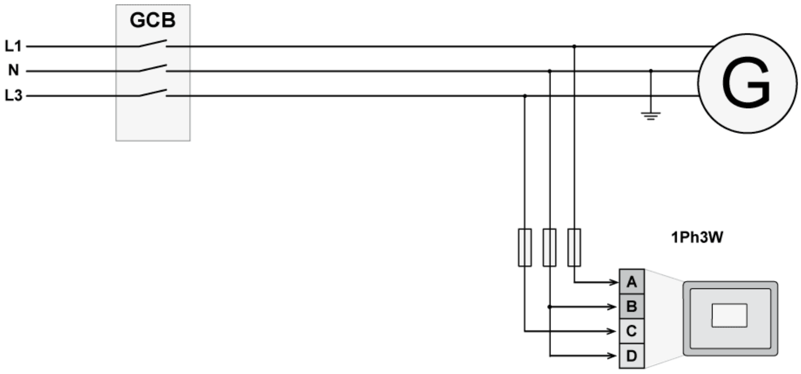


Fig. 26: Measuring inputs - 1Ph 3W

Terminal assignment

Measuring input / Phase	Terminal	
Generator voltage - L1	A	30
Generator voltage - L3	C	34
Generator voltage - N	D	36
	B	32

Table 12: Generator terminal assignment 1Ph 3W

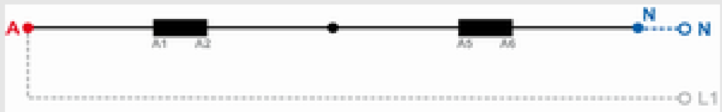
3.3.5.1.5 Parameter Setting '1Ph 2W' (1-phase, 2-wire)

The 1-phase, 2-wire measurement may be performed ***phase-neutral*** *or* ***phase-phase****.*

– *Please note to configure and wire the easYgen consistently.*

'1Ph 2W' Phase-Neutral Measuring

Generator windings



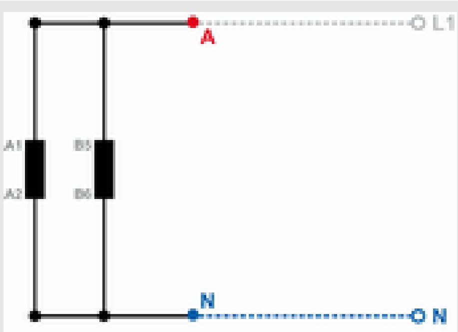


Table 13: Generator windings - 1Ph 2W (phase neutral)

Measuring inputs

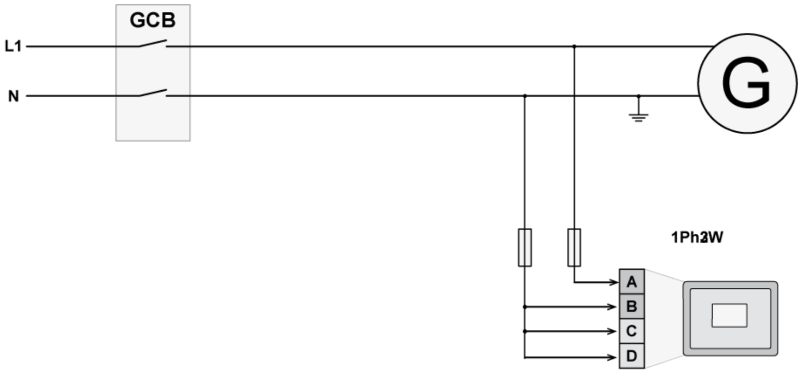


Fig. 27: Measuring inputs - 1Ph 2W (phase neutral)

Terminal assignment

Measuring input / Phase	Terminal	
Generator voltage - L1	A	30
Generator voltage - N	B	32
	C	34
	D	36

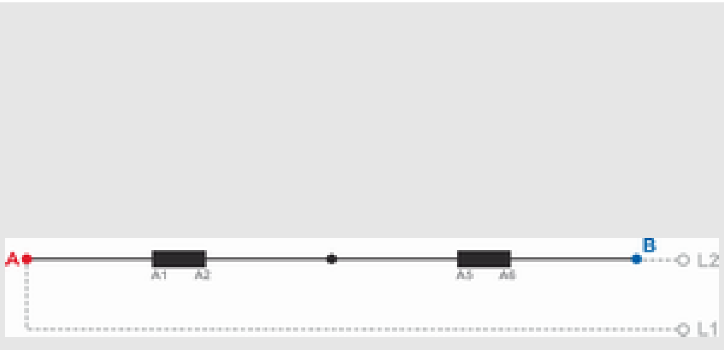
Table 14: Generator terminal assignment 1Ph 2W (phase neutral)

Never configure the busbar measurement for phase-neutral, if the other systems like mains and generator are configured as 3ph 3W or 4ph 4W without being the neutral in the middle of the triangle.

The phase angle for synchronization would be incorrect.

'1Ph 2W' Phase-Phase Measuring

Generator windings



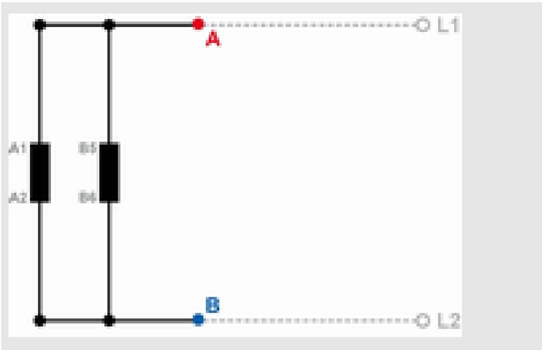


Table 15: Generator windings - 1Ph 2W (phase-phase)

Measuring inputs

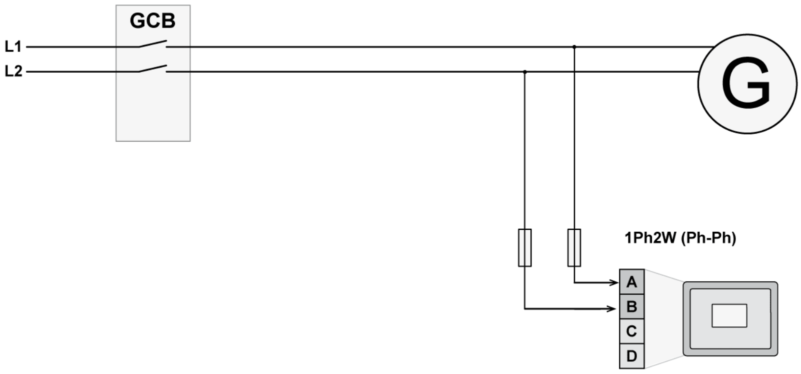


Fig. 28: Measuring inputs - 1Ph 2W (phase-phase)

Terminal assignment

Measuring input / Phase	Terminal	
Generator voltage - L1	A	30
Generator voltage - L2	B	32
Generator voltage - L3	-/-	
-/-	-/-	34, 36

Table 16: Generator terminal assignment 1Ph 2W (phase-phase)

3.3.5.2 Mains Voltage

General notes

The voltage measuring inputs for 120 V, 480 V, and 690 V are using the same terminals 22 to 28. The current voltage range must be selected by the corresponding settings via HMI and/or ToolKit.

Parameter 1803 p. 436 ("Mains PT secondary rated volt.") must be configured with the correct value to ensure proper measurement.

If the easYgen is intended to be operated in parallel with the mains, the mains voltage measuring inputs must be connected.

If an external mains decoupling is performed, jumpers between busbar and mains voltage measuring inputs may be installed.

Schematic and terminals

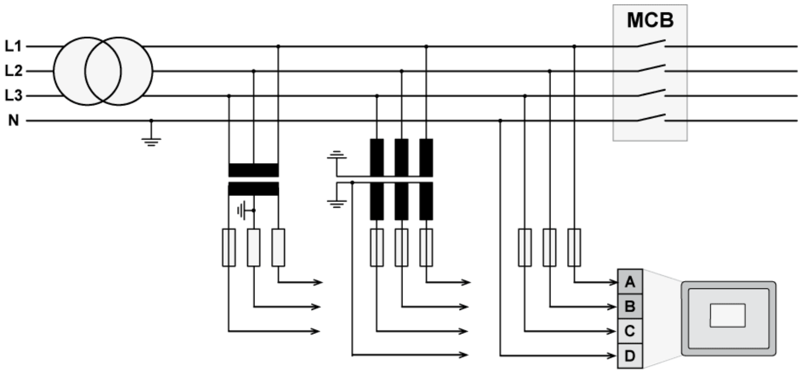


Fig. 29: Voltage measuring - mains - wiring

Measuring input / Phase	Terminal	
Mains voltage - L1	A	22
Mains voltage - L2	B	24
Mains voltage - L3	C	26
Mains voltage - N	D	28

Table 17: Voltage measuring - mains - terminal assignment

3.3.5.2.1 Parameter Setting '3Ph 4W' (3-phase, 4-wire)

Mains windings

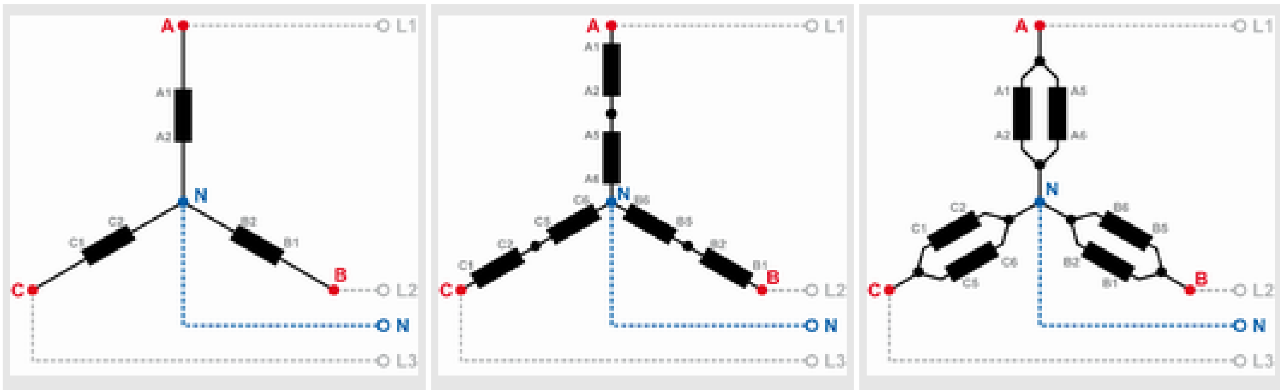


Table 18: Mains windings - 3Ph 4W

Measuring inputs

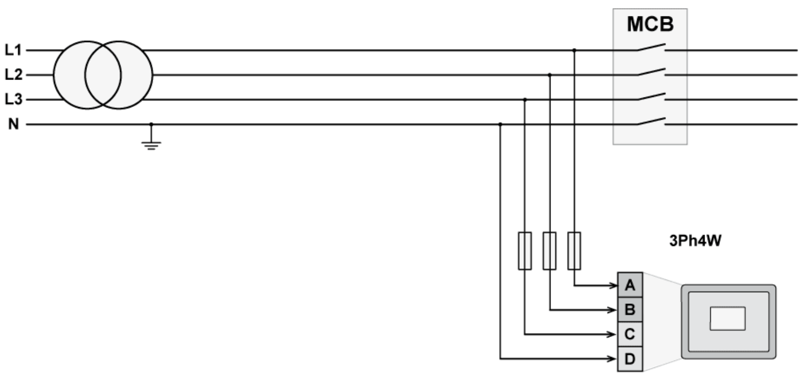


Fig. 30: Measuring inputs - 3Ph 4W

Terminal assignment

Measuring input / Phase	Terminal	
Mains voltage - L1	A	22
Mains voltage - L2	B	24
Mains voltage - L3	C	26
Mains voltage - N	D	28

Table 19: Mains terminal assignment 3Ph 4W

3.3.5.2.2 Parameter Setting '3Ph 3W' (3-phase, 3-wire)

Mains windings

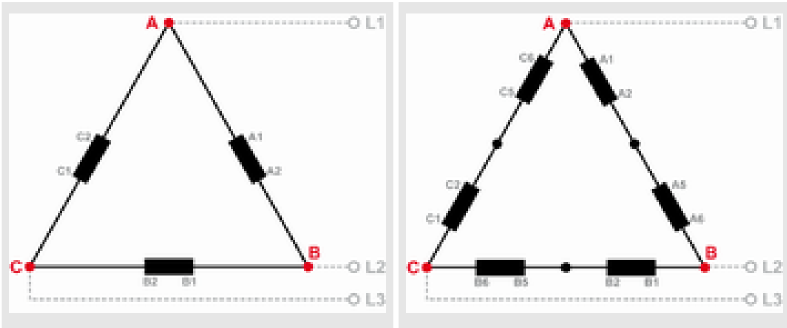


Table 20: Mains windings - 3Ph 3W

Measuring inputs

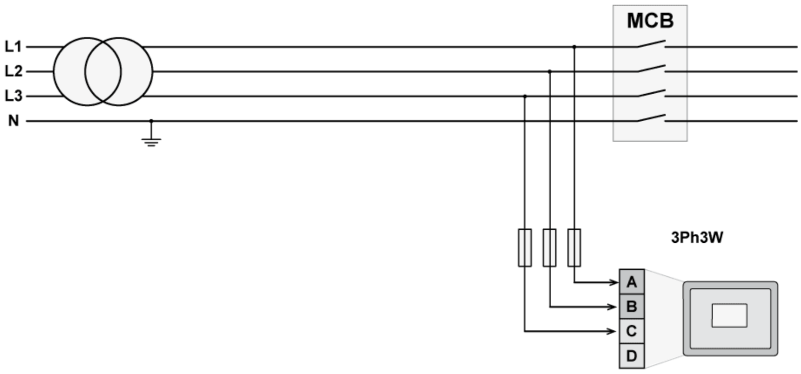


Fig. 31: Measuring inputs - 3Ph 3W

Terminal assignment

Measuring input / Phase	Terminal	
Mains voltage - L1	A	22
Mains voltage - L2	B	24
Mains voltage - L3	C	26
-/-	-/-	28

Table 21: Mains terminal assignment 3Ph 3W

3.3.5.2.3 Parameter Setting '1Ph 3W' (1-phase, 3-wire)

Mains windings

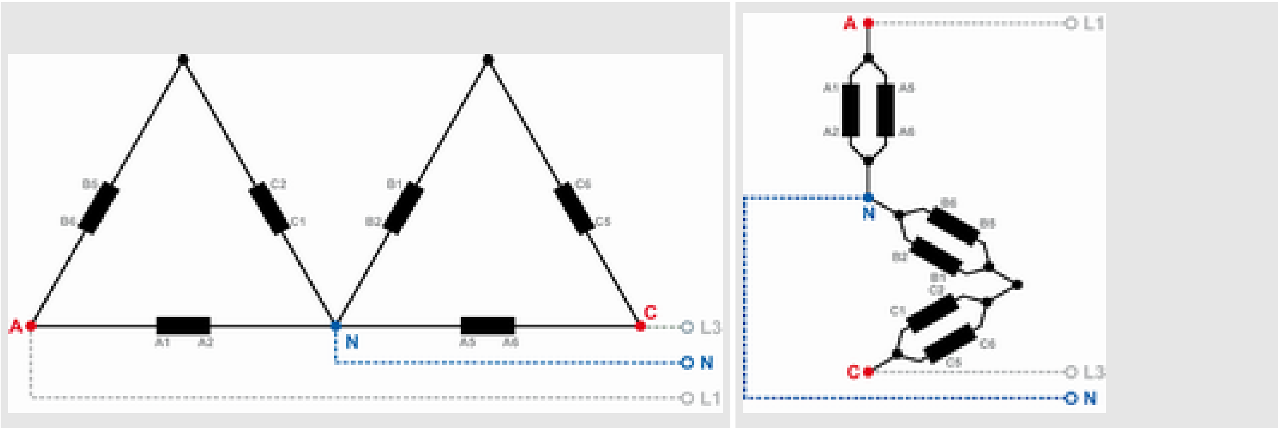


Table 22: Mains windings - 1Ph 3W

Measuring inputs

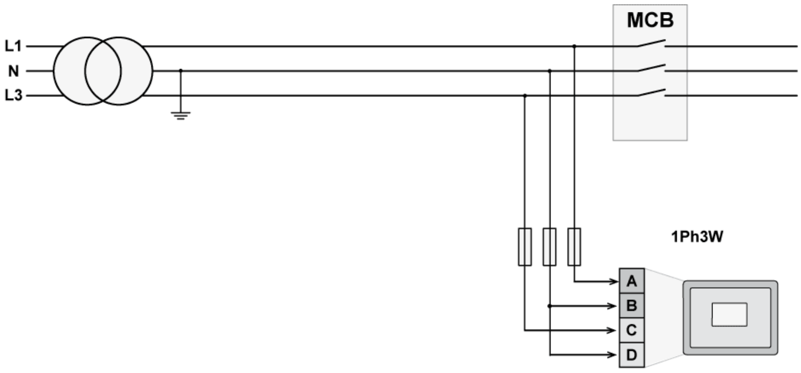


Fig. 32: Measuring inputs - 1Ph 3W

Terminal assignment

Measuring input / Phase	Terminal	
Mains voltage - L1	A	22
Mains voltage - L3	C	26
Mains voltage - N	B	24
	D	28

Table 23: Mains terminal assignment 1Ph 3W

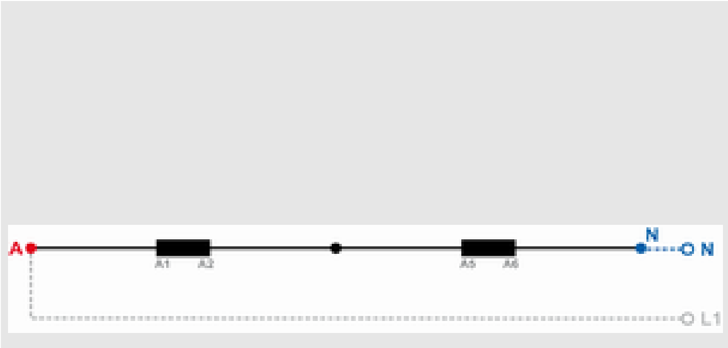
3.3.5.2.4 Parameter Setting '1Ph 2W' (1-phase, 2-wire)

The 1-phase, 2-wire measurement may be performed ***phase-neutral*** *or* ***phase-phase****.*

– *Please note to configure and wire the easYgen consistently.*

'1Ph 2W' Phase-Neutral Measuring

Mains windings



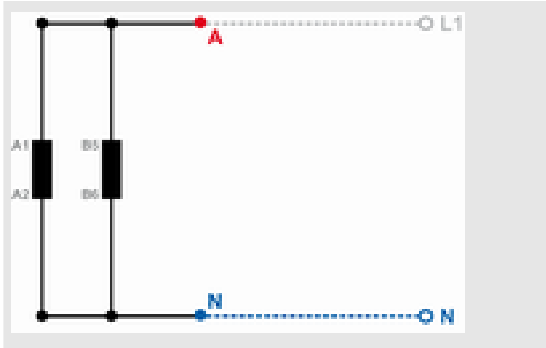


Table 24: Mains windings - 1Ph 2W (phase neutral)

Measuring inputs

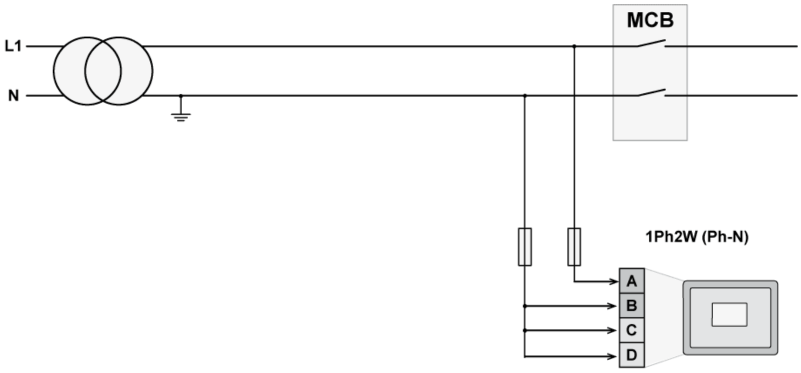


Fig. 33: Measuring inputs - 1Ph 2W (phase neutral)

Terminal assignment

Measuring input / Phase	Terminal	
Mains voltage - L1	A	22
Mains voltage - N	B	24
	C	26
	D	28

Table 25: Mains terminal assignment 1Ph 2W phase neutral

'1Ph 2W' Phase-Phase Measuring

Mains windings

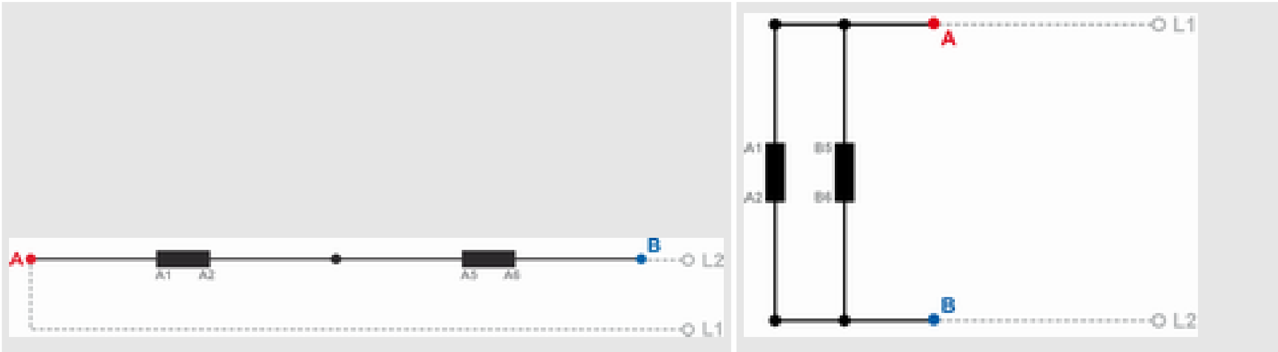


Table 26: Mains windings - 1Ph 2W (phase-phase)

Measuring inputs

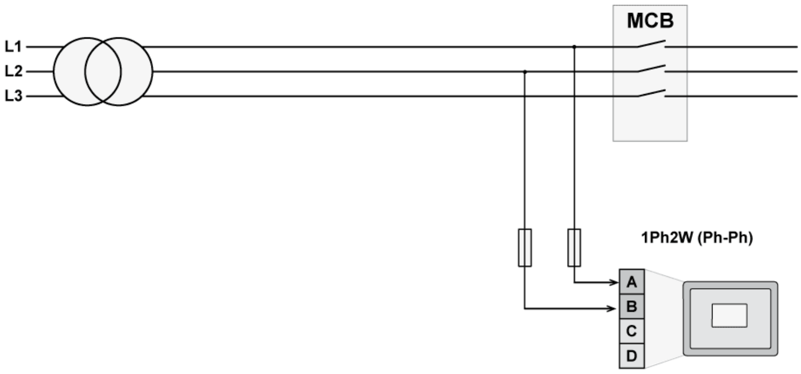


Fig. 34: Measuring inputs - 1Ph 2W (phase-phase)

Terminal assignment

Measuring input / Phase	Terminal	
Mains voltage - L1	A	22
Mains voltage - L2	B	24
Mains voltage - L3	-/-	-/-
-/-	-/-	26, 28

Table 27: Mains terminal assignment 1Ph 2W phase-phase

3.3.5.3 Busbar Voltage

General notes

The voltage measuring inputs for 120 V, 480 V, and 690 V are using the same terminals 38 to 40. The current voltage range must be selected by the corresponding settings via HMI and/or ToolKit.

Parameter 1812 *➪ p. 434* *("Busb1 PT secondary rated volt.") must be configured to the correct value to ensure proper measurement.*

Schematic and terminals

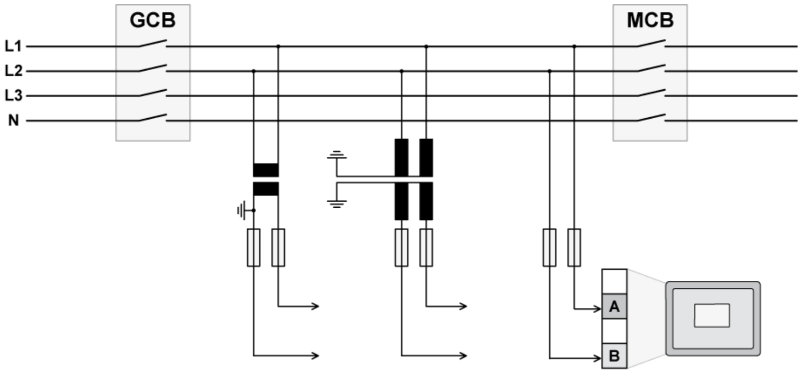


Fig. 35: Voltage measuring - busbar - wiring

Measuring input / Phase	Terminal		A_{max}
Busbar voltage (system 1) - L1	A	38	2.5 mm²
Busbar voltage (system 1) - L2/N	B	40	2.5 mm²

Table 28: Voltage measuring - busbar - terminal assignment

3.3.5.3.1 Parameter Setting '1Ph 2W' (1-phase, 2-wire)

*The 1-phase, 2-wire measurement may be performed **phase-neutral** or **phase-phase**.*

– *Please note to configure and wire the easYgen consistently.*

'1Ph 2W' Phase-Neutral Measuring

Busbar windings

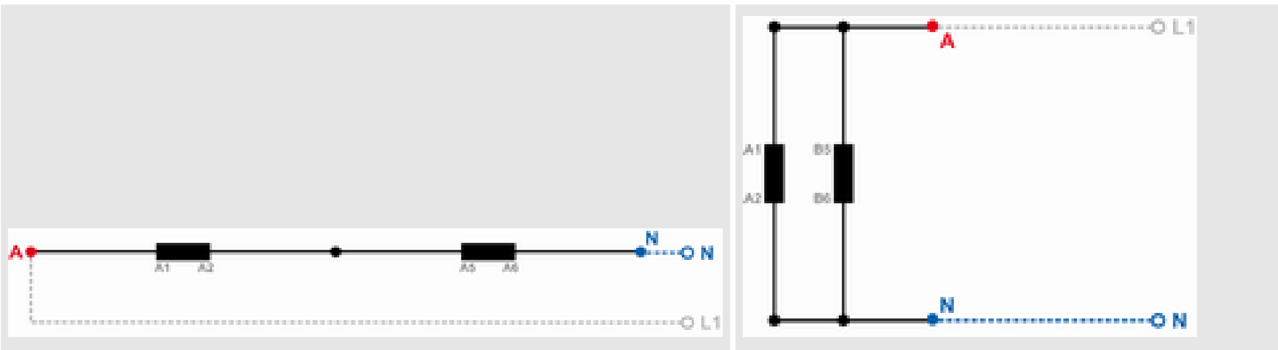


Table 29: Busbar windings - 1Ph 2W (phase neutral)

Measuring inputs

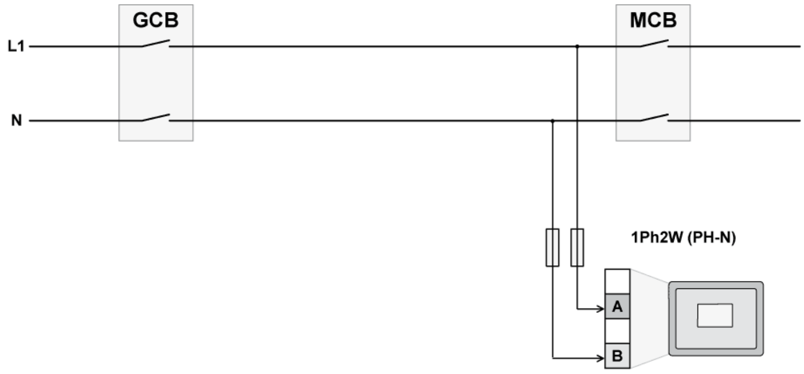


Fig. 36: Measuring inputs - 1Ph 2W (phase neutral)

Terminal assignment

Measuring input / Phase	Terminal	
Busbar voltage - phaseL1	A	38
Busbar voltage - N	B	40

Table 30: Busbar terminal assignment 1Ph 2W phase neutral

'1Ph 2W' Phase-Phase Measuring

Busbar windings

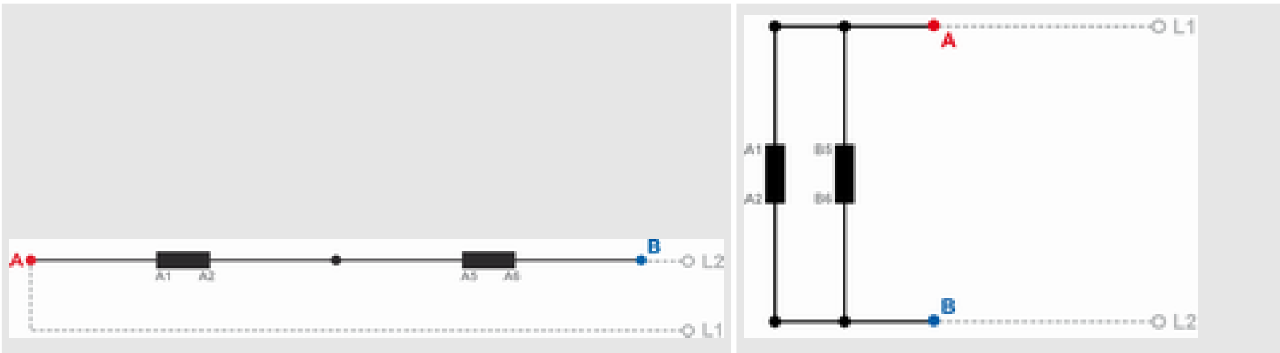


Table 31: Busbar windings - 1Ph 2W (phase-phase)

Measuring inputs

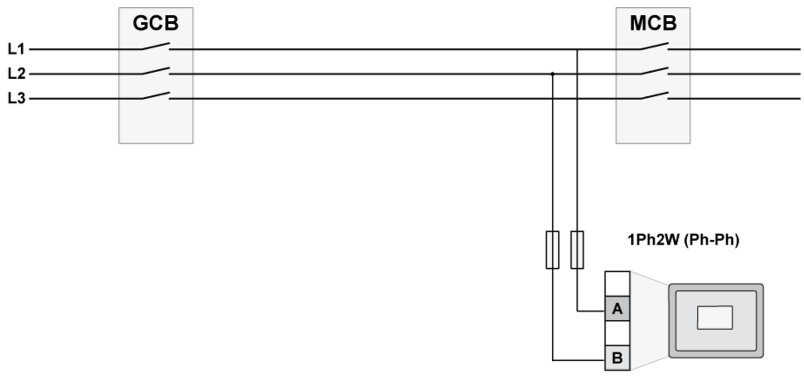


Fig. 37: Measuring inputs - 1Ph 2W (phase-phase)

Terminal assignment

Measuring input / Phase	Terminal	
Busbar voltage - phase L1	A	38
Busbar voltage - phase L2	B	40
Busbar voltage - phase L3	-/-	

Table 32: Busbar terminal assignment 1Ph 2W phase-phase

3.3.6 Current Measuring

3.3.6.1 Generator Current

General notes

WARNING!

Dangerous voltages due to missing load

– Before disconnecting the device, ensure that the current transformer (CT) is short-circuited.

The current measuring inputs for 1 A and 5 A are using the same terminals 3 to 8. The current range must be selected by the corresponding settings via HMI and/or ToolKit.

Generally, one line of the current transformers secondary must be grounded close to the CT.

Schematic and terminals

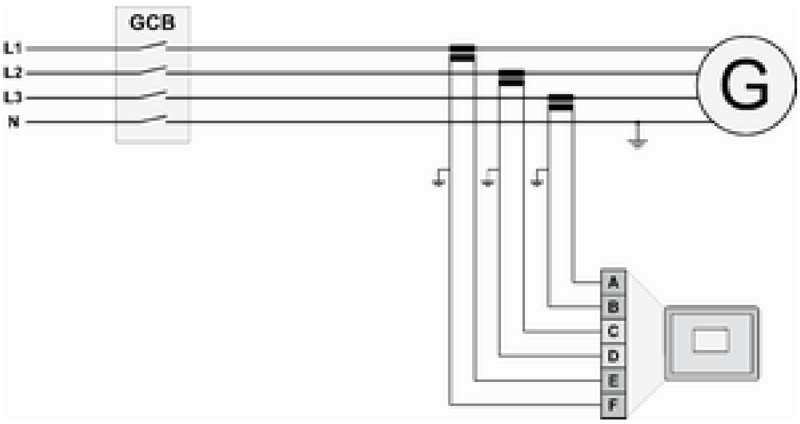


Fig. 38: Current measuring - generator - wiring

Terminal		Description
A	8	Generator current - L3 - transformer terminal s1 (k)
B	7	Generator current - L3 - transformer terminal s2 (l)
C	6	Generator current - L2 - transformer terminal s1 (k)

Terminal		Description
D	5	Generator current - L2 - transformer terminal s2 (l)
E	4	Generator current - L1 - transformer terminal s1 (k)
F	3	Generator current - L1 - transformer terminal s2 (l)

Table 33: Current measuring - generator - terminal assignment

3.3.6.1.1 Parameter Setting 'L1 L2 L3'

Schematic and terminals

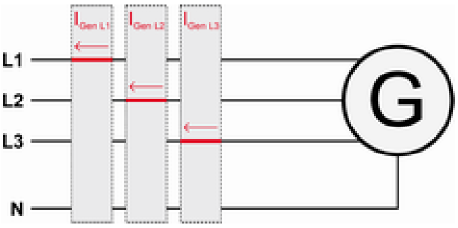


Fig. 39: Current measuring - generator, L1 L2 L3

	Wiring terminals					
	F	E	D	C	B	A
L1 L2 L3						
Terminal	3	4	5	6	7	8
Phase	s2 (l) L1	s1 (k) L1	s2 (l) L2	s1 (k) L2	s2 (l) L3	s1 (k) L3
Phase L1 and L3						
Terminal	3	4	5	6	7	8
Phase	s2 (l) L1	s1 (k) L1	—	—	s2 (l) L3	s1 (k) L3

"Phase L1 and L3" applies if the generator voltage measurement is configured to 1Ph 3W (*Chapter 3.3.5.1 "Generator Voltage" on page 53**).*

3.3.6.1.2 Parameter Setting 'Phase L1' 'Phase L2' 'Phase L3'

Schematic and terminals

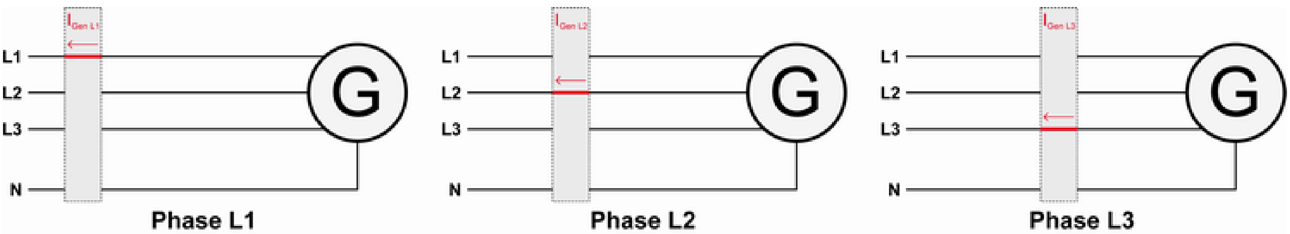


Fig. 40: Current measuring - generator, 'Phase L1' 'Phase L2' 'Phase L3'

	Wiring terminals					
	F	E	D	C	B	A
Phase L1						
Terminal	3	4	5	6	7	8
Phase	s2 (l) L1	s1 (k) L1	—	—	—	—

	Wiring terminals					
Phase L2						
Terminal	3	4	5	6	7	8
Phase	—	—	s2 (l) L2	s1 (k) L2	—	—
Phase L3						
Terminal	3	4	5	6	7	8
Phase	—	—	—	—	s2 (l) L3	s1 (k) L3

3.3.6.2 Mains Current

General notes

WARNING!

Dangerous voltages due to missing load

– Before disconnecting the device, ensure that the current transformer (CT) is short-circuited.

The current measuring inputs for 1 A and 5 A are using the same terminals 1 to 2. The current range must be selected by the corresponding settings via HMI and/or ToolKit.

Generally, one line of the current transformers secondary must be grounded close to the CT.

Schematic and terminals

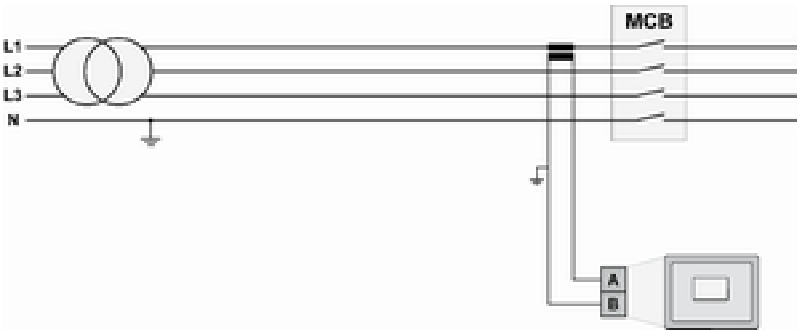


Fig. 41: Current measuring - mains - wiring

Terminal		Description
A	2	Mains current - transformer terminal s1 (k)
B	1	Mains current - transformer terminal s2 (l)

Table 34: Current measuring - mains - terminal assignment

3.3.6.2.1 Parameter Setting 'Phase L1' 'Phase L2' 'Phase L3'

Schematic and terminals

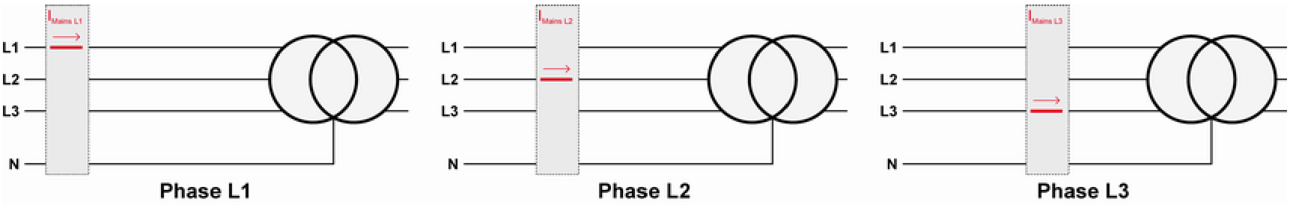


Fig. 42: Current measuring - mains, 'Phase L1' 'Phase L2' 'Phase L3'

	Wiring terminals	
	B	A
Phase L1		
Terminal	1	2
Phase	s2 (l) - L1	s1 (k) - L1
Phase L2		
Terminal	1	2
Phase	s2 (l) - L2	s1 (k) - L2
Phase L3		
Terminal	1	2
Phase	s2 (l) - L3	s1 (k) - L3

3.3.6.3 Ground Current

General notes

WARNING!

Dangerous voltages due to missing load

– Before disconnecting the device, ensure that the current transformer (CT) is short-circuited.

The current measuring inputs for 1 A and 5 A are using the same terminals 1 to 2. The current range must be selected by the corresponding settings via HMI and/or ToolKit.

The mains current input can be configured to measure the mains current or ground current. The parameter 'Mains current input' determines, if this input will measure the mains current (default) or the ground current.

Generally, one line of the current transformers secondary must be grounded close to the CT.

Schematic and terminals

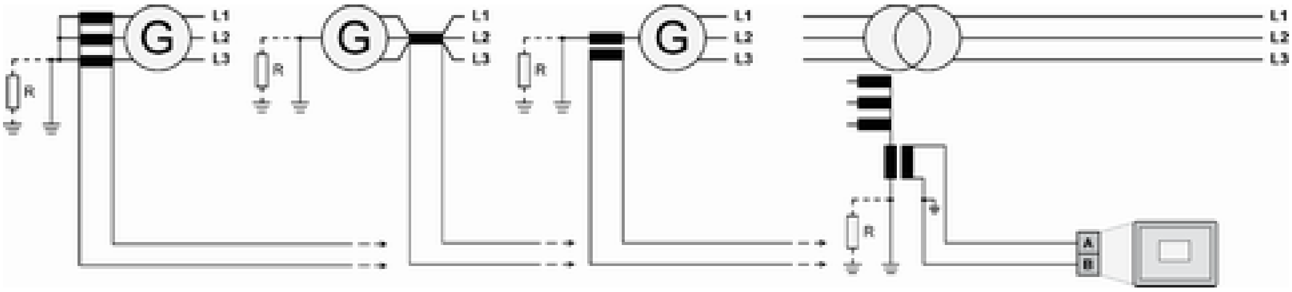


Fig. 43: Current measuring - ground current - wiring

Terminal		Description
A	2	Ground current - transformer terminal s1 (k)
B	1	Ground current - transformer terminal s2 (l)

Table 35: Current measuring - ground current - terminal assignment

3.3.7 Power Measuring

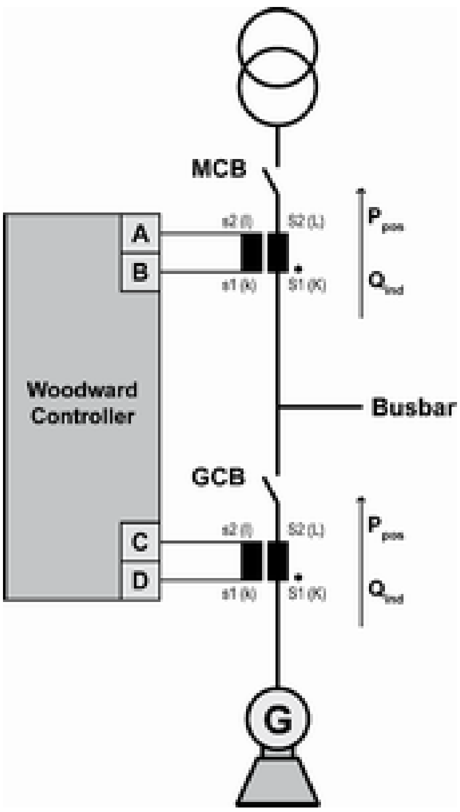


Fig. 44: Power measuring - wiring

If the unit's current transformers are wired according to the diagram (Fig. 44), the following values are displayed.

Terminal				Description
A	1			Mains or ground current
B	2			
C	3	5	7	Generator current
D	4	6	8	

Parameter	Description	Sign displayed
Generator real power	Genset generating kW	+ Positive
Generator real power	Genset in reverse power	- Negative

Parameter	Description	Sign displayed
Generator power factor (cos φ)	Inductive / lagging	+ Positive
Generator power factor (cos φ)	Capacitive / leading	- Negative
Mains real power	Plant exporting kW +	+ Positive
Mains real power	Plant importing kW -	- Negative
Mains power factor (cos φ)	Inductive / lagging	+ Positive
Mains power factor (cos φ)	Capacitive / leading	- Negative

Measuring 3PH 3W

The values of single active power, reactive power, and power factor in L1, L2 and L3 are not displayed. This values can not be determined through this connection type.

3.3.8 Power Factor Definition

Definition

Power Factor is defined as a ratio of the real power to apparent power. In a purely resistive circuit, the voltage and current waveforms are instep resulting in a ratio or power factor of 1.00 (often referred to as unity).

In an inductive circuit the current lags behind the voltage waveform resulting in usable power (real power) and unusable power (reactive power). This results in a positive ratio or lagging power factor (i.e. 0.85lagging).

In a capacitive circuit the current waveform leads the voltage waveform resulting in usable power (real power) and unusable power (reactive power). This results in a negative ratio or a leading power factor (i.e. 0.85leading).

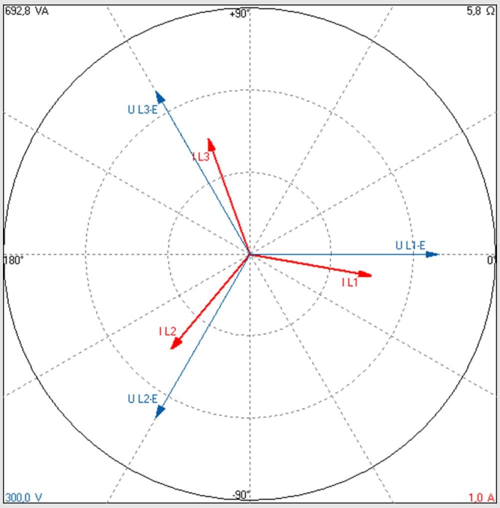
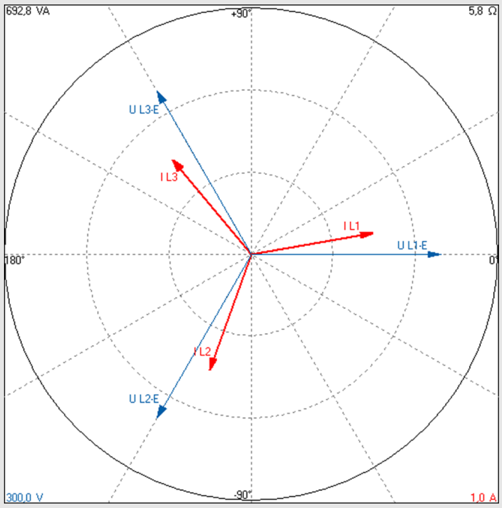
Properties

	Inductive	Capacitive
Load type	Electrical load whose current waveform lags the voltage waveform thus having a lagging power factor. Some inductive loads such as electric motors have a large startup current requirement resulting in lagging power factors.	Electrical load whose current waveform leads the voltage waveform thus having a leading power factor. Some capacitive loads such as capacitor banks or buried cable result in leading power factors.
Different power factor display on the unit	i0.91 (inductive) lg.91 (lagging)	c0.93 (capacitive) ld.93 (leading)
Reactive power display on the unit	70 kvar (positive)	-60 kvar (negative)
Output of the interface	+ (positive)	- (negative)
Current relation to voltage	Lagging	Leading
Generator state	Overexcited	Underexcited

	Inductive	Capacitive
Control signal	If the control unit is equipped with a power factor controller while in parallel with the utility:	
	A voltage lower "-" signal is output as long as the measured value is "more inductive" than the reference setpoint Example: measured = i0.91; setpoint = i0.95	A voltage raise "+" signal is output as long as the measured value is "more capacitive" than the reference setpoint Example: measured = c0.91; setpoint = c0.95

Phasor diagram

The phasor diagram is used from the generator's view.

	Inductive	Capacitive
Diagram		

3.3.9 Magnetic Pickup Unit (MPU)

General notes

The shield of the MPU (Magnetic Pickup Unit) connection cable must be connected to a single point ground terminal near the easYgen.

The shield must not be connected at the MPU side of the cable.

The number of teeth on the flywheel reference gear and the flywheel speed must be configured so that the magnetic pickup input frequency does not exceed 14 kHz.

Overview

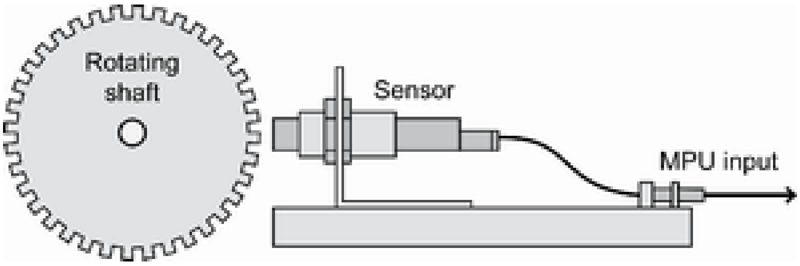


Fig. 45: MPU - overview

Schematic and terminals

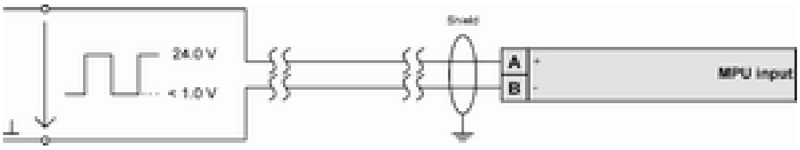


Fig. 46: MPU - input

Terminal		Description
A	79	MPU input - inductive/switching
B	80	MPU input - GND

Characteristic

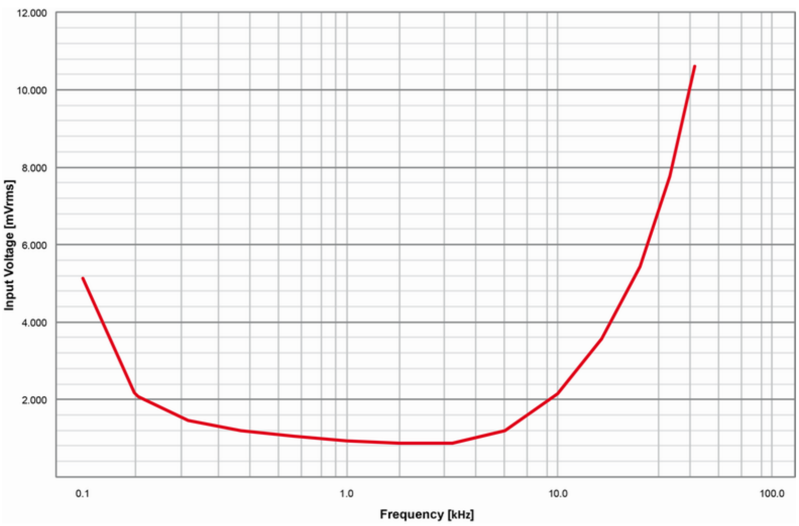


Fig. 47: MPU - characteristic

> *Fig. 47 shows the minimal necessary input voltage depending on frequency. It is recommended to ensure input voltage greater than minimal necessary with a margin of 2 to 3 V (especially at high ambient temperature above +50 °C).*

3.3.10 Discrete Inputs

General notes

> **WARNING!**
>
> **Hazards due to improper implementation of emergency stop**
>
> Discrete input [DI 01] "Emergency Stop" is only a signaling input. This input may only be used to signal that an external emergency stop button has been actuated.
>
> According to EN 60204, this input is not approved to be used as the emergency stop function.
>
> – The emergency stop function must be implemented external to the control and cannot rely on the control to function properly.

> *The discrete inputs are electrically isolated which permits the polarity of the connections to be either positive or negative.*
>
> – *All discrete inputs must use the same polarity, either positive or negative signals, due to the common ground.*

Schematic and terminal assignment

Fig. 48: Discrete input - positive polarity signal

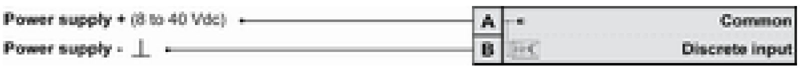


Fig. 49: Discrete input - negative polarity signal

Terminal		Description	
A	B		
66 GND Common ground	67	Discrete Input [DI 01]	Preconfigured to "Emergency stop"[1]
	68	Discrete Input [DI 02]	Preconfigured to "Start in AUTO"[1]
	69	Discrete Input [DI 03]	Preconfigured to "Low oil pressure"[1]
	70	Discrete Input [DI 04]	Preconfigured to "Coolant temperature"[1]
	71	Discrete Input [DI 05]	Preconfigured to "Alarm acknowledge"[1]
	72	Discrete Input [DI 06]	Preconfigured to "Enable MCB"[1]
	73	Discrete Input [DI 07]	Fixed to "Reply: MCB open"
	74	Discrete Input [DI 08]	Fixed to "Reply: GCB open"
	75	Discrete Input [DI 09]	LogicsManager[1]
	76	Discrete Input [DI 10]	LogicsManager[1]

Terminal		Description	
A	B		
	77	Discrete Input [DI 11]	LogicsManager[1]
	78	Discrete Input [DI 12]	LogicsManager[1] Preconfigured to "Alarm input or Neutral Contactor"[1]

Table 36: DI 01-12

[1] configurable via LogicsManager

Operation logic

Discrete inputs may be configured to normally open (N.O.) or normally closed (N.C.) states.

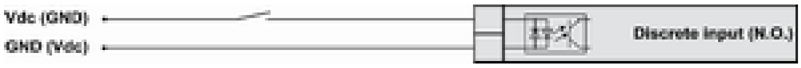


Fig. 50: Discrete inputs - state N.O.

In the state N.O., no potential is present during normal operation; if an alarm is issued or control operation is performed, the input is energized.

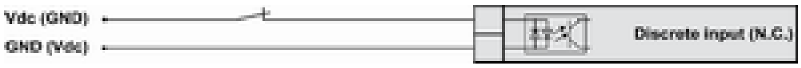


Fig. 51: Discrete inputs - state N.C.

In the state N.C., a potential is continuously present during normal operation; if an alarm is issued or control operation is performed, the input is de-energized.

The N.O. or N.C. contacts may be connected to the signal terminal as well as to the ground terminal of the discrete input (*"Schematic and terminal assignment" on page 76*).#

3.3.11 Relay Outputs (LogicsManager)

General notes

CAUTION!

The relay output "Ready for operation" must be wired in series with an emergency stop function. This means that it must be ensured that the generator circuit breaker is opened and the engine is stopped if this relay output is de-energize.

– We recommend to signal this fault independently from the unit if the availability of the plant is important.

For information on interference suppressing circuits when connecting 24 V relays, please refer to Chapter 3.3.11.1 "Connecting 24 V Relays" on page 79.

Schematic and terminals

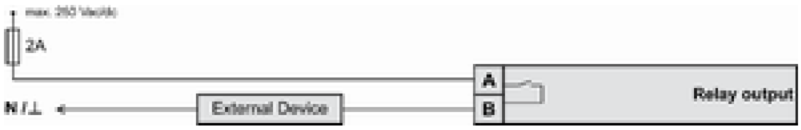


Fig. 52: Relay outputs - schematic

Terminal		Description		
N.O.	Common			
A	B	Form A		
42	41	Relay output [R 01]	All	Fixed to "Ready for operation"[1]
43	46	Relay output [R 02]	All	Preconfigured to "Centralized alarm"[1]
44		Relay output [R 03]	All	Preconfigured to "Starter"[1]
45		Relay output [R 04]	All	Preconfigured to "Fuel solenoid / gas valve"[1]
48	47	Relay output [R 05]	All	Preconfigured to "Preglow"[1]
50	49	Relay output [R 06]	A01 A02	LogicsManager[1]
			A03 to A11	Fixed to "Command: close GCB"[1]
52	51	Relay output [R 07]	A01	Preconfigured to "Mains decoupling"[1]
			A02 to A11	Fixed to "Command: open GCB"[1]
54	53	Relay output [R 08]	A01 A02 A03 A05 A07 A08 A09 A10 A11	LogicsManager[1]
			A04 A06	Fixed to "Command: close MCB"[1]
56	55	Relay output [R 09]	A01 A02 A03 A05 A07 A08 A09 A10 A11	Preconfigured to "Mains decoupling"[1]
			A04 A06	Fixed to "Command: open MCB"[1]
57	60	Relay output [R 10]	A01 A02 A03 A04 A07 A08 A10 A11	Preconfigured to "Auxiliary services"[1]
			A05 A06 A09	Fixed to "Command: close GGB"[1]
58		Relay output [R 11]	A01 A02 A03 A04 A07 A08 A10 A11	Preconfigured to "Alarm class A and B"[1]
			A05 A06 A09	Fixed to "Command: open GGB"[1]
59		Relay output [R 12]	All	Preconfigured to "Alarm class C, D, E or F"[1]

[1] *configurable via LogicsManager*

Notes

- ***LogicsManager**: Using the function LogicsManager it is possible to freely program the relays for all application modes.*
- A01*: no breaker mode;*
  A02*: GCB open*
  A03*: GCB*
  A04*: GCB/MCB*
  A05*: GCB/GGB*
  A06*: GCB/GGB/MCB*
  A07*: GCB/LS5*
  A08*: GCB/L-MCB*
  A09*: GCB/GGB/L-MCB*
  A10*: GCB/L-GGB*
  A11*: GCB/L-GGB/L-MCB*
- ***N.O.**: normally open (make) contact*

3.3.11.1 Connecting 24 V Relays

NOTICE!
Damage to adjacent electronic components due to induced voltages

- Implement protection circuits as detailed below.

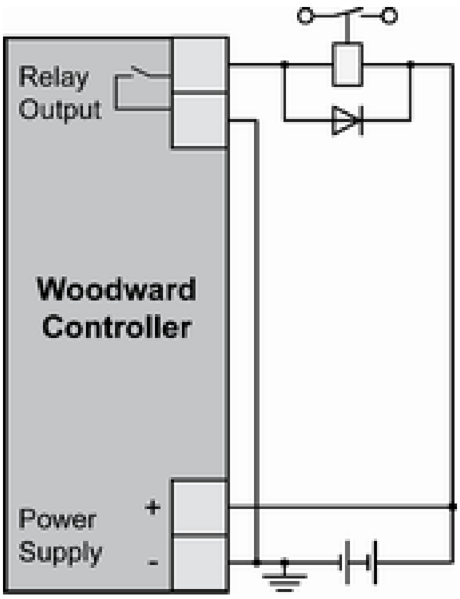


Fig. 53: Protection circuit (example)

Interferences in the interaction of all components may affect the function of electronic devices. One interference factor is disabling inductive loads, like coils of electromagnetic switching devices.

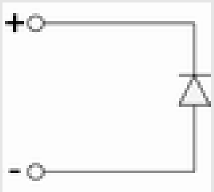
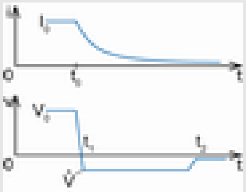
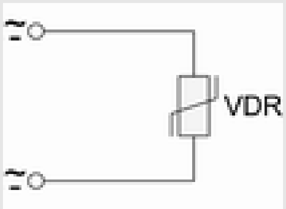
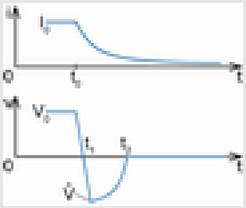
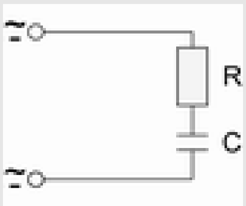
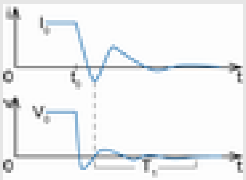
When disabling such a device, high switch-off induced voltages may occur, which might destroy adjacent electronic devices or result interference voltage pulses, which lead to functional faults, by capacitive coupling mechanisms.

Since an interference-free switch-off is not possible without additional equipment, the relay coil is connected with an interference suppressing circuit.

If 24 V (coupling) relays are used in an application, it is required to connect a protection circuit to avoid interferences.

Fig. 53 shows the exemplary connection of a diode as an interference suppressing circuit.

Advantages and disadvantages of different interference suppressing circuits are as follows:

Connection diagram	Load current / voltage curve	Advantages	Disadvantages
		Uncritical dimensioning Lowest possible induced voltage Very simple and reliable	High release delay
		Uncritical dimensioning High energy absorption Very simple setup Suitable for AC voltage Reverse polarity protected	No attenuation below VVDR
		HF attenuation by energy storage Immediate shut-off limiting Attenuation below limiting voltage Very suitable for AC voltage Reverse polarity protected	Exact dimensioning required

3.3.12 Analog Inputs (0 to 2000 Ohm | 0/4 to 20 mA | 0 to 1 V)

It is recommended to use two-pole analog senders for best possible accuracy.

*Connect the **resistive** analog input's return wires (GND) always to Engine Ground (terminal 15) and as close to the easYgen terminals as possible.*

*For two pole senders of **0/4 to 20 mA** or **0 to 1 V** sensors Engine Ground is no "must have".*

The following curves may be used for the analog inputs:

- Table A
- Table B
- Linear
- Pt100
- Pt1000
- AB 94099
- VDO 120° C
- VDO 150° C
- VDO 10 bar
- VDO 5 bar

The 9 setpoints of the free configurable Tables A and B can be selected for Type definition (parameters 1000, 1050, and 1100).

A catalog of all available VDO sensors is available for download at the VDO homepage (http://www.vdo.com)

Wiring senders

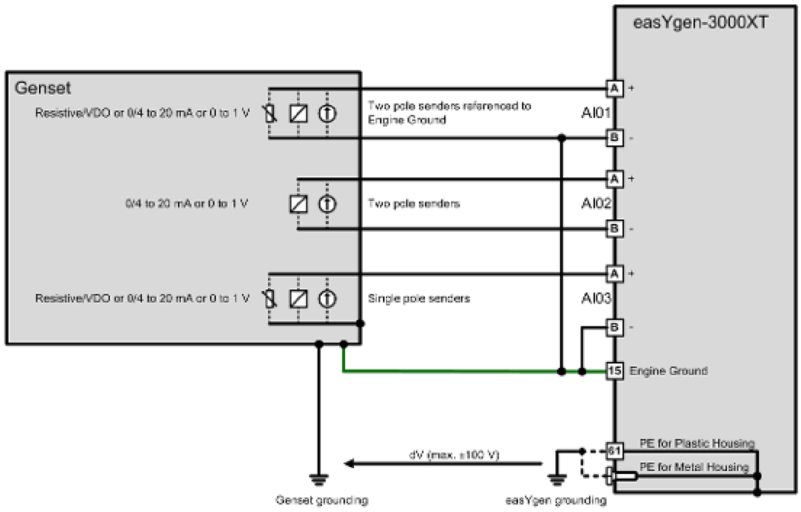


Fig. 54: Analog inputs - wiring senders

Terminal			Description
AI0 1	A	10	Analog input [AI 01 +]
	B	9	Analog input [AI 01 -] ground, connect with Engine ground terminal 15
AI0 2	A	12	Analog input [AI 02 +]
	B	11	Analog input [AI 02 -]
AI0 3	A	14	Analog input [AI 03 +]
	B	13	Analog input [AI 03 -] ground, connect with Engine ground terminal 15

CAUTION!

Mixed senders

When both types resistive sender **and** single pole sender are connected to the device, connection from *minus* (pins 9, 11, 13) should be made with short wire to the Engine Ground (pin 15) on input connector.

Wiring single and two-pole senders simultaneously

It is possible to combine single- and two-pole senders but with the lower accuracy.

3.3.13 Analog Outputs

The easYgen offers current, voltage or PWM analog outputs for different applications. Most commonly they are used for speed and voltage biasing.

Controller configuration can change the multifunction controller bias output signals. The analog outputs are galvanically isolated.

3.3.13.1 Analog Outputs (±20 mA, ± 10 V, PWM)

Controller wiring - two wires

Fig. 55: Analog controller output - two wires

CAUTION!
Connecting external power sources to the analog outputs may damage the device.

In case that higher permanent insulation voltages are required than described in the technical data, please install isolation equipment (isolation amplifier) for proper and safe operation.

Type	Terminal			Description
I Current **or** V* Voltage	A	16	+	Analog output [AO 01]
	B	17	GND	
		(Don't connect terminal 18!)		
I Current **or** V* Voltage	A	19	+	Analog output [AO 02]
	B	20	GND	

**) Internal shunt (resistor) is managed automatically.*

3.4 Setup Interfaces

NOTICE!
Avoid electrostatic discharge!
Before working with terminals please read and follow the instructions of chapter *"Electrostatic discharge" on page 31*.

For CAN and RS485 shielded cabling, no more than 25 mm wiring exposed without shield coverage are allowed at terminal plug side.

3.4.1 Interfaces overview

> ***Unshielded cable length***
>
> *For CAN and RS-485:*
>
> – *Cabling without shield coverage should be less than 25 mm.*

The following drawing shows all available interfaces of the device:

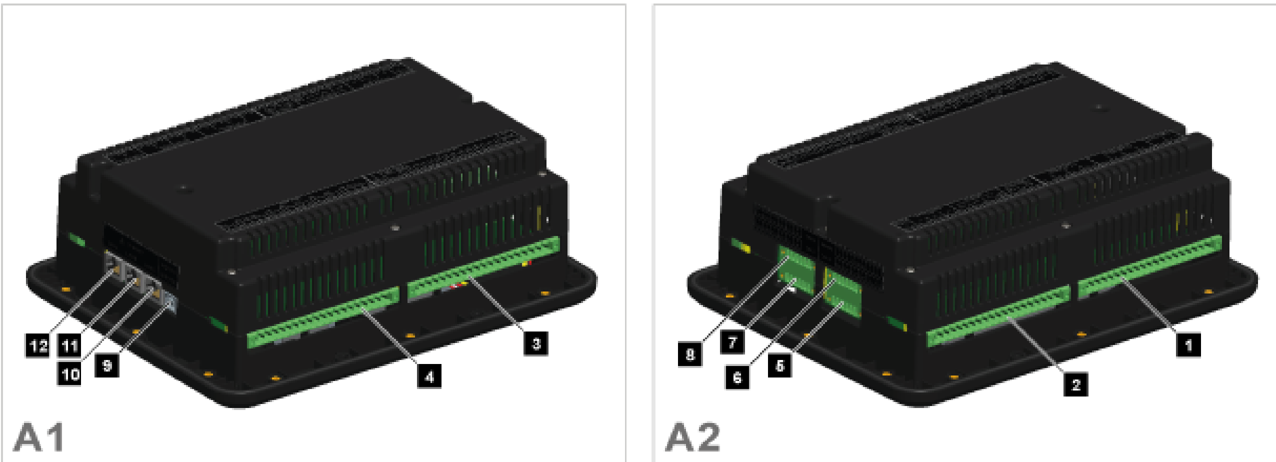


Fig. 56: easYgen-3500XT-P1 Series

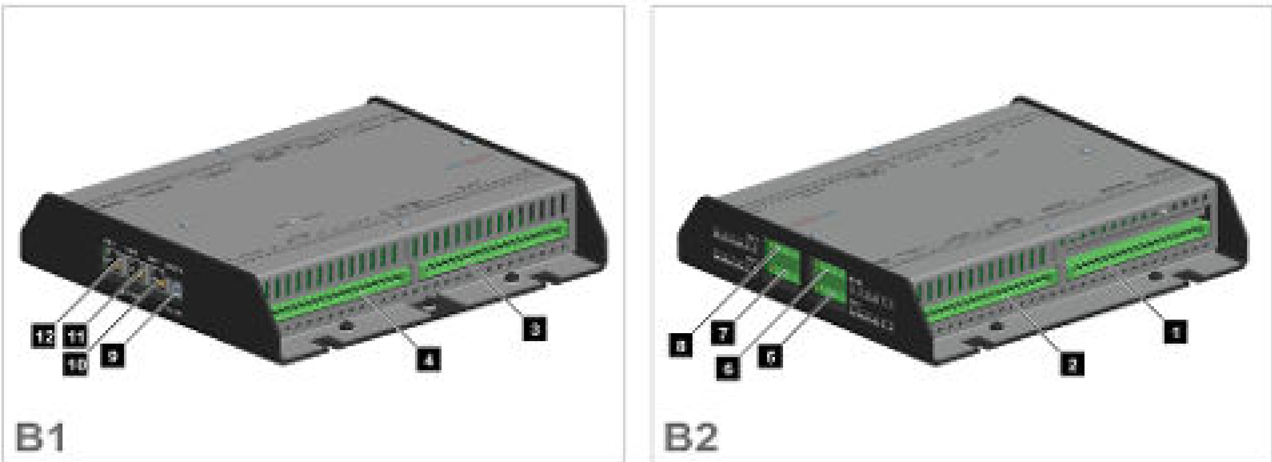


Fig. 57: easYgen-3400XT-P1 Series

- A easYgen-3500XT-P1(-LT) (plastic housing with display)
- B easYgen-3400XT-P1 (sheet metal housing)
- 1 Mains/generator/busbar PT terminal
- 2 Analog inputs/outputs, generator CT, and mains/GND current terminal
- 3 Discrete inputs, MPU, power supply, and D+ terminal
- 4 Relay outputs terminal
- 5 CAN bus interface connector CAN #2
- 6 RS-485 interface connector RS-485 #1
- 7 CAN bus interface connector CAN #1
- 8 CAN bus interface connector CAN #3
- 9 USB interface connector (2.0, slave) SERVICE port
- 10 ETHERNET interface connector (RJ-45) LAN C
- 11 ETHERNET interface connector (RJ-45) LAN B
- 12 ETHERNET interface connector (RJ-45) LAN A

3.4.2 RS-485 Interface

General notes

The easYgen must be configured for half- or full-duplex configuration.

Pin assignment

For location of interface 6 see *Chapter 3.4.1 "Interfaces overview" on page 83*.

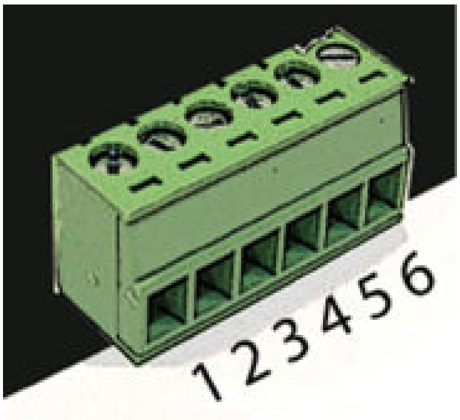


Fig. 58: screwable 6-terminal connector - RS-485

Terminal	Description	.. used for FULL duplex mode	... used for HALF duplex mode	A_{max}
1	A	A (RxD+)		1.5 mm²
2	B	B (RxD-)		1.5 mm²
3	GND	GND - local galvanically isolated		1.5 mm²
4	SHLD	Shield connected to earth via RC element		1.5 mm²
5	Y	Y (TxD+)	Y (TxD+ / RxD+)	1.5 mm²
6	Z	Z (TxD-)	Z (TxD- / RxD-)	1.5 mm²

Table 37: Pin assignment

RS-485 half-duplex

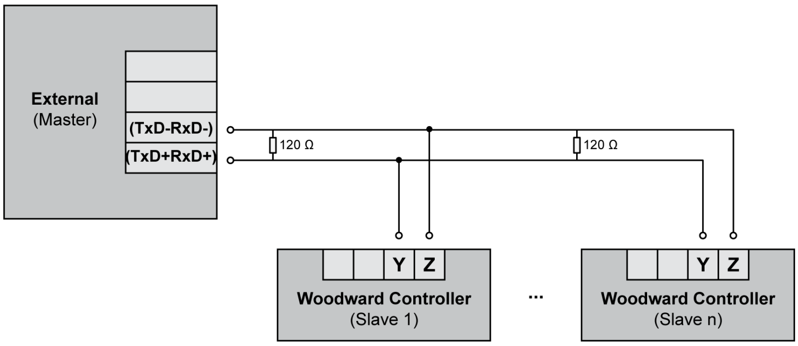


Fig. 59: RS-485 - connection for half-duplex operation (120 Ohms termination resistor at both ends)

RS-485 full-duplex

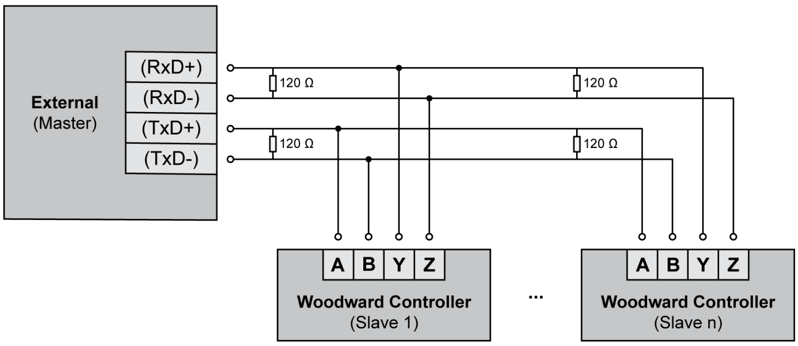


Fig. 60: RS-485 - connection for full-duplex operation

Shielding

easYgen-3000XT is prepared for shielding: Terminal 4 and the connector housing are internally grounded via an RC element. Therefore, they may either be grounded directly (recommended) or also via an RC element on the opposite connection.

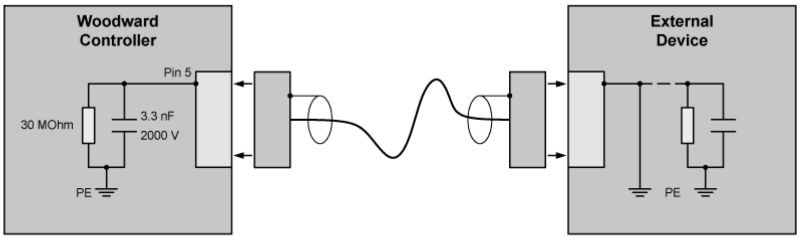


Fig. 61: Shielding preparation (internal RC element)

3.4.3 USB (2.0 slave) interface - Service Port

General notes

> ***Avoid electrostatic discharge!***
> *Avoid electrostatic discharge during USB cable connection to the unit.*

> *To connect this USB 2.0 (slave) device a USB cable with USB Type A (PC/laptop side) and Type B (Woodward device side) connectors is necessary.*
>
> *USB cable length shall be limited up to 3 m. It is recommended to use professional (high quality) USB cable: 28AWG/1P+24AWG/2C with good shielding.*

> ***Use USB service port for ToolKit connection***
> *The USB interface is a service port and the preferred ToolKit connection!*

'Read only' USB interface

For location see ↪ *Chapter 3.4.1 "Interfaces overview" on page 83*.

For others than ToolKit connection the USB interface is read-only!

It can be used for further service tasks from manufacturer's side.

Connecting it to a PC/laptop will display the USB interface available and all files prepared from Woodward manufacturing side. Read/write attributes of this service port are restricted to read only.

3.4.4 CAN Bus Interfaces

> ***Avoid electrostatic discharge!***
> *Avoid electrostatic discharge during cable connection to the unit.*

Pin assignment

For location of interface 5, 7, and 8 see *Chapter 3.4.1 “Interfaces overview” on page 83*.

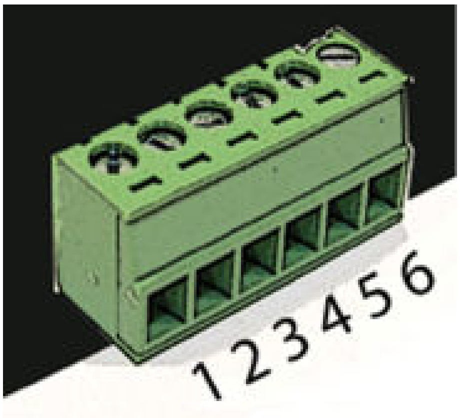


Fig. 62: screwable 6-terminal connector - CAN bus

Terminal	Description	A_{max}
1	GND - local galvanically isolated	1.5 mm^2
2	CAN-L	1.5 mm^2
3	Shield	1.5 mm^2
4	CAN-H	1.5 mm^2
5	Not connected	1.5 mm^2
6	Not connected	1.5 mm^2

Table 38: Pin assignment

Topology

> *Please note that the CAN bus must be terminated with a resistor, which corresponds to the impedance of the cable (e.g. 120 Ω, 1/4 W) at both ends.*
>
> *The termination resistor is connected between CAN-H and CAN-L.*

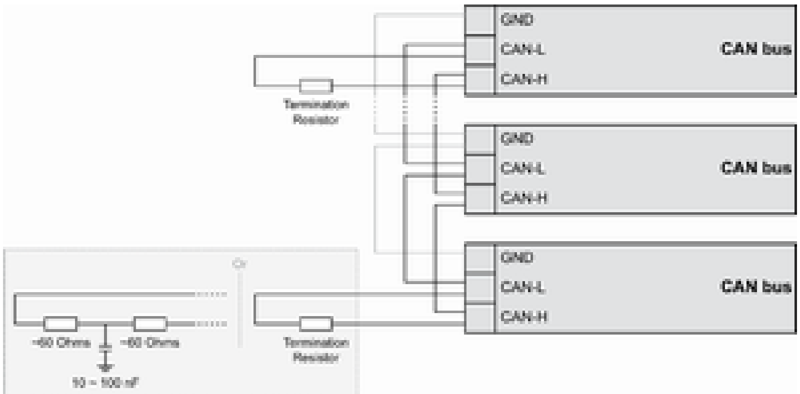


Fig. 63: CAN bus - termination

For very critical EMC conditions (many noise sources with high noise levels) and for high transmission rates we recommend to use the 'Split termination concept' as shown.

- Divide the termination resistance into 2x60 Ohms with a center tap connected to ground via a capacitor of 10 to 100 nF.

Maximum CAN bus length

The maximum length of the communication bus wiring is dependent on the configured baud rate. Observe the maximum bus length.

(Source: CANopen; Holger Zeltwanger (Hrsg.); 2001 VDE VERLAG GMBH, Berlin und Offenbach; ISBN 3-8007-2448-0).

Baud rate	Max. length
1000 kbit/s	25 m
800 kbit/s	50 m
500 kbit/s	100 m
250 kbit/s	250 m
125 kbit/s	500 m
50 kbit/s	1000 m
20 kbit/s	2500 m

Bus shielding

All bus connections of the easYgen are internally grounded via an RC element. Therefore, they may either be grounded directly (recommended) or also via an RC element on the opposite bus connection.

A shielded cable with shielded plug is required.

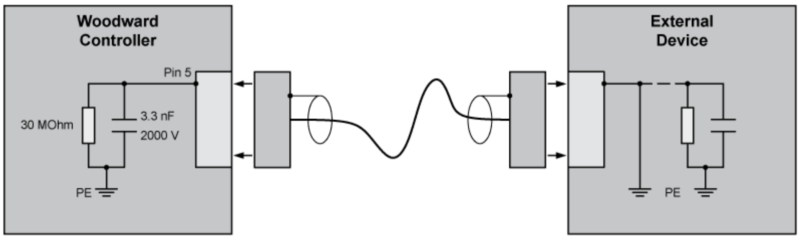


Fig. 64: Bus shielding (internal RC element)

Troubleshooting

> *If there is no data transmission on the CAN bus, check for the following common CAN bus communication problems:*
>
> – *A T-structure bus is utilized*
> – *CAN-L and CAN-H are switched*
> – *Not all devices on the bus are using identical baud rates*
> – *Termination resistor(s) are missing*
> – *The configured baud rate is too high for wiring length*
> – *The CAN bus cable is routed in close proximity with power cables*

> *Woodward recommends the use of shielded, twisted-pair cables for the CAN bus (see examples).*
>
> – *Lappkabel Unitronic Bus CAN UL/CSA*
> – *UNITRONIC-Bus LD 2×2×0.22*

3.4.5 Ethernet Interface (incl. Remote Panel)

This Ethernet interface 10/100Base-T/-XT complies with the IEEE 802.3 specifications.

> ***Avoid electrostatic discharge!***
> *Avoid electrostatic discharge during Ethernet cable connection to the unit.*

Pin assignment

For location of interfaces 10, 11, and 12 see *Chapter 3.4.1 "Interfaces overview" on page 83*.

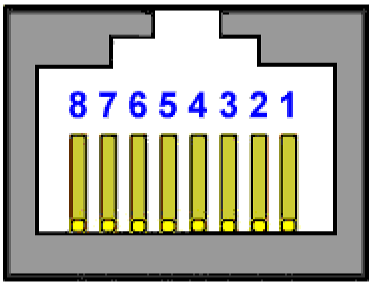


Fig. 65: RJ-45 connector - Ethernet

Pin	Description	10Base-T	100Base-T
1	Transmit Data+	TX+	TX+
2	Transmit Data-	TX-	TX-
3	Receive Data+	RX+	RX+
4	Not connected	NC	NC
5	Not connected	NC	NC
6	Receive Data-	RX-	RX-
7	Not connected	NC	NC
8	Not connected	NC	NC
		Notes NC: Not connected	

Table 39: Pin assignment

Visualization

Two LEDs (green and yellow) indicate communication status as well known by the standard.

- The green LED indicates the link activity: blinking during data transmission.
- The yellow LED indicates the link (speed) status:
  - 10MB – LED switched-OFF
  - 100MB – LED switched-ON

General notes

Ethernet category 5 (STP CAT 5) shielded cable is required with shielded plug RJ45. The chosen switch shall support a transmission speed of 10/100 Mb/s with a network segment expansion capability of 100 m.

> ***Flexibility***
> *All Ethernet ports have auto MDI/MDI-X functionality what allows to connect straight-through or crossover Ethernet cable.*
>
> *The Ethernet ports are named twice but mean the same: Ethernet #1 or Ethernet A; Ethernet #2 or B; and Ethernet #3 or C .*

Cable length / distance

The maximum length from connection to connection is 100 m. Some third party suppliers offer technology to expand the connection.

Topology

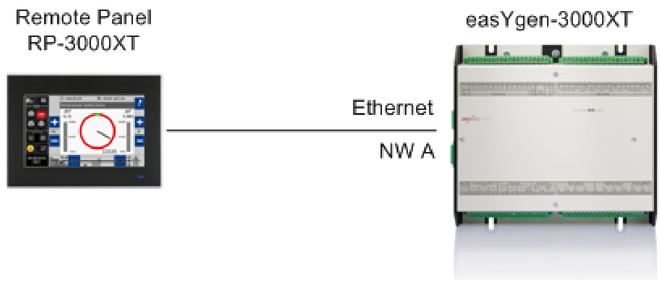


Fig. 66: Application Example: Simple constellation with easYgen-3000XT and RP-3000XT

> ***Remote Control***
> *The Woodward Remote Control is able to visualize the display of the remotely controlled device and to make front button and soft key related functionality available.*
>
> *Access via Remote Panel PR-3000XT is described in chapter and the Technical Manual "37593 RP-3000XT".*

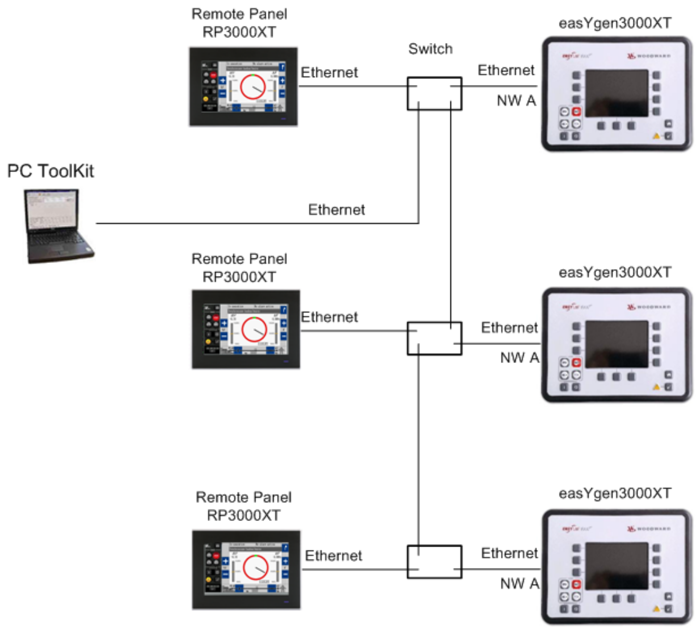


Fig. 67: Application Example: Multiple Generator operation with a ToolKit access point (A)

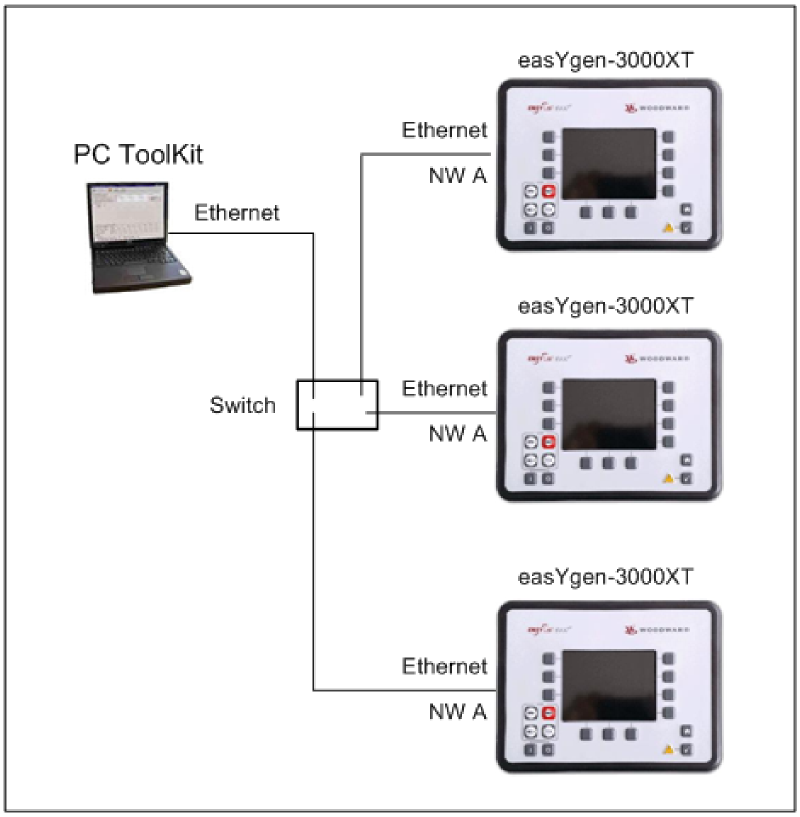


Fig. 68: Application Example: Multiple Generator operation with a ToolKit access point (B)

Troubleshooting

Check first the power supply of the switches.

Check the IP addressed of the single devices. See chapter ⮊ *Chapter 4.7.5 "Ethernet Interfaces" on page 472* for details.

4 Configuration

Parameter Numbers

All parameters are assigned a unique parameter identification number.

The parameter identification number may be used to reference individual parameters listed in this manual.

This parameter identification number is also displayed in the ToolKit configuration screens next to the respective parameter.

Values of variables and parameters

This device is working with variables and values in FLOAT format. This allows to handle values by number and exponent.

There is a need to convert FLOAT to INTEGER (32 bit) for common Data Protocols, communication with some PLCs, and for some display restrictions.

Rounding error

Numbers higher than 8388608 come with an rounding error of 0.005% of the number itself.

Displayed restrictions sample

Values of user defined tables (*"Parameter ➔ Configuration ➔ Configure Application ➔ Configure inputs/outputs ➔ Configure analog inputs ➔ General analog inputs ➔ User defined table A/B"*) have an input range from -900000.000 to 900000.000.

Type 12345.678 and ...

- ToolKit display will immediately change to 12345.680 for rounding error
- HMI/display shows 12345.678
- ... independent from where value is typed in (ToolKit or HMI/display)

Handle value and unit separately

Some parameters have a separate definition of value and unit. This flexibility comes with the need to take additional care for factorized units like "k..., M..., m..., µ..." multiplying or dividing the number of the value.

Values and units must fit

Device and software offer a very flexible handling of values with well defined selectable rules. It is on customers responsibility to combine what fits.

From device side it is neither restricted nor controlled to use values in a wrong way.

Values and units

V, kV, and %

FLOAT, INTEGER

Unit defined and definable

Configuration and Re-Booting

Wait before re-booting

Changing configuration/parameters becomes effective immediately. ***To be sure that the changes have been saved internally in the device needs max. 20 seconds.***

Menu structure (menu tree)

The menu structure of HMI/display and ToolKit is aligned.

Exceptions

- *The well introduced HMI/display softbutton [Next Page] is continued but in ToolKit named [STATUS MENU].*

  (In ToolKit [Next Page] is used to go to the next page.)
- *Some monitoring parameters in HMI/display are in ToolKit placed directly with it's settings e.g.: find 10341 [Freq. dep. derating of power] at*

  "Next page ➔ Setpoints ➔ Derating" in HMI/ display but

  "PARAMETER
  ➔ Configure: Configure application
  ➔ Configure controller: Load control
  ➔ General load control" in ToolKit
- *[Sequencing] in HMI/display comes with a sep- arate softbutton - ToolKit offers the information together with others as part of the [States easYgen/Sequencing] screen.*

The following drawing shows the first three (mayor) levels of easYgen-3400XT-P1/3500XT-P1 menu structure:

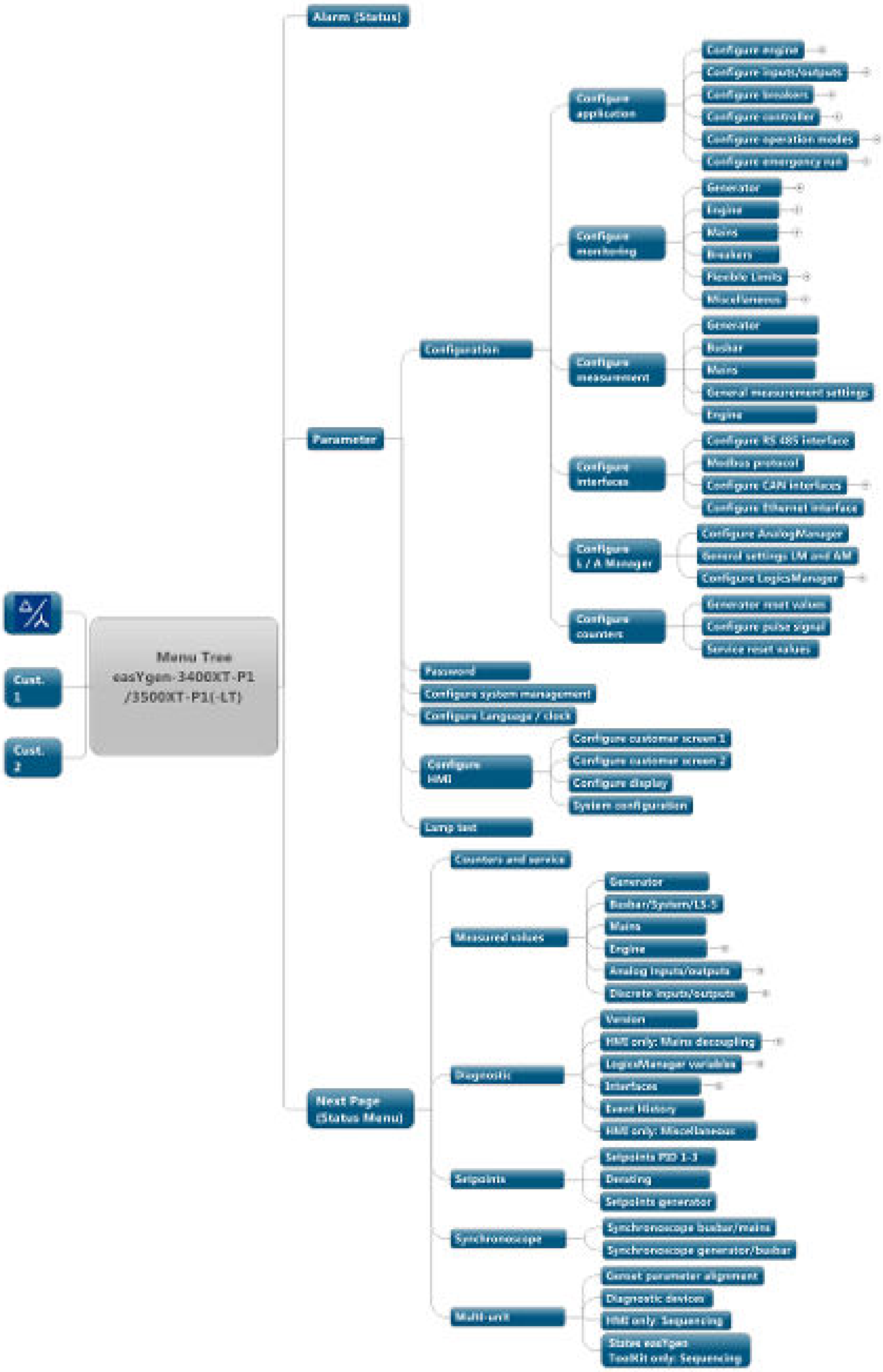


Fig. 69: Menu structure (menu tree) easYgen-3400XT-P1/3500XT-P1

4.1 Front Panel Access

> *The following chapters only apply to model with front panel and display.*

Front Panel / HMI / display

Please see chapter for detailed description of the front panel with display and buttons.

> *Buttons can be disabled by ToolKit with parameter* *12978 ↬ p. 141/↬ p. 930* *"Lock keypad".*

4.1.1 Basic Navigation

Main screen

After power-up the control unit displays the main screen / HOME screen (Fig. 70).

The main screen can be divided into the following basic sections:

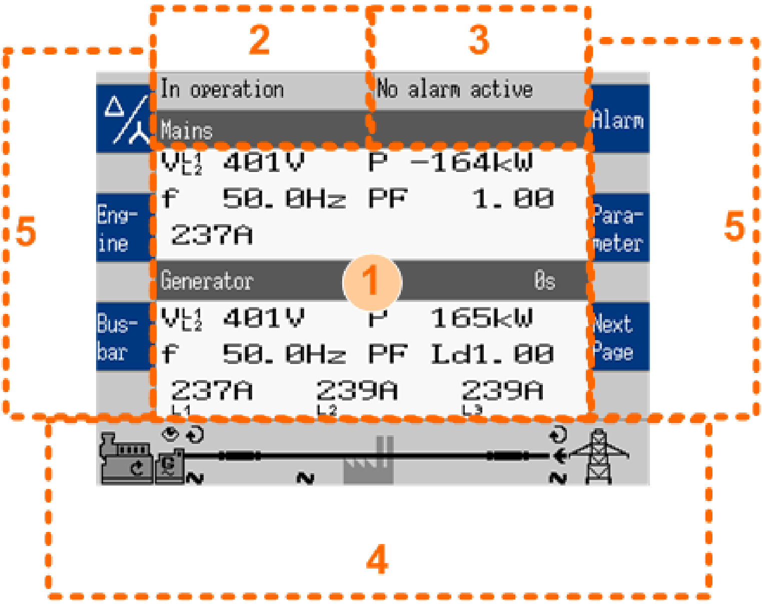


Fig. 70: Main screen

1 Values
2 Status Messages
3 Alarm Messages
4 Single Line Diagram
5 Current Softkey Functions

Values *[1]*

The "values" section (Fig. 70/1) of the screen illustrates all measured power related information including voltages, currents, frequencies, power, and power factor values.

> *If the mains data display is disabled, the main screen will only show generator data with bigger digits.*

> *The section's content changes based on the selected sub-menu screen.*
>
> *For information on specialized menu screens refer to ⇘ Chapter 4.1.5 "Specialized Menu Screens" on page 103*

Status messages *[2]*

The "status message" section (Fig. 70/2) of the screen shows the actual operating information.

> *For a list of all operation states refer to ⇘ Chapter 9.5.3 "Status Messages" on page 966.*

Alarm messages *[3]*

The "alarm message" section (Fig. 70/3) of the screen shows the last alarm message that is occurred and not yet acknowledged.

> *For a list of all alarm messages refer to ⇘ Chapter 9.5.4.2 "Alarm Messages" on page 971.*

Single line diagram *[4]*

The single line diagram (Fig. 70/4) shows the current status of the engine and power circuit breakers.

> *This section is also used for manual operation of the genset.*
>
> *For additional information refer to ⇘ Chapter 5.2.2 "Operating Mode MANUAL" on page 502.*

Softkeys *[5]*

The softkeys (Fig. 70/5) permit navigation between screens, levels and functions as well as configuration and operation.

Group	Softkey	Caption	Description
Display		Display Mode	Next step to display all measured (delta/wye) voltages one after the other.
	Cust. 1	Customer configurable screen 1 (and 2)	Change to "customer specific screen 1 (or 2)" **Notes** The name of this softbuttons is configurable, too.

Group	Softkey	Caption	Description
	CAN 1	CAN 1	Change to "CAN interface 1 state" screen.
	CAN 2	CAN 2	Change to "CAN interface 2 state" screen.
	Ext. I/O	Ext. I/O	Change to external discrete I/Os screen.
	Int. I/O	Int. I/O	Change to internal discrete I/Os screen.
		Reset Value Display Reset Maintenance	Reset the maximum value display. Reset the maintenance counter.
Operation	+	Increase Value	Increase selected value.
	−	Decrease Value	Decrease selected value.
	↵	Confirm Input	Confirm and store changed value.
	✓	Acknowledge Message	Acknowledge/Delete message/event.
		Open Breaker	Open mains/generator breaker (MANUAL mode).
		Close Breaker	Close mains/generator breaker (MANUAL mode).
	Code req.	Code req.	Request a blink code for one error message from the ECU. Repeated pressing of this softkey displays all stored error messages (J1939 Special Screen).
	Reset	Reset	Reset the blink code (J1939 Special Screen).
Navigation	↑	Move Up	Select previous value/entry.
	↓	Move Down	Select next value/entry.
	→	Move Cursor Position	Move cursor position
		Return	Return to previous menu.
	Next Page	Next Page	Go to following page/screen of the current menu.
	Para-meter	Parameter Screen	Show parameter screen.
	Alarm	Alarm Screen	Show alarm screen.

Status symbols

Menu screen	Symbol	Caption	Description
Main Screen		Voltage Display Mode	The index of the symbol indicates whether delta or wye voltage is displayed and which phases are displayed.
Single Line Diagram		Rotating Field CW	Generator, mains or busbar rotating field moves clockwise.
		Rotating Field CCW	Generator, mains or busbar rotating field moves counter-clockwise.
		Power Detected	Power is detected at the respective measuring point (generator, busbar or mains).
		Monitoring Enabled	Indicates that the engine delayed monitoring has expired and the monitoring functions are enabled.
		Power Imported	Power is imported (at mains interchange).
		Power Exported	Power is exported (at mains interchange).
Alarm List		Alarm Condition Present	Indicates that corresponding alarm condition is still present.
		Alarm class A/B/C/D/E/F present	Symbol with "!" indicates that an alarm of class A/B/C/D/E/F is present.
		Alarm class A/B/C/D/E/F not present	Symbol without "!" indicates that an alarm of class A/B/C/D/E/F is not present.
Setpoints		Generator Power	Indicates the generator power (actual value).
		Mains Power	Indicates the mains power (actual value).
Synchroscope		Phase Angle	Indicates the actual phase angle between busbar and mains or busbar and generator.
Sequencing		Breaker Closed	GCB of respective genset in sequence is closed.
		Breaker Open	GCB of respective genset in sequence is open.
		Add-on	Generator is becoming "Add-on" to the (multiple) genset system.
		Add-off	Generator is going "Add-off" from the (multiple) genset system.
LogicsManager		Delay ON	Delay before output becomes TRUE.
		Delay OFF	Delay before output becomes FALSE.
		TRUE/enabled	Variable is TRUE (LogicsManager). The bit is enabled (CAN Interface). Relay activated (Discrete Outputs)
		FALSE/disabled	Variable is FALSE (LogicsManager). The bit is disabled (CAN Interface). Relay deactivated (Discrete Outputs)

The following chapters list notes related to the specific menu screens.

For information on standard softkeys and status symbols refer to ↪ Chapter 4.1.1 "Basic Navigation" on page 94.

4.1.2 The HOME Screen

General notes

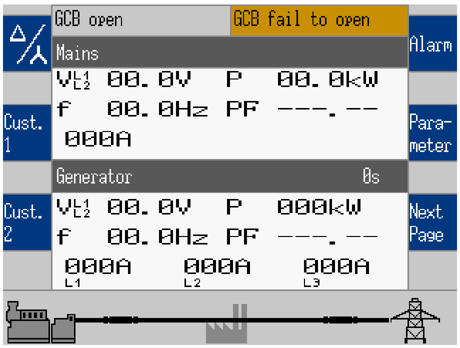


Fig. 71: HOME page/screen

- The "Home" button is a one-click way back to the overview starting point: the HOME page / HOME screen
- The "Home Screen" offers display alternatives via parameter 4103 ↪ p. 141 *"Home screen data"*
  - Generator
  - Generator/Mains
  - Generator/Busbar
  - Generator/Engine
  - Generator/LS-5
- To display the single line diagram with/without mains is selectable via parameter 4129 ↪ p. 141 *"Oneline diagram with mains"*
- **Two customizable buttons** enable selection of indications to display engine and auxiliary values (full access via ToolKit, name/description cannot be changed via HMI)

  Find menu: *"Parameter ➔ Configure HMI ➔ Configure customer screen x"*
- Two display brightness levels can be switched by LogicsManager. Can be used for e.g.:
  - Key activation determined
  - Brightness reduction on navigation bridge (vessels)
  - Saving energy

    Find menu: *"Parameter ➔ Configure HMI ➔ Configure display"*
- Lock keypad function is determined by LogicsManager 12978 ↪ p. 141/↪ p. 930. Result is available as logical command variable 11924 ↪ p. 910/↪ p. 921 (and can be used with 86.30).

  Find menu (ToolKit only!): *"Parameter ➔ Configure HMI ➔ Configure display"*

Display alternatives

The HOME screen allows a number of pre-selectable and soft-button controlled display variants.

- Generator
  – Voltages (pp - pn) - selectable via softbutton *[1]*
  – Power
  – Power Factor PF
  – Frequency
  – Currents (L1, L2, L3)
- Generator/Mains
  – Generator values as described above and additionally for Mains
  – Voltage
  – Frequency
  – Current
  – Power
  – Power factor
- Generator/Busbar
  – Generator values as described above and additionally for Busbar
  – Voltage
  – Power
  – Frequency
- Generator/Engines
  – Generator values as described above and additionally for Engine
  – Engine speed (rpm)
  – Oil pressure (bar or psi)
  – Water temperature (°C or °F)
  – Operating hours (h)
  – Battery voltage (V)
  – Fuel level (%)
- Generator/LS-5
  – Generator values as described above and additionally for LS-5
  – Voltage
  – Power
  – Frequency

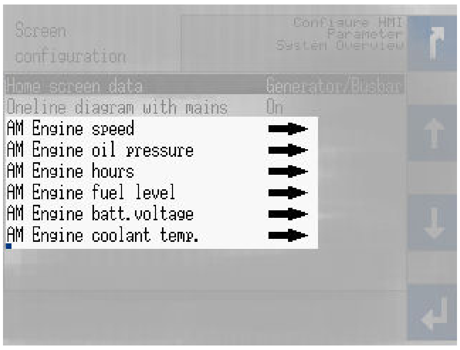


Fig. 72: AnalogManagers for "Engine" values at Home Screen

"Engines" parameter selection

The values to be displayed at "Engines" can be selected via AnalogManager definition of the parameters at "Parameter ➔ Configure HMI ➔ Screen configuration". Menu texts and symbols cannot be changed!

4.1.3 Customer Screens

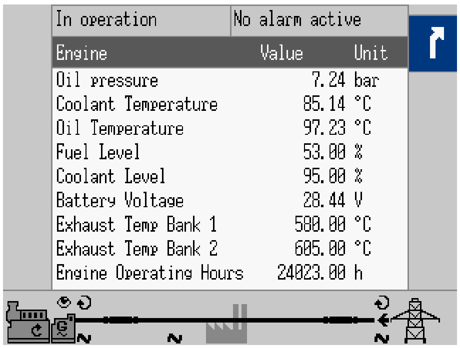


Fig. 73: Customer Screen sample: "Engine"

Available at HOME page, two softbuttons give one-click access to customer specific (monitoring) screens.

> *Full functionality available via ToolKit. HMI allows access to the AnalogManager but not to the text fields [Description] and [Unit].*

Find menu: *"Parameter ➔ Configure HMI ➔ Configure customer screen x ➔ AM Customer screen x.x"*

How to customize screens via ToolKit?

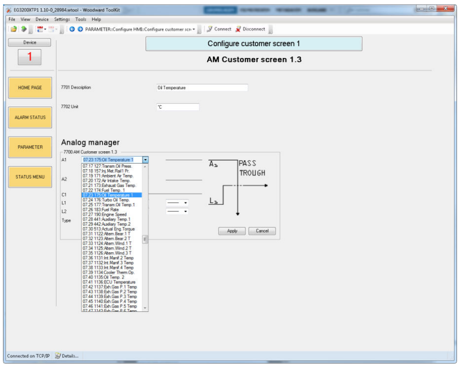


Fig. 74: Customer screen: setting sample

Two customer specific named screens enable flexible configuration of up to 18 values. Each displayed with Description (customer specific text), the result of a free configurable AM, and (a customer specific text for) Unit.

Customize via ToolKit	Parameter	Description
Configure homepage button names for screen 1 and screen 2:		
Screen/button Name	14895, 14897	Button text, displayed at easYgen-XT HMI homepage **Notes** The display allows two rows with five letters each. Use <WBR> for row separator because a blank is taken as one letter. If the text is too long it will not be visible and an "empty/clear button" will appear! We propose to check input immediately by refreshing home screen.
Configure each row of the customer screens with:		
Description	7691, 7696, 7701, ..., 7776	Text displayed
Value	AM 7690, 7695, 7700, ..., 7775	AnalogManager to select parameter for display. Additionally available via HMI, too.
Unit	7692, 7697, 7702, ..., 7777	Text displayed

4.1.4 Standard Menu Screens

The following chapters list standard menu screens, where all user input is handled similarly.

For information on standard softkeys and status symbols refer to *↳ Chapter 4.1.1 "Basic Navigation" on page 94.*

For information on all other menu screens refer to *↳ Chapter 4.1.5 "Specialized Menu Screens" on page 103.*

4.1.4.1 Navigation Screens

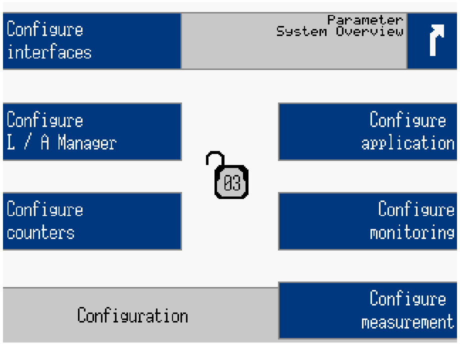


Fig. 75: Navigation screen (example)

Navigation screens offer access to sub-menu screens via the displayed softkey.

Navigation screens samples:

Parameter, Configuration, Measured values, Synchroscope, Engine (J1939), Diagnostic ...

➔ Press the desired softkey to change to a sub-menu screen.

Sub-menu entries are only displayed if the code level needed to access them is the same/or higher than the displayed code level in the center of the navigation screen.

4.1.4.2 Value Setting Screens

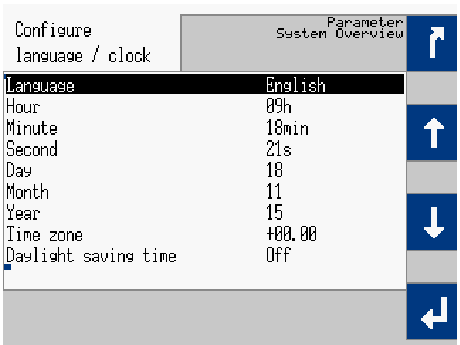


Fig. 76: Value setting screen (example)

At value setting screens the settings of the parameters can be changed.

Value setting screens samples:

Configure language / clock, Configure display, Password, Configure application ...

➔ Use the following softkeys in a value setting screen to select, change and confirm a setting.

Softkey	Description
↑	Select previous value/entry.
↓	Select next value/entry.
+	Increase selected value.
−	Decrease selected value.
↵	Confirm and store changed value.

4.1.4.3 Status/Monitoring Screens

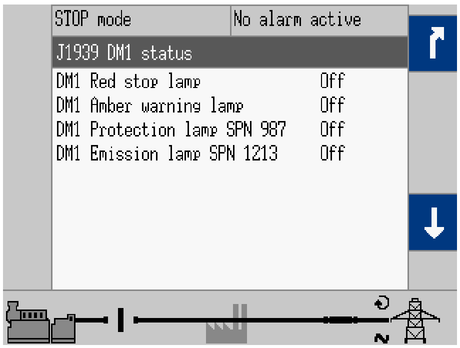


Fig. 77: Status/Monitoring screen (example)

Status/Monitoring screens display monitored values or set parameters.

Status/Monitoring screen	Notes
Generator	Which values are shown in the display and whether they are correct depends on the measurement type.
Busbar/System/LS-5	Which values are shown in the display and whether they are correct depends on the measurement type.
Mains	Which values are shown in the display and whether they are correct depends on the measurement type.
Analog inputs/outputs	The analog outputs are displayed as a percentage of the selected hardware range, i.e. 50% of a 0 to 20 mA output refer to 10 mA or alternatively as absolute values (depending on selected parameters).
Discrete inputs/outputs	The configured logic for the discrete input "N.O./N.C." will determine how the easYgen reacts to the state of the discrete input. If the respective DI is configured to N.O., the unit reacts on the energized state, if it is configured to N.C., it reacts on the de-energized state.
Counters and service	For additional information on setting/resetting counters refer to *Chapter 4.10 "Configure Counters" on page 495.*
Engine	—
Engine (J1939)	—
J1939 Analog values	—
J1939 Status	—
Actual date and time	—
Version	—
Load diagnostic	—

Table 40: Status/Monitoring screens samples

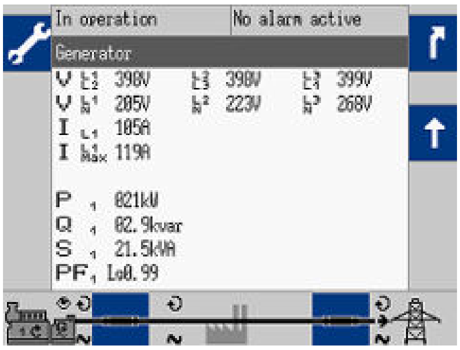


Fig. 78: Monitoring screen 2nd page (example)

If a softkey appears with a wrench symbol it is possible to reset the peak hold value(s).

4.1.5 Specialized Menu Screens

4.1.5.1 HOME Screen Voltage Display

The softkey *"Display mode"* on the main screen "HOME" changes the type of voltage display.

The amount of information available from the system depends on how the measuring is configured in the control unit.

The following tables illustrate what values are available depending on the configured measurement type:

	The displayed voltages ...			Displayed at parameter setting			
Press	**Symbol**	**Type**	**Measure**	**3Ph4W**	**3Ph3W**	**1Ph2W**	**1Ph3W**
0× (6×)		Delta	L1-L2	Yes	Yes	Yes[1]	—
1×		Delta	L2-L3	Yes	Yes	—	—
2×		Delta	L3-L1	Yes	Yes	—	Yes
3×		Wye	L1-N	Yes	—	Yes[1]	Yes
4×		Wye	L2-N	Yes	—	—	—
5×		Wye	L3-N	Yes	—	—	Yes

Table 41: Measuring point - generator

[1] Depends on setting of parameter 1858 *p. 429.*

	The displayed voltages ...			Displayed at parameter setting			
Press	**Symbol**	**Type**	**Measure**	**3Ph4W**	**3Ph3W**	**1Ph2W**	**1Ph3W**
0× (6×)		Delta	L1-L2	Yes	Yes	Yes[1]	—
1×		Delta	L2-L3	Yes	Yes	—	—

	The displayed voltages ...			Displayed at parameter setting			
Press	Symbol	Type	Measure	3Ph4W	3Ph3W	1Ph2W	1Ph3W
2×		Delta	L3-L1	Yes	Yes	—	Yes
3×		Wye	L1-N	Yes	—	Yes[1]	Yes
4×		Wye	L2-N	Yes	—	—	—
5×		Wye	L3-N	Yes	—	—	Yes

Table 42: Measuring point - mains

> [1] *Depends on setting of parameter 1858 ⇨ p. 429.*

4.1.5.2 Alarm List

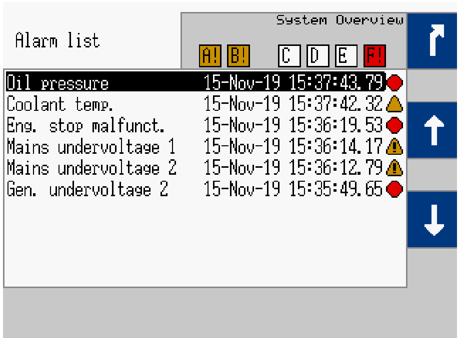


Fig. 79: Alarm List screen

All alarm messages, which have not been acknowledged and cleared, are displayed. Each alarm is displayed with the alarm message and the date and time of the alarm occurred in the format `yy-mon-dd hh:mm:ss.ss`.

> *Self-acknowledging alarm messages get a new timestamp when initializing the unit (switching on).*

Symbol/Softkey	Description
	Indicates that corresponding alarm condition (class A/B) is still present.
	Indicates that corresponding alarm condition (class A/B) is no longer present.
	Indicates that corresponding alarm condition (class C/D/E/F) is still present.
	Indicates that corresponding alarm condition (class C/D/E/F) is no longer present.
	Symbol with "!" indicates that an alarm of class A/B/C/D/E/F is present. ■ Amber color = alarm class A/B ■ Red color = alarm class C/D/E/F
	Symbol without "!" indicates that an alarm of class A/B/C/D/E/F is not present.
✓	Acknowledge the selected alarm message (displayed inverted).

Acknowledgment is only possible, if the alarm condition is no longer present. If the Alarm LED is still flashing (an alarm is present, which has not yet been acknowledged as 'Seen'), this softkey resets the horn and acknowledges the alarm as 'Seen'.

4.1.5.3 Event History

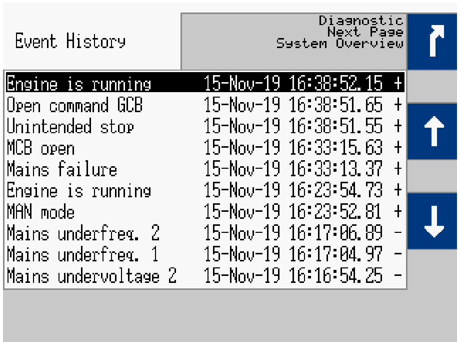


Fig. 80: Event History screen

This screen displays system events. A date/time stamp is added to each entry!

Symbol/Softkey	Description
+	Indicates when a condition was activated
-	Indicates when a condition was de-activated

4.1.5.4 Sequencing

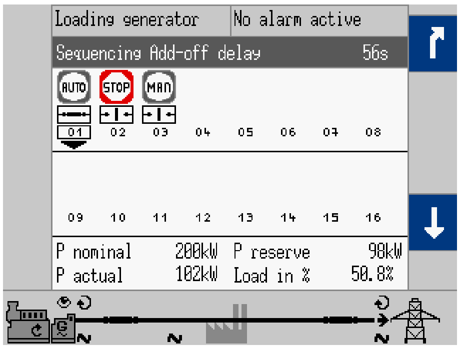


Fig. 81: Sequencing screen

The sequencing screen shows all gensets participating in load sharing. The operation mode of each genset as well as the state of its GCB is shown on this screen.

Symbol	Description
	AUTOMATIC Mode is active
	MANUAL Mode is active
	STOP Mode is active
	TEST Mode is active
	GCB of respective genset in sequence is closed.
	GCB of respective genset in sequence is open.
	Own easYgen device number
Sequence is running with respect to the settings e.g., the sequencing timing - see table below:	
	Generator is becoming "Add-on" to the (multiple) genset system.
	Generator is going "Add-off" from the (multiple) genset system.

The remaining time is displayed on the upper right side on the grey bar "Sequencing ...", see table below:

"..." text on the grey bar	Description	Parameter / ID
Sequencing Add-on delay ... s	Shows the remaining time until the own generator is add-on	Add-on delay, 13274 ↳ p. 970
Sequencing Minimum run time ... s	Shows the remaining time the own generator is running at minimum	Minimum run time, 13276 ↳ p. 970
Sequencing Add-off delay ...s	Shows the remaining time until the own generator is add-off	Add-off delay, 13275 ↳ p. 970

The bottom field displays the actual load sharing values. If this device is not participating in load sharing, "LD start stop Off" is displayed here.

4.1.5.5 States easYgen

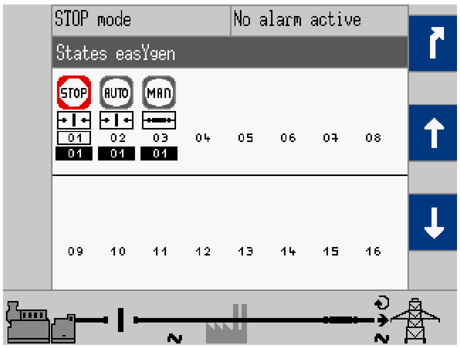


Fig. 82: States easYgen screen

The states of the easYgen devices are displayed. The operation mode of each genset as well as the state of its GCB is shown on this screen.

Symbol/Softkey	Description
	AUTOMATIC Mode is active
	MANUAL Mode is active
	STOP Mode is active
	TEST Mode is active
	GCB of respective genset in sequence is closed.
	GCB of respective genset in sequence is open.
	Own easYgen device number
	Other easYgen device numbers
	Segment number

4.1.5.6 States LS-5

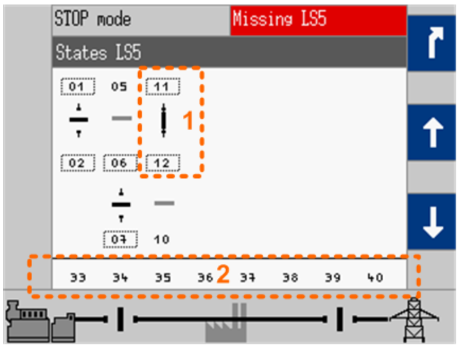


Fig. 83: States LS-5 screen

The states of the LS-5 devices are displayed.

Symbol/Softkey	Description
1: Segment numbers with switch in between	
	Segment numbers and breaker switch: opened/closed
	Segment numbers and isolation switch: opened/closed
	Frame around number indicates voltage and frequency are in range
	Dotted frame around number indicates voltage or frequency are not in range but even not Dead busbar
	NO frame around number indicates dead busbar
2: Device numbers (segments above and devices are aligned)	
	LS-5 device numbers

4.1.5.7 Genset Parameter Alignment

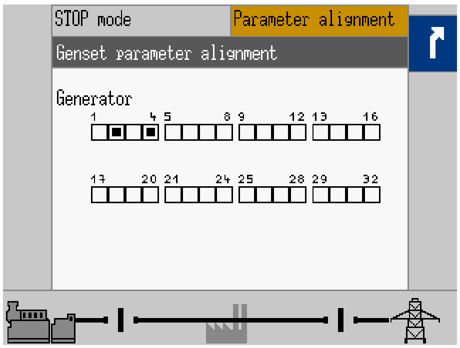


Fig. 84: Genset parameter alignment screen

This screen displays easYgen devices configured differently than the LDSS setting of your current device.

Symbol	Description
	The easYgen uses the same configuration as your current device.
	The easYgen uses a different configuration than your current device.

4.1.5.8 Diagnostic devices

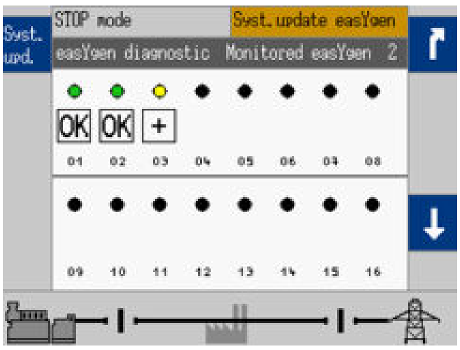


Fig. 85: Diagnostic screen example (HMI)

This screen displays the diagnostic status (the current communication state of the load share and system bus) of the accepted easYgen and/or LS-5 devices. Refer to ↪ *Chapter 4.5.6.15.2 "Diagnostic Screens: System Status" on page 425* for details.

4.1.5.9 Setpoints generator

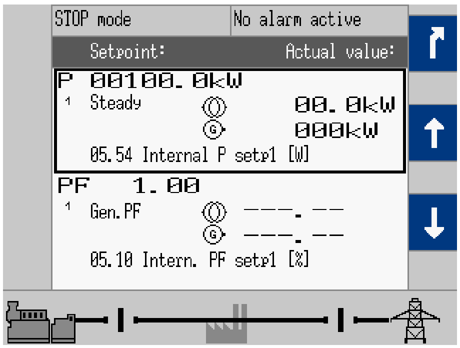


Fig. 86: Setpoints screen 1: P and PF/kvar

The setpoint is displayed on the left and the actual value is displayed on the right half of the screen.

The source, which is used for setpoint 1 or setpoint 2, is displayed with the respective AnalogManager function number.

The setpoints may only be adjusted if the respective controller is enabled. Frequency and voltage may be adjusted within the configured operating limits.

Active power may be adjusted between 0 and the configured load control setpoint maximum. The power factor may be adjusted between 0.71 leading and 0.71 lagging.

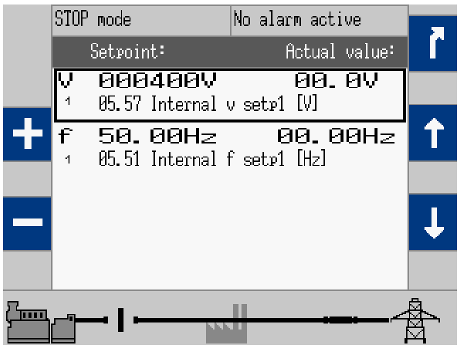


Fig. 87: Setpoints screen 2: V and f

Symbol/Softkey	Description
	Indicates the generator power (actual value).
	Indicates the mains power (actual value).
+	Raise the selected setpoint.
−	Lower the selected setpoint.

Manual mode and Auto mode do have separate setpoints. The Manual mode setpoints are temporary and can be set via front panel softkeys only.

Setpoint for ...	... in AUTO mode	... in MANUAL mode	... in TEST mode
Load	5542	5529	5542
Reactive power	5646		5646
Power factor	5641	5623	5641
Voltage	5640	5605	5640
Frequency	5541	5509	5541

ToolKit's setpoint page "STATUS MENU | Setpoints" gives an overview.

4.1.5.10 Setpoints PID1 - PID3

Menu path for configuration: *"Parameter ➔ Configuration ➔ Configure application ➔ Configure controller ➔ Miscellaneous ➔ PID x control"*

The PID screens enable direct access to PID control settings.

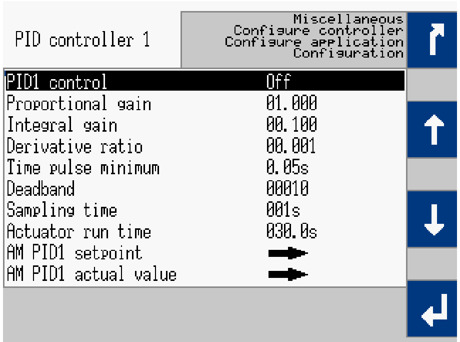


Fig. 88: PID1(-3) screen 1

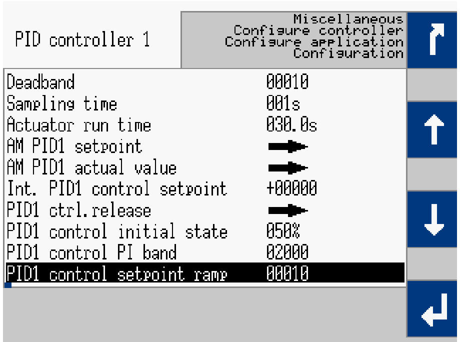


Fig. 89: PID1(-3) screen 2

Menu path for visualization: *"Next page ➔ Setpoints ➔ Setpoints PID 1-3"*

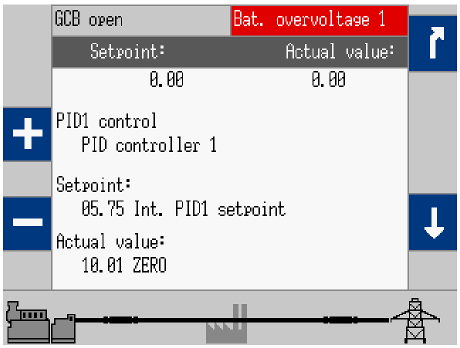


Fig. 90: PID1(-3) visualization screen

4.1.5.11 Synchroscope (Generator/Busbar And Busbar/Mains)

The needle indicates the actual phase angle between busbar and generator or mains.

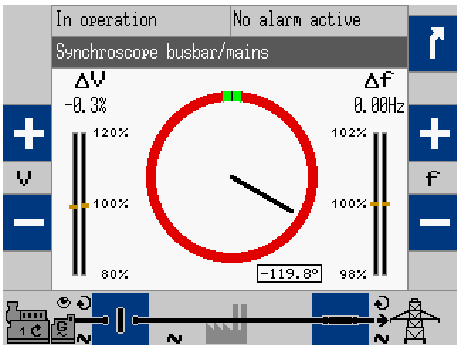


Fig. 91: Synchroscope screen (example)

> *Please take care for compensation settings with parameters 8825 ➪ p. 225 [Phase angle compensation GCB] and 8824 ➪ p. 225 [Phase angle GCB].*
>
> *If phase angle compensation 8825 ➪ p. 225 is active the compensated values are taken for synchroscope display (and synchronization)!*

WARNING!
Ensure correct synchronization configuration to avoid generator destructive power!

The 12 o'clock position on the top means 0° and the 6 o'clock position on the bottom means 180°.

The actual phase angle is indicated on the bottom of the screen. The maximum positive and negative phase angles are indicated 'green'. The length of the green part changes according to the parameters.

The frequency and voltage differences are indicated on top of the bargraphs.

Symbol/Softkey	Description
+	Operating mode MANUAL: Raise voltage/frequency.
−	Operating mode MANUAL: Lower voltage/frequency.

4.1.5.12 LogicsManager Conditions

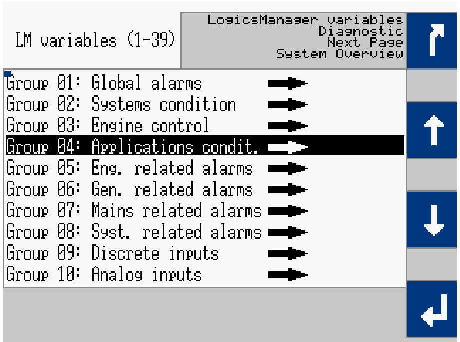


Fig. 92: LogicsManager conditions screen

This screen displays the conditions of all LogicsManager command variables, which are located in their respective groups.

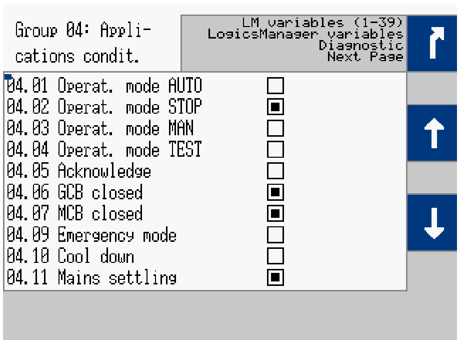


Fig. 93: Command variables screen (example)

Symbol	Description
↵	Select the highlighted command variable group and display the state of the command variables in this group.
▣	Variable is TRUE.
□	Variable is FALSE.

4.1.5.13 LogicsManager

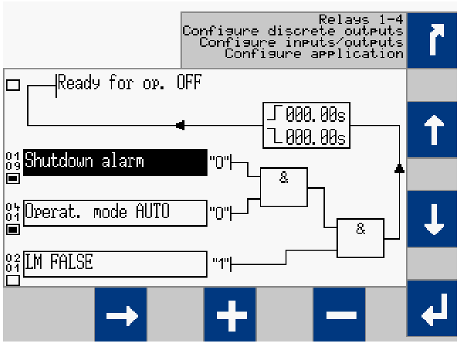


Fig. 94: LogicsManager screen

Some parameters of the easYgen are configured via the LogicsManager.

➔ Configure a logical operation using various command variables, signs, logical operators, and delay times to achieve the desired logical output.

Symbol/Softkey	Description
	Delay before output becomes TRUE.
	Delay before output becomes FALSE.
	State of the command variable is TRUE.
	State of the command variable is FALSE.
	Command variable selection field: Change the command variable group. Time delay configuration field: Change the cursor position.

> ***Help screen***
>
> *Help screen (displays logical operators) can be found at "Parameter ➔ Configuration ➔ Configure L/A Manager ➔ General settings LM and AM / Help for ASA/IEC symbols"*

4.1.5.14 Mains Decoupling Threshold

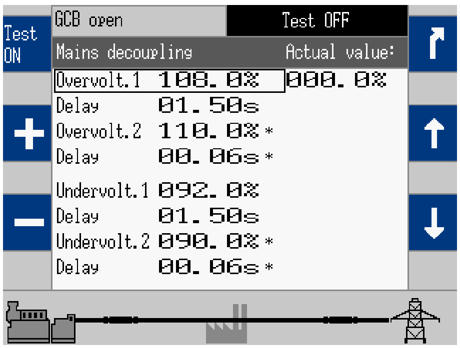


Fig. 95: Mains decoupling screen 1

Symbol/Softkey	Description
 Test ON	Starts a special TEST mode which allows mains decoupling test independent from breaker status (even if not mains parallel; GLS open, no rotation of prime mover/generator).
 Test OFF	Stops the TEST mode so mains decoupling is possible if system is mains parallel only.

Symbol/Softkey	Description
	Notes: TEST mode is deactivated not only by this button but too: ■ ... if firing speed is reached or ■ ... automatically after 60 minutes
*	Indicates parameters that are part of the mains decoupling configuration.

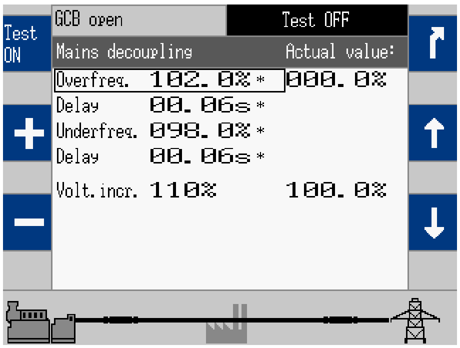


Fig. 96: Mains decoupling screen 2

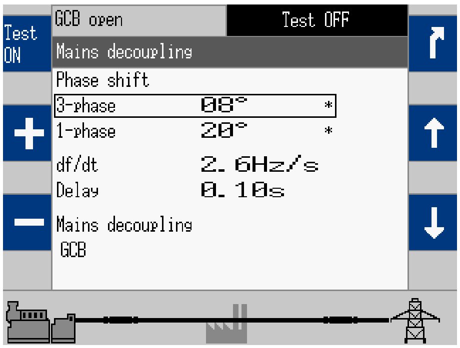


Fig. 97: Mains decoupling screen 3

4.1.5.15 Test Mains Decoupling (VDE AR-N 4105)

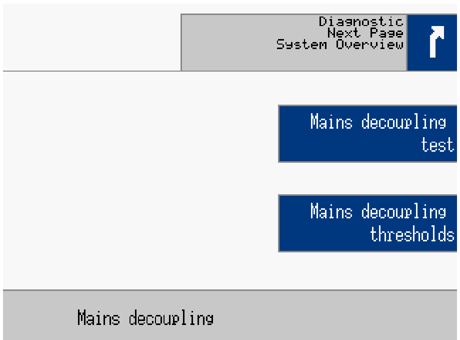


Fig. 98: Test mains decoupling selection screen

VDE AR-N 4105 is asking for a test button.

> ***Restricted Access***
> *The function Mains Decoupling Test is available on Code level CL3. Code levels CL0 to CL2 are intentionally not supported. Refer to ⇘ Chapter 4.3.4 “Enter Password” on page 143 for details.*

Mains decoupling test is running after the warning is accepted.

The Mains decoupling test opens the selected breaker for mains decoupling (parameter 3110 ⇘ p. 363).

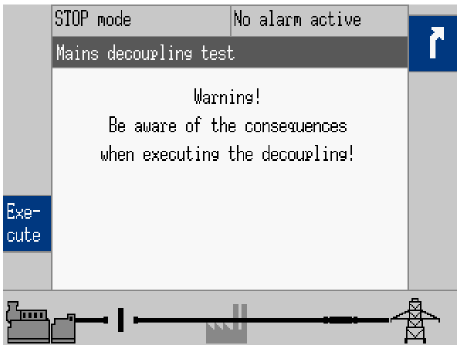


Fig. 99: Security query mains decoupling test

CAUTION!

This function is independent from the breaker status and is active for 1 sec.

No thresholds are considered.

As long as the decoupling function is executed the *"Execute"* button and the warning text are faded out.

4.1.5.16 CAN Interface 1 State

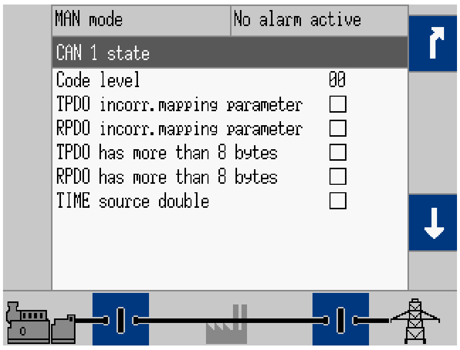


Fig. 100: CAN interface state screen (example)

Symbol	Description
■	State is TRUE
□	State is false

Table 43: Graphic assignments

Section		Description
Code level	00	Current code level of CAN1 connection
TPDO has incorrect mapping parameters	■	State is TRUE/false
RPDO has incorrect mapping parameters	/	
TPDO has more than 8 bytes	□	
RPDO has more than 8 bytes		
TIME source double		

Table 44: Bit assignments

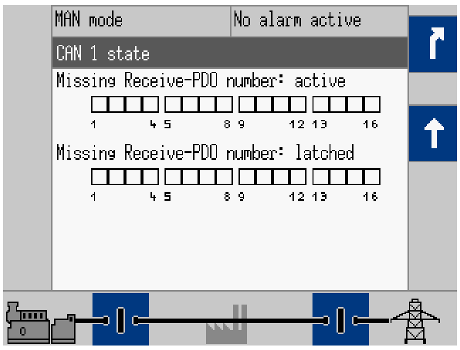


Fig. 101: CAN interface 1 state screen (example)

Symbol	State	Description
■	State is TRUE	PDO is missing

Symbol	State	Description
□	State is false	PDO is NOT missing

Table 45: Graphic assignments

Section		Assignment
Missing Receive-PDO number: active	{x}	RPDO {x} is not received at the moment
Missing Receive-PDO number: latched	{x}	RPDO {x} has not been received **Notes** CAN 1 monitoring 3150 must be enabled

4.1.5.17 CAN Interface 2 State

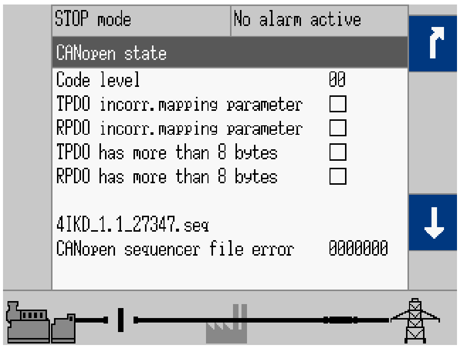


Fig. 102: CAN interface 2 state screen (example)

Symbol	Description
■	State is TRUE
□	State is false

Table 46: Graphic assignments

Section		Description
Code level	00	Current code level of CAN2 connection (don't care for the current applications)
TPDO has incorrect mapping parameters	■	State is TRUE/FALSE (The mapping is done automatically by the parameter 15320 p. 457 "Select external terminals")
RPDO has incorrect mapping parameters	/	
TPDO has more than 8 bytes	□	
RPDO has more than 8 bytes		
Text "4IKD_1.1_27347.seq"		This example indicates the name of the current selected file for the external terminals inclusive version. If this line shows "---", the file is missing on the device. **Notes** For the different selections of external terminals different files are stored in the device.
Text "CANopen sequencer file error"	0000000	If the value indicated here is not equal "0000000" there is something wrong with the file indicated above.

Table 47: (Bit) assignments

The next screen indicates missing Node-IDs of the external terminals.

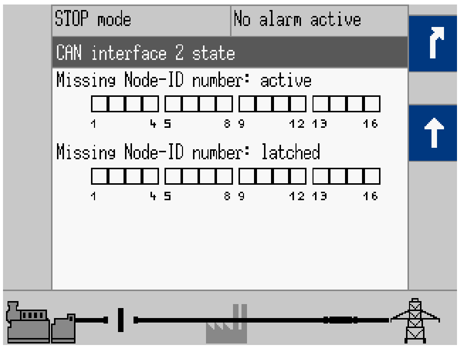


Fig. 103: CAN interface 2 state screen (example)

Symbol	State	Description
	State is TRUE	Node-ID is missing
	State is false	Node-ID is NOT missing

Table 48: Graphic assignments

Section		Assignment
Missing Node-ID number: active	{x}	Node {x} is not received at the moment
Missing Node-ID number: latched	{x}	Node {x} has not been received
		Notes CAN 2 monitoring 3150 must be enabled

J1939 state

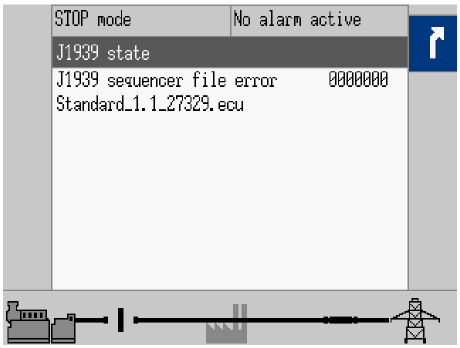


Fig. 104: CAN interface 2 j1939 state screen (example)

Section		Description
Text "J1939 state"		Screen title / Interface type
Text “J1939 sequencer file error”	0000000	If the value indicated here is not equal “0000000” there is something wrong with the file indicated below.
Text “Standard_1.1_27347.ecu”		This example indicates the name of the current selected file for ECU inclusive version. If this line shows “---”, the file is missing.
		Notes For the different selections of "Device type" different files are stored in the device.

Table 49: Assignments

4.1.5.18 CAN Interface 3 State

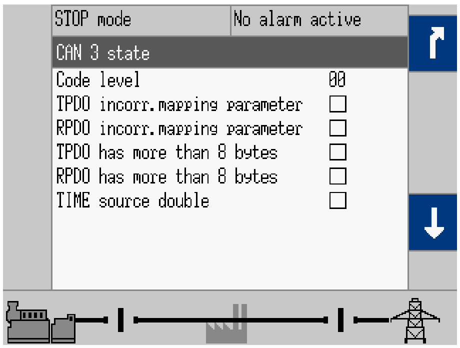


Fig. 105: CAN interface 3 state screen (example)

Symbol	Description
■	State is TRUE
□	State is false

Table 50: Graphic assignments

Section		Description
Code level	00	Current code level of CAN3 connection
TPDO has incorrect mapping parameters	■	State is TRUE/false
RPDO has incorrect mapping parameters	/	
TPDO has more than 8 bytes	□	
RPDO has more than 8 bytes		
TIME source double		

Table 51: Bit assignments

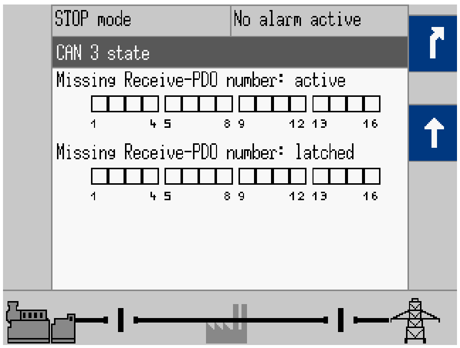


Fig. 106: CAN interface 3 state screen (example)

Symbol	State	Description
■	State is TRUE	PDO is missing
□	State is false	PDO is NOT missing

Table 52: Graphic assignments

Section		Assignment
Missing Receive-PDO number: active	{x}	RPDO {x} is not received at the moment
Missing Receive-PDO number: latched	{x}	RPDO {x} has not been received
		Notes CAN 3 monitoring 3165 must be enabled

4.1.5.19 Ethernet Network

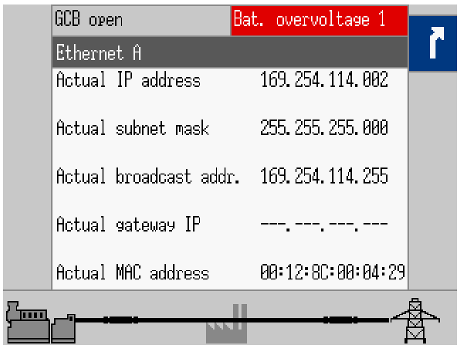


Fig. 107: Ethernet A state screen (example)

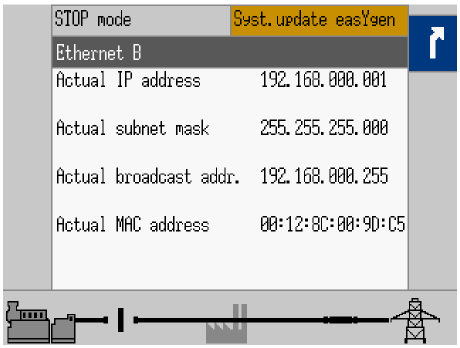


Fig. 108: Ethernet B state screen (example)

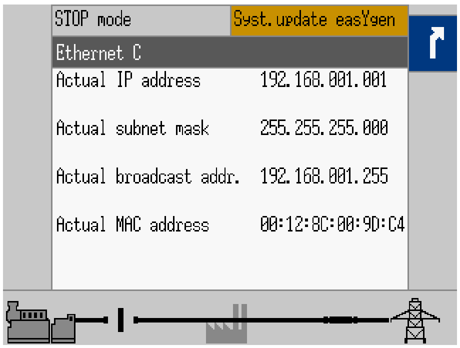


Fig. 109: Ethernet C state screen (example)

Current Ethernet state is displayed. Setting can be found under *"Next Page ➔ Diagnostic ➔ Interfaces ➔ Ethernet"*.

In this menu select:

- *[Ethernet A]*
- *[Ethernet B]*
- *[Ethernet C]*
- *[SNTP]*
- *[Servlink]*
- *[Modbus TCP/IP]*

> *See chapter ↬ Chapter 7.3 "Ethernet Interfaces" on page 641 for configuration.*

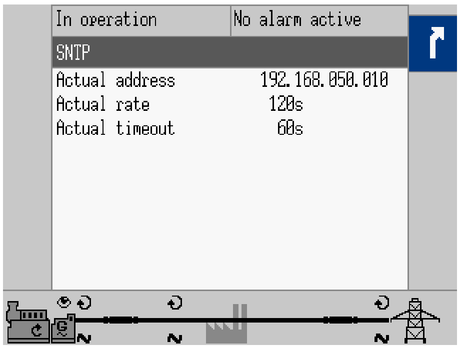


Fig. 110: Ethernet SNTP (example)

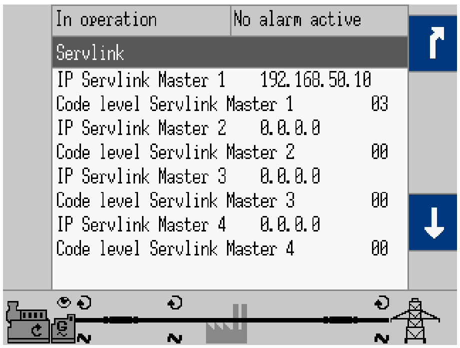


Fig. 111: Ethernet Servlink (example)

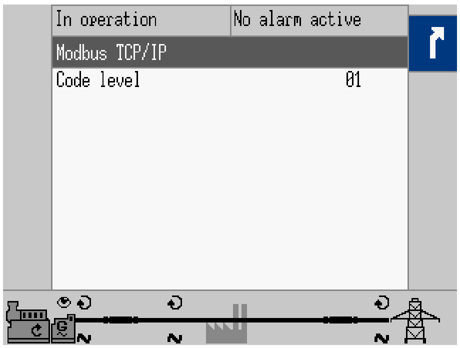


Fig. 112: Ethernet Modbus TCP/IP

4.1.5.20 USB

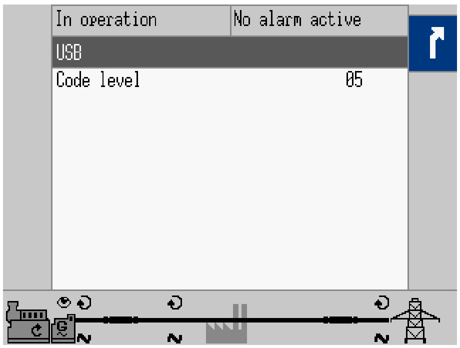


Fig. 113: USB interface

Current USB state is displayed. Setting can be found under *"Next Page ➔ Diagnostic ➔ Interfaces ➔ USB"*.

See chapter ⇘ Further information on page 439 for configuration.

4.1.5.21 RS-485

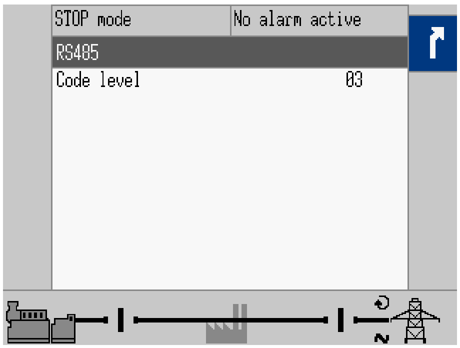


Fig. 114: RS-485 interface

Current RS-485 interface state is displayed. Setting can be found under *"Next Page ➔ Diagnostic ➔ Interfaces ➔ RS485"*.

See chapter ✎ Chapter 4.7.2 "RS-485 Interface" on page 440 for configuration.

4.1.5.22 J1939 Special

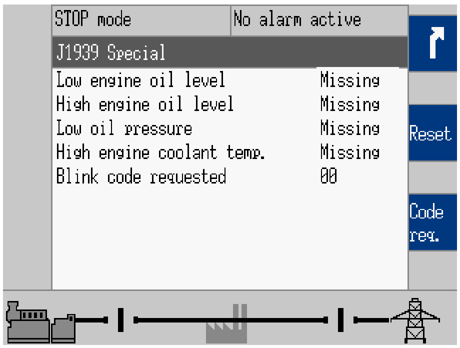


Fig. 115: J1939 Special screen (example)

The status of the configured J1939 ECU error messages is displayed here if the unit is configured accordingly. Some ECUs have a special screen for proprietary features. Fig. 115 shows the special screen for Scania S6.

The following softkeys are only visible if parameter 15127 ✎ p. 462 is configured to "ON".

Symbol/Softkey	Description
	Request a blink code for one error message from the ECU. Repeated pressing of this softkey displays all stored error messages. This symbol/softkey is **only** visible if the ECU is configured to "Scania S6".
	**Scania S6:** Reset the blink code. To do this, disable the ignition (terminal U15), press this softkey, and enable the ignition again within 2 seconds. **Other ECU:** Reset ECU failure codes.

4.1.5.23 Time Indication According To Operating Condition

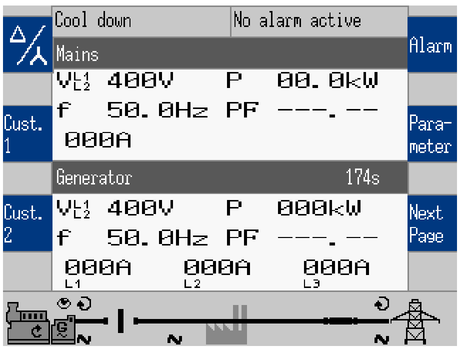


Fig. 116: Time indication according to operating condition

This screen element (on main screen) displays time indications according to the operating condition of the easYgen device. The time indications of the events indicated in the table below are shown in the display. The counter starts with the setting value of the related event and counts down to zero. After that, the status change of another event is shown. The sequence of the events is related on the configuration of the device.

Event	Description
Auxiliary services prerun	Refer to parameter 3300 ✎ p. 172 for details.
Crank protect	Refer to parameter 3326 ✎ p. 171 for details (only half of the configured time is used).
Preglow time	Refer to parameter 3308 ✎ p. 161 for details.
Starter time	Refer to parameter 3306 ✎ p. 171 for details.

Event	Description
Start pause time	Refer to parameter 3307 ↳ p. 171 for details.
Ignition delay	Refer to parameter 3310 ↳ p. 162 for details.
Gas valve delay	Refer to parameter 3311 ↳ p. 162 for details.
Engine monitoring delay time	Refer to parameter 3315 ↳ p. 171 for details.
Generator stable time	Refer to parameter 3415 ↳ p. 226 for details.
Cool down time	Refer to parameter 3316 ↳ p. 172 for details.
Stop time of engine	Refer to parameter 3326 ↳ p. 171 for details.
Auxiliary services postrun	Refer to parameter 3301 ↳ p. 172 for details.

4.2 Access Via PC (ToolKit)

Version

Woodward's ToolKit software is required to access the unit via PC

- *Required version: 5.5.1 or higher*
- *Please use the latest available version!*
- *For information on how to obtain the latest version see ↳ Chapter 4.2.1 "Install ToolKit" on page 121.*

NOTICE!

EXISTING wset Settings Files

wset file properties changed. easYgen-XT wset files are different from wset files of easYgen Series.

- wset Settings files created with easYgen must be converted before use with easYgen-XT!
- NEW ... .wset files are NOT BACKWARD COMPATIBLE!
- Please ask your Woodward sales support contact for conversion/update instruction to use files created with easYgen.

4.2.1 Install ToolKit

Load from CD

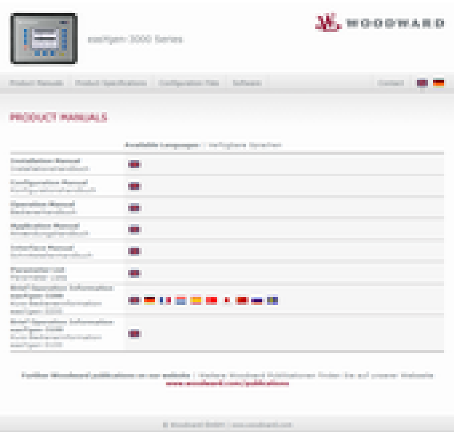


Fig. 117: Product CD - HTML menu

1. Insert the product CD (as supplied with the unit) in the CD-ROM drive of your computer.

   ⇨ The HTML menu is opened automatically in a browser.

   The 'autostart' function of your operating system needs to be activated.

   Alternately open the document "start.html" in the root directory of the CD in a browser.

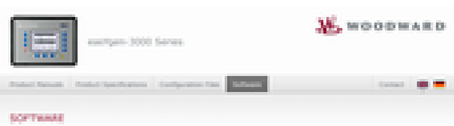


Fig. 118: HTML menu section 'Software'

2. Go to section *"Software"* and follow the instructions described there.

Load from the website

The latest version of the ToolKit software (5.5.1 or higher) can be obtained from our website.

The latest version of Microsoft .NET Framework (4.5.1 or higher) can be obtained from Microsoft website.

To get the software from the website:

1. Go to *http://www.woodward.com/software*
2. Fill the empty search field with "toolkit" and click on the *"Search"* button

   ⇨ The (software) products are listed

3. Select ToolKit in the list and click the *"Go"* button.
4. Click *"More Info"* to get further information about ToolKit.
5. Choose the preferred software version and click *"Download"*.
6. Login with your e-mail address or register first.

   ⇨ The download will start immediately.

Minimum system requirements

- Microsoft Windows® 10, 8.1, 7, Vista (32- & 64-bit)
- Microsoft .NET Framework 4.5.1 or higher
- 1 GHz or faster x86 or x64 processor
- 1 GB of RAM
- Screen
  – Resolution: 800 by 600 pixels
  – Colors: 256

- If using USB service port of the easYgen for ToolKit communication:
  – USB port
  – USB 2.0 cable (with type A and type B connector)
- If using Ethernet port of the easYgen for ToolKit communication
  – Appropriate Ethernet cable
- To install ToolKit and manage configuration files
  – CD-ROM drive

Microsoft .NET Framework must be installed on your computer to be able to install ToolKit.

– *If not already installed, Microsoft .NET Framework will be installed automatically (internet connection required).*
– *Alternatively use the .NET Framework installer found on the Product CD.*

Installation

To install ToolKit:

Hidden folder?

Depending on the (version of your) operating system, the preferred folder for installation "C:/ProgramData" can be hidden by default WINDOWS settings. Installation will work properly but installed sub-folders might not be visible.

Two possible solutions:

– *Change WINDOWS settings to see hidden files (e.g. in Windows explorer tab "Extras", "Folder options", tab "View", check box "...show.." below "Hidden files and folders")*
– *Select another (not hidden) directory/ folder for installation when asked for during installation.*

Run the self-extracting installation package and follow the on-screen steps to install.

⇨ ToolKit software and all relevant additional folders and files are installed.

4.2.2 Install ToolKit Configuration Files

Load from CD

1. Insert the product CD (as supplied with the unit) in the CD-ROM drive of your computer.

   ⇨ The HTML menu is opened automatically in a browser.

   The 'autostart' function of your operating system needs to be activated.

   Alternately open the document "start.html" in the root directory of the CD in a browser.

   Details of your current product CD menu may differ because of updates.

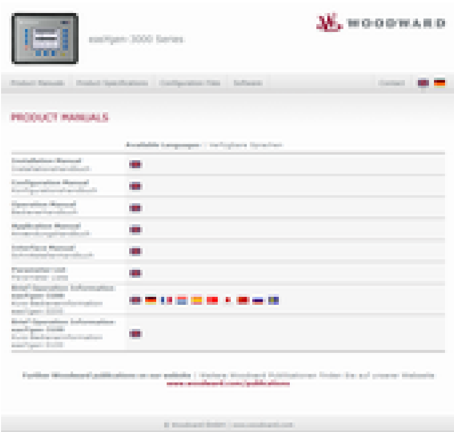


Fig. 119: Product CD - HTML menu

2. Go to section *"Configuration Files"* and follow the instructions described there.

Fig. 120: HTML menu section 'Software'

ToolKit files

*.WTOOL	
File name composition:	[P/N1][1]-[Revision]_[Language ID]_[product name short form]_[# of Release]-[# hotfix]_[# of build].WTOOL
Example file name:	8440-*2082*-new_EG3200XTP1_1.10-0_*56789*.wtool
File content:	Display screens and pages for online configuration, which are associated with the respective *.SID file.

*.SID	
File name composition:	[Product name short form]_[# of Release]-[# hotfix]__[# of build].].SID
Example file name:	EG3200XTP1_1.10-0_*56789*.sid
File content:	All display and configuration parameters available in ToolKit.

*.WSET	
File name composition:	[user defined].WSET
Example file name:	device_settings.WSET

*.WSET	
File content:	Default settings of the ToolKit configuration parameters provided by the SID file or user-defined settings read from the unit.
	Notes **New settings DON'T override Ethernet address!** ■ The local Ethernet address of a device is intentionally NOT overwritten by loading WSET files. It is possible to handle the complete set of Settings or even a part of it (selected settings). This can be done by using "Partial .WSET files". For more details please read Application Note 37572 *'How to create new complete/partial settings files offline'* at woodward.com (search for "37572").

- [1] P/N1 = Part number of the unit
- [2] P/N2 = Part number of the software in the unit

4.2.3 Configure ToolKit

Fig. 121: Tools menu

To change ToolKit settings:

1. Select *"Tools → Options"*.
   ⇨ The *"Options"* windows is displayed.

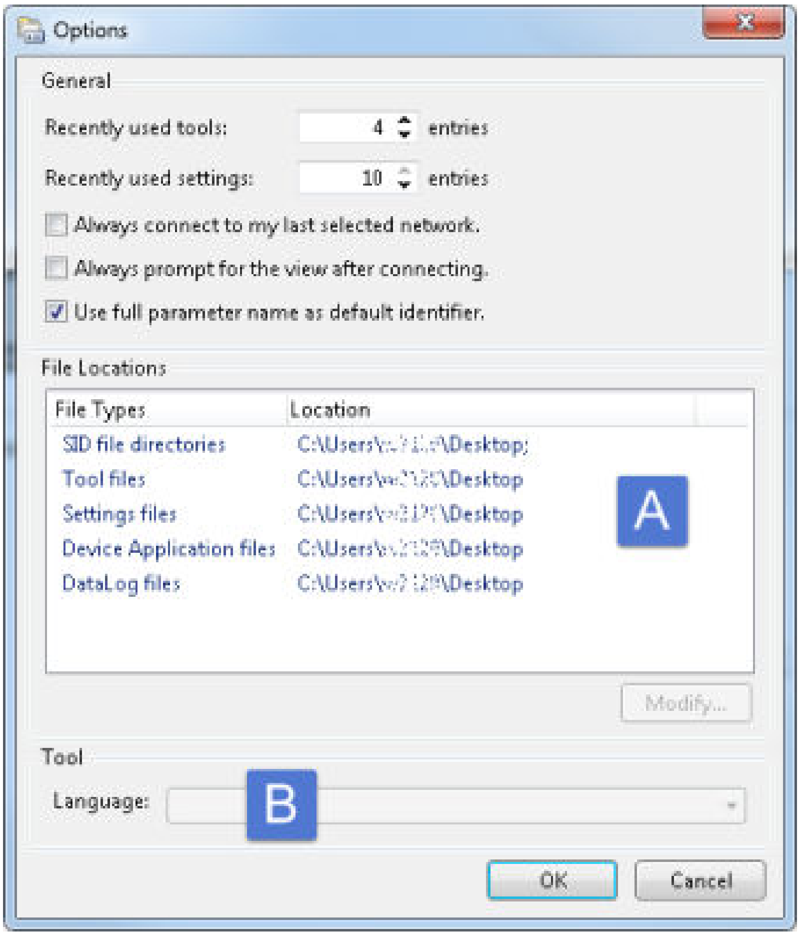


Fig. 122: ToolKit Options window

A File locations (default location is C:\Users\[users's name]\Documents\Woodward\ToolKit\Applications)
B Language (selection) setting for tools

2. Adjust settings as required.

> *For more information on the individual settings refer to the ToolKit help.*

⇨ Changes take effect after clicking *"OK"*.

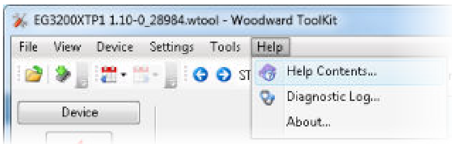


Fig. 123: Help

> *Please do not change the default installation folder! Otherwise the language selection will not work properly.*

4.2.4 Connect ToolKit via USB Service Port

> *A USB cable with USB 2.0 Type A and (at Woodward device side) Type B connector is necessary. It is not part of delivery.*

> ***Local ports***
> ***The number of the COM port used for USB connection depends on your configuration.*** *This sample is using COM4.*

Sample configuration procedure

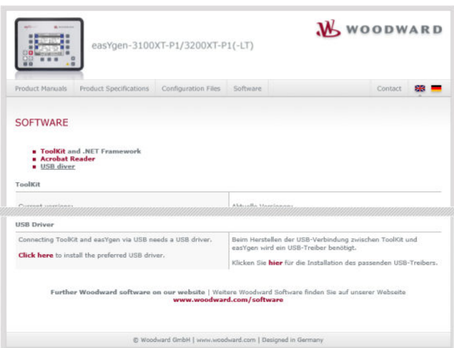


Fig. 124: Install USB driver from CD-ROM

1. Install the USB driver delivered with the CD-ROM

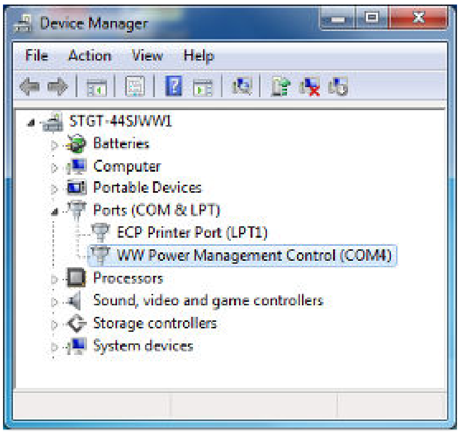


Fig. 125: USB device @ COM4

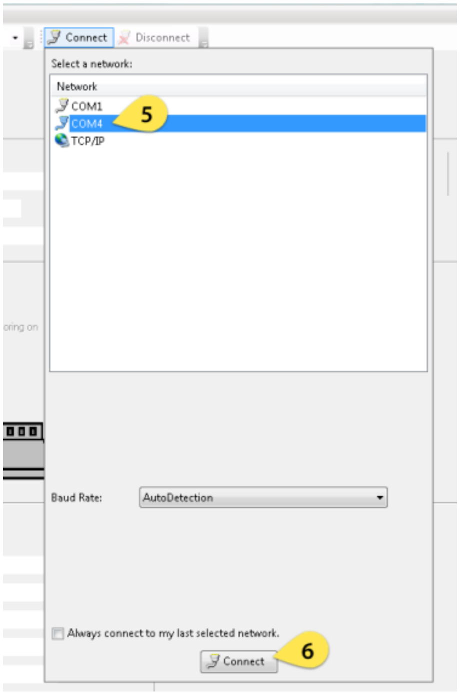


Fig. 126: Select COM4 for ToolKit USB connection

2. Check
3. Start easYgen and wait for "normal operation"
4. Connect the Woodward device and the PC/laptop ToolKit is running on with the USB cable
   - ⇨ USB drive will be automatically detected: WINDOWS offers pre-selected next step e.g., open in explorer what would display files on the easYgen-XT device but is not needed now
5. Open ToolKit
   - ⇨ wtool selection window opens
6. Select the .wtool file for your device by double click
   - ⇨ ToolKit Home Page (empty) opens
7. Click on *"Connect"*
   - ⇨ Network selection window opens
8. Select COM4 - the USB port
9. Click on *"Connect"*
   - ⇨ Connection will be established

     Security Login window opens

> ***USB connection fails?***
>
> *If USB connection fails please try the following methods before you contact your IT expert:*
>
> – *disconnect and reconnect USB cable*
> – *use another USB port*
> – *use a proper USB cable (for reference see* *Chapter 3.4.3 "USB (2.0 slave) interface - Service Port" on page 85**)*
> – *re-start ToolKit two or three times*

10. Log in with your *"Username"* and *"Password"*
    - ⇨ ToolKit is opened and homepage is displayed. Access (code) level depends on the password typed in.

> *Without entering username and password (correctly): Values are displayed (read) only.*

> *In case ToolKit doesn't open correctly please close ToolKit and open it a second time.*

4.2.5 Connect ToolKit via Ethernet Port

Ethernet category 5 (STP CAT 5) shielded cable is required with shielded plug RJ45. It is not part of delivery.

Description below exemplarily is done for Ethernet A.

Connection is also possible via Ethernet B or Ethernet C, please note the changed IP address.

During connecting ...
*Don't work with event history or *.wset files while connecting to ToolKit.*

1. Connect the Woodward device with the Ethernet cable to the network.
2. Find IP address of the device at the device with menu path *"Next page ➔ Diagnostic ➔ Interfaces ➔ Ethernet ➔ Ethernet A"*

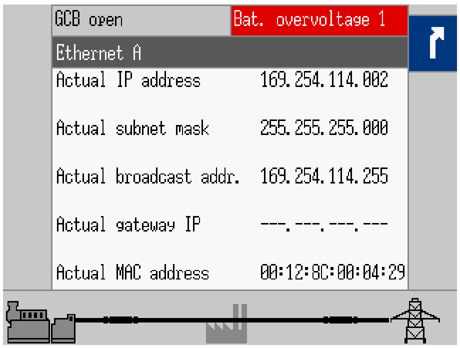


Fig. 127: IP-address: Ethernet A

Network restrictions
Both the easYgen control and your ToolKit running computer/laptop (PC) must be in the same IP address range. For example if the IP address of easYgen is 10.31.140.20, the IP address of the PC must be 10.31.140.xxx.

It is as well recommended to use an isolated/dedicated network for ToolKit communication (Anti-virus software sometimes may interfere with the Ethernet network). Please consult your IT team for adjustment help.

3. Check that the "ToolKit device" is in the same network but with a different device address
4. Click on the .wtool file for your device
   ⇨ ToolKit Home Page for easYgen-XT (empty) opens

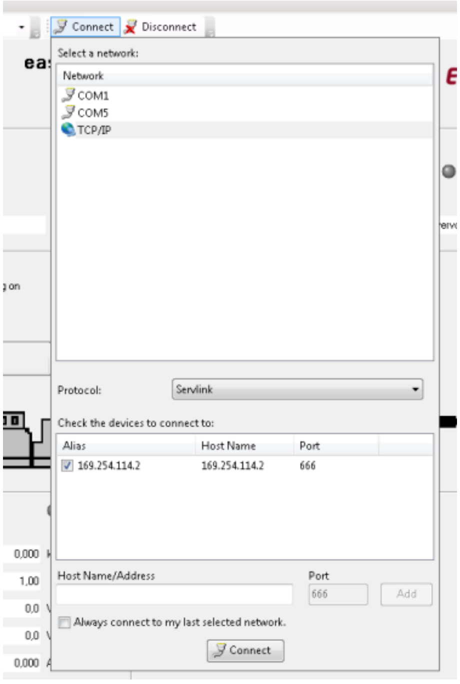


Fig. 128: Select TCP/IP for ToolKit connection

5. Click on *"Connect"*

⇨ Network selection window opens

6. Select Ethernet port "TCP/IP"

⇨ Check that device address is the host name address otherwise add the host address and select it for (preferred) use

> *Don't use leading "0" zero in address! This would lead to no connection.*
>
> *Sample: If displayed "Actual IP address" is 169.254.114.002 type 169.254.114.2 (instead of "... . **002**").*
>
> *Second sample - valid for every three-numbers-block: Type 169.54.14.2 if displayed "Actual IP address" is 169.054.014.002.*

7. Click on *"Connect"*

⇨ Connection will be established

Security Login window opens

8. Log in with your *"Username"* and *"Password"*

⇨ ToolKit is opened and homepage is displaying current states and values

CAUTION!

Avoid using the same IP address twice!

By mistake it is possible to assign the same IP address twice to two different devices e.g. for Remote Panel RP-3000XT as in the system is configured for the easYgen-3000XT so far.

In this case the last configured device (RP-3000XT) will work properly but the so far configured device (easYgen-XT) will be invisible on the Ethernet: **Load Share and ToolKit do not work on this device!** ... and cannot be found for remote connection.

Solution:

– Apply again properly IP addresses for devices A and B

or

– reset easYgen-XT (power cycle)

Network mismatch using the same IP address twice with other devices can be handled similarly.

4.2.6 View And Set Values In ToolKit

Basic navigation

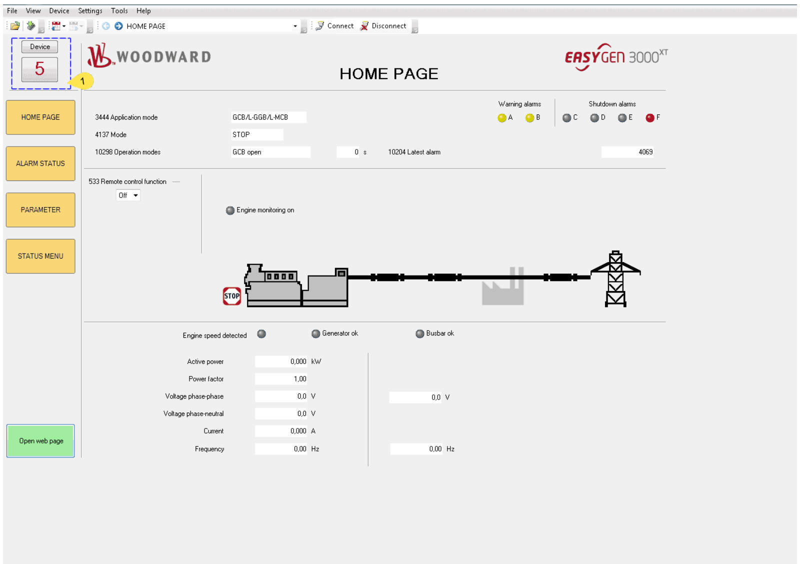
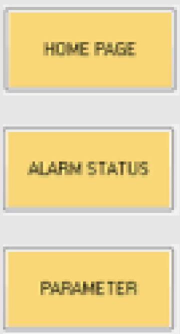
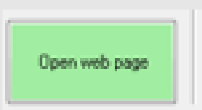
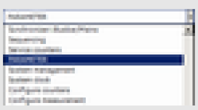
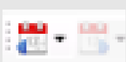
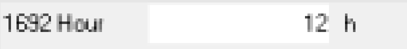
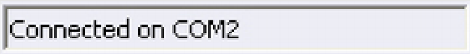


Fig. 129: ToolKit home screen

ToolKit offers the following graphical elements for basic navigation:

Graphical element	Caption	Description
PARAMETER Configure system management	On top of the page/screen	One level back in menu hierarchy (Visible at menu level 2 and higher)
	Left sidebar navigation buttons	Main Buttons in orange. Permanently visible
		Yellow buttons depend on current menu/page and guide to further pages "beside" the current page. This pages can be opened by *"Previous page" / "Next page"* and as result of a search *[Ctrl] [F]*
		Both *"HOME PAGE"* and page *"PARAMETER"* offer a green button *[Open web page]* to open product web page containing product information and links to additional information
	Navigation list	Directly select a configuration page based on its name
	Buttons *"Previous page"* and *"Next page"*	Go to the previous/next configuration page (as ordered in the list)
	Buttons *"Previous visited page"* and *"Next (already) visited page"*	Go to the previous/next visited page (as ordered in the list)

Value and status fields

Graphical element	Caption	Description
	Value field	To directly input (alpha)numeric values
		Display (read) only
	Option field	To select from a preset list of options
	Connection status field	Displays active port and unit connection status

To change the value of a value or option field:

1. Enter the value or select an option from the drop-down list.
2. Press *[Enter]* to confirm.
   ⇨ The new value is written directly to the unit.

Visualization

> *Values displayed by visualization graphical elements cannot be changed.*

Graphical element	Caption	Description
	System setup visualization (Oneline/ single line diagram)	Displays engine/busbar/mains connection status

Search

> ***[Ctrl][F]***
>
> *The short cut ctrl-F works to open ToolKit search window.*

To find specific parameters, settings and monitoring values more easily, ToolKit includes a full-text search function.

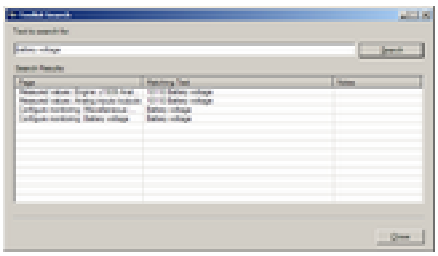


Fig. 130: Search dialog

To find a parameter/setting/monitoring value:

1. Select *"Tools ➔ Search"* from the menu.
   ⇨ The *"Search"* dialog opens.
2. Enter a search term and press *[Enter]*.
   ⇨ The results are displayed in the table.

> *Column width can be adjusted as usual (e.g. to read full path).*
>
> *"May not be visible": display (on not) of this value depends on settings.*

3. Double-click a table entry to go to the visualization/configuration page that includes this parameter/setting/monitoring value.

Value trending

The value trending view can chart up to eight values over time.

To select values for trending screen:

1. Right-click an analog value field on any configuration/visualization page and select *"Add to trend"* from the context-menu.

   ⇨ The trending screen opens.

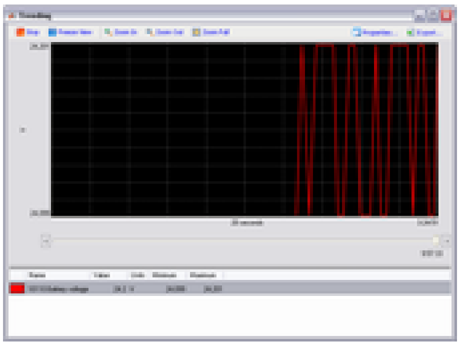


Fig. 131: Trending screen

2. Click the *"Start"* button to initiate charting.
3. Click the *"Stop"* button to stop charting the values.

> ***Viewed range!***
>
> *The range to be exported depends on the view and the start position of the time bar but is always reported 'til the end of charting.*
>
> *To export all (complete report) time marker must be at start position or the complete graph must be viewed.*

4. To store the tracked data select *"Export"*

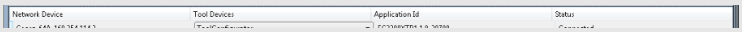
   ⇨ The tracked data are exported as a time/value table to a `.htm` file. This file can be opened and viewed with a web browser. A copy of the web page content can be inserted and edited/analyzed in external applications (e.g. MS Excel/OpenOffice.org Calc).

Graphical element	Caption	Description
	*"Start"*	Start value charting
	*"Stop"*	Stop value charting
	Zoom controls	Adjust detail of value chart
	*"Export"*	Export to `.htm` file
	*"Properties"*	Change scale limits, sample rate, time span, colors

Details ... of connection

The bottom of the ToolKit screen comes with information about connection and a button for more *"Details ..."*.

With a click on *"Details ..."* a list of all current connections will be displayed and further buttons appear:

Graphical element	Caption	Description
		Table/list of all connected devices
	Disconnect	Dissolving connection between ToolKit and device (same function as at the top of ToolKit page/screen)
	Log In	Opens *"Security login"* window
	Log Out	Reset of security level to "0"
	Save values	Opens *"Save values"* window to save values/settings (same function as at the top of ToolKit page/screen)

4.2.7 How to use (and prepare/update) non-XT easYgen ... .wset files

WSET file conversion

Please take care for device compatibility.

The .wset files of easYgen-XT are not compatible with the formerly used .wset files.

ToolKit can handle former non-XT .wset files. Loading a non-XT .wset file automatically guides into a supported conversion procedure.

Please read information of the step-by-step preparation and follow the displayed then. The resulting settings implemented will use all 1:1 settings, resolve all changes like re-naming or re-numbering, ask for taking over matching settings, and list all settings that do not fit the XT restrictions but offering notes for manual implementation.

New settings DON'T override Ethernet A address!

The local Ethernet A address of a device is intentionally NOT overwritten by loading any WSET files.

The save and re-load function for Ethernet address is implemented like for other settings (5330 ⇘ p. 474 "IP address") but it still needs parameter 7412 ⇘ p. 474 to "Set IP address".

Load a non-XT .wset file

1. Open ToolKit version 5.0 or higher
2. Open *"Settings ➔ Load Settings File to Device ..."*
   ⇨ Explorer window appears
3. Select the ... .wset file to be updated

4. Click *[OK]*

⇨ Window *"Setting Differences "* appears

5. Click on button *"Resolve Differences"* for details

6. Go through the left hand side list and select settings found

⇨ If possible, ToolKit offers you to *"Map"* the setting for easYgen-XT

Every mapped setting is listed below

7. Close mapping with a click on *"OK"* button and - back on *"Settings Differences"* screen - with *"Next >"* button

⇨ *"Settings Conversion Finished"* screen lists all Errors and Warnings

8. Click *"Next >"* to finalize settings loading

9. Define location/folder and name of the updated ... .wset file

10. Click *[OK]*

⇨ New updated ... .wset file is saved and ready for usage with easYgen-XT

4.2.8 Valuable Tips and Tricks With ToolKit

The ToolKit software help is worth to read: "Help ➔ Help Contents..."

Just click ...

- buttons to go to previous/next **page**
- buttons to go one **step/click** back/forward
- *"Tools ➔ Search..."* or (*[Ctrl] [F]*) to
  - find a parameter by number
  - find a parameter by name
  - find all pages/screen this parameter is found
  - find all pages/screen this name is found (e.g. occurrence of "engine")
- *"Navigation list"* to see
  - menu path (breadcrumb) of the current page/screen
  - located in the sequence list of all pages/screens
- *"Value field"* 300 h and see the value's range in the footer bar
- *"Details ..."* in the bottom line to
  - find a list of all connected devices and the connection states
  - get access to Log In / Log Out e.g. to change security level

4.3 Basic Setup

The "Basic Setup" describes a collection of configuration sub-menus:

- Configure language/clock
- Configure system management
- Password HMI
- Configure HMI
  – Configure customer screen 1
  – Configure customer screen 2
  – Configure display
  – Screen configuration

(Other configuration is "below" the sub-menu *"Configuration"*. See following chapters.

4.3.1 Configure Language/Clock

General notes

The following parameters are used to set the unit language, the current date and time, and the daylight saving time feature.

If an Asian language is configured, some parameter screens may be displayed with an empty space at the bottom of the parameter list, which may be interpreted as an end of the list, although more parameters exist and are displayed when scrolling down.

This can easily be checked:

– *The list display is a closed loop, so ...*
– *scrolling UP from first list entry goes to the end of the list and vice versa.*

Update Clock

HMI/display and ToolKit differ in updating the clock settings

– *HMI/displays the actual value and enables direct change of each parameter*
– *ToolKit displays the "Actual values" (ID 1690 to 1695) beside and the time values and date values can be prepared each as a set before transfer*

ID	Parameter	CL	Setting range [Default]	Description
1700	**Language** (Set language)	0	selectable languages **[English]**	The desired language for the unit display text is configured here. Available languages are: English, German, Dutch, Spanish, French, Italian, Portugese, Japanese, Chinese, Russian, Turkish, Polish, Slovakian, Finnish, Swedish.
"Values to be set"				
1710	**Hour**	0	hour 0 to 23 h	The hour of the clock time is set here.

ID	Parameter	CL	Setting range [Default]	Description
			[real-time clock]	**Example** ■ 0 = 0th hour of the day (midnight). ■ 23 = 23rd hour of the day (11 pm).
1709	**Minute**	0	0 to 59 min **[real-time clock]**	The minute of the clock time is set here. **Example** ■ 0 = 0th minute of the hour ■ 59 = 59th minute of the hour
1708	**Second**	0	0 to 59 s **[real-time clock]**	The second of the clock time is set here. **Example** ■ 0 = 0th second of the minute ■ 59 = 59th second of the minute
1698	**Transfer time to clock** TKit	2	Yes **[No]**	`Yes` transfers the time values to the clock. **Notes** ALL values are transferred and overwritten - even if you want to change only one.
1711	**Day**	0	day 1 to 31 **[real-time clock]**	The day of the date is set here. **Example** ■ 1 = 1st day of the month. ■ 31 = 31st day of the month.
1712	**Month**	0	month 1 to 12 **[real-time clock]**	The month of the date is set here. **Example** ■ 1 = 1st month of the year. ■ 12 = 12th month of the year.
1713	**Year**	0	year 0 to 99 **[real-time clock]**	The year of the date is set here. **Example** ■ 0 = Year 2000 ■ 99 = Year 2099
1699	**Transfer data to clock** TKit	2	Yes **[No]**	`Yes` transfers the date values to the clock. **Notes** ALL values are transferred and overwritten - even if you want to change only one.
4589	**Time zone**	2	-12 to 14 **[0.00]**	Time shift in hours between the time zone in which the device is used compared to the absolutely Greenwich Mean Time (GMT). This information is needed to transfer the general time signal into the local real-time clock setting.
"Daylight saving time"				
4591	**Daylight saving time**	2	On **[Off]**	`On` enables the Daylight saving time. The daylight saving time feature enables to automatically adjust the real-time clock to local daylight saving time (DST) provisions. If daylight saving time is enabled, the real-time clock will automatically be advanced by one hour when the configured DST begin date and time is reached and falls back again by one hour when the configured DST end date and time is reached. If the unit is used in the southern hemisphere, the DST function will be inverted automatically, if the DST begin month is later in the year than the DST end month.

ID	Parameter	CL	Setting range [Default]	Description
				Notes Do not change the time manually during the hour of the automatic time change if DST is enabled to avoid a wrong time setting. Events or alarms, which occur during this hour might have a wrong time stamp.
4594	**DST begin time**	2	0 to 23 **[0]**	The real-time clock will be advanced by one hour when this time is reached on the DST begin date.
				Example ■ 0 = 0th hour of the day (midnight) ■ 23 = 23rd hour of the day (11 pm)
				Notes This parameter is only displayed, if Daylight saving time (parameter 4591 ➩ p. 135) is set to "On".
4598	**DST begin weekday**	2	Sunday to Saturday **[Sunday]**	The weekday for the DST begin date is configured here
				Notes This parameter is only displayed, if Daylight saving time (parameter 4591 ➩ p. 135) is set to "On".
4592	**DST begin nth. weekday**	2		The order number of the weekday for the DST begin date is configured here.
			[1st]	DST starts on the 1st configured weekday of the DST begin month.
			2nd	DST starts on the 2nd configured weekday of the DST begin month.
			3rd	DST starts on the 3rd configured weekday of the DST begin month.
			4th	DST starts on the 4th configured weekday of the DST begin month.
			Last	DST starts on the last configured weekday of the DST begin month.
			LastButOne	DST starts on the last but one configured weekday of the DST begin month.
			LastButTwo	DST starts on the last but two configured weekday of the DST begin month.
			LastButThree	DST starts on the last but three configured weekday of the DST begin month.
				Notes This parameter is only displayed, if Daylight saving time (parameter 4591 ➩ p. 135) is set to "On".
4593	**DST begin month**	2	1 to 12 **[1]**	The month for the DST begin date is configured here.
				Example ■ 1 = 1st month of the year ■ 12 = 12th month of the year
				Notes This parameter is only displayed, if Daylight saving time (parameter 4591 ➩ p. 135) is set to "On".
4597	**DST end time**	2	0 to 23 **[0]**	The real-time clock will fall back by one hour when this time is reached on the DST end date
				Example ■ 0 = 0th hour of the day (midnight). ■ 23 = 23rd hour of the day (11 pm).
				Notes This parameter is only displayed, if Daylight saving time (parameter 4591 ➩ p. 135) is set to "On".
4599	**DST end weekday**	2	Sunday to Saturday **[Sunday]**	The weekday for the DST end date is configured here

ID	Parameter	CL	Setting range [Default]	Description
				Notes This parameter is only displayed, if Daylight saving time (parameter 4591 ➘ p. 135) is set to "On".
4595	**DST end nth. weekday**	2		The order number of the weekday for the DST begin date is configured here.
			[1st]	DST ends on the 1st configured weekday of the DST begin month.
			2nd	DST ends on the 2nd configured weekday of the DST begin month.
			3rd	DST ends on the 3rd configured weekday of the DST begin month.
			4th	DST ends on the 4th configured weekday of the DST begin month.
			Last	DST ends on the last configured weekday of the DST begin month.
			LastButOne	DST ends on the last but one configured weekday of the DST begin month.
			LastButTwo	DST ends on the last but two configured weekday of the DST begin month.
			LastButThree	DST ends on the last but three configured weekday of the DST begin month.
				Notes This parameter is only displayed, if Daylight saving time (parameter 4591 ➘ p. 135) is set to "On".
4596	**DST end month**	2	1 to 12 **[1]**	The month for the DST begin date is configured here.
				Example ■ 1 = 1st month of the year ■ 12 = 12th month of the year
				Notes This parameter is only displayed, if Daylight saving time (parameter 4591 ➘ p. 135) is set to "On".

Table 53: Parameters Language/Clock Configuration

Example

If daylight saving time starts at 2:00 am on the 2nd Sunday in March and ends at 2:00 am on the 1st Sunday in November, the unit has to be configured like shown in ➘ *Table 54 "Daylight saving time - configuration example" on page 137* to enable an automatic change to daylight saving time and back to standard time.

ID	Parameter	Setting
4591	Daylight saving time	On
4594	DST begin time	2
4598	DST begin weekday	Sunday
4592	DST begin nth weekday	2nd
4593	DST begin month	3
4597	DST end time	2
4599	DST end weekday	Sunday
4595	DST end Sunday	1st
4596	DST end month	11

Table 54: Daylight saving time - configuration example

	USA, Canada		European Union	
Year	DST Begins 2 a.m. (Second Sunday in March)	DST Ends 2 a.m. (First Sunday in November)	DST Begins 1 a.m. UTC=GMT (Last Sunday in March)	DST Ends 1 a.m. UTC=GMT (Last Sunday in October)
2008	March 9, 2008	November 2, 2008	March 30, 2008	October 26, 2008
2009	March 8, 2009	November 1, 2009	March 29, 2009	October 25, 2009
2010	March 14, 2010	November 7, 2008	March 28, 2010	October 31, 2010

Table 55: Daylight saving time - exemplary dates

4.3.2 Configure HMI

4.3.2.1 Configure Customer Screens

easYgen-3000XT comes with two **fully customizable screens - just one click (one level) from home screen**. Softbutton text and displayed name, values, and units can be defined/selected. The new full-featured AnalogManager 1:1 parameter monitoring but even math. function computing.

There are two configurable customer screens available.

Handling/set-up is similar so described one time only.

The (configurable) names of the customer screens are displayed at HMI home page as softbutton text. Pressing one of this softbuttons opens the screen with the configured Names, Values, and Units.

Customer Screen Configuration

Numbering convention

Customer Screen X.Y: Screen #X (1 or 2); Row #Y (1 to 9)

ID	Parameter	CL	Setting range [Default]	Description
AM Customer screen 1.1				
7691	**Description**	2	23 characters **[Cust. Screen row 1]**	`Name` displayed in row 1 **Notes** The max. number of characters is higher but will not be displayed correctly on HMI/display. The row is hidden if description is empty (no character, not even a blank)!
7692	**Unit**	2	6 characters **[Unit]**	`Unit` displayed in row 1

ID	Parameter	CL	Setting range [Default]	Description
				Notes The max. number of characters is higher but will not be displayed correctly on HMI/display. **Notes** If *"°C"* or *"bar"* is assigned the unit will be converted into "°F" or "psi" automatically if the corresponding parameter for conversion 3630 ⇘ p. 191 and/or 3631 ⇘ p. 191 is configured to YES.
7690	**AM Customer screen 1.1**	2	Determined by AnalogManager 90.01 **[Pass Through, ...]**	For details see Fig. 205.

Table 56: Parameters Customer Screen 1.1 Configuration (sample)

AM Customer screen #	ID "Description"	ID "Unit"	AnalogManager
1.1	7691	7692	7690
1.2	7696	7697	7695
1.3	7701	7702	7700
1.4	7706	7707	7705
1.5	7711	7712	7710
1.6	7716	7717	7715
1.7	7721	7722	7720
1.8	7726	7727	7725
1.9	7731	7732	7730
2.1	7736	7737	7735
2.2	7741	7742	7740
2.3	7746	7747	7745
2.4	7751	7752	7750
2.5	7756	7757	7755
2.6	7761	7762	7760
2.7	7766	7767	7765
2.8	7771	7772	7770
2.9	7776	7777	7775

Table 57: Overview Customer Screens/Rows IDs

Customer Screen Configuration

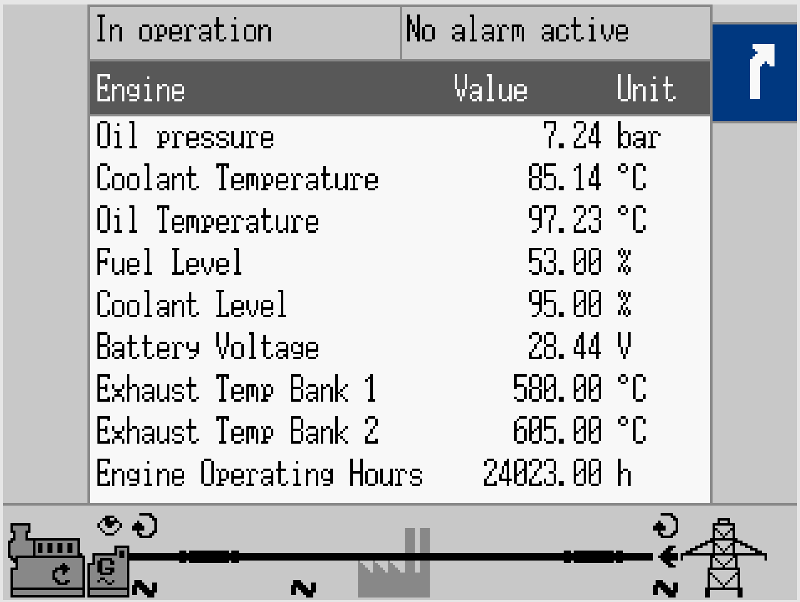


Fig. 132: Customer Screen sample: a set of interesting Engine values

ID	Parameter	CL	Setting range [Default]	Description
7701	**Description**	2	Oil Temperature	(Defined by customer)
7702	**Unit**	2	°C	(Defined by customer)
7700	**AM Customer screen 1.3**	2	Determined by AnalogManager 90.03: *[Pass Through]* of *[A1= 07.23 175:Oil Temperature 1]*	(Defined by customer)

Table 58: Parameters Customer Screen 1.3 Configuration sample

4.3.2.2 Configure Display

Display Configuration

ID	Parameter	CL	Setting range [Default]	Description
HMI	**Display brightness**	2	0 to 100% **[35]%**	Color bar visualization for immediately displayed selection
7796	**2nd display brightness**	2	1 to 100 **[5]%**	Level of 2nd brightness. Used if parameter 11971 ⤷ p. 911/⤷ p. 921 is true.
4557	**Key activation time**	2	1 to 999 min **[120 min]**	If no soft key has been pressed for the time configured here, the 2nd display brightness will be used. **Notes** This parameter is only effective, if LogicsManager 86.33 2nd disp. bright. 11971 ⤷ p. 911/⤷ p. 921 is configured to "Key activation".
7794	**Enable 2nd display brightness**	2	Determined by LogicsManager 86.33 **[(04.64 NOT& 1) & 1]**	Once the conditions of the LogicsManager have been fulfilled, the brightness level of the display switches to the 2nd brightness level defined by parameter 7796 ⤷ p. 140. This can save energy and support visualization of device/system state.

ID	Parameter	CL	Setting range [Default]	Description
			= 11971	For information on the LogicsManager and its default settings see *Chapter 4.8 "Configure LogicsManager" on page 479* *Chapter 9.3.1 "LogicsManager Overview" on page 882*.
7799	**Enable front (panel) heater**	2	Determined by LogicsManager 86.34 **[(1 & 1) & 1]** = 11972	If this parameter is TRUE and ambient temperature goes below -10° C, the display (front panel) will be heated for seven minutes (and wait further 3minutes).
				For information on the LogicsManager and its default settings see *Chapter 4.8 "Configure LogicsManager" on page 479* *Chapter 9.3.1 "LogicsManager Overview" on page 882*.
				Notes This parameter is always visible in HMI and ToolKit, even it is implemented in "-LT" variants for enhanced temperature use only
12978	**Lock keypad** TKit	2	Determined by LogicsManager 86.30 **[(0 & 1) & 1]** = 11924	Key pad can be locked remotely. This parameter is intentionally not available via HMI/display.
				For information on the LogicsManager and its default settings see *Chapter 4.8 "Configure LogicsManager" on page 479* *Chapter 9.3.1 "LogicsManager Overview" on page 882*.

Table 59: Parameters Display Configuration

4.3.2.3 Screen configuration

Screen Configuration

ID	Parameter	CL	Setting range [Default]	Description
4103	**Home screen data**	2		HMI: Home screen can display several pre-defined data collections.
			Generator	Generator relevant information are displayed.
			[Generator/ Mains]	Home screen is splitted and displays generator and mains related information.
			Generator/ Busbar	Home screen is splitted and displays generator and busbar related information.
			Generator/ Engine	Home screen is splitted and displays generator and engine related information.
			Generator/LS5	Home screen is splitted and displays generator and LS5 related information.
4129	**Oneline diagram with mains**	2	Off **[On]**	HMI: Display of oneline (single line) diagram on home screen can be reduced NOT to show mains symbols.
				Notes Softbutton for MCB is (visible and) valid only if this parameter is TRUE.
8891	**AM Engine speed**	2	Determined by AnalogManager 81.24 **[A1 = 11.51 Engine speed [rpm]]**	With this AnalogManager the according speed source may be selected from the available data sources. Even it is possible to select all data sources *Chapter 9.4.1 "Data Sources AM" on page 933*), only the following data source may be used: 11.51 Engine speed [rpm] The indication is displayed in the format 0000 rpm.
8892	**Show engine speed**	2	**[Yes]** No	Display of engine speed on home screen.
8893	**AM Engine oil pressure**	2	Determined by AnalogManager 81.25	With this AnalogManager the according oil pressure source can be configured and scaled. The indication is displayed in the format 00.0bar (000psi).

ID	Parameter	CL	Setting range [Default]	Description
			[A1 = 07.07 100:Engine Oil Press.]	**Notes** If *"bar"* is assigned the unit will be converted into "psi" automatically if the corresponding parameter for conversion 3630 ↪ p. 191 is configured to YES.
8894	**Show oil pressure**	2	Yes **[No]**	Display of engine oil pressure on home screen.
8895	**AM Engine hours**	2	Determined by AnalogManager 81.26 **[A1 = 11.55 Eng.oper.hours [h]]**	With this AnalogManager the according operating hours source can be configured and scaled. The indication is displayed in the format 00000.00h .
8896	**Show engine hours**	2	**[Yes]** No	Display of engine running hours on home screen.
8897	**AM Engine fuel level**	2	Determined by AnalogManager 81.27 **[A1 = 06.03 Analog input 3]**	With this AnalogManager the according fuel level source can be configured and scaled. The indication is displayed in the format 000.0% .
8898	**Show engine fuel level**	2	Yes **[No]**	Display of engine fuel level on home screen.
8899	**AM Engine batt.voltage**	2	Determined by AnalogManager 81.28 **[A1 = 10.54 Battery voltage [V]]**	With this AnalogManager the according battery voltage source can be configured and scaled. The indication is displayed in the format 00.0V .
8900	**Show engine battery voltage**	2	**[Yes]** No	Display of engine battery voltage on home screen.
8901	**AM Engine coolant temp.**	2	Determined by AnalogManager 81.29 **[A1 = 07.15 110:Eng.Coolant Temp.]**	With this AnalogManager the according coolant temperature source can be configured and scaled. The indication is displayed in the format 000°C (°F). **Notes** If *"°C"* is assigned the unit will be converted into "°F" automatically if the corresponding parameter for conversion 3631 ↪ p. 191 is configured to YES.
8902	**Show engine coolant temp.**	2	**[Yes]** No	Display of engine coolant temperature on home screen.

General notes

The home screen data configuration "Generator/Engine" offers an engine value indication. With the following AnalogManagers the according sources can be configured and scaled.

The according AnalogManager has to be configured as 'Pass Through'.

4.3.3 Lamp Test

> *All lights on the controller may be tested for correct operation with this function.*

"Parameter ➔ Lamp test"

Lamp test is available via HMI/display, ToolKit, and parameter 10773 with logical command variable 04.61.

4.3.4 Enter Password

General notes

The controller utilizes a password protected multi-level access hierarchy to prevent unauthorized access to parameters, configuration and calibration items. This permits varying degrees of access to the parameters being granted by assigning unique passwords to designated personnel.

Password protection covers direct and remote access through all methods and interfaces of interconnectivity of the device.

> ***Personal security***
>
> *Configure password security before handing over the device to the customer!*
>
> *Note your password on a secure location. The next higher password level (2 and 4) allows to reset the password of the level below (1 and 3).*
>
> *To restore the according User Name Account needs support from Woodward (authorized partner).*

Access via channel ...

The following table and drawing provide an overview about the possible access channels to the easYgen-XT.

Access to the easYgen-XT by a/an ...	**# used in drawing** ***"Access via channel ..." on page 143*** **below**
HMI on the control directly	①
PC running ToolKit servlink, connected over USB	②
Remote Panel with the Woodward screen share concept connected over Ethernet (HMI simulation)	③ = ①
3rd party Remote Panel (i.e. Proface, Sütron, ...) running Modbus TCP	④
PLC running Modbus TCP	④
PC running ToolKit servlink, connected over Ethernet	⑤
Netbiter® Easy Connect gateway running Servlink TCP (ToolKit via internet)	⑤
PLC running Modbus RTU via RS-485	⑥

Access to the easYgen-XT by a/an ...	**# used in drawing ↳ *"Access via channel ..." on page 143*below**
PLC running CANopen	⑦
PLC running CANopen via Profibus DP	⑦

Each channel has its own independent access level.

The according password handling for each of this access is defined afterwards.

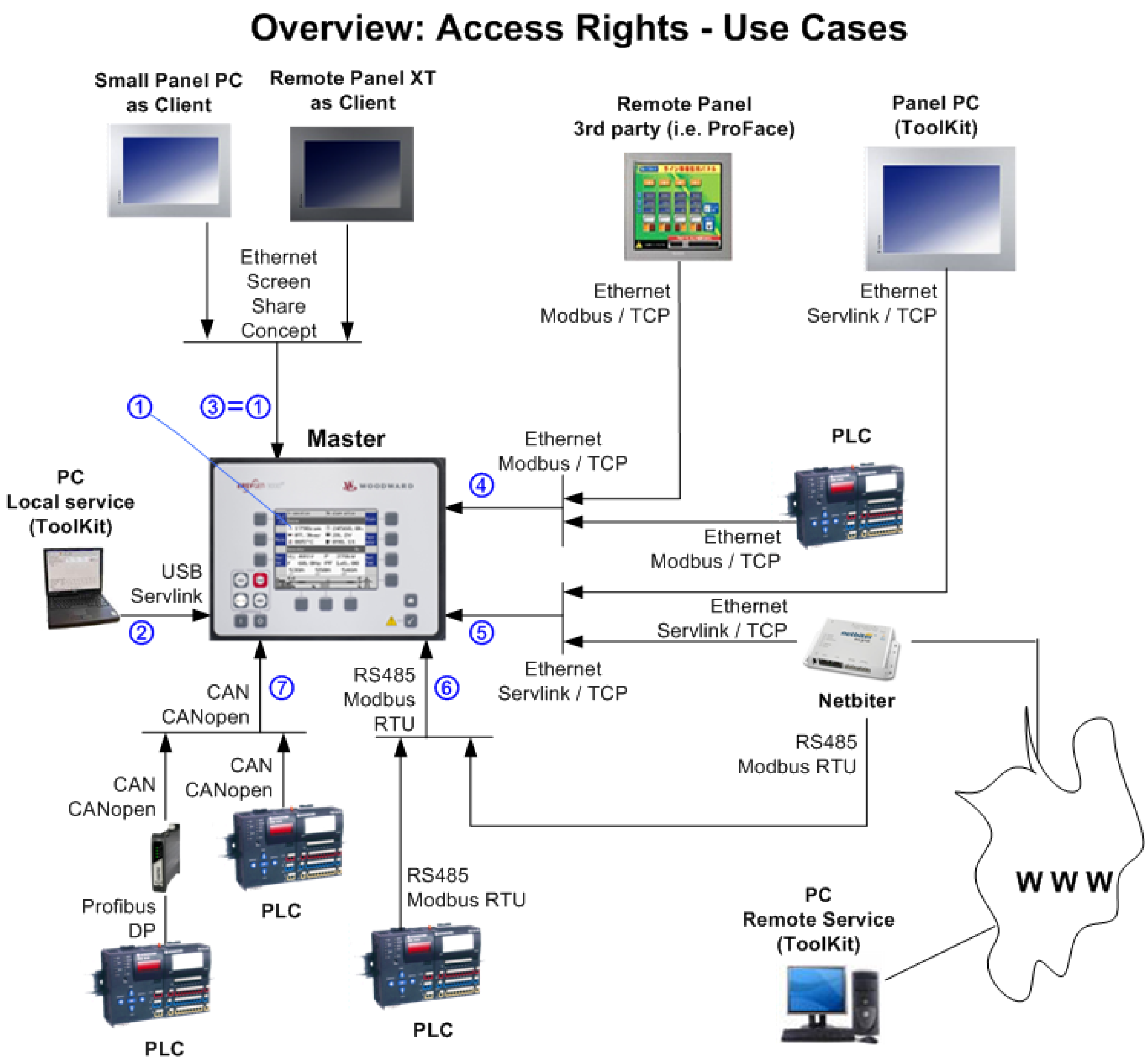


Fig. 133: Access to the easYgen-XT device - Overview

Two login procedures cover all access channel variants: The ...

- Basic Code Entry
- User Account Entry

Hidden entry for more security

The currently selected entry number is visible only - all other numbers are hidden and a "" asterisk is displayed instead.*

LOGIN procedure "Basic Code Entry"

The Basic Code Entry is valid for access ①, ③, ⑥, and ⑦.

The Basic Code Entry asks for four numbers to open the related password level. It starts with the default value of parameter 10416 ⇘ p. 157 *"Random number for password"*.

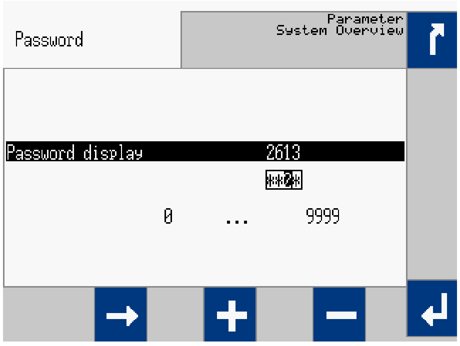


Fig. 134: Password entry: HMI

LOGIN procedure "User Account Entry"

The User Account Entry is valid for access ②, ④, and ⑤.

The User Account Entry comes with more security as requested for internet access. It asks for *"Username:"* **and** *"Password:"* ("Alpha-numeric Password"). To open the related password level, both rows entries need the correct alphanumeric strings.

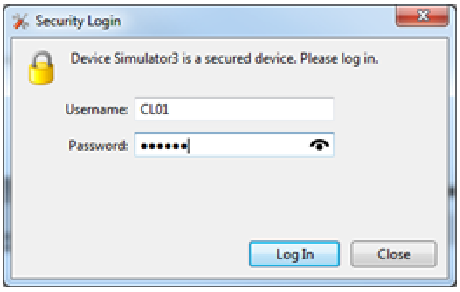


Fig. 135: Password entry: HMI

The already existing User names cannot be changed. They are fixed for the desired code level, which shall be entered.

Check you Password entry

View hidden password entry by pushing the symbol on the right side of the "Password:" box.

Enter Password for level ... (Overview)

A distinction is made between the access levels as follows:

Code Level	User Account Entry		Basic Code Entry	Comment
	User Name (fix)	**Password (default)**	**Password (default)**	
5	CL05	CL0500	500	**The Super Commissioning Level** Access to nearly all parameters and configurations, except calibration and super user items. The firmware updating is released. The own code level and the levels below can be indicated and configured.
4	AC04	Algorithm Code	Algorithm Code	**The temporary Super Commissioning Level** The same access rights like in the Super Commissioning Level but with the following exceptions: ■ The password for this level is not visible. ■ The access is dismissed afterwards.
3	CL03	CL0003	3	**The Commissioning Level** Access to well defined parameters and configurations, which are usually needed on a commissioning level. The own code level and the levels below can be indicated and configured.
2	AC02	Algorithm Code	Algorithm Code	**The temporary Commissioning Level** The same access rights like in the Commission Level. The Code level is entered in an algorithm code. The access is dismissed afterwards. Only the code levels below can be indicated and configured.
1	CL01	CL0001	1	**The Basic Level** Access to a limited number of parameters and configurations. The own code level can be indicated and configured.
0				No access rights to change, even viewed information is restricted.

Active Code Level
A code level always belongs to an access channel. Each access channel has its own password level. This password level can be different to others (other channels) at the same time.

The access related code level is available and visible beside the access related interface settings.

No direct access as expected?
Please check: LogicsManager 86.30 Parameter 12978 ➪ p. 141/➪ p. 930 "Lock keypad 1" = TRUE?

The Algorithm Code

The "Algorithm Code" is an implemented procedure to give an external user temporarily access to the device but without being able to see or change the according passwords. This temporary access needs a random number produced by the device. The actual password then is calculated from this random number using a secret formula. The secret formula is provided by a higher instance.

Access Channels

Maximum Security

Each of these channels have their own independent access level. That has the advantage that e.g. a HMI channel password level opens not automatically the access rights for the other channels.

Maximum Flexibility

The device offers the capability to disable the password protection for the individual interface communication channels RS485, Ethernet, CAN 1 and CAN 3. If the password level is disabled the access level is set on code level 5.

The device provides different access channels via ...	Remarks
HMI directly or by WW Remote Panel	screen share concept
USB	ToolKit Servlink
RS485	Modbus RTU
Ethernet	Modbus TCP
	ToolKit Servlink TCP, 8 sub channels are possible **Note:** Each of the 8 sub channels has its own independent password access level!
CAN1	CANopen
CAN2	
CAN3	

The different Password Code Levels

This chapter defines the properties of the single password code levels. The device differentiates several password levels. Generally with a higher reached password level the access rights increases.

Code Level 0

The Level 0 means there are no access rights enabled. All configurations are blocked.

Code Level 1 - The Basic Level CL01

- **General:**
  This level releases the access to a limited number of parameters and configurations
- **Basic Code entry:**
  In this and higher levels the password for the Basic Code Level CL01 can be changed
- **User Account Entry:**
  This level is selected with the User Name CL01 and the according password can only be changed being in code level CL01.
  Being in code level AC02 or higher the password of the Basic Level CL01 can be reset to its default by the Yes/No parameter 10434 ↳ p. 157.

Code Level	User Account Entry		Basic Code Entry
	User Name (fix)	Password (default)	Password (default)
1	CL01	CL0001	0001

Code Level 2 - The temporary Commissioning Level AC02

- **General:**
  This Level allows temporary access to parameters of the Commission Level.
  The access is dismissed automatically (see *"Automatic Logout from Password level (Fall into level 0)" on page 151*).
- **Basic Code Entry:**
  In this and higher Levels, the password for the Basic Code Level CL01 can be changed.
- **User Account Entry:**
  This level is selected with the User Name AC02 and the according algorithm for the password can only be changed being in the Commissioning code level CL03.
  Being in code level AC02 or higher the password of the Basic Level CL01 can be reset to its default by the Yes/No parameter 10434 p. 157.

Code Level	User Account Entry		Basic Code Entry
	User Name (fix)	Password	Password
2	AC02	The entry procedure: The operator connects ToolKit with the device and closes the upcoming security login window **without entering** username and password (Code level 0). The operator navigates with ToolKit to the page *"Parameter ➔ Configure system management"*. The operator reads on that page 10416 p. 157 *"Random number for password"*. He tells it to a higher instance. The higher instance calculates: (10414 *"Code temp. commissioning"* + 10416 *"Random Number"*) x 3. The higher instance takes the lower four digits of the result and puts the according algorithm string 10437 *"Alphanumeric code temp. comm."* as prefix in front. The higher instance tells the result to the operator, who enters the result as password into the control.	The entry procedure: The operator navigates on the easYgen-XT HMI or on RP-3000XT to the screen *"Parameter ➔ Password ➔ Password display"*. The operator reads the indicated random number. He tells it to a higher instance. The higher instance calculates: (10414 *"Code temp. commissioning"* + 10416 *"Random Number"*) x 3. The higher instance takes the lower four digits of the result and tells it the operator. The operator enters the result as password into the control.

Code Level 3 - The Commissioning Level CL03

- **General:**
  In this Level, the operator has access to all parameters and configurations, which are usually needed on a commissioning level
- **Basic Code Entry:**
  In this and higher levels the password for the Commissioning Level CL03 can be changed
- **User Account Entry:**
  This level is selected with the User name CL03 and the according password can only be changed being in the Commissioning Level CL03
  Being in code level AC04 or higher the password of the Commissioning Level CL03 can be reset to its default by the Yes/No parameter ID 10435 p. 157

Level	User Account Entry		Basic Code Entry
	User Name (fix)	Password (default)	Password (default)
3	CL03	CL0003	0003

Code Level 4 - The temporary Super Commissioning Level

- **General:**
  This Level allows temporary access to nearly all parameters and configurations, except calibration and super user items.
  The access is dismissed automatically
- **Basic Code Entry:**
  In this and higher levels the passwords for the Commissioning Level CL04 can be changed
- **User Account Entry:**
  This level is selected with the User name AC03 and the according algorithm for the password can only be changed being in the Super Commissioning Level CL05
  Being in code level AC04 or higher the password of the Commissioning Level CL03 can be reset to its default by the Yes/No parameter ID 10435 ➪ p. 157

Level	User Account Entry		Basic Code Entry
	User Name	Password	Password
4	AC04	The entry procedure: The operator connects ToolKit with the device and closes the upcoming security login window **without entering** username and password (Code level 0). The operator navigates with ToolKit to the page *"Parameter ➔ Configure system management"*. The operator reads on that page 10416 ➪ p. 157 *"Random number for password"*. He tells it to a higher instance. The higher instance calculates: (10412 *"Code temp. commissioning"* + 10416 *"Random Number"*) x 5. The higher instance takes the lower four digits of the result and puts the according algorithm string 10438 *"Alphanumeric code super temp. comm."* as prefix in front. The higher instance tells the result to the operator, who enters the result as password into the control.	The entry procedure: The operator navigates on the easYgen-XT HMI or on RP-3000XT to the screen *"Parameter ➔ Password ➔ Password display"*. The operator reads the indicated random number. He tells it to a higher instance. The higher instance calculates: (10412 *"Code temp. commissioning"* + 10416 *"Random Number"*) x 5. The higher instance takes the lower four digits of the result and tells it the operator. The operator enters the result as password into the control.

Code Level 5 - The Super Commissioning Level CL05

- **General:**
  In this Level, the operator has access to nearly all parameters and configurations, except calibration items
  The firmware updating is released
- **Basic Code Entry:**
  In this and higher Levels the password fro the Super Commissioning Level CL05 can be changed
- **User Account Entry:**
  This level is selected with the User name CL05 and the according password can only be changed being in the Super Commissioning Level CL05
  Being in a higher level as CL05 the password of the Super Commissioning Level CL05 can be reset to its default by the Yes/No parameter ID 10436 ↳ p. 158

If you have forgotten your password for the Super Commissioning Level, please contact Woodward or a representative for help.

Level	User Account Entry		Basic Code Entry
	User Name (fix)	Password (default)	Password (default)
5	CL05	CL0500	0500

Automatic Logout from Password level (Fall into level 0)

All basic code entry channels deny after 2h

The Modbus TCP access channel denies after 2h

Generally with power supply cycling the password level is denied.

The ToolKit Servlink access never logout

What forces the Logout from Password levels (Fall into level 0)

All basic code entry channels with *[0]* as password or a wrong password

The ToolKit Servlink access with logout function

The Modbus TCP (in all channels) with wrong password

Definition of the password

Numeric Password of the Basic Code entry

- The range of possible passwords is 1 to 9999

Alpha numeric Password of the User Account entry

- The maximum length of the alpha numeric password is 20 characters
- The maximum length of the alpha numeric prefix (ID 10437 ↳ p. 156; 10438 ↳ p. 156) is 6 characters

The Random Number

Each time a password is entered, the random number is calculated at new. This guarantees max. security.

Password handling on the HMI of the easYgen

The easYgen supports only the Basic Code entry.

The easYgen HMI password level shall be visible in the parameter menu screens.

A dynamic key symbol is visible and displays the currently entered code level number inside:

- code level = 00: locked
- code level > 00: unlocked

In case of a password level time out during configuration over HMI, the HMI display switches back to the main screen.

The Input of the code level number or string contains a disguise function.

Password handling in ToolKit

The ToolKit supports the User Account entry and in case of CAN-open connection the Basic Code entry.

Ethernet Connection: The ToolKit password level is visible in the menu *"STATUS MENU* ➔ *Diagnostic* ➔ *Interfaces* ➔ *Ethernet* ➔ *Servlink"*. Refer to your IP-address (PC).

USB Connection: The ToolKit password level is visible in the menu *"STATUS MENU* ➔ *Diagnostic* ➔ *Interfaces* ➔ *USB"*.

CAN Connection: The ToolKit password level is visible in the menu *"STATUS MENU* ➔ *Diagnostic* ➔ *Interfaces* ➔ *CAN* ➔ *CANx"*.

Password handling via Modbus TCP using Ethernet connection

The easYgen must be a member of an Ethernet network and both user name and password have to be transferred (from PLC) to the device.

Set easYgen-XT to code level CL05 via Modbus TCP

With factory settings username is expected to be "CL05" and password to be "CL0500" for code level CL05. With setting the Code Level all five communication channels (sockets) are released.

1. Write and transfer *[CL05]* as hex:

   43-4C-30-35-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00

   for "User name" to parameter 7490 p. 155 (40 bytes).

2. Write and transfer *[CL0500]* as hex:

   43-4C-30-35-30-30-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00

   for "Password" to parameter 7491 (40 bytes).

   ⇨ Code level can be read with parameter 10427

The password level is visible in the Ethernet interface diagnostic screen.

Password handling via Modbus using RS-485 connection

The easYgen must be a member of a RS-485 network and the password has to be transferred (from PLC) to the device.

Set easYgen-XT to code level 5 via Modbus RS-485

With factory settings the password is expected to be "500" for code level 5.

- Modbus address = 400000 + (Par. ID + 1) = 410431
- Modbus length = 1 (UNSIGNED 16)

Code level state can be read with parameter 10420.

Please find the password level in ToolKit: *"STATUS MENU ➔ Diagnostic/Interfaces ➔ RS485"*.

Password handling via CAN using CANopen connection

The easYgen must be a member of a CANopen network and the password has to be transferred (from PLC) to the device.

The easYgen provides several CAN ports and therefore each port has his own password level. The password is written by a SDO Communication Channel.

Set easYgen-XT to code level 5 via CANopen

With factory settings the password is expected to be "500" for code level 5.

Procedure for CAN 1

- CAN interface 1 Parameter ID = 10402 (dec) = 28A2 (hex)
- Incorporate the 2000 (hex) value: 28A2(hex) + 2000 (hex) = 48A2 (hex)
- Identifier: 600 (hex) + Node-ID
- Example Node-ID is 1

The following table shows exemplary send data for the device on the CANopen bus.

Identifier	Description	Data (hex)
601 (hex)	Password 500 writing on Parameter ID 10402	2B A2 48 01 F4 01 00 00

Code level state can be read with parameter 10407.

Please find the password level in ToolKit: *"STATUS MENU ➔ Diagnostic/Interfaces ➔ CAN ➔ CAN 1 state"*.

Procedure for CAN 2

- CAN interface 2 Parameter ID = 10432 (dec) = 28C0 (hex)
- Incorporate the 2000 (hex) value: 28C0 (hex) + 2000 (hex) = 48C0 (hex)
- Identifier: 600 (hex) + Node-ID
- Example Node-ID is 1

The following table shows exemplary send data for the device on the CANopen bus.

Identifier	Description	Data (hex)
601 (hex)	Password 500 writing on Parameter ID 10432	2B C0 48 01 F4 01 00 00

Code level state can be read with parameter 10422.

Please find the password level in ToolKit: *"STATUS MENU ➔ Diagnostic/Interfaces ➔ CAN ➔ CAN 2 state"*.

Procedure for CAN 3

- CAN interface 3 Parameter ID = 10433 (dec) = 28C1 (hex)
- Incorporate the 2000 (hex) value: 28C1 (hex) + 2000 (hex) = 48C1 (hex)
- Identifier: 600 (hex) + Node-ID
- Example Node-ID is 1

The following table shows exemplary send data for the device on the CANopen bus.

Identifier	Description	Data (hex)
601 (hex)	Password 500 writing on Parameter ID 10433	2B C1 48 01 F4 01 00 00

Code level state can be read with parameter 10423.

Please find the password level in ToolKit: *"STATUS MENU ➔ Diagnostic/Interfaces ➔ CAN ➔ CAN 3 state"*.

Code level display

The current code level is indicated by the lock symbol in the configuration menu screens. The lock symbol indicates the number of the code level and appears as "locked" (in code level CL00) or "unlocked" (in higher code levels).

Symbol	Status
	Locked
	Unlocked (Code Level 01)

ID	Parameter	CL	Setting range [Default]	Description
10400	**Password display**	0	0000 to 9999 **[random number]**	The password for configuring the control via the front panel must be entered here.
10405	**Code level display**	0	(display only) **[0]**	This value displays the code level which is currently enabled for access via the front panel display or the Woodward Remote Panel with screen share mode.

Code level interfaces

The password and/or User name for access via interface cannot be entered via HMI.

ID	Parameter	CL	Setting range [Default]	Description
10402	**Password for CAN interface 1**	0	0000 to 9999 **[random number]**	The password for configuring the control via the CAN interface #1 must be entered here. Not visible but can be accessed by interface!
10407	**Code level CAN interface 1**	0	**[0]**	This value displays the code level which is currently enabled for access via the CAN interface #1.

ID	Parameter	CL	Setting range [Default]	Description
10432	**Password for CAN interface 2**	0	0000 to 9999 **[random number]**	The password for configuring the control via the CAN interface #2 must be entered here. Not visible but can be accessed by interface!
10422	**Code level CAN interface 2**	0	**[0]**	This value displays the code level, which is currently enabled for access via the CAN interface #2.
10433	**Password for CAN interface 3**	0	0000 to 9999 **[random number]**	The password for configuring the control via the CAN interface #3 must be entered here. Not visible but can be accessed by interface!
10423	**Code level CAN interface 3**	0	**[0]**	This value displays the code level, which is currently enabled for access via the CAN interface #3.
7486	**Code level for USB**	0	**[0]**	This value displays the code level, which is currently enabled for access via the USB interface. The password is entered via the ToolKit login window.
10430	**Password for serial interface**	0	0000 to 9999 **[random number]**	The password for configuring the control via the RS485 interface must be entered here. Not visible but can be accessed by interface!
10420	**Code level for RS485**	0	**[0]**	This value displays the code level, which is currently enabled for access via the RS485 interface.
7490	**User name Modbus TCP**	0		The user name for configuring the control via the Modbus TCP/IP interface must be entered here. Not visible but can be accessed by interface!
7491	**Password Modbus TCP/IP**	0	0000 to 9999 **[random number]**	The password for configuring the control via the Modbus TCP/IP interface must be entered here. Not visible but can be accessed by interface!
10427	**Code level Modbus TCP/IP**	0	**[0]**	This value displays the code level, which is currently enabled for access via the Modbus TCP/IP interface.
7816	**IP Servlink Master 1**	0	**[0]**	This is the IP address of the PC that is connected via ToolKit with the device as Servlink Master 1.
7824	**Code level Servlink Master 1**	0	**[0]**	This value displays the code level, which is currently enabled for access as Servlink Master 1.
7817	**IP Servlink Master 2**	0	**[0]**	This is the IP address of the PC that is connected via ToolKit with the device as Servlink Master 2.
7825	**Code level Servlink Master 2**	0	**[0]**	This value displays the code level, which is currently enabled for access as Servlink Master 2.
7818	**IP Servlink Master 3**	0	**[0]**	This is the IP address of the PC that is connected via ToolKit with the device as Servlink Master 3.
7826	**Code level Servlink Master 3**	0	**[0]**	This value displays the code level, which is currently enabled for access as Servlink Master 3.
7819	**IP Servlink Master 4**	0	**[0]**	This is the IP address of the PC that is connected via ToolKit with the device as Servlink Master 4.
7827	**Code level Servlink Master 4**	0	**[0]**	This value displays the code level, which is currently enabled for access as Servlink Master 4.
7820	**IP Servlink Master 5**	0	**[0]**	This is the IP address of the PC that is connected via ToolKit with the device as Servlink Master 5.
7828	**Code level Servlink Master 5**	0	**[0]**	This value displays the code level, which is currently enabled for access as Servlink Master 5.
7821	**IP Servlink Master 6**	0	**[0]**	This is the IP address of the PC that is connected via ToolKit with the device as Servlink Master 6.

ID	Parameter	CL	Setting range [Default]	Description
7829	**Code level Servlink Master 6**	0	**[0]**	This value displays the code level, which is currently enabled for access as Servlink Master 6.
7822	**IP Servlink Master 7**	0	**[0]**	This is the IP address of the PC that is connected via ToolKit with the device as Servlink Master 7.
7830	**Code level Servlink Master 7**	0	**[0]**	This value displays the code level, which is currently enabled for access as Servlink Master 7.
7823	**IP Servlink Master 8**	0	**[0]**	This is the IP address of the PC that is connected via ToolKit with the device as Servlink Master 8.
7831	**Code level Servlink Master 8**	0	**[0]**	This value displays the code level, which is currently enabled for access as Servlink Master 8.

4.3.4.1 Password System - Parameter Overview

General notes

The following passwords grant varying levels of access to the parameters.

Each individual password can be used to access the appropriate configuration level through multiple access methods and communication protocols (via the front panel, via serial RS-485 interface, and via the CAN bus).

ID	Parameter	CL	Setting range [Default]	Description
10415	**Password Basic**	1	1 to 9999 **[-]**	The password for the code level "Basic" is defined in this parameter. Refer to *Chapter 4.3.4 "Enter Password" on page 143* for default values.
10413	**Password commissioning**	3	1 to 9999 **[-]**	The password for the code level "Commissioning" is defined in this parameter. Refer to *Chapter 4.3.4 "Enter Password" on page 143* for default values.
10414	**Code temp. commissioning**	3	1 to 9999 **[200]**	The algorithm for calculating the password for the code level "Temporary Commissioning" is defined in this parameter.
10412	**Code temp. super commissioning**	5	1 to 9999 **[400]**	The algorithm for calculating the password for the code level "Temporary Super commissioning" is defined in this parameter.
10411	**Password super commissioning**	5	1 to 9999 **[500]**	The password for the code level "Super commissioning" is defined in this parameter. Refer to *Chapter 4.3.4 "Enter Password" on page 143* for default values.
10437	**Alphanumeric code temp. comm.**	3	(up tp 6 characters) **[a9t5]**	Alphanumeric code for temporary commissioning level. This is the alphanumeric algorithm value for the formula to reach the temporary commissioning code level (Level 02), entered as string here.
10438	**Alphan. code temp. super comm.**	5	(up tp 6 characters) **[xk38]**	Alphanumeric code for temporary super commissioning level This is the alphanumeric algorithm value for the formula to reach the temporary commissioning code level (Level 04), entered as string here.

4.3.4.1.1 Random Number for Password

ID	Parameter	CL	Setting range [Default]	Description
10416	Random number for password		**[(random four letters number)]**	Random number generated by the easYgen-XT device. Needed to get an alphanumeric password by Woodward support.

4.3.4.1.2 Change/Reset Alphanumeric Password

ID	Parameter	CL	Setting range [Default]	Description
Change password basic level				
10439	Old password basic level	1	((empty))	Enter here your old alphanumeric password to release the password change for the basic code level (CL01)
10440	New password basic level	1	((empty))	Enter here your new alphanumeric password string for the basic code level (CL01)
10441	Confirm pass-word basic level	1	((empty))	Repeat here your new alphanumeric password string for the basic code level (CL01)
10442	Change pass-word basic level	1	**[No]** Yes	With switching this parameter to yes, the control checks the entries for changing the password and executes the password change, if the entries are correct. The visualization 10443 indicates the successful execution.
				Notes If the parameters 10439, 10440, and 10441 are not correct, the password change is not executed.
10443	Change passw. error basic level	0		Flag: illuminated LED
			[green]	Password was not changed or successfully changed
			red	Error: password could not be changed
10434	**Reset pass-word basic level**	2	Yes	The control resets the password of the basic level to "CL0001".
			[No]	
Change password commissioning level				
10444	Old password commiss. level	3	((empty))	Enter here your old alphanumeric password to release the password change for the commissioning code level (CL03)
10445	New password commiss. level	3	((empty))	Enter here your new alphanumeric password string for the commissioning code level (CL03)
10446	Confirm pass-word com-miss.level	3	((empty))	Repeat here your new alphanumeric password string for the commiss. code level (CL03)
10447	Change pass-word commiss. level	3	**[No]** Yes	With switching this parameter to *"Yes"*, the control checks the entries for changing the password and executes the password change, if the entries are correct. The visualization 1048 indicates the successful execution.
				Notes If the parameters 10444, 10445, and 1046 are not correct, the password change is not executed.
10448	Change passw. error commiss. level	0		Flag: illuminated LED
			[green]	Password was not changed or successfully changed
			red	Error: password could not be changed
10435	**Reset pass-word commiss. level**	4	Yes	The control resets the password of the commissioning level to "CL0003".

ID	Parameter	CL	Setting range [Default]	Description
			[No]	
Change password super commissioning level				
10449	Old passw. super comm. level	5	((empty))	Enter here your old alphanumeric password to release the password change for the super comm. code level (CL05)
10450	New passw. super comm. level	5	((empty))	Enter here your new alphanumeric password string for the super comm. code level (CL05)
10451	Confirm passw.super comm.level	5	((empty))	Repeat here your new alphanumeric password string for the super comm. code level (CL05)
10452	Change passw.super comm. level	5	**[No]** Yes	With switching this parameter to *"Yes"*, the control checks the entries for changing the password and executes the password change, if the entries are correct. The visualization 1053 indicates the successful execution.
				Notes If the parameters 10449, 10450, and 1051 are not correct, the password change is not executed.
10453	Change passw. super error comm. level	0		Flag: illuminated LED
			[green]	Password was not changed or successfully changed
			red	Error: password could not be changed
10436	**Reset passw. super comm. level**	11	Yes	The control resets the password of the commissioning level to "CL0005" e.g., if you forgot your password.
				Notes The code level to execute the password reset is provided by your Woodward sales support partner.
			[No]	

4.3.5 System Management

CAUTION!

Don't initiate *"Set factory default settings"* during controlling a genset! This causes easYgen rebooting.

Parameter 1701 ⤷ p. 159 *"Set factory default values"* causes a reboot of the control. During this time the genset system is not controlled by the easYgen! An uncontrolled operation can lead into life-threatening hazard or damage.

After settings changed: Please wait 30 seconds to be sure changes are saved before power cycling the device.

ID	Parameter	CL	Setting range [Default]	Description
1702	**Device number**	2	1 to 32 **[1]**	A unique address is assigned to the control though this parameter. This unique address permits the controller to be correctly identified on the CAN bus. The address assigned to the controller may only be used once. All other bus addresses are calculated on the number entered in this parameter. The device number is also important for the device assignment in load sharing and load-dependent start/stop.
				Notes The unit must be restarted after changing the device number to ensure proper operation. For multiple genset applications please make sure to change parameter 8952 ↳ p. 465 as well
1889	**Device name preset**	2	**[Device_name]** 12 to 38 characters but varies on font	After set with parameter 1893 this customer specific device name is used e.g. as device name in Ethernet network.
				Notes Recommended are 19 ASCII characters max. Blanks and special characters will be replaced.
1890	**Device name**	2	**["displayable characters of parameter 1889"]** up to 38 characters but varies on font	(Pre)view of device name.
1893	**Set device name**	2	**[No]** Yes	YES: Device name typed in as value of parameter 1889 taken, processed, and displayable characters saved as parameter 1890.
10417	**Factory default settings**	0	Yes	The following three parameters are visible and restoring the configured parameters to factory default values is enabled.
			[No]	The following three parameters are invisible and restoring the configured parameters to factory default values is not enabled.
1701	**Set factory default values**	4	Yes	All parameters, with the exception of customer defined passwords, will be restored to factory default values. If the default setting is initiated the alarm LED starts twinkling with a higher rate (ca. 5 Hz).
				Notes The device is power cycled and rebooting after approx. 20 seconds! In case of ToolKit connected via USB service port: USB connection will be lost!
			[No]	All parameters will remain as currently configured.
				Notes This parameter is only displayed, if factory default settings (parameter 10417 ↳ p. 159/↳ p. 635) is set to "Yes".

4.4 Configure Application

4.4.1 Configure Engine

4.4.1.1 Configure Engine (general)

ID	Parameter	CL	Setting range [Default]	Description
3321	**Start/Stop mode logic**	2		Diesel or gas engine start/stop logic must be selected.
			[Diesel]	**Start sequence** The relay "Preglow" will be energized for the preheating time period ("Preglow" is displayed). Following preheating, the fuel solenoid is first energized and then the starter is engaged ("Start" is displayed). When the configured firing speed is exceeded, the starter is disengaged and the fuel solenoid remains energized via the firing speed. "Ramp to rated" is displayed until the engine monitoring delay timer expires and the start sequence has finished. If the engine fails to start, a start pause is initiated ("Start - Pause" is displayed). If the number of unsuccessful start attempts reaches the configured value, an alarm message will be issued ("Start fail" is displayed). **Stop sequence** After opening the GCB, the coasting time starts and the engine runs without load ("Cool down" is displayed). On termination of the coasting time, the fuel solenoid is de-energized, and the engine is stopped ("Stop engine" is displayed). If the engine cannot be stopped via the fuel solenoid, the alarm message "Eng. stop malfunct." is displayed. **Start/stop diagram** The formula signs and indices mean: ■ tPRE Auxiliary services prerun [s] (parameter 3300 ➘ p. 172) ■ tPH Preglow time [s] (parameter 3308 ➘ p. 161) ■ tST Starter time [s] (parameter 3306 ➘ p. 171) ■ tSP Start pause [s] (parameter 3307 ➘ p. 171) ■ tED Engine delayed monitoring [s] (parameter 3315 ➘ p. 171) ■ tPOST Auxiliary services postrun [s] (parameter 3301 ➘ p. 172) ■ tCD Cool down time [s] (parameter 3316 ➘ p. 172) ■ tGS Generator stable time [s] (parameter 3415 ➘ p. 226) Refer to ➘ *"Diesel engine diagrams" on page 163.*

ID	Parameter	CL	Setting range [Default]	Description
			Gas	**Start sequence** The starter is engaged ("Turning" is displayed). Following the expiration of the firing delay time and if the engine is rotating with at least the configured "minimum speed for ignition", the ignition is switched on ("Ignition" is displayed). Following the expiration of the gas valve delay, the gas valve is then enabled ("Start" is displayed). If the configured firing speed is exceeded, the starter is disengaged. The gas valve and the ignition remain enabled via the firing speed. "Ramp to rated" is displayed until the engine monitoring delay timer expires and the start sequence has finished. If the configured "minimum speed for ignition" is not reached, a start pause is initiated ("Start - Pause" is displayed) before the next start attempt. **Stop sequence** After opening the GCB, the coasting time starts and the engine runs without load ("Cool down" is displayed). On termination of the coasting time, the gas valve is closed or de-energized, and the engine is stopped ("Stop engine" is displayed). If the engine cannot be stopped, the alarm message "Eng. stop malfunct." is displayed. If no speed is detected anymore, the ignition remains active for 5 seconds so that the remaining gas is able to combust. **Start/stop diagram** The formula signs and indices mean: ■ tPRE Auxiliary services prerun [s] (parameter 3300 ➡ p. 172) ■ tST Starter time [s] (parameter 3306 ➡ p. 171) ■ tSP Start pause [s] (parameter 3307 ➡ p. 171) ■ tID Ignition delay [s] (parameter 3310 ➡ p. 162) ■ tGD Gas delay [s] (parameter 3311 ➡ p. 162) ■ tED Engine delayed monitoring [s] (parameter 3315 ➡ p. 171) ■ tPOST Auxiliary services postrun [s] (parameter 3301 ➡ p. 172) ■ tCD Cool down time [s] (parameter 3316 ➡ p. 172) ■ tIC Ignition coasting ("post burning") [s] (fixed to 5 seconds) ■ tGS Generator stable time [s] (parameter 3415 ➡ p. 226) Refer to ➡ *"Gas engine diagrams" on page 164* and ➡ *"Gas engine diagrams" on page 164*. **CAUTION** It is imperative to connect an emergency stop circuit to discrete input DI 1 to be able to perform an emergency stop by disabling the ignition in case the gas valve fails to close.
			External	The start/stop sequence must be done externally.
			Off	The start/stop sequence is completely disabled. The delayed engine monitoring is dependent from LogicsManager release engine monitoring 12999 ➡ p. 173/➡ p. 930. The GCB release is activated by LogicsManager start request in AUTO (parameter 12120 ➡ p. 290/➡ p. 927). The controllers are deactivated in operating mode STOP. Please refer to ➡ *Chapter 6.3.12 "Start/Stop Logic Mode "Off"" on page 570* for details.
				Notes All functions which are described here, may be assigned by the LogicsManager to any relay that is available via the LogicsManager and not assigned to another function.
3308	**Preglow time** [tPH] (Diesel engine)	2	1 to 999 s **[5 s]**	**Notes** The display indicates "Preglow".
3347	**Preglow mode**	2		This parameter dictates if and under what conditions a diesel engine is preheated.

ID	Parameter	CL	Setting range [Default]	Description
	(Diesel engine only)		Off	The diesel engine is never preheated before a start attempt.
			[Always]	Before a start attempt the "Preheating" relay is always energized for the preglow time (parameter 3308 ↳ p. 161). After that a start attempt is initiated.
			Analog	A preglow sequence is initiated if the monitored analog input temperature (coolant temperature) is below the configured threshold (parameter 3309 ↳ p. 162). The preglow sequence is enabled for the configured preglow time (parameter 3308 ↳ p. 161). After that a start attempt is initiated.
3309	**Preglow temperature threshold** (Diesel engine only)	2	-10 to 250 °C **[0 °C]**	This is the temperature threshold, which must be exceeded to prevent a preheating process, if parameter 3347 ↳ p. 161 has been set to "Analog".
4057	**Pre-excitation D+**	2	**[On]**	When the engine is starting up, an exciting current is issued.
				Notes The resulting voltage at terminal 65 can be monitored. Refer to chapter ↳ *Chapter 4.5.2.7 "Engine Charge Alternator (D+)" on page 354* for details.
			Off	No exciting current is issued. The input D+ can be used as analog input which can be configured freely e.g. for (firing) speed detection.
				Notes This function is only working if the battery voltage is below 27.5 V to avoid overload of internal circuitry.
3346	**AM Preglow criterion** (Diesel engine only)	2	Determined by AnalogManager 81.01 **[A1 = 10.01 ZERO]**	The preglow criterion may be selected from the available data sources. Usually, a temperature measuring is selected here, which is measured via a sensor.
				Notes Refer to ↳ *Chapter 4.9 "Configure AnalogManager" on page 484* for explanation how to use the AnalogManager. Refer to ↳ *Chapter 9.4.1 "Data Sources AM" on page 933* for a list of all data sources.
3310	**Ignition delay** [tID] (Gas Engine only)	2	0 to 9999 s **[5 s]**	With gas engines often a purging operation is desired before starting. With the engaging of the starter the ignition delay is started. The display indicates "Turning". If the "Minimum speed for ignition" is reached after the expiration of this time, the ignition is energized.
3311	**Gas valve delay** [tGD] (Gas Engine only)	2	1 to 999 s **[5 s]**	By energizing the ignition relay the gas valve delay is started ("Ignition" is displayed). After the time set here has expired, and as long as the speed is higher than the minimum speed for ignition, the gas valve is enabled for the time configured in parameter 3306 ↳ p. 171 "Starter time" ("Start" is displayed). Once the ignition speed has been reached, the gas valve remains opened. If the speed falls below ignition speed, the gas valve will be closed and the "Ignition" relay is de-energized 5 seconds later.
3312	**Minimum speed for ignition** (Gas Engine only)	2	10 to 1,800 rpm **[100 rpm]**	After expiration of the ignition delay the number of revolutions set here must be reached, so the "Ignition" relay will be energized.

Diesel engine diagrams

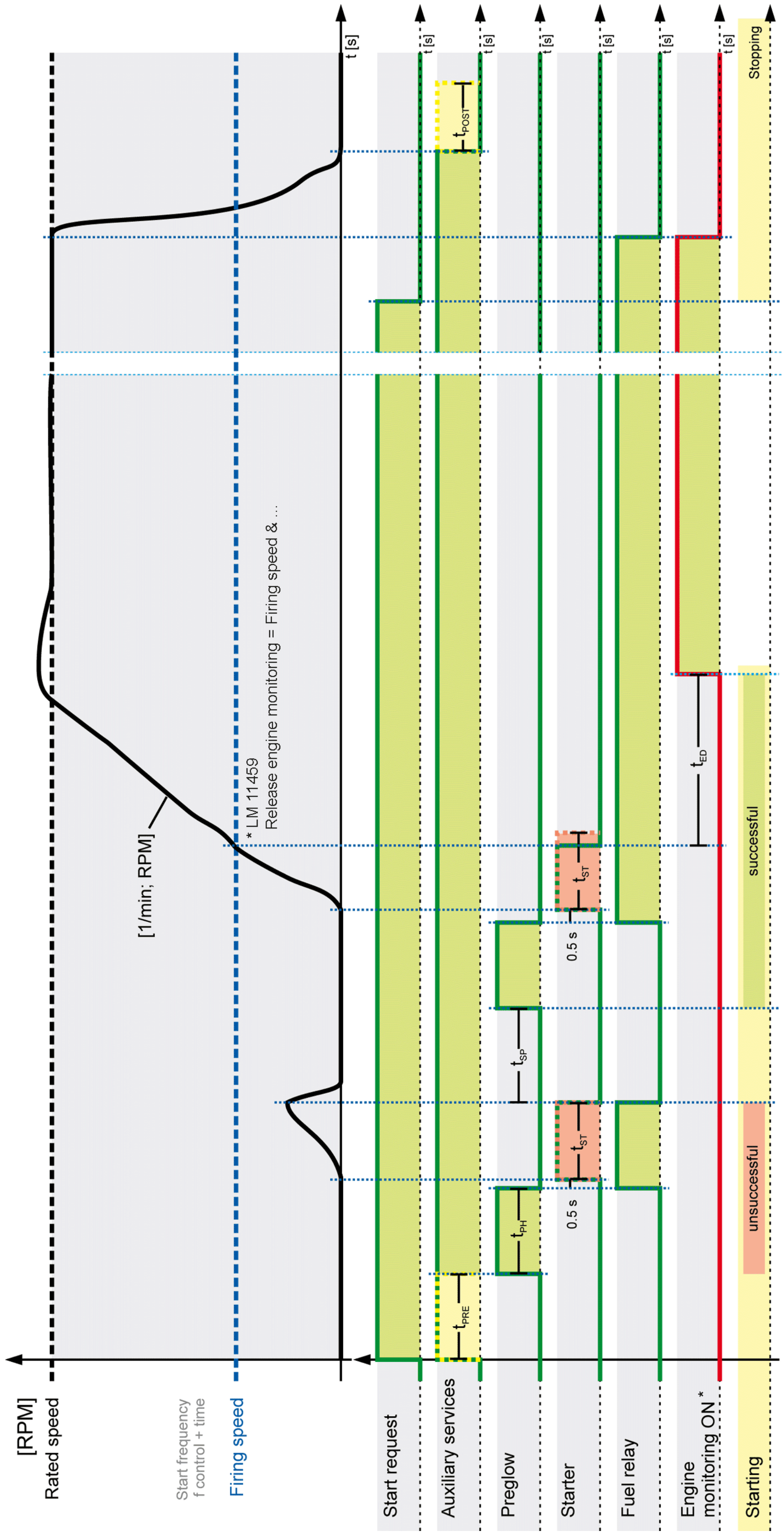


Fig. 136: Start/Stop sequence - diesel engine

Gas engine diagrams

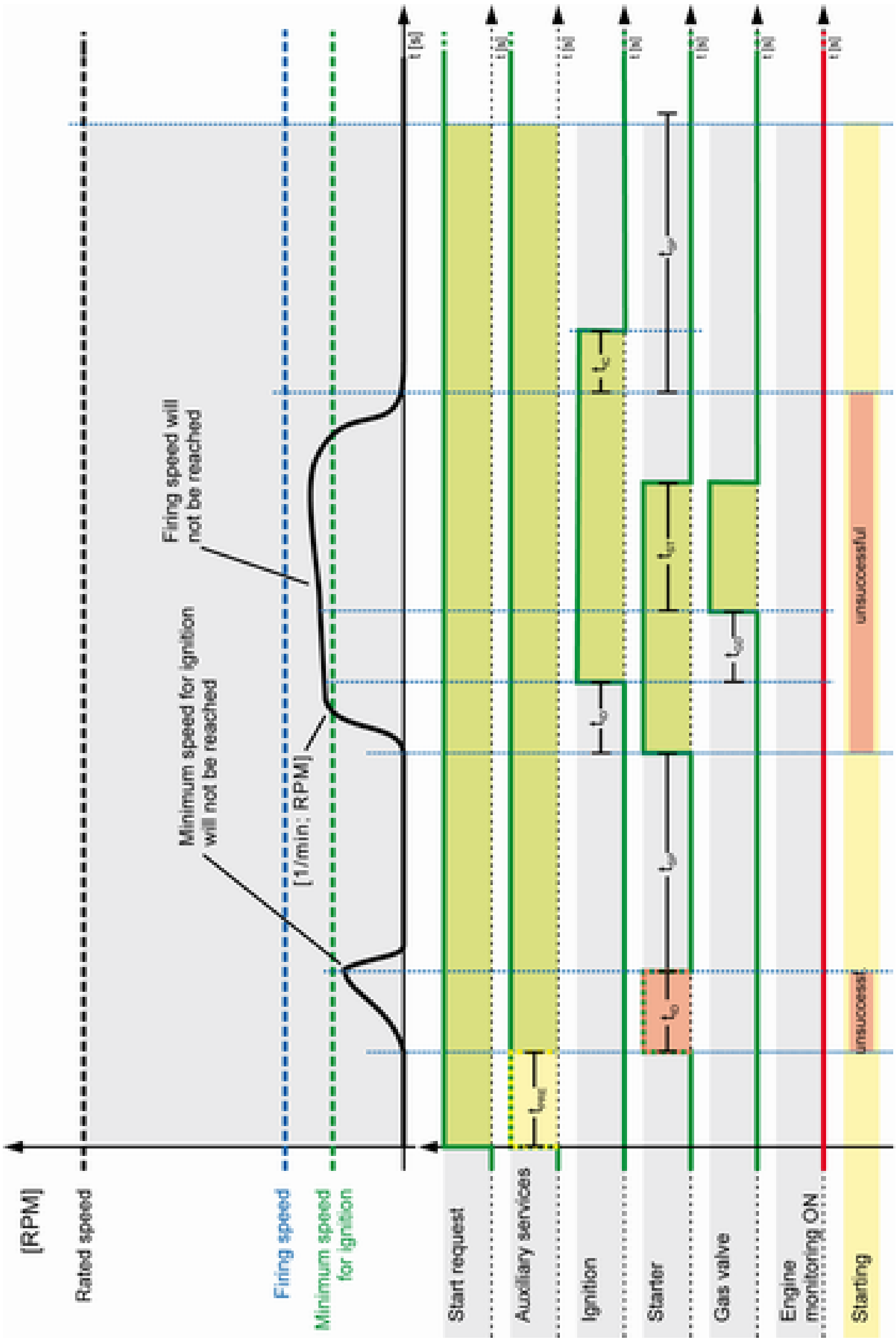


Fig. 137: Start/Stop sequence - gas engine - failure

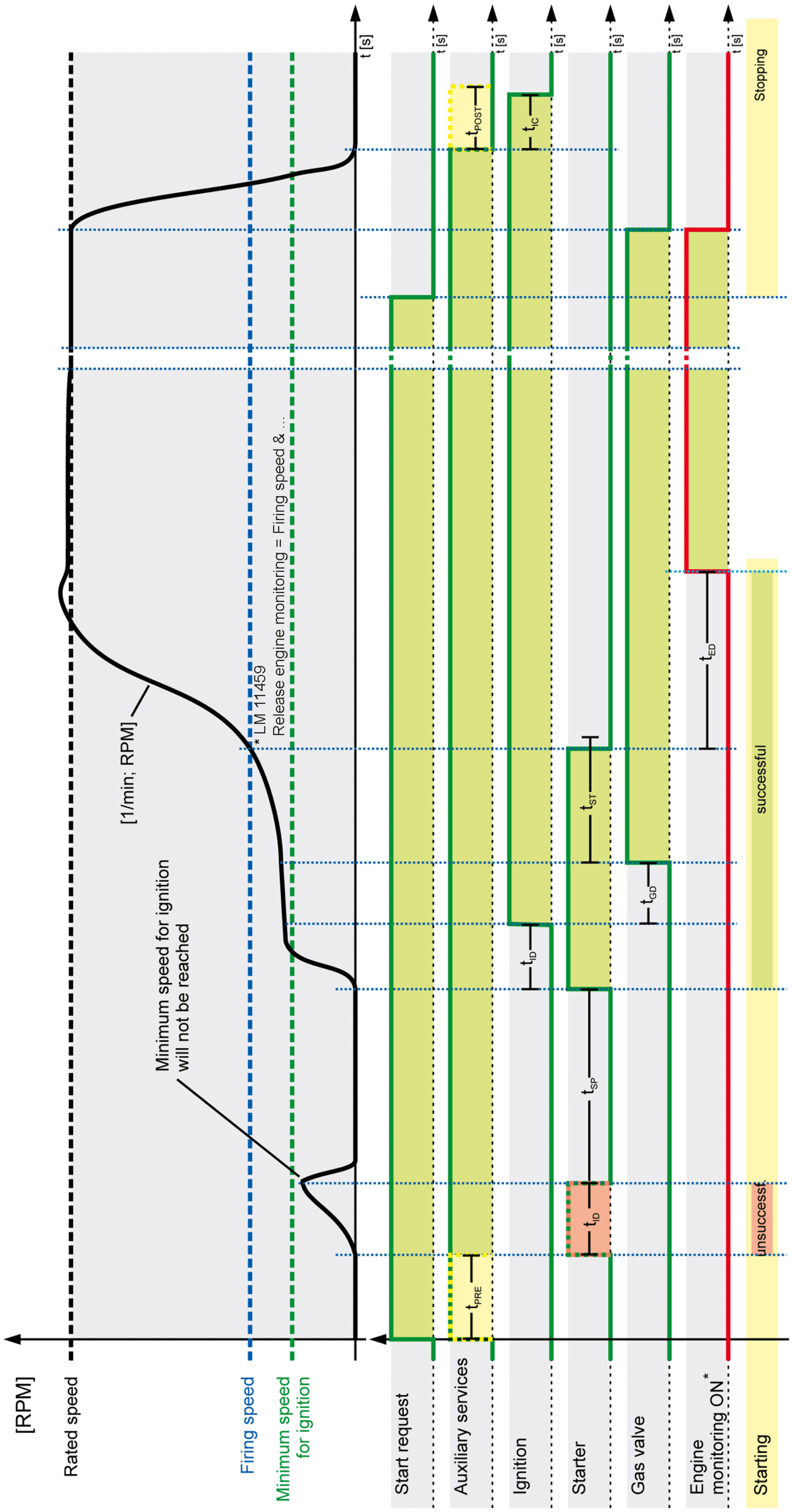


Fig. 138: Start/Stop sequence - gas engine - success

4.4.1.2 Engine Start/Stop

Speed States

easYgen-XT offers individually configurable speed and firing speed detection (non-XT easYgen was determined by the electrical frequency measurement only).

Firing speed and the speed detection is now managed by LogicsManager equations named “Firing speed detection” and “Speed detection”. The default setting of them is backward compatible!

The possibility to arrange different sources to determine speed and firing speed comes with more flexibility. Woodward recommends to spend some time to understand the parameters and dependencies listed below or on ToolKit page *“Parameter ➔ Configuration ➔ Configure application ➔ Configure engine ➔ Configure start/stop”*.

Firing Speed detection

The “Firing Speed” detection is a basic function of the easYgen genset controls. This information influences a lot of functions and therefore is to configure very carefully!

With the firing speed detection the device recognizes e.g. the engine as successfully started, removes the starter immediately and triggers the timer *“Monitoring delay time”* for engine speed relevant monitoring. The firing speed can be detected out of different sources. In comparison to the easYgen-3000 first generation, the firing speed is generated through a LogicsManager equation always and allows all speed source combinations.

By default the LogicsManager is configured backward compatible: easYgen-XT behaves like the first generation easYgen-3000.

Speed detection

With the “Speed” detection the device recognizes e.g. the engine as turning or as successful stopped. The speed can be detected out of different sources. In comparison to the easYgen-3000 first generation, the speed is generated through a LogicsManager equation and allows all speed source combinations.

By default the LogicsManager is configured backward compatible: easYgen-XT behaves like the first generation easYgen-3000.

The easYgen provides two LogicsManager command variables (LMCV) for detecting speed:

- Electrical measured determined speed
- Speed sensor (rpm) determined speed

Configuration of the Firing Speed Detection

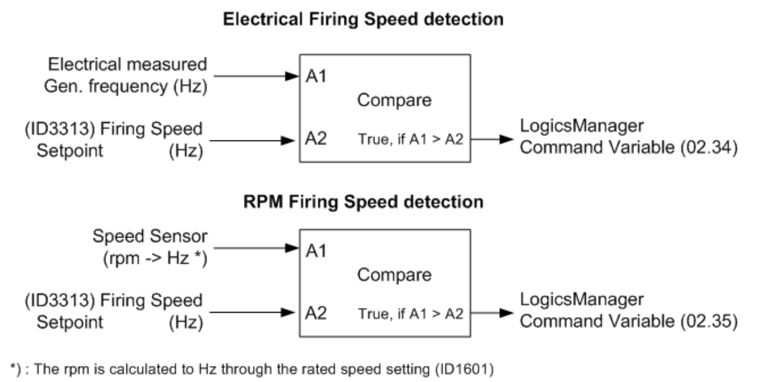


Fig. 139: Internally determined firing speed flags

The electrical frequency measurement starts at 15 Hz. So 15 Hz is usually the lowest firing speed limit. This corresponds for a 4-pole synchronous generator to 450 rpm at 50Hz.

The rpm measurement allows lower firing speed limits. With a speed sensor the firing speed can be configured down to 5 Hz.

Firing speed configuration

Configuration A)

- Firing speed: 5 Hz
- Rated speed: 1800 rpm
  Rated frequency: 60 Hz

Calculation

- Firing speed [rpm] = (Firing speed [Hz] * Rated speed [rpm]) / Rated frequency [Hz]
- Firing speed [rpm] = 5 Hz * 1800 rpm / 60 Hz = 150 rpm

Configuration B)

- Firing speed: 5 Hz
- Rated speed: 1500 rpm
  Rated frequency:50 Hz

Calculation

- Firing speed [rpm] = (Firing speed [Hz] * Rated speed [rpm]) / Rated frequency [Hz]
- Firing speed [rpm] = 5 Hz * 1500 rpm / 50 Hz = 150 rpm

Usually both command variables 02.34 and 02.35 are entered in the LogicsManager equation for detecting firing speed.

The result of the LM *"Firing speed detection"* goes directly into the start / stop logic and other functions of the easYgen. Through the LogicsManager approach other sources can be taken into account.

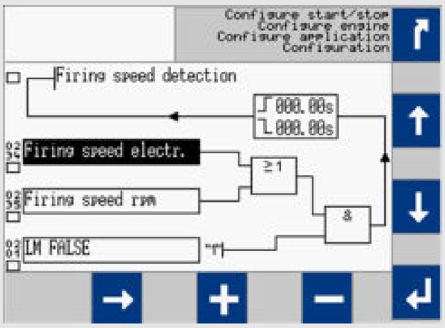


Fig. 140: LogigsManager Firing speed detection

Configuration of the Speed Detection

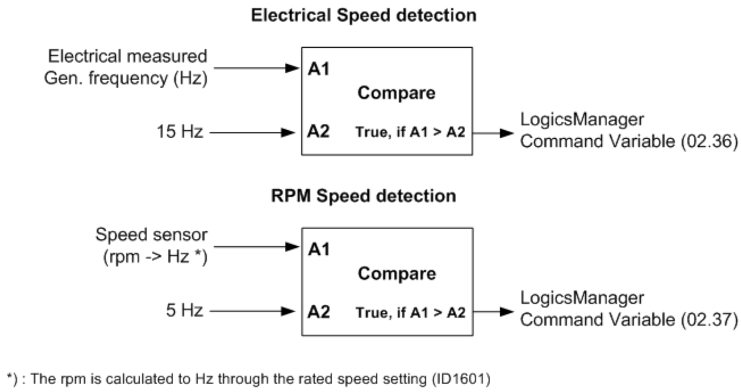


Fig. 141: Internally determined speed flags

> *The electrical frequency measurement starts at 15 Hz. So 15 Hz is usually the lowest speed limit. This corresponds for a 4-pole synchronous generator to 450 rpm at 50Hz.*
>
> *The rpm measurement allows lower speed limits. With a speed sensor the speed can be configured down to 5 Hz.*

Usually both command variables 02.36 and 02.37 are entered in the LogicsManager equation for detecting speed.

The result of the LM *"Speed detection"* goes directly into the start / stop logic and other functions of the easYgen. Through the LogicsManager approach other sources can be taken into account.

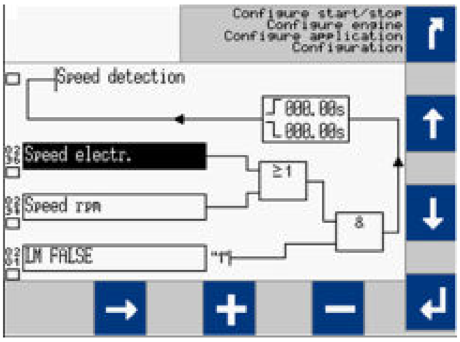


Fig. 142: LogicsManager for detecting speed

Firing speed and delayed monitoring

> *When the firing speed is reached, the starter is disengaged under one of the following conditions:*
>
> – *The measurement via MPU is enabled (On):*
>   – *Ignition speed measured via MPU is detected or*
>   – *Ignition speed measured via the generator voltage is detected or*
>   – *Conditions for "Ignition speed" (see LogicsManager) equal true.*
> – *The measurement via MPU is disabled (Off):*
>   – *Ignition speed measured via the generator voltage is detected or*
>   – *Conditions for "Ignition speed" (see LogicsManager) equal true.*

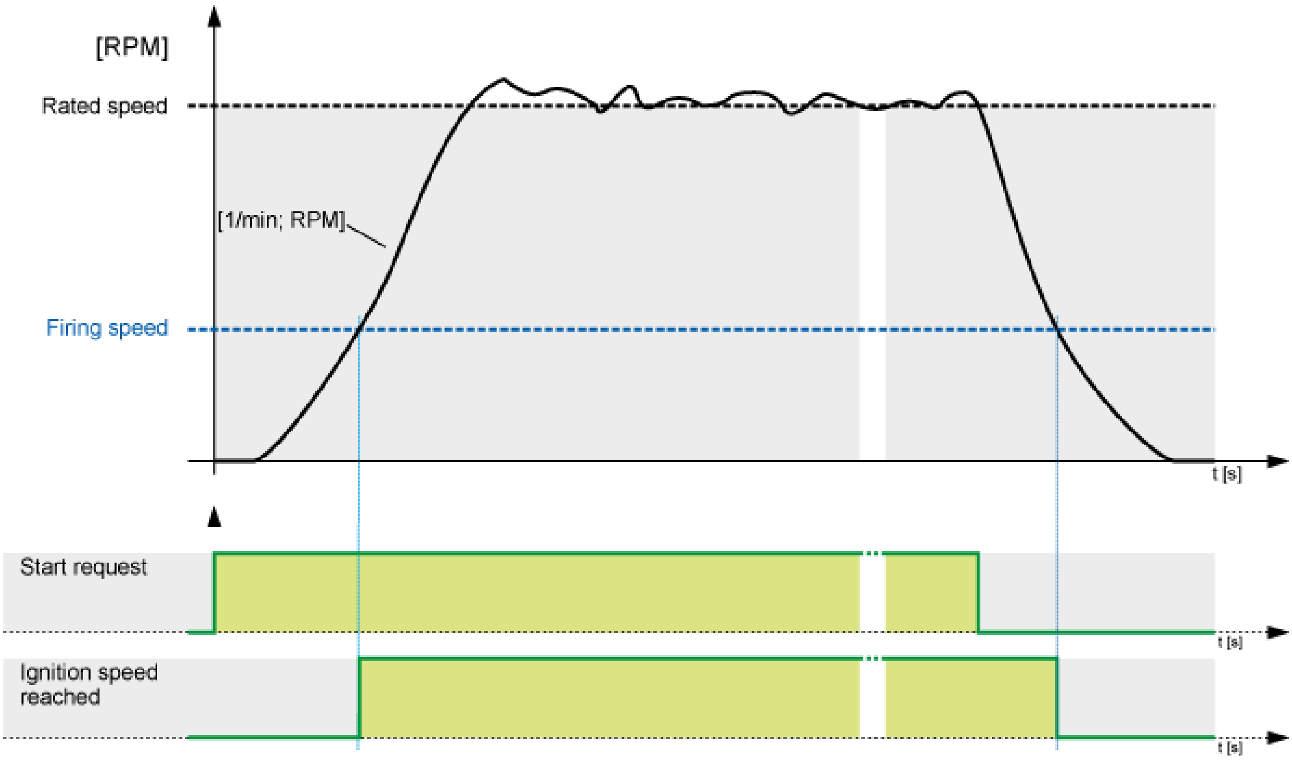


Fig. 143: Engine - firing speed

Auxiliary operations

The auxiliary operations start, as soon as the engine is to be started or a running engine is detected.

At the same time, the discrete output for the auxiliary services (LogicsManager 03.01) will be enabled. This discrete output remains enabled as long as speed is detected or if the controller is in the MANUAL mode.

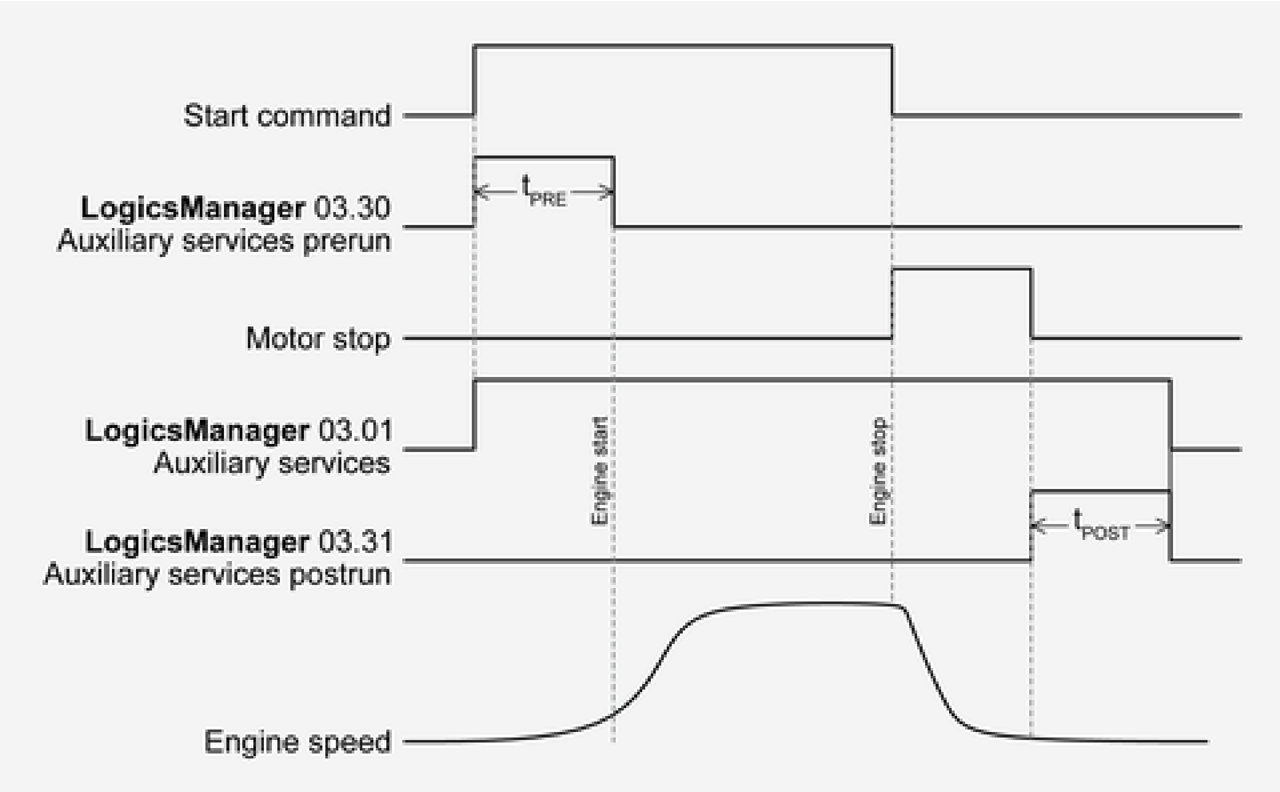


Fig. 144: : Engine - auxiliary services timing

Start/Stop logic (inhibit cranking)

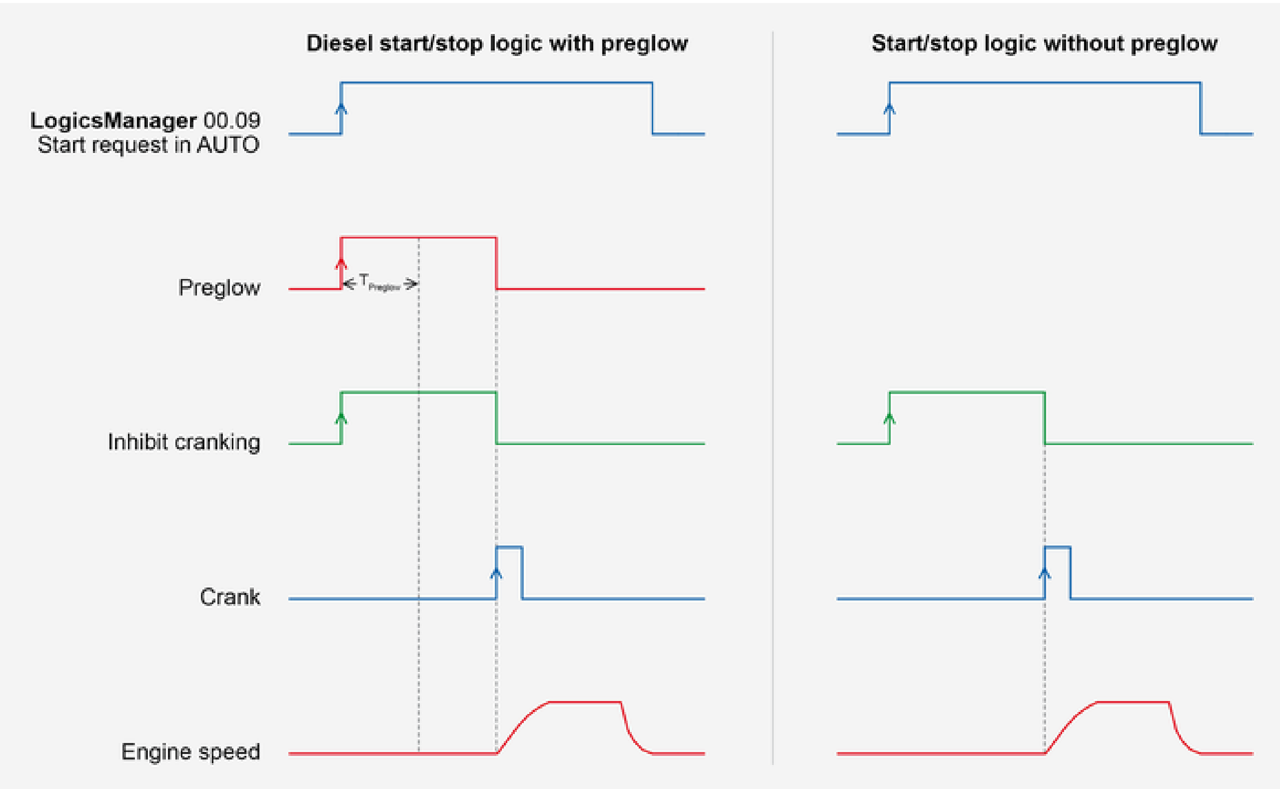


Fig. 145: Engine - start/stop logic (inhibit cranking)

ID	Parameter	CL	Setting range [Default]	Description
3302	**Start attempts**	2	1 to 20 **[3]**	The control will attempt to start the engine with this number of start attempts. If the engine fails to start after the configured number of attempts, an alarm will be initiated. An engine has been successfully started if the ignition speed reaches the configured firing speed and the delayed engine monitoring (set by release engine monitoring) has expired.
4102	**Start attempts critical mode**	2	1 to 20 **[10]**	If a critical operation mode (*Chapter 4.4.6 "Emergency Run" on page 312*) is initiated, the engine will continue to attempt to start for the number of starts configured here. An engine has been successfully started if the ignition speed reaches the configured firing speed and the delayed engine monitoring (set by release engine monitoring) has expired.
3306	**Starter time** (Maximum starter delay [t_{ST}])	2	1 to 99 s **[5 s]**	This is the maximum time that the starter relay will remain energized ("Start" display). If the LogicsManager output "Ignition speed reached" = TRUE, the speed/ frequency have reached firing speed, or the time has expired, the relay will be de-energized.
3307	**Start pause time** [t_{SP}]	2	1 to 99 s **[7 s]**	This is the delay time between the individual starting attempts. This time is also used to protect the starter relay. The message "Start - Pause" is displayed.
4844	**Inhibit cranking max. time**	2	1 to 999 s **[60 s]**	If the inhibit cranking (parameter 4871 p. 173 becomes active this counter starts. Once the counter exceeds the delay time, the message "Start fail" is displayed. The LogicsManager command variable "Inhibit cranking" (03.38) becomes TRUE as soon as the inhibit cranking signal has been issued and remains true until this timer has expired.
3326	**Stop time of engine** (Engine blocking)	2	1 to 99 s **[10 s]**	During this time a restart of the engine is blocked. This time should be configured so that the engine is total shutdown to protect the starting circuit. Once speed from the engine is no longer detected the time configured in this parameter is initiated. The message "Stop engine" is displayed. The LogicsManager command variable "Stop solenoid" (03.27) becomes TRUE as soon as the stop signal has been issued and remains true until this timer has expired.
3313	**Firing speed**	2	5 to 60 Hz **[15 Hz]**	After firing speed has been reached, the starter is disengaged. The firing speed is to be configured low enough that it is always exceeded during regular generator operation. **Notes** The time counter for the engine delayed monitoring is no longer activated directly by firing speed but by release engine monitoring 12999 p. 173/ p. 930. Frequency measurement via the generator voltage input is possible beginning with 15 Hz or higher. If the MPU measurement is enabled, values down to 5 Hz can be measured. With this firing speed limit are generated both the *"firing speed electric"* flag 02.34 and the *"firing speed rpm"* flag 02.35.
3315	**Engine monitoring delay time** (Engine delayed monitoring [t_{ED}])	2	1to 99 s **[8 s]**	Delay between reaching release engine monitoring and activation of the monitoring of engine speed delayed alarms (i.e. underspeed). After reaching the firing speed, the engine delayed monitoring timer is started. Upon expiration of this timer all "engine delayed monitoring" configured alarms and discrete inputs will be enabled. This timer should be configured in such a manner that it corresponds to the starting time of the engine plus any possible startup transients. A GCB closure may take place after the expiration of this timer.

ID	Parameter	CL	Setting range [Default]	Description
				Notes The overall time engine monitoring is delayed from firing speed becoming TRUE (former version's setup), Delay On and Delay OFF of LM equation 11459 release engine monitoring must be added. The GCB closure can be initiated prior to engine delayed monitoring by configuring the LogicsManager "Undelay close GCB" (parameter 12210 p. 226/ p. 927).
3316	**Cool down time** [t_{CD}]	2	1 to 9999 s **[180 s]**	**Regular stop** If the engine performs a normal stop (start request is disabled or change into STOP operating mode) or a stop caused by an alarm of alarm class C/D, a cool down with an opened GCB is carried out. This time is programmable. The message "Cool down" is displayed and the LogicsManager command variable 04.10 becomes TRUE. **Stop by a class 'C' or 'D' alarm** If the engine is stopped by an alarm of this alarm class, a cool down is carried out with an opened GCB. This time is programmable. **Stop by a class 'E' or 'F' alarm** If the engine is stopped by an alarm of this alarm class, the engine is shutdown without a cool down immediately.
				Notes If a critical operation mode (*Chapter 4.4.6 “Emergency Run” on page 312*) is initiated, the time configured in critical mode postrun (parameter 4109) will be used instead of the cool down time.
3319	**Cool down in STOP mode**	2	**[Yes]**	A cool down will be performed if the genset is changed to STOP operation mode.
			No	No cool down will be performed if the genset is changed to STOP operation mode.
3322	**Cool down without breaker**	2		This parameter may be used to perform a cool down if the application mode (parameter 3444 p. 220) is configured to "None" or "GCB open".
			Yes	A cool down will be performed if a start signal is disabled or a stop signal is enabled.
			[No]	No cool down will be performed if a start signal is disabled or a stop signal is enabled.
				Notes This parameter **only** applies to application mode A01 A02.
3300	**Auxiliary services prerun** [t_{PRE}] (Prerun auxiliary operation (start preparation))	2	0 to 9999 s **[0 s]**	Prior to a start sequence being initiated, the discrete output for the auxiliary services prerun (LogicsManager 03.30) remains enabled for the configured amount of time to permit engine related operations (i.e. open louvers) to be performed. While this discrete output is enabled the control screen will display the message "Aux.serv.prerun" for the configured time. The auxiliary services discrete output disables when the operation mode is changed from the MANUAL operation mode or, if engine speed is no longer detected, when the discrete output for the auxiliary services postrun (LogicsManager 03.31) is disabled.
				CAUTION During an emergency start this delay time "auxiliary prerun" is not initialized. The engine will be started immediately.
3301	**Auxiliary services postrun** [t_{POST}] (Coasting auxiliary operation (post operation))	2	0 to 9999 s **[0 s]**	After each engine stop (the engine stop timer has expired), the discrete output for the auxiliary services postrun (LogicsManager 03.31) remains energized for an adjustable time (i.e. operate a cooling pump). If the operating mode is changed from MANUAL to STOP or AUTOMATIC without a start command the relay remains energized for this period of time. The message "Aux.serv.postrun" will be displayed on the control unit screen. In the "MANUAL" operating mode this relay output is not used.

ID	Parameter	CL	Setting range [Default]	Description
4871	**Inhibit cranking**	2	Determined by LogicsManager 87.66 **[(0 & 1) & 1]** = 11455	Once the conditions of the LogicsManager have been fulfilled the cranking (03.38) is blocked. The discrete output relay [R 03] will be not energized. **Notes** For information on the LogicsManager and its default settings see *Chapter 9.3.1 "LogicsManager Overview" on page 882*. Please refer to Fig. 145 for details.
12951	**Firing speed detection**	2	Determined by LogicsManager 87.68 **[(02.34 Firing speed electr. OR 02.35 Firing speed rpm) & 1]** = 11457	This LogicsManager allows different sources to generate the general firing speed flag. This will be taken into account for the START/STOP automatic and some monitoring functions. **Notes** The former easYgen was fixed to the electrical frequency always and allowed other sources additionally. The default setting here is backward compatible.
12989	**Speed detection**	2	Determined by LogicsManager 87.69 **[(02.36 Speed electr. OR 02.37 Speed rpm) & 1]** = 11458	This LogicsManager allows different sources to generate the general speed flag. This will be taken into account for some monitoring functions. **Notes** The former easYgen was fixed to the electrical frequency always. The default setting here is backward compatible.
12970	**MAN engine start**	2	Determined by LogicsManager 87.50 **[(0 & 1) &1]** = 11439	With the rising edge of this LogicsManager equation an engine start command in operating mode MANUAL is initiated. The state TRUE of this LM inhibits the start command in MANUAL.
12971	**MAN engine stop**	2	Determined by LogicsManager 87.59 **[(0 & 1) &1]** =11448	With the rising edge of this LogicsManager equation an engine stop command in operating mode MANUAL is initiated. The state TRUE of this LM inhibits the start command in MANUAL.
12999	**Release eng.mon.**	2	Determined by LogicsManager 87.70 **[(02.34 Firing speed electr. & 02.35 Firing speed rpm) & 03.28 Start/Gas]** **t_{ON} = 0.00; t_{OFF} = 0.00]** = 11459	Switch to activate the delayed engine monitoring e.g., oil pressure, under frequency, ... **Notes** For more details see description below.

Release Engine Monitoring

This LogicsManager equation (ID = 12999 with logical command variable 11459) enables or blocks all monitoring functions, which are speed related by enabled setting: "Delayed by engine speed":

- Under/Over frequency
- Under speed
- Under voltage
- ...

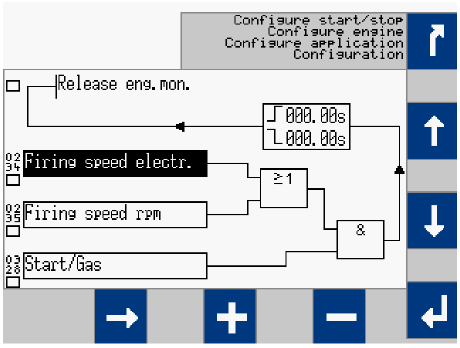


Fig. 146: Release Engine Monitoring screen

In the default setting of the easYgen the engine start/stop is executed by the easYgen directly. So the engine monitoring is released, if the control energizes the solenoid valve (Start/Gas 11657) and the firing speed is reached. In the moment the easYgen removes the solenoid valve the monitoring is disabled. This avoids wrong alarms during the engine stopping procedure.

In cases the start/stop of the drive is executed from outside, the command variable 03.28 Start/Gas (11657) is replaced by a command from outside i.e. any discrete input (09.XX). With starting the drive the operator gives the command for monitoring. With stopping the drive the command has to be removed to avoid wrong alarms during the engine stopping procedure.

The delayed engine monitoring can be seen with the upcoming “Eye” symbol in the single line diagram.

4.4.1.3 Magnetic Pickup Unit

To configure the MPU input, the number of teeth on the flywheel detected by the magnetic pick up (MPU) or the number of pickup pulses per revolution of the engine must be configured.

The table below shows the speed measuring range for various flywheel teeth numbers (parameter 1602 ➪ p. 175) and rated speeds (parameter 1601 ➪ p. 438) for a minimum signal voltage of 2 V_{rms}.

Fly wheel teeth	Rated speed [rpm]	Speed measuring range [rpm]
10	1500	1200 to 4500
10	1800	1200 to 5400
10	3000	1200 to 9000
10	3600	1200 to 10800
25	750	480 to 2250
25	1500	480 to 4500
25	1800	480 to 5400
25	3000	480 to 9000
25	3600	480 to 10800
50	750	240 to 2250
50	1500	240 to 4500
50	1800	240 to 5400
50	3000	240 to 9000
50	3600	240 to 10800
100	750	120 to 2250
100	1500	120 to 4500
100	1800	120 to 5400
100	3000	120 to 6000

Fly wheel teeth	Rated speed [rpm]	Speed measuring range [rpm]
100	3600	120 to 6000
150	750	80 to 2250
150	1500	80 to 4000
150	1800	80 to 4000
150	3000	80 to 4000
150	3600	80 to 4000
200	750	60 to 2250
200	1500	60 to 3000
200	1800	60 to 3000
200	3000	60 to 3000
260	750	50 to 2250
260	1500	50 to 2300
260	1800	50 to 2300
280	750	45 to 2100
280	1500	45 to 2100
280	1800	45 to 2100
300	750	40 to 2000
300	1500	40 to 2000
300	1800	40 to 2000
400	750	30 to 1500
400	1500	30 to 1500
500	750	24 to 1200
600	750	20 to 1200
700	750	18 to 850
800	750	15 to 750

Table 60: MPU input - typical configurations

ID	Parameter	CL	Setting range [Default]	Description
1600	**MPU input** (Pickup)	2	**[On]**	Speed monitoring of the engine is carried out by the MPU.
			Off	Speed/frequency monitoring of the generator set (the engine) is performed by measuring the frequency of the generator. There is no MPU wired to this unit.
15155	**Engine speed source**	2	**[Internal]**	The internal MPU input is used as engine speed source.
			ECU/J1939	An external ECU/J1939 signal is used as speed source.
1602	**Fly wheel teeth**	2	2 to 800 **[118]**	Number of pulse per revolution/teeth on the flywheel.
				Notes This parameter is only applicable if parameter 15155 ➫ p. 175 is set to "Internal".

4.4.1.4 Idle Mode

General notes

When the engine is operated at idle speed, undervoltage, underfrequency, and underspeed monitoring as well as the monitoring of the flexible limits 33 through 40 are not performed.

This function allows for a controlled operation of an engine without alarm messages at a lower speed (below the configured underspeed monitoring values) for e.g. a warm-up operation with low emission.

The frequency controller output does not control the idle speed; it will remain in initial state position. The GCB cannot be closed in idle mode.

A message may be output to a relay here using the LogicsManager (Idle mode is active, command variable 04.15), e.g. as a signal for a speed controller. The display indicates "Idle run active" during idle mode.

*The idle mode can be **only** used if the function is supported by the ECU or the frequency controller.*

The normal operation monitoring limits will be enabled again, if one of the following conditions is fulfilled:

- *Idle mode has ended and generator frequency has reached rated frequency -1 Hz. (e.g. 49 Hz at 50 Hz rated)*
- *Idle mode has ended and engine delayed monitoring (parameter 3315 ➪ p. 171) has expired.*

The flexible limits 33 through 40 are disabled during idle mode operation (➪ Chapter 4.5.5 "Flexible Limits" on page 402).

ID	Parameter	CL	Setting range [Default]	Description
12570	**Auto idle mode**	2	Determined by LogicsManager 86.20 **[(0 & 1) ≥1 0]** = 15719	Once the conditions of the LogicsManager have been fulfilled the engine will be operated in idle mode automatically for the configured time during start-up. Monitoring is limited as described above. This function may always be configured to "1" for example. **Notes** For information on the LogicsManager and its default settings see ➪ *Chapter 9.3.1 "LogicsManager Overview" on page 882.*
12550	**Constant idle run** (Continuous idle mode)	2	Determined by LogicsManager 86.14 **[(0 & 1) & 0]** = 10713	As long as the conditions of the LogicsManager have been fulfilled the engine will be continuously operated in idle mode. Monitoring is limited as described above. A key switch via a DI may be configured here for example. **Notes** The idle mode is blocked if the GCB is already closed. For information on the LogicsManager and its default settings see ➪ *Chapter 9.3.1 "LogicsManager Overview" on page 882.*

ID	Parameter	CL	Setting range [Default]	Description
3328	**Automatic idle time** (Time for automatic idle mode)	2	1 to 9999 s **[30 s]**	The automatic idle mode is active for the time configured here. Monitoring is limited as described above during this time.
3329	**During emergency / critical** (Idle mode possible during emergency / critical operation)	2	Yes	If an emergency or critical operation is enabled, the engine will go to rated speed only after completing the configured idle mode.
			[No]	If an emergency or critical operation is enabled, no idle run will be performed. The engine will go directly to rated speed.

4.4.1.5 Run-up Synchronization

General notes

The generators are paralleled together by closing their circuit breakers during the engine start sequence. Then after a certain speed is achieved the voltage regulators are enabled and the generators will produce voltage. The run-up synchronization method is used to get several synchronous generators onto load in a very short time. This time is determined by the engine start time and the AVR on-excitation.

The pickup input must be activated (parameter 1600 ⇨ p. 175).

Please refer to ⇨ Chapter 6.3.15 “Run-Up Synchronization” on page 580 for application examples.

ID	Parameter	CL	Setting range [Default]	Description
3435	**Run-up synchronization mode**	2	**[Off]**	The run-up synchronization is disabled and the command variable 03.24 “Excitation AVR” behaves like the command variable 03.06 “Engine released”.
			with GCB	The run-up synchronization is enabled and acts on the GCB. The command variable 03.24 “Excitation AVR” is activated according to the logical condition.
			with GCB/GGB	The run-up synchronization is enabled and acts on the GCB and GGB. The command variable 03.24 “Excitation AVR” is activated according to the logical condition.
12937	**Run up sync.**	2	Determined by LogicsManager 87.30 **[(0 & 1) & 1]** = 11419	This LogicsManager equation releases the run-up synchronization at all. With this LogicsManager the run-up synchronization can be reduced on several logical cases, like e.g. emergency start.
3436	**Minimum speed for close GCB**	2	0 to 4,000 rpm **[350 rpm]**	This configuration determines at what speed the GCB (GGB) shall be closed. If the speed is configured on 0 the GCB (GGB) will be closed before the engine starter begins to turn.
3437	**Speed for excitation start**	2	0 to 4,000 rpm **[700 rpm]**	This configuration determines at what speed the excitation shall be switched on. This limit must be above the minimum speed for close GCB.
3438	**Time of participation**	2	1 to 180 s **[7 s]**	This is the time allowed for the engine to start successfully. If the engine has not reached the correct speeds in this time, its breaker will be opened and it will not be included in the run-up synchronization.

ID	Parameter	CL	Setting range [Default]	Description
3442	**Simultaneous excitation**	2		There are existing two methods to release the excitation at run-up synchronization.
			[On]	The excitation is activated at all run-up members at the same time. Units who does not reach excitation speed within the participation time, will be dropped out.
			Off	The excitation is not activated at all run-up members at the same time. It only depends on the own speed.
				Notes If this parameter is configured to "Off", please be aware that larger speed deviations can occur between the excitated generators and damage them in exceptional cases.

4.4.1.5.1 Run-Up Synchronization w/o Speed

General notes

Application

- Step-up transformer with master and prime mover control
- No speed sensor (signal)
- Application Mode: "GCB" or "GCB/LS-5"

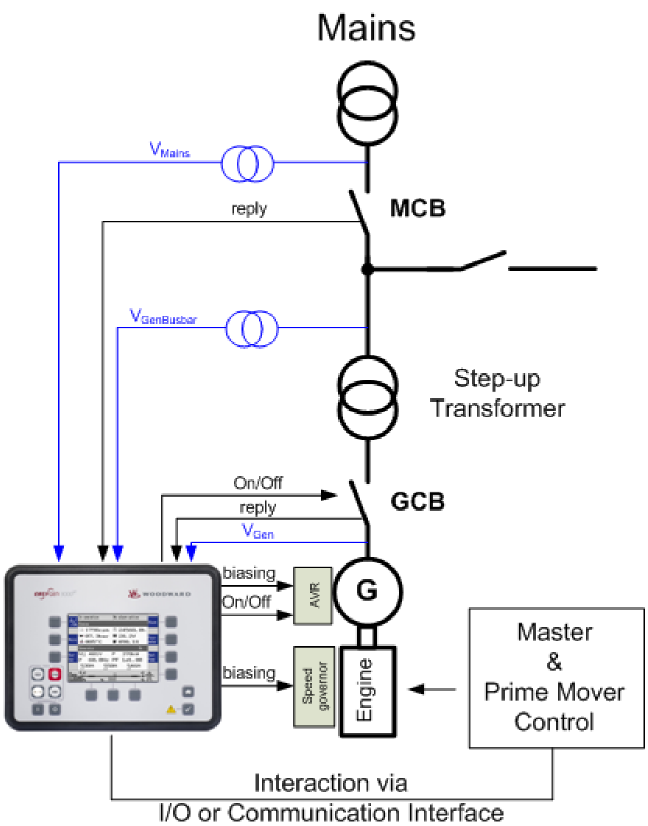


Fig. 147: Genset with separate master and prime mover control

In this application the run up synchronization supports a GCB closure for magnetizing a power transformer. The engine is initiated for start and controlled by an independent control device. The easYgen can support this feature without any speed sensor input as long the Start/Stop mode logic (ID3321) is configured on "Off".

This mode is only valid for applications in which no parallel start of multiple gensets are required. This mode only supports the single start of a genset with its generator and its power transformer to get it magnetized. If multiple gensets shall be started together the easYgen Start/Stop mode logic must be configured to Diesel, Gas or External and the MPU (speed sensor signal) must be passed to the easYgen.

*To run the run-up synchronization correctly it is mandatory **FIRST** to configure as described here.*

***AFTERWARDS** please follow the "Special run-up procedure".*

For application correct run-up synchronization, please **configure** the easYgen-XT as follows:

- Application mode must be set up to "GCB" or "GCB/LS-5"
- The run-up synchronization 3435 ↳ p. 177 must be set up to "with GCB"
- The Minimum speed for close GCB 3436 ↳ p. 177 must be set up to "0" rpm
- The Speed for excitation start 3437 ↳ p. 177 must be set up to "0" rpm
- The Simultaneous excitation 3442 ↳ p. 178 must be set up to "Off"
- The Start/Stop mode logic 3321 ↳ p. 160 must be set up to "Off"
- Check the Engine monitoring delay time 3315 ↳ p. 171. This time determines how long the easYgen-XT waits enabling the generator monitoring after starting the run-up procedure.

The procedure for run-up a transformer in the application shown above is:

1. The master control passes the run-up synchronization command to the easYgen-XT: 12937 ↳ p. 177 *"Run-up sync"*
2. The master control passes the Start command to the easYgen-XT: 12120 ↳ p. 290/↳ p. 927 *"Start request in AUTO"*)
   ⇨ If the MCB is open and the busbar is dead the easYgen-XT closes the GCB
3. The master control initiates the prime mover start
4. The master control activates the monitoring delay time with LogicsManager 12999 ↳ p. 173/↳ p. 930
   ⇨ The easygen-XT remains passive until the moment the time delay is passed
5. If the the monitoring delay time expired
   ⇨ The easYgen-XT starts biasing frequency and voltage according to its setpoint
6. The master control removes the run-up sync signal
   ⇨ Run-Up synchronization is done

4.4.2 Inputs And Outputs

Changed from easYgen series to easYgen-XT series:

*External Analog Inputs/Analog Outputs (**AI/AO**) configuration is enhanced from % values only to **to % values or absolute values in addition**.*

4.4.2.1 Function Of Inputs And Outputs

4.4.2.1.1 Discrete Inputs

The discrete inputs may be grouped into two categories:

- Programmable
  - The discrete input has been assigned a default function using either the LogicsManager or preconfigured alarms such as "emergency stop".
  - The following sections describe how these functions are assigned.
  - The function of a discrete input can be changed if required.
  - The following description of the inputs, labeled with "programmable", refers to the preconfiguration.
- Fixed
  - The discrete input has a specific function that cannot be changed depending upon the configured application mode.

Input	Type/Preset	Description
Discrete input [DI 01]	Programmable Preconfigured to "Emergency STOP"	This discrete input is configured as alarm class F and is not delayed by the engine speed.
Discrete input [DI 02]	Programmable Preconfigured to "Startrequest in AUTO"	Enabled in the AUTOMATIC operation mode This discrete input is configured as a Control input in the alarm class and is not delayed by the engine speed. ■ **Energized** If the unit is in the AUTOMATIC operation mode (selected with the operating mode selection push button on the front panel) the controlled engine is started automatically. ■ **De-energized** The engine is stopped.
Discrete input [DI 03]	Programmable Preconfigured to "Low oil pressure"	This discrete input is configured as alarm class B and is delayed by the engine speed.
Discrete input [DI 04]	Programmable Preconfigured to "Coolant temperature"	This discrete input is configured as alarm class B and is not delayed by the engine speed.
Discrete input [DI 05]	Programmable Preconfigured to "External acknowledgment"	This discrete input is used as a remote acknowledgment for alarms. The input is normally de-energized. When an alarm is to be acknowledged the input is energized. The first time an alarm in acknowledged, the centralized alarm/horn is silenced. When the input is energized a second time, all alarms, which are no longer active, will be acknowledged. This discrete input is configured as a Control input in the alarm class and is not delayed by the engine speed.

Input	Type/Preset	Description
Discrete input [DI 06]	Programmable Preconfigured to "Release MCB"	Only applicable for application mode A04 This discrete input is configured as a Control input in the alarm class and is not delayed by the engine speed. ■ **Energized** The MCB is enabled and closure of the breaker is permitted. ■ **De-energized** The MCB is not enabled and closure of the breaker is not permitted. This function permits a supervisory control (i.e. a PLC) to allow the closure of the MCB by the genset control.
Discrete input [DI 07]	Fixed to "MCB open reply"	Only applicable for application mode A04 This input implements negative function logic. The controller utilizes the CB auxiliary (B) contacts into this discrete input to reflect the state of the MCB. This discrete input must be energized to show when the breaker is open and de-energized to show when the MCB is closed. The status of the MCB is displayed on the screen. This input is usually used in all breaker modes to change between frequency/voltage and power/power factor control (refer to note below).
Discrete input [DI 08]	Fixed to "GCB open reply"	Only applicable for application modes A03 and A04 This input implements negative function logic. The controller utilizes the CB auxiliary (B) contacts into this discrete input to reflect the state of the GCB. This discrete input must be energized to show when the breaker is open and de-energized to show when the GCB is closed. The status of the GCB is displayed on the screen. This input is usually used in all breaker modes to enable reverse power protection, overload MOP protection, mains decoupling and the activation of the load sharing (refer to note below).
Discrete input [DI 09]	Programmable Fixed to "Reply: GGB open" if GGB control is activated	Only applicable for application mode A05, A06 and A09 This input implements negative function logic. The controller utilizes the CB auxiliary (B) contacts into this discrete input to reflect the state of the GGB. This discrete input must be energized to show when the breaker is open and de-energized to show when the GGB is closed. The status of the GGB is displayed on the screen. This input is usually used in all breaker modes to change between frequency/voltage and power/power factor control (refer to note below).
Discrete input [DI 10]	Programmable Fixed to "Load busbar is dead" if GGB control is activated	Only applicable for application mode A05, A06 and A09 The controller utilizes an external voltage relay output to reflect the condition of the load busbar. The discrete input must be energized to show the load busbar is dead. The status of the load busbar is displayed on the screen.
Discrete input [DI 11]	Programmable "Discrete Input 11"	Can be set-up with description, delay, operation, alarm class, self acknowledgment, and enable.
Discrete input [DI 12]	Programmable "Discrete Input 12"	

The genset control usually decides whether it performs voltage and frequency (V/f) control or power and power factor (P/PF) control using the reply of the circuit breakers, i.e. the discrete inputs DI 7 and DI 8.

- *If the GCB is open, only V/f control is performed*
- *If the GCB is closed and the MCB is open, V/f control as well as active and reactive power load sharing is performed*
- *If the GCB is closed and the MCB is closed, P/PF control or import power control with load sharing and PF control is performed.*

A different configuration is possible and depends on the following LogicsManager (parameter 12940 ➪ p. 269/➪ p. 929 "P control" and parameter 12941 ➪ p. 245/➪ p. 929 "Q control")

Alarm inputs

All discrete inputs, which are not assigned a function, can be used as alarm or control inputs. These discrete inputs can be freely configured as such (➪ Chapter 4.4.2.2 "Discrete Inputs" on page 185).

4.4.2.1.2 Discrete Outputs

- Programmable
  - The discrete output has been assigned a default function using the LogicsManager.
  - The following text describes how these functions are assigned using the LogicsManager.
  - It is possible to change the function of the discrete output if required.
  - The following description of the outputs, labeled with "programmable", refers to the preconfiguration.
- Fixed
  - The discrete output has a specific function that cannot be changed depending upon the configured application mode.
  - The discrete output cannot be viewed or changed in the LogicsManager.
  - However, the discrete output may be programmable in some application modes.

The discrete outputs can be "programmable" or "fixed" depending on the application mode (parameter 3444 ➪ p. 220).

For information on the function of the discrete outputs depending on the configured application mode refer to ➪ Chapter 4.4.2.3 "Discrete Outputs (LogicsManager)" on page 188.

CAUTION!

Uncontrolled operation due to faulty configuration

The discrete output "Ready for operation" must be wired in series with an emergency stop function.

This means that it must be ensured that the generator circuit breaker is opened and the engine is stopped if this discrete output is de-energized.

If the availability of the plant is important, this fault must be signaled independently from the unit.

CAUTION!

Uncontrolled operation due to unknown configuration

The circuit breaker commands must be checked before every commissioning because the relays can be used for different applications and can be assigned to various functions.

– Make sure that all relay outputs are configured correctly.

Output	Type/Preset	Description
Relay output [R 01]	Programmable Fixed to "Ready for operation" **CAUTION!** Only relay [R 01] has an inverse logic. The relay opens (all other relays close), if the logical output of the LogicsManager becomes TRUE.	This discrete output is used to ensure that the internal functions of the controller are operating properly. It is possible to configure additional events, which cause the contacts of this discrete output to open, using the LogicsManager.
Relay output [R 02]	Programmable Preconfigured to "Centralized alarm (horn)"	When a centralized alarm is issued, this discrete output is enabled. A horn or a buzzer maybe activated via this discrete output. Pressing the button with the "✓" symbol will acknowledge the centralized alarm and disable this discrete output. The discrete output will re-enable if a new fault condition resulting in a centralized alarm occurs. The centralized alarm is initiated by class B alarms or higher.
Relay output [R 03]	Programmable Preconfigured to "Starter"	The generator starting circuit is engaged when this discrete output is enabled. This discrete output will enable depending on the start sequence (refer to the start sequence description in ⇨ *Chapter 4.4.1.1 "Configure Engine (general)" on page 160*) to energize the starter for the configured starter time (parameter 3306 ⇨ p. 171).
Relay output [R 04]	Programmable Preconfigured to "Start/Gas"	**Fuel solenoid** The fuel solenoid for the diesel engine is energized when this discrete output is enabled. If the engine is given a stop command or engine speed drops below the configured firing speed, this discrete output is disabled immediately. **Gas valve** The gas valve for the engine is energized when this discrete output is enabled. If the engine is given a stop command or engine speed drops below the configured firing speed, this discrete output is disabled immediately.

Output	Type/Preset	Description
Relay output [R 05]	Programmable Preconfigured to "Preglow"	**Preglow** When this discrete output is enabled, the diesel engine's glow plugs are energized. This function only occurs if the control has been configured for diesel engine start/stop logic. **Ignition** When this discrete output is enabled, the gas engine's ignition is enabled. This function only occurs if the control has been configured for gas engine start/stop logic. **Notes** Refer to ↳ *Chapter 4.4.1.1 “Configure Engine (general)” on page 160*
Relay output [R 06]	Fixed to "Command: close GCB"	Only applicable for application modes A03 and A04. The "Command: close GCB" output issues the signal for the GCB to close. This relay may be configured as an impulse or steady output signal depending on parameter 3414 ↳ p. 223. **Impulse** If the output is configured as "Impulse", the discrete output will enable for the time configured in parameter 3416 ↳ p. 224). An external holding coil and sealing contacts must be installed into the GCB closing circuit if this discrete output is configured for an impulse output signal. **Steady** If the relay is configured as "Steady", the relay will energize and remain enabled as long as the discrete input "Reply GCB" remains de-energized and the generator and busbar voltages are identical. If a class C or higher alarm occurs, this discrete will disable and the GCB will open immediately.
Relay output [R 07]	Fixed to "Command: open GCB"	Not applicable for application mode A01 The parameter 3403 ↳ p. 223 defines how this relay functions. If this output is configured as "N.O.", the relay contacts close resulting in the GCB opening circuit energizing. If this output is configured as "N.C.", the relay contacts open resulting in the GCB opening circuit de-energizing. If this output is configured as "Not used", this relay is freely configurable. **Application mode A02** The open GCB command remains enabled until the GCB is manually closed and the discrete input "Reply GCB" is energized. The open GCB command will be issued when a fault condition or an engine shut down occurs. **Application mode A03 or A04** The controller enables the open GCB command when the GCB is to be opened for switching operations. If the discrete input "Reply GCB" is energized, the open GCB command will be disabled.
Relay output [R 08]	Fixed to "Command: close MCB"	Only applicable for application mode A04. The discrete output "Command: close MCB" is an impulse output signal. This discrete output is enabled for the time configured in parameter 3417 ↳ p. 229. An external holding coil and sealing contacts must be utilized with the MCB closing circuit.
Relay output [R 09]	Fixed to "Command: open MCB"	Only applicable for application mode A04. The controller enables this discrete output when the MCB is to be opened for switching operations. If the discrete input "Reply MCB" is energized, the discrete output "Command: open MCB" is disabled.

Output	Type/Preset	Description
Relay output [R 10]	Programmable Fixed to"Command: close GGB" if GGB is activated otherwise preconfigured to "Auxiliary services"	Only applicable for application mode A05, A06 and A09. The discrete output "Command: close GGB" is an impulse output signal. This discrete output is enabled for the time configured in parameter 5726 ➡ p. 227. An external holding coil and sealing contacts must be utilized with the GGB closing circuit. Preconfiguration "Auxiliary services": The auxiliary services output (LogicsManager 03.01) will be enabled with the start command (prior to the engine start because of the prerun time) and remains enabled as long as the engine is running. It will be disabled after the engine has stopped and the postrun time has expired(i.e. for operating a cooling pump). ➡ *"Auxiliary operations" on page 169* for this behavior. The auxiliary services output (LogicsManager 03.01) is always enabled in MANUAL operation mode.
Relay output [R 11]	Programmable Fixed to"Command: open GGB" if GGB is activated otherwise preconfigured to "Alarm class A and B"	Only applicable for application mode A05, A06 and A09. The controller enables this discrete output when the GGB is to be opened for switching operations. If the discrete input "Reply GGB" is energized, the discrete output "Command: open GGB" is disabled. Preconfiguration "Alarm class A and B": This discrete output is enabled when a warning alarm (class A or B alarm) is issued (➡ *Chapter 9.5.1 "Alarm Classes" on page 965*). After all warning alarms have been acknowledged, this discrete output will disable.
Relay output [R 12]	Programmable Preconfigured to "Shutdown alarm"	This discrete output is enabled when a shutdown alarm (class C or higher alarm; refer to ➡ *Chapter 9.5.1 "Alarm Classes" on page 965* for more information) is issued. After all shutdown alarms have been acknowledged, this discrete output will disable.
LogicsManager of DO xx / Relay output [R xx]:		All discrete outputs not assigned to a defined function, may be freely configured via the LogicsManager.

4.4.2.2 Discrete Inputs

General notes

Discrete inputs may be configured to normally open (N.O.) or normally closed (N.C.) states.

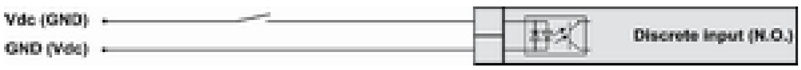


Fig. 148: Discrete inputs - alarm/control inputs - operation logic (state N.O.)

In the state N.O.:

- No potential is present during normal operation.
- If an alarm is issued or control operation is performed, the input is energized.

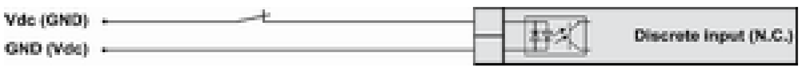


Fig. 149: Discrete inputs - alarm/control inputs - operation logic (state N.C.)

In the state N.C.:

- A potential is continuously present during normal operation
- If an alarm is issued or control operation is performed, the input is de-energized.

All reply messages from breakers are evaluated as N.C.

Alarm inputs may also be configured as control inputs and then be used as command variables in the LogicsManager.

The discrete inputs 1 to 6 are pre-configured to various functions and differ in their default values. However, they may still be configured freely.

The discrete inputs 7 & 8 are always used for the circuit breaker replies and cannot be configured.

If a discrete input has been configured with a shut-down alarm that has been enabled to self-acknowl-edge, and has been configured as engine delayed the following scenario may happen:

- *The discrete input shuts down the engine because of its alarm class.*
- *Due to the engine stopping, all engine delayed alarms are ignored.*
- *The alarm class is acknowledged automatically.*
- *The alarm will self-acknowledge and clear the fault message that shut the engine down.*
  This prevents the fault from being analyzed.
- *After a short delay, the engine will restart.*
- *After the engine monitoring delay expires, the fault that originally shut down the engine will do so again. This cycle will continue to repeat until corrected.*

Internal discrete inputs - terminal assignment

Number	Terminal	Assignment (all application modes)
[DI 01]	67	Pre-configured for Alarm input 'Emergency Stop'
[DI 02]	68	Pre-configured for Control input 'Start request in AUTO'
[DI 03]	69	Pre-configured for Alarm input 'Low oil pressure'
[DI 04]	70	Pre-configured for Alarm input 'Coolant temperature'
[DI 05]	71	Pre-configured for Control input 'External acknowledgment'
[DI 06]	72	Pre-configured for Control input 'Release MCB'
[DI 07]	73	Reply MCB

Number	Terminal	Assignment (all application modes)
[DI 08]	74	Reply GCB
[DI 09]	75	Pre-configured for Alarm input
[DI 10]	76	Pre-configured for Alarm input
[DI 11]	77	Pre-configured for Alarm input
[DI 12]	78	Pre-configured for Alarm input

Parameter IDs

The following parameters are used to configure the discrete inputs 1 through 12. The parameter IDs refer to discrete input 1.

– *Refer to* *Table 61 "Discrete inputs - parameter IDs" on page 187* *for the parameter IDs of the parameters DI 2 through DI 12(23).*

	DI 1	DI 2	DI 3	DI 4	DI 5	DI 6	DI 7	DI 8	DI 9	DI 10	DI 11	DI 12
							MCB open only	**GCB open only**				
Description	1400	1410	1420	1430	1440	1450	1460		1480	1488	1496	1504
Delay	1200	1220	1240	1260	1280	1300	1320		1360	1380	1205	1225
Operation	1201	1221	1241	1261	1281	1301	1321		1361	1381	1206	1226
Alarm class	1202	1222	1242	1262	1282	1302	1322		1362	1382	1207	1227
Self acknowledged	1204	1224	1244	1264	1284	1304	1324		1364	1384	1209	1229
Enabled	1203	1223	1243	1263	1283	1303	1323		1363	1383	1208	1228

Table 61: Discrete inputs - parameter IDs

ID	Parameter	CL	Setting range [Default]	Description
1400	**DI {x} Description**	2	user defined (up to 39 characters) for default see *Table on page 186*	If the discrete input is enabled with alarm class, this text is displayed on the control unit screen. The event history will store this text message as well.
				Notes This parameter may only be configured using ToolKit. 19 characters are best for HMI readability - text strings with 20 and more characters but without a blank in between are NOT visible as headline on DI {x} detail screen. DI selection screen on HMI/display works fine with up to 30 characters; others are overwritten by mandatory screen symbols. Please verify the length on the display for best view. If the DI is used as control input with the alarm class "Control", you may enter here its function (e.g. external acknowledgment) for a better overview within the configuration.

ID	Parameter	CL	Setting range [Default]	Description
1200	**DI {x} Delay**	2	0.08 to 650.00 s **[0.20 s]**	A delay time in seconds can be assigned to each alarm or control input. The discrete input must be enabled without interruption for the delay time before the unit reacts. If the discrete input is used within the LogicsManager this delay is taken into account as well.
1201	**DI {x} Operation**	2		The discrete inputs may be operated by an normally open (N.O.) or normally closed (N.C.) contact. The idle circuit current input can be used to monitor for a wire break. A positive or negative voltage polarity referred to the reference point of the DI may be applied.
			[N.O.]	The discrete input is analyzed as "enabled" by energizing the input (normally open).
			N.C.	The discrete input is analyzed as "enabled" by de-energizing the input (normally closed).
1202	**DI {x} Alarm class**	2		An alarm class may be assigned to the discrete input. The alarm class is executed when the discrete input is enabled.
			A/**[B]**	Warning alarm classes
			C/D/E/F	Shutdown alarm classes
			Control	Signal to issue a control command only. If "control" has been configured, there will be no entry in the event history and a function out of the LogicsManager (*Chapter 9.3.1 "LogicsManager Overview" on page 882*) can be assigned to the discrete input.
1204	**DI {x} Self acknowledge**	2	Yes	The control automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
				Notes If the DI is configured with the alarm class "Control", self acknowledgment is always active.
1203	**DI {x} Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.4.2.3 Discrete Outputs (LogicsManager)

The discrete outputs are controlled via the LogicsManager.

For information on the LogicsManager and its default settings see Chapter 9.3.1 "LogicsManager Overview" on page 882.

Some outputs are assigned a function according to the application mode (see following table).

<table>
<tr><th colspan="2">Relay</th><th colspan="11">Application mode</th></tr>
<tr><th>No.</th><th>Ter-minal</th><th>None A01</th><th>GCB open A02</th><th>GCB A03</th><th>GCB/MCB A04</th><th>GCB/GGB A05</th><th>GCB/GGB/MCB A06</th><th>GCB/LS5 A07</th><th>GCB/L-MCB A08</th><th>GCB/GGB/L-MCB A09</th><th>GCB/L-GGB A10</th><th>GCB/L-GGB/L-MCB A11</th></tr>
<tr><td>[R 01]</td><td>41/42</td><td colspan="11">'Ready for operation'; additionally programmable with LogicsManager
CAUTION! Only relay [R 01] has an inverse logic. The relay opens (all other relays close), if the logical output of the LogicsManager becomes TRUE.</td></tr>
<tr><td>[R 02]</td><td>43/46</td><td colspan="11">LogicsManager; pre-assigned with 'Centralized alarm (horn)'</td></tr>
<tr><td>[R 03]</td><td>44/46</td><td colspan="11">LogicsManager; pre-assigned with 'Starter'</td></tr>
<tr><td>[R 04]</td><td>45/46</td><td colspan="11">LogicsManager; pre-assigned with 'Diesel: Fuel solenoid, Gas: Gas valve'</td></tr>
<tr><td>[R 05]</td><td>47/48</td><td colspan="11">LogicsManager; pre-assigned with 'Diesel: Preglow, Gas: Ignition'</td></tr>
<tr><td>[R 06]</td><td>49/50</td><td colspan="2">LogicsManager</td><td colspan="9">Command: close GCB</td></tr>
<tr><td>[R 07]</td><td>51/52</td><td>Logi-csMan-ager</td><td colspan="10">Command: open GCB</td></tr>
<tr><td>[R 08]</td><td>53/54</td><td colspan="3">LogicsManager</td><td>Com-mand: close MCB</td><td>Logi-csMan-ager</td><td>Com-mand: close MCB</td><td colspan="5">LogicsManager</td></tr>
<tr><td>[R 09]</td><td>55/56</td><td colspan="3">LogicsManager; pre-assigned with 'Mains decoupling'</td><td>Com-mand: open MCB</td><td>Logi-csMan-ager; pre-assigned with 'Mains decou-pling'</td><td>Com-mand: open MCB</td><td colspan="5">LogicsManager; pre-assigned with 'Mains decoupling'</td></tr>
<tr><td>[R 10]</td><td>57/60</td><td colspan="4">LogicsManager; pre-assigned with 'Auxiliary services'</td><td colspan="2">Command: close GGB</td><td colspan="2">LogicsManager; pre-assigned with 'Auxiliary services'</td><td>Com-mand: close GGB</td><td colspan="2">LogicsManager; pre-assigned with 'Auxiliary services'</td></tr>
<tr><td>[R 11]</td><td>58/60</td><td colspan="4">LogicsManager; pre-assigned with 'Alarm class A, B active'</td><td colspan="2">Command: open GGB</td><td colspan="2">LogicsManager; pre-assigned with 'Alarm class A, B active'</td><td>Com-mand: open GGB</td><td colspan="2">LogicsManager; pre-assigned with 'Alarm class A, B active'</td></tr>
<tr><td>[R 12]</td><td>59/60</td><td colspan="11">LogicsManager; pre-assigned with 'Alarm class C, D, E, F active'</td></tr>
</table>

Table 62: Internal relay outputs - assignment

CAUTION!

Uncontrolled operation due to faulty configuration

The discrete output "Ready for operation" must be wired in series with an emergency stop function.

This means that it must be ensured that the generator circuit breaker is opened and the engine is stopped if this discrete output is de-energized.

If the availability of the plant is important, this fault must be signaled independently from the unit.

ID	Parameter	CL	Setting range [Default]	Description
12580	**Ready for op. Off** (Ready for operation OFF)	2	Determined by LogicsManager 99.01 **[(0 & 0) & 1]** = 11870	The "Ready for operation" relay is energized by default if the power supply exceeds 8 V. Once the conditions of the LogicsManager have been fulfilled, the relay will be de-energized. This LogicsManager output may be configured with additional conditions, which may signal a PLC an "out of operation" condition by de-energizing the relay on terminals 41/42, like "shutdown alarm" or no "AUTO mode" present. **Notes** For information on the LogicsManager and its default settings see *Chapter 9.3.1 "LogicsManager Overview" on page 882.*
12110 (See ID table below)	**Relay {x}** For (pre-defined) function see assignment table above)	2	Determined by LogicsManager 99.02 **[(03.05 Horn & 1) & 1]** = 11871	Once the conditions of the LogicsManager have been fulfilled, the relay will be energized. **Notes** For information on the LogicsManager and its default settings see *Chapter 9.3.1 "LogicsManager Overview" on page 882.*

Parameter IDs

The parameter IDs above refers to relay 2.

– *Refer to* *Table 63 "Discrete outputs - relay parameter IDs" on page 190* *for the parameter IDs of the parameters for relay 3 to relay 12.*

	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10	R 11	R 12
Parameter ID	12580	12110	12310	12320	12130	12140	12150	12160	12170	12180	12560	12590

Table 63: Discrete outputs - relay parameter IDs

4.4.2.4 Analog Inputs

4.4.2.4.1 Analog Inputs (general)

Displayed units

Conversion restricted to ...

The conversions described below are only active for parameters "Unit" of

– *J1939 pressure and temperature values and*
– *analog inputs which units are configured as [°C] or [bar].*

> ***Exact string mandatory***
>
> *Type in* the "Unit" string carefully!*
>
> *For example:*
>
> – *Temperature works with the exact string[°C] only but not with [°c] or [degC] or [° C] ...*
>
> – *Pressure needs the exact string [bar] only but don't work with [Bar] or [BAR] ... !*
>
> **) Parameters "Unit" are:*
>
> *AI {x} 1034, 1084, ...; external AI{x} 16208, 16218, ...; PID {x} setpoint 7494, 7495, ...; customer screens {x.y} 7692, 7697, ...*

ID	Parameter	CL	Setting range [Default]	Description
3630	**Convert bar to psi**	1	**[No]**	The pressure value is displayed in Bar.
			Yes	The pressure value is converted and then displayed in psi.
3631	**Convert °C to °F**	1	**[NO]**	The temperature is displayed in °C (Celsius).
			Yes	The temperature is displayed in °F (Fahrenheit).

User Defined Tables A/B (Characteristic Curves Setup)

General notes

The characteristic curves of "Table A" and "Table B" (freely configurable over 9 defined points) are independently configurable and can be used among other predefined curves for each of the analog inputs. Each point may be scaled to related values measured from the analog input (0 to 250/500/2500 Ohms, 0 to 10 V, or 0 to 20 mA), so that the actual display and monitoring reflects the corresponding values (e.g. 200 to 600 kW).

The created characteristic curves can be used for scaling the analog inputs.

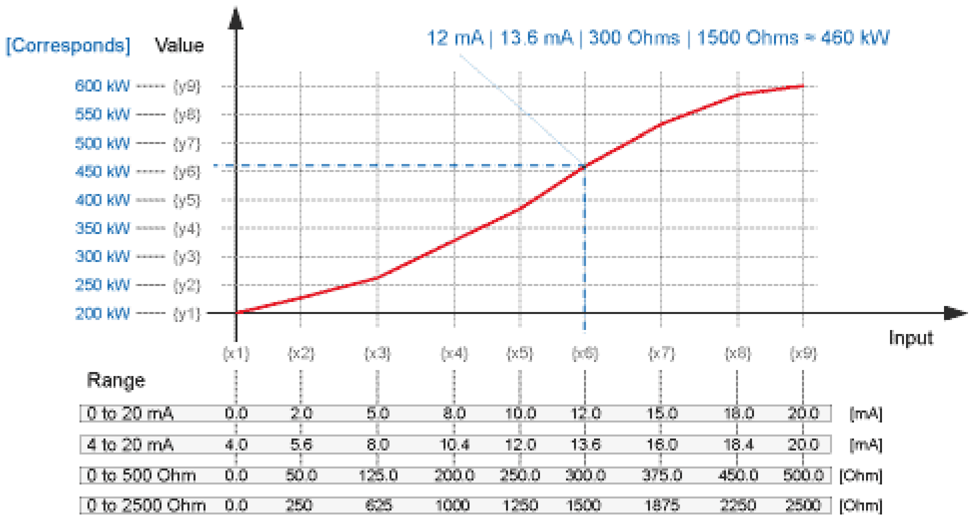


Fig. 150: Characteristic curves (example table)

The X and Y junction may be moved within the range of values and the space between setpoints can be nonuniform.

When configuring the X coordinates, ensure the coordinates always increase in scale continuously.

In the following example the first set of x/y coordinates is correct and the second set of x/y coordinates is wrong:

(correct)									
X-coordinate	0	10	20	40	50	60	80	90	100
Y-coordinate	-100	-95	-50	-10	+3	+17	+18	+100	+2000
wrong:									
X-coordinate	0	10	20	60	20	30	80	40	100
Y-coordinate	-100	-50	-95	+18	+17	+3	-10	+2000	+100

If the first X coordinate is >0, all values smaller than the first X value will be output with the first Y value.

If the last Y value is <100, all higher values will be output with the value of Y9.

All parameters used to configure the characteristic curve follow the samples listed below.

– *Refer to* *“Parameter IDs and default values for all scaling points” on page 193* *for the parameter IDs of the individual parameters for all scaling points of tables 'A' and 'B'.*

Scaling points settings

ID	Parameter	CL	Setting range [Default]	Description
3560 to 3568 or 3610 to 3618	**Table {A/B} X-value {1..9}**	2	-900000.000 to 900000.000 **[0, ...]**	The analog input is assigned to a curve. This parameter defines the actual value assigned to each of the nine points along the X-axis of the total range of the selected hardware for analog input.
				Example If a 0 to 20 mA input is configured and the X1-coordinate = 0, then the value configured for Y1 is output for an input of 0 mA.
3550 to 3558 or 3600 to 3608	**Table {A/B} Y-value {1..9}**	2	-21000000.00 to 21000000.00 **[0, ...]**	This parameter defines the Y-coordinate (the displayed and monitored value) at the corresponding X-coordinate.
				Example If a 0 to 20 mA input is configured and the X2-coordinate = 10, then the value configured for the Y2-coordinate is output for an input of 10 mA.

Table 64: Scaling point sample

Parameter IDs and default values for all scaling points

Scaling point no.	1	2	3	4	5	6	7	8	9
Table A - X value	3560 **[0]**	3561 **[2.5]**	3562 **[5]**	3563 **[7.5]**	3564 **[10]**	3565 **[12.5]**	3566 **[15]**	3567 **[17.5]**	3568 **[20]**
Table A - Y value	3550 **[0]**	3551 **[10]**	3552 **[20]**	3553 **[30]**	3554 **[45]**	3555 **[60]**	3556 **[70]**	3557 **[85]**	3558 **[100]**
Table B - X value	3610 **[0]**	3611 **[2.5]**	3612 **[5]**	3613 **[7.5]**	3614 **[10]**	3615 **[12.5]**	3616 **[15]**	3617 **[17.5]**	3618 **[20]**
Table B - Y value	3600 **[0]**	3601 **[10]**	3602 **[20]**	3603 **[30]**	3604 **[45]**	3605 **[60]**	3606 **[70]**	3607 **[85]**	3608 **[100]**

4.4.2.4.2 Analog Inputs 1 to 3 (0 to 2000 Ω | 0/4 to 20 m A | 0 to 1 V)

General notes

Monitoring of the analog inputs (overrun/underrun) must be configured manually to the flexible limits (↳ Chapter 4.5.5 "Flexible Limits" on page 402).

ID	Parameter	CL	Setting range [Default]	Description
1025 1075 1125	**Analog input {x}: Description**	2	user-defined (up to 39 characters) **[Analog inp. {x}]**	The event history will store this text message and it is also displayed on the visualization screen. If the programmed limit value of the analog input has been reached or exceeded this text is displayed in the control unit screen.
				Notes This parameter may only be configured using ToolKit. 19 characters are best for HMI readability - text strings with 20 and more characters but without a blank in between are NOT visible as headline on AI {x} detail screen. AI selection screen on HMI/display works fine with up to 30 characters; others are overwritten by mandatory screen symbols. The max. number of characters depends on the numbers of Bytes for each character. Please verify the length on the display for best view.
1000 1050 1100	**Analog input {x}: Type**	2		According to the following parameters different measuring ranges are possible at the analog inputs.
			[Off]	The analog input is switched off.
			VDO 5 bar	The value of the analog input is interpreted with the VDO characteristics 0 to 5 bar.
			VDO 10 bar	The value of the analog input is interpreted with the VDO characteristics 0 to 10 bar.
			VDO 150 °C	The value of the analog input is interpreted with the VDO characteristics 50 to 150 °C.
			VDO 120 °C	The value of the analog input is interpreted with the VDO characteristics 40 to 120 °C.
			Pt100	The value of the analog input is interpreted with a Pt100 characteristic.
			Pt1000	The value of the analog input is interpreted with a Pt1000 characteristic.
			AB 94099	The value of the analog input is interpreted with a AB 94099 characteristic.

ID	Parameter	CL	Setting range [Default]	Description
			Linear	Each analog input may be assigned to a linear characteristic curve, which can be only used for the respective defined input [T{x}] (x = 1 to 3). The minimum value refers to the value configured as "Sender value at display min." (parameter 1039 ⤷ p. 194, 1089 ⤷ p. 194 or 1139 ⤷ p. 194). The maximum value refers to the value configured as "Sender value at display max." (parameter 1040 ⤷ p. 194, 1090 ⤷ p. 194 or 1140 ⤷ p. 194).
			Table A Table B	The analog input is assigned to a characteristic curve which is defined over 9 points (stored in a table). Two independent tables (table A and table B) may be allocated to the analog inputs. **Notes** Points of these tables must be programmed into the control unit before use. For the characteristic curves of the inputs refer to ⤷ *Chapter 9.1.2 “VDO Inputs Characteristics” on page 678*.
1001 1051 1101	**User defined min. display value** (User defined minimum display value)	2	-21000000.00 to 21000000.00 **[0]**	The value (y-axis) to be displayed for the minimum of the input range must be entered here. **Notes** This parameter is only visible if the parameter "Type" (1000 ⤷ p. 193/⤷ p. 200/1050 ⤷ p. 193/1100 ⤷ p. 193) is configured to "Linear".
1002 1052 1102	**User defined max. display value** (User defined maximum display value)	2	-21000000.00 to 21000000.00 **[2000]**	The value (y-axis) to be displayed for the maximum of the input range must be entered here. **Notes** This parameter is only visible if the parameter "Type" (1000 ⤷ p. 193/⤷ p. 200/1050 ⤷ p. 193/1100 ⤷ p. 193) is configured to "Linear".
1039 1089 1139	**Sender value at display min.** (Sender value at display minimum)	2	0.000 to 2000.000 **[0.000]**	The value (x-axis) of the configured input range, which shall correspond with the minimum value configured for the display, must be entered here. This specifies the lower limit of the hardware range to be measured. **Example** If the input range is 0 to 20 mA and the value configured here is 4, an analog input value of 4 mA would correspond with the minimum value configured for the display. **Notes** This parameter is only visible if the parameter "Type" (1000 ⤷ p. 193/⤷ p. 200/1050 ⤷ p. 193/1100 ⤷ p. 193) is configured to "Linear".
1040 1090 1140	**Sender value at display max.** (Sender value at display maximum)	2	0.000 to 2000.000 **[20000.00]**	The value (y-axis) of the configured input range, which shall correspond with the maximum value configured for the display, must be entered here. This specifies the upper limit of the hardware range to be measured. **Example** If the input range is 0 to 20 mA and the value configured here is 20, an analog input value of 20 mA would correspond with the maximum value configured for the display. **Notes** This parameter is only visible if the parameter "Type" (1000 ⤷ p. 193/⤷ p. 200/1050 ⤷ p. 193/1100 ⤷ p. 193) is configured to "Linear".

Table 65: Analog Inputs 1 to 3 settings

Example: Hardware range 4 to 20 mA mapped to 0 to 1000 display value

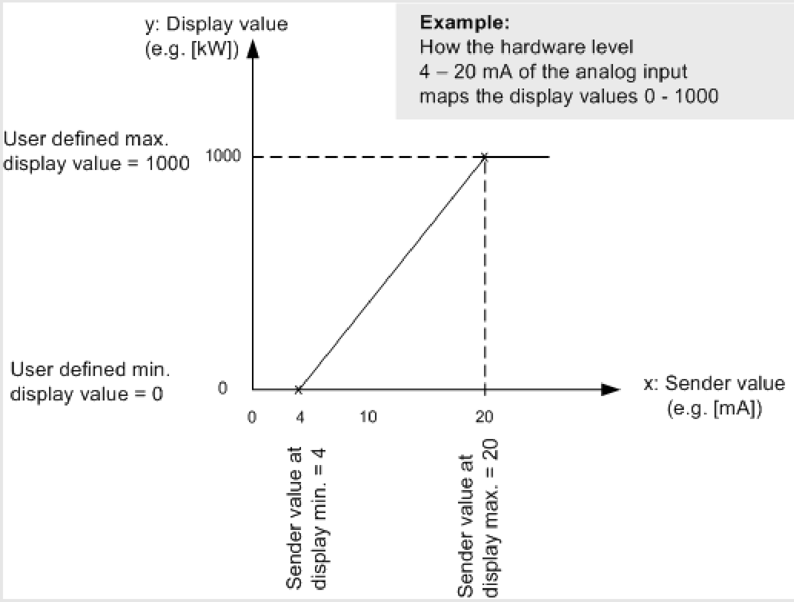


Fig. 151: Analog Input Mapping

ID	Parameter	CL	Setting range [Default]	Description
1020 1070 1120	**Sender type**	2		The software in the control unit may be configured for various types of sensors. The configurable ranges apply to the linear analog input.
			[0 to 2000 Ohms]	The measuring range of the analog input is 0 to 2000 Ohms.
			0 to 20 mA	The measuring range of the analog input is 0/4 to 20 mA.
			0 to 1 V	The measuring range of the analog input is 0 to 1 V.
				Notes If parameter "Type" (1000 ↳ p. 193/↳ p. 200/1050 ↳ p. 193/1100 ↳ p. 193) is set to "VDO xx" or "Pt100", this parameter must be configured to "0 to 2000 Ohm"!
1046 1096 1146	**Offset**	2	-20.0 to 20.0 Ohms **[0.0 Ohm]**	The resistive input (the "0 to 2000 Ohms" analog input) may be calculated with a permanent offset to adjust for inaccuracies. If the offset feature is utilized, the value configured in this parameter will be added to/subtracted from the measured resistive value. This has the following effect to the measured values (please note tables in ↳ *Chapter 9.1.2 "VDO Inputs Characteristics" on page 678*):
				Notes This parameter is only visible if the parameter "Sender type" (1020 ↳ p. 196/1070 ↳ p. 196/1120 ↳ p. 196) is configured to "0 to 2000 Ohms". VDO temperature and pressure senders use the ± range in different ways! Please take care for sender documentation.
1035 1085 1135	**Exponent for protocol**	2	-2 to 3 **[0]**	This is the exponent to adapt the decimal place of the actual value (parameter 1033/1083/1133) for the protocol format.
				Example Exponent is 3: value of analog input {½/3} x 10^3 = value of analog input {½/3} x 1000
1033	**Analog input {X}**	(displayed only)		Current scaled value of the AI {X}
1003 1053 1103	**Monitoring wire break**	2		The respective analog input can be monitored for wire breaks. If this protective function is triggered, the display indicates "Wb: {Text of Parameter [Description]}" (parameter 1025 ↳ p. 193/1075 ↳ p. 193/1125 ↳ p. 193). The following configurations are used to monitor for wire breaks:
			[Off]	No wire break monitoring is performed.
			High	If the actual value rises over the maximum value (overshoot), this is identified as a wire break.
			Low	If the actual value falls below the minimum value (undershoot), this is identified as a wire break.
			High/Low	If the actual value rises over the maximum value (overshoot) or falls below the minimum value (undershoot), this is identified as a wire break.

ID	Parameter	CL	Setting range [Default]	Description
				Notes Monitoring of the analog inputs (overrun/underrun) must be configured manually to the flexible limits (⇘ *Chapter 4.5.5 "Flexible Limits" on page 402*). If the control unit detects that the measuring range for an analog input has been exceeded and an alarm is issued, the limit value monitoring of this analog input is disabled and an error message is displayed. The measuring range is recognized as being exceeded and an alarm is issued: ■ 0 to 20 mA: Minimum value 2 mA Undershooting Maximum value 20.5 mA Overshooting ■ 0 to 2000 Ohms: Minimum value 20 Ohms Undershooting (Offset = 0 Ohm) Maximum value 2040 Ohms Overshooting (Offset = 0 Ohm) ■ 0 to 1 V: No wire break monitoring
				Resistive sender type only: Depending on what was configured for the offset value (parameter 1046 ⇘ p. 196/1096 ⇘ p. 196/1146 ⇘ p. 196) the displayed value may be shifted. This may result in a broken wire being recognized early or later than the actual value being measured. (An offset of +20 Ohms will recognize a wire break at 40 Ohms instead of 20 Ohms.)
				A wire break is indicated in ToolKit by displaying an analog input value "Error".
1004 1054 1104	**Wire break alarm class**	2		Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
			A/**[B]**	Warning alarm classes
			C/D/E/F	Shutdown alarm classes
			Control	Signal to issue a control command only
				Notes This parameter is only visible if wire break monitoring (parameter 1003 ⇘ p. 196/1053 ⇘ p. 196/1103 ⇘ p. 196) is not set to "Off" For additional information refer to ⇘ *Chapter 9.5.1 "Alarm Classes" on page 965*.
1005 1055 1105	**Self acknowledge wire break**	2	Yes	The control automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
				Notes This parameter is only visible wire break monitoring (parameter 1003 ⇘ p. 196/1053 ⇘ p. 196/1103 ⇘ p. 196) is not set to "Off"
10113 10114 10116	**Filter time constant for** **0/4 to 20 mA and 0 to 1 V**	2	Off, 1 to 5	A low pass filter may be used to reduce the fluctuation of an analog input reading. The cut-off-frequency is defined as usual with 63% (e^{-1}).
			Off	The analog input is displayed without filtering.
			1	Cut-off-frequency = 7.96 Hz (filter time constant = 0.02 s)
			2	Cut-off-frequency = 3.98 Hz (filter time constant = 0.04 s)
			[3]	Cut-off-frequency = 1.99 Hz (filter time constant = 0.08 s)
			4	Cut-off-frequency = 0.99 Hz (filter time constant = 0.16 s)

ID	Parameter	CL	Setting range [Default]	Description
			5	Cut-off-frequency = 0.50 Hz (filter time constant = 0.32 s)
	Filter time constant for **0 to 2000 Ω**	2	Off, 1 to 5	A low pass filter may be used to reduce the fluctuation of an analog input reading. The cut-off-frequency is defined as usual with 63% (e^{-1}).
			Off	Cut-off-frequency = 0.64 Hz (filter time constant = 0.25 s)
			1	Cut-off-frequency = 0.32 Hz (filter time constant = 0.5 s)
			2	Cut-off-frequency = 0.16 Hz (filter time constant = 1.0 s)
			[3]	Cut-off-frequency = 0.08 Hz (filter time constant = 2.0 s)
			4	Cut-off-frequency = 0.04 Hz (filter time constant = 4.0 s)
			5	Cut-off-frequency = 0.02 Hz (filter time constant = 8.0s)
1034 1084 1134	**Unit**	2	up to 6 characters text **[_ _ _ _ _ _]**	This parameter is assigning a unit text to the displayed analog value. **Notes** This parameter may only be configured using ToolKit. If *"°C"* or *"bar"* is assigned the unit will be converted into "F" or "psi" automatically if the corresponding parameter for conversion 3630 ↘ p. 191 and/or 3631 ↘ p. 191 is configured to YES. The max. number of characters is 39 but depends on numbers of Bytes for each character. The Bytes/character are defined by the font of the currently selected language. HMI Up to six characters are best for display/HMI; more will override screen border/frame. Please verify the length on the display for best view!
3632 3634 3636	**Bargraph minimum**	2	-21000000.00 to 21000000.00 **[0]**	The start value for the bar graph display of the analog input is defined here. The value must be entered according to the display format, which refers to the analog input type (parameter 1000 ↘ p. 193/↘ p. 200).
3633 3634 3637	**Bargraph maximum**	2	-21000000.00 to 21000000.00 **[2000]**	The end value for the bar graph display of the analog input is defined here. The value must be entered according to the display format, which refers to the analog input type (parameter 1000 ↘ p. 193/↘ p. 200).

Table 66: Analog Inputs 1 to 3 sender settings

4.4.2.5 Analog Outputs

4.4.2.5.1 Analog Outputs 1 and 2

The analog outputs AO 1 and AO 2 may either be configured as analog or PWM outputs. The analog outputs are prepared for speed and voltage biasing signal for a speed controller and voltage regulator.

- The following table shows two configuration examples with parameters and default values for the analog outputs 1 and 2.
- Example 1 at AO 1 is for a generator active power output at AO 1 with a range of -20 kW to 220 kW via a 4 to 20 mA signal (generator rated power = 200 kW).
- Example 2 at AO 2 is assigning the speed bias signal (0 to 100%) to PWM signal (0 to 100%) with level 6 V.

Configuration examples

Parameter / AnalogManager	Example 1 with AO 1		Example 2 with AO 2	
	ID		ID	Value
Selected hardware type (For details refer to)	5201	mA	5215	PWM
Minimum hardware level	5208	4	5222	0.00 (%)
Maximum hardware level	5209	20 (mA)	5223	100.00 (%)
PWM output level (visible only if *[PWM]* selected)	5210	—	5224	6 V
Source value at minimum level	5204	-20 (kW)	5218	0(%)
Source value at maximum level	5206	220 (kW)	5220	100 (%)
Filter time constant	5203	3	5217	Off
AM Data source AO1	5200	Type: Pass through A1 = 01.74 Gen. act. power [W]	5214	Type: Pass through A1 = 11.03 Speed bias [%]
Analog output 1	10310	Display of resulting value	10311	Display of resulting value

Settings/setup example

The following drawing shows the relation between the value of the AO signal selected and its corresponding values at the terminal pin. For settings see table below the drawing.

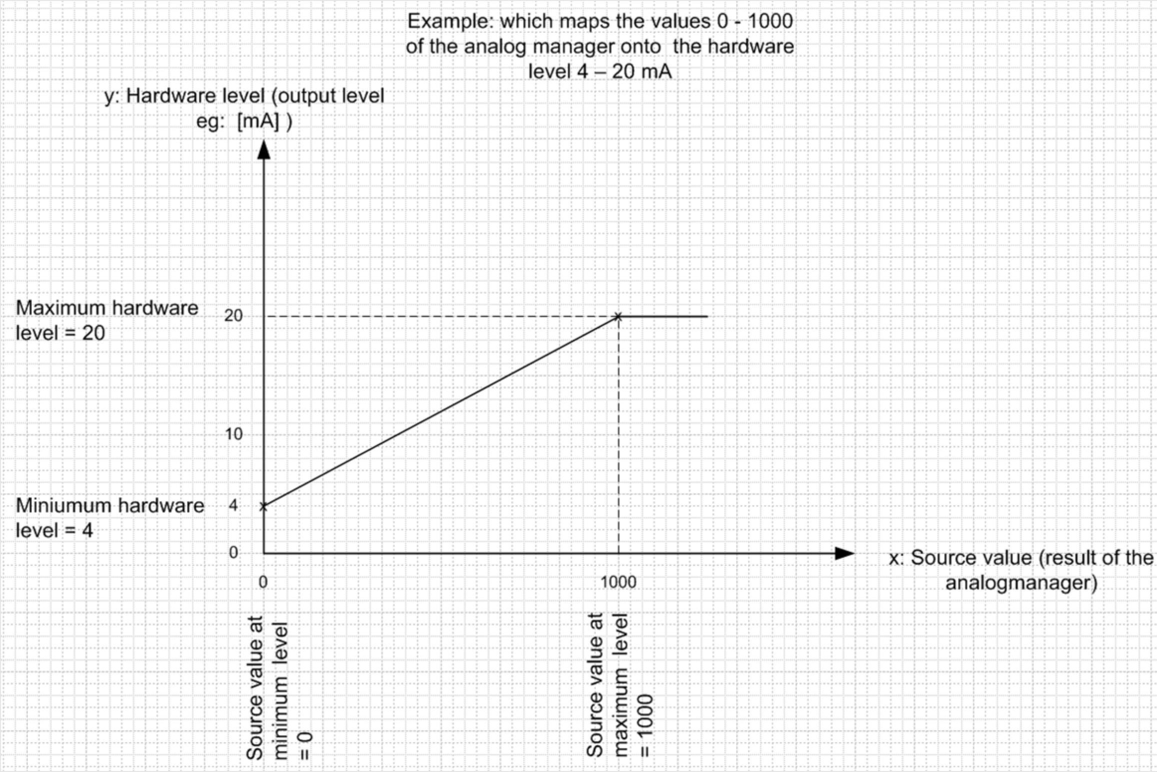


Fig. 152: Example to setup AO for 0 to 1000 IN becomes OUT 4 to 20 mA

Parameter / AnalogManager	Example 3 with AO 1	
	ID	
Selected hardware type (For details refer to)	5201	mA
Minimum hardware level	5208	4
Maximum hardware level	5209	20 mA
PWM output level (visible only if *[PWM]* selected)	5210	—
Source value at minimum level	5204	0
Source value at maximum level	5206	1000
Filter time constant	5203	3
AM Data source AO1	5200	Type: Pass through A1 = analog signal with range 0 to 1000
Analog output 1	10310	Display of resulting value

ID	Parameter	CL	Setting range [Default]	Description
5200 5214	**AM Data source ...**	2	Determined by AnalogManager 93.01, 93.02 AO1: **[A1 = 11.03 Speed bias (%)]** AO2: **[A1 = 11.02 Voltage bias (%)]**	The data source may be selected from the available data sources. **Notes** Refer to *Chapter 9.4.1 "Data Sources AM" on page 933* for a list of all data sources.
5201 5215	**Selected hardware type**	2		This parameter is used to configure the appropriate type of analog controller signal. The range of the analog output is configured here. PMW value is defined in %.
			Off	No analog output signal will be issued.
			[mA]	**Notes** Because of different isolation purposes the two biasing outputs must be clear labeled with their function.
			V	
			PWM	
5208 5222	**Minimum hardware level** (User defined minimum output value)	2	-20.00 to 100.00 **[0.00]**	The value of the configured hardware range, which shall correspond with the configured minimum source value, must be entered here (y-axis). This specifies the minimum limit of the hardware range. **Example** If the value configured here is 2.5, the maximum output range of +/-20 mA / +/-10 V has a lower limit of 2.5 mA / 2.5 V. **Notes** Value *[100]* is possible only for PWM.
5209 5223	**Maximum hardware level** (User defined maximum output value)	2	-20.00 to 100.00 **[20.00]**	The value of the configured hardware range, which shall correspond with the configured maximum source value, must be entered here (y-axis). This specifies the maximum limit of the hardware range. **Example** f the value configured here is 7.5, the maximum output range of +/-20 mA / +/-10 V has a upper limit of 7.5 mA / 7.5 V. **Notes** Value *[100]* is possible only for PWM.
5210 5224	**PWM output level**	2	0.00 to 10.00 V **[10.00 V]**	If PWM has been enabled in parameter 5203 p. 201/5217 p. 199/ p. 201, is defined in %, and the level of the PWM signal (amplitude) may be adjusted here.
5204 5218	**Source value at minimum level**	2	-21000000.00 to 21000000.00 **[0]**	The value from the data source must exceed the value configured here to raise the output signal above minimum hardware level. Negative percentage values may be used to change the sign, e.g. for power. The entry format of the value depends on the selected data source.
5206 5220	**Source value at maximum level**	2	-21000000.00 to 21000000.00 **[10000]**	If the value from the data source reaches the value configured here, the output signal will reach maximum hardware level. Negative percentage values may be used to change the sign, e.g. for power. The entry format of the value depends on the selected data source.
5203 5217	**Filter time constant**	2	Off, 1 to 7	A filter time constant may be used to reduce the fluctuation of an analog output value.
			[Off]	The analog output is displayed without filtering.
			1	Cut-off-frequency = 3.98 Hz (filter time constant = 0.04 s)
			2	Cut-off-frequency = 1.98 Hz (filter time constant = 0.08 s)
			3	Cut-off-frequency = 0.99 Hz (filter time constant = 0.16 s)
			4	Cut-off-frequency = 0.5 Hz (filter time constant = 0.32 s)
			5	Cut-off-frequency = 0.25 Hz (filter time constant = 0.64 s)

ID	Parameter	CL	Setting range [Default]	Description
			6	Cut-off-frequency = 0.12 Hz (filter time constant = 1.28 s)
			7	Cut-off-frequency = 0.06 Hz (filter time constant = 2.56 s)
				Notes The filter is not applied to the analog output display value, i.e. the end value of the analog output is displayed immediately.

4.4.2.6 External Analog Inputs

General notes

Configuration of these external analog inputs is performed similarly to the internal analog inputs.

> ***Changed from easYgen series to easYgen-XT series:***
>
> *External Analog Inputs/Analog Outputs (**AI/AO**)configuration is enhanced from % values to **absolute values additionally**.*

If an external expansion board (e.g. Phoenix Contact or WAGO) is connected to the easYgen via the CAN bus, it is possible to use 16 additional analog inputs.

- Refer to *Table on page 203* for the parameter IDs of the parameters for external analog inputs 1 through 16.

> *Please note that the available options for the parameters "Type" and "Sender type" differ from the internal analog inputs.*
>
> *The parameters "Offset" and "Monitoring wire break" are not available for the external analog inputs.*
>
> – *Refer to the Parameter List for details.*

> *A wire break or sender failure is indicated by a dedicated value sent via the CAN bus (Chapter 4.7.4.1 "CAN Interface 1" on page 444).*

> *For an example for the configuration of external analog inputs refer to Chapter 6.3.10 "Setup Expansion Modules at CAN 2" on page 559.*

> *Monitoring of the analog inputs (overrun/underrun) must be configured manually to the flexible limits (Chapter 4.5.5 "Flexible Limits" on page 402).*

External analog inputs - parameter IDs

Parameter external	AI 1	AI 2	AI 3	AI 4	AI 5	AI 6	AI 7	AI 8
Description	16203	16213	16223	16233	16243	16253	16263	16273
Type1	5851	5864	5877	5890	5903	5916	5929	5942
User defined min display value	5852	5865	5878	5891	5904	5917	5930	5943
User defined max display value	5853	5866	5879	5892	5905	5918	5931	5944
Sender value at display min.	5857	5870	5883	5896	5909	5922	5935	5948
Sender value at display max.	5858	5871	5884	5897	5910	5923	5936	5949
Sender type	5856	5869	5882	5895	5908	5921	5934	5947
Sender connection type	5859	5872	5885	5898	5911	5924	5937	5950
Filter time constant	5863	5876	5889	5902	5915	5928	5941	5954
Exponent for protocol	16204	16214	16229	16234	16244	16254	16264	16274
Wire break alarm class	5854	5867	5880	5893	5906	5919	5932	5945
Self acknowledge wire break	5855	5868	5881	5894	5907	5920	5933	5946
Unit	16208	16218	16228	16238	16248	16528	16268	16278
Bargraph minimum	5861	5874	5887	5900	5913	5926	5939	5952
Bargraph maximum	5862	5875	5888	5901	5914	5927	5940	5953

Parameter external	AI 9	AI 10	AI 11	AI 12	AI 13	AI 14	AI 15	AI 16
Description	16283	16293	16303	16313	16323	16333	16343	16353
Type	5955	5968	5981	6930	6943	6956	6969	6982
User defined min display value	5956	5969	5982	6931	6944	6957	6970	6983
User defined max display value	5957	5970	5983	6932	6945	6958	6971	6984
Sender value at display min.	5961	5974	5987	6936	6949	6962	6975	6988
Sender value at display max.	5962	5975	5988	6937	6950	6963	6976	6989
Sender type	5960	5973	5986	6935	6948	6961	6974	6987

Parameter external	AI 9	AI 10	AI 11	AI 12	AI 13	AI 14	AI 15	AI 16
Sender connection type	5963	5976	5989	6938	6951	6964	6977	6990
Filter time constant	5967	5980	5993	6942	6955	6968	6981	6994
Exponent for protocol	16284	16294	16304	16314	16324	16334	16344	16354
Wire break alarm class	5958	5971	5984	6933	6946	6959	6972	6985
Self acknowledge wire break	5959	5972	5985	6934	6947	6960	6973	6986
Unit	16288	16298	16308	16318	10390	10392	10394	10396
Bargraph minimum	5965	5978	5991	6940	6953	6966	6979	6992
Bargraph maximum	5966	5979	5992	6941	6954	6967	6980	6993

External analog inputs – example configuration analog input 1

Please make sure that the selected settings you are using are supported by your external devices.

Available "Type"s (parameters 5851, 5864, ...)				
Off		Table A		Pt DIN(R0)
Linear		Table B		Pt SAMA(R0)
		TC Type K		Ni DIN(R0)
		TC Type J		Ni SAMA(R0)
		TC Type E		Cu10
		TC Type R		Cu50
		TC Type S		Cu53
		TC Type T		Ni 1000(Landis)
		TC Type B		Ni 500(Viessm.)
		TC Type N		KTY 81-110
		TC Type U		KTY 84
		TC Type L		
		TC Type C		
		TC Type W		
		TC Type HK		

Available "Sender type"s (parameters 5856, 5869, ...)		
0 - 10 V		R0=100
±10 V		R0=10
0 - 20 mA		R0=20
±20 mA		R0=30
4 - 20 mA		R0=50
0 - 400 Ohms		R0=120
0 - 4000 Ohms		R0=150
Thermocouple		R0=200
		R0=240
		R0=300
		R0=400
		R0=500
		R0=1000
		R0=1500
		R0=2000
		R0=3000

Available "Sender connection type"s (parameters 5859, 5872, ...)
Two wire
Three wire

4.4.2.7 External Analog Outputs

If an external expansion board (e.g. from Phoenix Contact or WAGO) is connected to the easYgen via the CAN bus, it is possible to use 4 additional analog outputs.

The configuration of these external analog outputs is performed similarly to the internal analog outputs.

Refer to ✎ Table 67 “External analog outputs {1 to 4} - parameter IDs” on page 206 for the parameter IDs of the parameters for external analog outputs 1 through 4.

Please note that the available options for the Selected hardware type are limited. Refer to the Parameter List for details.

Parameter	Ext. AO 1	Ext. AO 2	Ext. AO 3	Ext. AO 4
Data source ext. AO {x}	10237	10247	10257	10267
	AnalogManager: **[Pass Through of 11.03 Speed bias (%)]**			
Source value at minimum level	10240	10250	10260	10270
Source value at maximum level	10241	10251	10261	10271
Filter time constant	10239	10249	10259	10269
Selected hardware type	10238	10248	10258	10268
	Setting range: **[Off]**; mA; V			
Minimum hardware level	10242	10252	10262	10272
Maximum hardware level	10243	10253	10263	10273
Ext. analog output {x} (displayed in ToolKit only: ON/OFF)	10245	10255	10265	10275
Notes: Refer to for details and definition of the parameters.				

Table 67: External analog outputs {1 to 4} - parameter IDs

ID	Parameter	CL	Setting range [Default]	Description
10237 10247 10257 10267	**Data source ...**	2	Determined by AnalogManager 93.21 .. 93.24 AO1 to AO 4: **[A1 = 11.03 Speed bias (%)]**	The data source may be selected from the available data sources.
				Notes Refer to ➜ *Chapter 9.4.1 "Data Sources AM" on page 933* for a list of all data sources.
10238 10248 10258 10268	**Selected hardware type**	2		This parameter is used to configure the appropriate type of analog controller signal. The range of the analog output is configured here.
			Off	No analog output signal will be issued.
			[mA]	
			V	
10242 20252 10262 10272	**Minimum hardware level** (User defined minimum output value)	2	0.00 to 20.00 **[0.00]**	The value of the configured hardware range, which shall correspond with the configured minimum source value, must be entered here (y-axis). This specifies the minimum limit of the hardware range.
				Example If the value configured here is 2.5, the maximum output range of +/-20 mA / +/-10 V has a lower limit of 2.5 mA / 2.5 V.
10243 10253 10263 10273	**Maximum hardware level** (User defined maximum output value)	2	0.00 to 20.00 **[20.00]**	The value of the configured hardware range, which shall correspond with the configured maximum source value, must be entered here (y-axis). This specifies the maximum limit of the hardware range.
				Example f the value configured here is 7.5, the maximum output range of +/-20 mA / +/-10 V has a upper limit of 7.5 mA / 7.5 V.

ID	Parameter	CL	Setting range [Default]	Description
10240 10250 10260 10270	**Source value at minimum level**	2	-21000000.00 to 21000000.00 **[0]**	The value from the data source must exceed the value configured here to raise the output signal above minimum hardware level. Negative percentage values may be used to change the sign, e.g. for power. The entry format of the value depends on the selected data source.
10241 10251 10261 10271	**Source value at maximum level**	2	-21000000.00 to 21000000.00 **[10000]**	If the value from the data source reaches the value configured here, the output signal will reach maximum hardware level. Negative percentage values may be used to change the sign, e.g. for power. The entry format of the value depends on the selected data source.
10239 10249 10259 10269	**Filter time constant**	2	Off, 1 to 7	A filter time constant may be used to reduce the fluctuation of an analog output value.
			[Off]	The analog output is displayed without filtering.
			1	Cut-off-frequency = 3.98 Hz (filter time constant = 0.04 s)
			2	Cut-off-frequency = 1.98 Hz (filter time constant = 0.08 s)
			3	Cut-off-frequency = 0.99 Hz (filter time constant = 0.16 s)
			4	Cut-off-frequency = 0.5 Hz (filter time constant = 0.32 s)
			5	Cut-off-frequency = 0.25 Hz (filter time constant = 0.64 s)
			6	Cut-off-frequency = 0.12 Hz (filter time constant = 1.28 s)
			7	Cut-off-frequency = 0.06 Hz (filter time constant = 2.56 s)
				Notes The filter is not applied to the analog output display value, i.e. the end value of the analog output is displayed immediately.

4.4.2.8 External Discrete Inputs

If a Woodward IKD 1 or other external expansion board (e.g. Phoenix Contact or WAGO) is connected to the easYgen via the CAN bus, it is possible to use 32 additional discrete inputs.

- *The configuration of these external DIs is performed similarly to the internal DIs (⇘ Chapter 4.4.2.2 "Discrete Inputs" on page 185).*
- *Refer to ⇘ Table 68 "External discrete inputs - parameter IDs 1..8" on page 207 for the parameter IDs of the parameters for external DIs 1 through 32.*

External	DI 1	DI 2	DI 3	DI 4	DI 5	DI 6	DI 7	DI 8
Description	16200	16210	16220	16230	16240	16250	16260	16270
Delay	16000	16010	16020	16030	16040	16050	16060	16070
Operation	16001	16011	16021	16031	16041	16051	16061	16071
Alarm class	16002	16012	16022	16032	16042	16052	16062	16072

External	DI 1	DI 2	DI 3	DI 4	DI 5	DI 6	DI 7	DI 8
Self acknowledge	16004	16014	16024	16034	16044	16054	16064	16074
Enabled	16003	16013	16023	16033	16043	16053	16063	16073

Table 68: External discrete inputs - parameter IDs 1..8

External	DI 9	DI 10	DI 11	DI 12	DI 13	DI 14	DI 15	DI 16
Description	16280	16290	16300	16310	16320	16330	16340	16350
Delay	16080	16090	16100	16110	16120	16130	16140	16150
Operation	16081	16091	16101	16111	16121	16131	16141	16151
Alarm class	16082	16092	16102	16112	16122	16132	16142	16152
Self acknowledge	16084	16094	16104	16114	16124	16134	16144	16154
Enabled	16083	16093	16103	16113	16123	16133	16143	16153

Table 69: External discrete inputs - parameter IDs 9..16

External	DI 17	DI 18	DI 19	DI 20	DI 21	DI 22	DI 23	DI 24
Description	16201	16211	16221	16231	16241	16251	16261	16271
Delay	16005	16015	16025	16035	16045	16055	16065	16075
Operation	16006	16016	16026	16036	16046	16056	16066	16076
Alarm class	16007	16017	16027	16037	16047	16057	16067	16077
Self acknowledge	16009	16019	16029	16039	16049	16059	16069	16079
Enabled	16008	16018	16028	16038	16048	16058	16068	16078

Table 70: External discrete inputs - parameter IDs 17..24

External	DI 25	DI 26	DI 27	DI 28	DI 29	DI 30	DI 31	DI 32
Description	16281	16291	16301	16311	16321	16331	16341	16351
Delay	16085	16095	16105	16115	16125	16135	16145	16155
Operation	16086	16096	16106	16116	16126	16136	16146	16156
Alarm class	16087	16097	16107	16117	16127	16137	16147	16157
Self acknowledge	16089	16099	16109	16119	16129	16139	16149	16159
Enabled	16088	16098	16108	16118	16128	16138	16148	16158

Table 71: External discrete inputs - parameter IDs 25..32

4.4.2.9 External Discrete Outputs

If a Woodward IKD 1 or other external expansion board (e.g. Phoenix Contact or WAGO) is connected to the easYgen via the CAN bus, it is possible to use 32 additional discrete outputs.

The configuration of the external DOs is performed in a similar way like for the internal DOs.

Refer to *Table 72 "External discrete outputs - parameter IDs (1 to 8)" on page 209* *for the parameter IDs of the parameters for external discrete outputs 1 through 32.*

External	DO 1	DO 2	DO 3	DO 4	DO 5	DO 6	DO 7	DO 8
Parameter ID	12330	12340	12350	12360	12370	12380	12390	12400

Table 72: External discrete outputs - parameter IDs (1 to 8)

External	DO 9	DO 10	DO 11	DO 12	DO 13	DO 14	DO 15	DO 16
Parameter ID	12410	12420	12430	12440	12450	12460	12470	12480

Table 73: External discrete outputs - parameter IDs (9 to 16)

External	DO 17	DO 18	DO 19	DO 20	DO 21	DO 22	DO 23	DO 24
Parameter ID	12331	12332	12333	12334	12335	12336	12337	12338

Table 74: External discrete outputs - parameter IDs (17 to 24)

External	DO 25	DO 26	DO 27	DO 28	DO 29	DO 30	DO 31	DO 32
Parameter ID	12339	12341	12342	12343	12344	12345	12346	12347

Table 75: External discrete outputs - parameter IDs (25 to 32)

4.4.3 Configure Breakers

General notes

The assignment of the defined relays to defined functions occurs by selection of the application mode (i.e. function "Command: Close GCB" on relay [R 6], this relay can no longer be operated via the LogicsManager).

The same way some relays are designated to specific functions, others may be assigned to different functions. These are listed as "programmed" relays. If a relay is "programmable" the function may be assigned to other relays via the LogicsManager by configuration.

For additional information refer to ⇘ Chapter 4.4.2.3 "Discrete Outputs (LogicsManager)" on page 188.

If the easYgen is intended to be operated in parallel with the mains, the mains voltage measuring inputs must be connected. If an external mains decoupling is performed, jumpers between busbar and mains voltage measuring inputs may be installed.

Changing the application mode will not change other configured values in the parameters. The application mode parameter is the only one.

Operation of the circuit breakers

The configuration of pulse switching takes place in the following screen and has the described effect on the signal sequence (the MCB cannot be controlled by the continuous pulse for security reasons, because otherwise, the MCB would be opened in case of a failure/exchange of the easYgen).

The parameter "Enable MCB" allows/prevents the closing of the MCB. A closed MCB will not be opened.

If the parameter "Auto unlock" is configured to YES, an open pulse will be issued prior to each close pulse.

External breaker handling

In operation mode AUTO the easYgen operates its breakers automatically according to the configured application and transition modes. Actually the breaker transition mode "external" would only allow the breaker closure from external. On the other hand the easYgen allows in special cases the closure of breaker from external, when the following configurations and modes are fulfilled:

External Breaker Handling	Synchronization Mode	Dead Bus Closure	Condition for the closure acceptance
GCB Synchronization	Off	-	■ The start request in automatic is active ■ The generator is in operating range ■ The engine start procedure is expired
GCB Dead bus closure	-	Off	
MCB Synchronization	Off	-	The mains is in operating range
GCB Dead bus closure	-	Off	
... and if GGB is available:			
GGB Synchronization	Off	-	Minimum 1 GCB is closed
GGB Dead bus closure	-	Off	

Interaction with LS-5

The easYgen provides some application modes, which contain the handling of the breaker control LS-5. According to the application mode a single LS-5 or a system of LS-5s is installed. The LS-5 technology shall give the designer an instrument to handle more complex breaker applications.

Here are some feature examples of the LS-5 technology:

- Open/close of individual breakers including synchronization and dead bus closure.
- Determining the generators in load share segments.
- Loading/unloading active and reactive power via the dedicated breaker.
- 3-phase power measurement at the interchange point to the utility.
- Included mains decoupling functions.

See further chapters in this document and in the LS-5 technical manual for more information.

4.4.3.1 Good to know: Actions with Breakers

4.4.3.1.1 Dead Bus Closing GCB

All parameters listed below only apply to application mode A03 to A11

The unit closes the GCB without synchronization, if the following conditions are met. The display indicates "GCB dead bus close".

Automatic operation

- The operating mode AUTOMATIC has been selected
- No class C alarm or higher is present
- The engine is running

- The engine delayed monitoring (parameter 3315 ➪ p. 171) as well as the generator stable time (parameter 3415 ➪ p. 226) have been expired or the LogicsManager function "Undelay close GCB" (parameter 12210 ➪ p. 226/➪ p. 927) is enabled
- The generator voltage and frequency are within the configured operating range (➪ *Chapter 4.5.1.1 " Generator Operating Ranges: Voltage / Frequency / Busbar" on page 315*)
- The MCB has been opened for at least the time configured in "Transfer time GCB↔MCB" (parameter 3400 ➪ p. 222)

  (Mode A04, A06, A08, A09 and A11 with open transition mode only)
- The function "Start without load" (parameter 12540 ➪ p. 290/ ➪ p. 928/➪ p. 928) has been disabled through the LogicsManager
- Only in critical mode: the parameter "Close GCB in override" (parameter 4100 ➪ p. 298) is configured to "Yes"
- The busbar voltage is below the dead bus detection limit (parameter 5820 ➪ p. 433)
- There is no other GCB closed in the same segment
- There is no other device with a smaller device ID willing to close its GCB too (Dead busbar closure negotiation)

Manual operation

- The operating mode MANUAL has been selected.
- No class C alarm or higher is present.
- The engine is running.
- The engine delayed monitoring (parameter 3315 ➪ p. 171) as well as the generator stable time (parameter 3415 ➪ p. 226) have been expired.
- The generator voltage and frequency are within the configured operating range (➪ *Chapter 4.5.1.1 " Generator Operating Ranges: Voltage / Frequency / Busbar" on page 315*).
- The button "Close GCB" has been pressed.
- The MCB has been open for at least the time configured in "Transfer time GCB↔MCB" (parameter 3400 ➪ p. 222).

  (Mode A04, A06, A08, A09 and A11 with open transition mode only)
- The busbar voltage is below the dead bus detection limit (parameter 5820 ➪ p. 433).
- There is no other GCB closed in the same segment.
- There is no other device with a smaller device ID willing to close its GCB too (Dead busbar closure negotiation).

Dead Busbar Negotiation

Each easYgen, who intends to close its GCB on a dead busbar publishes a "Dead busbar closure request" flag over CANbus and reads back whether there is any other easYgen publishing the same intension:

If not, the unit waits an estimated time for security and then closes its breaker.

If yes, the unit compares its own device number with the smallest device number of all others who also intend to close. If the own device number is smaller than the rest, the unit will close its breaker - otherwise it blocks its own closure.

The easYgen removes its wish to close its GCB on a dead busbar, if the GCB closure failure occurs in a multiple generator application. So the next easYgen with the higher device number gets the permission for closure.

The load sharing messages are monitored. In case of a “missing member” alarm on the load share bus, the single dead bus closures are delayed depending on the own Generator number to avoid simultaneous closure. The delay time is Generator Number multiplied with 500 ms.

The GCB dead busbar closure is realized faster, if LogicsManager "Undelayed close GCB" ID 12210 is set to TRUE.

The dead busbar negotiation is going over segments.

4.4.3.1.2 Synchronization GCB/MCB

All parameters listed below only apply to application mode A03 *to* A11

The synchronization is active, if the following conditions are met simultaneously.

The display indicates "Synchronization GCB" or "Synchronization MCB".

Automatic operation

- The operating mode AUTOMATIC has been selected
- The mains voltage is available and within the configured operating range (*Chapter 4.5.3.3 “Mains Operating Ranges: Voltage / Frequency” on page 361*)
- The generator and busbar voltage are available and within the configured operating range (*Chapter 4.5.1.1 “ Generator Operating Ranges: Voltage / Frequency / Busbar” on page 315*)
- The differential frequency/voltage is within the configured operating range
- Synchronizing the MCB
  – The GCB is closed (or at least one GCB is closed in a multiple genset application)
  – The busbar voltage is within the configured operating range
  – The "Enable MCB" (parameter 12923 p. 232/ p. 929) signal is present, for example discrete input 6 is energized if configured as DI 6
- Synchronizing the GCB
  – The MCB is closed
  – The busbar voltage is within the configured operating range
  – Engine delayed monitoring (parameter 3315 p. 171) and generator stable time (parameter 3415 p. 226) have expired or "Undelay close GCB" (parameter 12210 p. 226/ p. 927) is enabled

Manual operation

- Operating mode MANUAL has been selected
- The generator and busbar voltage are available and within the configured operating range (*Chapter 4.5.1.1 “ Generator Operating Ranges: Voltage / Frequency / Busbar” on page 315*)
- The differential frequency/voltage is within the configured operating range

- Synchronizing the MCB
  - The GCB is closed (or at least one GCB is closed in a multiple genset application)
  - The busbar voltage is within the configured operating range
  - The "Enable MCB" (parameter 12923 ↳ p. 232/↳ p. 929) signal is present, for example discrete input 6 is energized if configured as DI 6
  - The button "Close MCB" has been pressed
- Synchronizing the GCB
  - The MCB is closed
  - The busbar voltage is within the configured operating range
  - Engine delayed monitoring (parameter 3315 ↳ p. 171) and generator stable time (parameter 3415 ↳ p. 226) have expired or "Undelay close GCB" (parameter 12210 ↳ p. 226/↳ p. 927) is enabled
  - The button "Close GCB" has been pressed

4.4.3.1.3 Dead Bus Closing MCB

> *The following applies to application mode* A04 *and* A06*.*

The unit closes the MCB, if the following conditions are met simultaneously.

The display indicates "MCB dead bus close".

Automatic operation

- The operating mode AUTOMATIC has been selected
- The parameter "Dead busbar closure MCB" (parameter 3431 ↳ p. 231) is configured On
- The mains voltage is available and within the configured operating range (↳ *Chapter 4.5.3.3 "Mains Operating Ranges: Voltage / Frequency" on page 361*)
- The GCB is open or has been opened for at least the "Transfer time GCB↔MCB" (parameter 3400 ↳ p. 222) (open transition mode only)
- The "Enable MCB" (parameter 12923 ↳ p. 232/↳ p. 929) signal is present, for example discrete input 6 is energized if configured as DI 6
- The busbar voltage is below the dead bus detection limit (parameter 5820 ↳ p. 433)

Manual operation

- Operating mode MANUAL has been selected
- The parameter "Dead busbar closure MCB" (parameter 3431 ↳ p. 231) is configured "On"
- The mains voltage is available and within the configured operating range (↳ *Chapter 4.5.3.3 "Mains Operating Ranges: Voltage / Frequency" on page 361*)
- The GCB is open or has been opened for at least the "Transfer time GCB↔MCB" (parameter 3400 ↳ p. 222) (open transition mode only)

- The "Enable MCB" (parameter 12923 p. 232/ p. 929) signal is present, for example discrete input 6 is energized if configured so
- The button "Close MCB" has been pressed
- The busbar voltage is below the dead bus detection limit (parameter 5820 p. 433)

4.4.3.1.4 Open GCB

The following applies to application modes A03 to A11.

The GCB will be opened when the "Command GCB open" is issued. The behavior of the GCB open relay depends on the setting of parameter 3403 p. 223.

If this parameter is configured as "N.O.", the relay energizes to open the GCB, if it is configured as "N.C.", the relay de-energizes to open the GCB.

The GCB will be opened under the following conditions:

- In STOP operating mode after unloading the generator
- In case of a class C alarm or higher
- By pressing the "GCB" or "MCB" softkey (depending on the CB logic which has been set) in MANUAL operating mode
- By pressing the button "stop engine" in MANUAL operating mode
- In the event of an automatic stopping in the AUTOMATIC operating mode (the start request has been terminated or a stop request has been initiated)
- In critical mode (Sprinkler operation), provided that an emergency power operation is not active, and "Close GCB in override" (parameter 4100 p. 298) has been configured to No
- If "Start without load" has been enabled through the LogicsManager and the breaker was closed
- By pressing the "MCB" softkey (depending on the CB logic which has been set) in MANUAL operating mode

The conditions above are only valid if the GCB is closed, whereas the following conditions are valid regardless of the GCB is open or closed.

- Prior to the MCB closing onto the dead busbar (depending on the CB logic which has been set)
- In case of an alarm of class D or F

4.4.3.1.5 Open MCB

The following applies to application modes A04, A06, A08, A09 and A11.

The MCB will be opened when the relay "Command: MCB open" is energized.

The MCB will be opened under the following conditions if the MCB is closed:

- If an emergency power operation is initiated (mains failure) once the generator voltage is within the permissible limits
- Prior to the closure of the GCB (depending on the CB logic which has been set)
- Upon pressing the "MCB" or "GCB" softkey (dependent upon the configured CB logic) in MANUAL operating mode

4.4.3.1.6 Transition Modes (Breaker Logic)

Breaker logic "PARALLEL"

Parallel operation is enabled by configuring parameter 3411 ↳ p. 221 to "PARALLEL".

> *Parallel breaker logic must be selected for the following operation modes:*
>
> – *islanded operation*
> – *Mains parallel operation*

In the event of an engine start request the following occurs:

- The GCB is synchronized and closed
- The generator assumes load and the adjusted real power or reactive power setpoints are controlled

Following the stop request the following occurs:

- The generator sheds load until real power has reached the "Unload limit" (parameter 3125 ↳ p. 340)
- The generator power factor is controlled to "1.00" (unity)
- The GCB is opened
- The engine is shut down following the configured cool down period

> *When a stop command is issued to the engine, soft loading (power reduction) is carried out before opening the GCB, except an alarm of class D or F is present.*

Breaker logic "INTERCHANGE"

> *The following applies to application modes* A04*,* A06*,* A08*,* A09 *and* A11*.*

Mains interchange (import/export) real power control is enabled by configuring parameter 3411 ↳ p. 221 to "INTERCHANGE".

> *For this breaker logic to function correctly, the mains power measurement must be connected properly.*
>
> *The following applies for the power display:*
>
> – *Positive mains power = export power*
> – *Negative mains power = import power*

In the event of a start request, a change is made from mains to generator supply.

The following occurs:

- The GCB is synchronized and closed
- The generator assumes load until the imported mains interchange real power has reached 3 % of the "Generator rated active power" (parameter 1752 ↪ p. 431)
- The MCB is opened

When a stop request has been issued, a change is made from generator to mains supply.

The following occurs:

- The MCB is synchronized and closed
- The generator sheds load until real power has reached the "Unload limit" (parameter 3125 ↪ p. 340)
- The generator power factor is controlled to "1.00" (unity)
- The GCB is opened

Breaker logic "CLOSED TRANSIT."

> *The following applies to application modes A04, A06, A08, A09 and A11.*

Closed transition (make-before-break/overlap synchronization) is enabled by configuring parameter 3411 ↪ p. 221 to "CLOSED TRANSITION".

In the event of an engine start request, a change is made from mains to generator supply.

The following occurs:

- The GCB is synchronized and closed
- The MCB is opened and the generator assumes all loads

After the engine stop request has been issued, a change is made from generator to mains supply.

The following occurs:

- The MCB is synchronized and closed
- The GCB is opened and the mains assume all loads

> *The circuit breakers are opened irrespective of the power.*
>
> *The breaker closed transition time matches the duration time <100 ms.*

The maximum time between the reply from the CB and the CB open command is 100 ms.

Breaker logic "OPEN TRANSIT."

The following applies to application modes A04, A06, A08, A09 and A11.

Open transition (break-before-make/change over logic) is enabled via configuration of parameter 3411 ↳ p. 221 to "OPEN TRANSITION".

In the event of an engine start request, a change is made from mains to generator supply.

The following occurs:

- The MCB is opened
- The GCB is closed after the time configured in "Transfer time GCB<->MCB" (parameter 3400 ↳ p. 222) has expired.

The following occurs:

- The GCB is opened
- The MCB is closed after the time configured in "Transfer time GCB<->MCB" (parameter 3400 ↳ p. 222) has expired

Breaker logic "EXTERNAL"

External breaker logic is enabled via configuration of parameter 3411 ↳ p. 221 to "EXTERNAL".

All breaker control (especially the CB closing instructions) must be carried out via master controller (e.g. a PLC).

The easYgen controller always issues additionally the breaker open command under fault conditions and in the breaker unloading states (Unloading GCB) if the stop request is active.

Overview for application mode A04

STOP	MANUAL	AUTOMATIC
EXTERNAL: Breaker logic "External" In a mains parallel operation, decoupling from the mains is carried out via the MCB or the GCB in the event of a mains failure. The breakers will not automatically close in emergency power operation. Emergency power operation in accordance with European Community Specification DIN VDE 0108 is not possible in this power circuit breaker logic.		
The GCB is opened.	The MCB and the GCB may be manually opened. The circuit breakers are opened for decoupling from the mains.	The GCB is opened if the genset is stopped or if decoupling from the mains, but will not close if the engine is started. The MCB is opened only if decoupling from the mains, and is never closed.
PARALLEL: Breaker logic "Mains parallel operation" The MCB and GCB are synchronized to permit continuous mains parallel operation in this breaker logic mode.		

STOP	MANUAL	AUTOMATIC
The GCB is opened; the MCB is operated depending on the setting of "Enable MCB" (parameter 12923 ⤷ p. 232/⤷ p. 929).	Mains parallel operation can be initiated by pressing the "GCB On" or "MCB On" push-button.	The GCB is synchronized via an add-on request and a mains parallel operation is performed. When a shed-off request is issued, the generator sheds load and opens the GCB and the engine is shut down following the configured cool down period. Emergency power: The emergency power operation is terminated following the expiration of the mains settling time. The MCB is synchronized and closed, putting the system back into a mains parallel operation.
OPEN TRANSIT.: Breaker logic "Open transition / change-over / brake-before-make" The MCB and GCB are never synchronized in this breaker logic mode.		
The GCB is opened; the MCB is operated depending on the setting of "Enable MCB" (parameter 12923 ⤷ p. 232/⤷ p. 929).	A change can be made to either generator or mains operation by pressing either the "GCB On" or "MCB On" push-button. The "STOP" push-button opens the GCB and simultaneously stops the engine.	A change is made to generator operation through an add-on request. Once the add-on request is terminated, the system changes back to mains operation. The MCB is closed when the busbar is dead, even if there has not been an add-on request. Emergency power operations are terminated following the expiration of the mains settling timer. The GCB opens and the MCB closes, transferring all loads to the mains.
CLOSED TRANSIT.: Breaker logic "Closed transition / make-before-brake / overlap synchronization" The MCB and the GCB are synchronized, in order to avoid a dead busbar in this breaker logic mode. Immediately after the synchronization of one breaker, the other is opened. Continuous mains parallel operation is not possible.		
The GCB is opened; the MCB is operated depending on the setting of "Enable MCB" (parameter 12923 ⤷ p. 232/⤷ p. 929).	Synchronization of either the generator or the mains can be initiated by pressing the "GCB On" or "MCB On" push-button.	The GCB is synchronized via an add-on request. After the GCB closes the MCB is opened. Following the shed-off request being issued, the MCB is synchronized and closed. After the MCB has closed the GCB is opened. Emergency power: The emergency power operation is terminated following the expiration of the mains settling time and the MCB synchronizing to the generator. The MCB closes and the GCB opens immediately afterwards.
INTERCHANGE: Breaker logic "Soft loading / interchange synchronization" The MCB and the GCB are synchronized, in order to avoid a dead busbar in this breaker logic mode. The operation of a breaker under load is avoided by utilizing the ability to soft load. Continuous mains parallel operation is not possible with this breaker logic. Following the shed-off request, the MCB synchronizes and closes, the generator soft unloads to the mains and the GCB opens. After the GCB is open the engine is stopped following the expiration of the configured cool down period.		
The GCB is opened; the MCB is operated depending on the setting of "Enable MCB" (parameter 12923 ⤷ p. 232/⤷ p. 929).	Synchronization of either the generator or the mains can be initiated by pressing the "GCB On" or "MCB On" push-button.	Via an engine request, the GCB is synchronized and the generator power is increased. The MCB is then opened. Following the disabling of the engine request, the MCB is reverse synchronized and the GCB is then opened. Emergency power: The emergency power operation is terminated following the expiration of the mains settling time. The MCB closes, the load is transferred, and the GCB opens.

Overview for application mode A03

STOP	MANUAL	AUTOMATIC
PARALLEL: Breaker logic "Mains parallel" This operation mode may be used both in the case of an islanded system, an islanded parallel system, and a system that is operated in mains parallel.		
The GCB is opened.	Mains parallel operation can be performed via the "GCB On" push-button.	The GCB is synchronized via an add-on request and mains parallel operation is performed. When a shed-off request is issued, the generator sheds load, the GCB is opened, and the engine is shut down following the configured cool down period.

4.4.3.2 General Breaker Settings

ID	Parameter	CL	Setting range [Default]	Description
3444	**Application mode**	2		The unit may be configured to different application modes. The discrete inputs and relay outputs are pre-defined dependent upon the selected application mode. Only the screens and functions that pertain to the application mode selected are displayed. The single line diagram in the main screen will change. Refer to ↳ *Chapter 2.2 "Application Modes Overview" on page 35* for additional information.
			None	**Application mode** A01 The control unit will function as an engine start/stop control with generator and engine protection. All necessary inputs and outputs are assigned and pre-defined.
			GCB open	**Application mode** A02 The control unit will function as an engine start/stop control with generator and engine protection. The control unit can only open the GCB. All necessary inputs and outputs are assigned and pre-defined.
			GCB	**Application mode** A03 The control unit will function as a one-CB unit. The control unit performs full control like synchronizing, opening and closing the GCB with generator and engine protection. All necessary inputs and outputs are assigned and pre-defined.
			[GCB/MCB]	**Application mode** A04 The control unit will function as a two-CB unit. The control unit performs full control like synchronizing, opening and closing the GCB and the MCB with generator and engine protection. The GCB/MCB perform also full load transfer via open/closed transition, interchange and parallel mode. All necessary inputs and outputs are assigned and pre-defined.
			GCB/LS5	**Application mode** A07 In this mode the unit operates the GCB with close and open orders. All other breakers in the system are operated by the LS-5. The CAN system allows here a maximum 16 LS-5 and 32 easYgen-3400/3500(XT) devices.
			GCB/L-MCB	**Application mode** A08 In this mode the unit operates the breakers like in the mode "GCB/MCB". But instead of operating the MCB directly over relays the unit commands an LS-5 to operate the MCB.
			GCB/GGB	**Application mode** A05 In this mode the unit operates the GCB and a "Generator Group Breaker" (GGB) with close and open orders.
			GCB/GGB/MCB	**Application mode** A06 In this mode the unit operates the GCB, the GGB and the MCB with close and open orders.

ID	Parameter	CL	Setting range [Default]	Description
			GCB/GGB/L-MCB	**Application mode A09** In this mode the unit operates the breakers like in the mode "GCB/GGB/MCB". But instead of operating the MCB directly over relays the unit commands an LS-5 to operate the MCB.
			GCB/L-GGB	**Application mode A10** In this mode the unit operates the breakers like in the mode "GCB/GGB". But instead of operating the GGB directly over relays the unit commands an LS-5 to operate the GGB. In comparison to the "GCB/GGB" mode, it does not allow a mains parallel operation. So this is a purely islanded operation mode.
			GCB/L-GGB/L-MCB	**Application mode A11** In this mode the unit operates the breakers like in the mode "GCB/GGB/MCB". But instead of operating the MCB and GGB directly over relays the unit commands two single LS-5 to operate the MCB and GGB.
			GCB/L-GGBMCB	**Application mode A12** In this mode the unit operates the breakers like in the mode "GCB/GGB/MCB". But instead of operating the GGB and MCB directly over relays the unit commands the LS-5x2 to operate the GGB and the MCB. The LS-5x2 must be accordingly configured to application mode L-GGBMCB.
3411	**Breaker transition mode**	2		The control unit automatically controls the two breakers (MCB and GCB).
			External	
			Open Transition	
			Closed Transit.	
			Interchange	
			[Parallel]	
				Notes The following applies to application modes A04, A06, A08, A09, A11, and A12. For a detailed explanation for each mode refer to *Chapter 4.4.3.1.6 "Transition Modes (Breaker Logic)" on page 216.* The unit provides two alternative transition modes, which may be activated temporarily via the LogicsManager and override the transition mode configured in this parameter.
3412	**Breaker transition mode 1**	2		The control unit automatically controls the two breakers (MCB and GCB).
			External	
			Open Transition	
			Closed Transit.	
			Interchange	
			[Parallel]	
				Notes The following applies to application modes A04, A06, A08, A09, A11, and A12. For a detailed explanation for each mode refer to *Chapter 4.4.3.1.6 "Transition Modes (Breaker Logic)" on page 216.*
12931	**Transition mode 1**	2	Determined by LogicsManager 86.93 **[(0 & 1) & 1]** = 11922	Once the conditions of the LogicsManager have been fulfilled, the transition mode configured in parameter 3412 p. 221 will be used instead of the standard transition mode configured in parameter 3411 p. 221. For information on the LogicsManager and its default settings see *Chapter 9.3.1 "LogicsManager Overview" on page 882.*

ID	Parameter	CL	Setting range [Default]	Description
				Notes The following applies to application modes A04, A06, A08, A09, A11, and A12. Alternative transition mode 1 has priority over alternative transition mode 2, i.e. if both LogicsManager functions (parameters 12931 ➔ p. 221/➔ p. 929 and 12932 ➔ p. 222/➔ p. 929) are TRUE, breaker transition mode 1 (parameter 3412 ➔ p. 221) will be used.
3413	**Breaker transition mode 2**	2		The control unit automatically controls the two breakers (MCB and GCB).
			External	
			Open Transition	
			Closed Transit.	
			Interchange	
			[Parallel]	
				Notes The following applies to application modes A04, A06, A08, A09, A11, and A12. For a detailed explanation for each mode refer to ➔ *Chapter 4.4.3.1.6 "Transition Modes (Breaker Logic)" on page 216*.
12932	**Transition mode 2**	2	Determined by LogicsManager 86.94 **[(0 & 1) & 1]** = 11923	Once the conditions of the LogicsManager have been fulfilled, the transition mode configured in parameter 3412 ➔ p. 221 will be used instead of the standard transition mode configured in parameter 3411 ➔ p. 221.
				Notes Alternative transition mode 1 has priority over alternative transition mode 2, i.e. if both LogicsManager functions (parameters 12931 ➔ p. 221/➔ p. 929 and 12932 ➔ p. 222/➔ p. 929) are TRUE, breaker transition mode 1 (parameter 3412 ➔ p. 221) will be used. For information on the LogicsManager and its default settings see ➔ *Chapter 9.3.1 "LogicsManager Overview" on page 882.*
3400	**Transfer time GCB↔MCB**	2	1.00 to 99.99 s **[1.00 s]**	Switching from generator supply to mains supply or from mains supply to generator supply occurs automatically if the operating conditions have been met. The time between the reply "power circuit breaker is open" and a close pulse is set by this parameter. This time applies for both directions. During this time the consumers are de-energized.
				Notes The following applies to application modes A04, A06, A08, A09, A11, and A12. This is only valid, if parameter 3411 ➔ p. 221 is configured to OPEN TRANSITION
6676	**LS5 slip freq. separate offset**	2	-0.50 to 0.50 Hz **[-0.1 Hz]**	This is a separate slip frequency offset, being executed instead of the "standard slip frequency offset" 5502 ➔ p. 264 if the easYgen-XT receives an according flag "Synchronization with separated slip frequency offset". The flag is sent by the LS-5 (series II) Load share message.
				Notes This is usually receipt from an LS-5, which synchronizes a breaker at the interchange point to mains. Here exporting power to mains must be avoided.

4.4.3.3 Configure Breakers: GCB

General notes

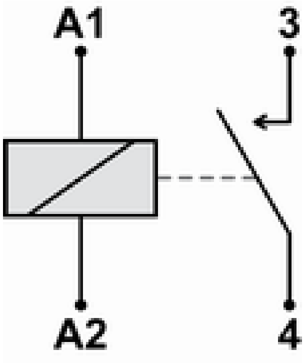


Fig. 153: Normally Open contacts - schematic

Normally Open (N.O.) contacts

The relay (discrete output) must be energized to close the contact.

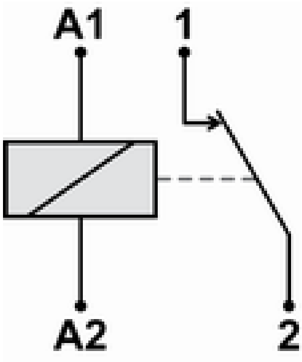


Fig. 154: Normally Closed contacts - schematic

Normally Closed (N.C.) contacts

The relay (discrete output) must be energized to open the contact.

ID	Parameter	CL	Setting range [Default]	Description
3403	**GCB open relay**	2	**[N.O.]**	Normally open: The relay "command: GCB open" will be energized to open the GCB and will be de-energized again after the discrete input "Reply GCB" is energized to signal the control that the GCB is open.
			N.C.	Normally closed: The relay "command: GCB open" will be de-energized to open the GCB and will be energized again after the discrete input "Reply GCB" is energized to signal the control that the GCB is open.
			Not used	A GCB open relay is not used and relay R7 (Command: open GCB) is freely programmable. In this case, parameter 3414 p. 223 must be configured to "Steady" to open the breaker.
				Notes This parameter **only** applies to application mode A02 to A12.
3414	**GCB close command**	2	Impulse	The relay "Command: GCB close" issues an add-on pulse. If the relay is configured in this manner a holding coil and sealing contacts must be installed externally to the control unit. The DI "Reply GCB" is used to identify closed contacts.
			[Steady]	The relay "Command: close GCB" may be wired directly into the holding circuit for the power circuit breaker. If this method is utilized it is recommended that isolation relays are used. After the connect pulse has been issued and the reply of the power circuit breaker has been received, the relay "Command: close GCB" remains energized. If a class C alarm or higher occurs or a GCB open command is issued, this relay de-energizes.

ID	Parameter	CL	Setting range [Default]	Description
				Notes In both cases the relay "Command: GCB open" energizes to open the GCB if parameter 3403 ↳ p. 223 is not configured as "Not used". This parameter **only** applies to application modes A03 to A12.
3416	**GCB time pulse**	2	0.10 to 1.00 s **[0.50 s]**	The time of the pulse output may be adjusted to the breaker being utilized.
				Notes This parameter **only** applies to application modes A03 to A12.
5729	**Synchronization GCB**	2	**[Slip frequency]**	The frequency controller adjusts the frequency in a way, that the frequency of the source (generator) is marginal greater than the target (busbar). When the synchronizing conditions are reached, a close command will be issued. The slipping frequency depends on the setting of "Slip frequency offset" (parameter 5502 ↳ p. 264).
			Phase matching	The frequency controller adjusts the phase angle of the source (generator) to that of the target (busbar), in view of turning the phase difference to zero.
				Notes This parameter **only** applies to application modes A03 to A12.
				Notes Regardless of breaker control, the values of 5700, 5701, 5702, 5703, 5704, 8824, and 8825 are important to the sync-check relay function.
5700	**Voltage differential GCB**	2	0.00 to 20.00% **[5.00%]**	The maximum permissible voltage differential for closing the generator circuit breaker is configured here. If the difference between generator and busbar voltage does not exceed the value configured here and the generator voltage is within the operating voltage window (parameters 5800 ↳ p. 316 and 5801 ↳ p. 316), the "Command: GCB close" may be issued.
				Notes This value refers to the generator rated voltage (parameter 1766 ↳ p. 431). This parameter **only** applies to application modes A03 to A12.
5701	**Positive frequency differential GCB**	2	0.00 to 0.49 Hz **[+0.18 Hz]**	The prerequisite for a close command being issued for the GCB is that the differential frequency is below the configured differential frequency. This value specifies the upper frequency (positive value corresponds to positive slip → generator frequency is higher than the busbar frequency).
				Notes This parameter **only** applies to application modes A03 to A12.
5702	**Negative frequency differential GCB**	2	-0.49 to 0.00 Hz **[-0.10 Hz]**	The prerequisite for a close command being issued for the GCB is that the differential frequency is above the configured differential frequency. This value specifies the lower frequency limit (negative value corresponds to negative slip → generator frequency is less than the busbar frequency).
				Notes This parameter **only** applies to application modes A03 to A12.
5703	**Maximum positive phase angle GCB**	2	0.0 to 60.0° **[7.0°]**	The prerequisite for a close command being issued for the GCB is that the leading phase angle between generator and busbar is below the configured maximum permissible angle.
				Notes This parameter **only** applies to application modes A03 to A12. This parameter is only displayed, if parameter 5729 ↳ p. 224 is configured to "Phase matching".
5704	**Maximum negative phase angle GCB**	2	-60.0 to 0.0° **[-7.0°]**	The prerequisite for a close command being issued for the GCB is that the lagging phase angle between generator and busbar is below the configured maximum permissible angle.

ID	Parameter	CL	Setting range [Default]	Description
				Notes This parameter **only** applies to application modes A03 to A12. This parameter is only displayed, if parameter 5729 ↪ p. 224 is configured to "Phase matching".
5707	**Phase matching GCB dwell time**	2	0.0 to 60.0 s **[3.0 s]**	This is the minimum time that the generator voltage, frequency, and phase angle must be within the configured limits before the breaker will be closed.
				Notes This parameter **only** applies to application modes A03 to A12. This parameter is only displayed, if parameter 5729 ↪ p. 224 is configured to "Phase matching".
8825	**Phase angle compensation GCB**	2		The phase angle between generator voltage and generator busbar voltage can be compensated according to an installed power transformer between generator and busbar.
			On	The compensation is active. The phase will be compensated according the value configured in parameter 8824 ↪ p. 225.
				Notes Measured values 181 'Ph.ang.busb1-gen.L12' and 184 'Ph.ang.mns.busb1 L12' are not changed but the compensated (8824 ↪ p. 225) values are taken for synchronization control and synchroscope display.
			[Off]	The compensation is inactive. The phase angle is directly taken from the measurement.
				Notes WARNING: Ensure the following parameters are configured correctly to prevent erroneous synchronization settings. Incorrect wiring of the system cannot be compensated for with this parameter! Please check during initial commissioning the phase angle and the synchronization with a zero voltmeter. **Recommendation:** For safety reasons, please mark the easYgen with a label showing the configured phase angle compensation. Refer to ↪ *Chapter 6.3.11 "Phase Angle Compensation" on page 568* for details.
8824	**Phase angle GCB**	2	-180 to 180° **[0°]**	The phase angle compensation corrects the degree between generator voltage and busbar voltage. The configured degree is added to the real measured phase angle. Visible only, if parameter 8825 is "On".
				Notes Ensure correct configuration to prevent erroneous synchronization settings to avoid **generator destructive power**. Incorrect wiring cannot be compensated for with this parameter!
3432	**Dead bus closure GCB**	2	**[On]**	A dead busbar closure is allowed if the required conditions are met.
			Off	A GCB close command to a dead busbar is prevented. Synchronization is still possible.
				Notes This parameter **only** applies to application modes A03 to A12.
15161	**Inhibit dead bus closure GCB**	2	Determined by LogicsManager 87.74 **[(0 & 1) & 1]** = 11463	If active the dead bus closure of the GCB can be inhibited.
				Notes For information on the LogicsManager and its default settings see ↪ *Chapter 9.3.1 "LogicsManager Overview" on page 882.*

ID	Parameter	CL	Setting range [Default]	Description
3415	**Generator stable time**	2	0 to 99 s **[2 s]**	The time configured here begins to count down once the engine monitoring delay timer has expired. This permits for an additional delay time before the breaker is closed in order to ensure that none of the engine delayed watchdogs trips. It is possible to bypass this delay time through the LogicsManager (parameter 12210 p. 226/ p. 927) in the event an emergency operation condition (mains failure) occurs. Unnecessary CB switching operations and voltage interruptions should be avoided by utilizing this parameter. **Notes** This parameter **only** applies to application modes A03 to A12.
12210	**Undelay close GCB**	2	Determined by LogicsManager 86.12 **[(04.09 Emergency mode & 1) & 1]** = 10711	Once the conditions of the LogicsManager have been fulfilled the GCB will be closed immediately (without waiting for engine speed delay and generator stable timer to expire). When using the standard setting, the GCB will be closed without delay in emergency power operation. **Notes** This parameter **only** applies to application modes A03 to A12. Usually the dead busbar negotiation is started with reaching the generator frequency and voltage operating window. But during the function "undelayed close GCB", the dead busbar negotiation is executed from the moment on the engine has reached the firing speed. *Through starting the dead bus bar negotiation earlier, the overall time before closing the GCB can be shorten.* For information on the LogicsManager and its default settings see *Chapter 9.3.1 "LogicsManager Overview" on page 882*.
12976	**GCB open in MAN**	2	Determined by LogicsManager 87.46 **[(0 & 1) & 1]** = 11435	With the rising edge of this LogicsManager equation a GCB open command in operating mode MANUAL is initiated. The state TRUE of this LM inhibits the GCB close command in MANUAL. **Notes** This parameter **only** applies to application mode A03 to A12. For information on the LogicsManager and its default settings see *Chapter 9.3.1 "LogicsManager Overview" on page 882*.
12977	**GCB close in MAN**	2	Determined by LogicsManager 87.47 **[(0 & 1) & 1]** = 11436	With the rising edge of this LogicsManager equation a GCB close command in operating mode MANUAL is initiated.Precondition: deactivated "GCB open in MAN" **Notes** This parameter **only** applies to application mode A03 to A12. For information on the LogicsManager and its default settings see *Chapter 9.3.1 "LogicsManager Overview" on page 882*.
5705	**Closing time GCB**	2	40 to 300 ms **[80 ms]**	The inherent closing time of the GCB corresponds to the lead-time of the close command. The close command will be issued independent of the differential frequency at the entered time before the synchronous point. **Notes** This parameter **only** applies to application modes A03 to A12.
3405	**GCB auto unlock**	2		This is used for special circuit breakers to put the GCB into a defined initial state or to enable closing at all.
			Yes	Before every close-pulse, an open-pulse is issued for defined duration (parameter 5708 p. 227. A CB close pulse is enabled only after the open pulse is issued.
			[No]	The CB close pulse is enabled without being preceded by a CB open pulse.
				Notes This parameter **only** applies to application modes A03 to A12.

ID	Parameter	CL	Setting range [Default]	Description
5708	**GCB open time pulse**	2	1.00 to 10.00 s **[1.00 s]**	This time defines the length of the GCB open time pulse, if the automatic switch unblocking GCB is activated.
				Notes This parameter **only** applies to application modes A03 to A12.

4.4.3.4 Configure Breakers: GGB

ID	Parameter	CL	Setting range [Default]	Description
3440	**Min. Generator power**	2	0.00 to 327.67 MW **[0.10 MW]**	GGB operation - the GGB shall be closed when a minimum of generator rated power is available. Each easYgen adds the nominal power of all active running generators to determine the closing of the GGB.
				Notes This parameter **only** applies to application mode A05, A06, A09, A10, and A12.
12936	**Bypass min. Pgen.**	2	Determined by LogicsManager 87.29 = 11418	This LogicsManager equation can bypass the considered minimal nominal generator power for closing the GGB. If the LogicsManager becomes TRUE the GGB will be closed independent of the current nominal generator power. According to the breaker transfer mode. Precondition: minimum one GGB is closed.
				Notes This parameter is valid for transition modes A05, A06, A09, A10, A11, and A12 now. On lower software versions (> SW 1.2100) this parameter **only** applied to application modes A05 and A06. For information on the LogicsManager and its default settings see ↪ *Chapter 9.3.1 "LogicsManager Overview" on page 882.*
5726	**GGB time pulse**	2	0.10 to 0.50 s **[0.50 s]**	The time of the pulse output may be adjusted to the breaker being utilized.
				Notes This parameter **only** applies to application mode A05, A06, A09, A10, A11, and A12.
5731	**Synchronization GGB**	2	**[Slip frequency]**	The frequency controller adjusts the frequency in a way, that the frequency of the source (generator) is marginal greater than the target (load busbar). When the synchronizing conditions are reached, a close command will be issued. The slipping frequency depends on the setting of "Slip frequency offset" (parameter 5502 ↪ p. 264).
			Phase matching	The frequency controller adjusts the phase angle of the source (generator) to that of the target (load busbar), in view of turning the phase difference to zero.
				Notes Please consider that the "Phase angle compensation MCB" (parameter 8841 ↪ p. 231 influences the GGB synchronization as well. In both synchronisations the phase angle between generator busbar and mains is used. This parameter **only** applies to application mode A05 and A06.
				Notes Regardless of breaker control, the values of 5723, 5724, and 5720 are important to the sync-check relay function.
5720	**Voltage differential GGB**	2	0.50 to 20.00% **[5.00%]**	The maximum permissible voltage differential for closing the generator group breaker is configured here. If the difference between generator busbar and mains voltage does not exceed the value configured here and the mains voltage is within the operating voltage window (parameters 5810 ↪ p. 362 and 5811 ↪ p. 362), the "Command: GGB close" may be issued.

ID	Parameter	CL	Setting range [Default]	Description
				Notes This value refers to the generator rated voltage (parameter 1766 p. 431) and mains rated voltage (parameter 1768 p. 434). This parameter **only** applies to application mode A05 and A06.
5721	**Positive frequency differential GGB**	2	0.0 to 0.49 Hz **[+0.18 Hz]**	The prerequisite for a close command being issued for the GGB is that the differential frequency is below the configured differential frequency. This value specifies the upper frequency (positive value corresponds to positive slip → generator frequency is higher than the load busbar frequency).
				Notes This parameter **only** applies to application mode A05 and A06.
5722	**Negative frequency differential GGB**	2	-0.49 to 0.00 Hz **[-0.10 Hz]**	The prerequisite for a close command being issued for the GGB is that the differential frequency is above the configured differential frequency. This value specifies the lower frequency limit (negative value corresponds to negative slip → generator frequency is less than the load busbar frequency).
				Notes This parameter **only** applies to application mode A05 and A06.
5723	**Maximum positive phase angle GGB**	2	0.0 to 60.0° **[7.0°]**	The prerequisite for a close command being issued for the GGB is that the leading phase angle between generator and load busbar is below the configured maximum permissible angle.
				Notes This parameter **only** applies to application mode A05 and A06. This parameter is only displayed, if parameter 5731 p. 227 is configured to "Phase matching".
5724	**Maximum negative phase angle GGB**	2	-60.0 to 0.0° **[-7.0°]**	The prerequisite for a close command being issued for the GGB is that the lagging phase angle between generator and load busbar is below the configured maximum permissible angle.
				Notes This parameter **only** applies to application mode A05 and A06. This parameter is only displayed, if parameter 5731 p. 227 is configured to "Phase matching".
5727	**Phase matching GGB dwell time**	2	0.0 to 60.0 s **[3.0 s]**	This is the minimum time that the generator voltage, frequency, and phase angle must be within the configured limits before the breaker will be closed.
				Notes This parameter **only** applies to application mode A05 and A06. This parameter is only displayed, if parameter 5731 p. 227 is configured to "Phase matching".
3445	**Dead bus closure GGB**	2	**[On]**	A dead busbar closure is allowed if the required conditions are met.
			Off	A GGB close command to a dead load busbar is prevented. Synchronization is still possible.
5725	**Closing time GGB**	2	40 to 300 ms **[80 ms]**	The inherent closing time of the GGB corresponds to the lead-time of the close command. The close command will be issued independent of the differential frequency at the entered time before the synchronous point.
				Notes This parameter **only** applies to application mode A05 and A06.
3441	**Voltage monitoring load busbar**	2		The decision to close the GGB or the MCB on a dead load busbar depends on the feedback of the GGB and MCB. To avoid damage because of a wrong breaker feedback the condition of the load busbar can additionally be monitored by a separate voltage relay.
			On	The external load busbar voltage monitoring is enabled and the terminal 76 (input 10) expects a dead load busbar signal according to the breaker feedback GGB and MCB. The signal is usually provided by an external three phase voltage relay.

ID	Parameter	CL	Setting range [Default]	Description
			[Off]	The external load busbar voltage monitoring is disabled and the terminal 76 (input 10) is free for other purposes.
3446	**GGB auto unlock**	2		This is used for special circuit breakers to put the GGB into a defined initial state or to enable closing at all.
			Yes	Before every close-pulse, an open-pulse is issued for defined duration (parameter 5719 ⇨ p. 229. A CB close pulse is enabled only after the open pulse is issued.
			[No]	The CB close pulse is enabled without being preceded by a CB open pulse.
				Notes This parameter **only** applies to application mode A05 and A06.
5719	**GGB open time pulse**	2	0.10 to 9.90 s **[1.00 s]**	This time defines the length of the GGB open time pulse, if the automatic switch unblocking GGB is activated.
				Notes This parameter **only** applies to application mode A05 and A06.
12972	**GGB open in MAN**	2	Determined by LogicsManager	With the rising edge of this LogicsManager equation a GGB open command in operating mode MANUAL is initiated. The state TRUE of this LM inhibits the GGB close command in MANUAL.
				Notes This parameter **only** applies to application mode A05, A06, A09, A10, A11, and A12. For information on the LogicsManager and its default settings see ⇨ *Chapter 9.3.1 "LogicsManager Overview" on page 882.*
12973	**GGB close in MAN**	2	Determined by LogicsManager	With the rising edge of this LogicsManager equation a GGB close command in operating mode MANUAL is initiated.Precondition: deactivated "GGB open in MAN"
				Notes This parameter **only** applies to application mode A05, A06, A09, A10, A11, and A12. For information on the LogicsManager and its default settings see ⇨ *Chapter 9.3.1 "LogicsManager Overview" on page 882.*

4.4.3.5 Configure Breakers: MCB

General notes

*The following parameters are **only** applicable for application modes A04 and A06.*

ID	Parameter	CL	Setting range [Default]	Description
3417	**MCB time pulse**	2	0.10 to 0.50 s **[0.50 s]**	Breaker pulse duration to close the MCB The time of the pulse output may be adjusted to the breaker being utilized.
				Notes This parameter **only** applies to application mode A04 and A06.
5730	**Synchronization MCB**	2	**[Slip frequency]**	The frequency controller adjusts the frequency in a way, that the frequency of the source (busbar) is marginal greater than the target (mains). When the synchronizing conditions are reached, a close command will be issued. The slipping frequency is positive to avoid reverse power.

ID	Parameter	CL	Setting range [Default]	Description
			Phase matching	The frequency controller adjusts the phase angle of the source (busbar) to that of the target (mains), in view of turning the phase difference to zero.
				Notes This parameter **only** applies to application mode A04 and A06.
				Notes Regardless of breaker control, the values of 5710, 5711, 5712, 5713, 5714, 8841, and 8842 are important to the sync-check relay function.
5713	**Max positive phase angle MCB** (Maximum permissible positive phase angle MCB)	2	0.0 to 60.0° **[7.0°]**	The prerequisite for a connect command being issued for the MCB is that the leading phase angle between busbar and mains is below the configured maximum permissible angle.
				Notes This parameter is only displayed, if parameter 5730 ➡ p. 229 is configured to "Phase matching". This parameter **only** applies to application mode A04 and A06.
5714	**Max negative phase angle MCB** (Maximum permissible negative phase angle MCB)	2	-60.0 to 0.0° **[-7.0°]**	The prerequisite for a connect command being issued for the MCB is that the lagging phase angle between busbar and mains is below the configured maximum permissible angle.
				Notes This parameter is only displayed, if parameter 5730 ➡ p. 229 is configured to "Phase matching". This parameter **only** applies to application mode A04 and A06.
5710	**Voltage differential MCB**	2	0.00 to 20.00% **[5.00%]**	The maximum permissible voltage differential for closing the mains circuit breaker is configured here.
				Notes This value refers to the generator rated voltage (parameter 1766 ➡ p. 431) and mains rated voltage (parameter 1768 ➡ p. 434). If the difference between mains and busbar voltage does not exceed the value configured here and the mains voltage is within the operating voltage window (parameters 5810 ➡ p. 362 and 5811 ➡ p. 362), the "Command: MCB close" may be issued. This parameter **only** applies to application mode A04 and A06.
5711	**Pos. freq. differential MCB** (Positive frequency differential MCB)	2	0.02 to 0.49 Hz **[0.18 Hz]**	The prerequisite for a connect command being issued for the MCB is that the differential frequency is below the configured differential frequency. This value specifies the upper frequency (positive value corresponds to positive slip → busbar frequency is higher than the mains frequency).
				Notes This parameter **only** applies to application mode A04 and A06.
5712	**Neg. freq. differential MCB** (Negative frequency differential MCB)	2	-0.49 to 0.00 Hz **[-0.10 Hz]**	The prerequisite for a connect command being issued for the MCB is that the differential frequency is above the configured differential frequency. This value specifies the lower frequency limit (negative value corresponds to negative slip → busbar frequency is less than the mains frequency).
				Notes This parameter **only** applies to application mode A04 and A06.
5709	**MCB sync. with separate slip**	2	On	The MCB is synchronized with an individual slip frequency (also negative).
				Notes The setting for the slipping frequency (parameter 5647 ➡ p. 231) via display is located under 'configure frequency control'.
			[Off]	The MCB is synchronized with the same slip frequency like the GCB (parameter 5502 ➡ p. 264).
				Notes This parameter **only** applies to application mode A04 and A06.

ID	Parameter	CL	Setting range [Default]	Description
5647	**MCB slip freq. setpoint offset**	2	-0.50 ... 0...50 Hz	Individual frequency offset for the MCB and LS5 synchronization. This value can be a positive or negative offset. The value is valid as long as the parameter 'MCB synchronization with separate slip' On/Off' (parameter 5709 ↪ p. 230) is set to 'On' .
			[-0.10 Hz]	
8841	**Phase angle compensation MCB**	2		The phase angle between busbar voltage and mains voltage can be compensated according to an installed power transformer between busbar and mains.
			On	The compensation is active. The phase will be compensated according the value configured in parameter 8842 ↪ p. 231.
				Notes Measured values 181 'Ph.ang.busb1-gen.L12' and 184 'Ph.ang.mns.busb1 L12' are not changed but the compensated (8842 ↪ p. 231) values are taken for synchronization control and synchroscope display.
			[Off]	The compensation is inactive. The phase angle is directly taken from the measurement.
				Notes WARNING: Ensure the following parameters are configured correctly to prevent erroneous synchronization settings. Incorrect wiring of the system cannot be compensated for with this parameter! Please check during initial commissioning the phase angle and the synchronization with a zero voltmeter. **Recommendation:** For safety reasons, please mark the easYgen with a label showing the configured phase angle compensation. Refer to ↪ *Chapter 6.3.11 "Phase Angle Compensation" on page 568* for details. This parameter **only** applies to application mode A04 and A06.
8842	**Phase angle MCB**	2	-180 to 180° **[0°]**	The phase angle compensation corrects the degree between busbar voltage and mains voltage. The configured degree is added to the real measured phase angle.
				Notes This parameter **only** applies to application mode A04 and A06. Ensure correct configuration to prevent erroneous synchronization settings to avoid generator **destructive power**. Incorrect wiring cannot be compensated for with this parameter!
5717	**Phase matching MCB dwell time**	2	0.0 to 60.0 s **[3.0 s]**	This is the minimum time that the generator/busbar voltage, frequency, and phase angle must be within the configured limits before the breaker will be closed.
				Notes This parameter is only displayed, if parameter 5730 ↪ p. 229 is configured to "Phase matching". This parameter **only** applies to application mode A04 and A06.
3431	**Dead bus closure MCB**	2	**[On]**	A dead busbar closure is allowed if the required conditions are met.
			Off	An MCB close command to a dead busbar is prevented. Synchronization is still possible.
				Notes This parameter **only** applies to application mode A04, A06, A08, A09, A11, and A12.
5715	**Closing time MCB**	2	40 to 300 ms **[80 ms]**	The inherent closing time of the MCB corresponds to the lead-time of the close command. The close command will be issued independent of the differential frequency at the entered time before the synchronous point.
				Notes This parameter **only** applies to application mode A04 and A06.
3407	**MCB auto unlock**	2		This is used for special circuit breakers to put the MCB into a defined initial state or to enable closing at all.

ID	Parameter	CL	Setting range [Default]	Description
			Yes	Before every close-pulse, an open-pulse is issued for defined duration (parameter 5718 p. 232. A CB close pulse is enabled only after the open pulse is issued.
			[No]	The CB close pulse is enabled without being preceded by a CB open pulse.
				Notes This parameter **only** applies to application mode A04 and A06.
12923	**Enable MCB**	2	Determined by LogicsManager 86.85 **[(09.06 DI06 & ! 08.07 MCB fail to close) & ! 07.05 Mns. ph. rot. mismatch]** = 11914	Once the conditions of the LogicsManager have been fulfilled the MCB will be enabled. **Notes** DI 6 is pre-assigned by default to this function, but may be configured freely. For information on the LogicsManager and its default settings see *Chapter 9.3.1 "LogicsManager Overview" on page 882*. This parameter **only** applies to application mode A04, A06, A08, A09, A11, and A12.
5718	**MCB open time pulse**	2	0.10 to 9.90 s **[1.00 s]**	This time defines the length of the MCB open time pulse, if the automatic switch unblocking MCB is activated. **Notes** This parameter **only** applies to application mode A04 and A06.
12974	**MCB open in MAN**	2	Determined by LogicsManager 87.48 **[(0 & 1) & 1]** = 11437	With the rising edge of this LogicsManager equation a MCB open command in operating mode MANUAL is initiated. The state TRUE of this LM inhibits the MCB close command in MANUAL. **Notes** This parameter **only** applies to application mode A04, A06, A08, A09, A11, and A12. For information on the LogicsManager and its default settings see *Chapter 9.3.1 "LogicsManager Overview" on page 882*.
12975	**MCB close in MAN**	2	Determined by LogicsManager 87.49 **[(0 & 1) & 1]** = 11438	With the rising edge of this LogicsManager equation a MCB close command in operating mode MANUAL is initiated.Precondition: deactivated "MCB open in MAN" **Notes** This parameter **only** applies to application mode A04, A06, A08, A09, A11, and A12. For information on the LogicsManager and its default settings see *Chapter 9.3.1 "LogicsManager Overview" on page 882*.

4.4.3.6 Configure Breakers: Synchronization

General notes

*The following parameters are **only** applicable for application modes A03 to A11.*

ID	Parameter	CL	Setting range [Default]	Description
5728	**Synchronization mode**	2	Off	The synchronization is disabled; the frequency and voltage adaptation for synchronization is not active. In operation mode AUTO the easYgen allows the external GCB closing in synchronization mode “Off” if: ■ Start request in automatic active ■ Generator is in operating range ■ The engine start procedure is finished In operation mode AUTO the easYgen allows the external MCB closing in synchronization mode “Off” if: ■ Mains is in the operating range In operation mode AUTO the easYgen allows the external GGB closing in synchronization mode “Off” if: ■ Minimum 1 GCB is closed
			Permissive	The unit acts as a synch check device. The unit will not issue speed or voltage bias commands to achieve a synchronization, but if phase matching synchronization conditions are matched (frequency, phase, voltage and phase angle), the control will issue a breaker close command. There are two different functionalities of this option depending on the setting of parameter 3414 ➪ p. 223 (GCB close command). ■ GCB close command set to "Impulse": The GCB close command is pulsed as long as the synchronization conditions are matched. ■ GCB close command set to "Steady": The GCB close command remains enabled as long as the synchronization conditions are matched.
			Check	Used for checking a synchronizer prior to commissioning. The control actively synchronizes generator(s) by issuing speed and voltage bias commands, but does not issue a breaker closure command for synchronizing.
			[Run]	Normal operating mode. The control actively synchronizes and issues breaker closure commands.
			Controlled by LM	The synchronization mode may be selected by enabling one of the respective LogicsManager functions (parameters 12907 ➪ p. 233/➪ p. 929, 12906 ➪ p. 233/➪ p. 929, or 12908 ➪ p. 233/➪ p. 929). If none of these parameters is enabled, the synchronization is disabled. If more than one of these parameters is enabled, the following priority is valid: ■ 1. PERMISSIVE ■ 2. CHECK ■ 3. RUN
				Notes The device will still perform a dead busbar closure if the conditions are valid.
12907	**Syn. mode PERMIS.** (Synchronization mode PERMISSIVE)	2	Determined by LogicsManager 86.39 **[(0 & 1) & 1]** = 11618	Once the conditions of the LogicsManager have been fulfilled the PERMISSIVE synchronization mode will be enabled. **Notes** For information on the LogicsManager and its default settings see ➪ *Chapter 9.3.1 “LogicsManager Overview” on page 882.*
12906	**Syn. mode CHECK** (Synchronization mode CHECK)	2	Determined by LogicsManager 86.38 **[(0 & 1) & 1]** = 11617	Once the conditions of the LogicsManager have been fulfilled the CHECK synchronization mode will be enabled. **Notes** For information on the LogicsManager and its default settings see ➪ *Chapter 9.3.1 “LogicsManager Overview” on page 882.*
12908	**Syn. mode RUN**	2	Determined by LogicsManager 86.40	Once the conditions of the LogicsManager have been fulfilled the RUN synchronization mode will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
	(Synchronization mode RUN)		**[(0 & 1) & 1]** = 11619	**Notes** For information on the LogicsManager and its default settings see *Chapter 9.3.1 "LogicsManager Overview" on page 882*.
15157	**Synchroscope autom. to front** (Synchroscope automatic to front)	2	On	The synchroscope screen automatically appears on the main screen, when the synchronization becomes active.
			[Off]	Functionality deactivated.

4.4.3.6.1 Independent Sync. Check Function

General notes

The device provides two independent "Sync Check" functions for the voltage comparisons generator to busbar and busbar to mains. The criteria are the same like for the according internal self-executed synchronization.

The easYgen provides two command variables available for the LogicsManager input:

- 02.29 Sync Check generator / busbar
- 02.32 Sync Check mains / busbar

WARNING!

No dead bus interlocking

Synch. Check is intended to be a redundant check function enhancing system security. **Don't use for MCB control!**

The Sync. Check functionality is available in every application mode. The command variables are independently calculated and depending on the same configurations, like the self-executed GCB and MCB close commands. The sync. Check function has no influence on any frequency or voltage biasing. There is no relationship to the Sync. Check mode for the internal self-executed synchronization.

The Synch. Check command variables do not care about:

– *Possible dead busbar closure capabilities*
– *Internally calculated self-executed circuit breaker close orders*
– *Synchronization control conditions, like "mains settling time "*

Variables and Parameters

[02.29 Sync.Check gen./busb] depends on

- Voltage
- Frequency
  and
- Phase angle

The command variable *[02.29 Sync.Check gen./busb]* is true if the synchronization conditions are matched according to (GCB) parameters:

- 5701: Pos. freq. differential
- 5702: Neg. freq. differential
- 5700: Voltage differential
- 8825, 8824: Phase angle compensation
- 5703: Max. positive phase angle
- 5704: Max. negative phase angle GCB

[02.32 Sync.Check mns/busb] depends on

- Voltage
- Frequency
  and
- Phase angle

The command variable *[02.32 Sync.Check mns/busb]* is true, if the synchronization conditions are matched according to parameters:

- 5711: Pos. freq. differential MCB
- 5712: Neg. freq. differential MCB
- 5710: Voltage differential MCB
- 8841,8842: Phase angle compensation MCB
- 5713: Max. positive phase angle MCB
- 5714: Max. negative phase angle MCB

4.4.3.7 Configure Breakers: Neutral Interlocking

General Notes

The Neutral Interlocking feature controls a Neutral Contactor (NC) of each generator. The rule is that only one neutral contactor of all running generators are closed. The Logic ensures that with changing of generators the neutral link is passed over to another running generator. Refer to *Chapter 6.3.14 “Neutral Interlocking” on page 576* for more information.

ID	Parameter	CL	Setting range [Default]	Description
1840	**Neutral interlocking**	2	On	Neutral interlocking is enabled. The command variable 03.39 Close neutral contactor is activated and the DI 12 is used for the NC feedback. The unit monitors the NC feedback according to the close order.
			[Off]	Neutral interlocking is disabled. The NC monitoring is disabled.
1841	**Priority**	2	1 ... 32 **[1]**	The priority determines which NC is closed, if multiple gens are running in the same segment.

To make use of the Close neutral interlocking contactor status, configure a discrete output relay DO x to react for 03.39.

4.4.4 Configure Controller

WARNING!

Hazards due to incorrect settings

The following parameters dictate how the easYgen controls voltage, frequency, load and power factor.

Failure to do so may lead to incorrect measurements and failures within the control unit resulting in damage to or destruction of the generator and/or personal injury or death.

– Always ensure that the correct settings are entered in these parameters.

The Real load, reactive load, and process control all utilize PID controllers. The response of each control loop can be adjusted for optimum response, however it is important to understand what a PID controller is and the effect of each controller adjustment has on the controller response.

Proportional gain, integral gain (stability) and DR (speed derivative ratio) are the adjustable and interacting parameters used to match the response of the control loop with the response of the system.

They correspond to the P (proportional), I (integral), and D (derivative) terms, and are displayed in the easYgen as follows:

P - Proportional gain (%)

I - Integral gain (%)

D - Derivative gain (determined by DR and I)

Proportional control

Proportional response is directly proportional to a process change.

- Analogy: Setting hand throttle to keep constant speed on straight and level road.

Proportional control (using the same analogy) results in a certain speed as long as the car is not subjected to any load change such as a hill. If a throttle is set to any particular setting, the speed of the car will remain constant as long as the car remains straight and level. If the car goes up a hill it will slow down. Of course, going down a hill the car would gain speed.

Integral control

Integral compensates for process and setpoint load changes.

- Analogy: Cruise control maintains constant speed regardless of hills.

Integral, sometimes called reset, provides additional action to the original proportional response as long as the process variable remains away from the setpoint. Integral is a function of the magnitude and duration of the deviation. In this analogy the reset response would keep the car speed constant regardless of the terrain.

Derivative

Derivative provides a temporary over-correction to compensate for long transfer lags and reduce stabilization time on process upsets (momentary disturbances). The behavior of the derivative parameter is shown in Fig. 155.

- Analogy: Accelerating into high speed lane with merging traffic.

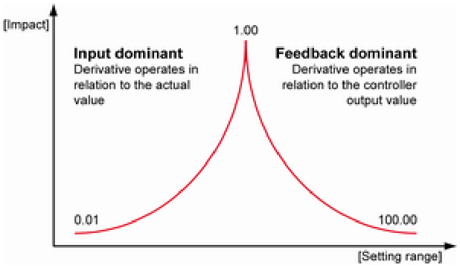


Fig. 155: Behavior of the derivative parameter

Derivative, sometimes called "preact" of "rate", is very difficult to draw an accurate analogy to, because the action takes place only when the process changes and is directly related to the speed at which the process changes.

Merging into high speed traffic of a freeway from an "on" ramp is no easy task and requires accelerated correction (temporary over-correction) in both increasing and decreasing directions. The application of brakes to fall behind the car in the first continuous lane or passing gear to get ahead of the car in the first continuous lane is a derivative action.

PID tuning example

If the system is unstable, make sure the governor is the cause. This can be checked by closing the valve limiter until it has control of the actuator output. If the governor is causing the oscillation, time the oscillation cycle time. A rule-of- thumb is, if the system's oscillation cycle time is less than 1 second, reduce the Proportional gain term. A rule-of-thumb is, if the system's oscillation cycle time is greater than 1 second, reduce the Integral gain term (proportional gain may need to be increased also).

On an initial startup with the easYgen, all PID dynamic gain terms will require adjustment to match the respective PID's response to that of its control loop. There are multiple dynamic tuning methods available that can be used with the easYgen's PIDs to assist in determining the gain terms that provide optimum control loop response times.

The following method can be used to achieve PID gain values that are close to optimum:

1. Increase Derivative Ratio (DR) to 100.
2. Reduce integral gain to 0.01.
3. Increase proportional gain until system just starts to oscillate.

   The optimum gain for this step is when the system just starts to oscillate and maintains a self-sustaining oscillation that does not increase or decrease in magnitude.

4. Record the control gain (Kc) and oscillation period (T) in seconds.

5. Set the dynamics as follows:
- For PI control G=P(I/s + 1) set:
  - Proportional gain = 0.45*Kc
  - Integral gain = 1.2/T
  - Derivative ratio = 100
- For PID control G=P(I/s + 1 + Ds) set:
  - Proportional gain = 0.60*Kc
  - Integral gain = 2/T
  - Deriv ratio = 8/(T*Integral Gain) for feedback dominant
  - Deriv ratio = (T*Integral Gain)/8 for input dominant

⇨ This method of tuning will get the gain settings close, they can be fine-tuned from this point.

4.4.4.1 Voltage Control

ToolKit: find settings screen

"Parameter ➔ Configuration: Configure application ➔ Configure controller: Configure voltage control"

AnalogManagers to define input signal of voltage setpoint (1, 2) are available in ToolKit by

- *a click from screen/page "Configure voltage control"*
  - *on the button "Analog manager" in the left sidebar (below permanent buttons) or*
  - *on two times "next page", or*
- *search for one of the AnalogManagers 5618 ➪ p. 240/➪ p. 958/5619 ➪ p. 240/➪ p. 958*

ToolKit: Trend chart

ToolKit offers a trend visualization accessible by

- *a click from screen/page "Configure voltage control"*
  - *on the button "Trend chart" in the left sidebar (below permanent buttons) or*
  - *on "next page", or*
- *search for one of the voltage controlled parameters 144 ➪ p. 687/➪ p. 718/➪ p. 787/➪ p. 820/➪ p. 871/5535/5635/171 ➪ p. 687/➪ p. 718/➪ p. 787/➪ p. 868/170 ➪ p. 679/➪ p. 687/➪ p. 718/➪ p. 787/➪ p. 868*

ID	Parameter	CL	Setting range [Default]	Description
5607	**Voltage Control**	2	**[PID analog]**	The voltage is controlled using an analog PID controller.
			3pos controller	The voltage is controlled using a three-step controller.

ID	Parameter	CL	Setting range [Default]	Description
			Off	Voltage control is not carried out.
5608	**Voltage control initial state**	2	0.0 to 100.0% **[50.0%]**	The value entered for this parameter is the start reference point for the analog output to the voltage controller. If the output to the voltage control has been disabled, the output will act as a control position reference point.
5610	**Proportional gain**	2	0.01 to 100.00 **[1.00]**	The proportional coefficient specifies the gain. By increasing the gain, the response is increased to permit larger corrections to the variable to be controlled. The farther out of tolerance the process is the larger the response action is to return the process to the tolerance band. If the gain is configured too high, the result is excessive overshoot/undershoot of the desired value. **Notes** This parameter is only visible if voltage control (parameter 5607 ➡ p. 238) is configured to "PID analog".
5611	**Integral gain**	2	0.01 to 100.00 **[1.00]**	The integral gain identifies the I part of the PID controller. The integral gain corrects for any offset (between setpoint and process variable) automatically over time by shifting the proportioning band. Reset automatically changes the output requirements until the process variable and the setpoint are the same. This parameter permits the user to adjust how quickly the reset attempts to correct for any offset. The integral gain constant must be greater than the derivative time constant. If the integral gain constant is too large, the engine will continually oscillate. If the integral gain constant is too small, the engine will take too long to settle at a steady state. **Notes** This parameter is only visible if voltage control (parameter 5607 ➡ p. 238) is configured to "PID analog".
5612	**Derivative ratio**	2	0.01 to 100.00 **[0.01]**	The derivative ratio identifies the D part of the PID controller. By increasing this parameter, the stability of the system is increased. The controller will attempt to slow down the action of the actuator in an attempt to prevent excessive overshoot or undershoot. Essentially this is the brake for the process. This portion of the PID loop operates anywhere within the range of the process unlike reset. **Notes** This parameter is only visible if voltage control (parameter 5607 ➡ p. 238) is configured to "PID analog". The default configured controller acts like a PI controller what is the valid D part setting for systems with secondary controllers.
5650	**Deadband**	1	0.1 to 9.9% **[1.0%]**	**islanded operation** The generator voltage is controlled in such a manner that the measured voltage does not deviate from the configured setpoint by more than the value configured in this parameter without the controller issuing a voltage raise/lower signal to the voltage regulator. This prevents unneeded wear on the voltage bias output control or the raise/lower relay contacts. **Synchronization** The generator voltage is controlled in such a manner that the measured voltage does not deviate from the monitored reference (mains or busbar) voltage by more than the value configured in this parameter without the controller issuing a voltage raise/lower signal to the voltage regulator. This prevents unneeded wear on the voltage bias output control or the raise/lower relay contacts. The value configured for this parameter must be less than the value configured for the dV max (maximum voltage differential) for synchronization (parameters 5700 ➡ p. 224 or 5710 ➡ p. 230). **Notes** This parameter is only visible if voltage control (parameter 5607 ➡ p. 238) is configured to "3pos controller".
5651	**Time pulse minimum**	1	0.01 to 2.00 s **[0.05 s]**	A minimum pulse on time must be configured here. The shortest possible pulse time should be configured to limit overshoot of the desired voltage reference point.

ID	Parameter	CL	Setting range [Default]	Description
				Notes This parameter is only visible if voltage control (parameter 5607 ⇘ p. 238) is configured to "3pos controller".
5652	**Gain factor**	1	0.1 to 10.0 **[5.0]**	The gain factor Kp influences the operating time of the relays. By increasing the number configured in this parameter, the operating time of the relay will be in-creased in response to a deviation from the voltage reference. By increasing the gain, the response is increased to permit larger corrections to the variable to be controlled. The farther out of tolerance the process is the larger the response action is to return the process to the tolerance band. If the gain is configured too high, the result is excessive overshoot/undershoot of the desired value. **Notes** This parameter is only visible if voltage control (parameter 5607 ⇘ p. 238) is configured to "3pos controller".
5659	**Cycle time factor**	1	1.0 to 20.0 **[1.0]**	The cycle time factor adjusts the time between the pulses (pause time). By increasing the cycle time factor, the time between the pulses increases. **Notes** This parameter is only visible if voltage control (parameter 5607 ⇘ p. 238) is configured to "3pos controller".
5653	**Expand dead-band factor**	1	1.0 to 9.9 **[1.0]**	If the measured generator voltage is within the deadband range (param-eter 5650 ⇘ p. 239) and the configured delay expand deadband time (param-eter 5654 ⇘ p. 240) expires, the deadband will be multiplied with the factor configured here. **Notes** This parameter is only visible if voltage control (parameter 5607 ⇘ p. 238) is configured to "3pos controller".
5654	**Delay expand deadband**	1	1.0 to 9.9 s **[2.0 s]**	The measured generator voltage must be within the deadband range for the time configured here in order to multiply the deadband with the factor config-ured in parameter 5653 ⇘ p. 240. **Notes** This parameter is only visible if voltage control (parameter 5607 ⇘ p. 238) is configured to "3pos controller".
5618	**AM Voltage SP1 [V]**	2	Determined by AnalogManager 81.09 **[A1 = 05.57 Internal v setp1 [V]]**	The voltage setpoint 1 source may be selected from the available data sources. The internal voltage setpoint 05.57 can be changed manually at the setpoint screen of the display. **Notes** The voltage setpoint may be adjusted within the configured operating limits (⇘ *Chapter 4.5.1.1 "Generator Operating Ranges: Voltage / Frequency / Busbar" on page 315*).
5600	**Int.voltage control set-point 1**	2	50 to 650,000 V **[400 V]**	The internal generator voltage setpoint 1 is defined in this screen. This value is the reference for the voltage controller when performing islanded and/or no-load operations.
5619	**AM Voltage SP2 [V]**	2	Determined by AnalogManager 81.10 **[A1 = 05.58 Internal v setp2 [V]]**	The voltage setpoint 2 source may be selected from the available data sources. The internal voltage setpoint 05.58 can be changed manually at the setpoint screen of the display. **Notes** The voltage setpoint may be adjusted within the configured operating limits (⇘ *Chapter 4.5.1.1 "Generator Operating Ranges: Voltage / Frequency / Busbar" on page 315*).
5601	**Int.voltage control set-point 2**	2	50 to 650,000 V **[400 V]**	The internal generator voltage setpoint 2 is defined in this screen. This value is the reference for the voltage controller when performing islanded and/or no-load operations.

ID	Parameter	CL	Setting range [Default]	Description
12920	**Setp. 2 voltage**	2	Determined by LogicsManager 86.83 **[(0 & 1) & 1]** = 11912	If this LogicsManager condition is TRUE, the voltage setpoint 2 will be used instead of voltage setpoint 1. The voltage (result of AM) 5619 ➪ p. 240/ ➪ p. 958 instead of 5618 ➪ p. 240/➪ p. 958 will be taken into account. **Notes** For information on the LogicsManager and its default settings see ➪ *Chapter 9.3.1 "LogicsManager Overview" on page 882*. Remotely switching the setpoint is possible: Use the LogicsManager command variable for input that is correlating with the dedicated bit of parameter 504 ➪ p. 608/➪ p. 621.
5616	**Start value**	1	0 to 100% **[70%]**	The voltage controller is activated when the monitored generator voltage has exceeded the value configured in this parameter. This prevents the easYgen from attempting to control the voltage while the engine is completing its start sequence. **Notes** This value refers to the generator voltage setpoint (parameter 5600 ➪ p. 240 or 5601 ➪ p. 240).
5617	**Start delay**	1	0 to 999 s **[5 s]**	The voltage controller is enabled after the configured time for this parameter expires.
5603	**Voltage control setpoint ramp**	2	1.00 to 300.00 %/s **[5.00 %/s]**	The different setpoint values are supplied to the controller via this ramp. The slope of the ramp is used to alter the rate at which the controller modifies the setpoint value. The faster the change in the setpoint is to be carried out, the greater the value entered here must be.
5604	**Voltage control droop**	2	0.0 to 20.0% **[5.0%]**	If this control is to be operated on a generator in parallel with other generators and voltage control is enabled, a droop characteristic curve must be used. Each generator in the system will require the same value to be configured for the droop characteristic, so that when the system is stable the reactive power will be distributed proportionally among all generators in relation to their rated reactive power.
12905	**Volt. droop act.** (Voltage droop active)	2	Determined by LogicsManager 86.26 **[(08.17 Missing member OR 08.06 GCB fail to open) & 1]** = 11605	If this LogicsManager condition is TRUE, the voltage droop is enabled. **Example** ■ Rated reactive power: 400 kvar ■ Rated voltage setpoint: 410 V ■ Droop 5.0% ■ Reactive power 0 kvar = 0% of rated power ■ Voltage is adjusted to (410 V – [5.0% * 0.0 * 410 V]) = 410 V. ■ Reactive power 400 kvar = 100% of rated reactive power ■ Voltage is adjusted to (410 V – [5.0% * 1.0 * 410 V]) = 410 V – 20.5 V = 389.5 V. **Notes** For information on the LogicsManager and its default settings see ➪ *Chapter 9.3.1 "LogicsManager Overview" on page 882*.
12938	**Release V-control**	2	Determined by LogicsManager 86.97 **[(1 & 1) & 1]** = 11926	This LogicsManager is used to activate generally the voltage biasing to the sub controller. If the LogicsManager is false the output will be on the initial state (see parameter 5608 ➪ p. 239). The LogicsManager condition status 'TRUE' is activating the voltage or reactive power regulation according to the LogicsManager 'V/Q control' ID 12941 ➪ p. 245/➪ p. 929). **Notes** For information on the LogicsManager and its default settings see ➪ *Chapter 9.3.1 "LogicsManager Overview" on page 882*.

4.4.4.2 Power Factor Control

The easYgen cover a wide range of power factor control tasks:

- Controller type can be selected for an analog PID or a three-step controller (see chapter ⮩ *Chapter 4.4.4.2.2 “Configure Power Factor Control” on page 243*)
- PF(P) characteristic is available (see chapter ⮩ *Chapter 4.4.4.2.3 “Power Factor Characteristic” on page 246*)
- Beside PF(P) characteristic, Q(V) characteristic is available too (see chapter ⮩ *Chapter 4.4.4.2.3 “Power Factor Characteristic” on page 246*).
- Reactive power control at the interchange point offers another opportunity of power factor control (see chapter ⮩ *Chapter 4.4.4.2.1 “Control The Power Factor / Reactive Power At The Mains Interchange Point” on page 242*).

4.4.4.2.1 Control The Power Factor / Reactive Power At The Mains Interchange Point

General notes

Being parallel to the utility, it is desired in some application to control either the power factor or the amount of imported/exported inductive reactive power in kvar at the mains interchange point. Similar to an import/export active power setpoint, all easYgens can be programmed to the same setpoint and will share between each other the reactive power to reach this setpoint.

The easYgen can work as reactive power control at the interchange point. In this mode the gensets are monitored and restricted in reactive power flow (outcome and income; respectively leading and lagging).

Generator Reactive Power Limitations

A reactive power control (kvar or power factor) can cause an overload or damage of the generator. To avoid this the easYgen provides a 2-step protection:

1. The own absolute generator current is monitored with an percentage setting related to rated current input (ID 1754 ⮩ p. 431). The easYgen limits or controls down the excitation that this given level (ID 5791 ⮩ p. 244) is not exceeded.
2. The inductive reactive power **outcome** of the own generator is limited according to the configuration of ID 5792 ⮩ p. 244.

   Or:

   The inductive reactive power **income** of the own generator is limited according to the configuration of ID 5793 ⮩ p. 244.

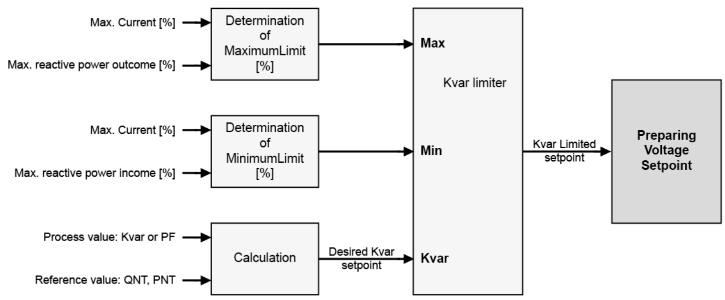


Fig. 156: The kvar setpoint is limited to protect the generator

Tracking of the limitation

An active Limitation is

- indicated as 'Gen excitation lim.' on the display (HMI)
- driving the LogicsManager command variable 05.18 Gen excitation lim. from FALSE to TRUE
- driving an event logger entry

4.4.4.2.2 Configure Power Factor Control

ID	Parameter	CL	Setting range [Default]	Description
5625	**Power factor Control**	2	**[PID analog]**	The power factor is controlled using an analog PID controller.
			3pos controller	The power factor is controlled using a three-step controller.
			Off	Power factor control is not carried out.
5613	**Proportional gain**	2	0.01 to 100.00 **[1.00]**	The proportional coefficient specifies the gain. By increasing the gain, the response is increased to permit larger corrections to the variable to be controlled. The farther out of tolerance the process is the larger the response action is to return the process to the tolerance band.
				Notes If the gain is configured too high, the result is excessive overshoot/undershoot of the desired value. This parameter is only visible if power factor control (parameter 5625 ⇘ p. 243) is configured to "PID analog".
5614	**Integral gain**	2	0.01 to 100.00 **[1.00]**	The integral gain identifies the I part of the PID controller. The integral gain corrects for any offset (between setpoint and process variable) automatically over time by shifting the proportioning band. Reset automatically changes the output requirements until the process variable and the setpoint are the same. This parameter permits the user to adjust how quickly the reset attempts to correct for any offset. The integral gain constant must be greater than the derivative time constant. If the integral gain constant is too large, the engine will continually oscillate. If the integral gain constant is too small, the engine will take too long to settle at a steady state.
				Notes This parameter is only visible if power factor control (parameter 5625 ⇘ p. 243) is configured to "PID analog".
5615	**Derivative ratio**	2	0.01 to 100.00 **[0.01]**	The derivative ratio identifies the D part of the PID controller. By increasing this parameter, the stability of the system is increased. The controller will attempt to slow down the action of the actuator in an attempt to prevent excessive overshoot or undershoot. Essentially this is the brake for the process. This portion of the PID loop operates anywhere within the range of the process unlike reset.
				Notes This parameter is only visible if power factor control (parameter 5625 ⇘ p. 243) is configured to "PID analog". The default configured controller acts like a PI controller what is the valid D part setting for systems with secondary controllers.
5660	**Deadband**	1	0.001 to 0.300 **[0.010]**	The generator power factor is controlled in such a manner, when paralleled with the mains, so that the monitored power factor does not deviate from the configured power factor setpoint by more than the value configured in this parameter without the controller issuing a raise/lower signal to the voltage regulator. This prevents unneeded wear on the raise/lower relay contacts.
				Notes This parameter is only visible if power factor control (parameter 5625 ⇘ p. 243) is configured to "3pos controller".

ID	Parameter	CL	Setting range [Default]	Description
5661	**Time pulse minimum**	1	0.01 to 2.00 s **[0.05 s]**	A minimum pulse on time must be configured here. The shortest possible pulse time should be configured to limit overshoot of the desired power factor reference point. **Notes** This parameter is only visible if power factor control (parameter 5625 ↳ p. 243) is configured to "3pos controller".
5662	**Gain factor**	1	0.1 to 10.0 **[5.0]**	The gain factor K_p influences the operating time of the relays. By increasing the number configured in this parameter, the operating time of the relay will be in-creased in response to a deviation from the power factor reference. By increasing the gain, the response is increased to permit larger corrections to the variable to be controlled. The farther out of tolerance the process is the larger the response action is to return the process to the tolerance band. If the gain is configured too high, the result is excessive overshoot/undershoot of the desired value. **Notes** This parameter is only visible if power factor control (param-eter 5625 ↳ p. 243) is configured to "3pos controller".
5667	**Cycle time factor**	1	1.0 to 20.0 **[1.0]**	The cycle time factor adjusts the time between the pulses (pause time). By increasing the cycle time factor, the time between the pulses increases. **Notes** This parameter is only visible if voltage control (parameter 5625 ↳ p. 243) is configured to "3pos controller".
5663	**Expand dead-band factor**	1	1.0 to 9.9 **[1.0]**	If the measured generator power factor is within the deadband range (param-eter 5660 ↳ p. 243) and the configured delay expand deadband time (param-eter 5664 ↳ p. 244) expires, the deadband will be multiplied with the factor configured here. **Notes** This parameter is only visible if power factor control (param-eter 5625 ↳ p. 243) is configured to "3pos controller".
5664	**Delay expand deadband**	1	1.0 to 9.9 s **[2.0 s]**	The measured generator power factor must be within the deadband range for the time configured here in order to multiply the deadband with the factor con-figured in parameter 5663 ↳ p. 244. **Notes** This parameter is only visible if power factor control (param-eter 5625 ↳ p. 243) is configured to "3pos controller".
5791	**Max. generator current**	2	0 to 150% **[100%]**	This is the maximum generator current during reactive power control. The percentage is related to the rated current setting (ID 1785 ↳ p. 434).
5792	**Max. react.inductive pwr.gen**	2	0 to 150% **[80%]**	This is the maximum accepted generator reactive inductive load (outcome) during reactive power control at the interchange point. The percentage is related to the reactive power setting (ID 1746 ↳ p. 434).
5793	**Max. react.capacity pwr.gen**	2	0 to 150% **[50%]**	This is the maximum accepted generator reactive capacitive load (income) during reactive power control at the interchange point. The percentage is related to the reactive power setting (ID 1746 ↳ p. 434).
5638	**AM PF/var SP1[-/var]**	2	Determined by AnalogManager 81.11 **[A1 = 05.10 Intern. PF setp1 [%]]**	The power factor / reactive power setpoint 1 source can be selected from the available data sources. The internal PF/var setpoint 05.10 can be changed manually at the setpoint screen of the display.

ID	Parameter	CL	Setting range [Default]	Description
5639	**AM PF/var SP2[-/var]**	2	Determined by AnalogManager 81.05 **[A1 = 05.11 Intern. PF setp2 [%]]**	The power factor / reactive power setpoint 2 source can be selected from the available data sources. The internal PF/var setpoint 05.11 can be changed manually at the setpoint screen of the display.
5743	**PF/kvar set-point 1 mode**		Mns. Export kvar Mns. Import kvar Mains PF **[Gen. PF]**	Selection of the mode for PF/kvar setpoint 1.
5620	**Int. power factor setpoint 1**	2	-0.999 to +1.000 **[+1.000]**	The desired power factor may be configured here so that the reactive power is regulated in the system. The designations "+" and "-" stand for inductive/lagging (generator overexcited) and capacitive/leading (generator underexcited) reactive power. This setpoint is active only in mains parallel operation.
5744	**PF/kvar set-point 2 mode**		Mns. Export kvar Mns. Import kvar Mains PF **[Gen. PF]**	Selection of the mode for PF/kvar setpoint 2.
5745	**Int. kvar set-point 1**		0.0 to +99999.9 **[0.0]**	This setpoint is active only if PF/kvar setpoint 1 is set to Mns. Export kvar or Mns. Import kvar.
5621	**Int. power factor setpoint 2**	2	-0.999 to +1.000 **[+1.000]**	The desired power factor may be configured here so that the reactive power is regulated in the system. The designations "–" and "+" stand for inductive/lagging (generator overexcited) and capacitive/leading (generator underexcited) reactive power. This setpoint is active only in mains parallel operation.
5746	**Int. kvar set-point 2**		0.0 to +99999.9 **[0.0]**	This setpoint is active only if PF/kvar setpoint 2 is set to Mns. Export kvar or Mns. Import kvar.
12921	**Setp. 2 pwr.factor**	2	Determined by LogicsManager 86.84 **[(0 & 1) & 1]** = 11913	If this LogicsManager condition is TRUE, the power factor setpoint 2 will be used instead of power factor setpoint 1. The power factor (result of AM) 5639 ➪ p. 245/➪ p. 958 instead of 5638 ➪ p. 244/➪ p. 957 will be taken into account. **Notes** For information on the LogicsManager and its default settings see ➪ *Chapter 9.3.1 "LogicsManager Overview" on page 882.*
5622	**React. pwr. ctrl setpoint ramp**	2	0.01 to 100.00 %/s **[3.00 %/s]**	The different setpoint values are supplied to the controller via this ramp. The slope of the ramp is used to alter the rate at which the controller modifies the setpoint value. The faster the change in the setpoint is to be carried out, the greater the value entered here must be. **Notes** This ramp is also used in islanded operation for loading or unloading an additional genset. An excessive oscillation may occur if the ramp is configured too high.
12941	**Q control**	2	Determined by LogicsManager 86.99 **[(04.07 MCB closed & 04.06 GCB closed) & 1]** = 11928	With LogicsManager can be controlled if a voltage control or a reactive power control should be performed. If this LogicsManager condition is TRUE, the reactive power control is performed.

4.4.4.2.3 Power Factor Characteristic

General notes

The Power Factor Characteristic function is adapting the reactive power flow between generator and mains to support a dynamic stabilization of the mains. Some network provider prefer therefore a power factor control over real power PF(P) (see chapter *Chapter 4.4.4.2.3.1 "Power factor characteristic PF(P) " on page 246* for more details).

Other provider prefer power factor control over mains voltage Q(V) as described in chapter *Chapter 4.4.4.2.3.2 "Power factor characteristic Q(V) " on page 247*. Both methods are configurable alternatively.

> ***Enhanced according BDEW Requirements***
>
> *Both power factor characteristic curves now offer four point settings.*
>
> *Factory settings come with backward compatibility.*

Power factor characteristic PF(P)

A method to support the mains is to feed different reactive power values into the grid in relation to the own active power value. The reactive power is defined through a power factor setpoint for the generator. This can be defined in characteristic curve.

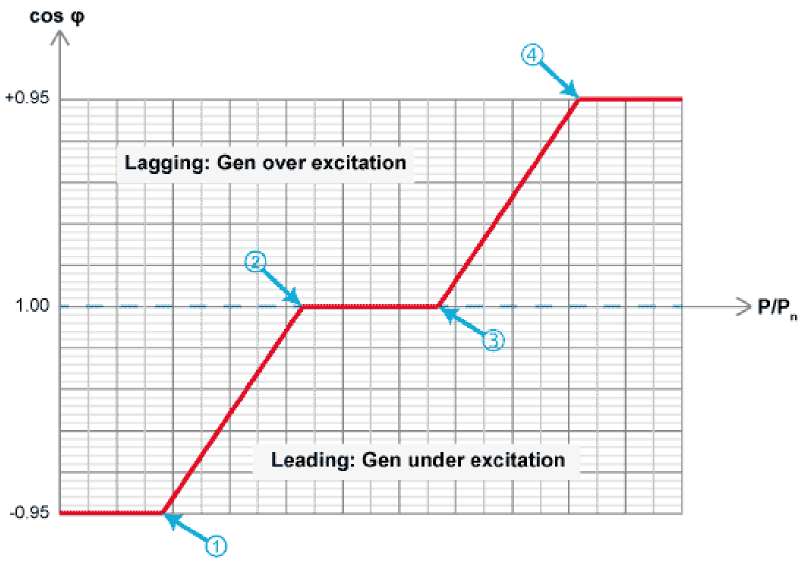


Fig. 157: Power factor characteristic (schematic)

The characteristic is defined by four points (① .. ④). The power factor corresponding to this characteristic is available as data source 05.29 in the AnalogManager.

> *To use this function, the source (05.29) must be applied as source to one of the setpoints e.g., "Power factor setpoint 1" (parameter 5638 p. 244/ p. 957).*

ID	Parameter	CL	Setting range [Default]	Description
5786	**Power factor characteristic**	2	**[PF(P)]**	A power factor setpoint is determined according to the characteristic curve: Power factor in relation to the actual Generator power.
			Q(V)	A power factor setpoint is calculated according to the characteristic curve: Generator reactive power in relation to the mains voltage.
5787	**Point 1 power**	2	0.0 to 150% **[0%]**	The value entered into "Point 1 power" defines the cos phi (P) characteristic.
5788	**Point 1 cos phi**	2	-0.999 to 1.000 **[-0.950]**	The desired "Point 1 cos phi" may be configured here which defines the cos phi (P) characteristic. The designations "+" and "-" stand for inductive/lagging (generator overexcited) and capacitive/leading (generator underexcited) reactive power.
5789	**Point 2 power**	2	0.0 to 150% **[100%]**	The value entered into "Point 2 power" defines the cos phi (P) characteristic.
5790	**Point 2 cos phi**	2	-0.999 to 1.000 **[0.950]**	The desired "Point 2 cos phi" may be configured here which defines the cos phi (P) characteristic. The designations "+" and "-" stand for inductive/lagging (generator overexcited) and capacitive/leading (generator underexcited) reactive power.
5028	**Point 3 power**	2	0.0 to 150% **[100%]**	The value entered into "Point 3 power" defines the cos phi (P) characteristic.
5029	**Point 3 cos phi**	2	-0.999 to 1.000 **[0.950]**	The desired "Point 3 cos phi" may be configured here which defines the cos phi (P) characteristic. The designations "+" and "-" stand for inductive/lagging (generator overexcited) and capacitive/leading (generator underexcited) reactive power.
5030	**Point 4 power**	2	0.0 to 150% **[100%]**	The value entered into "Point 4 power" defines the cos phi (P) characteristic.
5031	**Point 4 cos phi**	2	-0.999 to 1.000 **[0.950]**	The desired "Point 4 cos phi" may be configured here which defines the cos phi (P) characteristic. The designations "+" and "-" stand for inductive/lagging (generator overexcited) and capacitive/leading (generator underexcited) reactive power.

Power factor characteristic Q(V)

Another method to support the mains is to feed different reactive power values into the grid in relation to the mains voltage [parameter 5786 ➡ p. 247 = Q(V)]. The reactive power is defined through the value Q/S rated over voltage. This can be defined in a characteristic curve. The resulting outcome for the reactive power control is then a power factor setpoint.

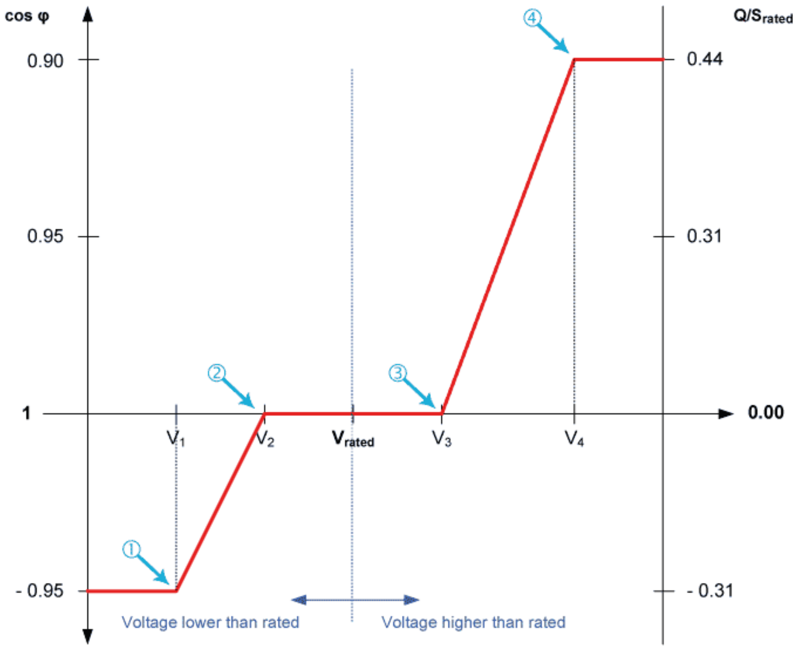


Fig. 158: Power factor characteristic according to the relation Q/S rated over rated voltage

The characteristic is defined by four points (① .. ④). The power factor corresponding to this characteristic is available as data source 05.29 in the AnalogManager.

To use this function, the source (05.29) must be applied as source to one of the setpoints e.g., "Power factor setpoint 1" (parameter 5638 ➪ p. 244/➪ p. 957).

ID	Parameter	CL	Setting range [Default]	Description
5778	**Point 1 voltage**		45.0 to 150.0% **[98.0%]**	The value entered into "Point 1 Voltage" defines the x-coordinate of point 1
5779	**Point 1 Q/S rated**		-0.99 to +0.99 **[-0.31]**	The value entered into "Point 1 Reactive power" defines the y-coordinate of point 1
5797	**Point 2 voltage**		45.0 to 150.0% **[106.0%]**	The value entered into "Point 2 Voltage" defines the x-coordinate of point 2
5798	**Point 2 Q/S rated**		-0.99 to +0.99 **[+0.31]**	The value entered into "Point 2 Reactive power" defines the y-coordinate of point 2
5032	**Point 3 voltage**		0.0 to 150.0% **[106.0%]**	The value entered into "Point 3 Voltage" defines the x-coordinate of point 3
5033	**Point 3 Q/S rated**		-0.99 to +0.99 **[+0.31]**	The value entered into "Point 3 Reactive power" defines the y-coordinate of point 3
5034	**Point 4 voltage**		0.0 to 150.0% **[106.0%]**	The value entered into "Point 4 Voltage" defines the x-coordinate of point 4
5035	**Point 4 Q/S rated**		-0.99 to +0.99 **[+0.31]**	The value entered into "Point 4 Reactive power" defines the y-coordinate of point 4

ID	Parameter	CL	Setting range [Default]	Description
5799	**Q(V) response time**		001 to 999 s **[10 s]**	The response with a new reactive power setpoint acting on the analog command variable 05.29 PF characteristic can be delayed. Q(V) response time is used to calculate the power factor characteristic Q(V), parameter 5786 ⇘ p. 247. **Notes** The delay is realized with a PT-1 filter. Therefore the reaction times are optimized for the range 10 s until 60 s within a symmetrical characteristic curve. Accuracy of the setup Q(V) response time is given within a symmetrical characteristic curve.
5023	**Q(V) Hysteresis**		0 to 20% **[0%]**	The hysteresis for the Q(V) characteristic acts as a deadband for the selected band. If the Mains voltage is within the hysteresis the resulting power factor characteristic reference doesn't change.

4.4.4.3 Load Share Control

CAUTION!

Load Share Communication

For correct load share communication all load sharing gensets in the system must actively use the same load share communication interface (and network)!

Load share communication is defined by parameter *[Load share interface]* 9924 ⇘ p. 254/ ⇘ p. 658 (CAN or Ethernet) and others.

Please see settings at

– *"Parameter ➔ Configuration ➔ Configure application ➔ Configure controller ➔ Configure load share"*
– Chapter ⇘ *Chapter 4.4.4.3.7 "Parameters" on page 254*

The easYgen performs proportional load and/or var sharing. This means each generator will share the load at the same percentage level of the generator rated power when paralleled against the mains, in an islanded operation with multiple generators paralleled, or when re-synchronizing the common bus to the mains.

Also in islanded operation the load ramp rate parameters 5522 ⇘ p. 268 and 5622 ⇘ p. 245 are used to ramp a new generator onto the other.

If not enough nominal power on the busbar is available, from now on the ramping of an engine onto others will be interrupted but the load sharing will be executed immediately. This is to avoid overloading of already online generators.

Proportional load/var sharing will not be performed when the easYgen has the GCB closed and is in the constant power/base load mode.

A system can consist out of 32 gensets which are controlled by a single easYgen.

4.4.4.3.1 Mains Parallel Operation With Mains Interchange Real Power Control (Import/Export)

The easYgen controllers maintain the real load level on the individually controlled generators at a level so that the real power setpoint at the mains interchange remains at the configured setpoint. The real power setpoint for the mains interchange must be configured identically for each easYgen.

The easYgen controller communicates with other controls in the system via a CAN bus. This enables the controllers to adjust the real power generated by the generator while remaining within the rated power of the generator. A smaller generator will contribute less real power as compared to a large generator, but they will both be utilized to the same capacity factor. An example of this would be a 100 kW generator with a configured 1000 kW generator and a mains interchange of 825 kW. The 100 kW generator would contribute 75 kW and the 1000 kW generator would contribute 750 kW or both generators would be at 75% of their rated capacity.

How the reactive power handling is executed depends the PF/kvar setpoint mode. Two setpoints (5743 ↻ p. 245 and 5744 ↻ p. 245) are available. Each setpoint allows the modes:

- Gen PF
- Mains PF
- Mains Import kvar
- Mains export kvar

In PF modes the reactive load sharing is not performed when operating in parallel with the mains. Reactive power control will be defined by the configured power factor setpoints (5620 ↻ p. 245 or 5621 ↻ p. 245) of the individual controllers. If the power factor controller setpoint is configured as +0.950, the easYgen will proportionally share the real load with all generators in parallel with the mains while controlling the reactive power at a 0.95 inductive (lagging) power factor regardless of the what power factor the mains is operating at.

The parameter "Active power Load share gain" (parameter 4522 ↻ p. 254) can be used to define the priority of the reference variable for real power sharing (real power at interchange). A higher configured value influences the control more towards maintaining the real power setpoint for the interchange. A lower configured value influences the control more towards maintaining real power sharing between units.

The parameter "React. power Load share gain" (parameter 4543 ↻ p. 254) has no influence here.

In kvar modes the reactive load sharing is performed when operating in parallel with the mains. Mains import/export kvar control at the interchange point will be determined by the configured int. kvar setpoints (5745 ↻ p. 245 or 5746 ↻ p. 245) of the individual controllers.

4.4.4.3.2 Islanded Operation In Parallel

The easYgen controllers maintain the voltage and frequency of the individually controlled generators at a constant level. This makes it imperative that the voltage and frequency setpoints are configured identically for each easYgen.

The easYgen controller communicates with other controls in the system via a CAN bus. This enables the controllers to adjust the real power generated by the generator while remaining within the rated power of the generator. A smaller generator will contribute less real power as compared to a large generator, but they will both be utilized to the same capacity factor.

Example

An example of this would be a 100 kW generator and a 1000 kW generator with an 825 kW load. The 100 kW generator would contribute 75 kW and the 1000 kW generator would contribute 750 kW or both generators would be at 75% of their rated capacity.

The reactive power will be shared proportionally among all generators involved.

The parameter "Active power Load share gain" (parameter 4522 ⇘ p. 254) can be used to define the priority of the reference variable for real power sharing. A higher configured value influences the control more towards frequency control. A lower configured value influences the control more towards real power sharing.

The parameter "Active power Load share gain" (parameter 4522 ⇘ p. 254) can be used to define the priority of the reference variable for real power sharing. A higher configured value influences the control more towards frequency control. A lower configured value influences the control more towards real power sharing.

4.4.4.3.3 Re-synchronization Of The Busbar To The Mains

The system is operating as an islanded system, for synchronization to be performed the voltage and frequency differentials of the mains and bus must be within the configured windows.

The bus frequency reference point is dictated by the measured mains frequency and the configured frequency differential (+ slip frequency setpoint offset (parameter 5502 ⇘ p. 264).

Example

If + slip frequency setpoint offset = 0.2 Hz, the easYgen will calculate the bus frequency reference point as:

- [measured mains frequency] + [slip frequency setpoint offset] = bus frequency reference point

A practical example of this would be:

- The monitored mains frequency is 60 Hz
- Configured + slip frequency setpoint offset = 0.2 Hz
- [60 Hz] + [0.2 Hz] = 60.2 Hz bus frequency reference point

The differential voltage is configured as a window. The monitored voltage from the potential transformers secondary for the mains and the bus must be within the configured voltage differential limit in relation to the rated voltage configuration.

This means that the voltage window dV [%] is in relation to the rated voltage configuration [%].

When the monitored bus frequency and voltage are within the configured differential limits, the "Command: close MCB" relay will enable, closing the MCB, and the system will be paralleled to the mains.

4.4.4.3.4 Prerequisites

All easYgen controllers connected to the system must have rated system frequencies and breaker logic configured identically and the parameter "Active power load share" (parameter 5531 ➪ p. 254) or "Reactive power load share" (parameter 5631 ➪ p. 254) must be enabled.

4.4.4.3.5 Load-Share Interface

The easYgen utilizes a peer relationship between units to control the system. This permits for parallel applications of up to 32 generators.

The current load-share interface is selected by parameters 9924 ➪ p. 254/➪ p. 658 and 11986 ➪ p. 659 LM 86.13.

> *For set-up of the load-share communication refer to ➪ Chapter 3.4.4 "CAN Bus Interfaces" on page 85 for information about the CAN bus connection or to ➪ Chapter 4.7.5 "Ethernet Interfaces" on page 472 for Ethernet*

4.4.4.3.6 Load Sharing

The "Active/Reactive power load share" together with the "Active/Reactive power load share gains" determine if and how a generator performs real power or frequency control when paralleled with other generators in an islanded operation.

In the illustrated control system, it must be noted that each control calculates the mean utilization factor of all controls from the data transmitted via the selected bus and then compares this with its own utilization factor. The utilization factor is compared with the reference variable and results in a new reference variable setpoint. Frequency and real power control are carried out simultaneously in these controls (corresponding to the reference variable).

Frequency control is carried out via the measured voltage/frequency of the voltage system. The MPU is used merely for monitoring functions, or is available as a control value to the secondary controller.

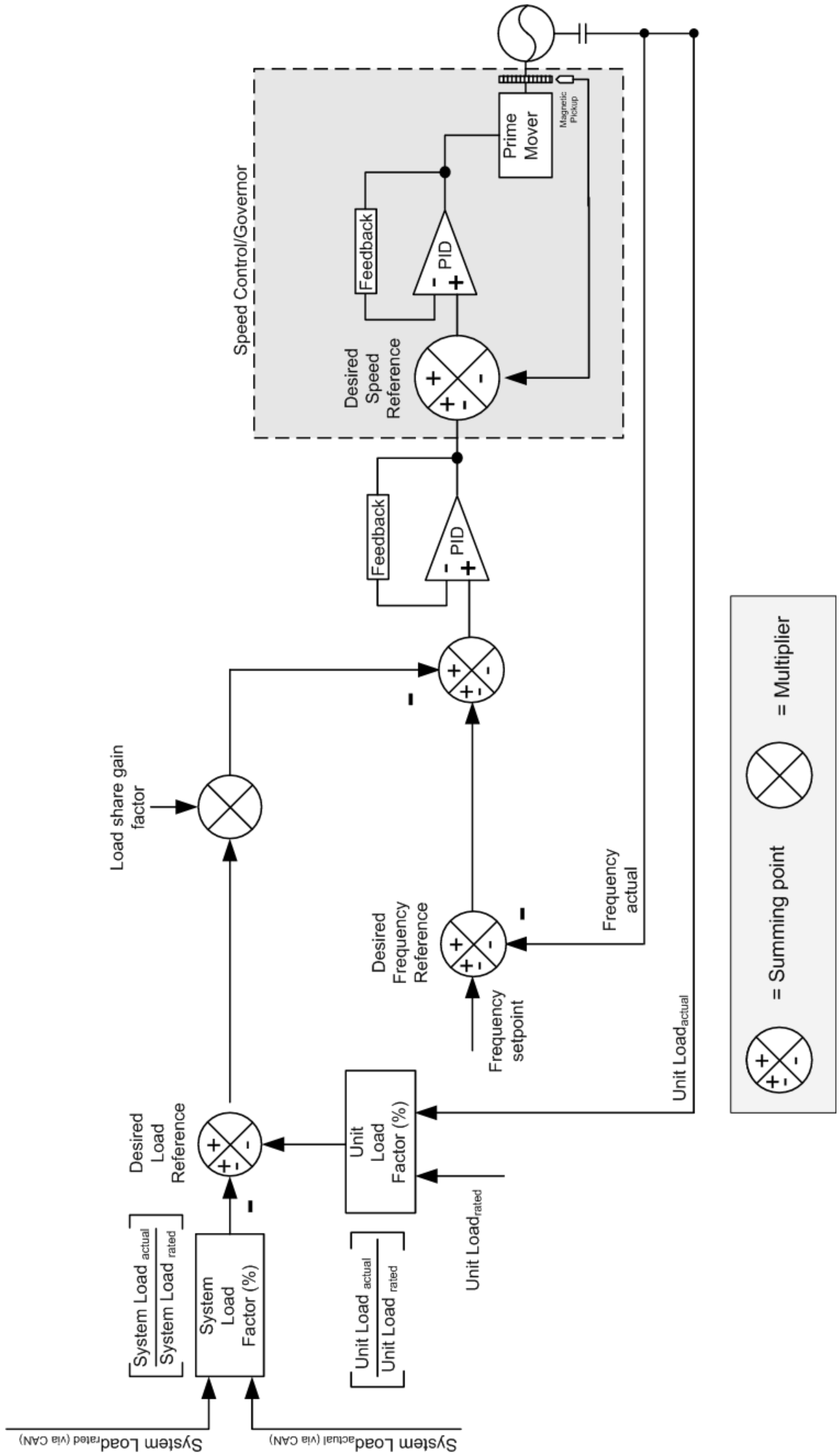


Fig. 159: Load sharing diagram

4.4.4.3.7 Parameters

ID	Parameter	CL	Setting range [Default]	Description
9924	**Load share Interface**	2		The interface, which is used for transmitting the load share data is configured here.
			[CAN]	Use CAN interface 3.
			Ethernet A	Use Ethernet A interface.
			Ethernet B/C	Use Ethernet B or C interface.
			CAN/EthA by LM	Use CAN interface 3 but switch to Ethernet A by TRUE of LM 86.13 (described below).
			Off	Deactivate load share interface.
5531	**Active power load share**	2	**[On]**	Active power load share is enabled. When multiple generators are operating in parallel, the real power is shared proportionally.
			Off	Active power load share is disabled
4522	**Active power load share gain**	2	0.01 to 9.99 **[1.25]**	This parameter defines the impact of the active power load sharing error signal on the frequency/load controller setpoint. The active power load share gain can be adjusted between 0.01 to 9.99. The load controller setpoint is considered, if an export import power control to mains is maintained. With a higher value the active load sharing has a higher correction factor in the regulation.
				Notes This parameter replaces the former existing weighting factor on non-XT easYgen (ID 5530). The default gain 1.25 relates to the 50% value.
5631	**Reactive power load share**	2	**[On]**	Reactive power load share is enabled. When multiple generators are operating in parallel, the reactive power is shared proportionally.
			Off	Reactive power load share is disabled
4543	**React. power load share gain**	2	0.01 to 9.99 **[1.25]**	This parameter defines the impact of the reactive power load sharing error signal on the voltage/reactive load controller setpoint. The reactive power load share gain can be adjusted between 0.01 to 9.99. The reactive load controller setpoint is considered, if an export/import reactive power control to mains is maintained. With a higher value the reactive load sharing has a higher correction factor in the regulation.
				Notes This parameter replaces the former existing weighting factor of non-XT easYgen (ID 5630). The default gain 1.25 relates to the 50% value.

Relation "... factor" <> "... gain"

This ... gain parameter replaces the former existing (%) ... factor of non-XT easYgen. The table below shows the relation between the old and new values.

The used defaults 1.25 / 50% ensure backward compatibility.

Weighting %	LS Gain
10	2,25
20	2
30	1,75
40	1,5

Weighting %	LS Gain
50	**1,25**
60	1
70	0,75
80	0,5
90	0,25
98	0,05

4.4.4.3.8 Load Sharing And Segments

Load Share Control Grouping

Load sharing with several gensets is possible for a supply of several split busbars. Each of this individual groups is called a segment.

Up to four segments can be managed easily for load share by LogicsManager!

In the application breaker mode GCB/LS-5 the LogicsManager equations described below are used to handle even more complex easYgen/LS-5 applications. Please read general information first and then continue with *✎ Chapter 4.4.4.3.8.1.1 "Segment Number in GCB/LS-5 mode" on page 257.*

General

a group breaker splits the busbar in a way that some gensets supply one busbar and some supply another one. However, it is necessary to group the gensets, which supply the same busbar.

The designer of a busbar system gives all individual bus bars an own number: The Segment Number for the easYgen is defined with ID 1723. Each easYgen is connected with its GCB on one of these segments.

The configured segment number can be changed to one of three alternative segment numbers by three LogicsManager equations. These LogicsManager equations stand for the segment numbers 2, 3, or 4. They are usually controlled by circuit breaker reply auxiliary contacts. This is finally the segment number the easYgens interacts with.

Example

Six gensets (G1 through G6) supply a system with two group breakers (A, B) as shown in . All gensets have the same segment number configured #1 (parameter 1723 ↳ p. 256)

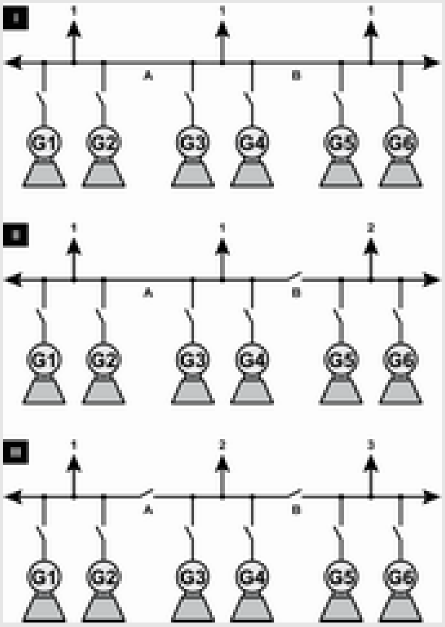


Fig. 160: Load sharing - grouping

Case I - Group breakers A and B are closed and G1 through G6 supply the same busbar. The same segment number is configured to each genset since all gensets supply the same busbar.

Case II - Group breaker A is closed and group breaker B is open (G1 through G4 supply a different busbar than G5 and G6). A different segment number must be selected for G5 and G6 by enabling the LogicsManager function "Segment no.2 act" (parameter 12929 ↳ p. 256/↳ p. 929) in order to change the segment number of G5 and G6 to #2.

Case III - Group breakers A and B are open (G1 and G2, G3 and G4, as well as G5 and G6 supply different busbars).

A different segment number must be selected for G3 and G4 (LogicsManager function "Segment no.2 act" (parameter 12929 ↳ p. 256/↳ p. 929)) as well as to G5 and G6 (LogicsManager function "Segment no.3 act" (parameter 12928 ↳ p. 256/↳ p. 929)).

With this, the segment number of G3 and G4 is changed to #2 and the segment number of G5 and G6 is changed to #3.

ID	Parameter	CL	Setting range [Default]	Description
1723	**Segment number**	2	1 to 32 **[1]**	The genset is assigned a load share segment number with this parameter. This segment number may be overridden by the following parameters 12929 ↳ p. 256/↳ p. 929, 12928 ↳ p. 256/↳ p. 929, and 12927 ↳ p. 256/↳ p. 929.
12929	**Segment no.2 act**	2	Determined by LogicsManager 86.87	Once the conditions of the LogicsManager have been fulfilled, this genset is assigned load share segment number 2 (this parameter has priority over parameters 12928 ↳ p. 256/↳ p. 929 and 12927 ↳ p. 256/↳ p. 929).
			[(0 & 1) & 1]	**Notes** For information on the LogicsManager and its default settings see ↳ *Chapter 9.3.1 "LogicsManager Overview" on page 882.*
12928	**Segment no.3 act**	2	Determined by LogicsManager 86.88	Once the conditions of the LogicsManager have been fulfilled, this genset is assigned load share segment number 3 (this parameter has priority over parameters 12927 ↳ p. 256/↳ p. 929).
			[(0 & 1) & 1]	**Notes** For information on the LogicsManager and its default settings see ↳ *Chapter 9.3.1 "LogicsManager Overview" on page 882.*
12927	**Segment no. 4 act**	2	Determined by LogicsManager 86.89	Once the conditions of the LogicsManager have been fulfilled, this genset is assigned load share segment number 4.
			[(0 & 1) & 1]	**Notes** For information on the LogicsManager and its default settings see ↳ *Chapter 9.3.1 "LogicsManager Overview" on page 882.*
5568	**Mode ext. load share gateway**	2		The operation mode for the external Woodward Load Share Gateway (LSG) is configured here.
			[0]	Off

ID	Parameter	CL	Setting range [Default]	Description
			1	*Woodward EGCP-2* RS-485 (P & Q)
			2	*Woodward SPM-D* **R** = 4.99k | **P**: 0 – 4 V (0 to 100%) | **Q**: 0 – 5 V (-85% to +85%)
				Woodward MFR 15 **R** = 4.99k | **P**: 0 – 4 V (0 to 100%)
			3	*Woodward 2301 A* **R** = 54.90k | **P**: 0 – 3 V (0 to 100%)
			4	*Caterpillar LSM* **R** = 25.00k | **P**: 0 – 3 V (0 to 100%)
			5	*Cummins PCC 3100, 3200, 3201, 3300* **R** = 5.00k | **P**: 0 – 2.5 V (-14.1 to 121.9%) | **Q**: 0 – 2.5 V (-16.7% to +125.3%)
			6	*POW-R-CON* **R** = 20.67k | **P**: 0 – 5 V (0 to 100%)
			7	Prepared **R** = 25.00k | **P**: -5 – +5 V (0 to 100%)
			8	Prepared **R** = 25.00k | **P**: 0 – 7 V (0 to 100%)
			9	*Woodward GCP/MFR* CAN (**P** & **Q**)1 – easYgens and GCP/MFR share the same CAN bus
			10 to 16	Not defined
				Notes Refer to the Load Share Gateway (LSG) Manual 37442 for security guidelines and detailed information about the configuration. **R**: Internal resistance **P**: Range for active power **Q**: range for reactive power

Segment Number in GCB/LS-5 mode

In the application breaker mode GCB/LS-5 the Segment Number (ID 1723) informs the LS-5 algorithm about the dedicated segment of the particular easYgens. Finally the LS-5 algorithm determines for each easYgen on which segment number it has to interact with others.

In cases, where different GCBs shall be served, the operator can switch over the Segment LogicsManager equations between up to four dedicated segments, three of them predefined: The Segment Number (ID 1723) or the segment number 2, 3, or 4.

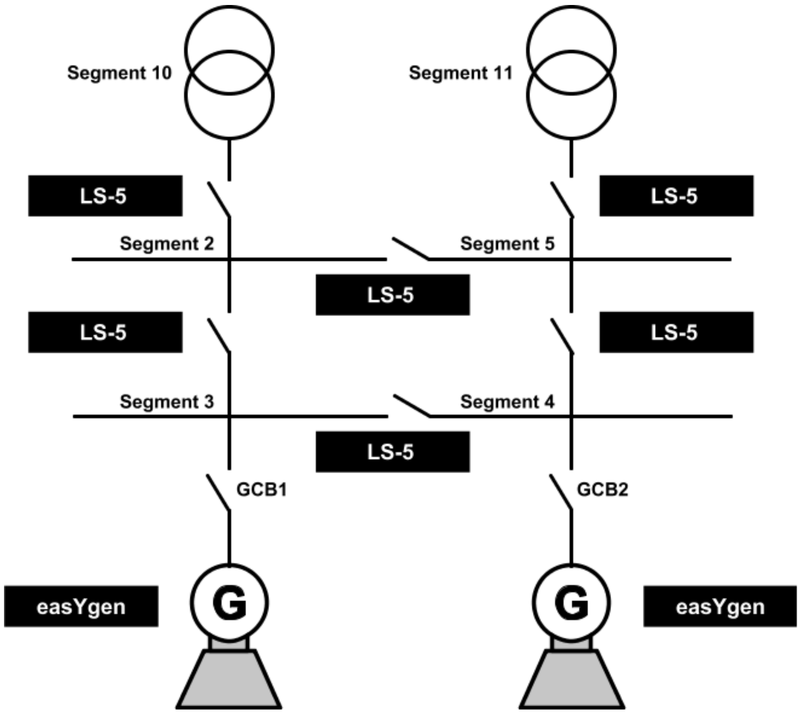


Fig. 161: Example: GCB/LS-5 application mode.

In cases, where different GCBs shall be served, the operator has to switch the correct segment number before he is closing the according GCB. Only one GCB per easYgen is allowed to be closed.

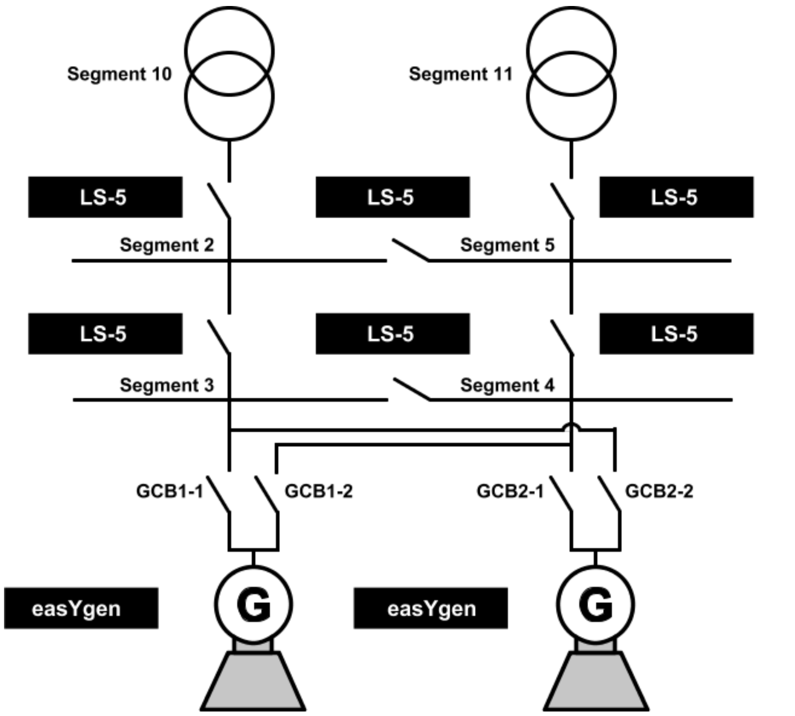


Fig. 162: Example: GCB/LS-5 application mode with 2 GCBs per easYgen.

4.4.4.3.9 Droop

The isochronous running frequency or voltage controllers keep the desired frequency or voltage set point independent on the real or reactive power of the generator.

The **frequency controller** with activated droop behavior (LogicsManager ID12904 ✎ p. 265/✎ p. 929) reduces the desired frequency setpoint dependent on the active power of the generator (ID1752 ✎ p. 431). In case of a full loaded engine the frequency setpoint will be reduced with the percentage value (ID5504 ✎ p. 265) related to rated frequency.

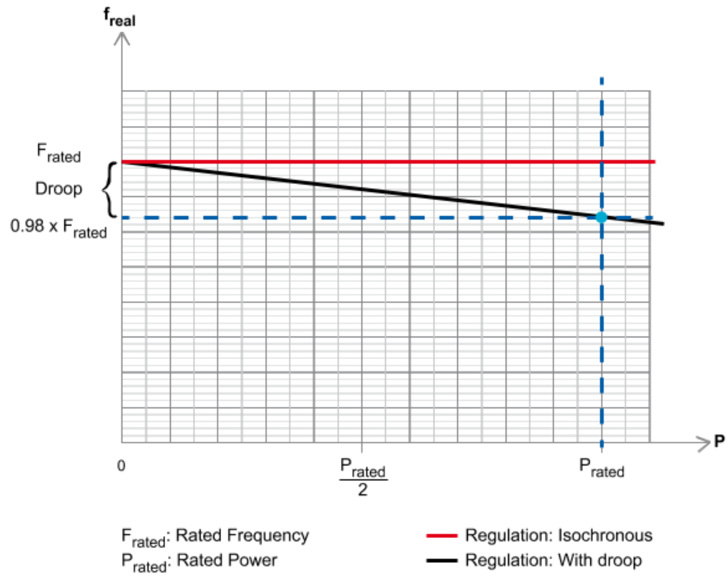


Fig. 163: Frequency controller - behavior with and without droop, diagram

The resulting frequency setpoint is calculated as follows: F'Set = FSet - (Preal * (Frated * droop factor) / Prated)

The **voltage controller** with activated droop behavior (LogicsManager ID12905 ✎ p. 241/✎ p. 929) reduces the desired voltage setpoint dependent on the reactive power of the generator (ID1758 ✎ p. 431). In case of a full reactive loaded generator the voltage will be reduced with the percentage value (ID5604 ✎ p. 241) of the rated frequency.

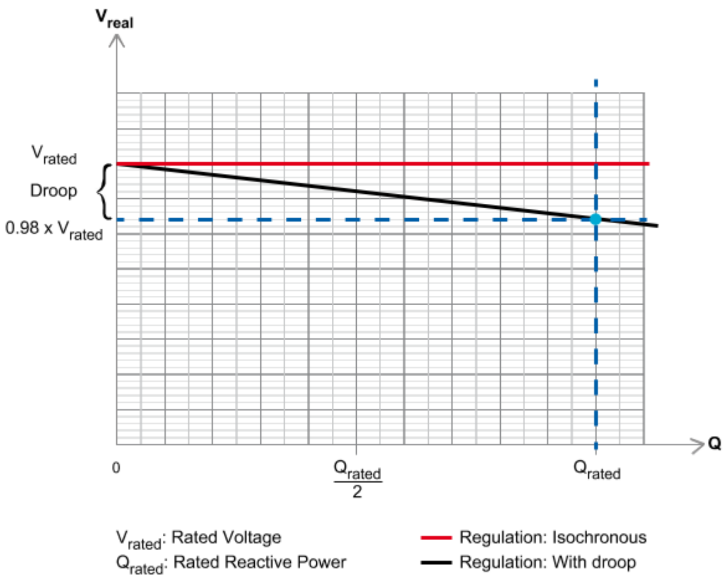


Fig. 164: Voltage controller - behavior with and without droop, diagram

The resulting voltage setpoint is calculated as follows: V'Set = VSet - (Qreal * (Vrated * droop factor) / Qrated)

Function Droop Tracking

The droop tracking for frequency/voltage control is implemented such that when the control is switched to frequency/voltage control with droop the frequency/voltage real value does not change at the current active/reactive load. This is provided by pre-calculating a setpoint offset, which is needed to hold rated frequency/voltage at present load.

This is a feature in applications where for example the load sharing over communication interface gets lost and the number of generators remains the same.

Droop Tracking On/Off

The easYgen allows disabling the droop tracking for frequency and voltage generally. This makes sense in applications where the number of generators can vary during running in droop mode.

Load sharing in Droop mode On/Off

Multiple easYgens are load sharing under each other, if they run islanded from mains or they control export/import power at a common interchange point. For dynamic reasons it makes sense to disable the load sharing, when the easYgens running in droop or can fall into droop mode (Missing member case).

ID	Parameter	CL	Setting Range [Default]	Description
5747	Droop tracking	2	[On]	The frequency and voltage setpoint offset is pre-calculated to hold the frequency and voltage, when control is switched into droop.
			Off	The setpoint offset is always zero.

ID	Parameter	CL	Setting Range [Default]	Description
5748	Load sharing in droop mode	2	[On]	As long the load sharing function is enabled, it is done in droop mode too.
			Off	The load sharing is generally disabled in droop mode.

Table 76: Droop related parameters

4.4.4.4 Frequency Control

Notes on kick impulse function

Frequency control provides a kick impulse function, which issues a pulse if the frequency control deadband (parameter 5550 p. 263) is not exceeded and no synchronization could be performed for 20 seconds. The function is enabled, if a synchronization is carried out.

- If the phase angle is between 0° and 180°, a "frequency lower" signal is issued.
- If the phase angle is between 180° and 360°, a "frequency raise" signal is issued.

The pulse duration is 100ms. If the synchronization still fails, another pulse will be issued after 10 seconds.

The following conditions are required for the kick impulse function:

- Frequency control (parameter 5507 p. 262) is configured to "3pos controller"
- Synchronization mode (parameter 5728 p. 233) is configured to "RUN" or "CHECK" (or "Controlled by LM" and RUN or CHECK enabled by the LogicsManager)

ToolKit: find settings screen

Analog Managers to define input signal of frequency setpoint (1, 2) are available in ToolKit by

- *a click from screen/page "Configure frequency control"*
  - *on the button "Analog manager" in the left sidebar (below permanent buttons) or*
  - *on two times "next page", or*
- *search (for parameter)*

ToolKit: Trend chart

ToolKit offers a trend visualization accessible by

- *a click from screen/page "Configure frequency control"*
  - *on the button "Trend chart" in the left sidebar (below permanent buttons) or*
  - *on "next page", or*
- *search (for parameter)*

ID	Parameter	CL	Setting range [Default]	Description
5507	**Frequency control**	2	**[PID analog]**	The frequency is controlled using an analog PID controller.
			3pos controller	The frequency is controlled using a three-step controller.
			Off	Frequency control is not carried out.
5508	**Freq. control initial state** (Frequency control initial state)	2	0.0 to 100.0% **[50.0%]**	The value entered for this parameter is the start reference point for the analog output to the speed controller.
				Notes If the output to the speed control has been disabled, the output will act as a control position reference point.
5510	**Proportional gain**	2	0.01 to 100.00 **[1.00]**	The proportional coefficient specifies the gain. By increasing the gain, the response is increased to permit larger corrections to the variable to be controlled. The farther outside tolerances the process is, the larger the response action is to return the process to the tolerance band.
				Notes If the gain is configured too high, the result is excessive overshoot/undershoot of the desired value. This parameter is only visible if frequency control (parameter 5507 ➪ p. 262) is configured to "PID analog".
5511	**Integral gain**	2	0.01 to 100.00 **[1.00]**	The integral gain identifies the I part of the PID controller. The integral gain corrects for any offset (between setpoint and process variable) automatically over time by shifting the proportioning band. Reset automatically changes the output requirements until the process variable and the setpoint are the same. This parameter permits the user to adjust how quickly the reset attempts to correct for any offset.
				Notes The integral gain constant must be greater than the derivative time constant. If the integral gain constant is too large, the engine will continually oscillate. If the integral gain constant is too small, the engine will take too long to settle at a steady state. This parameter is only visible if frequency control (parameter 5507 ➪ p. 262) is configured to "PID analog".
5512	**Derivative ratio**	2	0.01 to 100.00 **[0.01]**	The derivative ratio identifies the D part of the PID controller. By increasing this parameter, the stability of the system is increased. The controller will attempt to slow down the action of the actuator in an attempt to prevent excessive overshoot or undershoot. Essentially this is the brake for the process. This portion of the PID loop operates anywhere within the range of the process unlike reset.
				Notes This parameter is only visible if frequency control (parameter 5507 ➪ p. 262) is configured to "PID analog". The default configured controller acts like a PI controller what is the valid D part setting for systems with secondary controllers.

ID	Parameter	CL	Setting range [Default]	Description
5550	**Deadband**	1	0.02 to 9.99 Hz **[0.08 Hz]**	**islanded operation** The generator frequency is controlled in such a manner that the measured frequency does not deviate from the configured setpoint by more than the value configured in this parameter without the controller issuing a frequency raise/lower signal to the frequency control. This prevents unneeded wear on the frequency bias output control or the raise/lower relay contacts. **Example** ■ If the frequency setpoint is 50 Hz and a deadband of 0.5 Hz is configured, the measured generator frequency must exceed 50.5 Hz (50 + 0.5) to issue a lower pulse or fall below 49.5 Hz (50 - 0.5) to issue a raise pulse.
				Synchronization The generator frequency is controlled in such a manner that the measured frequency does not deviate from the monitored reference (mains or busbar) frequency by more than the value configured in this parameter without the controller issuing a frequency raise/lower signal to the frequency control. This prevents unneeded wear on the frequency bias output control or the raise/lower relay contacts. The value configured for this parameter must be less than the value configured for the df max (maximum frequency differential) for synchronization.
				Notes This parameter is only visible if frequency control (parameter 5507 ➪ p. 262) is configured to "3pos controller".
5551	**Time pulse minimum**	1	0.01 to 2.00 s **[0.05 s]**	A minimum pulse on time must be configured here. The shortest possible pulse time should be configured to limit overshoot of the desired speed reference point.
				Notes This parameter is only visible if frequency control (parameter 5507 ➪ p. 262) is configured to "3pos controller".
5552	**Gain factor**	1	0.1 to 10.0 **[5.0]**	The gain factor K_p influences the operating time of the relays. By increasing the number configured in this parameter, the operating time of the relay will be in-creased in response to a deviation from the frequency reference. By increasing the gain, the response is increased to permit larger corrections to the variable to be controlled. The farther out of tolerance the process is the larger the response action is to return the process to the tolerance band.
				Notes If the gain is configured too high, the result is excessive overshoot/undershoot of the desired value. This parameter is only visible if frequency control (parameter 5507 ➪ p. 262) is configured to "3pos controller".
5636	**Cycle time factor**	1	1.0 to 20.0 **[1.0]**	The cycle time factor adjusts the time between the pulses (pause time). By increasing the cycle time factor, the time between the pulses increases.
				Notes This parameter is only visible if voltage control (parameter 5507 ➪ p. 262) is configured to "3pos controller".
5553	**Expand deadband factor**	1	1.0 to 9.9 **[1.0]**	If the measured generator frequency is within the deadband range (parameter 5550 ➪ p. 263) and the configured delay expand deadband time (parameter 5554 ➪ p. 264) expires, the deadband will be multiplied with the factor configured here.
				Notes This parameter is only visible if frequency control (parameter 5507 ➪ p. 262) is configured to "3pos controller".

ID	Parameter	CL	Setting range [Default]	Description
5554	**Delay expand deadband**	1	1.0 to 9.9 s **[2.0 s]**	The measured generator frequency must be within the deadband range for the time configured here in order to multiply the deadband with the factor configured in parameter 5553 ⇘ p. 263. **Notes** This parameter is only visible if frequency control (parameter 5507 ⇘ p. 262) is configured to "3pos controller".
5518	**AM Frequency SP1 [Hz]**	2	Determined by AnalogManager 81.03 **[A1 = 05.51 Internal f setp1 [Hz]]**	The Frequency setpoint 1 source may be selected from the available data sources. The internal frequency setpoint 05.51 can be changed manually at the setpoint screen of the display. **Notes** The frequency setpoint may be adjusted within the configured operating limits (⇘ *Chapter 4.5.1.1 "Generator Operating Ranges: Voltage / Frequency / Busbar" on page 315*).
5500	**Int. freq. control setpoint 1** (Internal frequency control setpoint 1)	2	15.00 to 85.00 Hz **[50.00 Hz]**	The internal generator frequency setpoint 1 is defined in this screen. This value is the reference for the frequency controller when performing islanded and/or no-load operations. Generally 50 Hz or 60 Hz will be the values entered into this parameter. It is possible to enter a different value here.
5519	**AM Frequency SP2 [Hz]**	2	Determined by AnalogManager 81.04 **[A1 = 05.52 Internal f setp2 [Hz]]**	The Frequency setpoint 2 source may be selected from the available data sources. The internal frequency setpoint 05.52 can be changed manually at the setpoint screen of the display. **Notes** The frequency setpoint may be adjusted within the configured operating limits (⇘ *Chapter 4.5.1.1 "Generator Operating Ranges: Voltage / Frequency / Busbar" on page 315*).
5501	**Int. freq. control setpoint 2** (Internal frequency control setpoint 2)	2	15.00 to 85.00 Hz **[50.00 Hz]**	The internal generator frequency setpoint 2 is defined in this screen. This value is the reference for the frequency controller when performing islanded and/or no-load operations. Generally 50 Hz or 60 Hz will be the values entered into this parameter. It is possible to enter a different value here.
5502	**Slip frequency setpoint offset**	2	0.00 to 0.50 Hz **[0.10 Hz]**	This value is the offset for the synchronization to the busbar/utility. With this offset, the unit synchronizes with a positive slip. **Example** If this parameter is configured to 0.10 Hz and the busbar/mains frequency is 50.00 Hz, the synchronization setpoint is 50.10 Hz. **Notes** The MCB can be synchronized with an individual slip frequency (also negative). The activation of MCB sync. with separate slip can be selected with parameter 5709 ⇘ p. 230 (HMI: configuration | breakers | MCB) hat comes with the MCB slip freq. setpoint offset parameter 5647 ⇘ p. 231 (HMI: configuration | application | controller | frequency).
5505	**Phase matching gain**	2	1 to 99 **[5]**	The phase matching gain multiplies the setting of the proportional gain (parameter 5510 ⇘ p. 262) for phase matching control.
5506	**Phase matching df-start**	2	0.02 to 0.25 Hz **[0.05 Hz]**	Phase matching will only be enabled if the frequency difference between the systems to be synchronized is below the configured value.
12918	**Setpoint 2 freq.** (Setpoint 2 frequency)	2	Determined by LogicsManager 86.81 **[(0 & 1) & 1]**	If this LogicsManager condition is TRUE, the frequency setpoint 2 will be used instead of frequency setpoint 1. The frequency (result of AM) 5519 ⇘ p. 264/⇘ p. 956 instead of 5518 ⇘ p. 264/⇘ p. 956 will be taken into account.

ID	Parameter	CL	Setting range [Default]	Description
				Notes For information on the LogicsManager and its default settings see ➾ *Chapter 9.3.1 "LogicsManager Overview" on page 882*. Remotely switching the setpoint is possible: Use the LogicsManager command variable for input that is correlating with the dedicated bit of parameter 504 ➾ p. 608/➾ p. 621.
5516	**Start frequency control level**	1	15.00 to 85.00 Hz **[47.00 Hz]**	The frequency controller is activated when the monitored generator frequency has exceeded the value configured in this parameter. This prevents the easYgen from attempting to control the frequency while the engine is completing its start sequence.
5517	**Start frequency control delay**	1	0 to 999 s **[5 s]**	The frequency controller is enabled after the configured time for this parameter expires.
5503	**Freq. control setpoint ramp** (Frequency control setpoint ramp)	2	0.10 to 60.00 Hz/s **[2.50 Hz/s]**	The different setpoint values are supplied to the controller via this ramp. The slope of the ramp is used to alter the rate at which the controller modifies the setpoint value. The faster the change in the setpoint is to be carried out, the greater the value entered here must be.
5504	**Frequency control droop**	2	0.0 to 20.0% **[2.0%]**	If this control is to be operated on a generator in parallel with other generators and frequency control is enabled, a droop characteristic curve must be used. **Notes** Each generator in the system will require the same value to be configured for the droop characteristic, so that when the system is stable the active power will be distributed proportionally among all generators in relation to their rated power.
12904	**Freq. droop act.** (Frequency droop active)	2	Determined by LogicsManager 86.25 **[08.17 Missing member OR 08.06 GCB fail to open) & 1]**	If this LogicsManager condition is TRUE, the frequency droop is enabled. **Notes** For information on the LogicsManager and its default settings see ➾ *Chapter 9.3.1 "LogicsManager Overview" on page 882*. The active droop will also be sent to an ECU connected to the J1939 interface (CAN interface 2). This information is independent from the breaker states or active controller (frequency or power controller). **Example** ■ Rated power: 500 kW ■ Rated frequency setpoint: 50.0 Hz ■ Droop 5.0% ■ Active power: 0 kW = 0% of rated power Frequency is adjusted to: (50.0 Hz – [5.0% * 0.0 * 50 Hz]) = 50.0 Hz. ■ Active power: +250 kW = +50% of rated power Frequency is adjusted to: (50.0Hz – [5% * 0.50 * 50 Hz]) = 50.0 Hz – 1.25 Hz = 48.75 Hz. ■ Active power: +500 kW = +100% of rated power Frequency is adjusted to: (50.0Hz – [5% * 1.00 * 50 Hz]) = 50.0 Hz – 2.5 Hz = 47.50 Hz.
12909	**Release f-control**	2	Determined by LogicsManager 86.96 **[(1 & 1) & 1]**	This LogicsManager is used to activate generally the frequency biasing to the sub controller. If the LogicsManager is false the output will be on the initial state (see parameter 5508 ➾ p. 262). The LogicsManager condition status 'TRUE' is activating the frequency or power regulation according to the LogigsManager 'F/P control' ID 12940 ➾ p. 269/➾ p. 929). **Notes** For information on the LogicsManager and its default settings see ➾ *Chapter 9.3.1 "LogicsManager Overview" on page 882*.

4.4.4.5 Load Control

A 2nd ramp is implemented to meet both BDEW and VDE AR-N 4105 decoupling requirements

Additionally to the "Load control setpoint ramp" parameter 5522 ↳ p. 268 there is an alternative (2nd) "Load control ramp decoupling" parameter 5014 ↳ p. 268 available for ramping slower. So it is possible to follow the BDEW/VDE requirements

- *after mains decoupling*
  and
- *after "Frequency depending derating of power" (see chapter ↳ Chapter 4.4.4.5.4 "Derating And Uprating Of Power " on page 275) becomes inactive.*

Default ramping is backward compatible because parameter 5015 ↳ p. 269 per default comes with zero.

NEW LogicsManager to disable all load ramps (BDEW)

With LogicsManager 11465 ↳ p. 912/↳ p. 922 It is possible to activate the fastest load ramp e.g., for test.

4.4.4.5.1 Configure: Load Control (general)

ToolKit: find settings screen

Analog Managers to define input signal of load set-point (1, 2, 3, 4) are available in ToolKit by

- *a click from screen/page "Configure voltage control"*
  - *on the button "Analog manager" in the left sidebar (below permanent buttons) or*
  - *on "next page", or*
- *search (for parameter)*

ToolKit: Trend chart

ToolKit offers a trend visualization accessible by

- *a click from screen/page "General load control"*
  - *on the button "Trend chart" in the left sidebar (below permanent buttons) or*
  - *on "next page", or*

ID	Parameter	CL	Setting range [Default]	Description
5525	**Load Control**	2	**[PID analog]**	The generator load is controlled using an analog PID controller.
			3pos controller	The generator load is controlled using a three-step controller.
			Off	Load control is not carried out.
5513	**Proportional gain**	2	0.01 to 100.00 **[1.00]**	The proportional coefficient specifies the gain. By increasing the gain, the response is increased to permit larger corrections to the variable to be controlled. The farther out of tolerance the process is the larger the response action is to return the process to the tolerance band.
				Notes If the gain is configured too high, the result is excessive overshoot/undershoot of the desired value. This parameter is only visible if load control (parameter 5525 ➪ p. 267) is configured to "PID analog".
5514	**Integral gain**	2	0.01 to 100.00 **[1.00]**	The integral gain identifies the I part of the PID controller. The integral gain corrects for any offset (between setpoint and process variable) automatically over time by shifting the proportioning band. Reset automatically changes the output requirements until the process variable and the setpoint are the same. This parameter permits the user to adjust how quickly the reset attempts to correct for any offset.
				Notes The integral gain constant must be greater than the derivative time constant. If the integral gain constant is too large, the engine will continually oscillate. If the integral gain steady is too small, the engine will take too long to settle at a steady state. This parameter is only visible if load control (parameter 5525 ➪ p. 267) is configured to "PID analog".
5515	**Derivative ratio**	2	0.01 to 100.00 **[0.01]**	The derivative ratio identifies the D part of the PID controller. By increasing this parameter, the stability of the system is increased. The controller will attempt to slow down the action of the actuator in an attempt to prevent excessive overshoot or undershoot. Essentially this is the brake for the process. This portion of the PID loop operates anywhere within the range of the process unlike reset.
				Notes This parameter is only visible if load control (parameter 5525 ➪ p. 267) is configured to "PID analog". The default configured controller acts like a PI controller what is the valid D part setting for systems with secondary controllers.
5560	**Deadband**	1	0.10 to 9.99% **[1.00%]**	The generator load is controlled in such a manner, when paralleled with the mains, so that the monitored load does not deviate from the configured load setpoint by more than the value configured in this parameter without the controller issuing a raise/lower signal to the speed control. This prevents unneeded wear on the raise/lower relay contacts. The configured percentage for the dead band refers to the generator rated active power (parameter 1752 ➪ p. 431).
				Notes This parameter is only visible if load control (parameter 5525 ➪ p. 267) is configured to "3pos controller".
5561	**Time pulse minimum**	1	0.01 to 2.00 s **[0.05 s]**	A minimum pulse on time must be configured here. The shortest possible pulse time should be configured to limit overshoot of the desired speed reference point.

ID	Parameter	CL	Setting range [Default]	Description
				Notes This parameter is only visible if load control (parameter 5525 ➡ p. 267) is configured to "3pos controller".
5562	**Gain factor**	1	0.1 to 10.0 **[5.0]**	The gain factor K_p influences the operating time of the relays. By increasing the number configured in this parameter, the operating time of the relay will be in-creased in response to a deviation from the frequency reference. By increasing the gain, the response is increased to permit larger corrections to the variable to be controlled. The farther out of tolerance the process is the larger the response action is to return the process to the tolerance band. **Notes** If the gain is configured too high, the result is excessive overshoot/undershoot of the desired value. This parameter is only visible if load control (parameter 5525 ➡ p. 267) is configured to "3pos controller".
5637	**Cycle time factor**	1	1.0 to 20.0 **[1.0]**	The cycle time factor adjusts the time between the pulses (pause time). By increasing the cycle time factor, the time between the pulses increases. **Notes** This parameter is only visible if voltage control (parameter 5525 ➡ p. 267) is configured to "3pos controller".
5563	**Expand deadband factor**	1	1.0 to 9.9 **[1.0]**	If the measured generator load is within the deadband range (parameter 5560 ➡ p. 267) and the configured delay expand deadband time (parameter 5564 ➡ p. 268) expires, the deadband will be multiplied with the factor configured here. **Notes** This parameter is only visible if load control (parameter 5525 ➡ p. 267) is configured to "3pos controller".
5564	**Delay expand deadband**	1	1.0 to 9.9 s **[2.0 s]**	The measured generator load must be within the deadband range for the time configured here in order to multiply the deadband with the factor configured in parameter 5563 ➡ p. 268. **Notes** This parameter is only visible if load control (parameter 5525 ➡ p. 267) is configured to "3pos controller".
5522	**Load control setpoint ramp 1**	2	0.10 to 100.0%/s **[3.00%/s]**	The different setpoint values are supplied to the controller via this ramp. The slope of the ramp is used to alter the rate at which the controller modifies the setpoint value. The faster the change in the setpoint is to be carried out, the greater the value entered here must be. **Notes** This ramp is also used in islanded operation for loading or unloading an additional genset. An excessive oscillation may occur if the ramp is configured too high.
5014	**Load control setpoint ramp 2**	2	0.01 to 100.0%/s **[0.15%/s]**	The different setpoint values are supplied to the controller via this ramp. The slope of the ramp is used to alter the rate at which the controller modifies the setpoint value. The faster the change in the setpoint is to be carried out, the greater the value entered here must be. **Notes** This ramp is also used in islanded operation for loading or unloading an additional genset. An excessive oscillation may occur if the ramp is configured too high.
11978	**2nd load control setpoint ramp**	2	Determined by LogicsManager 87.77 **[(0 & 02.02) & 02.02]**	The LogicsManager can be used to switch from load ramp 1 to load ramp 2 settings. If this LogicsManager condition is TRUE and load ramp will be performed, *[Load control setpoint ramp 2]* will be used.

ID	Parameter	CL	Setting range [Default]	Description
5015	**Time until setpoint ramp reset**	2	0 to 9999 s **[0 s]**	The mains decoupling ramp (2nd load ramp) will be disabled after that time delay. **Notes** This parameter comes with default zero for backward compatibility (2nd load ramp disabled). BDEW prefers 600 s.
12853	**Disable load setpoint ramp**	2	Determined by LogicsManager 87.76 **[(02.01& 1) & 1]**	The LogicsManager can be used to perform fastest possible load ramp independent from load ramp settings. If this LogicsManager condition is TRUE and load ramp will be performed, e.g. a test with different setpoint steps but without any ramping is possible like requested by BDEW.
5569	**Load control unloading ramp**	2	0.10 to 100.00 [%/sec] **3.00 [%/sec]**	The ramp rate is used for the unloading in parallel operation or islanded operation.
5523	**Load control setpoint maximum**	2	0 to 150% **[100%]**	If the maximum generator load is to be limited, a percentage based on the rated generator power (parameter 1752 ⇨ p. 431) must be entered here. The controller adjusts the generator in such a manner that this value is not exceeded. This parameter limits the setpoint of the load controller when the generator is in a mains or island parallel operation.
3465	**Min. generator power**	2	0 to 100% **[0%]**	If the load controller is active, the generator operates with the configured minimum generator power, even if the actual active power setpoint is lower than that parameter value. This parameter isn't used during the unloading sequence.
5524	**Min. generator import/export**	2	0 to 100% **[0%]**	If the minimum generator load is to be limited, a percentage based on the rated generator power (parameter 1752 ⇨ p. 431) must be entered here. The controller will not permit the load to drop below the configured load limit value. This parameter is only functional when the generator is in a mains parallel operation.
12940	**P control**	2	Determined by LogicsManager 86.98 **[(04.07& 04.06) & 1]**	The LogicsManager can be used to control whether frequency control or active power control should be performed. If this LogicsManager condition is TRUE, the active power control is performed.
12998	**Setp. 3load** (Setpoint 3 load)	2	Determined by LogicsManager 87.67 **[(0 & 1) & 1]**	If this LogicsManager condition is TRUE, the frequency setpoint 3 will be enabled, i.e. the setting of parameter 5606 ⇨ p. 273/⇨ p. 957 overrides the setting of parameter 5539 ⇨ p. 272/⇨ p. 956 but setpoint 2 becomes priority. **Notes** For information on the LogicsManager and its default settings see ⇨ *Chapter 9.3.1 “LogicsManager Overview” on page 882.*
5796	**Load setpoint 3**	2	Import	The value entered for the import level shall always be supplied by the utility. All load swings are absorbed by the generator(s) provided the load rating for the generator(s) is not exceeded. The generator will always start when an import power operation is enabled.
			Export	The value entered for the export level shall always be supplied to the utility. All load swings are absorbed by the generator(s) provided the load rating for the generator(s) is not exceeded. The generator will always start when an export power operation is enabled.
			[Steady]	The generator shall always supply the value entered for the steady power level. All load swings are absorbed by the utility. The generator will always start when a steady power (base load) operation is enabled.
5795	**Int. load control setpoint 3** (Internal load control setpoint 3)	0	0.0 to 9999.9 kW **[200.0 kW]**	The load setpoint 3 is defined in this screen. This value is the reference for the load controller when performing parallel operations.

ID	Parameter	CL	Setting range [Default]	Description
3465	**Min. Generator power**	1	0 to 100% **[0%]**	This is the minimum active power setpoint. Any lower other active power setpoint will be ignored! **Notes** For backward compatibility reasons the default value is zero. This min. value is also used for the AnalogManager data sources ↳ *Chapter 9.4.1 "Data Sources AM" on page 933* ■ 05.19 Used power setpoint without ramp and ■ 05.20 Used power setpoint with ramp

Frequency Depending Derating Of Power

General notes

This controller function is supporting a dynamic stabilization of mains. Some grid codes require to derate the real power if the mains frequency increases to a value of e.g. 50.20 Hz (F_{Start}). The derating is stopped, if the frequency becomes lower than e.g. 50.15 Hz (F_{Stop}).

Triggering 2nd load control ramp (decoupling)

According to BDEW/VDE AR-N 4105 requirements a decoupling ramp (see chapter ↳ Chapter 4.4.4.5 "Load Control" on page 266) must be triggered

– *after mains decoupling*
  and
– *after "Frequency depending derating of power" becomes inactive.*

Both triggers are implemented.

Default ramping is backward compatible because parameter 5015 ↳ p. 269 per default comes with zero.

Function

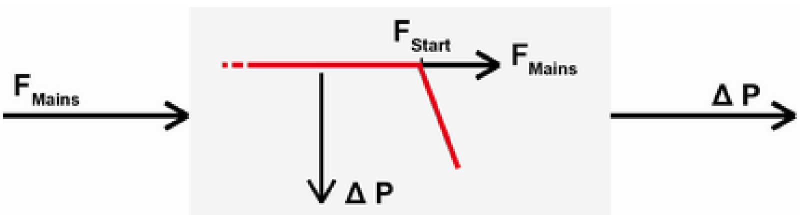


Fig. 165: Frequency depending derating of power (schematic)

If the frequency increases the value F_{Start} (Parameter 5782 ↳ p. 272), the momentary power of the generator will be memorized by the controller as an **internal** value P^M. Now the power will be derated with a gradient R [%/Hz] (parameter 5784 ↳ p. 272). The power derating is shown in Fig. 165.

Example

The power derating ΔP may be calculated using the following formula:

$\Delta P = P_M$ [kW] x R [%/Hz] x (F_{Mains} [Hz] - F_{Start} [Hz]) / 100 [%]

The example uses the following values:

- P_M = 130 kW
- R = 40%/Hz (parameter 5784 p. 272)
- F_{Start} = 50.20 Hz (parameter 5782 p. 272)
- F_{Mains} = 50.50 Hz

The power derating ΔP is calculated as follows:

- ΔP = 130 kW x 40 %/Hz x (50.50 Hz - 50.20 Hz] / 100% = 15.6 kW
- The assumed frequency increases to 50.70 Hz:
- ΔP = 130 kW x 40 %/Hz x (50.70 Hz - 50.20 Hz] / 100% = 26.0 kW

The derating becomes inactive, if the frequency becomes lower than F_{Stop} (Parameter 5783 p. 272). (If the frequency becomes too high, the frequency monitoring function trips.)

Start conditions

The power derating function becomes active, if the following conditions are true:

- Mains frequency > F_{Start} (parameter 5782 p. 272) AND
- Mains parallel operation active (MCB, GCB and if applicable GGB are closed) AND
- easYgen is in AUTOMATIC mode AND
- The corresponding controller functions are switched "On"

Stop conditions

The power derating function becomes inactive and will be reset, if at least one of the following conditions is true:

- Mains frequency < F_{Stop} (parameter 5783 p. 272) OR
- Mains parallel operation **not** active (MCB, GCB and if applicable GGB are open) OR
- easYgen is **not** in AUTOMATIC mode OR
- The corresponding controller functions are switched "Off"

Function behavior

If the frequency decreases, while the derating is still active, the behavior depends on parameter “Hold max.derating” (parameter 5785 p. 272).

Example

The following assumptions are made:

- The corresponding parameters are set to default
- Derating has started with F_{Start} = 50.20 Hz with P_M = 130 kW
- The current frequency is 50.70 Hz → reduction ΔP = 26 kW → current power = 104 kW

Now the measured frequency decreases to 50.50 Hz:

- “Hold max. derating” (parameter 5785 p. 272) = **Off** - The derating ΔP decreases to 15.6 kW according to the gradient 40 %/Hz → the power is increasing to 114.4 kW.
- “Hold max. derating” (parameter 5785 p. 272) = **On** - The derating still remains at 26 kW → the power remains at 104 kW. During a active derating process, the power will never increase again. The power can only increase again if the derating becomes inactive, that means that the measured frequency has reached F_{Stop}.

ID	Parameter	CL	Setting range [Default]	Description
5781	**Function**	2	On	F/P load derating is switched on. The power will be derated, if the frequency becomes higher than "f start value" (parameter 5782 ↬ p. 272).
			[Off]	F/P load derating is switched off.
5782	**f start value**	2	15.00 to 85.00 Hz **[50.20 Hz]**	The derating function becomes active if the measured frequency becomes higher than this value.
5783	**f stop value**	2	15.00 to 85.00 Hz **[50.15 Hz]**	The derating function becomes inactive if the measured frequency becomes lower than this value.
5784	**f dep. derating**	2	1 to 100%/Hz **[40 %/Hz]**	This function works with the derating gradient defined here, if the derating function is active. The higher this value, the higher the derating.
5785	**Hold max. derating**	2	On	While the derating is still active, the power **never** increases again.
			[Off]	While the derating is still active, the power **can** increase according to the defined gradient, if the measured frequency becomes lower. (Even if the frequency is still higher than "f stop value" (parameter 5783 ↬ p. 272))

4.4.4.5.2 Configure: Load Setpoints

ToolKit: find settings screen

Analog Managers to define input signal of load setpoint (1, 2, 3, 4) are available in ToolKit by

- *a click from screen/page "Load setpoints"*
  - *on the button "Analog manager" in the left sidebar (below permanent buttons) or*
  - *on "next page", or*
- *search (for parameter)*

ID	Parameter	CL	Setting range [Default]	Description
5526	**Load setpoint 1**	2	Import	The value entered for the import level shall always be supplied by the utility. All load swings are absorbed by the generator(s) provided the load rating for the generator(s) is not exceeded. The generator will always start when an import power operation is enabled.
			Export	The value entered for the export level shall always be supplied to the utility. All load swings are absorbed by the generator(s) provided the load rating for the generator(s) is not exceeded. The generator will always start when an export power operation is enabled.
			[Steady]	The generator shall always supply the value entered for the steady power level. All load swings are absorbed by the utility. The generator will always start when a steady power (base load) operation is enabled.
5520	**Int. load control setpoint 1** (Internal load control setpoint 1)	2	0.0 to 99999.9 kW **[100.0 kW]**	The load setpoint 1 is defined in this screen. This value is the reference for the load controller when performing parallel operations.
5539	**AM ActPower SP1 [W]**	2	Determined by AnalogManager 81.05 **[A1 = 05.54 Internal P setp1 [W]]**	The load setpoint 1 source may be selected from the available data sources. The internal load setpoint 05.54 can be changed manually at the setpoint screen of the display.

ID	Parameter	CL	Setting range [Default]	Description
				Notes The load setpoint may be adjusted between 0 and the configured load control setpoint maximum (parameter 5523 ➪ p. 269).
5527	**Load setpoint 2**	2	Import	The value entered for the import level shall always be supplied by the utility. All load swings are absorbed by the generator(s) provided the load rating for the generator(s) is not exceeded. The generator will always start when an import power operation is enabled.
			Export	The value entered for the export level shall always be supplied to the utility. All load swings are absorbed by the generator(s) provided the load rating for the generator(s) is not exceeded. The generator will always start when an export power operation is enabled.
			[Steady]	The generator shall always supply the value entered for the steady power level. All load swings are absorbed by the utility. The generator will always start when a steady power (base load) operation is enabled.
5521	**Int. load control setpoint 2** (Internal load control setpoint 2)	2	0.0 to 99999.9 kW **[200.0 kW]**	The load setpoint 2 is defined in this screen. This value is the reference for the load controller when performing parallel operations.
5540	**AM ActPower SP2 [W]**	2	Determined by AnalogManager 81.06 **[A1 = 05.55 Internal P setp2 [W]]**	The load setpoint 2 source may be selected from the available data sources. The internal load setpoint 05.55 can be changed manually at the setpoint screen of the display.
				Notes The load setpoint may be adjusted between 0 and the configured load control setpoint maximum (parameter 5523 ➪ p. 269).
12919	**Setp. 2 load** (Setpoint 2 load)	2	Determined by LogicsManager 86.82 **[(0 & 1) & 1]**	If this LogicsManager condition is TRUE, the ActPower setpoint 2 will be used instead of ActPower setpoint 1. The ActPower (result of AM) 5540 ➪ p. 273/ ➪ p. 542/➪ p. 956 instead of 5539 ➪ p. 272/➪ p. 956 will be taken into account.
				Notes For information on the LogicsManager and its default settings see ➪ *Chapter 9.3.1 "LogicsManager Overview" on page 882*. Remotely switching the setpoint is possible: Use the LogicsManager command variable for input that is correlating with the dedicated bit of parameter 504 ➪ p. 608/➪ p. 621.
5596	**Load setpoint 3**	2	Import	The value entered for the import level shall always be supplied by the utility. All load swings are absorbed by the generator(s) provided the load rating for the generator(s) is not exceeded. The generator will always start when an import power operation is enabled.
			Export	The value entered for the export level shall always be supplied to the utility. All load swings are absorbed by the generator(s) provided the load rating for the generator(s) is not exceeded. The generator will always start when an export power operation is enabled.
			[Steady]	The generator shall always supply the value entered for the steady power level. All load swings are absorbed by the utility. The generator will always start when a steady power (base load) operation is enabled.
5795	**Int. load control setpoint 3** (Internal load control setpoint 2)	2	0.0 to 99999.9 kW **[150.0 kW]**	The load setpoint 3 is defined in this screen. This value is the reference for the load controller when performing parallel operations.
5606	**AM ActPower SP3 [W]**	2	Determined by AnalogManager 81.07 **[A1 = 05.80 Internal P setp3 [W]]**	The load setpoint 3 source may be selected from the available data sources. The internal load setpoint 05.80 can be changed manually at the setpoint screen of the display.
				Notes The load setpoint may be adjusted between 0 and the configured load control setpoint maximum (parameter 5523 ➪ p. 269).

ID	Parameter	CL	Setting range [Default]	Description
12998	**Setp. 3 load** (Setpoint 3 load)	2	Determined by LogicsManager 87.67 **[(0 & 1) & 1]**	If this LogicsManager condition is TRUE and *[Setp. 2 load]* is not TRUE, the frequency setpoint 3 will be enabled., i.e. the setting of parameter 5606 ➜ p. 273/➜ p. 957 overrides the setting of parameter 5539 ➜ p. 272/➜ p. 956. If this LogicsManager condition is TRUE, the frequency setpoint 3 will be used instead of frequency setpoint 2. The ActPower SP3 (result of AM) 5606 ➜ p. 273/➜ p. 957 instead of 5539 ➜ p. 272/➜ p. 956 will be taken into account.
				Notes For information on the LogicsManager and its default settings see ➜ *Chapter 9.3.1 "LogicsManager Overview" on page 882*. Remotely switching the setpoint is possible: Use the LogicsManager command variable for input that is correlating with the dedicated bit of parameter 504 ➜ p. 608/➜ p. 621.
5999	**Load setpoint 4**	2	Import	The value entered for the import level shall always be supplied by the utility. All load swings are absorbed by the generator(s) provided the load rating for the generator(s) is not exceeded. The generator will always start when an import power operation is enabled.
			Export	The value entered for the export level shall always be supplied to the utility. All load swings are absorbed by the generator(s) provided the load rating for the generator(s) is not exceeded. The generator will always start when an export power operation is enabled.
			[Steady]	The generator shall always supply the value entered for the steady power level. All load swings are absorbed by the utility. The generator will always start when a steady power (base load) operation is enabled.
5998	**Int. load control setpoint 3** (Internal load control setpoint 4)	2	0.0 to 99999.9 kW **[50.0 kW]**	The load setpoint 4 is defined in this screen. This value is the reference for the load controller when performing parallel operations.
5609	**AM ActPower SP4 [W]**	2	Determined by AnalogManager 81.08 **[A1 = 05.84 Internal P setp4 [W]]**	The load setpoint 4 source may be selected from the available data sources. The internal load setpoint 05.84 can be changed manually at the setpoint screen of the display.
				Notes The load setpoint may be adjusted between 0 and the configured load control setpoint maximum (parameter 5523 ➜ p. 269).
12269	**Setp. 4 load** (Setpoint 4 load)	2	Determined by LogicsManager 87.75 **[(0 & 1) & 1]**	If this LogicsManager condition is TRUE and neither *[Setp. 2 load]* nor *[Setp. 3 load]* is true, the frequency setpoint 4 will be enabled, i.e. the setting of parameter 5609 ➜ p. 274/➜ p. 957 overrides the setting of parameter 5539 ➜ p. 272/➜ p. 956.
				Notes For information on the LogicsManager and its default settings see ➜ *Chapter 9.3.1 "LogicsManager Overview" on page 882*. Remotely switching the setpoint is possible: Use the LogicsManager command variable for input that is correlating with the dedicated bit of parameter 504 ➜ p. 608/➜ p. 621.

4.4.4.5.3 Configure: Warm-up

ID	Parameter	CL	Setting range [Default]	Description
5532	**Warm-up load limit**	2	0 to 100% **[15%]**	The maximum load is limited to this percentage of the generator rated power (parameter 1752 ➡ p. 431) until the warm-up time (parameter 5534 ➡ p. 275) has expired or the warm-up temperature threshold (parameter 5546 ➡ p. 275) has been exceeded.
5534	**Warm-up time**	2	0 to 9999 s **[0 s]**	The maximum load is limited to the value configured in parameter 5532 ➡ p. 275 for the time configured here.
				Notes This parameter is only effective if "Warm-up mode" (parameter 5533 ➡ p. 275) is configured to "Time controlled".
5533	**Warm-up mode**	2	Analog val contr	The maximum load is limited to the value configured in parameter 5532 ➡ p. 275 until the temperature measured according to the setting in parameter 5538 ➡ p. 275/➡ p. 957 has exceeded the threshold configured in parameter 5546 ➡ p. 275.
			[Time controlled]	The maximum load is limited to the value configured in parameter 5532 ➡ p. 275 until the time configured in parameter 5534 ➡ p. 275 has expired.
5546	**Warm-up threshold**	2	0 to 1000 °C **[80 °C]**	The maximum load is limited to the value configured in parameter 5532 ➡ p. 275 until the temperature has exceeded the threshold configured here.
				Notes This parameter is only effective if "Warm-up mode" (parameter 5533 ➡ p. 275) is configured to "Analog val contr".
5538	**AM Warm-up criterion**	2	Determined by AnalogManager 81.02 **[A1 = 10.01 ZERO]**	The engine warm-up criterion may be selected from the available data sources.
				Notes This parameter is only effective if "Warm-up mode" (parameter 5533 ➡ p. 275) is configured to "Analog val contr".

4.4.4.5.4 Derating And Uprating Of Power

General notes

The current active power setpoint can be derated to a defined value according to the application.

To ensure high flexibility the easYgen-XT offer the following derating functions:

- Direct derating
  (derating to a value of an analog manager)
- Derating according to a characteristic curve
  (derating according to a configured e.g. temperature characteristic)
- J1939 (ECU) derating
  (derating driven by ECU to prevent knocking of the engine)
- Frequency depending derating
  (requirement of some grid codes; described in chapter ➡ *Chapter 4.4.4.5 "Load Control" on page 266*)

Application fields

Derating examples:

- A fire pump is mechanically connected to an engine by a clutch. In this case the engine shall provide a limited amount of electrical power for the load sharing.
- An asynchronous load sharing is required. It is possible to operate an engine with limited power (e.g. if there is a new engine or after maintenance).

Uprating example:

- A single engine shall run with a higher load than the others e.g. for load test.

Block Diagram

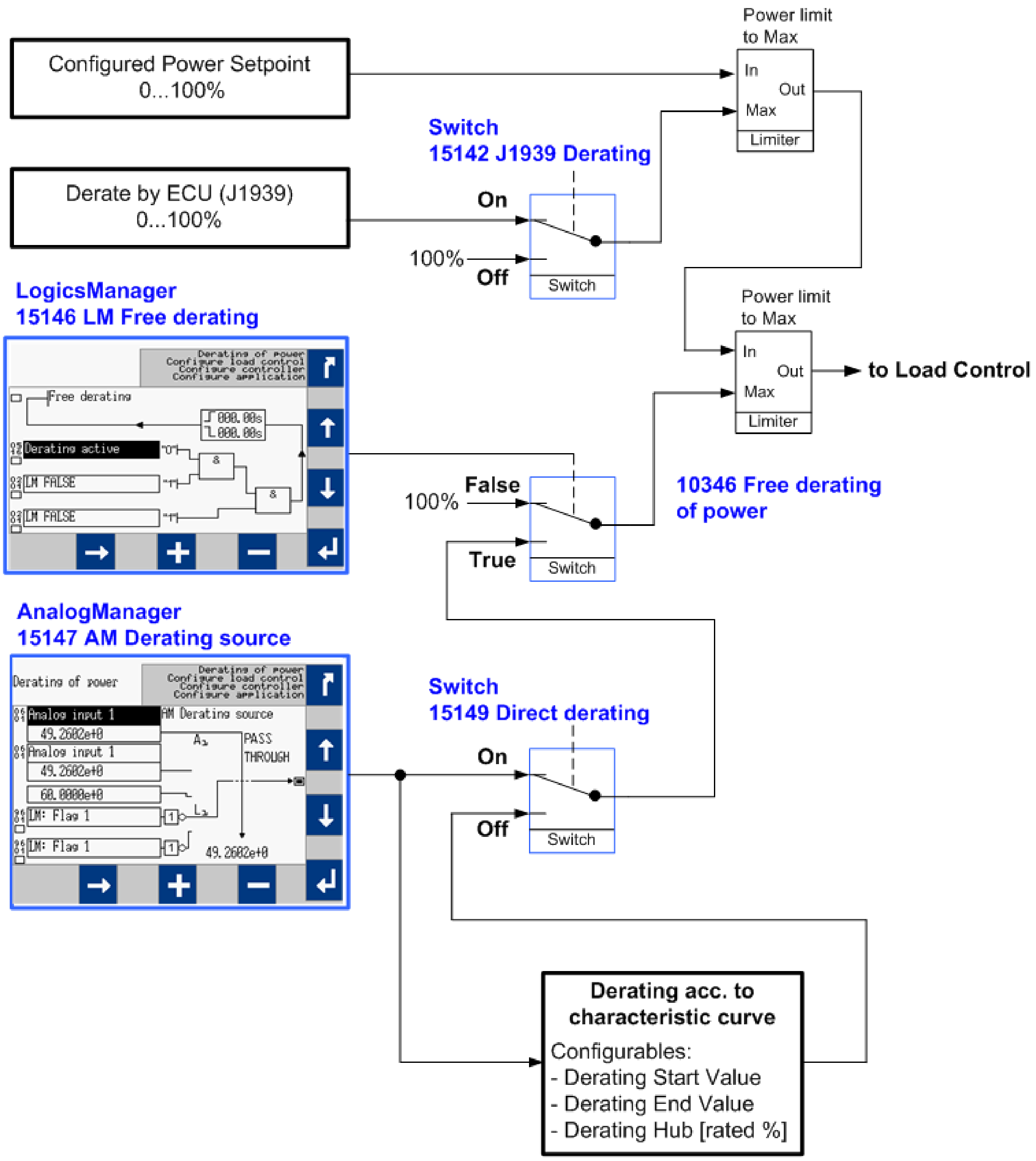


Fig. 166: Derating of Active Power

Derating priority

If more than one derating function is configured the one which calculates the lowest setpoint becomes effective.

Direct Derating

General notes

The idea of direct derating of power is that the user can control with an analog value, usually from outside, the amount of reduction. For this purposes mainly an analog input would be taken. Additionally in some applications are uprating desired, for example during load sharing procedures, which can be as well executed in determined circumstances.

Derating

If parameter Direct Derating (ID15149) is enabled, the output value of the AnalogManager AM Derating source (ID15147) determines the derating directly. This derating value is also provided as AnalogManager variable under "81.21 AM Derating source". For derating the active power setpoint, the value shall vary between 100% (no derating) and 0% (full derating). The derating function parameters 15143, 15144, 15145 are not in use.

Uprating

If parameter Direct Derating (ID 15149 ➪ p. 283) is enabled, the output value of the AnalogManager AM Derating source (ID15147) determines the uprating directly. This value is also provided as AnalogManager variable under "81.21 AM Derating source". For uprating the value shall vary between 100% (no uprating) and higher (uprating begins). The scaling with parameters 15143, 15144, 15145 is not in use.

Combined Derating and Uprating

If parameter Direct Derating (ID15149) is enabled, the output value of the AnalogManager AM Derating source (ID 15147 ➪ p. 283/ ➪ p. 956) determines the derating/uprating directly. This value is also provided as AnalogManager variable under "81.21 AM Derating source".

For derating the active power setpoint goes under 100%, for uprating the value goes over 100%, and with exact value of 100% the normal setpoint becomes active.

Derating With Characteristic Curve

General notes

Some application require a functionality to reduce the active power dependent on a well defined measured value. This could be for example a temperature measurement: The load should decrease with higher temperatures according to a configured characteristic.

If parameter "Direct derating" (ID 15149 ➪ p. 283) is OFF, the LogicsManager “Free derating" (ID 15146 ➪ p. 283/➪ p. 930) becomes TRUE and the analog value of power exceeds the value “Start derating at” (ID 15143 ➪ p. 283), the unit begins to reduce the present active power setpoint. The grade of reducing depends on the value “Stop derating at” (ID 15144 ➪ p. 283) and the value of “Max. power deviation” (ID 15145 ➪ p. 283) which are configurable.

If the LogicsManager "Free derating" becomes FALSE, the unit ramps back to its original setpoint. If derating/uprating is active, the display shows the indication “Derating”/"Uprating".

The derating/uprating function can be used in islanded operation, too. The available rated power from an engine can be reduced (derated) or increased (uprated) with an analog value without adjusting a parameter value. With this function the engine can be individually loaded within of an multiple gen islanded operation (asynchronous load sharing).

Freely scalable derating characteristic

The easYgen-XT offers a characteristic which is linearly decreasing the momentary active power setpoint according to the value offered by the AnalogManager 15147 ↳ p. 283/↳ p. 956.

The characteristic is defined by the following parameters:

- 15143: “Start derating at”
- 15144: “Stop derating at”
- 15145: “Maximal power deviation”

When the LogicsManager "Free derating" becomes active and the analog value crosses the reducing start value, the configured derating line becomes active. If the derating line falls below the active power setpoint the derating becomes effective. The grade of reduction depends on the reducing stop value and the power deviation freely configurable. If the LogicsManager "Power Reduction" becomes FALSE, the unit shall ramp back to its original setpoint.

To become more familiar please look at the examples below:

Example 1: Mains Parallel Operation (setpoint = below rated power)

- Rated generator power = 200 kW
- Current power setpoint of the generator = 150 kW (75%)
- Start derating at = 80 °C water temperature (i.e. analog input AI 01 is defined as free derating source by parameter 15147)
- Stop derating at = 90 °C water temperature
- Max. power deviation = 40% (80 kW)

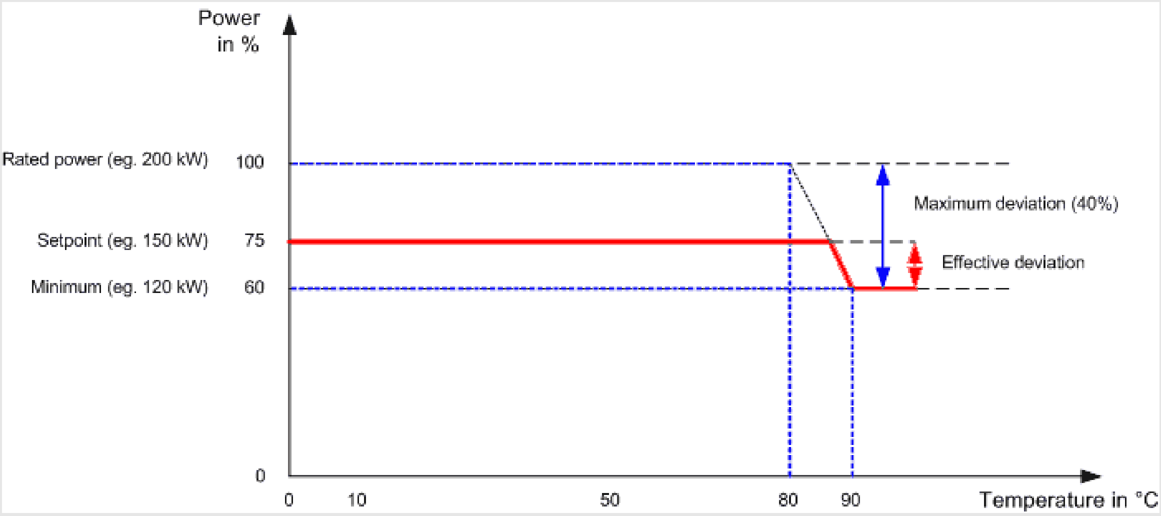


Fig. 167: Derating: Mains parallel operation; setpoint below rated power

If the engine is running and the LogicsManager "Free derating" is TRUE, the unit monitors the water temperature. If the water temperature remains below the value “Start derating at”, the reduction becomes not active and remains on 0%. If the water temperature increases and so exceeds the value “Start derating at” the reduction becomes active (the unit starts to derate the current active power setpoint). The rate of reduction (slope) is determined by the values of “Start derating at”, “Stop derating at”, and "Max. power deviation" ("Max. power deviation" also defines the minimum power).

In this example the power reduction would increase and so reduce power from 75% at 86.5 °C down to 60% = 120 kW at 90 °C. Temperature over 90 °C would cause the same reduction of 40% in this example. So it is guaranteed that the engine is not running with too less load.

A Setpoint below the Minimum (e.g. 55%) would not run into reduction.

With a smaller Maximum deviation (e.g. 20%) Minimum would be higher than Setpoint and so not cause reduction.

Example 2: Mains Parallel Operation (setpoint = rated power)

- Rated generator power = 200 kW
- Current power setpoint of the generator = 200 kW (100%)
- Start derating at = 80 °C water temperature (i.e. analog input AI 02 is defined as free derating source by parameter 15147)
- Stop derating at = 90 °C water temperature
- Max. power deviation = 40% (80 kW)

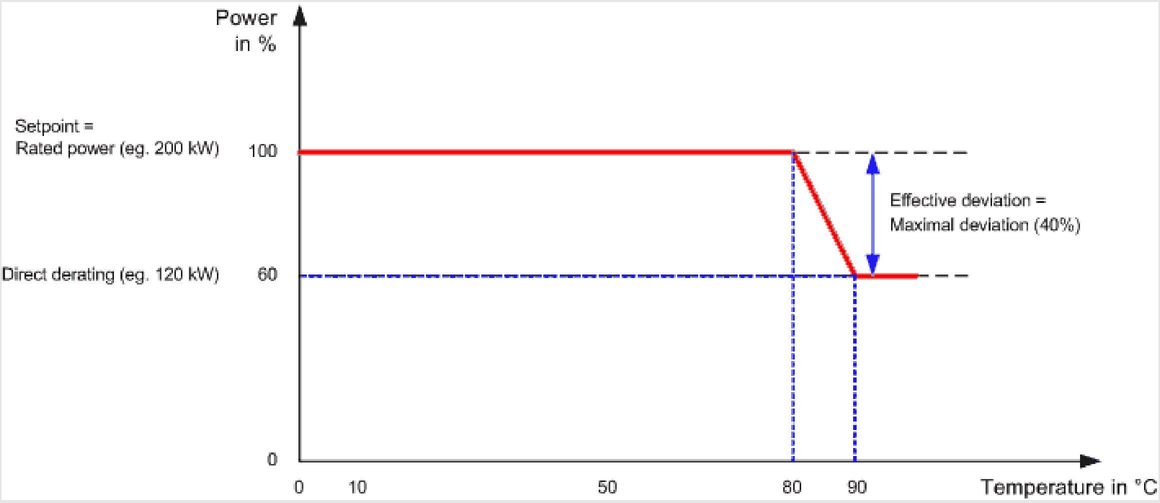


Fig. 168: Derating: Mains parallel operation; setpoint = rated power

If the engine is running and the LogicsManager "Free derating" is TRUE, the unit monitors the water temperature. If the water temperature remains below the value “Start derating at”, the reduction becomes not active and remains on 0%. If the water temperature increases and so exceeds the value “Start derating at” the reduction becomes active (the unit starts to derate the current active power setpoint). The rate of reduction (slope) is determined by the values of “Start derating at”, “Stop derating at”, and "Max. power deviation" ("Max. power deviation" also defines the minimum power).

The power reduction would increase and so reduce power from 100% at 80 °C down to 60% = 120 kW at 90 °C. Temperature over 90 °C would cause the same reduction of 40% in this example. So it is guaranteed that the engine is not running with too less load.

Example 3: Islanded Parallel Operation (IOP)

- Rated generator power = 200 kW
- Current average utilization of all generators = 95%
- Start derating at = 80 °C water temperature (i.e. analog input AI 02 is defined as free derating source by parameter 15147)
- Stop derating at = 90 °C water temperature
- Max. power deviation = 40%

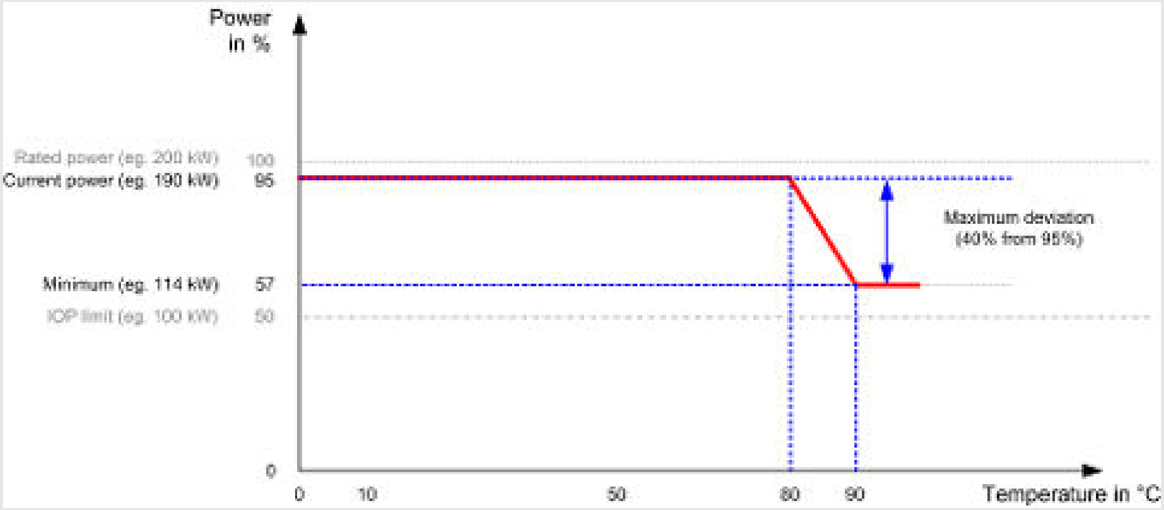


Fig. 169: Derating: Islanded parallel operation

In islanded parallel operation the derating factor is correlated to the utilization factor of all engines! This becomes the new Maximum for derating.

The engine is running with 95% (190 kW). If the LogicsManager is enabled and temperature has reached 80 °C the derating becomes effective (the unit starts to derate the current active power setpoint). If the temperature is 90 °C or higher the maximum reduction value of 40% becomes active. The current power of 95% will be reduced by 40% to 60%.

95% x 0.6 = 57% ≙ 0.57

This engine will run now with 200 kW x 0.57 = 114 kW.

In islanded parallel operation the derating is limited to 50%. It is not possible to get the utilization factor lower than 50% by derating function.

If the derating signals are digital (e.g. different relay outputs from a ripple control receiver; refer to *↳ Chapter 6.3.13 "Ripple Control Receiver" on page 573**), the digital signals can be transformed to an analog signal with a simple set of resistors.*

The derating of power has an impact on the Load-Dependent Start/Stop functionality (refer to *↳ Chapter 6.2.1.1 "Configuring Load-Dependent Start/Stop" on page 536**): The start of the next generator will be shifted.*

Derating Parameters

ID	Parameter	CL	Setting range [Default]	Description
15149	**Direct derating on/off**	2	On	Only the analog source is used for the up-/derating. The parameters 15143, 15144, and 15145 are not visible neither in the HMI nor in ToolKit.
			[Off]	The free derating function uses the parameters 15143, 15144, and 15145 for the calculation from the derating value. This parameters are visible in the HMI and ToolKit.
15143	**Start derating at**	2	-032000 to 032000 **[1000]**	This parameter defines the starting point when the derating becomes active. The value applies to the analog source (parameter 15147 p. 283/ p. 956). Value of the analog source which starts derating.
15144	**Stop derating at**	2	-032000 to 032000 **[0]**	This parameter defines (in combination with parameter 15143 p. 283) the ramp of the derating function. Value of the analog source which ends derating.
15145	**Max. power deviation**	2	1.0 to 100.0% **[100.0%]**	This parameter defines the maximal power deviation of the derating function. That means it determines also the minimal power while derating is active. 100% minus this value is the lowest P value reachable by free derating. The configured percentage for the max. power deviation refers to the generator rated active power (parameter 1752 p. 431).
15146	**Free derating**	2	Determined by LogicsManager 87.60 **[(02.01 & 1] & 1]**	This LogicsManager equation releases the free derating function.
15147	**AM Derating source**	2	Determined by AnalogManager 81.21 **[A1 = 06.01 Analog input 1]**	This parameter defines the analog source *[Analog input 1]* which controls the derating function.
15142 (see chapter below too)	**J1939 derating**	2		To prevent knocking in the engine, some ECUs (Engine Control Unit) transmit a J1939 CAN message to derate the power (in percentage of rated power). The easYgen is able to accept this message and to derate the power according to this message. If derating is active, the display shows the indication “Derating”.
			On	The derate command issued from the ECU via J1939 message is accepted.
			[Off]	The derate command via ECU is ignored.

Indication of derating

Where?	What?	Remarks
HMI	"Derating active"	ID 13281 (for protocols state indication)
	"Uprating active"	ID 13287 (for protocols state indication)
	Value of derating	The value is representing the derating in percent (not the resulting setpoint). For this reason this value becomes negative in case of uprating.
As LM command variable	05.16 for derating	If derating is active “Derating active” is shown in the status message and command variable 05.16 becomes active.
	05.17 for uprating	If uprating is active “Uprating active” is shown in the status message and command variable 05.17 becomes active.
Event list	entry	

The value of derating is shown under *“Status menu / Next page ➔ Setpoints ➔ Derating”*. In case of derating this value has positive in case of uprating has negative sign.

J1939 (ECU) Derating

General notes

In some conditions -- for example when knocking of the engine is detected -- the ECU (Engine Control Unit) is requesting a load reduction via J1939 standard message SPN 3644. This message is only supported by some ECUs e.g. Woodward EGS.

To allow J1939 ECU derating parameter 15142 *"J1939 derating "* must be configured to *[ON]*. The derating value of SPN 3644 is defined as a percentage value related to rated power, with 0% = no derating and 100% = maximum derating (= no load).

If parameter 15142 *"J1939 derating "*is on and the power P is limited to:

P_{lim} = (100% - derating value) x P_{rated}/ 100%

In islanded parallel operation this behavior does not meet exactly the derating required by the ECU. Because of the influence of load share, in the first moment the derating is stronger than required by the ECU.

ID	Parameter	CL	Setting range [Default]	Description
15142	**J1939 derating**	2		To prevent knocking in the engine, some ECUs (Engine Control Unit) transmit a J1939 CAN message to derate the power (in percentage of rated power). The easYgen is able to accept this message and to derate the power according to this message. If derating is active, the display shows the indication "Derating".
			On	The derate command issued from the ECU via J1939 message is accepted.
			[Off]	The derate command via ECU is ignored.

4.4.4.6 PID {x} Control

General notes

The easYgen provides three additional freely configurable PID controllers. These controllers are intended and optimized for slow processes, like temperature control for heating systems (CHPO applications). The controller can either operate as a PID analog controller or a three-position controller.

ID	Parameter	CL	Setting range [Default]	Description
16338 16339 16348	**Description**	2	user-defined **[PID controller {x}]**	This text will be displayed on the Setpoints screens. The text may have 1 through 16 characters.
				Notes This parameter may only be configured using ToolKit.
5571 5584 5670	**PID{x} control**	2	On	The PID controller is enabled.
			[Off]	No control is carried out.

ID	Parameter	CL	Setting range [Default]	Description
5580 5593 5679	**PID{x} ctrl.release**	2	PID{x} Determined by LogicsManager 87.17, 87.18, 87.19 **[(0 & 1) & 1]** = 11406/11407/11408	If this LogicsManager condition is TRUE, the PID {x} controller will be released. **Notes** For information on the LogicsManager and its default settings see *Chapter 9.3.1 "LogicsManager Overview" on page 882*.
5572 5585 5671	**Proportional gain**	2	0.001 to 65.000 **[1.000]**	The proportional coefficient specifies the gain. By increasing the gain, the response is increased to permit larger corrections to the variable to be controlled. The farther out of tolerance the process is the larger the response action is to return the process to the tolerance band. If the gain is configured too high, the result is excessive overshoot/undershoot of the desired value.
5573 5586 5672	**Integral gain**	2	0.010 to 10.000 **[0.100]**	The integral gain identifies the I part of the PID controller. The integral gain corrects for any offset (between setpoint and process variable) automatically over time by shifting the proportioning band. The integral gain automatically changes the output signal until the process variable and the setpoint are the same. The integral gain constant must be greater than the derivative time constant. If the integral gain constant is too large, the engine will continually oscillate. If the integral gain constant is too small, the engine will take too long to settle at a steady state.
5574 5587 5673	**Derivative ratio**	2	0.001 to 10.000 **[0.001]**	The derivative ratio identifies the D part of the PID controller. By increasing this parameter, the stability of the system is increased. The controller will attempt to slow down the action of the actuator in an attempt to prevent excessive overshoot or undershoot. Essentially this is the brake for the process.
5575 5588 5674	**Time pulse minimum**	1	0.01 to 2.00 s **[0.05 s]**	A minimum pulse on time must be configured here. The shortest possible pulse time should be configured, but the actuator should still react safe, to limit overshoot of the desired speed reference point. (Only three-position controller)
5576 5589 5675	**Deadband**	1	0 to 32000 **[10]**	Shows the adjust range around the setpoint value when no displace impulse is issued. This avoids an unnecessary abrasion of relay contacts for higher/lower. (Only three-position controller)
5578 5591 5677	**PID{x} control actual value**	2	Determined by AnalogManager 81.14, 81.16, 81.18: **[A1 = 10.01 ZERO]**	The PID {x} control actual value may be selected from the available analog data sources. It is possible to select all data sources (*Chapter 9.4.1 "Data Sources AM" on page 933*).
5577 5590 5676	**PID{x} control setpoint**	2	Determined by AnalogManager 81.13, 81.15, 81.17: **[A1 = 05.75/76/77 Int. PID{x} setpoint]**	The PID {x} control setpoint source may be selected from the available analog data sources. It is possible to select all data sources (*Chapter 9.4.1 "Data Sources AM" on page 933*).
5579 5592 5678	**Int. PID{x} control setpoint**	1	-32000 to 32000 **[0]**	The internal setpoint is defined in this screen. This value is the reference for the PID {x} controller.

ID	Parameter	CL	Setting range [Default]	Description
5581 5594 5680	**PID{x} control initial state**	2	0 to 100% **[50%]**	The value entered for this parameter is the start reference point for the analog output to the controller as long as the LogicsManager is false. If the PID controller has been disabled (e.g. Parameter 5571 ➲ p. 284), the bias output will change to 0 %.
5582 5595 5681	**Sampling time**	2	1 to 360 s **[1 s]**	The sampling time is configured here. This is the time between two consecutive samples. The sampling time shall be configured high enough that the actual value can react in case e.g. a temperature just shifts slowly.
5692 5693 5694	**Actuator run time**	2	0.1 to 999.0 s **[30.0 s]**	The actuator run time is configured here. This is the time the actuator needs to move from fully closed to fully open. This information is necessary because the controller does not receive a feedback of the actuator position and needs this value to calculate the desired actuator position.
5734 5735 5736	**PID{x} control PI band**	1	0 to 32000 **[2000]**	The PI band is configured here to encounter excessive overshoot of the process value when starting up. The PI band defines the range around the setpoint, in which the I portion of the PID controller is active. If the actual value is outside of this band, the I portion is reduced to a minimum value. The PI band is not that important for three-position controllers and should be disabled by entering a high value (e.g. default value).
5737 5738 5739	**PID{x} control setpoint ramp**	2	1 to 32000 **[10]**	The different setpoint values are supplied to the controller via this ramp to prevent an overshoot of the process value when enabling the controller. The slope of the ramp is used to alter the rate at which the controller modifies the setpoint value. The faster the change in the setpoint is to be carried out, the greater the value entered here must be.
7494 7495 7496	**Unit**	2	User-defined up to 6 characters text **[_ _ _ _ _ _]**	This parameter is assigning a unit text to the displayed analog value. **Notes** This parameter may only be configured using ToolKit. The max. number of characters is 39 but depends on numbers of Bytes for each character. The Bytes/character are defined by the font of the currently selected language. HMI Up to six characters are best for display/HMI; more will override screen border/frame. Please verify the length on the display for best view!

4.4.4.7 Discrete Raise/Low Function

General notes

The frequency / load and voltage / reactive power setpoints may be raised and lowered using the LogicsManager functionality, i.e. it is possible to use LogicsManager command variables to raise and lower these setpoints. In this case the discrete raise/lower function always starts with the rated value (frequency / load and voltage / reactive power).

Most commonly a button may be used to energize a discrete input on the control, which is used again as a LogicsManager command variable to enable the respective LogicsManager function to change the setpoint.

Frequency and voltage may be adjusted within the configured operating limits (➲ *Chapter 4.5.1.1 "Generator Operating Ranges: Voltage / Frequency / Busbar" on page 315*). Active power may be adjusted between 0 and the configured load control setpoint maximum (parameter 5523 ➲ p. 269). The power factor may be adjusted between 0.71 leading and 0.71 lagging.

ID	Parameter	CL	Setting range [Default]	Description
12900	**Discrete f/P +**	2	Determined by LogicsManager 86.21 **[(0 & 1) & 1]**	Once the conditions of the LogicsManager have been fulfilled, the frequency / load setpoint will be raised.
				Notes For information on the LogicsManager and its default settings see *Chapter 9.3.1 "LogicsManager Overview" on page 882*.
12901	**Discrete f/P -**	2	Determined by LogicsManager 86.22 **[(0 & 1) & 1]**	Once the conditions of the LogicsManager have been fulfilled, the frequency / load setpoint will be lowered.
				Notes For information on the LogicsManager and its default settings see *Chapter 9.3.1 "LogicsManager Overview" on page 882*.
12902	**Discrete V/PF +**	2	Determined by LogicsManager 86.23 **[(0 & 1) & 1]**	Once the conditions of the LogicsManager have been fulfilled, the voltage / reactive power setpoint will be raised.
				Notes For information on the LogicsManager and its default settings see *Chapter 9.3.1 "LogicsManager Overview" on page 882*.
12903	**Discrete V/PF -**	2	Determined by LogicsManager 86.24 **[(0 & 1) & 1]**	Once the conditions of the LogicsManager have been fulfilled, the voltage / reactive power setpoint will be lowered.
				Notes For information on the LogicsManager and its default settings see *Chapter 9.3.1 "LogicsManager Overview" on page 882*.
5024	**Discrete ramp f +/-**	2	000.01 ... 100.00 %/s **[000.07 %/s]**	Configurable ramp rate for frequency setpoint raise and lower commands.
5025	**Discrete ramp V +/-**	2	000.01 ... 100.00 %/s **[000.70 %/s]**	Configurable ramp rate for voltage setpoint raise and lower commands.
5026	**Discrete ramp P +/-**	2	000.01 ... 100.00 %/s **[003.00 %/s]**	Configurable ramp rate for active power setpoint raise and lower commands.
5027	**Discrete ramp Power Factor +/-**	2	000.01 ... 100.00 %/s **[007.50 %/s]**	Configurable ramp rate for Power Factor (PF) setpoint raise and lower commands.

4.4.5 Configure Operation Modes

4.4.5.1 Operation Modes: General

Priority of operation modes

The priority of operation modes is well defined from highest to lowest priority:

- *"STOP" is higher than*
- *"MANUAL" is higher than*
- *"AUTOMATIC" is higher than*
- *"TEST"*

ID	Parameter	CL	Setting range [Default]	Description
1795	**Startup in mode** (Operating mode after applying the power supply)	2		If the controller is powered down, the unit will start in the following configured mode when it is powered up again.
			[STOP]	The unit starts in the STOP operating mode.
			AUTO	The unit starts in the AUTOMATIC operating mode.
			MAN	The unit starts in the MANUAL operating mode.
			Last	The unit starts in the last operating mode the control was in prior to being de-energized.
			TEST	The unit starts in the TEST operating mode.
				Notes For the selection of the operating mode via the LogicsManager (if two different operating modes have been selected simultaneously) the control unit will prioritize the modes as follows: ■ 1. STOP ■ 2. MANUAL ■ 3. AUTOMATIC ■ 4. TEST
12510	**Operat. mode AUTO** (Activate operating mode AUTOMATIC)	2	**WARNING!**	In Operation mode AUTO (intentionally): ■ the STOP button on front panel is without function and ■ the soft buttons for operation mode selection are not displayed.
				Notes If both Operation mode AUTO and 12120 ➫ p. 290/➫ p. 927 Start req in AUTO are active the generator will start automatically with acknowledgment of the latest failure.
			Determined by LogicsManager 86.16 **[(0 & 1) & 1]** = 10715	Once the conditions of the LogicsManager have been fulfilled the unit will change into operating mode AUTOMATIC.
				Notes For information on the LogicsManager and its default settings see ➫ *Chapter 9.3.1 "LogicsManager Overview" on page 882.*
12520	**Operat. mode MAN** (Activate operating mode MANUAL)	2	Determined by LogicsManager 86.17 **[(0 & 1) & 1]** = 10716	Once the conditions of the LogicsManager have been fulfilled the unit will change into operating mode MANUAL. If MANUAL mode is selected via the LogicsManager it is not possible to change operating modes via the front panel.
				Notes For information on the LogicsManager and its default settings see ➫ *Chapter 9.3.1 "LogicsManager Overview" on page 882.*

ID	Parameter	CL	Setting range [Default]	Description
12530	**Operat. mode STOP** (Activate operating mode STOP)	2	Determined by LogicsManager 86.18 **[(0 & 1) & 1]** = 10717	Once the conditions of the LogicsManager have been fulfilled the unit will change into operating mode STOP. If STOP mode is selected via the LogicsManager it is not possible to change operating modes via the front panel. **Notes** For information on the LogicsManager and its default settings see ➪ *Chapter 9.3.1 "LogicsManager Overview" on page 882.*
12271	**Operat. mode TEST** (Activate operating mode TEST)	2	Determined by LogicsManager 86.29 **[(0 & 1) & 1]** = 12272	Once the conditions of the LogicsManager have been fulfilled the unit will change into operating mode TEST. If TEST mode is selected via the LogicsManager it is not possible to change operating modes via the front panel. **Notes** For information on the LogicsManager and its default settings see ➪ *Chapter 9.3.1 "LogicsManager Overview" on page 882.*

4.4.5.2 Operation Mode AUTO - Automatic Run

General notes

The start of the engine can be performed via the following different logical conditions.

- A discrete input
- A temperature level
- An interface start condition
- A start request from the LDSS function
- A timer
- Any logical combination

If this logical output becomes TRUE in AUTOMATIC operating mode, the generator starts and the GCB will be closed. The simultaneous activation of other LogicsManager outputs (e.g. Stop req. in Auto) may affect this function.

The breaker handling depends on the configured application mode and breaker logic.

Refer to Fig. 170 and ➪ Chapter 9.3.4 "Logical Outputs" on page 919 for the priority of the logical outputs in case that more than one logical output is TRUE.

Engine start conditions

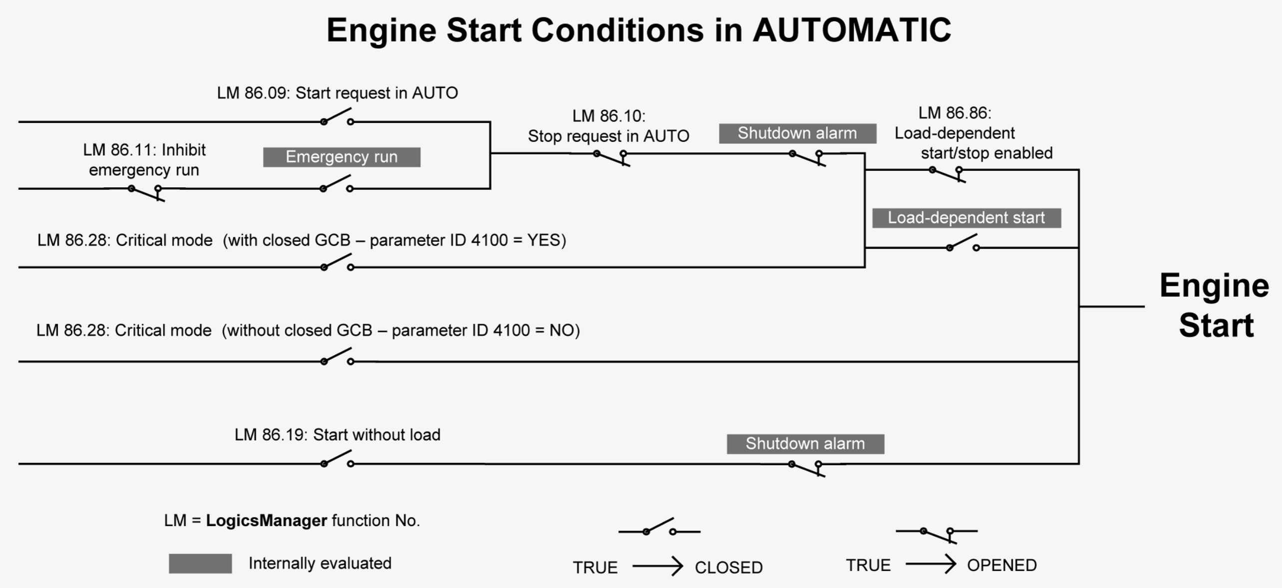


Fig. 170: Automatic run - engine start conditions

ID	Parameter	CL	Setting range [Default]	Description
12120	**Start req. in AUTO** (Start request in operation mode AUTOMATIC)	2	Determined by LogicsManager 86.09 **[(09.02 Discrete input OR 0) OR 04.13 Remote request]** = 10708	Once the conditions of the LogicsManager have been fulfilled, the control issues a start request in AUTOMATIC mode. **Notes** For information on the LogicsManager and its default settings see ↪ *Chapter 9.3.1 "LogicsManager Overview" on page 882.* ≥1: math. "OR"
12190	**Stop req. in AUTO** (Stop request in operation mode AUTOMATIC)	2	Determined by LogicsManager 86.10 **[(0 & 1) & 1]** = 10709	If this logical output becomes TRUE, it inhibits all other start processes (e.g. Start req. in Auto, emergency power, etc.). Stopping of the engine can be initiated externally via a discrete input or any logical combination. Once the conditions of the LogicsManager have been fulfilled, the control issues a stop request in AUTOMATIC mode. **Notes** It is possible to interrupt an already activated emergency run. For information on the LogicsManager and its default settings see ↪ *Chapter 9.3.1 "LogicsManager Overview" on page 882.*
12540	**Start w/o load** (Start without assuming load)	2	Determined by LogicsManager 86.19 **[(0 & 1) & 1]** = 10718	If this LogicsManager condition is TRUE switching from mains to generator supply following an engine start is prevented (the GCB close operation is blocked). This function may be used to perform a test operation. If an emergency power case occurs meanwhile, it is still possible to change to generator operation. If this condition becomes TRUE in islanded operation, the GCB cannot be opened before the MCB has been closed. **Notes** For information on the LogicsManager and its default settings see ↪ *Chapter 9.3.1 "LogicsManager Overview" on page 882.*

4.4.5.3 Operation Mode TEST

Fig. 171: TEST button

Operation mode TEST gives the opportunity to test the genset. It can be activated via HMI button *“TEST”* or parameter 4672 *“Test run mode”*.

> *When the Test Run is time restricted:*
>
> – *The remaining time is displayed on HMI.*
>
> – *The device can change its operating mode after execution of the TEST mode.*

> *In TEST mode the breakers are operated like in the application mode configured. The handling in the setpoint screen is be the same like in the AUTOMATIC mode.*
>
> ***Emergency run (AMF)** and **sprinkler run** -- if configured -- both are fully supported.*

ID	Parameter	CL	Setting range [Default]	Description
4672	**TEST run mode**	2	**[No load w/o time]**	With enabling the operation mode TEST, the engine starts automatically. The GCB remains open.
			OFF	It is not possible to enable the operation mode TEST.
			No load w. time	With enabling the operation mode TEST, the engine starts automatically. The GCB remains open. After a configurable time (4679 ↳ p. 291), the device switches to the operation mode configured with parameter 4680 ↳ p. 291 *“Operation mode after TEST”*.
			Load w/o time	With enabling the operation mode TEST, the engine starts automatically. The GCB will be closed according to the configured *“Breaker transition mode”* (3411 ↳ p. 221). If mains parallel operation is configured, the current active and reactive power setpoint is controlled.
			Load with time	With enabling the operation mode TEST, the engine starts automatically. The GCB will be closed according to the configured *“Breaker transition mode”* (3411 ↳ p. 221). If mains parallel operation is configured, the current active and reactive power setpoint is controlled. After a configurable time (4679 ↳ p. 291), the device switches to the operation mode configured with parameter 4680 ↳ p. 291 *“Operation mode after TEST”*.
			Breaker access	With enabling the operation mode TEST, the engine starts automatically. From there on the breakers can be operated manually according to the configured „Breaker transition mode“ (3411 ↳ p. 221).
				Notes In breaker transition mode “parallel” the MCB open and close commands are not supported.
4679	**TEST mode time restriction**	2	**[60 s]** 0..9999 s	This is the time duration for the time restricted TEST mode.
4680	**Operation mode after TEST**	2		This is the operation mode, on which the genset control changes after the time restricted TEST run. After the TEST run ...

ID	Parameter	CL	Setting range [Default]	Description
			[STOP]	... the genset control switches back to the STOP operation mode.
			Last	... the genset control switches back to the latest operation mode.
			MAN	... the genset control switches back to the MANUAL operation mode.
			AUTO	... the genset control switches back to the AUTOMATIC operation mode.

Control in TEST mode is application specific:

Breaker Transition Mode	Symbol	Available functionality in TEST mode
Parallel		■ The MCB is not active ■ With the GCB button the load test can be started and interrupted ■ If the GCB trips the load test is interrupted
Interchange		■ With the GCB button and the MCB button the load test can be started and interrupted ■ The load transfer is similar to the AUTOMATIC mode ■ If the GCB trips the load test is interrupted and the MCB will be closed if the condition matches: – Release MCB – Mains okay (similar to the closing in AUTOMATIC mode)
Closed transition / Open transition		■ With the GCB button and the MCB button the load test can be started and interrupted ■ If the GCB trips the load test is interrupted and the MCB will be closed if the condition matches: – Release MCB – Mains okay (similar to the closing in AUTOMATIC mode)
External		■ The MCB button isn't active ■ With the GCB button the load test can be started and interrupted ■ Only the GCB open logic is active similar to AUTOMATIC mode ■ If the GCB trips the load test is interrupted

4.4.5.4 Critical Mode

The critical mode may be used to operate a fire engine pump or any other critical operation which does not allow a shutdown of the genset under any alarm conditions.

The LogicsManager is used to define the conditions that will enable the critical mode like a discrete input (for conditions and explanation of programming refer to ↬ *Chapter 9.3.1 “LogicsManager Overview” on page 882*).

Alarm classes

When critical mode is enabled the alarm classes are reclassified as follows:

	Alarm classes					
Normal operation	A	B	C	D	E	F
Critical mode	A	B	B	B	B	B

During the postrun time all shutdown alarms become active again.

Critical mode "On"

A critical mode will be initiated/started once the critical mode operation LogicsManager output becomes TRUE (logic "1"). The "Critical mode" message is displayed on the display screen. If the engine is not already running, the controller will attempt to start the engine as configured (parameter 4102 ➪ p. 171). All shutdown alarms become warning messages (see above).

Critical mode "Off"

A critical mode will be interrupted/stopped once critical mode operation LogicsManager output becomes FALSE (logic "0") and the postrun time has expired. During the postrun time all shutdown alarms become active again.

If the operation mode changes to STOP, the postrun time will still be performed.

Refer to ➪ Chapter 9.3.4 “Logical Outputs” on page 919 for more information about the priorities of the logical outputs.

4.4.5.4.1 Critical Operation At Busbar

The fire engine pump mentioned before or other critical operation is connected to the busbar, i.e. it requires a closed GCB to be supplied by the generator during critical operation.

Parameter 4100 ➪ p. 298 (Close GCB in critical mode) should be configured to "Yes" and an external provision for load reduction should be provided. This ensures the pump operation of a sprinkler system.

Application and breaker transition mode remain as configured.

A mains parallel operation is possible.

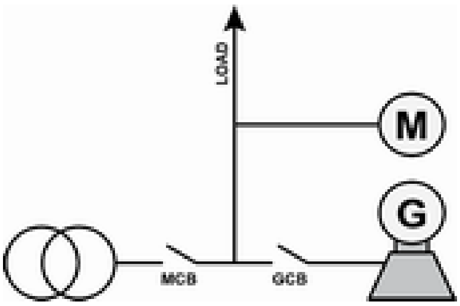


Fig. 172: Critical operation at busbar

The GCB will not be closed if the load is supplied by the mains until the mains fail and the MCB remains closed because emergency run (parameter 2802 ⇘ p. 314) is disabled.

Critical mode during mains supply

If critical mode is enabled during mains supply (MCB is closed), the generator will be started (if not already running) and the GCB will be closed.

- The "Critical mode" message is displayed on the display screen. All shutdown alarms become warning messages.
- If critical mode is disabled again, all shutdown alarms become active again.

If the genset was not running before critical mode has been enabled, it will be stopped after the critical mode postrun time (parameter 4102 ⇘ p. 171) has expired. MCB operation will be performed according to the configured transition mode.

Emergency power during critical mode

If there is a mains failure during critical mode, the "Emerg/Critical" message is displayed on the display screen after the mains fail delay time (parameter 2800 ⇘ p. 314) has expired.

All shutdown alarms become warning messages.

- Critical mode ends before mains recovery:
  - The emergency power operation will be continued and all shutdown alarms become active again.
  - If the mains returns, the unit transfers the load from generator supply to mains supply after the mains settling delay expires.
- Emergency power operation ends before the end of the critical mode:
  - The critical mode is maintained and the load is transferred from generator supply to mains supply after the mains settling delay expires.
  - If open transition mode is configured, the GCB will not be opened to prevent a dead busbar.
  - The engine remains running until the conditions for the critical mode are no longer existent.
  - If the genset was not running before critical mode has been enabled, it will be stopped after cool down time (parameter 3316 ⇘ p. 172) has expired.
  - The GCB will take the same state as it had before the critical mode has been enabled.

Critical mode during emergency power

An emergency power operation is active (load is supplied by the generator, GCB is closed, MCB is open). If critical mode is enabled now, the GCB remains closed and the "Emerg/Critical" message is displayed on the display screen. All shutdown alarms become warning messages.

- Critical mode ends before mains recovery:
  - The emergency power operation will be continued and all shutdown alarms become active again.
  - If the mains return, the unit transfers the load from generator supply to mains supply after the mains settling delay expires, if Enable MCB (parameter 12923 ➡ p. 232/ ➡ p. 929) has been enabled.
- Emergency power operation ends before the end of the critical mode:
  - The critical mode is maintained and the load is transferred from generator supply to mains supply after the mains settling delay expires.
  - The engine remains running until the conditions for the critical mode are no longer existent.
  - If the genset was not running before critical mode has been enabled, it will be stopped after cool down time (parameter 3316 ➡ p. 172) has expired.
  - The GCB will take the same state as it had before the critical mode has been enabled.

Start request during critical mode

The critical mode operation has a higher priority than the remote request (Start/Stop request in AUTO). Therefore, the remote request cannot start or stop the engine and has no effect on the breaker positions. The "Critical mode" message is displayed on the display screen and all shutdown alarms become warning alarms.

- Critical mode ends before the start request is terminated:
  - The engine continues running. All shutdown alarms will become active again.
  - By resetting the start request the GCB will be opened and the engine will be stopped.
- Start request will be terminated before the critical mode is terminated:
  - The critical mode operation is continued.
  - The engine keeps running until the conditions for the critical mode are no longer fulfilled and all shutdown alarms will become active again.
  - If the genset was not running before critical mode has been enabled, it will be stopped after cool down time (parameter 3316 ➡ p. 172) has expired.
  - The GCB will take the same state as it had before the critical mode has been enabled.

4.4.5.4.2 Critical Operation At The Generator

The fire engine pump mentioned before or other critical operation is connected to the generator, i.e. it does not require a closed GCB to be supplied by the generator during critical operation.

Parameter 4100 ➡ p. 298 (Close GCB in critical mode) should be configured to "No". This ensures an open GCB during critical mode. A closed GCB is possible in case of an emergency operation.

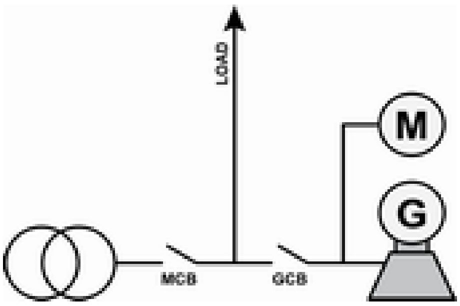


Fig. 173: Critical operation at the generator

Critical mode during mains supply

If critical mode is enabled during mains supply (MCB is closed), the generator will be started (if not already running) and operated with open GCB. The "Critical mode" message is displayed on the display screen. All shutdown alarms become warning messages.

If critical mode is disabled again, all shutdown alarms become active again. If the genset was not running before critical mode has been enabled, it will be stopped after the critical mode postrun time (parameter 4102 ↳ p. 171) has expired.

Emergency power during critical mode

If there is a mains failure during critical mode, the MCB will be opened after the mains fail delay time (parameter 2800 ↳ p. 314) has expired and the GCB will be closed. It is not necessary to configure parameter 4101 ↳ p. 314 (Break emerg. in critical mode) because the critical operation is already supplied. The "Emerg/Critical" message is displayed on the display screen and all shutdown alarms become warning messages.

- Critical mode ends before mains recovery:
  - The emergency power operation will be continued and all shutdown alarms become active again.
  - If the mains returns, the unit transfers the load from generator supply to mains supply after the mains settling delay expires.
- Emergency power operation ends before the end of the critical mode:
  - The critical mode is maintained and the load is transferred from generator supply to mains supply after the mains settling delay expires.
  - The GCB will be opened without unloading (transition mode interchange or parallel).
  - All shutdown alarms become active again.
  - If the genset was not running before critical mode has been enabled, it will be stopped after cool down time (parameter 3316 ↳ p. 172) has expired.

Critical mode during emergency power

An emergency power operation is active (load is supplied by the generator, GCB is closed, MCB is open). If critical mode is enabled now, the GCB will be opened dependent on the setting of the parameter 4101 ↳ p. 314 (Break emerg. in critical mode) and a closure of the GCB is prevented for this time. The "Emerg/Critical" message is displayed on the display screen and all shutdown alarms become warning messages.

- Critical mode ends before mains recovery:
  – The emergency power operation will be continued and all shutdown alarms become active again.
  – If the mains return, the unit transfers the load from generator supply to mains supply after the mains settling delay expires.
- Emergency power operation ends before the end of the critical mode:
  – The critical mode is maintained and the load is transferred from generator supply to mains supply after the mains settling delay expires.
  – The GCB will be opened without unloading (transition mode interchange or parallel).
  – All shutdown alarms become active again.
  – If the genset was not running before critical mode has been enabled, it will be stopped after cool down time (parameter 3316 ➪ p. 172) has expired.

Start request during critical mode

The critical mode operation has a higher priority than the remote request (Start/Stop request in AUTO). Therefore, the remote request cannot start or stop the engine and has no effect on the breaker positions. The "Critical mode" message is displayed on the display screen and all shutdown alarms become warning alarms.

- Critical mode ends before the start request is terminated:
  – The engine continues running and a change to generator or parallel operation is performed.
  – All shutdown alarms will become active again.
- Start request will be terminated before the critical mode is terminated:
  – The critical mode operation is continued. The engine keeps running until the conditions for the critical mode are no longer fulfilled and all shutdown alarms will become active again.
  – If the genset was not running before critical mode has been enabled, it will be stopped after cool down time (parameter 3316 ➪ p. 172) has expired.
  – The GCB will take on the same state as it has before the critical mode has been enabled.

Critical mode during start request

The generator supplies the load and the GCB is closed. If critical mode is enabled, the MCB will be operated according to the configured transition mode (parameter 3411 ➪ p. 221). The GCB will be opened without unloading (transition mode interchange or parallel). The "Critical mode" message is displayed on the display screen and all shutdown alarms become warning alarms.

- Critical mode ends before the start request is terminated:
  – The engine continues running and a change to generator or parallel operation is performed.
  – All shutdown alarms will become active again.
- Start request will be terminated before the critical mode is terminated:
  – The critical mode operation is continued.
  – The engine keeps running until the conditions for the critical mode are no longer fulfilled and all shutdown alarms will become active again.
  – If the genset was not running before critical mode has been enabled, it will be stopped after cool down time (parameter 3316 ↳ p. 172) has expired.

Critical mode during islanded operation

The busbar is supplied by the generator and emergency run (parameter 2802 ↳ p. 314) is disabled. If the critical mode is enabled, the GCB will be opened although the MCB is not enabled. This will cause a dead busbar.

4.4.5.4.3 Parameters

ID	Parameter	CL	Setting range [Default]	Description
12220	**Critical mode**	2	Determined by LogicsManager 86.28 **[(0 & !05.08 Start fail) & ! 09.01 DI01]** = 11607	If this logical output becomes TRUE in AUTOMATIC operating mode, it starts the critical mode. **Notes** For information on the LogicsManager and its default settings see ↳ *Chapter 9.3.1 "LogicsManager Overview" on page 882.*
4109	**Critical mode postrun**	2	0 to 6000 s **[600 s]**	The critical mode operation is continued for the time configured here after the critical mode request has been terminated. The message "Cool down" is displayed and the LogicsManager command variable 04.10 becomes TRUE.
4100	**Close GCB in critical mode**	2	Yes	If a critical mode operation is detected the GCB will close.
			[No]	The GCB cannot be closed during a critical mode operation.
				Notes This parameter **only** applies to application mode A03 to A12.
4105	**Critical mode alarm class MAN** (Critical mode alarm classes active in MANUAL operating mode)	2	Yes	The critical mode alarm classes will override the normal operation alarm classes when in MANUAL operation mode so alarm classes become restricted to WARNING level - NO engine shut down. LogicsManager output 12220 ↳ p. 298/↳ p. 927 becomes TRUE.
			[No]	The alarm classes will not be changed in the MANUAL operating mode e.g. engine shut down is possible!

4.4.5.5 Load Dependent Start/Stop (LDSS)

General notes

Load-dependent start/stop may either be performed according to a system reserve power or the generator load depending on the configuration of the "Start stop mode" (parameter 5752 ↳ p. 303).

Refer to *↳ Chapter 9.6.1 "Load Dependent Start Stop (LDSS) Formulas" on page 980* *for all formulas related to the LDSS function.*

4.4.5.5.1 Generator Load

If the "Start stop mode" (parameter 5752 ↳ p. 303) is configured to *"Generator load"*, load-dependent start stop is performed in a way that the next genset will be started if all gensets in operation reach the maximum generator load (parameter 5762 ↳ p. 307 or 5770 ↳ p. 311 "IOP/MOP Max. generator load"), a configured percentage (e.g. 80%) of the rated power. In order to stop one generator, the load of all gensets in operation must fall below the minimum generator load (parameter 5763 ↳ p. 308 or 5771 ↳ p. 311 "IOP/MOP Min. generator load"), a configured percentage (e.g. 30%) of the rated power. There are different setpoints for islanded and mains parallel operation.

The LDSS algorithm acting on *"Generator load"* offers different dynamic levels:

- With higher dynamic the efficiency can be increased, but the change of generators becomes more frequent.
- With lower dynamic the efficiency can be lower for the first couple of engines, but overall the change of generators becomes less frequent.

Three levels of Dynamic

High:

- After removing of generator rated power the new generator load level shall not lay higher than 75% within the Add-on / Add-off band.

Moderate:

- After removing of generator rated power the new generator load level shall not lay over 50% within the Add-on / Add-off band.

Low:

- After removing of generator rated power the new generator load level shall not lay over 25% within the Add-on / Add-off band

An additional dynamic parameter (parameter 5757 ↳ p. 308 or 5758 ↳ p. 311 "IOP/MOP Dynamic") with levels "Low", Moderate", and "High" prevents the gensets from being started and stopped continuously if only a few gensets are in operation.

This function provides an easy calculation for the start of the next genset.

– *Refer to the description of the dynamic parameters for detailed information.*

The following parameters need to configured for this operation:

Parameter ID	Parameter text	Note
5757	IOP Dynamic	only for islanded operation
5758	MOP Dynamic	only for mains parallel operation
5767	MOP Minimum load	only for mains parallel operation
5769	MOP Hysteresis	only for mains parallel operation
5770	MOP Max. generator load	only for mains parallel operation

Table 77: Load-dependent start/stop - parameters for generator load operation

Islanded operation (IOP)

If the configured maximum generator capacity utilization is exceeded, another genset will be added.

- $PGN_{real\ active} > P_{max.\ load\ islanded}$

If the configured minimum generator capacity utilization has been fallen below, a genset will be stopped depending on the dynamic setting (parameter 5757 ➡ p. 308).

- $PGN_{\ real\ active} < P_{min.\ load\ islanded}$

Mains parallel operation (MOP)

If the required generator load setpoint for the control at the mains interchange point exceeds the MOP minimum load threshold (parameter 5767 ➡ p. 310), the first genset will be added.

- $PMN_{setpoint} – PMN_{real} > PMOP_{minimum}$

If at least one genset is supplying the load in parallel with the mains and the total generator load exceeds the MOP maximum generator load threshold (parameter 5770 ➡ p. 311), another genset will be added.

- $PGN_{real\ active} > P_{max.\ load\ parallel}$

If at least two gensets are supplying the load in parallel with the mains and the configured minimum generator capacity utilization has been fallen below, a genset will be stopped depending on the dynamic setting (parameter 5758 ➡ p. 311)

- $PGN_{real\ active} < P_{min.\ load\ parallel}$

If one genset is supplying the load in parallel with the mains and the generator load exceeds the MOP minimum load threshold (parameter 5767 ➡ p. 310) minus the hysteresis (parameter 5769 ➡ p. 310), the genset will be stopped.

The hysteresis is intended to prevent frequent starting and stopping of gensets in case of small load variations.

- $PMN_{setpoint} – PMN_{real} + PGN_{\ real\ active} < PMOP_{\ minimum} – P_{hysteresis}$ MOP

4.4.5.5.2 System Reserve Power

If the "Start stop mode" (parameter 5752 ⇘ p. 303) is configured to "Reserve power", load-dependent start stop is performed in a way that a configured minimum reserve power is maintained in the system. This means that there is always enough reserve power for load swings on the busbar regardless of the generator load. The actual reserve power in the system is the total rated power of all gensets on the busbar minus the actual total generator real power.

This functionality provides high system reliability and is intended for applications that require a dedicated reserve power on the busbar, independent of the number of gensets on the busbar.

The following parameters need to configured for this operation:

Parameter ID	Parameter text	Note
5760	IOP Reserve power	only for islanded operation
5761	IOP Hysteresis	only for islanded operation
5767	MOP Minimum load	only for mains parallel operation
5768	MOP Reserve power	only for mains parallel operation
5769	MOP Hysteresis	only for mains parallel operation

Table 78: Load-dependent start/stop - parameters for reserve power operation

Islanded operation (IOP)

- $P_{Reserve} = P_{rated\ active} - P_{GN\ real\ active}$
- $P_{rated\ active} = P_{RatedGen[1]} + P_{RatedGen\ [2]} + \dots + P_{RatedGen\ [n]}$
  (total rated power of all gensets on the busbar in the system)
- $P_{GN\ real\ active} = P_{ActualGen\ [1]} + P_{ActualGen\ [2]} + \dots + P_{ActualGen\ [n]}$
  (total actual load of all gensets on the busbar in the system)

If the reserve power falls below the IOP reserve power threshold (parameter 5760 ⇘ p. 307), another genset will be added.

- $P_{Reserve} < P_{Reserve\ IOP}$

If the reserve power exceeds the IOP reserve power threshold (parameter 5760 ⇘ p. 307) plus the hysteresis (parameter 5761 ⇘ p. 307) plus the rated load of the genset, the genset will be stopped.

The hysteresis is intended to prevent frequent starting and stopping of gensets in case of small load variations.

- $P_{reserve} > P_{reserve\ islanded\ IOP} + P_{hysteresis\ IOP} + P_{RatedGen}$

Mains parallel operation (MOP)

- $P_{reserve} = P_{rated\ active} - P_{GN\ real\ active}$
- $P_{rated\ active} = P_{RatedGen\ [1]} + P_{RatedGen\ [2]} + \dots + P_{RatedGen\ [n]}$
  (total rated power of all gensets on the busbar in the system)
- $P_{GN\ real\ active} = P_{ActualGen\ [1]} + P_{ActualGen\ [2]} + \dots + P_{ActualGen\ [n]}$
  (total actual load of all gensets on the busbar in the system)

If the required generator load setpoint for the control at the mains interchange point exceeds the MOP minimum load threshold (parameter 5767 ↳ p. 310), the first genset will be added.

- $P_{MN\ setpoint} - P_{MN\ real} > P_{MOP\ minimum}$

If at least one genset is supplying the load in parallel with the mains and the reserve power falls below the reserve power threshold (parameter 5768 ↳ p. 310), another genset will be added.

- $P_{reserve} < P_{reserve\ parallel}$

If at least two gensets are supplying the load in parallel with the mains and the reserve power exceeds the MOP reserve power threshold (parameter 5768 ↳ p. 310) plus the hysteresis (parameter 5769 ↳ p. 310) plus the rated load of the genset, the genset will be stopped.

The hysteresis is intended to prevent frequent starting and stopping of gensets in case of small load variations.

- $P_{reserve} > P_{reserve\ parallel} + P_{hysteresis\ MOP} + P_{RatedGen}$

If one genset is supplying the load in parallel with the mains and the generator load exceeds the MOP minimum load threshold (parameter 5767 ↳ p. 310) minus the hysteresis (parameter 5769 ↳ p. 310), the genset will be stopped.

The hysteresis is intended to prevent frequent starting and stopping of gensets in case of small load variations.

- $P_{MN\ setpoint} - P_{MN\ real} + P_{GN\ real\ active} < P_{MOP\ minimum} - P_{hysteresis\ MOP}$

4.4.5.5.3 Generator Selection

General notes

If a genset is to be started, the genset with the highest priority configured will be started. If a genset is to be stopped, the genset with the lowest priority configured will be stopped.

If all gensets have the same priority, the next genset is selected according to the size of engine, i.e. the genset combination, which allows an optimum efficiency will be used.

If all gensets have the same rated load or this parameter is disabled, the remaining hours until the next maintenance are considered. If these are also the same, the genset with the lowest generator number will be started first or stopped last.

Priority order:

- 1. Priority (parameter 5751 ↳ p. 303)
- 2. Efficiency (size of engines) (parameter 5754 ↳ p. 304)
- 3. Service hours (parameter 5755 ↳ p. 304)
- 4. Generator (device) number (parameter 1702 ↳ p. 159)

The load-dependent start/stop function requires the following conditions have been met:

- The control has been placed in AUTOMATIC operating mode
- A start request (Start req. in AUTO, Emergency run) is active
- All LDSS parameters are configured identically for all members at the load share line (↳ *Chapter 4.5.6.12 “Multi-Unit Parameter Alignment” on page 419*)

- The mains interchange load control (import/export power) has been enabled or the gensets are in islanded operation
- The conditions of the LogicsManager function "Load-dependent start/stop" have been fulfilled

ID	Parameter	CL	Setting range [Default]	Description
12930	**LD start stop** (Load-dependent start stop)	2	Determined by LogicsManager 86.86 **[(0 & 1) & 1]** = 11915	Once the conditions of the LogicsManager have been fulfilled, the load-dependent start/stop function is enabled.
				Notes For information on the LogicsManager and its default settings see ✎ *Chapter 9.3.1 “LogicsManager Overview” on page 882*.
5752	**Start stop mode**	2	**[Reserve power]**	Load-dependent start stop is performed in a way that a configured minimum reserve power is maintained in the system. The reserve power is the total generator rated power minus the total actual generator power. If the reserve power falls below the threshold, another genset will be started. If the reserve power is sufficient to stop one genset without falling below the threshold, a genset will be stopped.
			Generator load	Load-dependent start stop is performed in a way that a configured maximum generator capacity utilization is not exceeded. If the generator capacity utilization exceeds this threshold, another genset will be started. If the generator capacity utilization is low enough to stop one genset without exceeding the threshold again, a genset will be stopped.
5753	**Dead busbar start mode**	2	**[All]**	All available gensets will be started in case of a dead busbar and remain connected to the busbar for the minimum running time (parameter 5759 ✎ p. 305). Then the gensets will be stopped according to the configured LDSS procedure. The start delay is configured in parameter 2800 ✎ p. 314 (Mains fail delay time).
			LDSS	The start of the gensets will be performed according to the configured LDSS priority in case of a dead busbar.
				Notes This function cannot be used as an emergency power function in mains parallel operations because it cannot control the MCB operation. If the MCB should be operated, the emergency run function (parameter 2802 ✎ p. 314) must be enabled.
5751	**Base priority**	2	1 to 32 **[5]**	The priority of the genset in the load-dependent start/stop network is configured with this parameter (✎ *Chapter 4.4.5.5.3 “Generator Selection” on page 302*). The lower the number configured here, the higher the priority. This priority may be overridden by the LDSS Priority parameters (parameters 12924 ✎ p. 303/✎ p. 929, 12925 ✎ p. 303/✎ p. 929, and 12926 ✎ p. 303/✎ p. 929).
12926	**LDSS Priority 2**	2	Determined by LogicsManager 86.90 **[(0 & 1) & 1]** = 111919	Once the conditions of the LogicsManager have been fulfilled, the load-dependent start/stop priority will be set to 2 (the highest priority is valid).
				Notes For information on the LogicsManager and its default settings see ✎ *Chapter 9.3.1 “LogicsManager Overview” on page 882*.
12925	**LDSS Priority 3**	2	Determined by LogicsManager 86.91 **[(0 & 1) & 1]** = 11920	Once the conditions of the LogicsManager have been fulfilled, the load-dependent start/stop priority will be set to 3 (the highest priority is valid).
				Notes For information on the LogicsManager and its default settings see ✎ *Chapter 9.3.1 “LogicsManager Overview” on page 882*.
12924	**LDSS Priority 4**	2	Determined by LogicsManager 86.92 **[(0 & 1) & 1]** = 11921	Once the conditions of the LogicsManager have been fulfilled, the load-dependent start/stop priority will be set to 4 (the highest priority is valid).
				Notes For information on the LogicsManager and its default settings see ✎ *Chapter 9.3.1 “LogicsManager Overview” on page 882*.

ID	Parameter	CL	Setting range [Default]	Description
5754	**Fit size of engine**	2		This parameter defines whether the start/stop priority order (*Chapter 4.4.5.5.3 "Generator Selection" on page 302*) considers the size of the engine (generator rated power) or not. In case of different sized gensets, the control can start a genset combination which results in optimum efficiency. The fuel efficiency may be optimized when this parameter is enabled. This parameter may be disabled if all generators have the same size.
				Notes The algorithm prefers one large engine instead of multiple small engines, even if this does not match the best possible efficiency. If an engine selection yields a condition, in which multiple small engines with its rated power cover exactly the rated power of an possible bigger engine, the bigger engine is preferred
			Yes	The priority order considers the engine size for the start of the next engine for gensets with the same priority.
			[No]	The priority order does not consider the rated power of the engines to fit the best size of engines.
5755	**Fit service hours**	2		With this parameter the LDSS function can be configured to start and stop redundant engines according to their engine running hours with different methods.
			[Off]	The engine running hours are not considered when evaluating the engines to be started for gensets with same priority. The parameter 5756 p. 304 *"Changes of engines"* has no influence and can be ignored.
			Staggered	The remaining *hours until the next service is required* are considered when evaluating the engines to be started for gensets with same priority. The gensets are utilized in a way that the maintenance may be performed at different times to ensure that not all gensets have a downtime due to a maintenance at the same time. The genset with the lowest hours until the next service will be started first.
				Notes To run this functionality properly the maintenance call must be acknowledged accordingly.
			Equal	The remaining *hours until the next service is required* are considered when evaluating the engines to be started for gensets with same priority. The gensets are utilized in a way that the maintenance may be performed at the same time for all gensets. The genset with the highest hours until the next service will be started first.
				Notes To run this functionality properly the maintenance call must be acknowledged accordingly.
			Period of use	The *"period of use hours"* (parameters 15723 p. 947) are considered when evaluating the engines to be started for gensets with same priority. The gensets are utilized in a way that the period of use hours are equalized over time for all participating gensets. The genset with the lowest period of use hours will be started first.
5756	**Changes of engine**	2		Load dependent start stop: Changes of engine With setting "Off" no time slot is considered and the change of engine is related directly on the passed engine hours. With a configured time slot (32/64/128 h) a minimum of passed engine running hours is taken into account before changing the gensets. If LDSS is configured to act on best possible equal maintenance hours or "period of use" hours, the change of engines can be determined by given time slots. The LDSS therefore creates an individual unit's time group for each engine. Refer to manual chapter *"Engine time groups"* for more details.
				Notes If the LDSS function *"Fit service hours"* (parameter 5755 p. 304) is enabled with "Equal" or "Period of use" hours, this configuration gets valid. Otherwise this parameter can be ignored. For more details go to chapter *Chapter 9.4.1.10 "Group 11: Engine Values" on page 947.*

ID	Parameter	CL	Setting range [Default]	Description
			[Off]	No engine change will be performed. The engines are selected according to the setting of parameter 5755 ↪ p. 304 (Fit service hours) with 1 hour spacing in case of load changes.
			All 32 h	All relevant engines are changed with a 32 hour spacing.
			All 64 h	All relevant engines are changed with a 64 hour spacing.
			All 128 h	All relevant engines are changed with a 128 hour spacing.
5777	**LDSS sort priority always**	2	On	The priority is considered in each moment. The priority will be changed depending on priority input and running hours even with constant load.
				Notes This parameter is only effective if *[Start stop mode]* (parameter 5752 ↪ p. 303) is configured to *[Reserve power]*. This feature can cause more start and stop sequences, even there is only one additional generator brought into the LDSS system.
			[Off]	The priority is depending on priority input and running hours but only considered, if the nominal power in the system changes. The nominal power changes when another generator is to stop or to start anyway.
				Notes This setting causes less generator changes and brings more calmness in the system.

ID	Parameter	CL	Setting range [Default]	Description
5759	**Minimum running time**	2	0 to 32000 s **[180 s]**	If a genset has been started by the LDSS function, it continues to operate at least for this time even if it would have been stopped before. This timer is started with the closure of the GCB. If an emergency run is active (↪ *Chapter 4.4.6 "Emergency Run" on page 312*) and the mains return, this timer will be overridden and the load is transferred back to the mains after the mains settling time (parameter 2801 ↪ p. 360) has expired.

- "Changes of engines" is configured to "All 64h"
- Generator 1 has 262 maintenance hours remaining
- Generator 2 has 298 maintenance hours remaining
- The time group for generator 1 is calculated as: 262h/64h = 4.09 = Time group 4
- The time group for generator 2 is calculated as: 298h/64h = 4.66 = Time group 4
- Both generators are in time group 4.
  Time group 4 consists of any generator that the time group calculation total ranges from 4.00 through 4.99.

In this instance the assigned generator number is used to determine which generator is brought online. Generator 1 will be started.

Example 2

- "Changes of engines" is configured to "All 64h"
- Generator 1 has 262 maintenance hours remaining
- Generator 2 has 345 maintenance hours remaining
- Generator 3 has 298 maintenance hours remaining
- The time group for generator 1 is calculated as: 262h/64h = 4.09 = Time group 4
- The time group for generator 2 is calculated as: 345h/64h = 5.39 = Time group 5
- The time group for generator 3 is calculated as: 298h/64h = 4.66 = Time group 4
- Generators 1 and 3 are in time group 4.
- Time group 4 consists of any generator that the time group calculation total ranges from 4.00 through 4.99.
- Generator 2 is in time group 5.
- Time group 5 consists of any generator that the time group calculation total ranges from 5.00 through 5.99.

In this instance the largest time group will determine which generator is brought online. Generator 2 will be started because it is in time group 5.

4.4.5.5.4 Islanded Parallel Operation (IOP)

General notes

In case of an islanded parallel operation (MCB open), the first genset will be connected to the de-energized busbar.

At least one genset must be in operation in islanded operation.

There are dedicated LDSS parameters for islanded parallel operation because the supply of the load is important here.

ID	Parameter	CL	Setting range [Default]	Description
5760	**IOP Reserve power**	2	1 to 999999 kW **[100 kW]**	The value configured for the reserve power determines when an additional generator will be started. The reserve power is the desired spinning reserve of a generator or generators. The reserve power is usually estimated as the largest load swing that a power plant may encounter during the time it takes to bring an additional generator online. The available generator power is calculated by adding up the generator real power ratings of all generators with closed GCBs. The reserve generator power is calculated by subtracting the power currently being produced by all generators with closed GCBs from the total available generator power. If the actual reserve power of the generators is less than the value configured in this parameter, the next generator will be started.
				Currently available total generator rated real power
			–	Currently available total generator actual real power
			=	Reserve power
				Notes This parameter is only effective if start stop mode (parameter 5752 ➧ p. 303) is configured to "Reserve power".
5648	**IOP Reserve power 2**	2	1 to 999999 kW **[200 kW]**	The value configured for the reserve power determines when an additional generator will be started. The reserve power is the desired spinning reserve of a generator or generators. The reserve power is usually estimated as the largest load swing that a power plant may encounter during the time it takes to bring an additional generator online. The available generator power is calculated by adding up the generator real power ratings of all generators with closed GCBs. The reserve generator power is calculated by subtracting the power currently being produced by all generators with closed GCBs from the total available generator power. If the actual reserve power of the generators is less than the value configured in this parameter, the next generator will be started.
				Currently available total generator rated real power
			–	Currently available total generator actual real power
			=	Reserve power
				Notes This parameter is only effective if start stop mode (parameter 5752 ➧ p. 303) is configured to "Reserve power".
12604	**IOP Reserve power 2**	2	Determined by LogicsManager 86.41 **[(0 & 1) & 1]** = 11975	Once the conditions of the LogicsManager have been fulfilled, the 'IOP Reseve power 2' (parameter 5648 ➧ p. 307) is used instead of the 'IOP Reseve power' (parameter 5760 ➧ p. 307). **Notes** For information on the LogicsManager and its default settings see ➧ *Chapter 9.3.1 "LogicsManager Overview" on page 882*.
5761	**IOP Hysteresis**	2	1 to 65000 kW **[20 kW]**	If the reserve power is sufficient to stop one genset without falling below the threshold and the hysteresis configured here, a genset will be stopped. **Notes** This parameter is only effective if start stop mode (parameter 5752 ➧ p. 303) is configured to "Reserve power".
5762	**IOP Max. generator load**	2	0 to 100% **[70%]**	If the generator load exceeds the threshold configured here, the load-dependent start/stop function will start another genset. **Notes** This parameter is only effective if start stop mode (parameter 5752 ➧ p. 303) is configured to "Generator load". The maximum generator load must be configured higher then the minimum generator load for proper operation.

ID	Parameter	CL	Setting range [Default]	Description
5763	**IOP Min. generator load**	2	0 to 100% **[30%]**	If the generator load falls below the threshold configured here, the load-dependent start/stop function will stop a genset. If only a few gensets are operating in a multi-genset application, the IOP Dynamic (parameter 5757 ➪ p. 308) will also be considered when stopping a genset.
				Notes This parameter is only effective if start stop mode (parameter 5752 ➪ p. 303) is configured to "Generator load". The maximum generator load must be configured higher then the minimum generator load for proper operation.
5757	**IOP Dynamic**	2		The dynamic determines when to start or stop the next genset and shows the following behavior: **Starting genset** The control requests a certain amount of additional load depending on the dynamic. It may start two or more gensets to supply the required load. Also refer to the following example. **Stopping genset** The dynamic determines how soon a genset will be stopped. It prevents continuous start and stop if only a few gensets are in operation. In this case, the remaining gensets would not reach the maximum limit if one genset stops (if, for example, two gensets with 100 kW rated load, a minimum load of 40 % and a maximum load of 70 % are operated, the second genset will be shut down if both reach 40 kW and the remaining engine would operate with 80 kW and request the next engine and so on). The more gensets are running, the less the influence of this parameter. Also refer to the following example.
			[Low]	**Starting genset** A larger genset is requested and it will take longer until the next change is required. The engines are operated with more reserve power. The requested load is calculated so that the gensets will be loaded with 25 % of the range between minimum and maximum generator load (parameters 5762 ➪ p. 307 & 5763 ➪ p. 308) after the new genset has been started. **Stopping genset** The genset will shut down at a lower limit and be operated longer. The number of gensets in operation will remain constant for a wider range of load. The load on the remaining gensets must not exceed 25 % of the range between minimum and maximum generator load (parameters 5762 ➪ p. 307 & 5763 ➪ p. 308).
			Moderate	**Starting genset** A medium genset is requested. The requested load is calaculated so that the gensets will be loaded with 50 % of the range between minimum and maximum generator load (parameters 5762 ➪ p. 307 & 5763 ➪ p. 308) after the new genset has been started. **Stopping genset** The load on the remaining gensets must not exceed 50 % of the range between minimum and maximum generator load (parameters 5762 ➪ p. 307 & 5763 ➪ p. 308).
			High	**Starting genset** A smaller genset is requested to operate the engines with higher efficiency. This may lead to more frequent starts and stops. The requested load is calaculated so that the gensets will be loaded with 75 % of the range between minimum and maximum generator load (parameters 5762 ➪ p. 307 & 5763 ➪ p. 308) after the new genset has been started. **Stopping genset** The genset will be shut down earlier. This may lead to more frequent starts and stops. The load on the remaining gensets must not exceed 75 % of the range between minimum and maximum generator load (parameters 5762 ➪ p. 307 & 5763 ➪ p. 308).
				Notes This parameter is only effective if start stop mode (parameter 5752 ➪ p. 303) is configured to "Generator load".

ID	Parameter	CL	Setting range [Default]	Description
				Example (Starting genset) A plant made up of several gensets with a rated power of 50, 100, and 200 kW is configured to a maximum generator load of 70 % and a minimum generator load of 40 %. One genset with 200 kW is running and the actual load reaches 140 kW. This is the 70 % maximum load limit of the running genset and requires the start of the next genset. ■ Low: a total generator rated power of 294.7 kW is requested and a 100 kW genset will be started. ■ Moderate: a total generator rated power of 254.5 kW is requested and a 100 kW genset will be started. ■ High: a total generator rated power of 224.0 kW is requested and a 50 kW genset will be started. Refer to *Chapter 9.6.1 "Load Dependent Start Stop (LDSS) Formulas" on page 980* for details about the formulas used for calculation.
				Example (Stopping genset) Two gensets with the same rated power are configured to a maximum generator load of 70 % and a minimum generator load of 40 %. The following example shows the load level before stopping the second genset and the resulting load level for the first genset depending on the dynamic setting. ■ Low: Load level before stopping: 23.75% Resulting load level for remaining engine: 47.5% (25% of the difference between 70 and 40%) ■ Moderate: Load level before stopping: 27.5% Resulting load level for remaining engine: 55% (50% of the difference between 70 and 40%) ■ High: Load level before stopping: 31.25% Resulting load level for remaining engine: 62.5% (75% of the difference between 70 and 40%)
5764	**IOP Add on delay**	2	0 to 32000 s **[10 s]**	Load swings may exceed the threshold momentarily. In order to prevent the engine from starting due to short-term load swings, a delay time may be configured. The LDSS criterion for adding load must be exceeded without interruption for this delay time, configured in seconds, prior to a start command being issued. If the LDSS criterion for adding load is fallen below before the delay time expires, the delay time is reset and a start command is not issued.
5765	**IOP Add on delay at rated load**	2	0 to 32000 s **[3 s]**	The command to start the next genset in case a genset exceeds rated load will be issued after the delay configured here has expired. **Notes** This parameter becomes only effective in case a genset exceeds rated load to achieve a faster start and overrides parameter 5764 p. 309.
5766	**IOP Add off delay**	2	0 to 32000 s **[60 s]**	Load swings may fall below the threshold momentarily. In order to prevent the engine from stopping due to short-term load swings, a delay time may be configured. The load must remain below the hysteresis setpoint without interruption for the delay time, configured in seconds, prior to a stop command being issued. If the load exceeds the hysteresis setpoint before the delay time expires, the delay time is reset and a stop command is not issued.

4.4.5.5.5 Mains Parallel Operation

General notes

In case of a mains parallel operation (MCB closed), load-dependent start stop is only enabled, if the gensets participates in load sharing at the interchange point (all participating gensets must be configured to the same setpoint).

> *A minimum load threshold must be exceeded to start the first genset, i.e. a genset will only be started if a minimum load would be demanded from the generator.*
>
> *There are dedicated LDSS parameters for mains parallel operation.*

ID	Parameter	CL	Setting range [Default]	Description
5767	**MOP Minimum load**	2	0 to 65000 kW **[10 kW]**	For the mains interchange (import/export) real power control to function, a minimum generator power setpoint value is required to start the first genset. In many cases, it is desirable that the engine is prevented from starting unless the generator will operate at a specific kW level or higher to ensure a reasonable degree of efficiency. **Example** The mains interchange must reach a level that will permit an 80 kW generator to operate at a minimum load of 40 kW prior to the engine starting.
5769	**MOP Hysteresis**	2	0 to 65000 kW **[10 kW]**	Start stop mode configured to "Reserve power": If the reserve power is sufficient to stop one genset without falling below the reserve power threshold and the hysteresis configured here, a genset will be stopped. If the generator load falls below the minimum load threshold minus the hysteresis configured here, the last genset will be stopped. **Notes** The importance of this parameter depends on the setting of the start stop mode (parameter 5752 ↪ p. 303).
5768	**MOP Reserve power**	2	0 to 999999 kW **[50 kW]**	The minimum reserve power in mains parallel operation is configured here. This is the maximum expected load swing on the busbar, which shall be supported by the gensets. If the reserve power falls below this value, the load-dependent start/stop function will start another genset. **Notes** This parameter is only effective if start stop mode (parameter 5752 ↪ p. 303) is configured to "Reserve power".
5649	**MOP Reserve power 2**	2	0 to 999999 kW **[100 kW]**	The minimum reserve power in mains parallel operation is configured here. This is the maximum expected load swing on the busbar, which shall be supported by the gensets. If the reserve power falls below this value, the load-dependent start/stop function will start another genset. **Notes** This parameter is only effective if start stop mode (parameter 5752 ↪ p. 303) is configured to "Reserve power".
12605	**MOP Reserve power 2**	2	Determined by LogicsManager 86.42 **[(0 & 1) & 1]** = 11976	Once the conditions of the LogicsManager have been fulfilled, the 'MOP Reseve power 2' (parameter 5649 ↪ p. 310) is used instead of the 'MOP Reseve power' (parameter 5768 ↪ p. 310). **Notes** For information on the LogicsManager and its default settings see ↪ *Chapter 9.3.1 "LogicsManager Overview" on page 882.*

ID	Parameter	CL	Setting range [Default]	Description
5770	**MOP Max. generator load**	2	0 to 100% **[70%]**	If the generator load exceeds the threshold configured here, the load-dependent start/stop function will start another genset. **Notes** This parameter is only effective if start stop mode (parameter 5752 ⤷ p. 303) is configured to "Generator load". The maximum generator load must be configured higher then the minimum generator load for proper operation.
5771	**MOP Min. generator load**	2	0 to 100% **[30%]**	If the generator load falls below the threshold configured here, the load-dependent start/stop function will stop a genset. If only a few gensets are operating in a multi-genset application, the MOP Dynamic (parameter 5758 ⤷ p. 311) will also be considered when stopping a genset. **Notes** This parameter is only effective if start stop mode (parameter 5752 ⤷ p. 303) is configured to "Generator load". The maximum generator load must be configured higher then the minimum generator load for proper operation.
5758	**MOP Dynamic**	2		The dynamic determines when to start or stop the next genset and shows the following behavior: **Starting genset** The Dynamic is only considered for the start sequence if "Fit size of engines" is enabled (refer to parameter 5754 ⤷ p. 304). The control requests a certain amount of additional load depending on the dynamic. It may start two or more gensets to supply the required load. **Stopping genset** The dynamic determines how soon a genset will be stopped. It prevents continuous start and stop if only a few gensets are in operation. In this case, the remaining gensets would not reach the maximum limit if one genset stops (if, for example, two gensets with 100 kW rated load, a minimum load of 40 % and a maximum load of 70 % are operated, the second genset will be shut down if both reach 40 kW and the remaining engine would operate with 80 kW and request the next engine and so on). The more gensets are running, the less the influence of this parameter. Also refer to the following example.
			[Low]	**Starting genset** A larger genset is requested and it will take longer until the next change is required. The engines are operated with more reserve power. The requested load is calaculated so that the gensets will be loaded with 25 % of the range between minimum and maximum generator load (parameters 5762 ⤷ p. 307 & 5763 ⤷ p. 308) after the new genset has been started. **Stopping genset** The genset will shut down at a lower limit and be operated longer. The number of gensets in operation will remain constant for a wider range of load. The load on the remaining gensets must not exceed 25 % of the range between minimum and maximum generator load (parameters 5762 ⤷ p. 307 & 5763 ⤷ p. 308).
			Moderate	**Starting genset** A medium genset is requested. The requested load is calaculated so that the gensets will be loaded with 50 % of the range between minimum and maximum generator load (parameters 5762 ⤷ p. 307 & 5763 ⤷ p. 308) after the new genset has been started. **Stopping genset** The load on the remaining gensets must not exceed 50 % of the range between minimum and maximum generator load (parameters 5762 ⤷ p. 307 & 5763 ⤷ p. 308).

ID	Parameter	CL	Setting range [Default]	Description
			High	**Starting genset** A smaller genset is requested to operate the engines with higher efficiency. This may lead to more frequent starts and stops. The requested load is calaculated so that the gensets will be loaded with 75 % of the range between minimum and maximum generator load (parameters 5762 ➘ p. 307 & 5763 ➘ p. 308) after the new genset has been started. **Stopping genset** The genset will be shut down earlier. This may lead to more frequent starts and stops. The load on the remaining gensets must not exceed 75 % of the range between minimum and maximum generator load (parameters 5762 ➘ p. 307 & 5763 ➘ p. 308).
				Notes This parameter is only effective if start stop mode (parameter 5752 ➘ p. 303) is configured to "Generator load". Refer to parameter 5757 ➘ p. 308 for examples on stating and stopping a genset depending on the dynamic setting.
5772	**MOP Add on delay**	2	0 to 32000 s **[20 s]**	Load swings may exceed the threshold momentarily. In order to prevent the engine from starting due to short-term load swings, a delay time may be configured. The LDSS criterion for adding load must be exceeded without interruption for this delay time, configured in seconds, prior to a start command being issued. If the LDSS criterion for adding load is fallen below before the delay time expires, the delay time is reset and a start command is not issued.
5773	**MOP Add on delay at rated load**	2	0 to 32000 s **[3 s]**	The command to start the next genset in case a genset exceeds rated load will be issued after the delay configured here has expired. This parameter becomes only effective in case a genset exceeds rated load to achieve a faster start and overrides parameter 5772 ➘ p. 312.
				Notes This parameter becomes only effective in case a genset exceeds rated load to achieve a faster start and overrides parameter 5764 ➘ p. 309.
5774	**MOP Add off delay**	2	0 to 32000 s **[60 s]**	Load swings may fall below the threshold momentarily. In order to prevent the engine from stopping due to short-term load swings, a delay time may be configured. The load must remain below the hysteresis setpoint without interruption for the delay time, configured in seconds, prior to a stop command being issued. If the load exceeds the hysteresis setpoint before the delay time expires, the delay time is reset and a stop command is not issued.

4.4.6 Emergency Run

General notes

The automatically start by mains trip is possible only in application mode A04, A06, A07, A08, A09 *and* A11 *(2 power circuit breakers).*

If the LogicsManager outputs 'Stop request in AUTO' or 'Inhibit emergency run' are TRUE, an emergency power operation may be prevented or interrupted from an external source.

Prerequisites

– *The emergency power function can only be activated for synchronous generators with parameter 2802 ⇘ p. 314.*
– *Emergency power is carried out in operating mode AUTOMATIC regardless of the status of the LogicsManager output 'Start request in AUTO' (LogicsManager).*

The display indicates "Emergency run" during emergency power operation.

The following principles are observed in case of an emergency power operation:

- If an emergency power operation is initiated, the engine is started automatically, unless the start sequence is interrupted via an alarm or prevented via the LogicsManager or the operating mode is changed.
- The GCB can be closed regardless of the engine delay time if the generator frequency and voltage are within the configured operating limits (⇘ *Chapter 4.5.1.1 "Generator Operating Ranges: Voltage / Frequency / Busbar" on page 315*) if the parameter "Undelay close GCB" (parameter 12210 ⇘ p. 226/ ⇘ p. 927) has been set accordingly (default setting).
- If the mains return during an emergency power operation (GCB is closed), the mains settling time (parameter 2801 ⇘ p. 360) must expire before the load is transferred from the generator to mains operation.

Activation of emergency power

If the mains are not within the configured frequency and voltage operating limits (⇘ Chapter 4.5.3.3 "Mains Operating Ranges: Voltage / Frequency" on page 361) for at least the time configured in the parameter "Mains fail delay time" (parameter 2800 ⇘ p. 314), an emergency power operation is activated.

MCB malfunction

An emergency power operation will be performed, if the control is not able to close or recluse the MCB and the alarm "Fail to close MCB" occurs.

Mains rotation field alarm

If the mains returns after a mains failure with a reversed rotation direction the generator remains in emergency power operation until the mains rotation matches the rotation of the generator set.

The generator will not start upon a mains rotation field alarm, but it will keep on running if it has already started.

*The following parameters **only** apply to application mode A04, A06, A07, A08, A09 and A11.*

ID	Parameter	CL	Setting range [Default]	Description
2802	**Emergency run**	2	**[On]**	If the unit is in the AUTOMATIC operating mode and a mains fault occurs according to the following parameters, the engine is started and an automatic emergency operation is carried out.
			Off	No emergency operation is carried out.
2800	**Mains fail delay time** (Mains failure start delay)	2	0.00 to 99.99 **[3.00 s]**	To start the engine and to carry out an emergency operation the monitored mains must be failed continuously for the minimum period of time set with this parameter.
				Notes This delay time starts only if the easYgen is in AUTOMATIC operating mode and emergency power is activated.
3408	**Emerg. start with MCB failure**	2	**[Yes]**/No	Emergency power operations may be configured with the failure of the MCB in addition to a loss of power on the mains supply.
				Notes An MCB breaker alarm is indicated if parameter "MCB monitoring" (parameter 2620 ➪ p. 400) is configured "On".
12200	**Inhibit emergency run** (Inhibit emerg. run)	2	Determined by LogicsManager 86.11 **[(0 & 1) & 1]** = 10710	Once the conditions of the LogicsManager have been fulfilled the emergency power operation will be terminated or blocked.
				Notes It is possible to interrupt an already activated emergency run. For information on the LogicsManager and its default settings see ➪ *Chapter 9.3.1 "LogicsManager Overview" on page 882*.
4101	**Break emerg. in critical mode** (Override emergency operations in critical mode)	2	0 to 999 s **[5 s]**	The emergency power operations are overridden for the configured time when the critical mode starts in order to supply the complete generator power to the sprinkler pump.
2805	**Emergency start Seg No 1-16**	2	—	In the application mode GCB/LS5 the easYgen provides an emergency run according to the configured segments. If the operating range of the particular segment is lost, the easYgen starts and closes the GCB. When the easYgen has recognized being parallel to mains it ramps down and opens the breaker with cooldown. The entry is bitwise. ToolKit offers therefore a more comfortable configuration. In the easYgen display must be entered a hexadecimal value related to the segment number.
				Notes This parameter **only** applies to application mode A07.
2806	**Emergency start Seg No 17-32**	2	—	In the application mode GCB/LS5 the easYgen provides an emergency run according to the configured segments. If the operating range of the particular segment is lost, the easYgen starts and closes the GCB. When the easYgen has recognized being parallel to mains it ramps down and opens the breaker with cooldown. The entry is bitwise. ToolKit offers therefore a more comfortable configuration. In the easYgen display must be entered a hexadecimal value related to the segment number.
				Notes This parameter **only** applies to application mode A07.

ID	Parameter	CL	Setting range [Default]	Description
2807	**Emergency start Seg No 33-48**	2	—	In the application mode GCB/LS5 the easYgen provides an emergency run according to the configured segments. If the operating range of the particular segment is lost, the easYgen starts and closes the GCB. When the easYgen has recognized being parallel to mains it ramps down and opens the breaker with cooldown. The entry is bitwise. ToolKit offers therefore a more comfortable configuration. In the easYgen display must be entered a hexadecimal value related to the segment number. **Notes** This parameter **only** applies to application mode A07.
2808	**Emergency start Seg No 49-64**	2	—	In the application mode GCB/LS5 the easYgen provides an emergency run according to the configured segments. If the operating range of the particular segment is lost, the easYgen starts and closes the GCB. When the easYgen has recognized being parallel to mains it ramps down and opens the breaker with cooldown. The entry is bitwise. ToolKit offers therefore a more comfortable configuration. In the easYgen display must be entered a hexadecimal value related to the segment number. **Notes** This parameter **only** applies to application mode A07.

4.5 Configure Monitoring

Replacement: "Delayed by engine speed" becomes "Enabled"

Formerly (non-XT easYgen) several monitoring functions could be delayed each by use of parameter "Delayed by engine speed". Exchanging it by the new parameter "Enabled" introduces the one-change-switch of all monitoring functions by LogicsManager 11459 LM 87.70 Release Engine Monitoring.

With software revision 1.13 or higher each monitoring LogicsManager can be enabled alternatively by one of 32 Flags.

Factory settings ensure same behavior of each affected monitoring function as of non-XT easYgen series before.

4.5.1 Configure Generator Monitoring

4.5.1.1 Generator Operating Ranges: Voltage / Frequency / Busbar

The operating voltage/frequency/busbar parameters are used to check if the values are in range when performing a dead bus closure and synchronization of the generator. Busbar 1 must be within this ranges to synchronize the generator to the busbar.

It is recommended to configure the operating limits within the monitoring limits.

ID	Parameter	CL	Setting range [Default]	Description
5800	**Upper voltage limit** (Generator maximum operating voltage limit)	2	100 to 150% **[110%]** (Hysteresis: 1%)	The maximum permissible positive deviation of the generator voltage from the generator rated voltage (parameter 1766 ➪ p. 431) is configured here. This value may be used as a voltage limit switch. The conditional state of this switch may be used as a command variable for the LogicsManager (02.03).
5801	**Lower voltage limit** (Generator minimum operating voltage limit)	2	50 to 100% **[90%]** (Hysteresis: 1%)	The maximum permissible negative deviation of the generator voltage from the generator rated voltage (parameter 1766 ➪ p. 431) is configured here. This value may be used as a voltage limit switch. The conditional state of this switch may be used as a command variable for the LogicsManager (02.03).
5802	**Upper frequency limit** (Generator maximum operating frequency limit)	2	100.0 to 150.0% **[105.0%]** (Hysteresis: 0.05%)	The maximum permissible positive deviation of the generator frequency from the rated system frequency (parameter 1750 ➪ p. 429) is configured here. This value may be used as a frequency limit switch. The conditional state of this switch may be used as a command variable for the LogicsManager (02.04).
5803	**Lower frequency limit** (Generator minimum operating frequency limit)	2	50.0 to 100.0% **[95.0%]** (Hysteresis: 0.05%)	The maximum permissible negative deviation of the generator frequency from the rated system frequency (parameter 1750 ➪ p. 429) is configured here. This value may be used as a frequency limit switch. The conditional state of this switch may be used as a command variable for the LogicsManager (02.04).

Table 79: Parameter settings: Voltage/frequency

Busbar monitoring

Busbar monitoring compares the actual voltage and frequency of the busbar with the configured generator operating ranges. The voltage operating range is configured with the "Upper voltage Limit" and "Lower voltage limit" parameter. The frequency operating range is configured with the "Upper frequency limit" and "Lower frequency limit" parameter. If the measured busbar voltage or frequency deviates from the operating range for a time exceeding the configurable delay, an alarm will be issued.

ID	Parameter	CL	Setting range [Default]	Description
5118	**Monitoring**	2	On	Monitoring is enabled
			[Off]	Monitoring is disabled
5122	**Delay**	2	0.02 to 99.99 s **[10.00 s]**	If one of the monitored values exceeds the threshold value for the delay time configured here, an alarm will be issued.
5119	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to ➪ *Chapter 9.5.1 "Alarm Classes" on page 965*
5120	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).

Table 80: Parameter settings: Busbar

4.5.1.2 Generator Voltage Monitoring

ID	Parameter	CL	Setting range [Default]	Description
1770	**Generator voltage moni-toring**	2		The unit can either monitor the phase-neutral (wye) voltages or the phase-phase (delta) voltages. If the controller is used in a compensated or isolated network, voltage protection monitoring should be configured as phase-neutral to prevent earth-faults resulting in tripping of the voltage protections.
			[Phase - phase]	The phase-phase voltage will be monitored and all subsequent parameters concerning voltage monitoring "generator" are referred to this value (V_{L-L}).
			Phase - neutral	The phase-neutral voltage will be monitored and all subsequent parameters concerning voltage monitoring "generator" are referred to this value (V_{L-N}).
				Notes WARNING: This parameter defines how the protective functions operate.

Table 81: Settings: Generator Voltage Monitoring

4.5.1.2.1 Generator Overvoltage (Level 1 & 2) ANSI# 59

General notes

Voltage is monitored according to how the parameter "Generator voltage measuring" (parameter 1851 ↳ p. 431) is configured. This controller provides the user with two alarm levels for generator overvoltage. Both alarms are definite time alarms.

Monitoring for overvoltage faults is performed in two steps.

If this protective function is triggered, the display indicates "Gen. overvoltage 1" or "Gen. over-voltage 2" and the logical command variable "06.05" or "06.06" will be enabled.

Refer to ↳ *Chapter 9.1.1 "Triggering Characteristics" on page 673* for the triggering characteristic of this monitoring function. The diagrams listed there show a frequency trend and the associated pickup times and length of the alarms.

The parameter limits listed below have identical setting ranges. Each parameter may be configured with different settings to create unique trip characteristics for specific thresholds.

ID	Parameter	CL	Setting range [Default]	Description
2000 2006	**Monitoring**	2	**[On]**	Overvoltage monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: Level 1 limit < limit 2).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
2004 2010	**Limit**	2	50.0 to 150.0% 2004: **[108.0%]** 2010: **[112.0%]** (Hysteresis: 0.7%)	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or exceeded for at least the delay time without interruption, the action specified by the alarm class is initiated.

ID	Parameter	CL	Setting range [Default]	Description
			(Reset Delay: 80 ms)	**Notes** This value refers to the System rated frequency (parameter 1766 ➡ p. 431).
2005 2011	**Delay**	2	0.02 to 99.99 s 2005: **[5.00 s]** 2011: **[0.30 s]**	If the monitored generator voltage value exceeds the threshold value for the delay time configured here, an alarm will be issued.
				Notes If the monitored generator voltage falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.
2001 2007	**Alarm class**	2	Class A/B/C/D/E/F, Control 2001: **[B]** 2007: **[F]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ➡ *Chapter 9.5.1 “Alarm Classes” on page 965*
2002 2008	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
2003 2009	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.1.2.2 Generator Undervoltage (Level 1 & 2) ANSI# 27

General notes

Voltage is monitored according to how the parameter "Generator voltage measuring" (parameter 1851 ➡ p. 431) is configured. This controller provides the user with two alarm levels for generator undervoltage. Both alarms are definite time alarms.

Monitoring for undervoltage faults is performed in two steps.

> *If this protective function is triggered, the display indicates "Gen. undervoltage 1" or "Gen. undervoltage 2" and the logical command variable "06.07" or "06.08" will be enabled.*

Refer to ➡ *Chapter 9.1.1 “Triggering Characteristics” on page 673* for the triggering characteristic of this monitoring function. The diagrams listed there show a frequency trend and the associated pickup times and length of the alarms.

> *The parameter limits listed below have identical setting ranges. Each parameter may be configured with different settings to create unique trip characteristics for specific thresholds.*

This monitoring function is disabled when the idle mode (➡ Chapter 4.4.1.4 "Idle Mode" on page 176) is active.

ID	Parameter	CL	Setting range [Default]	Description
2050 2056	**Monitoring**	2	**[On]**	Undervoltage monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: Level 1 limit < limit 2).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
2054 2060	**Limit**	2	50.0 to 150.0% 2054: **[92.0%]** 2060: **[88.0%]** (Hysteresis: 0.7%) (Reset Delay: 80 ms)	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or exceeded for at least the delay time without interruption, the action specified by the alarm class is initiated. **Notes** This value refers to the System rated frequency (parameter 1766 ➡ p. 431).
2055 2061	**Delay**	2	0.02 to 99.99 s 2055: **[5.00 s]** 2061: **[0.30 s]**	If the monitored generator voltage value falls below the threshold value for the delay time configured here, an alarm will be issued. **Notes** If the monitored generator voltage exceeds the threshold (plus the hysteresis) before the delay expires the time will be reset.
2051 2057	**Alarm class**	2	Class A/B/C/D/E/F, Control 2051: **[B]** 2057: **[F]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to ➡ *Chapter 9.5.1 "Alarm Classes" on page 965*
2052 2058	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
2053 2059	**Enabled**	2	Always	Monitoring for this fault condition is continuously enabled.
			[87.70 LM:Eng.mon]	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.1.2.3 Generator Voltage Asymmetry

General notes

The voltage asymmetry monitors absolute value of all three phase-phase voltage difference: $dV_1=|V_{12}- V_{23}|$, $dV_2=|V_{23}- V_{31}|$ and $dV_3=|V_{31}- V_{12}|$. If one of measured dV_1, dV_2 or dV_3 exceeds a configured permissible asymmetrical limit, an alarm is issued.

The percentage of permissible asymmetrical limit refers to the generator rated voltage.

If this protective function is triggered, the display indicates "Gen. volt. asymmetry" and the logical command variable "06.18" will be enabled.

Refer to ➪ *Chapter 9.1.1 "Triggering Characteristics" on page 673* for the triggering characteristic of this monitoring function.

This monitoring function is only enabled if Generator voltage measuring (parameter 1851 ➪ p. 431) is configured to "3Ph 4W" or "3Ph 3W".

ID	Parameter	CL	Setting range [Default]	Description
3900	**Monitoring**	2	**[On]**	Voltage asymmetry monitoring is carried out according to the following parameters.
			Off	No monitoring is carried out.
3903	**Limit**	2	0.5 to 15.0% **[10.0%]** (Hysteresis: 0.5%) (Reset Delay: 80 ms)	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or exceeded for at least the delay time without interruption, the action specified by the alarm class is initiated. **Notes** This value refers to the Generator rated voltage (parameter 1766 ➪ p. 431).
3904	**Delay**	2	0.02 to 99.99 s **[5.00 s]**	If the monitored generator voltage asymmetry exceeds the threshold value for the delay time configured here, an alarm will be issued. **Notes** If the monitored generator voltage asymmetry falls below the threshold (minus the hysteresis) before the delay expires the time will be reset
3901	**Alarm class**	2	Class A/B/C/D/E/F, Control **[F]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to ➪ *Chapter 9.5.1 "Alarm Classes" on page 965*
3902	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
3905	**Enabled**	2	Always	Monitoring for this fault condition is continuously enabled.
			[87.70 LM:Eng.mon]	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.1.3 Generator Frequency Monitoring

4.5.1.3.1 Plausibility Check of Voltages' AC Wiring

General Notes

The easYgen-3000XT detects the frequency out of up to six voltages (L1-N, L2-N, L3-N, L1-L2, L2-L3 and L3-L1). The frequency measurement (of all three systems) additionally checks the values on plausibility. With this monitoring the easYgen can detect wrong wiring issues.

> ***Wrong Wiring Issue***
> *It might occur that for example a generator frequency is measured even if the generator is not running. This can happen e.g. if PE (terminal 61) is not connected, the generator neutral connection is broken, and mains is energized with 1Ph2W connection. In this case a potential shift occurs which could lead to "ghostly" voltages at the generator (or busbar, or mains) phase-neutral system. This voltages lead to a frequency measurement even if no voltage is detected in the generator phase-phase system.*

The *"Plausibility AC wiring "* monitoring is introduced to indicate such situations at generator, busbar, and mains measurement. These alarms are tripping if only "Phase-Phase" or only "Phase-Neutral" frequency is detected. If such an alarm ("Gen. AC wiring", "Busbar 1 AC wiring" or "Mains AC wiring" has tripped please check all "Phase-Phase" and "Phase-Neutral" voltages via HMI or Toolkit to get more information and check the AC wiring.

> *This "Plausibility AC wiring " monitoring function is only active if the wiring can provide "Phase-Phase" and "Phase-Neutral" values.*

The plausibility monitoring offers one setting for all three measurement systems. The Monitor is placed under: *"Parameter ➔ Configure: Monitoring ➔ Miscellaneous: Other monitoring"*.The alarm indications are called Gen. .../Busbar .../Mains AC wiring (see *Chapter 9.5.3 "Status Messages" on page 966*).

ID	Parameter	CL	Setting range [Default]	Description
1964	**Monitoring**	2	**[On]**	Enabling Plausibility AC Wiring monitoring.
			Off	Monitoring is disabled
1965	**Delay**	2	00.2 to 99.99 s **[00.30]**	If the monitored value undershoots the threshold value for the delay time configured here, an alarm will be issued.
1966	**Alarm class**	2	Class A, B, C, D, E, F, Control **[Class B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
1967	**Self acknowledge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected.
1968	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.

ID	Parameter	CL	Setting range [Default]	Description
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.1.3.2 Generator Overfrequency (Level 1 & 2) ANSI# 81O

General notes

This controller provides the user with two alarm levels for generator overfrequency. Both alarms are definite time alarms.

Monitoring for overfrequency faults is performed in two steps.

If this protective function is triggered, the display indicates "Gen. overfrequency 1" or "Gen. overfrequency 2" and the logical command variable "06.01" or "06.02" will be enabled.

Refer to ⇘ *Chapter 9.1.1 "Triggering Characteristics" on page 673* for the triggering characteristic of this monitoring function. The diagrams listed there show a frequency trend and the associated pickup times and length of the alarms.

The parameter limits listed below have identical setting ranges. Each parameter may be configured with different settings to create unique trip characteristics for specific thresholds.

ID	Parameter	CL	Setting range [Default]	Description
1900 1906	**Monitoring**	2	**[On]**	Overfrequency monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: Level 1 limit < limit 2).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
1904 1910	**Limit**	2	50.0 to 140.0% 1904: **[110.0%]** 1910: **[115.0%]** (Hysteresis: 0.05 Hz) (Reset Delay: 80 ms)	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or exceeded for at least the delay time without interruption, the action specified by the alarm class is initiated. **Notes** This value refers to the System rated frequency (parameter 1750 ⇘ p. 429).
1905 1911	**Delay**	2	0.02 to 99.99 s 1905: **[1.50 s]** 1911: **[0.30 s]**	If the monitored generator frequency value exceeds the threshold value for the delay time configured here, an alarm will be issued. **Notes** If the monitored generator frequency falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.

ID	Parameter	CL	Setting range [Default]	Description
1901 1907	**Alarm class**	2	Class A/B/C/D/E/F, Control 1901: **[B]** 1907: **[F]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ⇨ *Chapter 9.5.1 "Alarm Classes" on page 965*
1902 1908	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
1903 1909	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.1.3.3 Generator Underfrequency (Level 1 & 2) ANSI# 81O

General notes

This controller provides the user with two alarm levels for generator underfrequency. Both alarms are definite time alarms.

Monitoring for underfrequency faults is performed in two steps.

If this protective function is triggered, the display indicates "Gen. underfrequency 1" or "Gen. underfrequency 2" and the logical command variable "06.01" or "06.02" will be enabled.

Refer to ⇨ *Chapter 9.1.1 "Triggering Characteristics" on page 673* for the triggering characteristic of this monitoring function. The diagrams listed there show a frequency trend and the associated pickup times and length of the alarms.

The parameter limits listed below have identical setting ranges. Each parameter may be configured with different settings to create unique trip characteristics for specific thresholds.

ID	Parameter	CL	Setting range [Default]	Description
1950 1956	**Monitoring**	2	**[On]**	Underfrequency monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: Level 1 limit < limit 2).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
1954 1960	**Limit**	2	50.0 to 130.0% 1954: **[90.0%]** 1960: **[84.0%]** (Hysteresis: 0.05 Hz) (Reset Delay: 80 ms)	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or lower for at least the delay time without interruption, the action specified by the alarm class is initiated. **Notes** This value refers to the System rated frequency (parameter 1750 ➡ p. 429).
1955 1961	**Delay**	2	0.02 to 99.99 s 1955: **[5.00 s]** 1961: **[0.30 s]**	If the monitored generator frequency value falls below the threshold value for the delay time configured here, an alarm will be issued.
				Notes If the monitored generator frequency falls below the threshold (plus the hysteresis) before the delay expires the time will be reset.
1951 1957	**Alarm class**	2	Class A/B/C/D/E/F, Control 1951: **[B]** 1957: **[F]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ➡ *Chapter 9.5.1 “Alarm Classes” on page 965*
1952 1958	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
1953 1959	**Enabled**	2	Always	Monitoring for this fault condition is continuously enabled.
			[87.70 LM:Eng.mon]	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.1.4 Generator Current Monitoring

4.5.1.4.1 Generator Time-Overcurrent (Level 1, 2 & 3) ANSI# 50/51

General notes

Current is monitored according to how the parameter "Generator current measuring" (parameter 1850 ➡ p. 432) is configured. This controller provides the user with three definite time alarm levels for generator overcurrent faults.

Monitoring of the maximum phase current is performed in three steps. Every step can be provided with a delay time independent of the other steps.

If this protective function is triggered, the display indicates "Gen. overcurrent 1", "Gen. overcurrent 2", or "Gen. overcurrent 3" and the logical command variable "06.09", "06.10.", or "06.11" will be enabled.

Refer to ✎ *Chapter 9.1.1 "Triggering Characteristics" on page 673* for the triggering characteristic of this monitoring function.

ID	Parameter	CL	Setting range [Default]	Description
2200 2206 2212	**Monitoring**	2	**[On]**	Overcurrent monitoring is carried out according to the following parameters. Monitoring is performed at three levels. All three values may be configured independent from each other (prerequisite: Level 1 < Level 2 < Level 3).
			Off	Monitoring is disabled for Level 1 limit, Level 2 limit, and/or Level 3 limit.
2204 2210 2216	**Limit**	2	50.0 to 300.0% 2204: **[110.0%]** 2210: **[150.0%]** 2216: **[250.0%]** (Hysteresis: 1%) (Reset Delay: 1 s)	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or exceeded for at least the delay time without interruption, the action specified by the alarm class is initiated. **Notes** This value refers to the System rated frequency (parameter 1754 ✎ p. 431).
2205 2211 2217	**Delay**	2	0.02 to 99.99 s 2205: **[30.00 s]** 2211: **[1.00 s]** 2217: **[0.40 s]**	If the monitored generator current exceeds the threshold value for the delay time configured here, an alarm will be issued. **Notes** If the monitored generator current falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.
2224 2225 2226	**Voltage restraint monitoring**	2	Yes	The control provides voltage restrained overcurrent relay according to ANSI 51 V individually for each generator current monitoring function. For details refer to ✎ *Chapter 4.5.1.4.3 "Generator Voltage Restrained Overcurrent Monitoring - ANSI #51" on page 329.*
			[No]	Voltage restrained monitoring is disabled.
2201 2207 2213	**Alarm class**	2	Class A/B/C/D/E/F, Control 2201: **[E]** 2207: **[F]** 2213: **[F]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to ✎ *Chapter 9.5.1 "Alarm Classes" on page 965*
2202 2208 2214	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
2203 2209 2215	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.1.4.2 Generator Inverse Time-Overcurrent ANSI# IEC 255

General notes

The current produced by the generator is monitored depending on how parameter "Generator current measuring" (parameter 1850 ↳ p. 432) is configured. If an overcurrent condition is detected, the fault recognition time is determined by the configured tripping characteristic curve and the measured current.

The tripping time is faster as the measured current increases in magnitude according to a defined curve. According to IEC 255 three different characteristics are available.

If this protective function is triggered, the display indicates "Inv. time overcurr." and the logical command variable "06.22" will be enabled.

- "Normal inverse" characteristic:
  $t = 0.14 / (I/I_P)^{0.02} - 1) * t_P[s]$
- "Highly inverse" characteristic:
  $t = 13.5 / (I/I_P) - 1) * t_P[s]$
- "Extremely inverse" characteristic:
  $t = 80 / (I/I_P)^2 - 1) * t_P[s]$

Variables:

- t =tripping time
- t_P = setting value time
- I = measured fault current
- I_P = setting value current

Please take into account during configuration:

- for I_{start}:
  $I_{start} > I_n$ and $I_{start} > I_P$
- for I_P the smaller I_P is, the steeper is the slope of the tripping curve

> *The maximum tripping time is 327 s. If a tripping time greater than 327 s is configured, an overcurrent fault condition will not be recognized.*

Characteristics

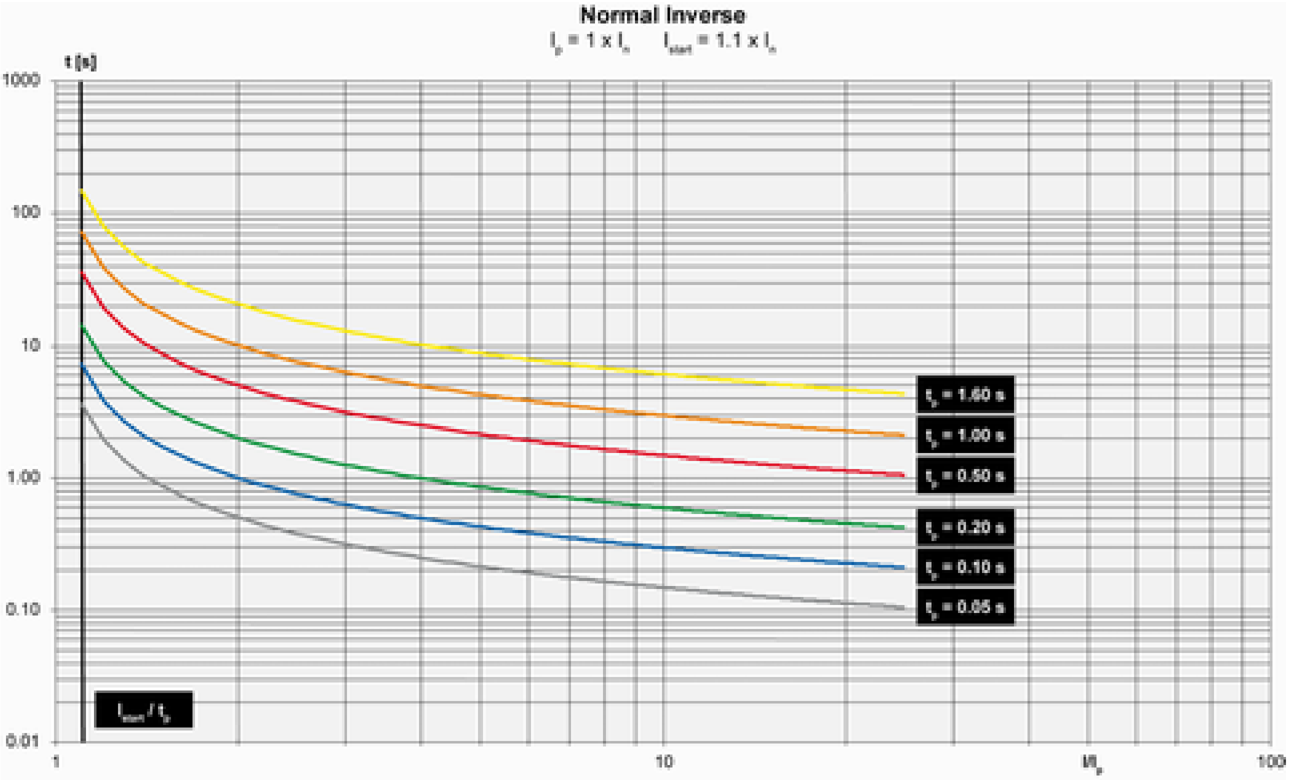


Fig. 174: "Normal inverse" characteristic

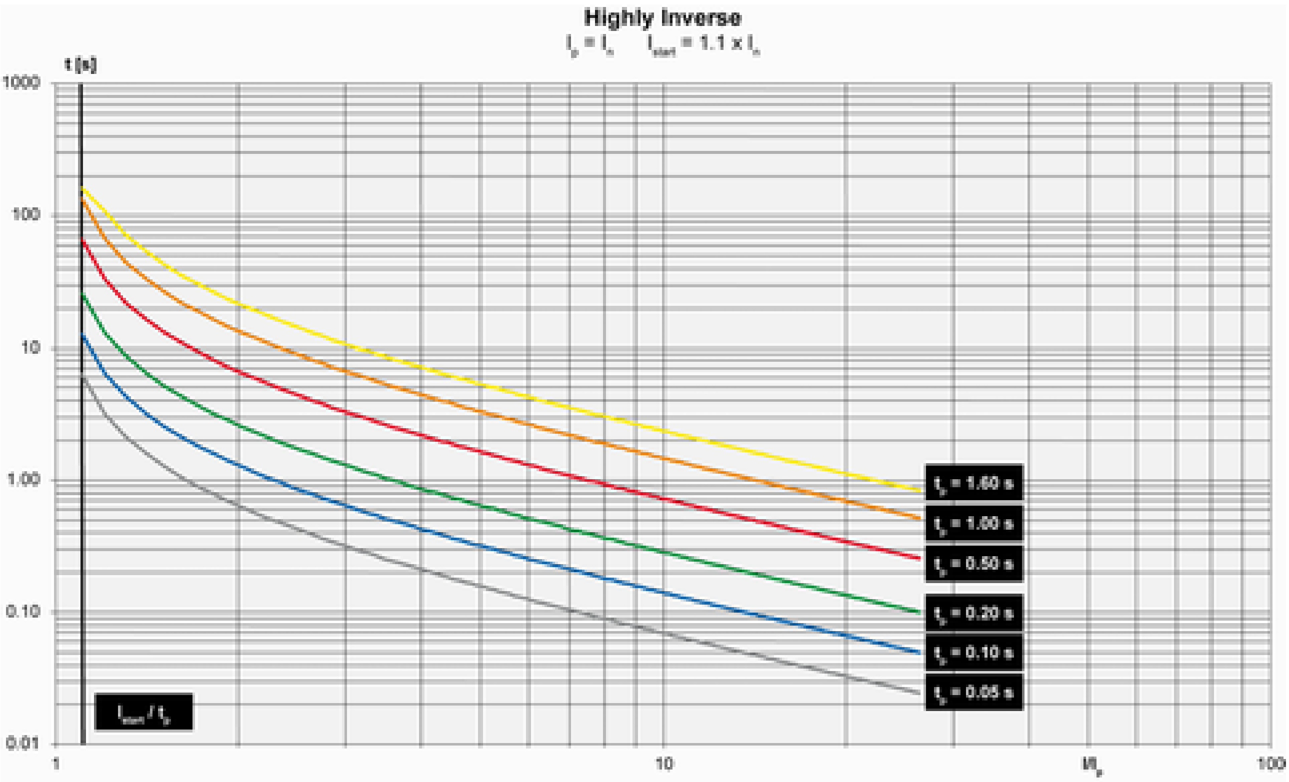


Fig. 175: "Highly inverse" characteristic

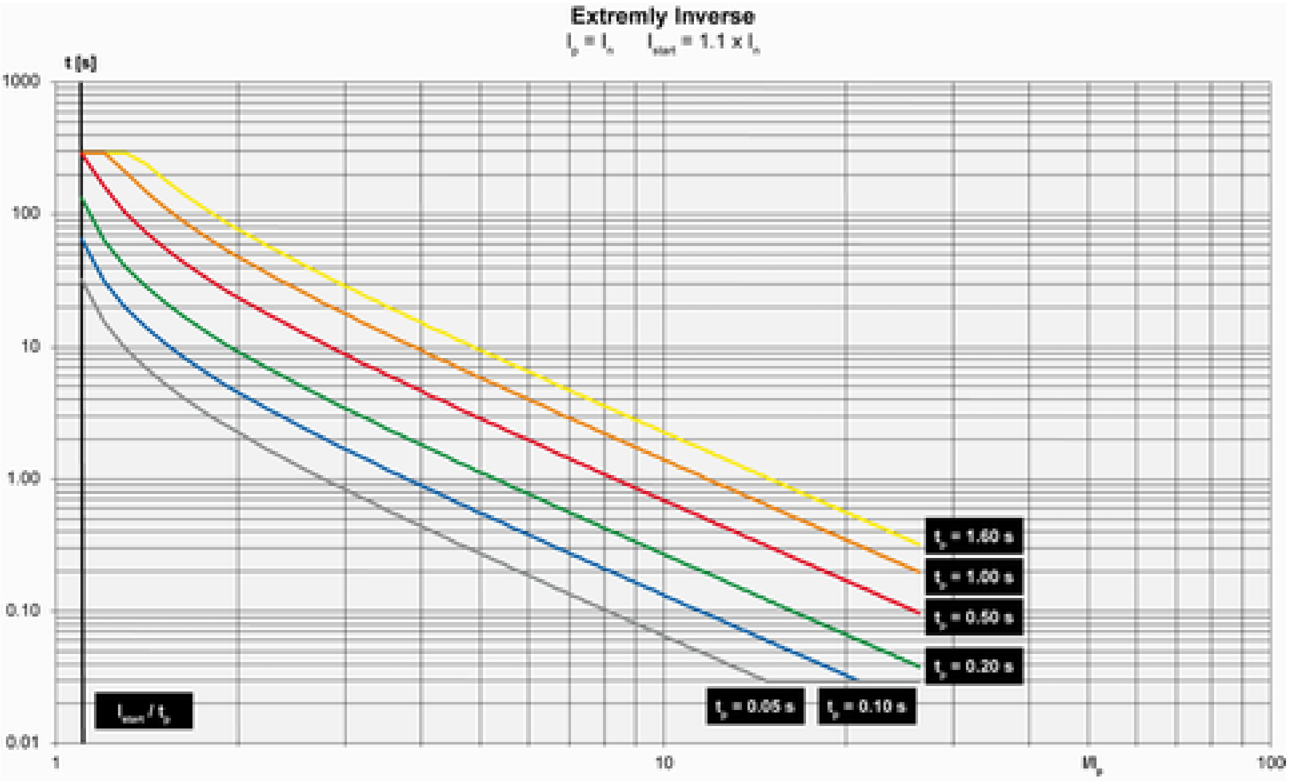


Fig. 176: "Extremely inverse" characteristic

ID	Parameter	CL	Setting range [Default]	Description
4030	**Monitoring**	2	**[On]**	Overcurrent monitoring is carried out according to the following parameters.
			Off	No monitoring is carried out.
4034	**Inverse time characteristic**	2		Selection of the used overcurrent characteristic.
			[Normal]	The "normal inverse" tripping curve will be used
			High	The "highly inverse" tripping curve will be used
			Extreme	The "extremely inverse" tripping curve will be used.
4035	**Inverse time overcurrent T_p=**	2	0.01 to 1.99 s **[0.06 s]**	Time constant T_p used to calculate the characteristics.
4036	**Inverse time overcurr. I_P =**	2	10.0 to 300.0% **[100.0%]**	Current constant I_P used to calculate the characteristics.
4037	**Inv time over-curr. I_{start} =**	2	100.0 to 300.0% **[115.0%]** (Hysteresis: 1%) (Reset Delay: 1 s)	Lower tripping value for inverse time-overcurrent protection. If the monitored current is less than I_{start}, the inverse time-overcurrent protection does not trip. If I_{start} is less than I_P, I_P is used as the lower tripping value.
2227	**Voltage restraint moni-toring**	2	Yes	The control provides voltage restrained inverse time overcurrent monitoring. For general information about voltage restrained monitoring refer to ↳ *Chapter 4.5.1.4.3 "Generator Voltage Restrained Overcurrent Monitoring - ANSI #51" on page 329.*
			[No]	Voltage restrained monitoring is disabled.
4031	**Alarm class**	2	Class A/B/C/D/E/F, Control	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.

ID	Parameter	CL	Setting range [Default]	Description
			[F]	**Notes** For additional information refer to *Chapter 9.5.1 "Alarm Classes" on page 965*
4032	**Self acknowl-edge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
4033	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.1.4.3 Generator Voltage Restrained Overcurrent Monitoring - ANSI #51

General Notes

This function is an add-on to the over current monitoring and decreases the activation limit dependent on the amount of voltage dip. Especially in near to generator located over currents it can lead to situations, where the failure current remains under the generator rated current. In this case a normal over current monitoring does not trip. The voltage restraint over current monitoring considers this and decreases the configured over current limit according to a modification factor, that it comes to a trip.

The considered voltages are either the single phase-phase or phase-neutral voltages. (Refer to "Generator voltage monitoring" 1770 p. 317). The monitor takes always the lowest considered voltage into account for calculating the modification factor.

Voltage restraint over current monitoring can be activated individually for "Generator over current (limit 1-3)" and Generator inverse time over current, if the according parameter "Voltage restraint monitoring" is switched to "Yes".

The modification factor depends on the measured voltage in percent of rated voltage. It is defined by a characteristic which is defined by three parameters (ID 2230, 2231, 2232 cf. figure). This characteristic is taken into account for all over current monitoring functions, if enabled.

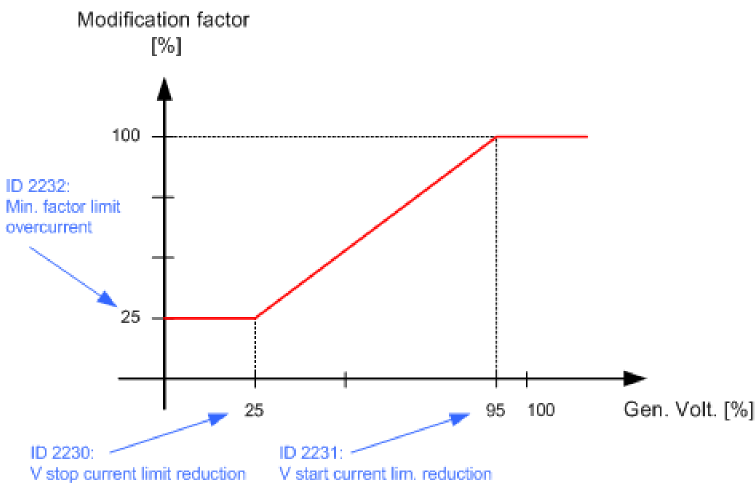


Fig. 177: Example for generator voltage restraint overcurrent characteristic

Beginning at a voltage dip of 95% rated voltage (configured by 2231), the modification factor will be linearly reduced (cf. figure 86). If the voltage reaches 25% or less (configured by 2230) the modification factor will remain at 25% (configured by 2232).

Now the effective limit is calculated as:

Effective limit [%] = Limit [%] * Modification Factor [%]/ 100[%]

Supposed the configured limit of an over current monitor is 110% and the measured voltage is 25%:

Effective limit [%] =110% * 25%/100% = 27.5%

The V (voltage) start value configuration must be entered higher as the V stop value configuration. Otherwise the function does not work properly!

ID	Parameter	CL	Setting range [Default]	Description
2231	V start current lim. reduction	2	5.0 ... 100.0% **[95.0%]**	Voltage for starting current limitation reduction
2230	V stop current lim. reduction	2	5.0 ... 100.0% **[25.0%]**	Voltage for stopping current limitation reduction
2232	Min. factor limit overcurrent	2	5.0 ... 100.0% **[25.0%]**	Minimum factor limit for current limitation reduction

4.5.1.5 Generator Power Monitoring

4.5.1.5.1 Generator Overload IOP (Level 1 & 2) ANSI# 32

General notes

IOP = islanded Operation in Parallel

The power produced by the generator is calculated from the voltage and current values measured in accordance with how parameters "Generator voltage measuring" (parameter 1851 ➡ p. 431) and "Generator current measuring" (parameter 1850 ➡ p. 432) are configured. The controller monitors if the system is in a mains parallel or an islanded operation.

When the controller detects that the system is operating islanded from the mains, the Generator Overload MOP (refer to ➡ *Chapter 4.5.1.5.2 "Generator Overload MOP (Level 1 & 2) ANSI# 32" on page 332*) monitoring is disabled. If the measured generator real power during an islanded operation is above the configured limit an alarm will be issued.

If this protective function is triggered, the display indicates "Gen. Overload IOP 1" or "Gen. Overload IOP 2" and the logical command variable "06.14" or "06.15" will be enabled.

Refer to ➡ *Chapter 9.1.1 "Triggering Characteristics" on page 673* for the triggering characteristic of this monitoring function.

ID	Parameter	CL	Setting range [Default]	Description
2300 2306	**Monitoring**	2	**[On]**	Overload monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: Level 1 limit < Level 2 limit).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
2304 2310	**Limit**	2	50.0 to 300.00% 2304: **[110.0%]** 2310: **[120.0%]** (Hysteresis: 1%) (Reset Delay: 80 ms)	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or exceeded for at least the delay time without interruption, the action specified by the alarm class is initiated. **Notes** This value refers to the Generator rated active power (parameter 1752 ➡ p. 431).
2305 2311	**Delay**	2	0.02 to 99.99 s 2305: **[11.00 s]** 2311: **[0.10 s]**	If the monitored generator load exceeds the threshold value for the delay time configured here, an alarm will be issued. **Notes** If the monitored generator load falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.
2301 2307	**Alarm class**	2	Class A/B/C/D/E/F, Control 2301: **[B]** 2307: **[D]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to ➡ *Chapter 9.5.1 "Alarm Classes" on page 965*
2302 2308	**Self acknowledge**	2	Yes	The control automatically clears the alarm if the fault condition is no longer detected.

ID	Parameter	CL	Setting range [Default]	Description
			[No]	The control does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
2303 2309	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.1.5.2 Generator Overload MOP (Level 1 & 2) ANSI# 32

General notes

MOP = Mains Parallel Operation

The power produced by the generator is calculated from the voltage and current values measured in accordance with how parameters "Generator voltage measuring" (parameter 1851 ↳ p. 431) and "Generator current measuring" (parameter 1850 ↳ p. 432) are configured.

The controller monitors if the system is in a mains parallel or an islanded operation. When the controller detects that the system is operating parallel with the mains, the Generator Overload IOP (refer to ↳ *Chapter 4.5.1.5.1 "Generator Overload IOP (Level 1 & 2) ANSI# 32" on page 331*) monitoring is disabled. If the measured generator real power during a mains parallel operation is above the configured limit an alarm will be issued.

If this protective function is triggered, the display indicates "Gen. Overload MOP 1" or "Gen. Overload MOP 2" and the logical command variable "06.23" or "06.24" will be enabled.

Refer to ↳ *Chapter 9.1.1 "Triggering Characteristics" on page 673* for the triggering characteristic of this monitoring function.

ID	Parameter	CL	Setting range [Default]	Description
2350 2356	**Monitoring**	2	**[On]**	Overload monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: Level 1 limit < Level 2 limit).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.

ID	Parameter	CL	Setting range [Default]	Description
2354 2360	**Limit**	2	50.0 to 300.00% 2354: **[105.0%]** 2360: **[110.0%]** (Hysteresis: 1%) (Reset Delay: 80 ms)	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or exceeded for at least the delay time without interruption, the action specified by the alarm class is initiated. **Notes** This value refers to the Generator rated active power (parameter 1752 p. 431).
2355 2361	**Delay**	2	0.02 to 99.99 s 2355: **[5.00 s]** 2361: **[0.10 s]**	If the monitored generator load exceeds the threshold value for the delay time configured here, an alarm will be issued. **Notes** If the monitored generator load falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.
2351 2357	**Alarm class**	2	Class A/B/C/D/E/F, Control 2351: **[B]** 2357: **[D]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to *Chapter 9.5.1 "Alarm Classes" on page 965*
2352 2358	**Self acknowledge**	2	Yes	The control automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
2353 2359	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.1.5.3 Generator Reverse/Reduced Power (Level 1 & 2) ANSI# 32R/F

General notes

The power produced by the generator is calculated from the voltage and current values measured in accordance with how parameters "Generator voltage measuring" (parameter 1851 p. 431) and "Generator current measuring" (parameter 1850 p. 432) are configured.

The generator power limits may be configured for reduced power and/or reverse power depending on the threshold values entered. The note below explains how a reduced or reverse power limit is configured.

If the single-phase or three-phase measured real power is below the configured limit of the reduced load or below the configured value of the reverse power, an alarm will be issued.

If this protective function is triggered, the display indicates "Gen. rev./red. pwr.1" or "Gen. rev./red. pwr.2" and the logical command variable "06.12" or "06.13" will be enabled.

Refer to ↬ *Chapter 9.1.1 "Triggering Characteristics" on page 673* for the triggering characteristic of this monitoring function.

> ***Definition***
>
> – *Reduced power Fault initiated if the monitored real power falls below the configured (positive) limit.*
>
> – *Reverse power Fault initiated if the direction of the monitored real power reverses and the configured (negative) limit is exceeded.*

Configuration examples

The values for reverse /reduced power monitoring can be configured as follows:

- Level 1 limit = Positive and Level 2 limit = Positive
  (whereas Level 1 limit > Level 2 limit > 0 %)
- Both limits are configured for reduced power monitoring.

Example

- Rated power is 100 kW, Level 1 limit = 5 % > Level 2 limit = 3 %
- Tripping if real power falls below 5 kW (Level 1 limit) or 3 kW (Level 2 limit)

- Level 1 limit = Negative and Level 2 limit = Negative
  (whereas Level 2 limit < Level 1 limit < 0%)
  Both limits are configured for reverse power monitoring.

Example

- Rated power is 100 kW, Level 1 limit = -3 % > Level 2 limit = -5 %
- Tripping if real power falls below -3 kW (Level 1 limit) or -5 kW (Level 2 limit)

- Level 1 limit = Positive and Level 2 limit = Negative
  (whereas Level 1 limit > 0 % > Level 2 limit)
- Level 1 is configured for reduced power monitoring and
- Level 2 is configured for reverse power monitoring.

Example

- Rated power is 100 kW, Level 1 limit = 3 % > Level 2 limit = -5 %
- Tripping if real power falls below 3 kW (Level 1 limit) or -5 kW (Level 2 limit)

ID	Parameter	CL	Setting range [Default]	Description
2250 2256	**Monitoring**	2	**[On]**	Reverse/reduced power monitoring is carried out according to the following parameters. Both values may be configured independent from each other.
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
2254 2260	**Limit**	2	-99.9 to 99.9% 2254: **[-3.0%]** 2260: **[-5.0%]** (Hysteresis: 1%)	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or fallen below for at least the delay time without interruption, the action specified by the alarm class is initiated.

ID	Parameter	CL	Setting range [Default]	Description
			(Reset Delay: 80 ms)	**Notes** This value refers to the Generator rated active power (parameter 1752 ⇘ p. 431).
2255 2261	**Delay**	2	0.02 to 99.99 s 2255: **[5.00 s]** 2261: **[5.00 s]**	If the monitored generator power falls below the threshold value for the delay time configured here, an alarm will be issued. **Notes** If the monitored generator power exceeds or falls below the threshold (plus/ minus the hysteresis) again before the delay expires the time will be reset.
2251 2257	**Alarm class**	2	Class A/B/C/D/E/F, Control 2251: **[B]** 2257: **[F]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to ⇘ *Chapter 9.5.1 "Alarm Classes" on page 965*
2252 2258	**Self acknowl-edge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
2253 2259	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.1.5.4 Generator Unbalanced Load (Level 1 & 2) ANSI# 46

General notes

Unbalanced load is monitored according to how the parameters "Generator voltage measuring" (parameter 1851 ⇘ p. 431) and "Generator current measuring" (parameter 1850 ⇘ p. 432) are configured. The unbalanced load alarm monitors the individual phase currents of the generator. The percentage threshold value is the permissible variation of one phase from the average measured current of all three phases.

> *If this protective function is triggered, the display indicates "Unbalanced load 1" or "Unbalanced load 2" and the logical command variable "06.16" or "06.17" will be enabled.*

Refer to ⇘ *Chapter 9.1.1 "Triggering Characteristics" on page 673* for the triggering characteristic of this monitoring function.

This monitoring function is only enabled when Generator voltage measuring (parameter 1851 *➪ p. 431**) is configured to "3Ph 4W" or "3Ph 3W" and Generator current measuring (parameter 1850* *➪ p. 432**) is configured to "L1 L2 L3".*

Formulas

	Phase L1	Phase L2	Phase L3
Exceeding	$I_{L1} \geq (3 * I_N * P_A + I_{L2} + I_{L3}) / 2$	$I_{L2} \geq (3 * I_N * P_A + I_{L1} + I_{L3}) / 2$	$I_{L3} \geq (3 * I_N * P_A + I_{L1} + I_{L2}) / 2$
Falling below	$I_{L1} \leq (I_{L2} + I_{L3} - 3 * I_N * P_A) / 2$	$I_{L2} \leq (I_{L1} + I_{L3} - 3 * I_N * P_A) / 2$	$I_{L3} \leq (I_{L1} + I_{L2} - 3 * I_N * P_A) / 2$

Examples

Exceeding a limit value

- Current in phase L1 = current in phase L3
- Current in phase L2 has been exceeded
- P_A = tripping value percentage (example 10 %)
- I_N = rated current (example 300 A)

Tripping value for phase L2:

- $I_{L2} \geq (3 * I_N * P_A + I_{L1} + I_{L3}) / 2$
  = (3 * 300 A * 10% + 300 A + 300 A) / 2
  = ((3 * 300 A * 10) / 100 + 300 A + 300 A) / 2
  = 345 A

Falling below a limit value

- Current in phase L2 = current in phase L3
- Current in phase L1 has been undershot
- P_A = tripping value percentage (example 10 %)
- I_N = rated current (example 300 A)

Tripping value for phase L1:

- $I_{L1} \leq (I_{L2} + I_{L3} - 3 * I_N * P_A) / 2$
  = (300 A + 300 A - 3 * 300 A * 10%) / 2
  = (300 A + 300 A - (3 * 300 A * 10) / 100)) / 2
  = 255 A

ID	Parameter	CL	Setting range [Default]	Description
2400 2406	**Monitoring**	2	**[On]**	Unbalanced load monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (condition: Level 1 < Level 2).
			Off	No monitoring is carried out for either Level 1 limit or Level 2 limit.
2404 2410	**Limit**	2	0.0 to 100.0% 2404: **[10.0%]** 2410: **[15.0%]** (Hysteresis: 0.5%)	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or exceeded for at least the delay time without interruption, the action specified by the alarm class is initiated.

ID	Parameter	CL	Setting range [Default]	Description
			(Reset Delay: 80 ms)	**Notes** This value refers to the "Generator rated current" (parameter 1754 ➡ p. 431)
2405 2411	**Delay**	2	0.02 to 99.99 s 2405: **[5.00 s]** 2411: **[1.00 s]**	If the monitored current exceeds the threshold value for the delay time configured here, an alarm will be issued.
				Notes If the monitored current falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.
2401 2407	**Alarm class**	2	Class A/B/C/D/E/F, Control 2401: **[B]** 2407: **[E]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ➡ *Chapter 9.5.1 "Alarm Classes" on page 965*
2402 2408	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
2403 2409	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.1.5.5 Load sharing

Active power load sharing mismatch

ID	Parameter	CL	Setting range [Default]	Description
5100	**Monitoring**	2	On	Load share monitoring is carried out according to the following parameters.
			[Off]	Monitoring is disabled.
4841	**Limit**	2	1.0 to 100.0% **[30.0%]**	The percentage value that is to be monitored for the threshold limit is defined here. If this value is reached or exceeded for at least the delay time without interruption, the action specified by the alarm class is initiated.
				Notes This value is rated to the absolute difference between generator rated power (parameter 1752 ➡ p. 431) and the percent average power of the other devices. The generator rated power is modified by the derating factor if derating is activated.
5104	**Delay**	2	1.0 to 999.9 s **[10.0 s]**	If the monitored generator power value exceeds the threshold value for the delay time configured here, an alarm will be issued.
				Notes If the monitored generator power falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.

ID	Parameter	CL	Setting range [Default]	Description
5101	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to *Chapter 9.5.1 "Alarm Classes" on page 965*
5102	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
5103	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

Reactive power load sharing mismatch

ID	Parameter	CL	Setting range [Default]	Description
5106	**Monitoring**	2	On	Load share monitoring is carried out according to the following parameters.
			[Off]	Monitoring is disabled.
4842	**Limit**	2	1.0 to 100.0% **[30.0%]**	The percentage value that is to be monitored for the threshold limit is defined here. If this value is reached or exceeded for at least the delay time without interruption, the action specified by the alarm class is initiated. **Notes** This value is rated to the absolute difference between generator rated reactive power (parameter 1758 p. 431) and the percent average reactive power of the other devices. The generator rated reactive power is modified by the derating factor if derating is activated.
5110	**Delay**	2	1.0 to 999.9 s **[10.0 s]**	If the monitored generator power value exceeds the threshold value for the delay time configured here, an alarm will be issued. **Notes** If the monitored generator power falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.
5107	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to *Chapter 9.5.1 "Alarm Classes" on page 965*
5108	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).

ID	Parameter	CL	Setting range [Default]	Description
5109	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.1.5.6 Engine/Generator Active Power Mismatch

General notes

If enabled, this monitoring function becomes only active if generator power control is enabled (refer to ↳ *Chapter 4.4.4.5 "Load Control" on page 266*). If the measured generator power deviates from the power setpoint by a value exceeding the limit configured in parameter 2925 ↳ p. 339 for a time exceeding the delay configured in parameter 2923 ↳ p. 339, an alarm will be issued.

If this protective function is triggered, the display indicates "Gen act.pwr mismatch" and the logical command variable "06.29" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
2920	**Monitoring**	2	**[On]**	Monitoring of the generator active power mismatch is carried out according to the following parameters.
			Off	Monitoring is disabled.
2925	**Limit**	2	1.0 to 30.0% **[5.0%]**	If the difference between the measured generator power and the power setpoint exceeds this value for at least the delay time (parameter 2923 ↳ p. 339) without interruption, the action specified by the alarm class is initiated.
				Notes This value refers to the generator rated active power (parameter 1752 ↳ p. 431).
2923	**Delay**	2	3 to 9999 s **[30 s]**	If the monitored active power mismatch exceeds the threshold value configured in parameter 2925 ↳ p. 339 for the delay time configured here, an alarm will be issued.
				Notes If the monitored active power mismatch falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.
2921	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ↳ *Chapter 9.5.1 "Alarm Classes" on page 965*

ID	Parameter	CL	Setting range [Default]	Description
2922	**Self acknowl-edge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).

4.5.1.5.7 Engine/Generator Unloading Mismatch

General notes

This monitoring function is always enabled and becomes active when a stop command is issued. Following a stop command, the controller tries to reduce the power before opening the GCB. If the power falls below the unload limit (parameter 3125 ➪ p. 340) before the delay (parameter 3123 ➪ p. 340) expires, a "GCB open" command will be issued. If the controller fails to reduce the power to fall below the unload limit (parameter 3125 ➪ p. 340) before the delay (parameter 3123 ➪ p. 340) expires, a "GCB open" command will be issued together with an alarm.

If this protective function is triggered, the display indicates "Gen. unloading fault" and the logical command variable "06.30" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
3120	**Monitoring**	2	**[On]**	Monitoring of engine unloading is carried out according to the following parameters.
			Off	Monitoring is disabled.
3125	**Unload limit**	2	0.5 to 99.9% **[3.0%]**	If the monitored generator power falls below this value, a "GCB open" command will be issued.
				Notes This value refers to the generator rated active power (parameter 1752 ➪ p. 431).
3123	**Delay**	2	3 to 999 s **[60 s]**	If the monitored generator power does not fall below the limit configured in parameter 3125 ➪ p. 340 before the time configured here expires, a "GCB open" command will be issued together with an alarm.
3121	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ➪ *Chapter 9.5.1 "Alarm Classes" on page 965*
3122	**Self acknowl-edge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).

4.5.1.6 Other Monitoring

4.5.1.6.1 Power Factor - configure generator power factor monitoring

Generator Lagging Power Factor (Level 1 & 2)

General notes

The power factor is monitored for becoming more lagging (i.e. inductive) than an adjustable limit. This limit may be a lagging or leading power factor limit. There are two lagging power factor alarm levels available in the control. This monitoring function may be used for monitoring an overexcitation with a warning and a shut-down alarm level. Both alarms are definite time alarms.

The power factor monitoring

- *is activated,*
  if the generator current expires 5% rated Generator current and
- *is blocked,*
  if the generator current underrun 3% rated Generator current.

Fig. 178 shows an example of a leading and a lagging power factor limit and the power factor range, for which the lagging power factor monitoring issues an alarm.

If this protective function is triggered, the display indicates "Gen. PF lagging 1" or "Gen. PF lagging 2" and the logical command variable "06.25" or "06.26" will be enabled.

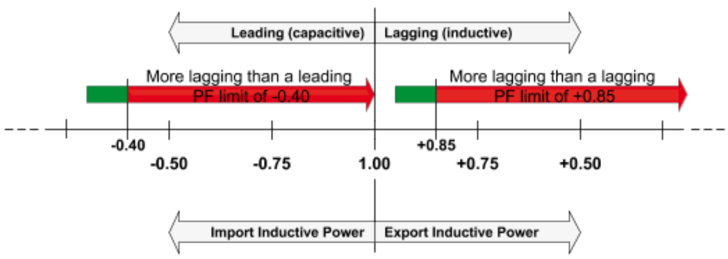


Fig. 178: Generator lagging power factor

ID	Parameter	CL	Setting range [Default]	Description
2325 2331	**Monitoring**	2	**[On]**	Generator lagging power factor monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other.
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
2329 2335	**Limit**	2	-0.999 to 1.000 2329 **[+ 0.900]** 2335: **[+ 0.700]** (Hysteresis: 0.02%) (Reset Delay: 80 ms)	The values that are to be monitored for each threshold limit are defined here. **Notes** If the power factor becomes more lagging (i.e. inductive, Fig. 178) than a lagging PF value (positive) or a leading PF value (negative) for at least the delay time (parameters 2330 ⇘ p. 341 or 2336 ⇘ p. 341) without interruption, the action specified by the alarm class is initiated.
2330 2336	**Delay**	2	0.02 to 99.99 s 2330: **[30.00 s]**	If the monitored generator power factor is more lagging than the configured limit for the delay time configured here, an alarm will be issued.

ID	Parameter	CL	Setting range [Default]	Description
			2336: **[10.00 s]**	**Notes** If the monitored generator power factor returns within the limit before the delay expires the time will be reset.
2326 2332	**Alarm class**	2	Class A/B/C/D/E/F, Control 2326: **[B]** 2332: **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to *Chapter 9.5.1 “Alarm Classes” on page 965*
2327 2333	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
2328 2334	**Enabled**	2	Always	Monitoring for this fault condition is continuously enabled.
			[87.70 LM:Eng.mon]	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

Generator Leading Power Factor (Level 1 & 2)

General notes

The power factor is monitored for becoming more leading (i.e. capacitive) than an adjustable limit. This limit may be a leading or lagging power factor limit. There are two leading power factor alarm levels available in the control. This monitoring function may be used for monitoring an under excitation with a warning and a shutdown alarm level. Both alarms are definite time alarms.

Refer to *Chapter 6.3.1 “Generator Excitation Protection” on page 539* for a detailed description of this monitoring function.

The power factor monitoring

- *is activated,*
  if the generator current expires 5% rated Generator current and
- *is blocked,*
  if the generator current underruns 3% rated Generator current.

Fig. 179 shows an example of a leading and a lagging power factor limit and the power factor range, for which the leading power factor monitoring issues an alarm.

If this protective function is triggered, the display indicates "Gen. PF leading 1" or "Gen. PF leading 2" and the logical command variable "06.27" or "06.28" will be enabled.

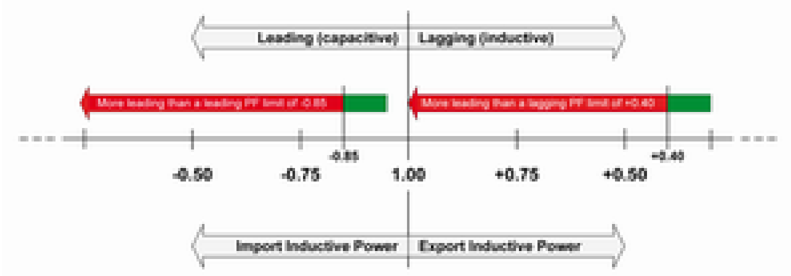


Fig. 179: Generator leading power factor

ID	Parameter	CL	Setting range [Default]	Description
2375 2381	**Monitoring**	2	**[On]**	Generator leading power factor monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other.
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
2379 2385	**Limit**	2	-0.999 to 1.000 2379: **[- 0.900]** 2385: **[- 0.700]** (Hysteresis: 0.02%) (Reset Delay: 80 ms)	The values that are to be monitored for each threshold limit are defined here. **Notes** If the power factor becomes more leading (i.e. capacitive, Fig. 179) than a leading PF value (negative) or a lagging PF value (positive) for at least the delay time (parameters 2380 ➪ p. 343 or 2386 ➪ p. 343) without interruption, the action specified by the alarm class is initiated.
2380 2386	**Delay**	2	0.02 to 99.99 s 2380: **[30.00 s]** 2386: **[10.00 s]**	If the monitored generator power factor is more leading than the configured limit for the delay time configured here, an alarm will be issued. **Notes** If the monitored generator power factor returns within the limit before the delay expires the time will be reset.
2376 2382	**Alarm class**	2	Class A/B/C/D/E/F, Control 2376: **[B]** 2382: **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to ➪ *Chapter 9.5.1 "Alarm Classes" on page 965*
2377 2383	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
2378 2384	**Enabled**	2	Always	Monitoring for fault conditions is continuously enabled.
			[87.70 LM:Eng.mon]	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.1.6.2 Miscellaneous

Generator Ground Fault (Level 1 & 2)

General notes

The generator ground fault is determined differently depending on the following configuration options:

- *Mains current input is configured for mains current*
  (calculated ground fault)
- *Mains current input is configured for ground current*
  (measured ground fault)

Refer to parameter 1854 ⇘ p. 430.

Calculated ground fault

The current produced by the generator is monitored depending on how parameter "Generator current measuring" (parameter 1850 ⇘ p. 432) is configured. The measured three conductor currents IGen-L1, IGen-L2 and IGen-L3 are vectorially totaled (IS = IGen-L1 + IGen-L2 + IGen-L3) and compared with the configured fault limit (the calculated actual value is indicated in the display). If the measured value exceeds the fault threshold limit, a ground fault is present, and an alarm is issued.

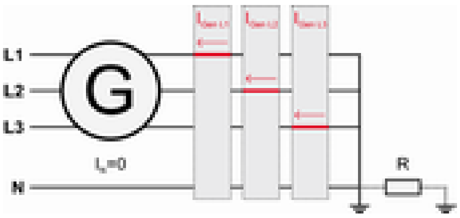


Fig. 180: Generator ground fault - schematic

If this protective function is triggered, the display indicates "Ground fault 1" or "Ground fault 2" and the logical command variable "06.19" or "06.20" will be enabled.

The ground fault protection zone is determined by the location where the generator current transformer are physically installed.

Test

➜ Short-circuit one of the three generator current transformers while the generator is at full load.

⇨ The measured current should read 100% of rated on the two phases that do not have their current transformers short-circuited.

The ground current calculation does not take current on the neutral conductor into consideration. In order for the controller to be able to perform calculated ground fault current protection accurately, the neutral conductor must not conduct current.

The fault threshold value is configured as a percentage. This percentage threshold refers to the generator rated current (parameter 1754 ⇘ p. 431). Due to unavoidable load asymmetries, the minimum value for this parameter should be 10% or greater.

Calculation

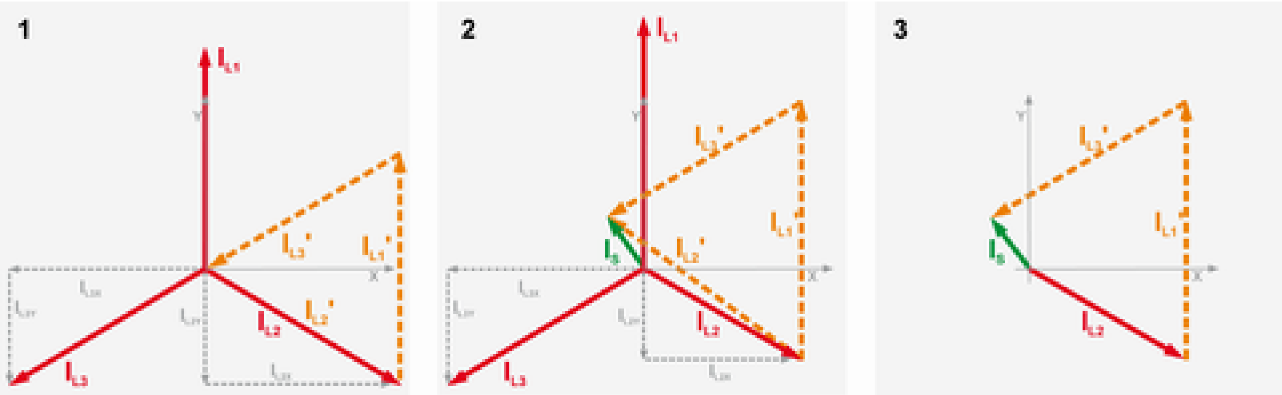


Fig. 181: Generator ground fault - calculation

1 No ground fault
2 Ground fault (with vectorial calculation)
3 Ground fault (I_S = ground fault current)

The ground current I_S is calculated geometrically/vectorially. The pointers for phase currents IL1 and IL2 are parallel shifted and lined up as shown in (Fig. 181/1).

The pointer between the neutral point and the point of the shifted pointer I_{L2}' results is the sum current I_S as shown in (Fig. 181/2).

In order to be able to add the pointers vectorially, these must be divided into their X- and Y-coordinates (IL2X, IL2Y, IL3X and IL3Y).

The ground fault current may be calculated using the following formula:

- $(I_{L1rated} + I_{L2rated} + I_{L3rated}) - (I_{L1measured} + I_{L2measured} + I_{L3measured})$ / $1.73 = I_S$
- (7 A + 7 A + 7 A) – (7A + 6.5 A + 6 A) / 1.73 = 0.866 A

Results of a calculation example:

- Phase current $I_{L1} = I_{Rated}$ = 7 A
- Phase current I_{L2} = 6.5 A
- Phase current I_{L3} = 6 A

Measured ground fault

Ground fault current is actively measured when the mains current input is configured to monitor for ground current. The ground fault threshold is configured as a percentage of the value entered for parameter "Ground current transformer" (parameter 1810 ➡ p. 430).

The ground fault protection zone is determined by the physical installation location of the generator current transformer.

ID	Parameter	CL	Setting range [Default]	Description
3250 3256	**Monitoring**	2	On	Ground current monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: Level 1 < Level 2).
			[Off]	Monitoring is disabled for Level 1 limit and/or Level 2 limit.

ID	Parameter	CL	Setting range [Default]	Description
3254 3260	**Limit**	2	0 to 300% 3254: **[10%]** 3260: **[30%]** (Hysteresis: 1%) (Reset Delay: 80 ms)	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or exceeded for at least the delay time without interruption, the action specified by the alarm class is initiated.
				Notes This value refers to the Generator rated current of the generator (parameter 1754 ➪ p. 431), if the ground current is calculated from the generator current values. It refers to the parameter "Ground current transformer" (parameterr 1810 ➪ p. 430), if the ground current is measured directly. The ground fault threshold shall not exceed the mains/ground current measuring range (approx. 1.5 × I_{rated}; ➪ *Chapter 8.1 “Technical Data” on page 661*).
3255 3261	**Delay**	2	0.02 to 99.99 s 3255: **[0.20 s]** 3261: **[0.10 s]**	If the monitored ground fault exceeds the threshold value for the delay time configured here, an alarm will be issued.
				Notes If the monitored ground fault falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.
3251 3257	**Alarm class**	2	Class A/B/C/D/E/F, Control 3251: **[B]** 3257: **[F]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ➪ *Chapter 9.5.1 “Alarm Classes” on page 965*
3252 3258	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
3253 3259	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

Generator Phase Rotation

General notes

NOTICE!

Damage to the control unit and/or generation equipment

– Ensure that the control unit is properly connected to phase voltages on both sides of the circuit breaker(s) during installation.

Failure to do so may result in damage to the control unit and/or generation equipment due to the breaker closing asynchronously or with mismatched phase rotations. Also ensure that phase rotation monitoring is enabled at all connected components (engine, generator, breakers, cable, busbars, etc.).

This function will block a connection of systems with mismatched phases only under the following conditions:

– The voltages being measured are wired correctly with respect to the phase rotation at the measuring points (i.e. the potential transformers in on both sides of the circuit breaker)
– The voltages being measured are wired so that angular phase shifts or any interruptions from the measuring point to the control unit do not exist
– The voltages being measured are wired to the correct terminals of the control unit (i.e. L1 phase of the generator is connected with the terminal of the control unit which is intended for the generator L1 phase)
– The configured alarm class is of class C, D, E, or F (shutdown alarm).

Correct phase rotation of the phase voltages ensures that damage will not occur during a breaker closure to either the mains or the generator. The voltage phase rotation alarm checks the phase rotation of the measured voltages and the configured phase rotation to ensure they are identical.

The directions of rotation are differentiated as "clockwise" and "counter clockwise". With a clockwise field the direction of rotation is "L1-L2-L3"; with a counter clockwise field the direction of rotation is "L1-L3-L2". If the control is configured for a clockwise rotation and the measured voltages are monitored as counterclockwise, the alarm will be initiated.

The direction of configured rotation being monitored by the control unit is displayed on the screen.

If this protective function is triggered, the display indicates "Gen.ph.rot. mismatch" and the logical command variable "06.21" will be enabled.

This monitoring function is only enabled if Generator voltage measuring (parameter 1851 ⇨ p. 431) is configured to "3Ph 4W", "3Ph 3W", or "3Ph 4W OD" and the measured voltage exceeds 50 % of the rated voltage (parameter 1766 ⇨ p. 431) or if Generator voltage measuring (parameter 1851 ⇨ p. 431) is configured to "1Ph 2W" (in this case, the phase rotation is not evaluated, but defined by the 1Ph2W phase rotation (parameter 1859 ⇨ p. 430)).

ID	Parameter	CL	Setting range [Default]	Description
3950	**Monitoring**	2	**[On]**	Phase rotation monitoring is carried out according to the following parameters.
				Notes The phase rotation monitor is internally configured with a two seconds delay, so that the expected response time is less than three seconds.
			Off	No monitoring is carried out.
3954	**Generator phase rotation**	2	**[CW]**	The three-phase measured generator voltage is rotating CW (clock-wise; that means the voltage rotates in L1-L2-L3 direction; standard setting).
			CCW	The three-phase measured generator voltage is rotating CCW (counter clock-wise; that means the voltage rotates in L1-L3-L2 direction).
3951	**Alarm class**	2	Class A/B/C/D/E/F, Control **[F]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ⇨ *Chapter 9.5.1 "Alarm Classes" on page 965*
3952	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
3953	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.2 Configure Engine Monitor

4.5.2.1 Engine Overspeed (Level 1 & 2) ANSI# 12

General notes

The speed measured by the magnetic pickup unit (MPU) is monitored for overspeed. If the MPU is disabled, the speed may only be monitored using the generator overfrequency monitoring. If the MPU speed exceeds the overspeed limits the configured alarms will be initiated.

If this protective function is triggered, the display indicates "Overspeed 1" or "Overspeed 2" and the logical command variable "05.01" or "05.02" will be enabled.

Refer to ↳ *Chapter 9.1.1 "Triggering Characteristics" on page 673* for the triggering characteristic of this monitoring function.

ID	Parameter	CL	Setting range [Default]	Description
2100 2106	**Monitoring**	2	**[On]**	Overspeed monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: Level 1 > Level 2).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
2104 2110	**Limit**	2	0 to 9,999 rpm 2104: **[1,850.0 rpm]** 2110: **[1,900.0 rpm]** (Hysteresis: 50 rpm) (Reset Delay: 1 s)	The revolutions per minute (rpm) values that are to be monitored for each threshold limit are defined here. If this value is reached or exceeded for at least the delay time without interruption, the action specified by the alarm class is initiated.
2105 2111	**Delay**	2	0.02 to 99.99 s 2105: **[1.00 s]** 2111: **[0.10 s]**	If the monitored engine speed exceeds the threshold value for the delay time configured here, an alarm will be issued. **Notes** If the monitored engine speed falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.
2101 2107	**Alarm class**	2	Class A/B/C/D/E/F, Control 2101: **[B]** 2107: **[F]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to ↳ *Chapter 9.5.1 "Alarm Classes" on page 965*
2102 2108	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
2103 2109	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.

ID	Parameter	CL	Setting range [Default]	Description
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.2.2 Engine Underspeed (Level 1 & 2)

General notes

The speed measured by the magnetic pickup unit (MPU) is monitored for underspeed. If the MPU is disabled or not available, the speed may only be monitored using the generator underfrequency monitoring. If the MPU speed falls below the underspeed limits the configured alarms will be initiated.

If this protective function is triggered, the display indicates "Underspeed 1" or "Underspeed 2" and the logical command variable "05.03" or "05.04" will be enabled.

Refer to *Chapter 9.1.1 “Triggering Characteristics” on page 673* for the triggering characteristic of this monitoring function.

ID	Parameter	CL	Setting range [Default]	Description
2150 2156	**Monitoring**	2	**[On]**	Underspeed monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: Level 1 > Level 2).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
2154 2160	**Limit**	2	0 to 9999 rpm 2154: **[1,300.0 rpm]** 2160: **[1,250.0 rpm]** (Hysteresis: 50 rpm) (Reset Delay: 1 s)	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or exceeded for at least the delay time without interruption, the action specified by the alarm class is initiated.
2155 2161	**Delay**	2	0.02 to 99.99 s 2155: **[1.00 s]** 2161: **[0.10 s]**	If the monitored engine speed falls below the threshold value for the delay time configured here, an alarm will be issued.
				Notes If the monitored engine speed exceeds the threshold (plus the hysteresis) again before the delay expires the time will be reset.
2151 2157	**Alarm class**	2	Class A/B/C/D/E/F, Control 2151: **[B]** 2157: **[F]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to *Chapter 9.5.1 “Alarm Classes” on page 965*
2152 2158	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.

ID	Parameter	CL	Setting range [Default]	Description
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
2153 2159	**Enabled**	2	Always	Monitoring for this fault condition is continuously enabled.
			[87.70 LM:Eng.mon]	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.2.3 Engine/Generator Speed Detection

General notes

Speed detection checks if the generator voltage frequency f (determined from the measured generator voltage) differs from the measured engine speed n (determined from the Pickup signal) and determines a difference (Δf-n).

If the two frequencies are not identical (Δf-n ≠ 0) and the monitored frequency mismatch reaches or exceeds the threshold, an alarm is output. Additionally the LogicsManager output "Firing speed" is checked upon its logical status with respect to the measuring values "generator frequency" and "Pickup speed".

If this protective function is triggered, the display indicates "Speed/freq. mismatch" and the logical command variable "05.07" will be enabled.

Speed/frequency mismatch (n/f mismatch) is carried out only if an MPU is connected to the control and parameter "Speed pickup" (parameter 1600 ⇘ p. 175), is configured On. The following is valid:

The measurement via Pickup is enabled (On):

Mismatch monitoring is carried out using the engine speed from the Pickup and the generator frequency. If the speed/frequency mismatch or the LogicsManager is enabled and the frequency is outside of the configured limit, an alarm will be issued.

The measurement via Pickup is disabled (Off):

Mismatch monitoring is carried out using the generator frequency and the LogicsManager. If the LogicsManager output is enabled and the frequency is outside of the configured limit, an alarm will be issued.

ID	Parameter	CL	Setting range [Default]	Description
2450	**Monitoring**	2	**[On]**	Monitoring of the speed/frequency/LogicsManager mismatch (n/f/LM mismatch) is carried out according to the following parameters.
			Off	Monitoring is disabled.
2454	**Speed/ frequency mismatch limit**	2	1.5 to 8.5 Hz **[5.0 Hz]**	The frequency mismatch that is to be monitored is defined here. If the monitored frequency mismatch reaches or exceeds this value for at least the delay time without interruption, the action specified by the alarm class is initiated.
				Notes The LogicsManager is monitored with respect to his status.
2455	**Delay**	2	1 to 99 s **[1.00 s]**	If the monitored frequency mismatch exceeds the threshold value for the delay time configured here, an alarm will be issued.
				Notes If the monitored frequency mismatch falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.
2453	**Activation frequency**	2	15 to 85 Hz **[20 Hz]**	The speed/frequency mismatch monitoring is enabled at this generator frequency.
2451	**Alarm class**	2	Class A/B/C/D/E/F, Control **[E]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to *Chapter 9.5.1 “Alarm Classes” on page 965*
2452	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
2458	**Enabled**	2	Always	Monitoring for this fault condition is continuously enabled.
			[87.70 LM:Eng.mon]	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.2.4 Engine Start Failure

General notes

If it is not possible to start the engine within a configured number of start attempts (refer to *Chapter 4.4.1.2 “Engine Start/Stop” on page 166*), an alarm will be initiated.

If this protective function is triggered, the display indicates "Start fail" and the logical command variable "05.08" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
3303	**Monitoring**	2	**[On]**	Monitoring of the start sequence is carried out according to the following parameters.
			Off	Monitoring is disabled.
3304	**Alarm class**	2	Class A/B/C/D/E/F, Control **[F]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ␥ *Chapter 9.5.1 "Alarm Classes" on page 965*
3305	**Self acknowl-edge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).

4.5.2.5 Engine Shutdown Malfunction

General notes

If it is not possible to stop the engine within a configured time, an alarm will be initiated.

If this protective function is triggered, the display indicates "Eng. stop malfunct." and the logical command variable "05.06" will be enabled.

We recommend to assign this monitoring function to a discrete output to be able to shutdown the engine with an external device to provide a shutdown redundancy.

ID	Parameter	CL	Setting range [Default]	Description
2500	**Monitoring**	2	**[On]**	Monitoring of the stop sequence is carried out according to the following parameters.
			Off	Monitoring is disabled.
2503	**Maximum stop delay**	2	3 to 999 s **[30 s]**	The maximum permissible time between the output of a stop command and the reply that the engine is stopped successfully is defined here.
				Notes If the engine cannot be stopped within this time (this means speed via the Pickup, frequency via the generator voltage, or the LogicsManager is detected) the action specified by the alarm class is initiated.
2501	**Alarm class**	2	Class A/B/C/D/E/F, Control **[F]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.

ID	Parameter	CL	Setting range [Default]	Description
				Notes For additional information refer to ↪ *Chapter 9.5.1 "Alarm Classes" on page 965*
2502	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).

4.5.2.6 Engine Unintended Stop

General notes

If an engine stop has been detected without a stop command being issued, an alarm will be initiated.

If this protective function is triggered, the display indicates "Unintended stop" and the logical command variable "05.05" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
2650	**Monitoring**	2	**[On]**	Monitoring of an unintended stop is carried out according to the following parameters.
			Off	Monitoring is disabled.
2651	**Alarm class**	2	Class A/B/C/D/E/F, Control **[F]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ↪ *Chapter 9.5.1 "Alarm Classes" on page 965*
2657	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).

4.5.2.7 Engine Charge Alternator (D+)

General notes

The charge alternator monitoring issues an alarm if the voltage measured at the auxiliary excitation input D+ (terminal 65) falls below a fix limit.

The fix limit depends on the power supply voltage. If a power supply voltage exceeding 15 V is detected, the unit assumes a 24 V system and uses a limit of 20 V. If a power supply voltage below 15 V is detected, the unit assumes a 12 V system and uses a limit of 9 V.

If this protective function is triggered, the display indicates "Charge alt. low volt" and the logical command variable "05.11" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
4050	**Monitoring**	2	On	Monitoring of the charge alternator is carried out according to the following parameters.
			[Off]	Monitoring is disabled.
4055	**Delay**	2	2 to 9999 s **[10 s]**	If the voltage measured at the auxiliary excitation input D+ falls below a fixed limit for the time defined here, an alarm will be issued. If the voltage returns within the limit before the delay time expires, the delay time will be reset.
4051	**Alarm class**	2	Class A/B/C/D/E/F **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ✎ *Chapter 9.5.1 “Alarm Classes” on page 965*
4052	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
4053	**Enabled**	2	Always	Monitoring for this fault condition is continuously enabled.
			[87.70 LM:Eng.mon]	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.2.8 Cylinder Temperature

General Notes

Up to 20 temperatures monitored!

Gas engines needs to be monitored for equal exhaust or cylinder head temperatures. If one cylinder temperature deviates too much from the others, something must be wrong. This could be for example a failed spark plug or a too hot combustion.

The easYgen-3000XT series provides a monitor which supervises the deviation of a single temperature to the average temperature of a group. Whereby either one average temperature exists (inline engine) or two average temperatures are available (V-engine with two banks).

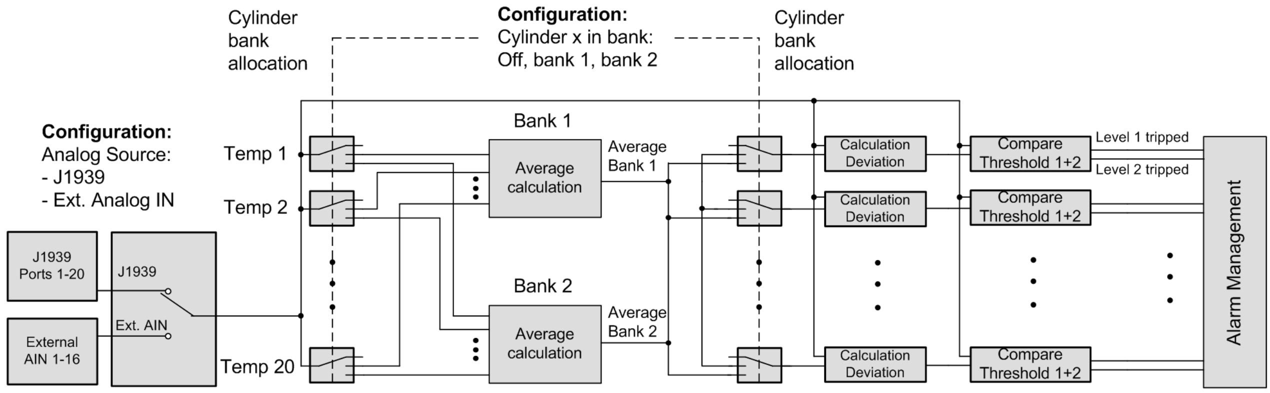


Fig. 182: Cylinder Temperature Monitoring

The monitor is configurable for:

- overrun,
- underrun
- or both.
- Two monitoring levels per temperature measurement.
  – The both levels can be individually activated by different power limits.

The temperatures could be provided by either CAN J1939 (SPN 1137 - 1156, 20 ports) for example *Axiomatic Thermocouple Scanner* or by External Analog Inputs (AI1 - AI16, 16 ports) for example *Phoenix Temperature Module*.

Monitoring Function

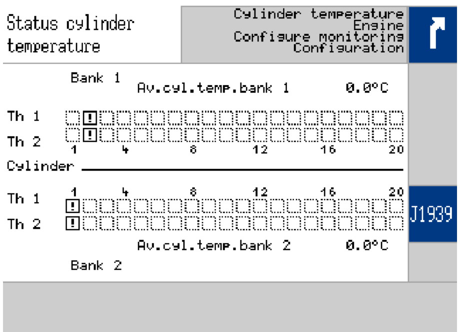


Fig. 183: Status Cylinder Temperature

The monitor compares the single temperature deviations from the average temperature of the according bank. An inline engine has only one group (one bank), so all temperatures are usually allocated to bank 1. A V-engine has two groups (two banks), so the single temperatures are distributed to bank 1 and bank 2. The monitoring mode is valid for all temperatures. The monitoring mode can be 'Off', 'Overrun', 'Underrun' or 'Overrun and Underrun'. The mode is valid for all banks.

The monitoring generally is released by a LogicsManager equation. Each monitoring level (level 1 or 2) can be separately released by a configurable generator power.

A cylinder with sensor defect is removed from the average temperature calculation and trips an independent alarm!

Alarm System / Eventlogger

The alarm system provides three alarm messages:

- Cylinder temperature level 1
- Cylinder temperature level 2
- Wire break

Command Variables

The easYgen provides LogicsManager command variables:

- 87.71 LM: Release cyl. temp.
- 05.18 Cyl. temp. lev. 1
- 05.19 Cyl. temp. lev. 2
- 05.20 Cyl. temp.wire break

Analog Variables

The easYgen provides AnalogManager variables::

- 11.56 Average Cyl. Temp. Bank 1
- 11.57 Average Cyl. Temp. Bank 2

> – *The hysteresis for the temperature limit is 2°C.*
> – *The hysteresis for the power limit is 1% rated generator power.*

Alarm Screen

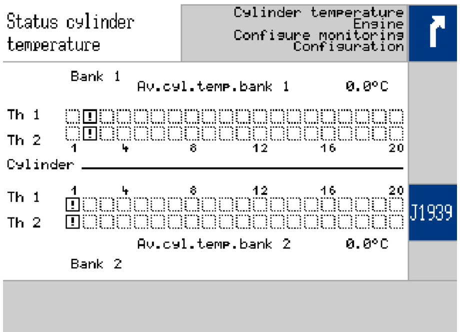


Fig. 184: Cylinder temperature screen

- The square is dotted, if the according cylinder is not configured
- The square contains an arrow-up, if the limit is exceeded
- The square contains an arrow-down, if limit is below target
- The square contains a '!' exclamation point sign, if the sensor is missing (wire break) or error was detected
- If an alarm occurs and the monitor is still active, the new alarm is linked by logic 'OR' to the others
- The monitor ignores values of cylinders with wire break or sensor defect
- The alarm trip displaying is removed, if the alarm of the according level was successful acknowledged
- The wire break trip has a higher priority as the limit monitoring. That means: with up-coming wire break only the according trip bits are RESET. Other cylinders not touched.

General monitoring

ID	Parameter	CL	Setting range [Default]	Description
15158	**Release cyl.temp.**	2	Determined by LogicsManager 87.71 **[(0 & 1) & 1; t_{ON} = 0.00; t_{OFF} = 0.00]** = 11460	True: The temperature deviation monitoring is released. False: The temperature deviation monitoring is blocked.
8876	**Monitoring at**	2	**[Off]**	The monitoring is deactivated. The alarm screen is not displayed.
			Overrun	The single temperatures are monitored on maximum deviation in direction of higher temperatures.
			Underrun	The single temperatures are monitored on maximum deviation in direction of lower temperatures.
			Both	The single temperatures are monitored on maximum deviation in direction of lower and higher temperatures.
8877	**Source cylinder temperature**	2	Ext.AIN	The temperatures are taken from external temperature module (Phoenix, AI1 - AI16, 16 ports).

ID	Parameter	CL	Setting range [Default]	Description
			[J1939]	The temperatures are taken from the J1939 protocol. (SPN 1137 - 1156, 20 ports).
				Notes Parameter available only if external sources for cylinder temperature are connected.

Level 1

ID	Parameter	CL	Setting range [Default]	Description
8878	**Minimum generator power**	2	000.0 ... 150.0%	When the generator power exceeds this value the level 1 monitoring is activated.
			[30.0%]	Respectively the level 1 is deactivated, if the power level is undershoot.
8879	**Limit**	2	0000 ... 9999° C	Threshold level 1
			[100° C]	
8880	**Delay**	2	0000 ... 9999 s	Time between *** exceeds limits and *** is activated.
			[60 s]	
8881	**Alarm class**	2	Class A/B/C/D/E/F, Control	Each limit may be assigned to an independent alarm class that specifies what action should be taken when the limit is surpassed.
			[B]	For additional information refer to. *Chapter 9.5.1 "Alarm Classes" on page 965*.
8882	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).

Level 2

ID	Parameter	CL	Setting range [Default]	Description
8883	**Minimum generator power**	2	000.0 ... 150.0%	When the generator power exceeds this value the level 2 monitoring is activated.
			[30.0%]	Respectively the level 2 is deactivated, if the power level is undershoot.
8884	**Limit**	2	0000 ... 9999° C	Threshold level 2
			[150° C]	
8886	**Alarm class**	2	Class A/B/C/D/E/F, Control	Each limit may be assigned to an independent alarm class that specifies what action should be taken when the limit is surpassed.
			[B]	For additional information refer to. *Chapter 9.5.1 "Alarm Classes" on page 965*.
8885	**Delay**	2	0000 ... 9999 s	Time between *** exceeds limits and *** is activated.
			[60 s]	

ID	Parameter	CL	Setting range [Default]	Description
8887	**Self acknowl-edge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).

Wirebreak Cylinder Temperature

ID	Parameter	CL	Setting range [Default]	Description
8890	**Delay**	2	0000 ... 9999 s	Time between *** exceeds limits and *** is activated.
			[2 s]	
8888	**Alarm class**	2	Class A/B/C/D/E/F, Control	Each limit may be assigned to an independent alarm class that specifies what action should be taken when the limit is surpassed.
			[B]	For additional information refer to. *Chapter 9.5.1 "Alarm Classes" on page 965*.
8889	**Self acknowl-edge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).

Temperature X Bank

ID	Parameter	CL	Setting range [Default]	Description
8856 to 8875	**Bank selct cyl-inder {x}**	2	**[Off]**	The temperature does not exist.
			Bank 1	The temperature exists and is located in cylinder bank 1.
			Bank 2	The temperature exists and is located in cylinder bank 2.

Cylinder status

Each cylinder is represented by a 2-bit combination that has the following meanings:

- 00 - OK
- 01 - Overrun
- 10 - Underrun
- 11 - Error/missing

These two bits are carried by parameters ID 3352 ..3354 for the cylinders of bank 1 and ID 3355..3357 for the cylinders of bank 2:

Bank	Cyl-inder	ID	Bits		Bank	Cyl-inder	ID	Bits
1	1	3352	0..1		2	1	3355	0..1
	2		2..3			2		2..3
	...		...			...		...

Bank	Cyl-inder	ID	Bits	Bank	Cyl-inder	ID	Bits
	8		14..15		8		14..15
	9	3353	0..1		9	3356	0..1
	10		2..3		10		2..3
	...		...		...		...
	16		14..15		16		14..15
	17	3354	0..1		17	3357	0..1
	18		2..3		18		2..3
	19		4..5		19		4..5
	20		6..7		20		6..7
	(not in use)		8..15		(not in use)		8..15

4.5.3 Mains

4.5.3.1 General Mains Monitoring

ID	Parameter	CL	Setting range [Default]	Description
1771	**Mains voltage monitoring**	2		The unit can either monitor the wye voltages (phase-neutral) or the delta voltages (phase-phase). The monitoring of the wye voltage is above all necessary to avoid earth-faults in a compensated or isolated network resulting in the tripping of the voltage protection.
			[Phase - phase]	The phase-phase voltage will be monitored and all subsequent parameters concerning voltage monitoring "mains" are referred to this value (VL-L).
			Phase - neutral	The phase-neutral voltage will be monitored and all subsequent parameters concerning voltage monitoring "mains" are referred to this value (VL-N).
			All	The phase-phase **and** phase-neutral voltage will be monitored and all subsequent parameters concerning voltage monitoring "mains" are referred to this value (VL-L & VL-N). This setting is only effective if "Mains voltage measuring" (parameter 1853 ➪ p. 434) is configured to "3Ph 4W".
				Notes WARNING: This parameter influences the protective functions. Please be aware that if "Mains voltage monitoring" (parameter 1771 ➪ p. 360) is configured to "All" and the function ➪ *Chapter 4.5.3.9 "Mains Voltage Increase" on page 375* is used, that this function only monitors "Phase - neutral".
2801	**Mains settling time**	2	0 to 9999 s **[20 s]**	To end the emergency operation, the monitored mains must be within the configured operating parameters without interruption for the minimum period of time set with this parameter without interruption. This parameter permits delaying the switching of the load from the generator to the mains. The display indicates "Mains settling" during this time.

4.5.3.2 Blocking of Mains Protection

General notes

The operator can deactivate the mains monitoring features and the decoupling function. A dedicated LogicsManager is installed to disable all mains monitoring and the decoupling function.

Already latched alarms (self acknowledge = No) are not removed from the alarm list by this function.

Following functions are blocked:

- Mains decoupling
- Mains over frequency 1&2
- Mains under frequency 1&2
- Mains over voltage 1&2
- Mains under voltage 1&2
- Mains voltage increase (10 minutes average value)
- Mains Time-dependent Voltage (FRT)
- Mains Q(V) Monitoring
- Mains phase shift
- Mains df/dt

ID	Parameter	CL	Setting range [Default]	Description
15159	**Disable mains monitoring**	2	Determined by LogicsManager 87.72 **[(0 & 1) & 1]** **t_{ON} = 0.00; t_{OFF} = 0.00]** = 11461	Switch to disable ▪ all mains monitoring functions and ▪ the mains decoupling function.

4.5.3.3 Mains Operating Ranges: Voltage / Frequency

General notes

The mains operating voltage/frequency parameters are used to trigger mains failure conditions and activate an emergency run.

The mains values must be within this ranges to synchronize the mains circuit breaker. It is recommended to configure the operating limits within the monitoring limits.

Example

If the mains rated voltage is 400 V, the upper voltage limit is 110 % (of the mains rated voltage, i.e. 440 V), and the hysteresis for the upper voltage limit is 5 % (of the mains rated voltage, i.e. 20 V), the mains voltage will be considered as being out of the operating limits as soon as it exceeds 440 V and will be considered as being within the operating limits again as soon as it falls below 420 V (440 V – 20 V).

If the rated system frequency is 50 Hz, the lower frequency limit is 90 % (of the rated system frequency, i.e. 45 Hz), and the hysteresis for the lower frequency limit is 5 % (of the rated system frequency, i.e. 2.5 Hz), the mains frequency will be considered as being out of the operating limits as soon as it falls below 45 Hz and will be considered as being within the operating limits again as soon as it exceeds 47.5 Hz (45 Hz + 2.5 Hz).

ID	Parameter	CL	Setting range [Default]	Description
5810	**Upper voltage limit**	2	100 to 150% **[110%]**	The maximum permissible positive deviation of the mains voltage from the mains rated voltage (parameter 1768 ↳ p. 434) is configured here. This value may be used as a voltage limit switch. The conditional state of this switch may be used as a command variable for the LogicsManager (02.09).
5814	**Hysteresis upper voltage limit**	2	0 to 50% **[2%]**	If the mains voltage has exceeded the limit configured in parameter 5810 ↳ p. 362, the voltage must fall below the limit and the value configured here, to be considered as being within the operating limits again.
5811	**Lower voltage limit**	2	50 to 100% **[90%]**	The maximum permissible negative deviation of the mains voltage from the mains rated voltage (parameter 1768 ↳ p. 434) is configured here. This value may be used as a voltage limit switch. The conditional state of this switch may be used as a command variable for the LogicsManager (02.09).
5815	**Hysteresis lower voltage limit**	2	0 to 50% **[2%]**	If the mains voltage has fallen below the limit configured in parameter 5811 ↳ p. 362, the voltage must exceed the limit and the value configured here, to be considered as being within the operating limits again.
5812	**Upper frequency limit**	2	66.7[1] to 150.0% **[110.0%]**	The maximum permissible positive deviation of the mains frequency from the rated system frequency (parameter 1750 ↳ p. 429) is configured here. This value may be used as a frequency limit switch. The conditional state of this switch may be used as a command variable for the LogicsManager (02.10). **Notes** [1] The lowest measurable frequency is 40 Hz. 66.7 % of 60 Hz is 40 Hz. Equivalent for 50 Hz don't go below 80 %.
5816	**Hysteresis upper frequency limit**	2	0 to 50.0% **[0.5%]**	If the mains frequency has exceeded the limit configured in parameter 5812 ↳ p. 362, the frequency must fall below the limit and the value configured here, to be considered as being within the operating limits again.
5813	**Lower frequency limit**	2	66.7[1] to 100.0% **[90.0%]**	The maximum permissible negative deviation of the mains frequency from the rated system frequency (parameter 1750 ↳ p. 429) is configured here. This value may be used as a frequency limit switch. The conditional state of this switch may be used as a command variable for the LogicsManager (02.10). **Notes** [1] The lowest measurable frequency is 40 Hz. 66.7 % of 60 Hz is 40 Hz. Equivalent for 50 Hz don't go below 80 %.
5817	**Hysteresis lower frequency limit**	2	0 to 50.0% **[0.5%]**	If the mains frequency has exceeded the limit configured in parameter 5813 ↳ p. 362, the frequency must raise above the limit and the value configured here, to be considered as being within the operating limits again.

4.5.3.4 Mains Decoupling

General notes

The mains decoupling function is intended for use in a mains parallel operation and monitors a series of subordinate mains protection thresholds. If a threshold is exceeded, the genset control initiates a breaker opening and separates the generator(s) from the mains at the defined breaker.

The following thresholds are monitored:

- Overfrequency level 2 (⇨ *Chapter 4.5.3.5 "Mains Overfrequency (Level 1 & 2) ANSI# 81O" on page 370*)
- Underfrequency level 2 (⇨ *Chapter 4.5.3.6 "Mains Underfrequency (Level 1 & 2) ANSI# 81U" on page 371*)
- Overvoltage level 2 (⇨ *Chapter 4.5.3.7 "Mains Overvoltage (Level 1 & 2) ANSI# 59" on page 372*)
- Undervoltage level 2 (⇨ *Chapter 4.5.3.8 "Mains Undervoltage (Level 1 & 2) ANSI# 27" on page 374*)
- Mains phase shift / df/dt (ROCOF) (⇨ *Chapter 4.5.3.12 "Change Of Frequency" on page 384*)

If one of these protective functions is triggered, the display indicates "Mains decoupling" (the logical command variable "07.25" will be enabled) and the active level 2 alarm.

The mains decoupling function is optimized on the both relay outputs "GCB open" and "MCB open". In case of using a free relay output in conjunction with the command variable 07.25 an additional delay time of up to 20 ms is to consider.

Managing Breaker Open alarm

When the mains decoupling function detects a breaker open failure, the according breaker alarm will be triggered as long the monitoring function is activated. Additionally in cases where the decoupling mode has to change over to the other breaker, (GCB→MCB, MCB→GCB), the alarm text "Decoupling GCB↔MCB" is indicated. The breaker open alarm already occurs after the mains decoupling feedback delay (refer to ID 3113 ⇨ p. 364).

ID	Parameter	CL	Setting range [Default]	Description
12922	**Ext. mns. decoupl.** (External mains decoupling)	2	Determined by LogicsManager 86.27 **[(0 & 1) & 1]**	The unit may be configured to decouple from the mains when commanded by an external device. Once the conditions of the LogicsManager have been fulfilled, an external mains failure is issued.
				Notes For information on the LogicsManager and its default settings see ⇨ *Chapter 9.3.1 "LogicsManager Overview" on page 882.*
12942	**Enable mains decoupl.** (Enable mains decoupling)	2	Determined by LogicsManager 87.31 **[(02.02 & 1) & 1]**	Once the conditions of the LogicsManager have been fulfilled, the mains decoupling function is enabled.
				Notes For information on the LogicsManager and its default settings see ⇨ *Chapter 9.3.1 "LogicsManager Overview" on page 882.*
3110	**Mains decoupling**	2	Off	Mains decoupling monitoring is disabled.
			[GCB]	Mains decoupling is carried out according to the following parameters. If one of the subordinate monitoring functions is triggered, the GCB will be opened. If the unit is operated in parallel with the mains and the MCB opens, the GCB will be closed again.

ID	Parameter	CL	Setting range [Default]	Description
			GCB->MCB	Mains decoupling is carried out according to the following parameters. If one of the subordinate monitoring functions is triggered, the GCB will be opened. If the reply "GCB open" is not present within the delay configured in parameter 3113 ➪ p. 364, the MCB will be opened as well.
			MCB	Mains decoupling is carried out according to the following parameters. If one of the subordinate monitoring functions is triggered, the MCB will be opened.
			MCB->GCB	Mains decoupling is carried out according to the following parameters. If one of the subordinate monitoring functions is triggered, the MCB will be opened. If the reply "MCB open" is not present within the delay configured in parameter 3113 ➪ p. 364, the GCB will be opened as well.
			GCB/MCB by LM	Mains decoupling is carried out. If one of the subordinate monitoring functions is triggered, a breaker will be opened, which is determined by the LogicsManager equation "15160 ➪ p. 364/➪ p. 930 LM mains decoupling MCB". If it's status is TRUE, the MCB will be opened. If it's status is FALSE, the GCB will be opened.
15160	**Mains decoupling MCB**	2	Determined by LogicsManager 87.73 **[(0 & 1) & 1]**	**FALSE**: If the decoupling is triggered, the GCB will be opened. **TRUE**: If the decoupling is triggered, the MCB will be opened. Only available in Mains decoupling mode "GCB/MCB by LM".
3113	**Mains decoupling feedback delay**	2	0.2 to 99.9 s **[0.4 s]**	If the open signal from the respective circuit breaker cannot be detected within the time configured here, the mains decoupling function performs the action as configured in parameter 3110 ➪ p. 363.
3111	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ➪ *Chapter 9.5.1 "Alarm Classes" on page 965*.
3112	**Self acknowledge**	2	Yes	The control automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
8845	**Mns. decoupling by overvolt. 1**	2		The mains overvoltage 1 alarm can be linked to the mains decoupling function, if required.
			On	The mains overvoltage 1 trip is linked to the mains decoupling function with all its consequences.
			[Off]	The mains overvoltage 1 trip is ignored in the mains decoupling function.
				Notes It is recommended to configure the operating limits (parameter 5810 ➪ p. 362 to 5817 ➪ p. 362) within the monitoring limits.
8844	**Mns. decoupling by undervolt. 1**	2		The mains undervoltage 1 alarm can be linked to the mains decoupling function, if required.
			On	The mains undervoltage 1 trip is linked to the mains decoupling function with all its consequences.
			[Off]	The mains undervoltage 1 trip is ignored in the mains decoupling function.
				Notes It is recommended to configure the operating limits (parameter 5810 ➪ p. 362 to 5817 ➪ p. 362) within the monitoring limits.
8808	**Mns. decoupl. by volt. increase**	2	On	Voltage increase monitoring does cause a decoupling.
			[Off]	Voltage increase monitoring does not cause a decoupling.

ID	Parameter	CL	Setting range [Default]	Description
4989	**Mns. decoupl. by time-dep. volt.**	2	On	Time-dependent voltage monitoring does cause a decoupling.
			[Off]	Time-dependent voltage monitoring does not cause a decoupling.
3296	**Mains decoupling by QV**	2	On	The QV monitoring function is linked to the mains decoupling function with all its consequences and is assigned to "Delay step 1" (parameter 3283 ↳ p. 383).
			[Off]	The QV monitoring function is ignored in the mains decoupling function.
1733	**Test**	2	On	Activates a test mode which allows a comfortable mains decoupling test.
			[Off]	Deactivates the test mode. Mains decoupling is working normal.
				Notes When the test mode is activated a mains decoupling according to the parametrization is triggered, once a mains failure is detected. Thereby the states of things of the breaker reply are irrelevant. A retriggering of the mains decoupling can be performed after 0.5 s + "Mns. decoupling feedback delay" (parameter 3113 ↳ p. 364) without leaving the test mode. As long as the codelevel is ≥ 2 it is possible to switch-off the test mode manually. The test mode switches off automatically after one hour since having turned on or after switching on the operation magnet (engine should start).

4.5.3.4.1 Setup Grid Code AR—4105

General notes

The German Grid Code VDE-AR-N 4105 instructs the handling of electrical energy sources running parallel to the low voltage grid. This rule has an impact with some items on the genset control. A more detailed description relating to that VDE rule is done through the separated application note “easYgen-3000_VDE-AR-N 4105” on the manual CD of this product.

Here are some functions which have to be covered according to the 4105 rule:

- The mains decoupling is executed through following monitors:
  - Mains under voltage V<
  - Mains over voltage V>
  - Mains under frequency f<
  - Mains over frequency f>
- Recognizing isolation operation (other decoupling argument)
  - Phase shift OR
  - df/dt
- Button for Testing the Decoupling Facility
- Single-failure-security including self-monitoring

The VDE-AR-N 4105 demands a Single-failure-proof of the mains decoupling function. That means that the decoupling of the generator from the mains must be always ensured, even if a single element in the system fails. So the system must contain two circuit breakers with two independent monitoring functions acting individually on each breaker. From the perspective of the network provider that rule pursuits the mains protection but not the availability of the electrical source, so in case of doubt the generator should be decoupled from mains.

Woodward solves this requirement with the use of a minimum of two units acting as a system (for example two easYgens or an easYgen and an LS-5 with 4105 functionality). The system allows incorporating more units, so that the availability of the generator can still be increased.

The demanded two breakers in series are realized through the use of a GCB and a MCB. If only a GCB is available, the customer must install another circuit breaker in addition.

An important item of the VDE-AR-N 4105 is the Single-Failure-Diagnostic, at which a minimum of two units exchange their measurement data and settings over communication interface (usually CANbus). This allows determining, if the Single-Failure-Proof is lost and the unit can issue an alarm.

> ***Using Ethernet?***
>
> *To us Ethernet communication interface for Single-failure-proof it is mandatory that load-share is using Ethernet, too. For interface selection refer to* *↬ Chapter 4.4.4.3.5 "Load-Share Interface" on page 252.*

Enable 4105 monitoring

Monitoring according VDE AR-N 4105 per default is [Off]. It can be enabled via ToolKit *"Configure Monitoring ➔ Mains: Other monitoring ➔ Setup VDE-AR-N 4105"* or via Menu (see screen Fig. 185).

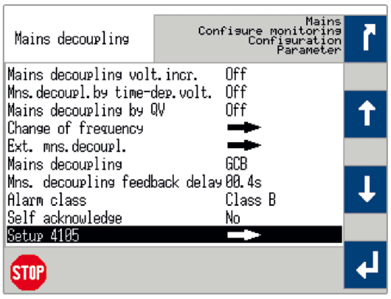


Fig. 185: Select mains decoupling 4105

Monitoring according AR—4105

ID	Parameter	CL	Setting range [Default]	Description
3297	**Monitoring**	2	**[Off]**	The diagnostic function is disabled, no related monitoring is executed.
				If the diagnostic function is enabled, the related messages can be received via CAN 1, CAN 3 or Ethernet. **Notes** The following alarms can be triggered: ■ Missing member 4105 ■ Para. alignment 4105 ■ Meas.difference 4105
3298	**Monitoring mode**	2	Single	The diagnostic function is related to one partner unit.

ID	Parameter	CL	Setting range [Default]	Description
			[Multi]	The diagnostic function is executed with according partner units.
3299	**Device number partner**	2	**[01]** 01 to 64	The device ID of the expected partner unit. This configuration is only valid, if the mode 'single' is enabled.
1828	**Voltage difference**	2	**[4.0%]** 2.0 to 9.9%	This is the voltage measurement tolerance for all participating 4105 partners relating to the mains rated voltage measurement (refer to ID1768 ↪ p. 434). This is a part within the 4105 diagnostic.
1836	**Frequency difference**	2	**[1.0%]** 0.5 to 9.9%	This is the frequency measurement tolerance for all participating 4105 partners relating to the system rated frequency measurement. (refer to ID1750 ↪ p. 429). This is a part within the 4105 diagnostic.

Monitoring Missing Member AR—4105

ID	Parameter	CL	Setting range [Default]	Description
5125	**Alarm class**	2	**[C]** A to F, control	The alarm class specifies what action should be taken in case of missing communication with devices(s) being member(s) of the AR-–4105 system. **Notes** For additional information refer to ↪ *Chapter 9.5.1 “Alarm Classes” on page 965*.
5126	**Self acknowledge**	2	Yes	The control automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).

Monitoring Parameter Alignment VDE AR-‑4105

The following parameters are compared for monitoring its alignment:

Control	Parameter ID	Parameter
Mains Decoupling	3110	Mains Decoupling
Overfrequency level 2	2856	Monitoring
	2860	Limit
	2861	Delay
Underfrequency level 2	2906	Monitoring
	2910	Limit
	2911	Delay
Overvoltage level 2	2956	Monitoring
	2960	Limit
	2961	Delay
Undervoltage level 2	3006	Monitoring
	3010	Limit
	3011	Delay
Mains voltage increase	8806	Monitoring
	8808	Mains decoupling volt.incr.
	8807	Limit
Change of frequency	3058	Change of frequency
	3054	Phase shift: Limit 1-phase
	3055	Phase shift: Limit 3-phase
	3104	Limit (df/dt)
	3105	Delay (df/dt)
Disable mains monitoring	15159	Set TRUE
		Notes In applications with LS-5, this LogicsManager must be permanent FALSE. Otherwise the LS-5 parameter alignment alarm will remain.

Table 82: VDE 4105 alignment: Supervised parameters

ID	Parameter	CL	Setting range [Default]	Description
5131	**Alarm class**	2	**[C]** A to F, control	The alarm class specifies what action should be taken if the parameter alignment between the communication devices(s) of the AR-‑4105 system is active.
				Notes For additional information refer to ␗ *Chapter 9.5.1 “Alarm Classes” on page 965.*

ID	Parameter	CL	Setting range [Default]	Description
5132	**Self acknowledge**	2	Yes	The control automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).

Table 83: VDE 4105 alignment: Monitoring

Monitoring Measurement Difference AR—4105

ID	Parameter	CL	Setting range [Default]	Description
5137	**Alarm class**	2	**[C]** A to F, control	The alarm class specifies what action should be taken if the measurement difference (frequency, 1836 ➡ p. 367 or voltage, 1828 ➡ p. 367) between the communication devices(s) of the AR—4105 system differ more than allowed.
				Notes For additional information refer to ➡ *Chapter 9.5.1 "Alarm Classes" on page 965*.
5138	**Self acknowledge**	2	Yes	The control automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).

4.5.3.4.2 Setup Grid Code BDEW (medium voltage guideline)

The BDEW Grid Code instructs the handling of electrical energy sources running parallel to the medium voltage grid. This rule has an impact with some items on the genset control. A more detailed description relating to that BDEW technical guideline can be ordered directly by the BDEW Germany. With easYgen-3000... genset control series functions which have to be covered according to this BDEW rule are supported.

The mains decoupling is executed through following monitors:

- Mains under voltage V<
- Mains under voltage V<<
- Mains over voltage V>
- Mains over voltage V>>
- Mains under frequency f<
- Mains over frequency f>
- Q(V) Monitoring
- Mains Time-Dependent Voltage (FRT)

The Change of frequency monitors (vector/phase shift or df/dt) is not directly required by BDEW. These monitors are depending on the according network providers.

Other functions related to the BDEW guideline:

- Frequency Depending Derating Of Power. Refer to ➪ *Chapter 4.4.4.5.1.1 “Frequency Depending Derating Of Power” on page 270* for details.
- Reactive Power Control, alternatively:
  – Power Factor Control. Refer to ➪ *Chapter 4.4.4.2 “Power Factor Control” on page 241* for details.
  – Power Factor Characteristic. Refer to ➪ *Chapter 4.4.4.2.3 “Power Factor Characteristic” on page 246* for details.

4.5.3.5 Mains Overfrequency (Level 1 & 2) ANSI# 81O

General notes

There are two overfrequency alarm levels available in the control. Both alarms are definite time alarms and are illustrated in the figure below. The figure diagrams a frequency trend and the associated pickup times and length of the alarms. Monitoring of the frequency is accomplished in two steps.

If this protective function is triggered, the display indicates "Mains overfreq. 1" or "Mains overfreq. 2" and the logical command variable "07.06" or "07.07" will be enabled.

Refer to ➪ *Chapter 9.1.1 “Triggering Characteristics” on page 673* for the triggering characteristic of this monitoring function.

The mains overfrequency Level 2 limit configuration parameters are located below the mains decoupling function menu on the display.

ID	Parameter	CL	Setting range [Default]	Description
2850 2856	**Monitoring**	2	**[On]**	Overfrequency monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: limit 1 < Level 2 limit).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
2854 2860	**Limit**	2	100.0 to 140.0% 2854: **[100.4%]** 2860: **[102.0%]** (Hysteresis: 0.05 Hz) (Reset Delay: 80 ms)	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or exceeded for at least the delay time without interruption, the action specified by the alarm class is initiated. **Notes** This value refers to the System rated frequency (parameter 1750 ➪ p. 429).
2855 2861	**Delay**	2	0.02 to 99.99 s **[0.06 s]**	If the monitored mains frequency value exceeds the threshold value for the delay time configured here, an alarm will be issued. **Notes** If the monitored mains frequency falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.
2851 2857	**Alarm class**	2	Class A/B/C/D/E/F, Control 2851: **[A]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.

ID	Parameter	CL	Setting range [Default]	Description
			2857: **[B]**	**Notes** For additional information refer to ↻ *Chapter 9.5.1 "Alarm Classes" on page 965*
2852 2858	**Self acknowl-edge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
2853 2859	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.3.6 Mains Underfrequency (Level 1 & 2) ANSI# 81U

General notes

There are two underfrequency alarm levels available in the control. Both alarms are definite time alarms and are illustrated in the figure below. The figure diagrams a frequency trend and the associated pickup times and length of the alarms. Monitoring of the frequency is performed in two steps.

> *If this protective function is triggered, the display indicates "Mains underfreq. 1" or "Mains underfreq. 2" and the logical command variable "07.08" or "07.09" will be enabled.*

Refer to ↻ *Chapter 9.1.1 "Triggering Characteristics" on page 673* for the triggering characteristic of this monitoring function.

> *The mains underfrequency Level 2 limit configuration parameters are located below the mains decoupling function menu on the display.*

ID	Parameter	CL	Setting range [Default]	Description
2900 2906	**Monitoring**	2	**[On]**	Underfrequency monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: Level 1 > Level 2).
			Off	Monitoring is disabled for limit 1 and/or Level 2 limit.
2904 2910	**Limit**	2	50.0 to 140.0% 2904: **[99.6%]** 2910: **[98.0%]**	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or fallen below for at least the delay time without interruption, the action specified by the alarm class is initiated.

ID	Parameter	CL	Setting range [Default]	Description
			(Hysteresis: 0.05 Hz) (Reset Delay: 80 ms)	**Notes** This value refers to the System rated frequency (parameter 1750 ➡ p. 429).
2905 2911	**Delay**	2	0.02 to 99.99 s 2905: **[1.50 s]** 2911: **[0.06 s]**	If the monitored mains frequency value falls below the threshold value for the delay time configured here, an alarm will be issued. **Notes** If the monitored mains frequency exceeds the threshold (plus the hysteresis) again before the delay expires the time will be reset.
2901 2907	**Alarm class**	2	Class A/B/C/D/E/F, Control 2901: **[A]** 2907: **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to ➡ *Chapter 9.5.1 “Alarm Classes” on page 965*
2902 2908	**Self acknowl-edge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condi-tion is no longer detected. The alarm must be acknowledged and reset by manually pressing the appro-priate buttons or by activating the LogicsManager output "External acknowl-edgment" (via a discrete input or via an interface).
2903 2909	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is ena-bled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.3.7 Mains Overvoltage (Level 1 & 2) ANSI# 59

General notes

Voltage is monitored depending on parameter "Mains voltage measuring" (parameter 1853 ➡ p. 434). There are two overvoltage alarm levels available in the control. Both alarms are definite time alarms and are illustrated in the figure below. The figure diagrams a frequency trend and the associated pickup times and length of the alarms. Monitoring of the voltage is done in two steps.

> *If this protective function is triggered, the display indicates "Mains overvoltage 1" or "Mains over-voltage 2" and the logical command variable "07.10" or "07.11" will be enabled.*

Refer to ➡ *Chapter 9.1.1 “Triggering Characteristics” on page 673* for the triggering characteristic of this monitoring function.

> *The mains overvoltage Level 2 limit configuration parameters are located below the mains decou-pling function menu on the display.*

ID	Parameter	CL	Setting range [Default]	Description
2950 2956	**Monitoring**	2	**[On]**	Overvoltage monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: limit 1 < Level 2 limit).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
2954 2960	**Limit**	2	50.0 to 150.0% 2954: **[108.0%]** 2960: **[110.0%]** (Hysteresis: 0.7%) (Reset Delay: 80 ms)	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or exceeded for at least the delay time without interruption, the action specified by the alarm class is initiated. **Notes** This value refers to the Mains rated voltage (parameter 1768 p. 434).
2955 2961	**Delay**	2	0.02 to 99.99 s 2955: **[1.50 s]** 2961: **[0.06 s]**	If the monitored mains voltage exceeds the threshold value for the delay time configured here, an alarm will be issued. **Notes** If the monitored mains voltage falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.
2951 2957	**Alarm class**	2	Class A/B/C/D/E/F, Control 2951: **[A]** 2957: **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to *Chapter 9.5.1 "Alarm Classes" on page 965*
2952 2958	**Self acknowledge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
2953 2959	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32
8845	**Mns. decoupling by overvolt. 1**	2		The mains overvoltage 1 alarm can be linked to the mains decoupling function, if required.
			On	The mains overvoltage 1 trip is linked to the mains decoupling function with all its consequences.
			[Off]	The mains overvoltage 1 trip is ignored in the mains decoupling function.
				Notes It is recommended to configure the operating limits (parameter 5810 p. 362 to 5817 p. 362) within the monitoring limits.

4.5.3.8 Mains Undervoltage (Level 1 & 2) ANSI# 27

General notes

Voltage is monitored depending on parameter "Mains voltage measuring" (parameter 1853 ↪ p. 434). There are two undervoltage alarm levels available in the control. Both alarms are definite time alarms and are illustrated in the figure below. The figure diagrams a frequency trend and the associated pickup times and length of the alarms. Monitoring of the voltage is done in two steps.

If this protective function is triggered, the display indicates "Mains undervoltage 1" or "Mains undervoltage 2" and the logical command variable "07.12" or "07.13" will be enabled.

Refer ↪ *Chapter 9.1.1 "Triggering Characteristics" on page 673* for the triggering characteristic of this monitoring function.

The mains undervoltage Level 2 limit configuration parameters are located below the mains decoupling function menu on the display.

ID	Parameter	CL	Setting range [Default]	Description
3000 3006	**Monitoring**	2	**[On]**	Undervoltage monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: Level 1 limit < Level 2 limit).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
3004 3010	**Limit**	2	10.0 to 150.0% 3004: **[92.0%]** 3010: **[90.0%]** (Hysteresis: 0.7%) (Reset Delay: 80 ms)	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or exceeded for at least the delay time without interruption, the action specified by the alarm class is initiated. **Notes** This value refers to the "Mains rated voltage" (parameter 1768 ↪ p. 434). Minimum value follows BDEW requirement.
3005 3011	**Delay**	2	0.02 to 99.99 s 3005: **[1.50 s]** 3011: **[0.06 s]**	If the monitored mains voltage falls below the threshold value for the delay time configured here, an alarm will be issued. **Notes** If the monitored mains voltage exceeds the threshold (plus the hysteresis) again before the delay expires the time will be reset.
3001 3007	**Alarm class**	2	Class A/B/C/D/E/F, Control 3001: **[A]** 3007: **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to ↪ *Chapter 9.5.1 "Alarm Classes" on page 965*
3002 3008	**Self acknowledge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.

ID	Parameter	CL	Setting range [Default]	Description
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
3003 3009	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32
8844	**Mns. decoupling by undervolt. 1**	2		The mains undervoltage 1 alarm can be linked to the mains decoupling function, if required.
			On	The mains undervoltage 1 trip is linked to the mains decoupling function with all its consequences.
			[Off]	The mains undervoltage 1 trip is ignored in the mains decoupling function.
				Notes It is recommended to configure the operating limits (parameter 5810 ↳ p. 362 to 5817 ↳ p. 362) within the monitoring limits.

4.5.3.9 Mains Voltage Increase

General notes

Voltage is monitored depending on parameter "Monitoring" (parameter 8806 ↳ p. 376). This function allows the monitoring of the voltage quality over a longer time period. It is realized as a 10 minute moving average. The function is only active, if mains is within the operating range. If "Mains voltage measuring" (parameter 1853 ↳ p. 434) is configured to a three-phase measurement, the slow voltage increase alarm is monitoring the individual three-phase voltages of the mains according to parameter “AND characteristics” (parameter 8849 ↳ p. 376). The parameter "Mains decoupling volt. incr." (parameter 8808 ↳ p. 377) determines if a voltage increase shall trigger a mains decoupling or not.

> *If this protective function is triggered, the display indicates "Mains volt. increase". The alarm can be incorporated into the mains decoupling function.*

The average is set to "Mains rated voltage" (parameter 1768 ↬ p. 434) if:

- *Frequency is not in the operating range OR*
- *Monitoring (parameter 8806 ↬ p. 376) is "Off" OR*
- *Monitoring is "Delayed by engine speed" (parameter 8833 ↬ p. 377) OR*
- *Monitoring is tripped AND the measured voltage is again in the operating range*

Back synchronization is only possible, if:

- *The 10 minute average value is smaller than the defined limit AND*
- *The actual measured value is inside the operating range AND*
- *The mains settling time is over*

Please be aware that if "Mains voltage monitoring" (parameter 1771 ↬ p. 360) is configured to "All" and the mains voltage increase monitoring (parameter 8806 ↬ p. 376) is used, that this function only monitors "Phase - neutral".

ID	Parameter	CL	Setting range [Default]	Description
8806	**Monitoring**	2	On	Voltage increase monitoring is carried out according to the following parameters.
			[Off]	No monitoring is carried out.
8807	**Limit**	2	100 to 150% **[110%]**	The percentage voltage value that is to be monitored is defined here. If the average voltage over 10 minutes is higher, the action specified by the alarm class is initiated.
				Notes This value refers to the "Mains rated voltage" (parameter 1768 ↬ p. 434).
8849	**AND characteristics**	2	On	If the 10 minute voltage averages of **all** phases exceed the limit, the monitoring is tripping.
			[Off]	If the 10 minute voltage average of **at least one** phase exceeds the limit, the monitoring is tripping.
8831	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ↬ *Chapter 9.5.1 "Alarm Classes" on page 965*
8832	**Self acknowledge**	4	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).

ID	Parameter	CL	Setting range [Default]	Description
8833	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32
8808	**Mns. decoupl. by volt. increase**	2	On	Voltage increase monitoring does cause a decoupling.
			[Off]	Voltage increase monitoring does not cause a decoupling.
8850	**Volt. incr. average**	0	—	This visualization value shows the current 10 minute average voltage.

4.5.3.10 Mains Time-Dependent Voltage

General notes

Two Time Dependent Mains Voltage Monitors Available

Both monitors behave similar but each with a separate Fault-Ride-Through (FRT) curve.

Example of a Time Dependent Mains Voltage Curve

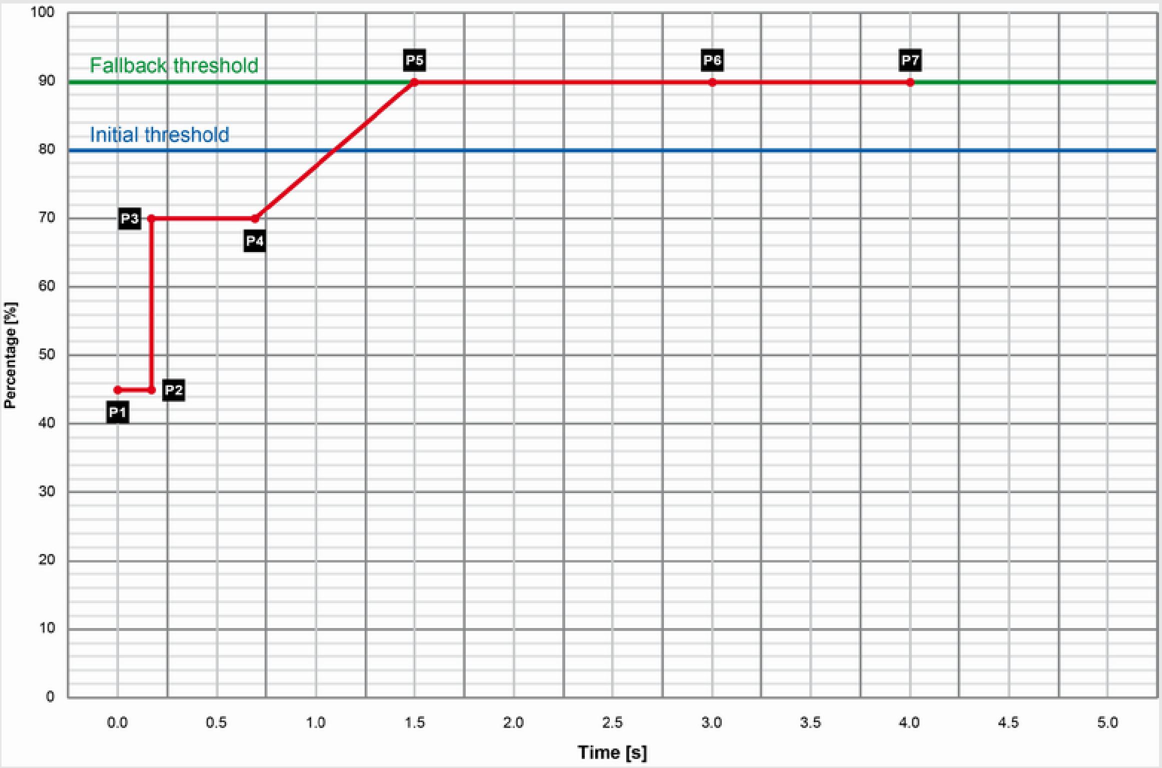


Fig. 186: Time-dependent voltage monitoring curve

P1	0.00 s → 45.0%	P4	0.70 s → 70.0%
P2	0.15 s → 45.0%	P5	1.50 s → 90.0%
P3	0.15 s → 70.0%	P6	3.00 s → 90.0%

P7	4.00 s → 90.0%
Fallback threshold	90.0%
Initial threshold	80.0%
Fallback time	1.00 s

General settings for Mains decoupling and Monitoring Voltage 1 & 2

Find parameters ...

Find parameters in two menus:

– *“Configuration ➔ Configure Monitoring ➔ Mains decoupling ➔ General ...”*

– *“Configuration ➔ Configure Monitoring ➔ Mains: Frequency / Voltage ➔ ... time-dependent voltage”*

ID	Parameter	CL	Setting range [Default]	Description
4989	**Mns. decoupl. by time-dep. volt.**	2	On	Time-dependent voltage monitoring does cause a decoupling.
			[Off]	Time-dependent voltage monitoring does not cause a decoupling.
4951	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ↳ *Chapter 9.5.1 “Alarm Classes” on page 965*
4959	**Self acknowledge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).

Table 84: Time Dependent Voltage Monitoring settings

4.5.3.10.1 Time Dependent Mains Voltage Monitor 1

This monitoring function is supporting a dynamic stabilization of mains. For this reason, a FRT (Fault-Ride-Through) curve can be defined.

Voltage is monitored depending on parameter "Mains voltage measuring" (parameter 1853 ↳ p. 434).

Furthermore it can be configured either as undervoltage or overvoltage monitoring (*“underrun”* or *“overrun”* selected with parameter "Monitoring at ..4953 ↳ p. 380). If the measured voltage of at least one phase (depends on the settings of parameter 4952 ↳ p. 379) falls below/exceeds the configured "Initial threshold" (parameter 4970 ↳ p. 380), the time-dependent voltage monitoring sequence starts and the voltage threshold will change in time according to the configured threshold curve points (see figure Fig. 186).

If the measured voltage falls below/exceeds this curve, the monitoring function triggers and LogicsManager 07.28 becomes TRUE. The mains decoupling function is incorporated, if configured. If the measured voltage falls below/exceeds the configured "Fallback threshold" (parameter 4978 ↳ p. 380) for at least the configured "Fallback time" (parameter 4968 ↳ p. 380), the time-dependent voltage monitoring sequence will be reset.

The threshold curve results from seven configurable points and a linear interpolation between these points. Fig. 186 shows the default FRT curve for time-dependent voltage monitoring. The curve shows the device default values according to a typical grid code requirement.

Rules for configuration

The time points should always have an ascending order. The fallback threshold (parameter 4978 ↳ p. 380) should always be configured to a value higher/lower than the initial threshold (parameter 4970 ↳ p. 380).

The monitoring on undervoltage over the undervoltage curve (or overvoltage or overvoltage curve) is always active, if the *"Monitoring"* (parameter 4950 ↳ p. 379) is enabled. A mains decoupling is only executed, if the generator runs parallel to mains.

The monitor behaves according to the configured *"AND characteristic"* (parameter 4952). When the AND characteristic is configured to "On", all 3 phases are taken into account. Only if **all** phases are below/above the configurable curve, the monitor will trip. When the AND characteristic is configured to "Off", the single phases are taken into account. Even if only one phase runs below/above the configurable curve, the monitor will trip.

The monitoring starts with passing the initial threshold. The tripping time is determined by the voltage deviation and its according curve location. The monitoring is disabled, if the voltage value (values) have crossed the fallback threshold. The monitor trips the LogicsManager 07.28 command variable 10877.

FRT Monitoring type

Parameter "Mains voltage monitoring" 1771 ↳ p. 360 determines, if the Ph-Ph or Ph-N measurement is used.

If type "**All**" is available and configured, and **3Ph4W** is configured, "Time dependent Voltage Monitoring" is calculated from both voltages. If **All and 1Ph3W** is configured, only PH-N values are used.

Time-dep. voltage 1

ID	Parameter	CL	Setting range [Default]	Description
4950	**Monitoring**	2	On	Time-dependent voltage monitoring is carried out according to the following parameters.
			[Off]	No monitoring is carried out.
4952	**AND characteristics**	2	On	Each phase falls below/exceeds the threshold for tripping.
			[Off]	At least one phase falls below/exceeds the threshold for tripping.

ID	Parameter	CL	Setting range [Default]	Description
4953	**Monitoring at**	2		Selects whether the system shall do over- or undervoltage monitoring.
			[Underrun]	The undervoltage monitoring is carried out (The monitoring function triggers if the measured voltage is below the curve).
			Overrun	The overvoltage monitoring is carried out (The monitoring function triggers if the measured voltage exceeds the curve).
4970	**Init threshold**	2	0.0 to 150.0% **[80.0%]**	The time-dependent voltage monitoring initial threshold is configured here. If the measured voltage falls below/exceeds this threshold, the monitoring sequence starts and the voltage threshold will change in time according to the configured threshold curve points. If the measured voltage falls below/exceeds this curve, the monitoring function triggers and the configured relay will energize.
4978	**Fallback threshold**	2	0.0 to 150.0% **[90.0%]**	The time-dependent voltage monitoring fallback voltage is configured here. If the measured voltage falls below/exceeds the voltage configured here for at least the configured "Fallback time" (parameter 4968 ⇘ p. 380), the monitoring sequence will be reset.
				Notes This parameter should always be configured to a value higher/lower than the "Init threshold" (parameter 4970 ⇘ p. 380) for proper operation. The parameter "Point 7 voltage" (parameter 4977 ⇘ p. 380) is used as fallback threshold if it is configured to a value higher/lower than the parameter "Fallback threshold" (parameter 4978 ⇘ p. 380).
4968	**Fallback time**	2	0.00 to 320.00 s **[1.00 s]**	The time-dependent voltage monitoring fallback time is configured here. If the measured voltage falls below/exceeds the configured "Fallback threshold" (parameter 4978 ⇘ p. 380) for at least the time configured here, the monitoring sequence will be reset.
4971 4972 4973 4974 4975 4976 4977	**Point {x} voltage** [x = 1 to 7]	2	0.0 to 150.0% 4971: **[45.0%]** 4972: **[45.0%]** 4973: **[70.0%]** 4974: **[70.0%]** 4975: **[90.0%]** 4976: **[90.0%]** 4977: **[90.0%]**	The voltage values of time-dependent voltage monitoring voltage points are configured here.
				Notes Please avoid a setting between 0.1% and 5.0%.
4961 4962 4963 4964 4965 4966 4967	**Point {x} time** [x = 1 to 7]	2	0.00 to 320.00 s 4961: **[0.00 s]** 4962: **[0.15 s]** 4963: **[0.15 s]** 4964: **[0.70 s]** 4965: **[1.50 s]** 4966: **[3.00 s]** 4967: **[4.00 s]**	The time values of time-dependent voltage monitoring time points are configured here.

4.5.3.10.2 Time Dependent Mains Voltage Monitor 2

The Time dependent voltage monitoring 2 is an additional independent FRT monitoring, which behaves like the Time dependent voltage monitoring 1 described in the previous chapter.

It serves a LogicsManager 07.31 command variable "Time-dep. voltage 2" 11750 to trip a relay or to incorporate the monitoring into the mains decoupling feature of the device.

The alarm class and the self-acknowledge feature is taken from the original time dependent voltage monitoring (see *"General settings for Mains decoupling and Monitoring Voltage 1 & 2" on page 378*.

Time-dep. voltage 2

ID	Parameter	CL	Setting range [Default]	Description
4954	**Monitoring**	2	On	Time-dependent voltage 2 monitoring is carried out according to the following parameters.
			[Off]	No monitoring is carried out.
4956	**AND characteristics**	2	On	Each phase falls below/exceeds the threshold for tripping.
			[Off]	At least one phase falls below/exceeds the threshold for tripping.
4957	**Monitoring at**	2		Selects whether the system shall do over- or undervoltage monitoring.
			[Underrun]	The undervoltage monitoring is carried out (The monitoring function triggers if the measured voltage is below the curve).
			Overrun	The overvoltage monitoring is carried out (The monitoring function triggers if the measured voltage exceeds the curve).
4990	**Init threshold**	2	0.0 to 200.0% **[80.0%]**	The time-dependent voltage 2 monitoring initial threshold is configured here. If the measured voltage falls below/exceeds this threshold, the monitoring sequence starts and the voltage threshold will change in time according to the configured threshold curve points. If the measured voltage 2 falls below/exceeds this curve, the monitoring function triggers and the configured relay will energize.
4998	**Fallback threshold**	2	0.0 to 200.0% **[90.0%]**	The time-dependent voltage 2 monitoring fallback voltage is configured here. If the measured voltage falls below/exceeds the voltage configured here for at least the configured "Fallback time" (parameter 4988 p. 381), the monitoring sequence will be reset.
				Notes This parameter should always be configured to a value higher/lower than the "Init threshold" (parameter 4990 p. 381) for proper operation. The parameter "Point 7 voltage" (parameter 4997 p. 381) is used as fallback threshold if it is configured to a value higher/lower than the parameter "Fallback threshold" (parameter 4998 p. 381).
4988	**Fallback time**	2	0.00 to 320.00 s **[1.00 s]**	The time-dependent voltage 2 monitoring fallback time is configured here. If the measured voltage falls below/exceeds the configured "Fallback threshold" (parameter 4998 p. 381) for at least the time configured here, the monitoring sequence will be reset.
4991 4992 4993 4994 4995 4996 4997	**Point {x} voltage (2)** [x = 1 to 7]	2	0.0 to 200.0% 4991: **[10.0%]** 4992: **[10.0%]** 4993: **[90.0%]** 4994: **[90.0%]** 4995: **[90.0%]** 4996: **[90.0%]** 4997: **[90.0%]**	The voltage values of time-dependent voltage 2 monitoring voltage points are configured here.

ID	Parameter	CL	Setting range [Default]	Description
				Notes Please avoid a setting between 0.1% and 5.0%.
4981 4982 4983 4984 4985 4986 4987	**Point {x} time** [x = 1 to 7]	2	0.00 to 320.00 s 4981: **[0.00 s]** 4982: **[0.15 s]** 4983: **[1.50 s]** 4984: **[10.00 s]** 4985: **[20.00 s]** 4986: **[30.00 s]** 4987: **[40.00 s]**	The time values of time-dependent voltage 2 monitoring time points are configured here.

4.5.3.11 QV Monitoring

General notes

In case of mains undervoltage some grid codes require a special monitoring function to avoid the import of inductive reactive power at the mains interchange point. The monitoring function measures close to the generator. For this reason the QV monitoring is a function of generator voltage and generator reactive power.

QV monitoring is triggered if the following conditions are fulfilled: (Refer to Fig. 187 for details)

- QV monitoring is configured to "On" (parameter 3292 ↳ p. 383)
- Measured reactive power is higher than the configured “Reactive power threshold” (parameter 3291 ↳ p. 383)
- Measured voltages are below the configured “Limit undervoltage” (parameter 3285 ↳ p. 383)

As a result Timer 1 and Timer 2 are starting. If the delay time "Delay step 1" (parameter 3283 ↳ p. 383) has exceeded, LogicsManager 07.29 becomes TRUE and the corresponding alarm message "QV monitoring 1" is indicated. If the delay time "Delay step 2" (parameter 3284 ↳ p. 383) has exceeded, LogicsManager 07.30 becomes TRUE and the corresponding alarm message "QV monitoring 2" is indicated.

If parameter “Mains decoupling by QV” (parameter 3296 ↳ p. 384) is configured to "On" the decoupling function is assigned to “Delay step 1” (parameter 3283 ↳ p. 383).

- *The LogicsManager command flags 07.29 and 07.30 can be additionally used to cause other actions according to the corresponding regulations of the grid.*
- *The QV Monitoring function according the German grid code VDE-AR-N 4105 depends on the parameter 1770 ↳ p. 317 "phase-phase/phase-neutral monitoring".*

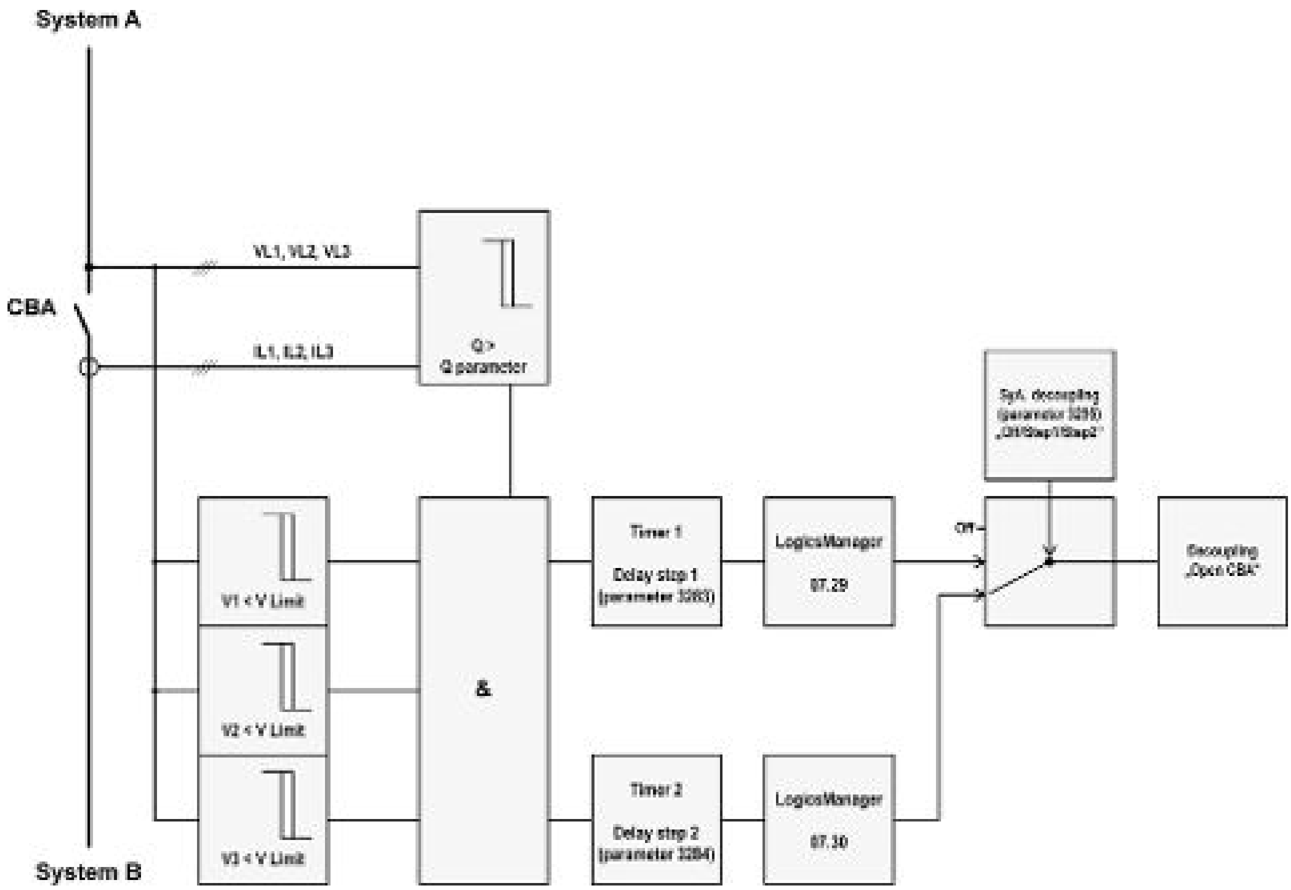


Fig. 187: QV monitoring - schematic

ID	Parameter	CL	Setting range [Default]	Description
3292	**Monitoring**	2	On	QV monitoring is carried out according to the following parameters.
			[Off]	No monitoring is carried out.
3285	**Limit under-voltage**	2	45 to 150% **[85%]**	The percentage voltage value that is to be monitored is defined here. If the voltages of all phases (one phase in 1Ph 2W system) are below this limit, the voltage condition for tripping the monitoring function is TRUE.
				Notes This value refers to the "Generator rated voltage" (parameter 1766 ␇ p. 431).
3291	**Reactive power threshold**	2	2 to 100% **[5%]**	The percentage reactive value that is to be monitored is defined here. If the absolute value of reactive power Q is higher than this threshold, the reactive power condition for tripping the monitoring function is TRUE.
				Notes This value refers to the "Gen. rated react. power [kvar]" (parameter 1758 ␇ p. 431).
3283	**Delay step 1**	2	0.10 to 99.99 s **[0.50 s]**	If the QV monitoring conditions are met, for the delay time configured here, an alarm "QV monitoring 1" will be issued and LogicsManager 07.29 becomes TRUE.
				Notes The decoupling function is only activated if "Mains decoupling by QV" (parameter 3296 ␇ p. 384) is configured to "On".
3284	**Delay step 2**	2	0.10 to 99.99 s **[1.50 s]**	If the QV monitoring conditions are met, for the delay time configured here, an alarm "QV monitoring 2" will be issued and LogicsManager 07.30 becomes TRUE.

ID	Parameter	CL	Setting range [Default]	Description
3280	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	The alarm class specifies what action should be taken when at least one delay has been exceeded.
				Notes The alarm class is valid for parameter 3283 ↳ p. 383 and 3284 ↳ p. 383. For additional information refer to ↳ *Chapter 9.5.1 "Alarm Classes" on page 965*
3293	**Self acknowledge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
				Notes The self acknowledge is valid for parameter 3283 ↳ p. 383 and 3284 ↳ p. 383.
3296	**Mains decoupling by QV**	2	On	The QV monitoring function is linked to the mains decoupling function with all its consequences and is assigned to "Delay step 1" (parameter 3283 ↳ p. 383).
			[Off]	The QV monitoring function is ignored in the mains decoupling function.

4.5.3.12 Change Of Frequency

Phase shift

A vector/phase shift is defined as the sudden variation of the voltage curve which may be caused by a major generator load change. It usually occurs, if the utility opens the MCB, which causes a load change for the genset.

The genset control measures the duration of a cycle, where a new measurement is started with each voltage passing through zero. The measured cycle duration will be compared with an internal quartz-calibrated reference time to determine the cycle duration difference of the voltage signal.

The phase shift monitoring is a very sensitive functionality and reacts according to the settings on each sinus wave constellation.

Please be aware that under special circumstances it may come to a phase shift trip, when switching elements are taken into the mains measurement lines because mains voltage sensing lines are switched nearby the genset control.

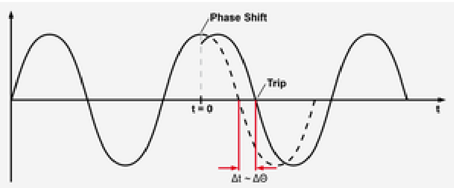


Fig. 188: Phase shift

A vector/phase shift as shown in Fig. 188 causes a premature or delayed zero passage. The determined cycle duration difference corresponds with the occurring phase shift angle.

The monitoring may be carried out three-phased or one/three-phased. Different limits may be configured for one-phase and three-phase monitoring. The vector/phase shift monitor can also be used as an additional method to decouple from the mains. Vector/phase shift monitoring is only enabled after the monitored voltage exceeds 50% of the PT secondary rated voltage.

Function "Voltage cycle duration not within the permissible range"

The voltage cycle duration exceeds the configured limit value for the phase/vector shift. The result is, that the power circuit breaker that disconnects from the mains, is opened, the message "Mains phase shift" is displayed, and the logical command variable "07.14" is enabled.

The prerequisite for phase/vector shift monitoring is that the generator is operating in a mains parallel operation (the MCB and GCB are both closed).

df/dt (ROCOF)

df/dt (rate of change of frequency) monitoring measures the stability of the frequency. The frequency of a source will vary due to changing loads and other effects. The rate of these frequency changes due to the load variances is relatively high compared to those of a large network.

Function "Rate of change of frequency not within permissible limits"

The control unit calculates the unit of measure per unit of time. The df/dt is measured over 4 sine waves to ensure that it is differentiated from a phase shift. This results in a minimum response time of approximately 100 ms (at 50 Hz).

ID	Parameter	CL	Setting range [Default]	Description
3058	**Change of frequency**	2	Off	Monitoring is disabled.
			[Phase shift]	Phase shift monitoring is carried out according to the parameters described in ↳ *"Phase shift" on page 384.*
			df/dt	df/dt monitoring is carried out according to the parameters described in ↳ *"df/dt (ROCOF)" on page 385.*
			Phase shift df/dt	Phase shift monitoring and df/dt monitoring is carried out. Tripping occurs if phase shift **or** df/dt is triggered.
3053	**Phase shift: Monitoring**	2	**[1- and 3 phase]**	During single-phase voltage phase/vector shift monitoring, tripping occurs if the phase/vector shift exceeds the configured threshold value (parameter 3054 ↳ p. 386) in at least one of the three phases.
			3 phase	During three-phase voltage phase/vector shift monitoring, tripping occurs only if the phase/vector shift exceeds the specified threshold value (parameter 3055 ↳ p. 386) in all three phases within 2 cycles.
				Notes If a phase/vector shift occurs in one or two phases, the single-phase threshold value (parameter 3054 ↳ p. 386) is taken into consideration; if a phase/vector shift occurs in all three phases, the three-phase threshold value (parameter 3055 ↳ p. 386) is taken into consideration. Single phase monitoring is very sensitive and may lead to nuisance tripping if the selected phase angle settings are too small. 3 phase mains phase shift monitoring is only enabled if Mains voltage measuring (parameter 1853 ↳ p. 434) is configured to "3Ph 4W" or "3Ph 3W".

ID	Parameter	CL	Setting range [Default]	Description
3054	**Phase shift: Limit 1 phase**	2	3 to 30° **[20°]**	If the electrical angle of the mains voltage shifts more than this configured value in any single phase, an alarm with the class configured in parameter 3051 ➡ p. 386 is initiated. Depending on the configured mains decoupling procedure (parameter 3110 ➡ p. 363), the GCB, MCB, or an external CB will be opened.
3055	**Phase shift: Limit 3 phase**	2	3 to 30° **[8°]**	If the electrical angle of the mains voltage shifts more than this configured value in all three phases, an alarm with the class configured in parameter 3051 ➡ p. 386 is initiated. Depending on the configured mains decoupling procedure (parameter 3110 ➡ p. 363), the GCB, MCB, or an external CB will be opened.
3051	**Phase shift: Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to ➡ *Chapter 9.5.1 "Alarm Classes" on page 965*.
3052	**Phase shift: Self acknowledge**	2	**[Yes]**	The control automatically clears the alarm if the fault condition is no longer detected.
			No	The control does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
3056	**Phase shift: Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32
3104	**df/dt: df/dt Limit**	2	0.1 to 9.9 Hz/s **[2.6 Hz/s]** (Hysteresis: 0.1 Hz/s) (Reset Delay: 80 ms)	The df/dt threshold is defined here. If this value is reached or exceeded for at least the delay time without interruption, an alarm with the class configured in parameter 3101 ➡ p. 386 is initiated. Depending on the configured mains decoupling procedure (parameter 3110 ➡ p. 363), the GCB, MCB, or an external CB will be opened.
3105	**df/dt: Delay**	2	0.10 to 2.00 s **[0.10 s]**	If the monitored rate of df/dt exceeds the threshold value for the delay time configured here, an alarm will be issued. If the monitored df/dt exceeds the threshold (plus the hysteresis) again before the delay expires the time will be reset.
3101	**df/dt: Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to ➡ *Chapter 9.5.1 "Alarm Classes" on page 965*.
3102	**df/dt: Self acknowledge**	2	Yes	The control automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
3103	**df/dt: Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.

ID	Parameter	CL	Setting range [Default]	Description
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.3.13 Mains Voltage Phase Rotation

General notes

NOTICE!

Damage to the control unit and/or generation equipment

– Please ensure during installation that all voltages applied to this unit are wired correctly to both sides of the circuit breaker.

Failure to do so may result in damage to the control unit and/or generation equipment due to closing the breaker asynchronous or with mismatched phase rotations and phase rotation monitoring enabled at all connected components (engine, generator, breakers, cable, busbars, etc.).

This function will block a connection of systems with mismatched phases only under the following conditions:

– The voltages being measured are wired correctly with respect to the phase rotation at the measuring points (i.e. the voltage transformer in front and behind the circuit breaker)
– The measuring voltages are wired without angular phase shift or interruption from the measuring point to the control unit
– The measuring voltages are wired to the correct terminals of the control unit (i.e. L1 of the generator is connected with the terminal of the control unit which is intended for the L1 of the generator)
– The LogicsManager function "Enable MCB" (refer to parameter 12923 ➷ p. 232/➷ p. 929) is false in case of a incorrect rotation field

Correct phase rotation of the phase voltages ensures that damage will not occur during a breaker closure to either the mains or the generator. The voltage phase rotation alarm checks the phase rotation of the voltages and the configured phase rotation to ensure they are identical.

The directions of rotation are differentiated as "clockwise" and "counter clockwise". With a clockwise field the direction of rotation is "L1-L2-L3"; with a counter clockwise field the direction of rotation is "L1-L3-L2".

If the control is configured for a clockwise rotation and the voltages into the unit are calculated as counterclockwise the alarm will be initiated. The direction of configured rotation being monitored by the control unit is displayed on the screen.

If this protective function is triggered, the display indicates "Mns.ph.rot. mismatch" and the logical command variable "07.05" will be enabled.

This monitoring function is only enabled if Mains voltage measuring (parameter 1853 ✎ p. 434) is configured to "3Ph 4W" or "3Ph 3W" and the measured voltage exceeds 50 % of the rated voltage (parameter 1768 ✎ p. 434) or if Mains voltage measuring (parameter 1853 ✎ p. 434) is configured to "1Ph 2W" (in this case, the phase rotation is not evaluated, but defined by the 1Ph2W phase rotation (parameter 1859 ✎ p. 430)).

ID	Parameter	CL	Setting range [Default]	Description
3970	**Monitoring**	2	**[On]**	Phase rotation monitoring is carried out according to the following parameters.
			Off	No monitoring is carried out.
3974	**Mains phase rotation**	2	**[CW]**	The three-phase measured mains voltage is rotating CW (clock-wise; that means the voltage rotates in L1-L2-L3 direction; standard setting).
			CCW	The three-phase measured mains voltage is rotating CCW (counter clock-wise; that means the voltage rotates in L1-L3-L2 direction).
3971	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes CAUTION: If an alarm class that leads to an engine shutdown (alarm class C or higher) is configured into this parameter, a main phase rotation alarm may lead to a genset shutdown due to an alarm of class C or higher. For additional information refer to ✎ *Chapter 9.5.1 “Alarm Classes” on page 965*
3972	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
3973	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.3.14 Mains Import Power (Level 1 & 2)

General notes

It is possible to monitor two independently configurable mains import power limit values. This function makes it possible to initiate external load shedding.

If this protective function is triggered, the display indicates "Mains import power 1" or "Mains import power 2" and the logical command variable "07.21" or "07.22" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
3200 3206	**Monitoring**	2	On	Mains import power monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: Level 1 limit < Level 2 limit).
			[Off]	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
3215 3216	**Monitoring at**	2	**[Overrun]**	The monitored value must exceed the limit to be considered as out of limits.
			Underrun	The monitored value must fall below the limit to be considered as out of limits.
3204 3210	**Limit**	2	0 to +150.00% 3204: **[80.00%]** 3210: **[100.00%]**	If this threshold value has been exceeded or fallen below (depending on the setting of parameter 3215 ➫ p. 389 or 3216 ➫ p. 389) for at least the delay time (parameter 3205 ➫ p. 389 or 3211 ➫ p. 389), the action specified by the alarm class is initiated. **Notes** This value refers to the Mains rated active power (parameter 1748 ➫ p. 434).
3213 3214	**Hysteresis**	2	0 to 99.99% **[0.01%]** (Reset Delay: 80 ms)	The monitored mains power level must return within the limits configured in parameter 3204 ➫ p. 389 or 3210 ➫ p. 389 plus or minus (depending on the setting of parameter 3215 ➫ p. 389 or 3216 ➫ p. 389) the value configured here, to reset the alarm.
3205 3211	**Delay**	2	0.02 to 99.99 s **[1.00 s]**	If the monitored mains import power falls below or exceeds (depending on the setting of parameter 3215 ➫ p. 389 or 3216 ➫ p. 389) the threshold value for the delay time configured here, an alarm will be issued. **Notes** If the monitored mains import power exceeds or falls below the threshold (plus or minus the hysteresis configured in parameter 3213 ➫ p. 389 or 3214 ➫ p. 389) before the delay expires the time will be reset.
3201 3207	**Alarm class**	2	Class A/B/C/D/E/F, Control 3201: **[A]** 3207: **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to ➫ *Chapter 9.5.1 "Alarm Classes" on page 965*
3202 3208	**Self acknowledge**	2	3202: **[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			3208: **[No]**	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
3203 3209	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.

ID	Parameter	CL	Setting range [Default]	Description
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.3.15 Mains Export Power (Level 1 & 2)

General notes

It is possible to monitor two independently configurable mains export power limit values. This function makes it possible to initiate external load shedding.

If this protective function is triggered, the display indicates "Mains export power 1" or "Mains export power 2" and the logical command variable "07.23" or "07.24" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
3225 3233	**Monitoring**	2	On	Mains export power monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: Level 1 limit < Level 2 limit).
			[Off]	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
3232 3240	**Monitoring at**	2	**[Overrun]**	The monitored value must exceed the limit to be considered as out of limits.
			Underrun	The monitored value must fall below the limit to be considered as out of limits.
3229 3237	**Limit**	2	0 to +150.00% 3229: **[80.00%]** 3237: **[100.00%]**	If this threshold value has been exceeded or fallen below (depending on the setting of parameter 3232 ➜ p. 390 or 3240 ➜ p. 390) for at least the delay time (parameter 3230 ➜ p. 390 or 3238 ➜ p. 390), the action specified by the alarm class is initiated. **Notes** This value refers to the Mains rated active power (parameter 1748 ➜ p. 434).
3231 3239	**Hysteresis**	2	0 to 99.99% **[0.01%]** (Reset Delay: 80 ms)	The monitored mains power level must return within the limits configured in parameter 3229 ➜ p. 390 or 3237 ➜ p. 390 plus or minus (depending on the setting of parameter 3232 ➜ p. 390 or 3240 ➜ p. 390) the value configured here, to reset the alarm.
3230 3238	**Delay**	2	0.02 to 99.99 s **[1.00 s]**	If the monitored mains export power falls below or exceeds (depending on the setting of ns export power falls below or exceeds (depending on the setting of parameter 3232 ➜ p. 390 or 3240 ➜ p. 390) the threshold value for the delay time configured here, an alarm will be issued. **Notes** If the monitored mains import power exceeds or falls below the threshold (plus or minus the hysteresis configured in parameter 3231 ➜ p. 390 or 3239 ➜ p. 390) before the delay expires the time will be reset.
3226 3234	**Alarm class**	2	Class A/B/C/D/E/F, Control 3226: **[A]** 3234: **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to ➜ *Chapter 9.5.1 "Alarm Classes" on page 965*

ID	Parameter	CL	Setting range [Default]	Description
3227 3235	**Self acknowledge**	2	3227: **[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			3235: **[No]**	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
3228 3236	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.3.16 Engine/Mains Active Power Mismatch

General notes

If enabled, this monitoring function becomes only active if generator power control is enabled and the active power setpoint is configured to "Import" or "Export" (refer to *Chapter 4.4.4.5 "Load Control" on page 266*). If the measured import or export power deviates from the power setpoint by a value exceeding the limit configured in parameter 2935 p. 391 for a time exceeding the delay configured in parameter 2933 p. 391, an alarm will be issued.

If this protective function is triggered, the display indicates "Mns act.pwr mismatch" and the logical command variable "07.16" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
2930	**Monitoring**	2	**[On]**	On Monitoring of the mains active power mismatch is carried out according to the following parameters.
			Off	Monitoring is disabled.
2935	**Limit**	2	1.0 to 99.9% **[5.0%]**	If the difference between the measured import or export power and the power setpoint exceeds this value for at least the delay time (parameter 2933 p. 391) without interruption, the action specified by the alarm class is initiated.
				Notes This value refers to the mains rated active power (parameter 1748 p. 434).
2933	**Delay**	2	3 to 9999 s **[30 s]**	If the monitored active power mismatch exceeds the threshold value configured in parameter 2935 p. 391 for the delay time configured here, an alarm will be issued.
				Notes If the monitored active power mismatch falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.

ID	Parameter	CL	Setting range [Default]	Description
2931	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to *Chapter 9.5.1 "Alarm Classes" on page 965*
2932	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
2936	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.3.17 Mains Lagging Power Factor (Level 1 & 2)

General notes

The power factor is monitored for becoming more lagging (i.e. inductive) than an adjustable limit. This limit may be a lagging or leading power factor limit. There are two lagging power factor alarm levels available in the control. This monitoring function may be used for monitoring or controlling the power factor compensation. Both alarms are definite time alarms.

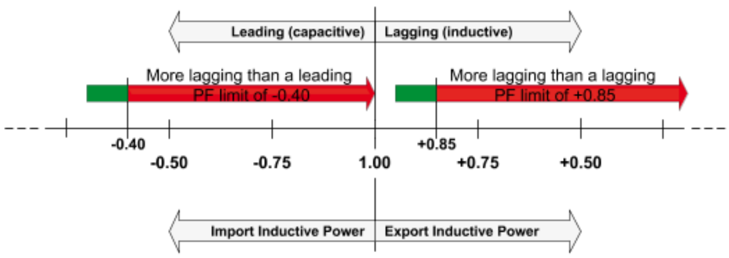


Fig. 189: Mains lagging power factor

Fig. 189 shows an example of a leading and a lagging power factor limit and the power factor range, for which the lagging power factor monitoring issues an alarm.

If this protective function is triggered, the display indicates "Mains PF lagging 1" or "Mains PF lagging 2" and the logical command variable "07.17" or "07.18" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
2975 2980	**Monitoring**	2	On	Mains lagging power factor monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other.
			[Off]	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
2978 2983	**Limit**	2	-0.999 to 1.000 2978: **[+ 0.900]** 2983: **[+ 0.800]**	The values that are to be monitored for each threshold limit are defined here.
				Notes If the power factor becomes more lagging (i.e. inductive, Fig. 189) than a lagging PF value (pos.) or a leading PF value (neg.) for at least the delay time (parameters 2979 ↬ p. 393 or 2984 ↬ p. 393) without interruption, the logical command variables 07.17 (level 1) or 07.18 (level 2) are enabled and the action specified by the alarm class is initiated.
2989 2990	**Hysteresis**	2	0.0 to 0.99 **[0.02]** (Reset Delay: 80 ms)	The monitored power factor must return within the limits configured in parameter 2978 ↬ p. 393 or 2983 ↬ p. 393 minus the value configured here, to reset the alarm.
2979 2984	**Delay**	2	0.02 to 99.99 s 2979: **[30.00 s]** 2984: **[1.00 s]**	If the monitored generator power factor is more lagging than the configured limit for the delay time configured here, an alarm will be issued.
				Notes If the monitored generator power factor returns within the limit (minus the Hysteresis configured in parameter 2989 ↬ p. 393 or 2990 ↬ p. 393) before the delay expires the time will be reset.
2987 2988	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ↬ *Chapter 9.5.1 "Alarm Classes" on page 965*
2976 2981	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
2977 2982	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.3.18 Mains Leading Power Factor (Level 1 & 2)

General notes

The power factor is monitored for becoming more leading (i.e. capacitive) than an adjustable limit. This limit may be a leading or lagging power factor limit. There are two leading power factor alarm levels available in the control. This monitoring function may be used for monitoring or controlling the power factor compensation. Both alarms are definite time alarms.

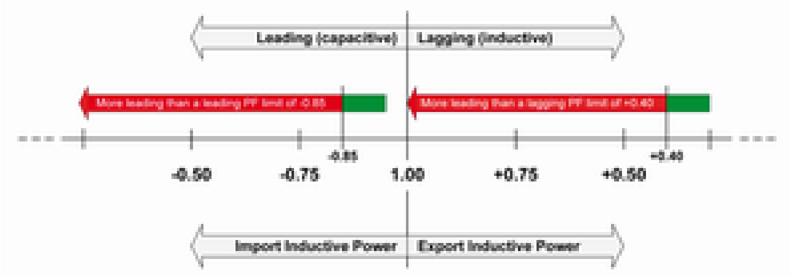


Fig. 190: Mains leading power factor

Fig. 190 shows an example of a leading and a lagging power factor limit and the power factor range, for which the leading power factor monitoring issues an alarm.

If this protective function is triggered, the display indicates "Mains PF leading 1" or "Mains PF leading 2" and the logical command variable "07.19" or "07.20" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
3025 3030	**Monitoring**	2	On	Mains leading power factor monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other.
			[Off]	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
3028 3033	**Limit**	2	-0.999 to 01.000 3028: **[- 0.900]** 3033: **[- 0.800]**	The values that are to be monitored for each threshold limit are defined here. **Notes** If the power factor becomes more leading (i.e. inductive, Fig. 190) than a leading PF value (pos.) or a leading PF value (neg.) for at least the delay time (parameters 3029 ➪ p. 394 or 3034 ➪ p. 394) without interruption, the logical command variables 07.17 (level 1) or 07.18 (level 2) are enabled and the action specified by the alarm class is initiated.
3039 3040	**Hysteresis**	2	0.0 to 0.99 **[0.02]** (Reset Delay: 80 ms)	The monitored power factor must return within the limits configured in parameter 3028 ➪ p. 394 or 3033 ➪ p. 394 minus the value configured here, to reset the alarm.
3029 3034	**Delay**	2	0.02 to 99.99 s 3029: **[10.00 s]** 3034: **[1.00 s]**	If the monitored generator power factor is more leading than the configured limit for the delay time configured here, an alarm will be issued. **Notes** If the monitored generator power factor returns within the limit (minus the Hysteresis configured in parameter 3039 ➪ p. 394 or 3033 ➪ p. 394) before the delay expires the time will be reset.
3037 3038	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to ➪ *Chapter 9.5.1 "Alarm Classes" on page 965*
3026 3031	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).

ID	Parameter	CL	Setting range [Default]	Description
3027 3032	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.4 Breaker

4.5.4.1 Configure GCB

General notes

Circuit breaker monitoring contains two alarms: A "breaker reclose" alarm and a "breaker open" alarm.

"Breaker reclose alarm"

If the control initiates a close of the breaker and the breaker fails to close after the configured number of attempts the monitoring CB alarm will be initiated (refer to parameter "GCB maximum closing attempts", parameter 3418 ➦ p. 396).

If this protective function is triggered, the display indicates "GCB fail to close" and the logical command variable "08.05" will be enabled.

"Breaker open alarm"

If the control is attempting to open the circuit breaker and it fails to see that the CB is open within the configured time in seconds after issuing the breaker open command then the monitoring CB alarm will be initiated (refer to parameter "GCB open monitoring", parameter 3420 ➦ p. 396).

NOTICE!

If load-dependent start/stop (refer to ➦ *Chapter 4.4.5.5 "Load Dependent Start/Stop (LDSS)" on page 298*) is enabled, this monitoring function must be configured with a shutdown alarm class C, D, E, or F) or disable load-dependent start/stop if triggered to ensure that the next engine will be started.

If this protective function is triggered, the display indicates "GCB fail to open" and the logical command variable "08.06" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
2600	**Monitoring**	2	**[On]**	Monitoring of the GCB is carried out according to the following parameters.
			Off	Monitoring is disabled.

ID	Parameter	CL	Setting range [Default]	Description
2601	**GCB Alarm class**	2	Class A/B/C/D/E/F/ Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ✎ *Chapter 9.5.1 "Alarm Classes" on page 965*
3418	**GCB maximum closing attempts**	2	1 to 10 **[5]**	The maximum number of breaker closing attempts is configured in this parameter (relay output "Command: close GCB"). When the breaker reaches the configured number of attempts, a "GCB fail to close" alarm is issued. The counter for the closure attempts will be reset as soon as the "Reply GCB" is de-energized for at least 5 seconds to signal a closed GCB.
3420	**GCB open monitoring**	2	0.10 to 5.00 s **[2.00 s]**	If the "Reply GCB" is not detected as energized once this timer expires, a "GCB fail to open" alarm is issued. This timer initiates as soon as the "open breaker" sequence begins. The alarm configured in parameter 2601 ✎ p. 396 is issued.

4.5.4.2 Synchronization GCB

General notes

> **NOTICE!**
> If load-dependent start/stop (refer to ✎ *Chapter 4.4.5.5 "Load Dependent Start/Stop (LDSS)" on page 298*) is enabled, this monitoring function must be configured with a shutdown alarm class C, D, E, or F) or disable load-dependent start/stop if triggered to ensure that the next engine will be started.

ID	Parameter	CL	Setting range [Default]	Description
3060	**Monitoring**	2	**[On]**	Monitoring of the GCB synchronization is carried out according to the following parameters.
			Off	Monitoring is disabled.
3063	**Timeout**	2	3 to 999 s **[60 s]**	If it was not possible to synchronize the GCB within the time configured here, an alarm will be issued. The message "GCB syn. timeout" is issued and the logical command variable "08.30" will be enabled.
3061	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ✎ *Chapter 9.5.1 "Alarm Classes" on page 965*

ID	Parameter	CL	Setting range [Default]	Description
3062	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).

4.5.4.3 Configure GGB

General notes

All parameters listed below only apply to application mode A05, A06, A09, A10, A11 and A12.

Circuit breaker monitoring contains two alarms: A breaker reclose alarm and a breaker open alarm.

"Breaker reclose alarm"

If the control unit initiates a close of the breaker and the breaker fails to close after the configured number of attempts the monitoring CB alarm will be initiated.

- Refer to parameter "GGB maximum closing attempts", parameter 3087 ↳ p. 398.

If this protective function is triggered, the display indicates "GGB fail to close" and the logical command variable "08.34" will be enabled.

"Breaker open alarm"

If the control unit is attempting to open the circuit breaker and it fails to see that the CB is open within the configured time in seconds after issuing the breaker open command then the monitoring CB alarm will be initiated.

- Refer to parameter "GGB open monitoring", parameter 3088 ↳ p. 398.

If this protective function is triggered, the display indicates "GGB fail to open" and the logical command variable "08.35" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
3085	**GGB monitoring**	2	**[On]**	Monitoring of the GGB is carried out according to the following parameters.
			Off	Monitoring is disabled.
3086	**GGB Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.

ID	Parameter	CL	Setting range [Default]	Description
				Notes For additional information refer to ⇨ *Chapter 9.5.1 "Alarm Classes" on page 965*
3087	**GGB maximum closing attempts**	2	1 to 10 **[5]**	The maximum number of breaker closing attempts is configured in this parameter (relay output "Command: close GGB"). When the breaker reaches the configured number of attempts, an "GGB fail to close" alarm is issued. The counter for the closure attempts will be reset as soon as the "Reply GGB" is de-energized for at least 5 seconds to signal a closed GGB.
3088	**GGB open monitoring**	2	0.10 to 5.00 s **[2.00 s]**	If the "Reply GGB" is not detected as energized once this timer expires, an "GGB fail to open" alarm is issued. This timer initiates as soon as the "open breaker" sequence begins. The alarm configured in parameter 3086 ⇨ p. 397 is issued.

4.5.4.4 Synchronization GGB

ID	Parameter	CL	Setting range [Default]	Description
3080	**Monitoring**	2	On	Monitoring of the GGB synchronization is carried out according to the following parameters.
			[Off]	Monitoring is disabled.
3083	**Delay**	2	3 to 999 s **[30 s]**	If it was not possible to synchronize the GGB within the time configured here, an alarm will be issued. The message "GGB syn. timeout" is issued and the logical command variable "08.32" will be enabled.
3081	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ⇨ *Chapter 9.5.1 "Alarm Classes" on page 965*
3082	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).

4.5.4.5 Configure MCB

General notes

If an alarm is detected when attempting to close the MCB, an emergency power operation will be carried out if the "Emergency start with MCB failure" is "On".

If an alarm class higher than 'B' class has been selected it will not be possible to start the engine with the setting "Emergency start with MCB failure" (parameter 3408 ➡ p. 314) = configured as "On" in an emergency power condition.

All parameters listed below only apply to application mode A04, A06, A08, A09, and A11.

Circuit breaker monitoring contains two alarms: A breaker reclose alarm and a breaker open alarm.

"Breaker reclose alarm"

If the control unit initiates a close of the breaker and the breaker fails to close after the configured number of attempts the monitoring CB alarm will be initiated.

- Refer to parameter "MCB maximum closing attempts", parameter 3419 ➡ p. 400.

If this protective function is triggered, the display indicates "MCB fail to close" and the logical command variable "08.07" will be enabled.

"Breaker open alarm"

If the control unit is attempting to open the circuit breaker and it fails to see that the CB is open within the configured time in seconds after issuing the breaker open command then the monitoring CB alarm will be initiated.

- Refer to parameter "MCB open monitoring", parameter 3421 ➡ p. 400.

If this protective function is triggered, the display indicates "MCB fail to open" and the logical command variable "08.08" will be enabled.

Fault at 'closing the MCB'

Alarm classes A & B

- Parameter 2802 ↬ p. 314 "Emergency run" = Off;
  If the MCB cannot be closed, the busbar remains without voltage, until the MCB breaker fault is acknowledged.
  The control continues attempting to close the MCB.
- Parameter 2802 ↬ p. 314 "Emergency run" = On, parameter 3408 ↬ p. 314 "Emergency start with MCB failure" = Off;
  If the MCB cannot be closed, the busbar remains without voltage, until the MCB breaker fault is acknowledged.
  The control continues attempting to close the MCB.
- Parameter 2802 ↬ p. 314 "Emergency run" = On, parameter 3408 ↬ p. 314 "Emergency start with MCB failure" = On;
  If the MCB cannot be closed, an emergency power operation is initiated (the engine is started and the GCB is closed; the busbar is supplied by the generator).
  If the alarm is acknowledged and if the MCB can be closed, the load is switched to mains supply and the emergency power operation terminates.

Fault at 'opening the MCB'

This alarm class has the following influence to the function of the unit:

- This fault is processed according to the action described within the alarm classes. As long as the reply is present that the MCB is still closed, the GCB cannot be closed.

ID	Parameter	CL	Setting range [Default]	Description
2620	**MCB monitoring**	2	**[On]**	Monitoring of the MCB is carried out according to the following parameters.
			Off	Monitoring is disabled.
2621	**MCB Alarm class**	2	Class A/B/C/D/E/F/Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ↬ *Chapter 9.5.1 "Alarm Classes" on page 965*
3419	**MCB maximum closing attempts**	2	1 to 10 **[5]**	The maximum number of breaker closing attempts is configured in this parameter (relay output "Command: close MCB"). When the breaker reaches the configured number of attempts, an "MCB fail to close" alarm is issued. The counter for the closure attempts will be reset as soon as the "Reply MCB" is de-energized for at least 5 seconds to signal a closed MCB.
3421	**MCB open monitoring**	2	0.10 to 5.00 s **[2.00 s]**	If the "Reply MCB" is not detected as energized once this timer expires, an "MCB fail to open" alarm is issued. This timer initiates as soon as the "open breaker" sequence begins. The alarm configured in parameter 2621 ↬ p. 400 is issued.

4.5.4.6 Synchronization MCB

ID	Parameter	CL	Setting range [Default]	Description
3070	**Monitoring**	2	**[On]**	Monitoring of the MCB synchronization is carried out according to the following parameters.
			Off	Monitoring is disabled.
3073	**Timeout**	2	3 to 999 s **[60 s]**	If it was not possible to synchronize the MCB within the time configured here, an alarm will be issued. The message "MCB syn. timeout" is issued and the logical command variable "08.31" will be enabled.
3071	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to *Chapter 9.5.1 “Alarm Classes” on page 965*
3072	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).

4.5.4.7 Configure Neutral Contactor

General notes

The monitoring of the Neutral Contactor (NC) feedback "Neutral contactor reply mismatch" 17.09 is performed always, if the Neutral Interlocking (parameter 1840 p. 235) and the Monitoring function are enabled (parameter 5148 p. 401). The monitor checks, if the feedback behaves according to the NC command. With a configurable delay time, the alarm is activated with a general alarm text. Open failure or closure failure are not differentiated.

Please refer to *Chapter 6.3.14 “Neutral Interlocking” on page 576* for more details.

ID	Parameter	CL	Setting range [Default]	Description
5148	**Monitoring**	2	On	Monitoring of the Neutral Contactor is carried out according to the following parameters, if the Neutral Interlocking function (parameter 1840 p. 235) is enabled .
			[Off]	Monitoring is disabled.
5152	**Delay**	2	0.10 ... 5.00 s **[2.00 s]**	Period of continuous failure signal before tripping a failure.
5149	**Alarm class**	2	Class A/B/C/D/E/F/ CONTROL **[B]**	This function may be assigned an independent alarm class that specifies what action should be taken when this function triggers an alarm.
				Notes For additional information refer to *Chapter 9.5.1 “Alarm Classes” on page 965*.

ID	Parameter	CL	Setting range [Default]	Description
5150	**Self acknowledge**	2	Yes	The control automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
5153	**Alarm text**	-	**[N-cont. reply mism.]**	Text is visible in display during alarm is detected.

4.5.5 Flexible Limits

General notes

CAUTION!

Hazards due to improper configuration of protective functions

Flexible Limits must not be used for protective functions, because the monitoring function is not guaranteed beyond an exceeding of 320 %.

It is not possible to monitor temperature values in Degree Fahrenheit and pressure values in psi. Although parameters 3631 ↻ p. 191 or 3630 ↻ p. 191 are configured to a value display in °F or psi, flexible limit monitoring always refers to the value in Degree Celsius or bar (J1939 protocol: kPa).

This control unit offers 40 flexible limits. They may be used for "limit switch" functions of all measured analog values. It is possible to choose between alarm (warning and shutdown) and control operation via the LogicsManager.

If an alarm class is triggered, the display indicates "Flexible limit {x}", where {x} indicates the flexible limit 1 to 40, or the text configured using ToolKit and the logical command variable "15.{x}" will be enabled.

The flexible limits 25 through 32 are configurable additionally with a 'Fallback time' e.g., for load shedding.

The flexible limits 33 through 40 are disabled during idle mode operation (refer to ↻ Chapter 4.4.1.4 “Idle Mode” on page 176).

The following parameter description refers to flexible limit 1. The flexible limits 2 through 40 are configured accordingly. The parameter IDs of the flexible limits 2 through 40 are listed below.

ID	Parameter	CL	Setting range [Default]	Description
4208	**Description**	2	user defined (up to 39 characters) **[Flex. limit {x}]**	A description for the respective flexible limit may be entered here. The description may have 4 through 20 characters and is displayed instead of the default text if this limit is exceeded.
				Notes This parameter may only be configured using ToolKit. 19 characters are best for HMI readability - text strings with 20 and more characters but without a blank in between are NOT visible as headline on detail screen. Selection screen on HMI/display works fine with up to 30 characters; others are overwritten by mandatory screen symbols. The max. number of characters depends on the numbers of Bytes for each character. Please verify the length on the display for best view.
4200	**Monitoring**	2	On	Monitoring of the limit {x} is carried out according to the following parameters.
			[Off]	Monitoring is disabled.
4204	**Monitoring at**	2	**[Overrun]**	The monitored value must exceed the threshold limit for a fault to be recognized.
			Underrun	The monitored value must fall below the threshold limit for a fault to be recognized.
4205	**Limit**	2	-21000000.00 to 21000000.00 **[100.00]**	The threshold limit of the value to be monitored is defined by this parameter. If this value is reached or exceeded / fallen below (dependent on parameter 4207 p. 403) for at least the delay time configured in parameter 4207 p. 403 the action specified by the alarm class is initiated after the configured delay expires. The entry format of the threshold depends on the respective analog value. If the monitored analog value has a reference value, the threshold is expressed as a percentage of this reference value (-320.00 % to 320.00 %). If an analog input is monitored, the threshold refers to the display value format (refer to *Chapter 9.4.2.12 "Display Value Format" on page 955*).
				Notes Refer to *"Examples" on page 405* for examples on how to configure the limit.
4216	**Hysteresis**	2	0 to 21000000.00 **[1.00]**	During monitoring, the actual value must exceed or fall below one of the limits defined in parameter 4205 p. 403 to be recognized as out of permissible limits. For a value to register as having returned to the permissible limits, the monitored value must rise above or fall below this value for the hysteresis. The format for entering the hysteresis depends on the monitored analog input and corresponds with the one of the threshold listed in parameter 4205 p. 403.
4207	**Delay**	2	0.02 to 99999.99 s **[1.00 s]**	If the monitored value exceeds or falls below the threshold value for the delay time configured here, an alarm will be issued. If the monitored value falls below the threshold (plus/minus the hysteresis, dependent on parameter 4204 p. 403) before the delay expires the time will be reset.
	Beginning: For flexible limit 25 ... 32 only; sample refers to flexible limit #25.			
6646	**Fallback time**	2	00.02 to 327.00 s **[1.00 s]**	If the monitored value exceeds or falls below the threshold value, a counter will start and finally disable the alarm. If the monitored value comes back into the threshold value (plus/minus the hysteresis) before the fallback time expires the time will be reset.
	End: For flexible limit 25 ... 32 only; sample referred to flexible limit #25.			
4201	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to *Chapter 9.5.1 "Alarm Classes" on page 965*

ID	Parameter	CL	Setting range [Default]	Description
4202	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
4203	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32
4206	**AM FlexLim 1 source**	2	Determined by AnalogManager 82.01 **[A1 = 10.01 ZERO]**	Any possible data sources may be selected. Analog and digital OUT value/ signal are available as sources for AnalogManager and LogicsManager. Refer to *Chapter 9.4.1 "Data Sources AM" on page 933* for a list of all data sources.

Parameter IDs

Flexible limit #	Description	Monitoring	Monitored analog value	Monitoring at	Limit	Hysteresis	Delay Fallback	Alarm class	Self acknowledge	Enabled
1	4208	4200	4206	4204	4205	4216	4207	4201	4202	4203
2	4225	4217	4223	4221	4222	4233	4224	4218	4219	4220
3	4242	4234	4240	4238	4239	4250	4241	4235	4236	4237
4	4259	4251	4257	4255	4256	4267	4258	4252	4253	4254
5	7108	4270	4276	4274	4275	4278	4277	4271	4272	4273
6	7116	4280	4286	4284	4285	4288	4287	4281	4282	4283
7	7124	4290	4296	4294	4295	4298	4297	4291	4292	4293
8	7132	6000	6006	6004	6005	6008	6007	6001	6002	6003
9	7140	6010	6016	6014	6015	6018	6017	6011	6012	6013
10	7148	6020	6026	6024	6025	6028	6027	6021	6022	6023
11	7156	6030	6036	6034	6035	6038	6037	6031	6032	6033
12	7164	6040	6046	6044	6045	6048	6047	6041	6042	6043
13	7172	6050	6056	6054	6055	6058	6057	6051	6052	6053
14	7180	6060	6066	6064	6065	6068	6067	6061	6062	6062
15	7188	6070	6076	6074	6075	6078	6077	6071	6072	6073
16	7196	6080	6086	6084	6085	6088	6087	6081	6082	6083
17	7204	6090	6096	6094	6095	6098	6097	6091	6092	6093
18	7212	6100	6106	6104	6105	6108	6107	6101	6102	6103
19	7220	6110	6116	6114	6115	6118	6117	6111	6112	6113
20	7228	6120	6126	6124	6125	6128	6127	6121	6122	6123
21	7236	6130	6136	6134	6135	6138	6137	6131	6132	6133

Flexible limit #	Descrip-tion	Moni-toring	Moni-tored analog value	Moni-toring at	Limit	Hyste-resis	Delay Fallback	Alarm class	Self acknowl-edge	Enabled
22	7244	6140	6146	6144	6145	6148	6147	6141	6142	6143
23	7252	6150	6156	6154	6155	6158	6157	6151	6152	6153
24	7260	6160	6166	6164	6165	6168	6167	6161	6162	6163
25	7268	6170	6176	6174	6175	6178	6177 6646	6171	6172	6173
26	7276	6180	6186	6184	6185	6188	6187 6647	6181	6182	6183
27	7284	6190	6196	6194	6195	6108	6197 6648	6191	6192	6193
28	7292	6200	6206	6204	6205	6208	6207 6649	6201	6202	6203
29	7300	6210	6216	6214	6215	6218	6217 6650	6211	6212	6213
30	7308	6220	6226	6224	6225	6228	6227 6651	6221	6222	6223
31	7316	6230	6236	6234	6235	6238	6237 6652	6231	6232	6233
32	7324	6240	6246	6244	6245	6248	6247 6653	6241	6242	6243
33	7332	6250	6256	6254	6255	6258	6257	6251	6252	6253
34	7340	6260	6266	6264	6265	6268	6267	6261	6262	6263
35	7348	6270	6276	6274	6275	6278	6277	6271	6272	6273
36	7356	6280	6286	6284	6285	6288	6287	6281	6282	6283
37	7364	6290	6296	6294	6295	6298	6297	6291	6292	6293
38	7372	6300	6306	6304	6305	6308	6307	6301	6302	6303
39	7380	6310	6316	6314	6315	6318	6317	6311	6312	6313
40	7388	6320	6326	6324	6325	6328	6327	6321	6322	6323

Table 85: Flexible limits - parameter IDs

Examples

Example value	Desired limit	Reference value / display value	Limit entry format
01.24 Total generator real power in %	160 kW	Generator rated real power (parameter 1752 ⤷ p. 431) = 200 kW	8000 (= 80.00%)
01.09 Generator frequency in %	51.5 Hz	Rated frequency (param-eter 1750 ⤷ p. 429) = 50 Hz	10300 (= 103.00%)
11.01 Engine speed	1256 rpm	Rated speed (param-eter 1601 ⤷ p. 438) = 1500 rpm	08373 (= 83.73%)
06.03 Analog input 3 (config-ured to VDO 5 bar)	4.25 bar	Display in 0.01 bar	00425 (= 4.25 bar)

Example value	Desired limit	Reference value / display value	Limit entry format
06.02 Analog input 2 (configured to VDO 150 °C)	123 °C	Display in °C	00123 (= 123 °C)
06.03. Analog input 3 (configured to Linear, Value at 0% = 0, Value at 100% = 1000)	10 mm	Display in 0.000 m (parameter 1035 ↳ p. 196/ ↳ p. 575 configured to 0.000 m)	00010 (= 0.010 mm)

Table 86: Flexible limits - analog value examples

The flexible limits must be used to monitor analog inputs like oil pressure or coolant temperature for example. We recommend to change the flexible limit description accordingly.

The table below gives some configuration examples. The analog inputs must be configured accordingly.

Parameter	Example for low oil pressure monitoring	Example for high coolant temperature monitoring
Description	Oil pressure	Coolant temp.
Monitoring	On	On
Monitored data source	06.01 Analog input 1	06.02 Analog input 2
Monitoring at	Underrun	Overrun
Limit	200 (2.00 bar)	80 (80 °C)
Hysteresis	10	2
Delay	0.50 s	3 s
Alarm class	F	B
Self acknowledgment	No	No
Delayed by engine speed	Yes	No

Table 87: Flexible limits - configuration examples

4.5.6 Miscellaneous

4.5.6.1 General monitoring settings

ID	Parameter	CL	Setting range [Default]	Description
1756	**Time until horn reset**	0	0 to 1,000 s **[180 s]**	After each alarm of alarm class B through F occurs, the alarm LED flashes and the horn (command variable 03.05) is enabled. After the delay time "time until horn reset" has expired, the horn (command variable 03.05) is disabled. The alarm LED flashes until the alarm has been acknowledged either via the push button, the LogicsManager, or the interface. **Notes** If this parameter is configured to 0, the horn will remain active until it will be acknowledged.

ID	Parameter	CL	Setting range [Default]	Description
12490	**Ext. acknowl-edge** (External acknowledg-ment of alarms)	2	Determined by LogicsManager 86.15 **[(09.05 Dis-crete input 5 & 1) OR 04.14 Remota acknowledge]** = 10714	It is possible to acknowledge all alarms simultaneously from remote, e.g. with a discrete input. The logical output of the LogicsManager has to become TRUE twice. The first time is for acknowledging the horn, the second for all alarm mes-sages. The On-delay time is the minimum time the input signals have to be "1". The Off-delay time is the time how long the input conditions have to be "0" before the next high signal is accepted. Once the conditions of the LogicsManager have been fulfilled the alarms will be acknowledged. The first high signal into the discrete input acknowledges the command vari-able 03.05 (horn). The second high signal acknowledges all inactive alarm messages. **Notes** For information on the LogicsManager and its default settings see *Chapter 9.3.1 "LogicsManager Overview" on page 882.*
1849	**Stop mode with stopping alarm**	2	If operating mode is not fixed via LogicsManager (see chapter *Chapter 6.3.5 "Performing Remote Start/Stop And Acknowledgment" on page 545* for details) with this parameter it can be decided if the operation mode changes to STOP mode when a shutdown alarm of class C, D, E, F occurs.	
			No	A shut down alarm does not cause an operating mode change. This can be useful in applications with remote control, where the operator wants to acknowledge alarms and restart the engine without the need to change operating mode in the easYgen. **Notes** If the shut down alarm disappears, generator can start automatically!
			[Yes]	Each shut down alarm (class C, D, E, F) will change operating mode to STOP. **Notes** LM 12510 p. 288/ p. 928, 12520 p. 288/ p. 928, 12530 p. 289/ p. 928 do have priority.
5775	**IOP Delayed unload. Alarm C,E**	2	0 to 9999 s **[0 s]**	This parameter gives a load sharing participant the opportunity to delay the unload if an shutdown alarm of alarm class C or E occurs. The time gained gives another generator the chance to participate in the load sharing network. The time configured here delays the triggering of alarm class C and E. A set-ting of 0 s deactivates this function. **Notes** For additional information refer to *Chapter 9.5.1 "Alarm Classes" on page 965*

4.5.6.2 Free Configurable Alarms

General Notes

The easYgen-XT provides 16 freely configurable alarms.

Each alarm is configurable by:

- A LogicsManager equation
- Alarm text/description (configurable with ToolKit only)
- Delay time
- Alarm class
- Self acknowledgment
- Being enabled depending on Engine Monitoring LM 87.70 (selectable)

Free Alarm 1 for example

ID	Parameter	CL	Setting range [Default]	Description
8120	**Free alarm 1**	2	Determined by LogicsManager 88.01 **[02.01 FALSE & 1 & 1]** = 11550	This LogicsManager is used to select the source of monitoring. **Notes** For information on the LogicsManager and its default settings see ♘ *Chapter 9.3.1 “LogicsManager Overview” on page 882*.
8121	**Alarm class**	2	Class A/B/C/D/E/F, Control **[Class B]**	The assigned independent alarm class specifies what action should be taken when the alarm becomes TRUE.
8122	**Self acknowledge**	2	Yes/No	The control automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control does not automatically clears the alarm if the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
8123	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32
8236	**Delay**	2	0.02 to 99999.99 s **[1.00 s]**	Period before alarm becomes TRUE.
6680	**Description**	2	**[Free alarm 1]** ...((30 characters))*	Text is configurable by ToolKit. **Notes** *) The max. number of characters is 48 but 30 characters can be read on easYgen HMI without restrictions.

Parameter IDs

Free alarm #	Description	LogicsManager	Alarm class	Self acknowledge	Enabled	Delay
1	6680	8120	8121	8122	8123	8236
2	6681	8124	8125	8126	8127	8237
3	6682	8128	8129	8130	8131	8238
4	6683	8132	8133	8134	8135	8239
5	6688	8136	8137	8138	8139	8240
6	6689	8140	8141	8142	8143	8241
7	6690	8144	8145	8146	8147	8242
8	6691	8148	8149	8152	8153	8243
9	6692	8154	8155	8156	8157	8244
10	6693	8158	8159	8161	8163	8245
11	6694	8165	8167	8168	8169	8246
12	6695	8170	8171	8172	8173	8247

Free alarm #	Description	LogicsManager	Alarm class	Self acknowl-edge	Enabled	Delay
13	6696	8174	8175	8176	8177	8248
14	6697	8178	8179	8180	8181	8249
15	6698	8182	8183	8184	8185	8250
16	6699	8186	8187	8188	8189	8251

Table 88: Free alarms - parameter IDs

4.5.6.3 CAN Interface 1

General notes

The CANopen interface 1 is monitored. If the interface does not receive a Receive Process Data Object (RPDO) before the delay expires, an alarm will be initiated.

If this protective function is triggered, the display indicates "CANopen interface 1" and the logical command variable "08.18" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
3150	**Monitoring**	2	On	CANopen interface 1 monitoring is carried out according to the following parameters.
			[Off]	Monitoring is disabled.
3154	**Delay**	2	0.01 to 650.00 s **[0.20 s]**	The maximum receiving break is configured with this parameter. If the interface does not receive an RPDO within this time, the action specified by the alarm class is initiated. The delay timer is re-initialized after every message is received.
3151	**Alarm class**	2	Class A/B/C/D/E/F/ Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to *Chapter 9.5.1 "Alarm Classes" on page 965*
3152	**Self acknowl-edge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
3153	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.6.4 CAN Interface 2

General notes

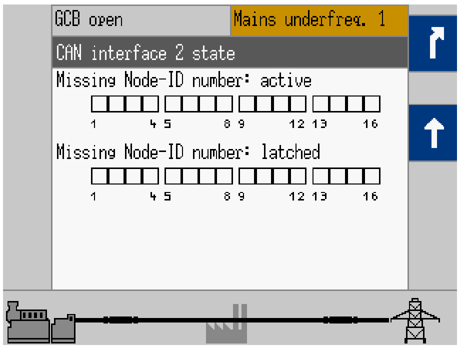


Fig. 191: CAN2 state

The CANopen interface 2 is monitored. If the interface does not receive a message from the external expansion board (Node-ID) before the delay expires, an alarm will be initiated. This is indicated in menu *"Next Page/STATUS MENU ➔ Diagnostic ➔ Interfaces ➔ CAN ➔ CAN 2 state"*

If this protective function is triggered, the display indicates "CANopen interface 2" and the logical command variable "08.19" will be enabled.

If you are not using the exact amount of external I/O modules you have defined, the monitoring function does not work correctly.

ID	Parameter	CL	Setting range [Default]	Description
16187	**Monitoring**	2	On	CANopen interface 2 monitoring is carried out according to the following parameters.
			[Off]	Monitoring is disabled.
16186	**Delay**	2	0.01 to 650.00 s **[0.20 s]**	The maximum receiving break is configured with this parameter. If the interface does not receive message from the external expansion board (Node-ID) within this time, the action specified by the alarm class is initiated. The delay timer is re-initialized after every message is received.
16188	**Alarm class**	2	Class A/B/C/D/E/F/ Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to *Chapter 9.5.1 "Alarm Classes" on page 965*
16190	**Self acknowl-edge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
16189	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.6.5 CAN Interface 3

General notes

The CANopen interface 3 is monitored. If the interface does not receive a Receive Process Data Object (RPDO) before the delay expires, an alarm will be initiated.

If this protective function is triggered, the display indicates "CANopen interface 3" and the logical command variable "08.29" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
3165	**Monitoring**	2	On	CANopen interface 3 monitoring is carried out according to the following parameters.
			[Off]	Monitoring is disabled.
3169	**Delay**	2	0.01 to 650.00 s **[0.20 s]**	The maximum receiving break is configured with this parameter. If the interface does not receive an RPDO within this time, the action specified by the alarm class is initiated. The delay timer is re-initialized after every message is received.
3166	**Alarm class**	2	Class A/B/C/D/E/F/ Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to *Chapter 9.5.1 "Alarm Classes" on page 965*
3167	**Self acknowledge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
3168	**Enabled**	2	87.70 LM:Eng.mon.	Enabling depends on LM state.
			[Always]	Always enabled.

4.5.6.6 CAN Interface 2 - J1939 Interface

General notes

This monitor function can monitor messages of up to 4 different J1939 devices separately by their source addresses.

If the easYgen doesn't receive any message from the corresponding device within the configured time the command variable 08.10 "CAN fault J1939" becomes active. Additionally a specific alarm 08.37: "J1939 ECU timeout", 08.38: "J1939 dev. 1 timeout", 08.39: "J1939 dev. 2 timeout", or 08.40: "J1939 dev. 3 timeout" will be triggered.

ECU settings

ID	Parameter	CL	Setting range [Default]	Description
15172	**Monitoring**	2	On	Monitoring of the ECU's CAN messages is carried out according to the following parameters. The address of the ECU is taken from parameter "Engine control address" (15107 ✎ p. 461)
			[Off]	Monitoring is disabled.
15176	**Delay**	2	0.02 to 999 s **[1 s]**	The delay is configured with this parameter. If the interface does not receive a CAN message from the ECU within this delay time, the action specified by the alarm class is initiated. The delay timer is re-initialized if any message from the ECU is received.
15173	**Alarm class**	2	Class A/B/C/D/E/F/ Control **[B]**	Each limit may be assigned to an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ✎ *Chapter 9.5.1 "Alarm Classes" on page 965*
15174	**Self acknowl-edge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
15175	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

Table 89: J1939 Monitoring

Device 1 settings

ID	Parameter	CL	Setting range [Default]	Description
15177	**Monitoring**	2	On	Monitoring of the CAN messages of device 1 is carried out according to the following parameters.
			[Off]	Monitoring is disabled.
15178	**Address**	2	0 to 255 s **[1 s]**	This device address is monitored.
15182	**Delay**	2	0.02 to 999 s **[1 s]**	The delay is configured with this parameter. If the interface does not receive a CAN message from device 1 within this delay time, the action specified by the alarm class is initiated. The delay timer is re-initialized if any message from the device 1 is received.
15179	**Alarm class**	2	Class A/B/C/D/E/F/ Control **[B]**	Each limit may be assigned to an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to ✎ *Chapter 9.5.1 "Alarm Classes" on page 965*

ID	Parameter	CL	Setting range [Default]	Description
15180	**Self acknowl-edge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condi-tion is no longer detected. The alarm must be acknowledged and reset by manually pressing the appro-priate buttons or by activating the LogicsManager output "External acknowl-edgment" (via a discrete input or via an interface).
15181	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is ena-bled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

Table 90: J1939 Monitoring: Device 1

Device 2 settings

ID	Parameter	CL	Setting range [Default]	Description
15183	**Monitoring**	2	On	Monitoring of the CAN messages of device 2 is carried out according to the following parameters.
			[Off]	Monitoring is disabled.
15184	**Address**	2	0-255 s **[1 s]**	This device address is monitored.
15188	**Delay**	2	0.02 to 999 s **[1 s]**	The delay is configured with this parameter. If the interface does not receive a CAN message from device 2 within this delay time, the action specified by the alarm class is initiated. The delay timer is re-initialized if any message from the device 2 is received.
15185	**Alarm class**	2	Class A/B/C/D/E/F/ Control **[B]**	Each limit may be assigned to an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to *Chapter 9.5.1 "Alarm Classes" on page 965*
15186	**Self acknowl-edge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condi-tion is no longer detected. The alarm must be acknowledged and reset by manually pressing the appro-priate buttons or by activating the LogicsManager output "External acknowl-edgment" (via a discrete input or via an interface).
15187	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is ena-bled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

Table 91: J1939 Monitoring: Device 2

Device 3 settings

ID	Parameter	CL	Setting range [Default]	Description
15189	**Monitoring**	2	On	Monitoring of the CAN messages of device 3 is carried out according to the following parameters.
			[Off]	Monitoring is disabled.
15190	**Address**	2	0 to 255 s **[1 s]**	This device address is monitored.
15194	**Delay**	2	0.02 to 999 s **[1 s]**	The delay is configured with this parameter. If the interface does not receive a CAN message from device 3 within this delay time, the action specified by the alarm class is initiated. The delay timer is re-initialized if any message from the device 3 is received.
15191	**Alarm class**	2	Class A/B/C/D/E/F/ Control **[B]**	Each limit may be assigned to an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to *Chapter 9.5.1 "Alarm Classes" on page 965*
15192	**Self acknowl-edge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
15193	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

Table 92: J1939 Monitoring: Device 3

4.5.6.7 J1939 Interface - Red (Stop) Alarm

General notes

This monitor monitors, whether a specific alarm bit is received from the CAN J1939 interface. This enables to configure the easYgen in a way that a reaction is caused by this bit (e.g. warning, shutdown).

If this protective function is triggered, the display indicates "Red stop lamp" and the logical command variable "05.13" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
15115	**Monitoring**	2	On	Monitoring of the Red Stop Lamp message from the ECU is carried out according to the following parameters.
			[Off]	Monitoring is disabled.

ID	Parameter	CL	Setting range [Default]	Description
15119	**Delay**	2	0 to 999 s **[2 s]**	The red stop lamp delay is configured with this parameter. If the ECU sends the Red Stop Lamp On message, the action specified by the alarm class is initiated after the delay configured here expires.
15116	**Alarm class**	2	Class A/B/C/D/E/F/ Control **[A]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ⇘ *Chapter 9.5.1 "Alarm Classes" on page 965*
15117	**Self acknowl-edge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
15118	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.6.8 J1939 Interface - Amber Warning Alarm

General notes

This monitor monitors, whether a specific alarm bit is received from the CAN J1939 interface. This enables to configure the easYgen in a way that a reaction is caused by this bit (e.g. warning, shutdown).

If this protective function is triggered, the display indicates "Amber warning lamp" and the logical command variable "05.14" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
15120	**Monitoring**	2	On	Monitoring of the Amber Warning Lamp message from the ECU is carried out according to the following parameters.
			[Off]	Monitoring is disabled.
15124	**Delay**	2	0 to 999 s **[2 s]**	The amber warning lamp delay is configured with this parameter. If the ECU sends the Amber Warning Lamp On message, the action specified by the alarm class is initiated after the delay configured here expires.
15121	**Alarm class**	2	Class A/B/C/D/E/F/ Control **[A]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.

ID	Parameter	CL	Setting range [Default]	Description
				Notes For additional information refer to *Chapter 9.5.1 “Alarm Classes” on page 965*
15122	**Self acknowl-edge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
15123	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.6.9 J1939 Interface – DM1 Alarms

This monitor is a switch to transfer the content of the DM1 alarm message onto the alarm screen of the easYgen. The event log is as well considered.

ID	Parameter	CL	Setting range [Default]	Description
15156	**Monitoring**	2		Most of the J1939 devices release a standardized DM1 message as an error message on the CAN bus. These messages can be entered into the alarm list of the easYgen. The alarm class is fixed to alarm class A. A J1939 device CAN monitor the states of his inputs. When a error occurs a DM1 message is released.
			[On]	DM1 messages will be recorded in the alarm list.
			Off	DM1 messages will be not recorded in the alarm list.
				Notes Only known SPNs can be recorded in the alarm list. These are J1939 Standard SPNs which also can be visualized. Manufacturer specific SPNs will be ignored.
9947	**Self acknowl-edge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).

4.5.6.10 Battery Overvoltage (Level 1 & 2)

General notes

There are two battery overvoltage alarm levels available in the control. Both alarms are definite time alarms. Monitoring of the voltage is done in two steps.

If this protective function is triggered, the display indicates "Bat. overvoltage 1" or "Bat. over-voltage 2" and the logical command variable "08.01" or "08.02" will be enabled.

Refer to ⇘ *Chapter 9.1.1 "Triggering Characteristics" on page 673* for the triggering characteristic of this monitoring function.

ID	Parameter	CL	Setting range [Default]	Description
3450 3456	**Monitoring**	2	3450: **[On]** 3456: **[Off]** (Hysteresis: 0.1 V) (Reset Delay: 1s)	Overvoltage monitoring of the battery voltage is carried out according to the following parameters. Both values may be configured independent from each other (prerequisite: Level 1 > Level 2). Monitoring is disabled for Level 1 limit and/or Level 2 limit.
3454 3460	**Limit**	2	8.0 to 42.0 V 3454: **[32.0 V]** 3460: **[35.0 V]**	The threshold values that are to be monitored are defined here. If the monitored battery voltage reaches or exceeds this value for at least the delay time without interruption, the action specified by the alarm class is initiated.
3455 3461	**Delay**	2	0.02 to 99.99 s 3455: **[5.00 s]** 3461: **[1.00 s]**	If the monitored battery voltage exceeds the threshold value for the delay time configured here, an alarm will be issued.
				Notes If the monitored battery voltage falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.
3451 3457	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ⇘ *Chapter 9.5.1 "Alarm Classes" on page 965*
3452 3458	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
3453 3459	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.6.11 Battery Undervoltage (Level 1 & 2)

General notes

There are two battery undervoltage alarm levels available in the control. Both alarms are definite time alarms. Monitoring of the voltage is done in two steps.

If this protective function is triggered, the display indicates "Bat. undervoltage 1" or "Bat. undervoltage 2" and the logical command variable "08.03" or "08.04" will be enabled.

Refer to *Chapter 9.1.1 "Triggering Characteristics" on page 673* for the triggering characteristic of this monitoring function.

ID	Parameter	CL	Setting range [Default]	Description
3500 3506	**Monitoring**	2	**[On]**	Undervoltage monitoring of the battery voltage is carried out according to the following parameters. Both values may be configured independent from each other (prerequisite: Level 1 > Level 2).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
3504 3510	**Limit**	2	8.0 to 42.0 V 3504: **[24.0 V]** 3510: **[20.0 V]** (Hysteresis: 0.1 V) (Reset Delay: 1s)	The threshold values that are to be monitored are defined here. If the monitored battery voltage reaches or falls below this value for at least the delay time without interruption, the action specified by the alarm class is initiated.
				Notes The default monitoring limit for battery undervoltage is 24 Vdc after 60 seconds. This is because in normal operation the terminal voltage is approximately 26 Vdc (alternator charged battery).
3505 3511	**Delay**	2	0.02 to 99.99 s 3505: **[60.00 s]** 3511: **[10.00 s]**	If the battery voltage falls below the threshold value for the delay time configured here, an alarm will be issued.
				Notes If the battery voltage exceeds the threshold (plus the hysteresis) again before the delay expires the time will be reset.
3501 3507	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to *Chapter 9.5.1 "Alarm Classes" on page 965*
3502 3508	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
3503 3509	**Enabled**	4	**[Always]**	Monitoring for this fault condition is continuously enabled.
			87.70 LM:Eng.mon	Monitoring for fault conditions is not performed until engine monitoring is enabled. This is determined through the LogicsManager equation "Release engine monitoring".
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.6.12 Multi-Unit Parameter Alignment

General notes

The multi-unit parameter alignment functionality requires that the relevant parameters are all configured identically at all participating units.

If at least one of these parameters is configured different in at least one of the units, the display indicates "Parameter alignment" on all units and the logical command variable "08.16" will be enabled. To identify different configured units, please use the diagnostic screen "Genset parameter alignment": "Next Page / Status Menu
➔ System Overview / Multi-unit
➔ Genset parameter alignment"

This alarm is always self-acknowledging, i.e. the control automatically clears the alarm if it is no longer valid.

The setting of the following parameters will be monitored:

Parameter	ID
Start stop mode	5752 ↳ p. 303
Dead busbar start mode	5753 ↳ p. 303
Fit size of engine	5754 ↳ p. 304
Fit service hours	5755 ↳ p. 304
Changes of engines	5756 ↳ p. 304
IOP Reserve power	5760 ↳ p. 307
IOP Hysteresis	5761 ↳ p. 307
IOP Max. generator load	5762 ↳ p. 307
IOP Min. generator load	5763 ↳ p. 308
IOP Dynamic	5757 ↳ p. 308
IOP Add on delay	5764 ↳ p. 309
IOP Add on delay at rated load	5765 ↳ p. 309
IOP Add off delay	5766 ↳ p. 309
MOP Minimum load	5767 ↳ p. 310
MOP Reserve power	5768 ↳ p. 310
MOP Hysteresis	5769 ↳ p. 310
MOP Max. generator load	5770 ↳ p. 311
MOP Min. generator load	5771 ↳ p. 311
MOP Dynamic	5758 ↳ p. 311
MOP Add on delay	5772 ↳ p. 312
MOP Add on delay at rated load	5773 ↳ p. 312
MOP Add off delay	5774 ↳ p. 312
LDSS sort priority always	5777 ↳ p. 305/ ↳ p. 536
Transfer rate LS fast message	9921 ↳ p. 478

Table 93: Multi-unit parameter alignment - monitored parameters

ID	Parameter	CL	Setting range [Default]	Description
4070	**Monitoring**	2	**[On]**	Multi-unit parameter alignment monitoring is carried out.
			Off	Monitoring is disabled.
4071	**Alarm class**	2	Alarm class Class A/B/C/D/E/F, Control **[B]**	This function may be assigned an independent alarm class that specifies what action should be taken when this function triggers an alarm.
				Notes For additional information refer to *Chapter 9.5.1 "Alarm Classes" on page 965*.

4.5.6.13 Multi-Unit Missing easYgen

General notes

The multi-unit missing easYgen monitoring function checks whether all participating units are available (sending data on the load share line).

If the number of available units is less than the number of displayed "Monitored easYgen" 9925 p. 424 (initiated by parameter 13334 p. 424 System update) for at least the delay time, the display indicates "Missing easYgen" and the logical command variables "08.17" and "08.27" will be enabled.

After energizing the easYgen, a delay is started, which allows a possible "Missing easYgen" alarm to become active. This delay depends on the Node-ID of the easYgen (parameter 8952 p. 465) and the transfer rate of a load share fast message (parameter 9921 p. 478) and may last for approx. 140 seconds for a high Node-ID (e.g. 127). This delay serves for detecting the Master of a CAN bus connection. Approximately two minutes after energizing the easYgen, the alarm delay will be set to a fix time, which depends on the setting of parameter 9921 p. 478 (Transfer rate LS fast message) and is in the range between 3 to 12 seconds.*

**) CAN bus connection is preferred but [9924 Load share Interface] offers Ethernet connection to be used instead.*

During [System update] the alarm is disabled.

If the easYgen is configured to the application modes A07 to A12, the monitoring function also checks the participating LS-5 units.

ID	Parameter	CL	Setting range [Default]	Description
4060	**Monitoring**	2	On	Multi-unit missing members monitoring is carried out.
			[Off]	Monitoring is disabled.
4061	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	This function may be assigned an independent alarm class that specifies what action should be taken when this function triggers an alarm.
				Notes For additional information refer to ⇘ *Chapter 9.5.1 "Alarm Classes" on page 965*.
4062	**Self acknowl-edge**	2	Yes	The control automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).

4.5.6.14 Multi-Unit Missing LS-5

General notes

If the easYgen is configured to the application modes A07 and A11, the monitoring function also checks the participating LS-5 units.

The multi-unit missing LS-5 monitoring function works as described above for "Missing easYgen".

If the number of available units is less than the number of displayed "Monitored LS-5" 9926 ⇘ p. 424 (initiated by parameter 13334 ⇘ p. 424 System update) for at least the delay time, the display indicates "Missing LS-5" and the logical command variables "08.17" and "08.28" will be enabled.

After energizing the easYgen, a delay is started, which allows a possible "Missing LS-5" alarm to become active. This delay depends on the Node-ID of the LS-5 (parameter 8952 ⇘ p. 465) and the transfer rate of a load share fast message (parameter 9921 ⇘ p. 478) and may last for approx. 140 seconds for a high Node-ID (e.g. 127). This delay serves for detecting the Master of a CAN bus connection. Approximately two minutes after energizing the easYgen, the alarm delay will be set to a fix time, which depends on the setting of parameter 9921 ⇘ p. 478 (Transfer rate LS fast message) and is in the range between 3 to 12 seconds.*

**) Use CAN bus connection selected with [9924 Load share Interface]. Ethernet connection is not possible with LS-5.*

During [System update] the alarm is disabled.

ID	Parameter	CL	Setting range [Default]	Description
4066	**Monitoring**	2	On	Multi-unit missing members monitoring is carried out.
			[Off]	Monitoring is disabled.
4067	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	This function may be assigned an independent alarm class that specifies what action should be taken when this function triggers an alarm.
				Notes For additional information refer to *Chapter 9.5.1 "Alarm Classes" on page 965*.
4068	**Self acknowledge**	2	Yes	The control automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).

4.5.6.15 Communication Management

4.5.6.15.1 System Update

General notes

The easYgen device provides a function to monitor the communication members on the load share bus. The monitor recognizes not only missing members, it monitors also a defined constellation of members. This constellation was registered before by executing a "system update" order *[13334 Syst. update]*.

The system update function teaches-in all members with the current member constellation on the load share bus. Additionally the missing member monitor of each participant is loaded with the correct amount of number.

The missing member monitor compares permanently the current number of members with the amount of the last system update. If the number of the current communicating members is smaller, the missing member alarm trips and an according flag (08.17 Missing members) is set. Usually this flag is incorporated in the frequency droop LogicsManager 12904 p. 265/ p. 929.

The system update function incorporates as well the LS-5 members on the load share bus. So with the system update order the amount and constellation of LS-5 in the load share bus is considered. Deviations to the last system update are also monitored and the amount of LS-5 member are loaded in the missing LS-5 monitor.

In the "non-XT" easYgen-3000 devices was only checked, if minimum 1 LS-5 is connected. The correct amount was checked in the LS-5 system only. In the easYgen-3400XT/500XT is now monitored also the LS-5 constellation. This improves trouble shooting.

If a redundant Ethernet bus for load sharing is chosen (doesn't work with LS-5: no Ethernet interface), the system update function considers also the correct constellations of both busses. Additionally it gives insight and alerts, if the redundancy is lost or a new member is not registered properly.

> ***Diagnostic screen***
> *The easYgen-XT provides an overview screen to check all members on the load share bus and helps trouble shooting. This screen "easYgen diagnostic" should be watched, when the system update is executed. It is located under "Status Menu / Next page ➔ Multi-unit ➔ Diagnostic devices".*

Availability

The system update function is valid for:

- Load share and control information exchanged over CAN 3 bus
- Load share and control information exchanged over Ethernet network A
- Load share and control information exchanged over redundant Ethernet network B and C
- LS-5 control information exchanged over CAN 3 bus

How to initiate a system update

Navigate to *"Next page (Status Menu) ➔ Multi-unit ➔ Diagnostic Devices"*

The system update can be initiated by

- softkey button *[Syst. upd.]* in the HMI,
- ToolKit switch 13334 ⇘ p. 424 *"System update"*, or
- LogicsManager 86.35 with parameter 7801 ⇘ p. 424 *"System update"*.

> **NOTICE!**
> Please ensure, if you are using the LogicsManager *"7801 System update"* or the parameter *"13334 Syst. upd"*., that the signal goes false after executing. Otherwise, all buttons relating to system update are locked.

> *The number of monitored easYgens is accessible via communication interfaces. The system update command can be initiated through a free control flag.*

ID	Parameter	CL	Setting range [Default]	Description
7801	**System update**	2	Determined by LogicsManager 86.35 **[(0 & 1) & 1]** = 11974	To select logical input(s) to cause a system update.
13334	**System update**	2	Yes	Network is checked for members and its states. Updated results become new status.
			[No]	Check and update is disabled.
9925	**Monitored easYgen**	-/-	Latest result of members count	Result of members count driven by system update parameter 13334.
9926	**Monitored LS-5**	-/-	Latest result of members count	Result of members count driven by system update parameter 13334. **Notes** Applies to the application modes A07, A08, A09, A10, A11, and A12 only.

Table 94: Parameter setting: System update

Monitoring of the *"System update"* depends on the following parameters:

ID	Parameter	CL	Setting range [Default]	Description
7832	**Monitoring**	2	**[On]**	Enabling to monitor the system if there are **more** devices against latest updated system configuration. **Notes** To detect **less** easYgen devices against latest updated system configuration use missing member monitor 4060 ↳ p. 421. To detect **less** LS-5 devices against latest updated system configuration use missing member monitor 4066 ↳ p. 422.
			Off	Monitoring is disabled.
7833	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to ↳ *Chapter 9.5.1 "Alarm Classes" on page 965*
7834	**Self acknowl-edge**	-/-	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condi-tion is no longer detected. The alarm must be acknowledged and reset by manually pressing the appro-priate buttons or by activating the LogicsManager output "External acknowl-edgment" (via a discrete input or via an interface).

Table 95: Parameter setting: Monitoring system update

The device at which the system update has been initiated sends a System update request for 30 seconds to all members on the load share (system) bus.

During this time all members (including missing LS-5 and missing easYgen) disable their missing member monitoring function and observing which members are momentarily actively participating. This condition will be fixed for this 30 seconds period and the number of members will be stored in the missing member monitor in all easYgens short before the 30 seconds are ending. Then the missing member monitoring will be enabled again in all easYgens.

> *The system update procedure flag is available in the LogicsManager system under 04.65 System update active.*

The number of accepted easYgen and LS-5 devices (and Load Share Gateways LSG) is displayed in the according diagnostic screens in HMI and ToolKit.

4.5.6.15.2 Diagnostic Screens: System Status

The diagnostic screens

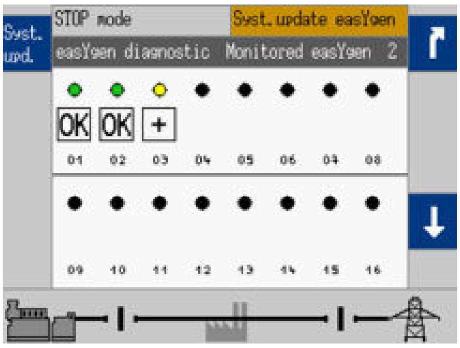


Fig. 192: Diagnostic screen example (HMI)

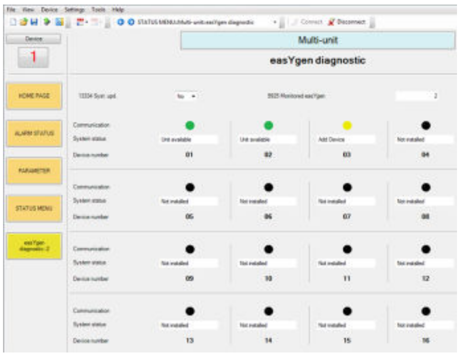


Fig. 193: Diagnostic screen example (ToolKit)

The diagnostic screens are helping the operator to recognize the current communication state of the load share and system bus. The system update order is usually executed during watching these screens. Because the update procedure fixes exactly that state which is displayed in these screens.

Actually, the screens inform the operator, when there was any alarm raised in order of a missing member alarm or a system update alarm. With these information it should be easier to detect the root cause for it.

Because of space restrictions on the easYgen display, the indications in the easYgen is realized with symbols. Use ToolKit for text indications.

Single Bus Topology

Single bus topology means there is no redundant bus topology in use. Single bus topologies are load share over CAN bus or over Ethernet network A. The occurring cases here are restricted and will be treated therefore separately.

System and Control bus (CAN; Ethernet)			
LED	**ToolKit: displayed text**	**easYgen: HMI**	**Explanation**
GREEN	Unit available	OK	This device is recognized and monitored with the missing member monitor according to the latest System Update order.
YELLOW	Add Device	+	This device is recognized but not registered according to the latest system update order. Therefore, the missing member monitoring does not observe the device. **System update is required!**
RED	Unit not recognized		This device is not recognized according to the latest system update order. (Missing Member Alarm)
BLACK	Not installed	X	This device is neither recognized nor registered through the latest system update order.
(/) RED / BLACK (twinkling)	Unit not recognized	X	There is no device recognized according to the latest system update. Communication error on network. This unit is suspected. **Notes** This is only displayed in the affected easYgen.

4.5.6.15.3 Practicing the System Update Functionality

Commissioning

If the devices are connected to a network system, during the first commissioning it is to observe in the diagnostic screens, whether all devices are recognized. If all desired controls are recognized, the system update order can be executed. If not all controls are recognized do trouble shooting before you hit any system update order.

Commissioning

- Executing system update
  - ⇨ After 30 seconds all devices must be indicated with a green lamp in the diagnostic screens. The correct number of monitored easYgens must be indicated.

Adding a device

If a device shall be added to an already running and commissioned network, proceed as follows:

Adding a device

1. Connect the additional device onto the network.
2. Check the availability in the diagnostic screen
   - ⇨ If everything is displayed correctly, ...
3. ... execute the system update order
   - ⇨ After 30 seconds all devices must be indicated with a green lamp in the diagnostic screens. The correct number of monitored easYgens is indicated.

Removing a device

If a device shall be removed from an already running and commissioned network, proceed as follows:

Removing a device

1. Execute the system update order

If you are removing the device before you hit the system update order, you must know that it will come to a missing member alarm with the consequence that the system goes into a droop function (if configured). If that has happened, you can solve the issue by a system update order. But do not forget to make a system check via the diagnostic screens.

2. You have now 30 seconds time to remove the device, without getting any consequences on the system

4.5.6.16 Operating Range Failure

General notes

The operating range failure monitoring issues an Operating Range Failure Alarm "Oper.range failed XX" (where XX is the number of Check 01 to 12) if one of the following conditions is fulfilled. Example: Check 4 **failed** causes *"Oper.range failed 4"*.

Only the first incoming operation range failure will tripp an alarm. Because in most cases this will be the root cause for eventually incoming further operating range alarms. Any other operating range alarm can only be tripped if there is no active or latched operating range alarm.

If there are more than one failures only the first incoming failure will be indicated and is available at protocol 5014.

If there is no alarm this number is 0.

- **Check 1**: The easYgen tries to close the GCB, but the generator is not within its operating range (parameters 5800 ↳ p. 316, 5801 ↳ p. 316, 5802 ↳ p. 316, or 5803 ↳ p. 316).
- **Check 2**: The easYgen tries to synchronize the GCB, but the busbar is not within the generator operating range (parameters 5800 ↳ p. 316, 5801 ↳ p. 316, 5802 ↳ p. 316, or 5803 ↳ p. 316).
- **Check 3**: The easYgen tries close the GCB in breaker transition mode "Open transition" with GCB and MCB open status. In this condition the busbar is expected as dead, but the busbar voltage is NOT below the dead busbar detection limit (parameter 5820 ↳ p. 433).
- **Check 4**: The easYgen wants to close the GCB onto a dead busbar, but the device cannot close the breaker because there is at least one neighbor device recognized with a closed GCB.
- **Check 5**: The easYgen tries to synchronize the GCB, the MCB is closed, but mains and/or bussbar are not within its operating range (parameters 5810 ↳ p. 362, 5811 ↳ p. 362, 5812 ↳ p. 362, or 5813 ↳ p. 362).

- **Check 6**: The easYgen wants close the GGB, but the generator minimum power is not reached.
- **Check 7**: The easYgen wants close the GGB in the Open Transition Mode, but the generator minimum power is not reached.
- **Check 8**: The easYgen wants synchronize the GGB , but the generator minimum power is not reached.
- **Check 9**: (GGB control mode) The MCB or the GGB is closed with min. one neighbor GCB is closed to the busbar. There is a conflict, the external voltage monitoring of the Load Busbar signals a "Dead load busbar", which cannot be the case.
- **Check 10**: The easYgen wants synchronize the GGB, the MCB is closed, but the mains is not in operating range
- **Check 11**: The easYgen checks the plausibility of generator and busbar, if GCB is closed and the engine runs without run-up synchronization, but he operating range of generator OR busbar is not matched.
- **Check 12**: The easYgen checks the phase rotation of generator, busbar, and mains and a synchronisation shall be executed, but the phase rotation of all systems does not match. (Synchronisation is blocked.)

> ***Regarding Check 9 and 10:** The GGB application mode GCB/GGB/L-MCB is tapping the Load busbar via the internal mains measurement. Therefore the check 10 is made via the load busbar condition. So the "load busbar" -OK flag is created out of the mains operation ranges.*

No alarm will be issued in idle mode. This monitoring function is disabled below firing speed.

> **NOTICE!**
>
> If load-dependent start/stop (refer to *Chapter 4.4.5.5 “Load Dependent Start/Stop (LDSS)” on page 298*) is enabled, this monitoring function must be configured with a shutdown alarm class C, D, E, or F) or disable load-dependent start/stop if triggered to ensure that the next engine will be started.

> *If this protective function is triggered, the display indicates "Operat. range failed" /("Operating Range failed") and the logical command variable "06.31" will be enabled.*

ID	Parameter	CL	Setting range [Default]	Description
2660	**Monitoring**	2	**[On]**	Monitoring of the operating range is carried out according to the following parameters.
			Off	Monitoring is disabled.
2663	**Delay**	2	1 to 999 s **[30 s]**	If one of the above mentioned conditions for an operating range failure is fulfilled, an alarm will be issued. If the respective condition is not fulfilled anymore before the delay time expires, the delay time will be reset.

ID	Parameter	CL	Setting range **[Default]**	Description
2661	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ✎ *Chapter 9.5.1 “Alarm Classes” on page 965*
2662	**Self acknowl-edge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).

Table 96: Operating Range Failure settings

4.6 Configure Measurement

General notes

> *If the genset control is intended to operate a genset in parallel to the mains, the mains voltage measuring inputs must be connected.*

Dependencies

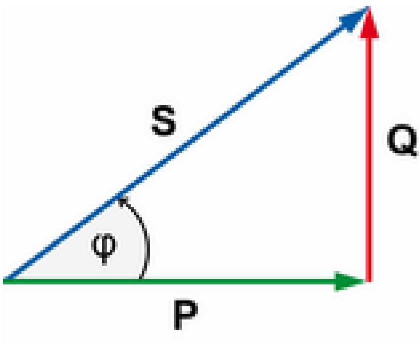


Fig. 194: AC power triangle

PF Power Factor
P Active Power [kW]
S Apparent power [kVA]
Q Reactive Power [kvar]

The AC power triangle illustrates the dependencies between active power, apparent power, reactive power and power factor.

- PF = P/S = cos Φ
- Q = √(S²-P²)
- S = √(P²+Q²)
- P = S * PF

4.6.1 General measurement settings

ID	Parameter	CL	Setting range **[Default]**	Description
1750	**System rated frequency**	2	50 / 60 Hz **[50 Hz]**	The rated frequency of the system is used as a reference figure for all frequency related functions, which use a percentage value, like frequency monitoring, breaker operation windows or the AnalogManager.
1825	**System rated active power [kW]**	2	0.5 to 99999.9 **[200.0 kW]**	This value specifies 100% of the system rated power, which is used for system related indications and calculations. The AnalogManager 10.11 "System active nominal power" and 10.12 "System total real power" are related to this value or setting.
1858	**1Ph2W voltage measuring**	3	**[Phase - phase]**	The unit is configured for measuring phase-phase voltages if 1Ph 2W measuring is selected.

ID	Parameter	CL	Setting range [Default]	Description
			Phase - neutral	The unit is configured for measuring phase-neutral voltages if 1Ph 2W measuring is selected.
				Notes For information on measuring principles refer to *Chapter 3.3.5.1 "Generator Voltage" on page 53.* Never configure the busbar measurement for phase-neutral, if the other systems like mains and generator are configured as 3Ph 3W or 3Ph 4W. The phase angle for synchronization would be not correct.
1859	**1Ph2W phase rotation**	3	**[CW]**	A clockwise rotation field is considered for 1Ph 2W measuring .
			CCW	A counter-clockwise rotation field is considered for 1Ph 2W measuring.
				Notes For information on measuring principles refer to *Chapter 3.3.5.1 "Generator Voltage" on page 53.*
1854	**Additional CT input**	2	**[Mains current]** / Ground current / Off	This parameter configures whether ground or mains current is measured on terminals ½ or the input is disabled.
1835	**Ground current range**	2	1A **[5A]**	Application specific ground current range must be selected e.g. for rated values.
1810	**Gnd. CT primary rated current**	2	**[500 A/x]** 1..3200 A/x	CT ground current measuring primary rated value.
				Notes Available if parameter *"1854 Additional CT input "*is set to *[Ground current].* *"A/x"*: "/x" shows the relation to the current range which can be selected (1 A or 5 A).

4.6.2 Generator

ID	Parameter	CL	Setting range [Default]	Description
235	**Generator type**	2		The genset control supports two types of generators: ■ synchronous generators ■ asynchronous generators (induction generators)
			[Synchronous]	The unit provides all functions which are needed for synchronous generator applications. islanded and mains parallel operation is supported.
			Asynchronous	The unit provides the special function of the asynchronous generator with: ■ The speed is regulated with the speed signal from the MPU or J1939/CAN input (as long as the GCB is open). ■ The closing of the GCB is executed, if the speed is within the corresponding frequency range of the generator operating window. The voltage and phase angle is ignored in this case. ■ The generator monitoring (under/over frequency and under/overvoltage/asymmetry) is switched off, until the generator breaker is closed. ■ After opening the GCB, under/over frequency and under/overvoltage and asymmetry monitoring is switched on again. ■ The Frequency/MPU speed plausibility monitoring is only active, if the GCB is closed. ■ The synchroscope is not displayed in the asynchronous modus.
				Notes The asynchronous mode is used in slip synchronization only (Synchronization GCB (parameter 5729 p. 224) = Slip frequency.

ID	Parameter	CL	Setting range [Default]	Description
				Recommended settings The asynchronous modus is normally used in mains parallel operation. Please consider the following settings: ■ Application mode (parameter 3444 ➪ p. 220) = GCB ■ Mains decoupling (parameter 3110 ➪ p. 363) = GCB ■ MPU input (parameter 1600 ➪ p. 175) = On ■ Generator operating frequency (parameter 5802 ➪ p. 316, 5803 ➪ p. 316)
				Notes The asynchron mode is not recommended for emergency power applications.
1766	**Generator rated voltage**	2	50 to 650000 V **[400 V]**	This value refers to the rated voltage of the generator (generator voltage on data plate) and is the voltage measured on the potential transformer primary. The generator rated voltage is used as a reference figure for all generator voltage related functions, which use a percentage value, like generator voltage monitoring, breaker operation windows or the AnalogManager.
1752	**Gen. rated active power [kW]**	2	0.5 to 99999.9 kW **[200.0 kW]**	This value specifies the generator real power rating, which is used as a reference figure for related functions. The generator rated active power is the generator apparent power multiplied by the generator power factor (typically ~0.8). These values are indicated in the generator data plate (➪ *"Dependencies" on page 429*).
1758	**Gen. rated react. power [kvar]**	2	0.5 to 99999.9 kvar **[200.0 kvar]**	This value specifies the generator reactive power rating, which is used as a reference figure for related functions. The generator rated reactive power also depends on the generator values (➪ *"Dependencies" on page 429*).
1754	**Generator rated current**	2	1 to 32000 A **[300 A]**	This value specifies the generator rated current, which is used as a reference figure for related functions.
1851	**Generator voltage measuring**	2	3Ph 4W OD	Measurement is performed Line-Neutral (Open Delta connected system). The voltage is connected via transformer with 3 Wire. Phase voltages and the neutral must be connected for proper calculation. Measurement, display and protection are adjusted according to the rules for Open Delta connected systems. Monitoring refers to the following voltages: ■ VL12, VL23 and VL31
			1Ph 3W	Measurement is performed Line-Neutral (WYE connected system) and Line-Line (Delta connected system). The protection depends on the setting of parameter 1770 ➪ p. 317. Measurement, display, and protection are adjusted according to the rules for single-phase systems. Monitoring refers to the following voltages: ■ VL13 (parameter 1770 ➪ p. 317 configured to "Phase-phase") ■ VL1N, VL3N (parameter 1770 ➪ p. 317 configured to "Phase-neutral")
			1Ph 2W	Measurement is performed Line-Neutral (WYE connected system) if parameter 1858 ➪ p. 429 is configured to "Phase - neutral" and Line-Line (Delta connected system) if parameter 1858 ➪ p. 429 is configured to "Phase - phase". Measurement, display and protection are adjusted according to the rules for phase-phase systems. Monitoring refers to the following voltages: ■ VL1N, VL12

ID	Parameter	CL	Setting range [Default]	Description
			3Ph 3W	Measurement is performed Line-Line (Delta connected system). Phase voltages must be connected for proper calculation. Measurement, display and protection are adjusted according to the rules for Delta connected systems. Monitoring refers to the following voltages: ■ VL12, VL23, VL31
			[3Ph 4W]	Measurement is performed Line-Neutral (WYE connected system) and Line-Line (Delta connected system). The protection depends on the setting of parameter 1770 ➪ p. 317. Phase voltages and the neutral must be connected for proper calculation. Measurement, display and protection are adjusted according to the rules for WYE connected systems. Monitoring refers to the following voltages: ■ VL12, VL23 and VL31 (parameter 1770 ➪ p. 317 configured to "Phase-phase") ■ VL1N, VL2N and VL3N (parameter 1770 ➪ p. 317 configured to "Phase-neutral")
				Notes If this parameter is configured to 1Ph 3W, the generator and mains rated voltages (parameters 1766 ➪ p. 431 and 1768 ➪ p. 434) must be entered as Line-Line (Delta) and the busbar 1 rated voltage (parameter 1781 ➪ p. 433) must be entered as Line-Neutral (WYE). For information on measuring principles refer to ➪ *Chapter 3.3.5.1 "Generator Voltage" on page 53*.
1850	**Generator current measuring**	2	**[L1 L2 L3]**	All three phases are monitored. Measurement, display and protection are adjusted according to the rules for 3-phase measurement. Monitoring refers to the following currents: IL1, IL2, IL3
			Phase L{1/2/3}	Only one phase is monitored. Measurement, display and protection are adjusted according to the rules for single-phase measurement. Monitoring refers to the selected phase.
				Notes This parameter is only effective if generator voltage measuring (parameter 1851 ➪ p. 431) is configured to "3Ph 4W" or "3Ph 3W". For information on measuring principles refer to ➪ *Chapter 3.3.6.1 "Generator Current" on page 68*.

4.6.2.1 Configure transformer

General notes

The setpoints for specific parameters will differ depending upon the setting of parameter *"Generator current range"* 1830 ➪ p. 433.

- 1830 = "1A": Current transformer with ../1 A rated current
- 1830 = "5A": Current transformer with ../5 A rated current

ID	Parameter	CL	Setting range [Default]	Description
1801	**Gen. PT primary rated voltage** (Generator potential transformer primary voltage rating)	2	50 to 650000 V **[400 V]**	Some generator applications may require the use of potential transformers to facilitate measuring the voltages produced by the generator. The rating of the primary side of the potential transformer must be entered into this parameter. If the application does not require potential transformers (i.e. the measured voltage is 690 V or less), then the measured voltage will be entered into this parameter.
1800	**Gen. PT secondary rated volt.** (Generator potential transformer secondary voltage rating)	2	50 to 690 V **[400 V]**	Some generator applications may require the use of potential transformers to facilitate measuring the voltages produced by the generator. The rating of the secondary side of the potential transformer must be entered into this parameter. If the application does not require potential transformers (i.e. the measured voltage is 690 V or less), then the measured voltage will be entered into this parameter.
1806	**Gen. CT primary rated current** (Generator current transformer primary rating)	2	1 to 32000 A/x **[500 A/x]**	The input of the current transformer ratio is necessary for the indication and control of the actual monitored value. **Notes** The current transformers ratio should be selected so that at least 60% of the secondary current rating can be measured when the monitored system is at 100% of operating capacity (i.e. at 100% of system capacity a 5 A CT should output 3 A). If the current transformers are sized so that the percentage of the output is lower, the loss of resolution may cause inaccuracies in the monitoring and control functions and affect the functionality of the control. *"A/x"*: "/x" shows the relation to the current range which can be selected (1 A or 5 A).
1830	**Generator current range**	2	1 A **[5 A]**	The input range of the current transformer must be selected/defined.

4.6.3 Busbar

The busbar parameters in the device are often named with the affix "1". This preparation is done to avoid confusion e.g., if a model with a second busbar measurement is introduced.

ID	Parameter	CL	Setting range [Default]	Description
1781	**Busbar 1 rated voltage**	2	50 to 650000 V **[400 V]**	This value refers to the rated voltage of busbar 1 and is the voltage measured on the potential transformer primary. If voltage measuring is configured to 1Ph 3W, the WYE voltage (VL1N) must be entered here. The busbar 1 potential transformer primary voltage is entered in this parameter. The busbar rated voltage is used as a reference figure for all busbar voltage related functions, which use a percentage value, like synchronization.
5820	**Dead bus detection max. volt.**	2	0 to 30% **[10%]**	If the busbar voltage falls below this percentage of the busbar 1 rated voltage (parameter 1781 ➪ p. 433), a dead bus condition is detected and the logical command variable 02.21 (Busbar 1 is dead) becomes TRUE.

4.6.3.1 Configure transformer

ID	Parameter	CL	Setting range [Default]	Description
1813	**Busb1 PT primary rated voltage** (Busbar 1 potential transformer primary voltage rating)	2	50 to 650000 V **[400 V]**	Some applications may require the use of potential transformers to facilitate measuring the voltages to be monitored. The rating of the primary side of the potential transformer must be entered into this parameter. **Notes** If the application does not require potential transformers (i.e. the measured voltage is 690 V or less), then the measured voltage will be entered into this parameter.
1812	**Busb1 PT secondary rated volt.** (Busbar 1 potential transformer secondary voltage rating)	2	50 to 690 V **[400 V]**	Some applications may require the use of potential transformers to facilitate measuring the busbar voltages. The rating of the secondary side of the potential transformer must be entered into this parameter. If the application does not require potential transformers (i.e. the measured voltage is 690 V or less), then the measured voltage will be entered into this parameter.

4.6.4 Mains

ID	Parameter	CL	Setting range [Default]	Description
1768	**Mains rated voltage**	2	50 to 650000 V **[400 V]**	This value refers to the rated voltage of the mains and is the voltage measured on the potential transformer primary. The mains potential transformer primary voltage is entered in this parameter. The mains rated voltage is used as a reference figure for all mains voltage related functions, which use a percentage value, like mains voltage monitoring, breaker operation windows or the AnalogManager.
1748	**Mains rated active power [kW]**	2	0.5 to 99999.9 kW **[200.0 kW]**	This value specifies the mains real power rating, which is used as a reference figure for related functions. The mains rated active power is a reference value used by several monitoring and control functions (⇘ *"Dependencies" on page 429*).
1746	**Mains rated react. pwr. [kvar]**	2	0.5 to 99999.9 kvar **[200.0 kvar]**	This value specifies the mains reactive power rating, which is used as a reference figure for related functions. The mains rated reactive power is a reference value used by several monitoring and control functions(⇘ *"Dependencies" on page 429*).
1785	**Mains rated current**	2	1 to 32000 A **[300 A]**	This value specifies the mains rated current, which is used as a reference figure for related functions.
1853	**Mains voltage measuring**	2	**[3Ph 4W]**	Measurement is performed Line-Neutral (WYE connected system) and Line-Line (Delta connected system). The protection depends on the setting of parameter 1771 ⇘ p. 360. Phase voltages and the neutral must be connected for proper calculation. Measurement, display and protection are adjusted according to the rules for WYE connected systems. Monitoring refers to the following voltages: ■ VL12, VL23 and VL31 (parameter 1771 ⇘ p. 360 configured to "Phase-phase") ■ VL1N, VL2N and VL3N (parameter 1771 ⇘ p. 360 configured to "Phase-neutral") ■ VL12, VL23, VL31, VL1N, VL2N and VL3N (parameter 1771 ⇘ p. 360 configured to "All")

ID	Parameter	CL	Setting range [Default]	Description
			3Ph 3W	Measurement is performed Line-Line (Delta connected system). Phase voltages must be connected for proper calculation. Measurement, display and protection are adjusted according to the rules for Delta connected systems. Monitoring refers to the following voltages: ■ VL12, VL23, VL31
			1Ph 2W	Measurement is performed Line-Neutral (WYE connected system) if parameter 1858 ➪ p. 429 is configured to "Phase - neutral" and Line-Line (Delta connected system) if parameter 1858 ➪ p. 429 is configured to "Phase - phase". Measurement, display and protection are adjusted according to the rules for phase-phase systems. Monitoring refers to the following voltages: ■ VL1N, VL12
			1Ph 3W	Measurement is performed Line-Neutral (WYE connected system) and Line-Line (Delta connected system). The protection depends on the setting of parameter 1771 ➪ p. 360. Measurement, display, and protection are adjusted according to the rules for single-phase systems. Monitoring refers to the following voltages: ■ VL13 (parameter 1771 ➪ p. 360 configured to "Phase-phase") ■ VL1N, VL3N (parameter 1771 ➪ p. 360 configured to "Phase-neutral") ■ VL1N, VL3N (parameter 1771 ➪ p. 360 configured to "All")
				Notes If this parameter is configured to 1Ph 3W, the generator and mains rated voltages (parameters 1766 ➪ p. 431 and 1768 ➪ p. 434) must be entered as Line-Line (Delta) and the busbar 1 rated voltage (parameter 1781 ➪ p. 433) must be entered as Line-Neutral (WYE).
1852	**Mains current measuring**	2	**[Phase L1]** / Phase L2 / Phase L3	Phase L{1/2/3} Measurement is performed for the selected phase only. The measurement and display refer to the selected phase. The configured phase CT must be connected to perform current measurement.
				Notes For information on measuring principles refer to ➪ *Chapter 3.3.6.2 "Mains Current" on page 70.* This parameter is only effective if mains voltage measuring (parameter 1853 ➪ p. 434) is configured to "3Ph 4W" or "3Ph 3W".

4.6.4.1 Configure transformer

General notes

The setpoints for specific parameters will differ depending upon the setting of parameter *"Mains current range"*1832 ➪ p. 436.

- 1832 = "1A": Current transformer with ../1 A rated current
- 1832 = "5A": Current transformer with ../5 A rated current

ID	Parameter	CL	Setting range [Default]	Description
1804	**Mains PT primary rated voltage** (Mains potential transformer primary voltage rating)	2	50 to 650000 V **[400 V]**	Some applications may require the use of potential transformers to facilitate measuring the voltages to be monitored. The rating of the primary side of the potential transformer must be entered into this parameter.
				Notes If the application does not require potential transformers (i.e. the measured voltage is 690 V or less), then the measured voltage will be entered into this parameter.
1803	**Mains PT secondary rated volt.** (Mains potential transformer secondary voltage rating)	2	50 to 690 V **[400 V]**	Some applications may require the use of potential transformers to facilitate measuring the mains voltages. The rating of the secondary side of the potential transformer must be entered into this parameter. If the application does not require potential transformers (i.e. the measured voltage is 690 V or less), then the measured voltage will be entered into this parameter.
1807	**Mains CT primary rated current** (Mains current transformer primary rating)	2	1 to 32000 A/x **[500 A/x]**	The input of the current transformer ratio is necessary for the indication and control of the actual monitored value. The current transformers ratio should be selected so that at least 60% of the secondary current rating can be measured when the monitored system is at 100% of operating capacity (i.e. at 100% of system capacity a 5 A CT should output 3 A). If the current transformers are sized so that the percentage of the output is lower, the loss of resolution may cause inaccuracies in the monitoring and control functions and affect the functionality of the control.
				Notes This screen is only visible if parameter 1854 ↬ p. 430 is configured as Mains.
1832	**Mains current range**	2	1 A **[5 A]**	The input range of the current transformer must be selected/defined.
				Notes This screen is only visible if parameter 1854 ↬ p. 430 is configured as Mains.

4.6.4.2 External Mains Active Power

ID	Parameter	CL	Setting range [Default]	Description
2966	**External mains active power**	2	Yes	The mains active power is coming from an external source. The following measurement values of the external mains active power depend on the external mains **re**active power measurement. So there is to differentiate between two cases: **Case 1:** External mains **reactive** power measurement (parameter 2969 ⇘ p. 438) is disabled: ▪ The mains power factor is assumed as "1". ▪ The mains power factor monitoring is switched off. ▪ The mains power factor is not displayed. ▪ The mains total reactive power is not displayed. **Case 2:** External mains **reactive** power measurement (parameter 2969 ⇘ p. 438) is enabled: ▪ The mains power factor is calculated. ▪ The mains power factor monitoring is switched off. ▪ The mains power factor is not displayed. ▪ The mains total reactive power is not displayed. ▪ The mains total apparent power is calculated and displayed. **Notes** Mains power monitoring is not available. Please make sure to assign the external mains active power to the corresponding analog data source (parameter 5780 ⇘ p. 437/⇘ p. 962). The same data source must be used if the mains active power is requested via interface.
			[No]	The mains active power is internally measured.
5780	**AM Ext.mains act.pwr**	2	Determined by AnalogManager 81.19: **[A1 = 06.01 Analog input 1]**	Typically an analog input is selected as data source which is connected to an external transducer.
2967	**Mains power meas. resolution** (Mains power measurement resolution)	2		This parameter controls the resolution and the format.
			Selected resolution	Power at 100% analog value
			0.01 kW	10.00 kW
			0.1 kW	100.0 kW
			[1 kW]	1000 kW
			0.01 MW	10.00 MW
			0.1 MW	100.0 MW

4.6.4.3 External Mains Reactive Power

ID	Parameter	CL	Setting range [Default]	Description
2969	**External mains reactive power**	2	Yes	The mains reactive power is coming from an external source. This power is displayed and used for control purposes. The source is taken via AnalogManager. The following measurement values depend on the external mains active power measurement. So there is to differentiate between two cases: **Case 2:** External mains **active** power measurement (parameter 2966 ␣ p. 437) is disabled: ■ The mains power factor is assumed as "1". ■ The mains active power monitoring is switched off. ■ The mains power factor monitoring is switched off. ■ The mains power factor is not displayed. ■ The mains total active power is not displayed. **Case 1:** External mains **active** power measurement (parameter **2966**) is enabled: ■ The mains power factor is calculated. ■ The mains power factor monitoring is switched off. ■ The mains power factor is not displayed. ■ The mains total reactive power is not displayed. ■ The mains total apparent power is calculated and displayed. **Notes** Mains power monitoring is not available. Please make sure to assign the external mains reactive power to the corresponding analog data source (parameter 5794 ␣ p. 438/␣ p. 962). The same data source must be used if the mains active power is requested via interface.
			[No]	The mains reactive power is internally measured.
5794	**AM Ext.mains RPower**	2	Determined by AnalogManager 81.20: **[A1 = 06.02 Analog input 2]**	Typically an analog input is selected as data source (kvar value) which is connected to an external transducer.
2970	**Mains react. power meas. resolution** (Mains reactive power measurement resolution)	2		This parameter controls the resolution and the format.
			Selected resolution:	Power at 100% analog value:
			0.01 kvar	10.00 kvar
			0.1 kW	100.0 kvar
			[1 kvar]	1000 kvar
			0.01 Mvar	10.00 Mvar
			0.1 Mvar	100.0 Mvar

4.6.5 Engine

ID	Parameter	CL	Setting range [Default]	Description
1601	**Engine rated speed**	2	100 to 4,000 rpm **[1,500 rpm]**	Number of revolutions per minute of the engine at rated engine speed. The speed control with an ECU via J1939 CAN bus refers to this value.

4.7 Configure Interfaces

Interfaces / Communication
easYgen-3400XT/3500XT-P1

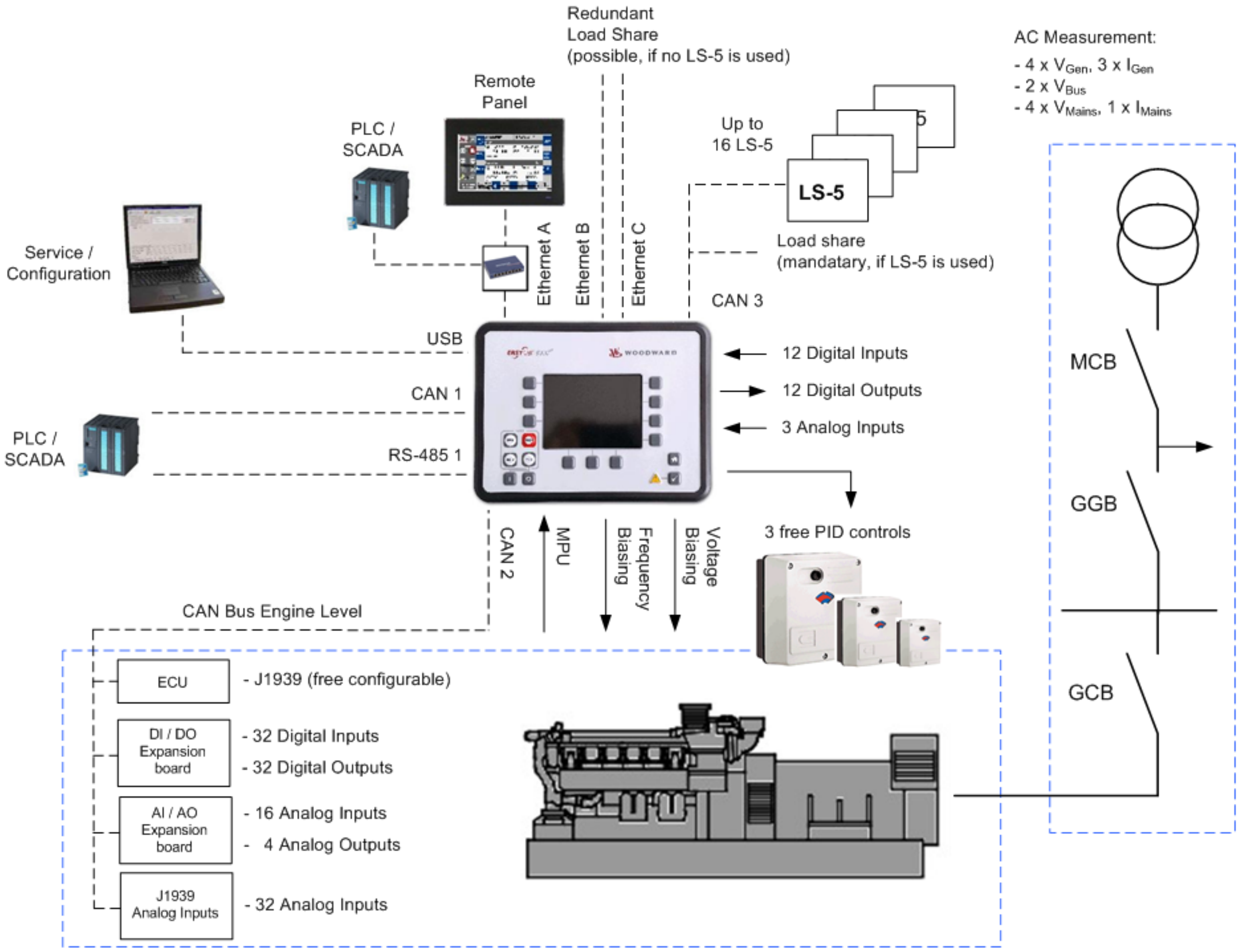


Fig. 195: easYgen-3400XT/3500XT-P1 communication interfaces

4.7.1 USB (Service Port) Interface

There is no configuration to do for the USB Service Port but the driver installer .exe from CD-ROM must be proceeded: *"Software ➔ USB driver ➔ Click here"*

> ***USB Service Port***
>
> *The USB service port is restricted for ToolKit communication, Woodward service communication, and - if provided by factory side - read only files.*
>
> *The "Automatic Reconnection" over USB is not possible.*
>
> *If connection over USB is lost, please reconnect manually:*
>
> – *1. Wait until the easYgen-XT is recognized again through the PC (as an external hard drive)*
> – *2. Start via ToolKit at new by "Disconnect" and then "Connect" again*

4.7.2 RS-485 Interface

ID	Parameter	CL	Setting range [Default]	Description
3170	**Baudrate**	2	2.4 / 4.8 / 9.6 / **[19.2]** / 38.4 / 56 / 115 kBaud	This parameter defines the baud rate for communications. Please note, that all participants on the bus must use the same baud rate.
3171	**Parity**	2	**[No]** / Even / Odd	The used parity of the interface is set here.
3172	**Stop bits**	2	**[One]** / Two	The number of stop bits is set here.
3173	**Full-, half-duplex mode**	2	**[Fullduplex]**	Fullduplex mode is enabled.
			Half-duplex	Half-duplex mode is enabled.
				Modbus Interface
3188	**ModBus Slave ID**	2	0 to 255 **[1]**	The Modbus device address, which is used to identify the device via Modbus, is entered here. If "0" is configured here, the Modbus is disabled.
3189	**Reply delay time**	2	0.00 to 2.55 s **[0.00 s]**	This is the minimum delay time between a request from the Modbus master and the sent response of the slave. This time is required in half-duplex mode.
9128	**Password protection**	5	Off	Password protection for Modbus RS 485 is **not active**. **Notes** Take care for a protected access!
			[On]	Password protection for Modbus RS 485 is active.

4.7.3 Modbus Protocol

> ***Data Format(s)***
>
> *Modbus registers are read and written according to the Modbus standard as Big-endian.*
>
> *Composite data types like LOGMAN, ANALOGMANAGER, and TEXT use separate descriptions.*

ID	Parameter	CL	Setting range [Default]	Description
3184	**Modbus protocol number**	2	0 to 65535	A Modbus protocol may be selected by entering the data protocol ID here. If an unknown data protocol ID is configured here, nothing will be transmitted. Possible data protocol IDs (existing protocols) are listed in this Technical Manual. Instead of a Woodward protocol, a customer specific data protocol can be selected. Such a protocol must have been uploaded onto the device and its file name must fit the reserved range from protocol number 65100 to 65199. Use Woodward *"TelegramMapper"* software to create your own Data Telegrams.
				Notes Another protocol can be used after power-cycle of the control: Change Modbus protocol number first, then power cycle!
			[5010]	Number of the Data Telegram to be used for communication (corresponds to the file name [xxxx].scp).
				Notes All Date Telegrams described in this Technical Manual are device implemented: no separate scp-file (e.g. "5010.scp") needed.
3179	**Detect a gap in a Modbus frame**	2	**[On]**	If a received Modbus command has a gap between its byte of more than 5 ms, this command is ignored.
			Off	The Modbus message is not checked.
3181	**Power [W] exponent 10^x**	2	2 to 5 **[3]**	This setting adjusts the format of the 16 bit power values in the data telegram.
				Notes Valid for data telegram 5010 only! Refer to *"Power measurement example" on page 443* for examples.
3182	**Voltage [V] exponent 10^x**	2	-1 to 2 **[0]**	This setting adjusts the format of the 16 bit voltage values in the data telegram.
				Notes Valid for data telegram 5010 only! Refer to *"Voltage measurement example" on page 443* for examples.
3183	**Current [A] exponent 10^x**	2	-1 to 0 **[0]**	This setting adjusts the format of the 16 bit current values in the data telegram.
				Notes Valid for data telegram 5010 only! Refer to *"Power measurement example" on page 443* for examples.

Customer Written Data Protocols

Select standard or customized Data Protocol with parameter 3184 *"Modbus protocol number"*

In many applications customers ask for self-definable protocols. That means they want to create individual Modbus Address Point lists for Modbus RTU, TCP, and UDP. Therefore the address range (4)50000 can be taken. The user will be able to arrange contents from the easYgen database (Index No.), AnalogManager Variables, and LogicsManager Command Variables to a customer specific protocol. Therefore Woodward offers the Telegram-Mapper software for free and enables easYgen-XT to import, make accessible, and proceed customer specific Modbus protocols.

The TelegramMapper software can be installed separately from other Woodward software. After starting the program the HELP file can guide through the required settings. Data from ...

- the AnalogManager variables,
- the LogicsManager command variables,
- and the easYgen database ...

of the particular easYgen model will be available/selectable.

The according data types must be defined and each address entry can be commented. There is a maximum length of 300 addresses.

The final protocol can be saved with a **protocol number from 65100 to 65199 used as file name(!)** as an

- SCP-file for import into the easYgen device
- HTML-file for easy to read documentation of the (self) created data protocol
- MAP-file for further edits with the TelegramMapper software

To load your created Data Protocol(s) - the scp-file(s) - into your easYgen device use ToolKit.

To switch to your Data Protocol and use it for communication: Configure parameter 3184 ↳ p. 441 *"Modbus protocol number"* to your customer specific protocol number and power cycle the control.

Summary: The self-mappable address range is defined with a protocol number from 65100 to 65199 and has a maximum length of 300 addresses. Communication using customer specific data protocols is configurable similar to other already existing protocols 5003, 5011 etc. (*"Parameter ➔ Configuration/Configure interfaces ➔ Modbus protocol"*).

Handling Customer Specific Protocols

It is possible to upload several protocols (.scp files) onto the easygen. Only one protocol can be used at a time.*

Power measurement example

How to use *"Power exponent"* 3181

Power measurement:

- The measurement range is 0…250 kW
- Momentary measurement value = 198.5 kW (198.500 W)

Setting value 3181	Meaning	Calculation	Transfer value (16 Bit, max. 32767)	Possible display format
2	10^2	198500 W / 10^2 W	1985	198.5 kW
3	10^3	198500 W / 10^3 W	198	198 kW
4	10^4	198500 W / 10^4 W	19	N/A
5	10^5	198500 W / 10^5 W	1	N/A

Table 97: Power measurement example

Voltage measurement example

How to use *"Voltage exponent"* 3182

Voltage measurement:

- The measurement range is 0…480 V
- Momentary measurement value = 477.8 V

Setting	Meaning	Calculation	Transfer value (16 Bit, max. 32767)	Possible display format
-1	10^{-1}	477.8 V / 10^{-1} W	4778	477.8 V
0	10^0	477.8 V / 10^0 V	477	477 V
1	10^1	477.8 V / 10^1 V	47	N/A
2	10^2	477.8 V / 10^2 V	4	N/A

Table 98: Voltage measurement example

Current measurement example

How to use *"Current exponent"* 3183

Current measurement:

- The measurement range is 0…500 A
- Momentary measurement value = 345.4 A

Setting	Meaning	Calculation	Transfer value (16 Bit, max. 32767)	Possible display format
-1	10^{-1}	345.4 A / 10^{-1} A	3454	345.4 A
0	10^0	345.4 A / 10^0 A	345	345 A

Table 99: Current measurement example

4.7.4 CAN Interfaces

4.7.4.1 CAN Interface 1

General notes

The CAN bus is a field bus and subject to various disturbances. Therefore, it cannot be guaranteed that every request will be answered. We recommend to repeat a request, which is not answered within reasonable time.

COB-ID of SYNC/TIME messages

Parameters 9100 ➪ p. 445 and 9101 ➪ p. 446 use synchronization and time messages that adhere to the following structure.

Bit number	Value	Meaning
31 (MSB)	0	Unit does not apply TIME message
	1	Unit applies TIME message
30	0	Unit does not generate SYNC/TIME message
	1	Unit generates SYNC/TIME message
29	X	N/A
28-11	0	Always
10-0 (LSB)	X	Bits 10-0 of SYNC/TIME COB-ID

TIME synchronization message

CANopen master	COB-ID TIME	Time applied	Time transmitted
Off	Bit 30 = 0; Bit 31 = 0	No	No
	Bit 30 = 1; Bit 31 = 0	Yes	No
	Bit 30 = 0; Bit 31 = 1	Yes	No
	Bit 30 = 1; Bit 31 = 1	Yes	Yes
Default	Bit 30 = 0; Bit 31 = 0	No	No
	Bit 30 = 1; Bit 31 = 0	No	Yes
	Bit 30 = 0; Bit 31 = 1	Yes	No[1]
	Bit 30 = 1; Bit 31 = 1	Yes	Yes[1]
On	Bit 30 = 0; Bit 31 = 0	No	No
	Bit 30 = 1; Bit 31 = 0	No	Yes
	Bit 30 = 0; Bit 31 = 1	Yes	No
	Bit 30 = 1; Bit 31 = 1	Yes	Yes

[1] If CANopen master (lowest Node-ID).

ID	Parameter	CL	Setting range [Default]	Description
3156	**Baudrate**	2	20 / 50 / 100 / 125 / 250 / 500 / 800 / 1000 kBaud **[250 kBd]**	This parameter defines the used baud rate. Please note, that all participants on the CAN bus must use the same baud rate.
1894	**Align device no. with Node-ID**	2	No **[Yes]**	If this parameter is configured to "Yes" the parameter *"Node-ID CAN bus 1"* 8950 ⇘ p. 445 will be overwritten with the value of the *"Device number "*1702 ⇘ p. 159 and is not visible. If configured to "No", parameter *"Device number "* 1702 is visible and will not be overwritten.
				Notes This is to avoid CAN ID conflict in multi unit systems if using the same ID more than one time. This can cause CAN "Bus-Off" failure.
8950	**Node-ID CAN bus 1**	2	1 to 127 (dec) **[1]**	A number that is unique to the control must be set in this parameter so that this control unit can be correctly identified on the CAN bus. This address number may only be used once on the CAN bus. All additional addresses are calculated based on this unique device number.
				Notes We recommend to configure the Node-IDs for units, which participate in load sharing, as low as possible to facilitate establishing of communication.
8993	**CANopen Master**	2		One bus participant must take over the network management and put the other participants into "operational" mode. The easYgen is able to perform this task.
			[Default Master]	The unit starts up in "operational" mode and sends a "Start_Remote_node" message after a short delay (the delay is the Node-ID (parameter 8950 ⇘ p. 445) in seconds, i.e. if the Node-ID is configured to 2, the message will be sent after 2 seconds). If more than one easYgen is configured to Default Master, the unit with the lower Node-ID will take over control. Therefore, the CAN bus devices, which are intended to act as Default Master should be assigned a low Node-ID. No other device on the CAN bus (except the easYgens) may operate as Master).
			On	The unit is the CANopen Master and automatically changes into operational mode and transmits data.
			Off	The unit is a CANopen Slave. An external Master must change into operational mode.
				Notes If this parameter is configured to "Off", the Master controller (for example a PLC) must send a "Start_Remote_node" message to initiate the load share message transmission of the easYgen. If no "Start_Remote_node" message would be sent, the complete system would not be operational.
9120	**Producer heartbeat time**	2	0 to 65500 ms **[2000 ms]**	Independent from the CANopen Master configuration, the unit transmits a heartbeat message with this configured heartbeat cycle time. If the producer heartbeat time is equal 0, the heartbeat will only be sent as response to a remote frame request. The time configured here will be rounded up to the next 20 ms step.
9100	**COB-ID SYNC Message**	2	1 to FFFFFFFF hex **[80 hex]**	This parameter defines whether the unit generates the SYNC message or not. The message complies with CANopen specification: object 1005 hex; subindex 0 defines the COB-ID of the synchronization object (SYNC).
				Notes The structure of this object is shown in ⇘ *"COB-ID of SYNC/TIME messages" on page 444*
8940	**Producer SYNC Message time**	2	0 to 65000 ms **[20 ms]**	This is the cycle time of the SYNC message. If the unit is configured for this function (parameter 9100 ⇘ p. 445) it will send the SYNC message with this interval. The time configured here will be rounded up to the next 10 ms step.

ID	Parameter	CL	Setting range [Default]	Description
9101	**COB-ID TIME Message**	2	1 to FFFFFFFF hex **[100 hex]**	This parameter defines whether the unit generates the TIME message or not. Complies with CANopen specification: object 1012 hex, subindex 0; defines the COB-ID of the time object (TIME).
				Notes The structure of this object is shown in ↬ *"COB-ID of SYNC/TIME messages" on page 444*
9102	**Cycle of TIME sync. message**	2	1.0 to 6500.0 s **[10.0 s]**	This is the cycle time of the TIME message. If the unit is configured for this function (parameter 9101 ↬ p. 446) it will send the TIME message with this interval.
				Notes The structure of this object is shown in ↬ *"TIME synchronization message" on page 444*
9126	**Password protection**	5	Off	Password protection for CAN 1 is **not active**.
				Notes Take care for a protected access!
			[On]	Password protection for CAN 1 is active.

4.7.4.1.1 Additional Server SDOs (Service Data Objects)

General notes

The CAN bus is a field bus and subject to various disturbances. Therefore, it cannot be guaranteed that every request will be answered. We recommend to repeat a request, which is not answered within reasonable time.

The first Node-ID is the standard Node-ID of CAN interface 1 (parameter 8950 ↬ p. 445).

ID	Parameter	CL	Setting range [Default]	Description
12801	**2. Node-ID**	2	0 to 127 (dec) **[0]**	In a multi-master application, each Master needs its own identifier (Node-ID) from the unit. in order to send remote signals (i.e. remote start, stop, shutdown, or acknowledge) to the unit. The additional SDO channel will be made available by configuring this Node-ID to a value different than zero. This is the additional CAN ID for the PLC.
12802	**3. Node-ID**	2	0 to 127 (dec) **[0]**	In a multi-master application, each Master needs its own identifier (Node-ID) from the unit. in order to send remote signals (i.e. remote start, stop, shutdown, or acknowledge) to the unit. The additional SDO channel will be made available by configuring this Node-ID to a value different than zero. This is the additional CAN ID for the PLC.
12803	**4. Node-ID**	2	0 to 127 (dec) **[0]**	In a multi-master application, each Master needs its own identifier (Node-ID) from the unit. in order to send remote signals (i.e. remote start, stop, shutdown, or acknowledge) to the unit. The additional SDO channel will be made available by configuring this Node-ID to a value different than zero. This is the additional CAN ID for the PLC.
12804	**5. Node-ID**	2	0 to 127 (dec) **[0]**	In a multi-master application, each Master needs its own identifier (Node-ID) from the unit. in order to send remote signals (i.e. remote start, stop, shutdown, or acknowledge) to the unit. The additional SDO channel will be made available by configuring this Node-ID to a value different than zero. This is the additional CAN ID for the PLC.

4.7.4.1.2 Receive PDO {x} (Process Data Object)

General notes

RPDO mapping is carried out as shown in (Fig. 196).

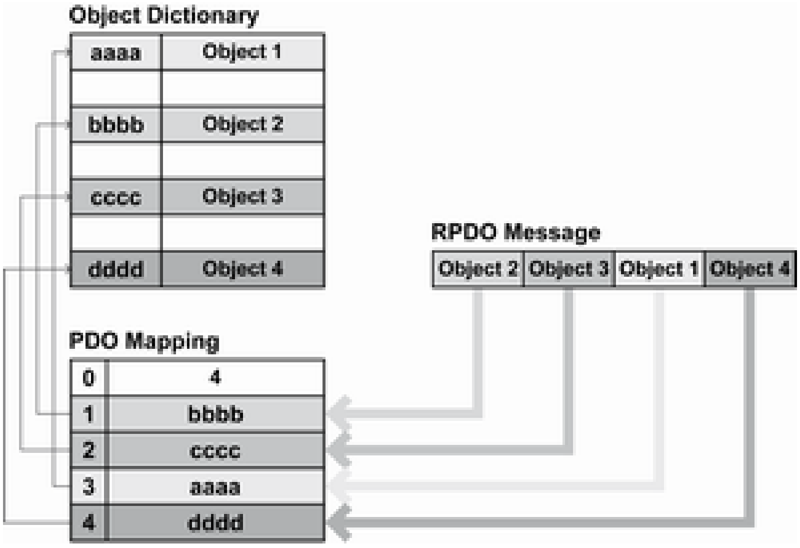


Fig. 196: RPDO mapping principle

Parameters
9300 ➪ p. 448/9310 ➪ p. 448/9320 ➪ p. 448/12805 ➪ p. 448/12806 ➪ p. 448 use communication parameters that adhere to the following structure.

RPDO Objects can be remote signals (parameter 503; please refer to ➪ "Remote control word 1" on page 875 for details), DI states and AI measured values.

Bit number	Value	Meaning
31 (MSB)	0	PDO exists / is valid
	1	PDO does not exist / is not valid
30	X	N/A
29	X	N/A
28-11	0	Always
10-0 (LSB)	X	Bits 10-0 of COB-ID

PDO valid / not valid allows to select, which PDOs are used in the operational state.

ID	Parameter	CL	Setting range [Default]	Description
9300 9310 9320 12805 12806	**COB-ID**	2	1 to FFFFFFFF hex **[80000000 hex]**	This parameter contains the communication parameters for the PDOs, the device is able to receive. Complies with CANopen specification: object 1400 hex (for RPDO 1, 1401 hex for RPDO 2, 1402 hex for RPDO 3, 1403 hex for RPDO 4, and 1404 hex for RPDO 5), subindex 1.
				Notes The structure of this object is shown in ↳ *Further information on page 447*. Do not configure an RPDO or TPDO with a COB-ID higher than 580 hex or lower than 180 hex. These IDs are reserved for internal purposes.
9121 9122 9123 9124 9125	**Event-timer**	2	0 to 65500 ms **[2000 ms]**	This parameter configures the time, from which this PDO is marked as "not existing". The time configured here will be rounded up to the next 5 ms step. Received messages are processed by the control unit every 20 ms. Messages, which are sent faster, will be discarded. We recommend to configure ten times the cycle time of the received data here.
				Notes Complies with CANopen specification: object 1400 hex (for RPDO 1, 1401 hex for RPDO 2, 1402 hex for RPDO 3, 1403 hex for RPDO 4, and 1404 for RPDO 5), subindex 5
8970 8971 8972 8973 8974	**Selected Data Protocol**	2	0 to 65535 **[0]**	A data protocol may be selected by entering the data protocol ID here. If 0 is configured here, the message assembled by the mapping parameters is used. If an unknown data protocol ID is configured here, a failure is indicated by the CAN status bits. Possible data protocol IDs are:
			65000	IKD 1 – external DIs/DOs 1 through 8
			65001	IKD 1 – external DIs/DOs 9 through 16
			65002	
			65003	
9910 9915 9905 12821 12831	**Number of Mapped Objects**	2	0 to 4 **[0]**	This parameter defines the number of valid entries within the mapping record. This number is also the number of the application variables, which shall be received with the corresponding PDO.
				Notes Complies with CANopen specification: object 1600 hex (for RPDO 1, 1601 hex for RPDO 2, 1602 hex for RPDO 3, 1603 hex for RPDO 4, and 1604 hex for RPDO 5), subindex 0
9911 9916 9906 12822 12832	**1. Mapped Object**	2	0 to 65535 **[0]**	This parameter contains the information about the mapped application variables. These entries describe the PDO contents by their index. The sub-index is always 1. The length is determined automatically.
				Notes Complies with CANopen specification: object 1600 hex (for RPDO 1, 1601 hex for RPDO 2, 1602 hex for RPDO 3,1603 hex for RPDO 4, and 1604 hex for RPDO 5), subindex 1.
9912 9917 9907 12823 12833	**2. Mapped Object**	2	0 to 65535 **[0]**	This parameter contains the information about the mapped application variables. These entries describe the PDO contents by their index. The sub-index is always 1. The length is determined automatically.
				Notes Complies with CANopen specification: object 1600 hex (for RPDO 1, 1601 hex for RPDO 2, 1602 hex for RPDO 3, 1603 hex for RPDO 4, and 1604 hex for RPDO 5), subindex 2.
9913 9918 9908 12824 12834	**3. Mapped Object**	2	0 to 65535 **[0]**	This parameter contains the information about the mapped application variables. These entries describe the PDO contents by their index. The sub-index is always 1. The length is determined automatically.
				Notes Complies with CANopen specification: object 1600 hex (for RPDO 1, 1601 hex for RPDO 2, 1602 hex for RPDO 3, 1603 hex for RPDO 4, and 1604 hex for RPDO 5), subindex 3.

ID	Parameter	CL	Setting range [Default]	Description
9914 9919 9909 12825 12835	**4. Mapped Object**	2	0 to 65535 **[0]**	This parameter contains the information about the mapped application variables. These entries describe the PDO contents by their index. The sub-index is always 1. The length is determined automatically. **Notes** Complies with CANopen specification: object 1600 hex (for RPDO 1, 1601 hex for RPDO 2, 1602 hex for RPDO 3, 1603 hex for RPDO 4, and 1604 hex for RPDO 5), subindex 4.

4.7.4.1.3 Transmit PDO {x} (Process Data Object)

General notes

TPDO mapping is carried out as shown in (Fig. 197).

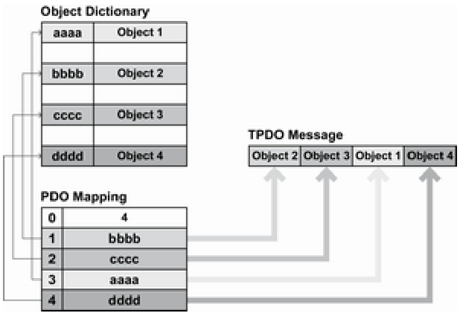


Fig. 197: TPDO mapping

CANopen allows to send 8 byte of data with each Transmit PDO. These may be defined separately if no pre-defined data protocol is used.

All data protocol parameters with a parameter ID may be sent as an object with a CANopen Transmit PDO.

The data length will be taken from the data byte column (see ↪ *"The following data protocols are implemented to be used" on page 685):*

- *1,2 UNSIGNED16 or SIGNED16*
- *3,4 UNSIGNED16 or SIGNED16*
- *5,6 UNSIGNED16 or SIGNED16*
- *1,2,3,4 UNSIGNED32 or SIGNED32*
- *3,4,5,6 UNSIGNED32 or SIGNED32*
- *etc.*

The object ID is identical with the parameter ID when configuring via front panel or ToolKit.

Parameters 9600 ↪ *p. 450/9610* ↪ *p. 450/9620* ↪ *p. 450/9630* ↪ *p. 450/12792* ↪ *p. 450 use communication parameters that adhere to the following structure.*

Bit number	Value	Meaning
31 (MSB)	0	PDO exists / is valid
	1	PDO does not exist / is not valid
30	X	N/A
29	X	N/A
28-11	0	Always
10-0 (LSB)	X	Bits 10-0 of COB-ID

PDO valid / not valid allows to select, which PDOs are used in the operational state.

Transmission types

Parameters 9602 ↪ p. 451/9612 ↪ p. 451/9622 ↪ p. 451/9632 ↪ p. 451/12793 ↪ p. 451 are used to select one of the following transmission types.

Transmission type	PDO transmission				
	Cyclic	Acyclic	Synchronous	Asynchronous	RTR only
0	Will not be sent				
1-240	X		X		
241-251	Will not be sent				
252	Will not be sent				
253	Will not be sent				
254				X	
255				X	

A value between 1 and 240 means that the PDO is transferred synchronously and cyclically. The transmission type indicating the number of SYNC messages, which are necessary to trigger PDO transmissions.

Transmit PDOs are always triggered by the following SYNC upon reception of data independent of the transmission types 0 to 240. For TPDOs, transmission type 254 and 255 means, the application event is the event timer.

ID	Parameter	CL	Setting range [Default]	Description
9600 9610 9620 9630 12792	**COB-ID**	2	1 to FFFFFFFF hex **[80000000 hex]**	This parameter contains the communication parameters for the PDOs the unit is able to transmit. The unit transmits data (i.e. visualization data) on the CAN ID configured here. Complies with CANopen specification: object 1800 hex for (TPDO 1, 1801 hex for TPDO 2, 1802 hex for TPDO 3, 1803 hex for TPDO 4, and 1804 hex for TPDO 5), subindex 1.
				Notes The structure of this object is shown in ↪ *Further information on page 449* Do not configure an RPDO or TPDO with a COB-ID higher than 580 hex or lower than 180 hex. These IDs are reserved for internal purposes. In case a LSG is part of CAN 1, do not configure COB-IDs 181 - 18E hex because legacy devices are using same IDs but cannot be switched.

ID	Parameter	CL	Setting range [Default]	Description
9602 9612 9622 9632 12793	**Transmission type**	2	0 to 255 **[255]**	This parameter contains the communication parameters for the PDOs the unit is able to transmit. It defines whether the unit broadcasts all data automatically (value 254 or 255) or only upon request with the configured address of the COB-ID SYNC message (parameter 9100 ➪ p. 445).
				Notes Complies with CANopen specification: object 1800 hex (for TPDO 1, 1801 hex for TPDO 2, 1802 hex for TPDO 3, 1803 hex for TPDO 4, and 1804 hex for TPDO 5), subindex 2. The description of the transmission type is shown in ➪ *"Transmission types" on page 450*.
9604 9614 9624 9634 12794	**Event timer**	2	0 to 65535 ms **[20 ms]**	This parameter contains the communication parameters for the PDOs the unit is able to transmit. The broadcast cycle for the transmitted data is configured here. The time configured here will be rounded up to the next 5 ms step.
				Notes Complies with CANopen specification: object 1800 hex (for TPDO 1, 1801 hex for TPDO 2, 1802 hex for TPDO 3, 1803 hex for TPDO 4, and 1804 hex for TPDO 5), subindex 5
8962 8963 8964 8965 8966	**Selected Data Protocol**	2	0 to 65535 8962: **[5003]** 8963: **[5008]** 8964: **[0]** 8965: **[0]** 8966: **[0]**	A data protocol may be selected by entering the data protocol ID here. If 0 is configured here, the message assembled by the mapping parameters is used. If an unknown data protocol ID is configured here, a failure is indicated by the CAN status bits. Possible data protocol IDs are:
			65000	IKD 1 – external DIs/DOs 1 through 8
			65001	IKD 1 – external DIs/DOs 9 through 16
			65002	IKD 1 – external DIs/DOs 17 through 24
			65003	IKD 1 – external DIs/DOs 25 through 32
			5003	Data telegram (CAN and MODBUS)
			5005	Data telegram (CAN mains values)
			5010	Data telegram (MODBUS)
			5011	Data telegram (CAN alarm values)
			4103	Data telegram (CAN J1939)
			4104	Data telegram (CAN J1939 Scania S6)
			4105	Data telegram (CAN J1939 Deutz EMR2)
			4110	Data telegram (CAN J1939 MTU ADEC)
9609 9619 9629 9639 12799	**Number of Mapped Objects**	2	0 to 4 **[0]**	This parameter contains the mapping for the PDOs the unit is able to transmit. This number is also the number of the application variables, which shall be transmitted with the corresponding PDO.
				Notes Complies with CANopen specification: object 1A00 hex (for TPDO 1, 1A01 hex for TPDO 2, 1A02 hex for TPDO 3, 1A03 hex for TPDO 4, and 1A04 hex for TPDO 5), subindex 0
9605 9615 9625 9635 12795	**1. Mapped Object**	2	0 to 65535 **[0]**	This parameter contains the information about the mapped application variables. These entries describe the PDO contents by their index. The sub-index is always 1. The length is determined automatically.
				Notes Complies with CANopen specification: object 1A00 hex (for TPDO 1, 1A01 hex for TPDO 2, 1A02 hex for TPDO 3, 1A03 hex for TPDO 4, and 1A04 hex for TPDO 5), subindex 1

ID	Parameter	CL	Setting range [Default]	Description
9606 9616 9626 9636 12796	**2. Mapped Object**	2	0 to 65535 **[0]**	This parameter contains the information about the mapped application variables. These entries describe the PDO contents by their index. The sub-index is always 1. The length is determined automatically. **Notes** Complies with CANopen specification: object 1A00 hex (for TPDO 1, 1A01 hex for TPDO 2, 1A02 hex for TPDO 3, 1A03 hex for TPDO 4, and 1A04 hex for TPDO 5), subindex 2
9607 9617 9627 9637 12797	**3. Mapped Object**	2	0 to 65535 **[0]**	This parameter contains the information about the mapped application variables. These entries describe the PDO contents by their index. The sub-index is always 1. The length is determined automatically. **Notes** Complies with CANopen specification: object 1A00 hex (for TPDO 1, 1A01 hex for TPDO 2, 1A02 hex for TPDO 3, 1A03 hex for TPDO 4, and 1A04 hex for TPDO 5), subindex 3
9608 9618 9628 9638 12798	**4. Mapped Object**	2	0 to 65535 **[0]**	This parameter contains the information about the mapped application variables. These entries describe the PDO contents by their index. The sub-index is always 1. The length is determined automatically. **Notes** Complies with CANopen specification: object 1A00 hex (for TPDO 1, 1A01 hex for TPDO 2, 1A02 hex for TPDO 3, 1A03 hex for TPDO 4, and 1A04 hex for TPDO 5), subindex 4

4.7.4.2 CAN Interface 2

General notes

This CAN Interface is dedicated to

- *J1939 devices and*
- *external CANopen devices with analog and/or digital terminals.*

General Settings

ID	Parameter	CL	Setting range [Default]	Description
3157	**Baudrate**	2	20 / 50 / 100 / 125 / 250 kBaud **[250 kBd]**	This parameter defines the used baud rate. **Notes** All participants on the CAN bus must use the same baud rate.

4.7.4.2.1 Expansion Modules at CANopen Interface

The CANopen interface at CAN 2 is very flexible.

The configuration of the expansion modules is split into two parts:

- One part is located at the CAN2 interface pages and defines the Node IDs and the types of external devices and is described here.
  An application description explains the setup in detail (refer to *Chapter 6.3.10 "Setup Expansion Modules at CAN 2" on page 559*).
- One other part is located at the external analog/digital inputs/outputs pages and defines how many inputs/outputs are used and the scaling of the analog types. Refer to chapters *Chapter 4.4.2.4 "Analog Inputs" on page 190* for reference.
- Six Node-IDs can be selected to be used with different combinations of external terminals ("# Node-ID", parameters 9930-9935)
- A number of well defined combinations is available for Woodward IKD and/or third party expansion modules from Phoenix and WAGO: ("Select external terminals", parameter 15320 p. 457)
  This parameter defines the type and the maximal number of DI, DO, AI, AO combinations.
- Alternatively new combinations can be implemented by selecting "Ext.term.file" and define this separate file by "Sequencer filename", parameter 15318 p. 458.
  Such files can be prepared by Woodward. Please ask you local Woodward partner for an offer.

How to read the table ...

- *"2 IKD: 16 X DI/DO": 2 devices with 8 DI/DO each (2 x 8 = 16 DI/DO together)*
- *"P": Phoenix*
- *"W": Wago*
- *"_": separator for combinations with different headers*

For basic configuration see Chapter 6.3.10 "Setup Expansion Modules at CAN 2" on page 559 - especially the flow charts of "Configuration process help" on page 564ff

Combination selected by ...		**Terminal assigned to ...**					
Select external terminals **ID 15320**	**# of** **terminals: I/O**	**1st Node-ID** **ID 9930**	**2nd Node-ID** **ID 9931**	**3rd Node-ID** **ID 9932**	**4th Node-ID** **ID 9933**	**5th Node-ID** **ID 9934**	**6th Node-ID** **ID 9935**
DI/DO: Digital Inputs and Digital Outputs, only							
1IKD	1 IKD: 8 x DI/DO	IKD1 DI/DO 1-8					
2IKD	2 IKD: 16 x DI/DO	IKD1 DI/DO 1-8	IKD2 DI/DO 9-16				
3IKD	3 IKD: 24 x DI/DO	IKD1 DI/DO 1-8	IKD2 DI/DO 9-16	IKD3 DI/DO 17-24			

Combination selected by ...		Terminal assigned to ...					
Select external terminals **ID 15320**	**# of** **terminals: I/O**	**1st Node-ID** **ID 9930**	**2nd Node-ID** **ID 9931**	**3rd Node-ID** **ID 9932**	**4th Node-ID** **ID 9933**	**5th Node-ID** **ID 9934**	**6th Node-ID** **ID 9935**
4IKD	4 IKD: 32 x DI/DO	IKD1 DI/DO 1-8	IKD2 DI/DO 9-16	IKD3 DI/DO 17-24	IKD4 DI/DO 25-32		
P16D	1 Phoenix: 16 x DI/DO			P16DIDO DI/DO 1-16			
W16D	1 WAGO: 16 x DI/DO			W16DIDO DI/DO 1-16			
P32D	1 Phoenix: 32 x DI/DO			P32DIDO DI/DO 1-32			
W32D	1 WAGO: 32 x DI/DO			W32DIDO DI/DO 1-32			
P16D_16D	2 Phoenix: 32 x DI/DO			P16DIDO DI/DO 1-16	P16DIDO DI/DO 17-32		

Table 100: Assignment of selectable Combinations CAN 2 (Node 1-6) used for DI/DO: Digital Inputs and Digital Outputs, only

Combination selected by ...		Terminal assigned to ...					
Select external terminals **ID 15320**	**# of** **terminals: I/O**	**1st Node-ID** **ID 9930**	**2nd Node-ID** **ID 9931**	**3rd Node-ID** **ID 9932**	**4th Node-ID** **ID 9933**	**5th Node-ID** **ID 9934**	**6th Node-ID** **ID 9935**
AI/AO: Analog Inputs and Analog Outputs, only							
P16AI4AO	1 Phoenix: 16 x AI / 4 x AO					P16AI4AO AI 1-16 AO 1-4	
W16AI4AO	1 WAGO: 16 x AI / 4 x AO					W16AI4AO AI 1-16 AO 1-4	

Table 101: Assignment of selectable Combinations CAN 2 (Node 1-6) used for AI/AO: Analog Inputs and Analog Outputs, only

Combination selected by ...		Terminal assigned to ...					
Select external terminals **ID 15320**	**# of** **terminals: I/O**	**1st Node-ID** **ID 9930**	**2nd Node-ID** **ID 9931**	**3rd Node-ID** **ID 9932**	**4th Node-ID** **ID 9933**	**5th Node-ID** **ID 9934**	**6th Node-ID** **ID 9935**
DI/DO/AI/AO: Combinations of the expansion modules IKD and/or Phoenix							
1IKD_ P16AI4AO	1 IKD: 8 x DI/DO 1 Phoenix: 16 x AI / 4 x AO	IKD1 DI/DO 1-8				P16AI4AO AI 1-16 AO 1-4	

Combination selected by ...		Terminal assigned to ...					
Select external terminals ID 15320	# of terminals: I/O	1st Node-ID ID 9930	2nd Node-ID ID 9931	3rd Node-ID ID 9932	4th Node-ID ID 9933	5th Node-ID ID 9934	6th Node-ID ID 9935
2IKD_ P16AI4AO	2 IKD: 16 x DI/DO 1 Phoenix: 16 x AI / 4 x AO	IKD1 DI/DO 1-8	IKD2 DI/DO 9-16			P16AI4AO AI 1-16 AO 1-4	
3IKD_ P16AI4AO	3 IKD: 24 x DI/DO 1 Phoenix: 16 x AI / 4 x AO	IKD1 DI/DO 1-8	IKD2 DI/DO 9-16	IKD3 DI/DO 17-24		P16AI4AO AI 1-16 AO 1-4	
4IKD_ P16AI4AO	4 IKD: 32 x DI/DO 1 Phoenix: 16 x AI / 4 x AO	IKD1 DI/DO 1-8	IKD2 DI/DO 9-16	IKD3 DI/DO 17-24	IKD4 DI/DO 25-32	P16AI4AO AI 1-16 AO 1-4	
P16D_16AI4AO	1 Phoenix:: 16 x DI/DO 1 Phoenix: 16 x AI / 4 x AO			P16DIDO DI/DO 1-16		P16AI4AO AI 1-16 AO 1-4	
P16D16AI4AO	1 Phoenix: 16 x DI/DO 16 x AI / 4 x AO					P16DIDO DI/DO 1-16 P16AI4AO AI 1-16 AO 1-4	
W16D16AI4AO	1 WAGO: 16 x DI/DO 16 x AI / 4 x AO					W16DIDO DI/DO 1-16 W16AI4AO AI 1-16 AO 1-4	
P32D16AI4AO	1 Phoenix,: 32 x DI/DO 16 x AI / 4 x AO					P32DIDO DI/DO 1-32 P16AI4AO AI 1-16 AO 1-4	
W32D16AI4AO	1 WAGO,: 32 x DI/DO 16 x AI / 4 x AO					W32DIDO DI/DO 1-32 W16AI4AO AI 1-16 AO 1-4	

Combination selected by ...		Terminal assigned to ...					
Select external terminals **ID 15320**	**# of** **terminals: I/O**	**1st Node-ID** **ID 9930**	**2nd Node-ID** **ID 9931**	**3rd Node-ID** **ID 9932**	**4th Node-ID** **ID 9933**	**5th Node-ID** **ID 9934**	**6th Node-ID** **ID 9935**
2P16D_16AI4AO	2 Phoenix: 32 x DI/DO 1 Phoenix: 16 x AI / 4 x AO			P16DIDO DI/DO 1-16	P16DIDO DI/DO 17-32	P16AI4AO AI 1-16 AO 1-4	
P32D_16AI4AO	1 Phoenix: 32 x DI/DO 1 Phoenix: 16 x AI / 4 x AO			P32DIDO DI/DO 1-32		P16AI4AO AI 1-16 AO 1-4	
DI/DO/AI/AO: Combinations of the expansion modules IKD and/or WAGO							
W16AI4AO	1 Wago: 16 x AI / 4 x AO					W16AI4AO AI 1-16 AO 1-4	
1IKD_W16AI4AO	1 IKD: 8 x DI/DO 1 Wago: 16 x AI / 4 x AO	IKD1 DI/DO 1-8				W16AI4AO AI 1-16 AO 1-4	
2IKD_W16AI4AO	2 IKD: 16 x DI/DO 1 Wago: 16 x AI / 4 x AO	IKD1 DI/DO 1-8	IKD2 DI/DO 9-16			W16AI4AO AI 1-16 AO 1-4	
3IKD_W16AI4AO	3 IKD: 24 x DI/DO 1 Wago: 16 x AI / 4 x AO	IKD1 DI/DO 1-8	IKD2 DI/DO 9-16	IKD3 DI/DO 17-24		W16AI4AO AI 1-16 AO 1-4	
4IKD_W16AI4AO	4 IKD: 32 x DI/DO 1 Wago: 16 x AI / 4 x AO	IKD1 DI/DO 1-8	IKD2 DI/DO 9-16	IKD3 DI/DO 17-24	IKD4 DI/DO 25-32	W16AI4AO AI 1-16 AO 1-4	

Table 102: Assignment of selectable Combinations CAN 2 (Node 1-6) used for DI/DO/AI/AO: Combinations of the expansion modules

If you need only four analog inputs, select "P16AI4AO" and configure only four inputs to ON at the configuration for the external analog inputs.

CANopen Settings and Procedure

Proceed as follows to configure an external device:

- Connect external device(s)
- **Check that WAGO devices are configured to default.**
  This is the case if the WAGO CAN-Coupler is new or if there was any change in number or kind of WAGO modules.
- Configure and check parameters at the easYgen (Select external terminals, Node-ID, DI/DOs, AI/AOs)
  Power up the device that the setting (15320) becomes effective
- If WAGO terminals are connected and the configuration of the external AIs and/or AOs is done, the easYgen must send a configuration string to the WAGO coupler one time. This can be done by setting parameter *"Configure external devices"* 15134 ➡ p. 458 to "YES". This must be repeated if there is any change in number or kind of WAGO modules.
- If you have changed parameter *"Select external terminals "* 15320 ➡ p. 457: **re-power the device**
- Set parameter *"Configure external devices"* 15134 ➡ p. 458 to "Yes"
- Verify the successful configuration of the external device(s)

Update WAGO After Any Change!
The update procedure described above must be repeated if there is any change in number or kind of Wago modules.

ID	Parameter	CL	Setting range [Default]	Description
9940	**This device**	2	Node-ID 1-126 **[Node-ID 7]**	The Node-ID for the control unit (this device) is configured here.
9930	**1st Node-ID**	2	Node-ID 1-126 **[Node-ID 1]**	This Node-ID's are used for the communication with CANopen devices. Parameter 15320 ➡ p. 457 "Select external terminals" offers often used pre-settings and the possibility to point to a file containing customer specific settings.
9931	**2nd Node-ID**	2	Node-ID 1-126 **[Node-ID 2]**	
9932	**3rd Node-ID**	2	Node-ID 1-126 **[Node-ID 3]**	
9933	**4th Node-ID**	2	Node-ID 1-126 **[Node-ID 4]**	
9934	**5th Node-ID**	2	Node-ID 1-126 **[Node-ID 5]**	
9935	**6th Node-ID**	2	Node-ID 1-126 **[Node-ID 6]**	
15320	**Select external terminals**	2		**Notes** A change of this parameter becomes **only effective if the device is powered up!** and: the external devices itself must be configured with **the correct node ID**.
			[Off]	No external CANopen device is supported on CAN2
			Ext. term file	File defined with parameter 15318 ➡ p. 458 is active.
			1IKD	Selection of the combination of terminal(s) at the six pre-set Node-IDs.

ID	Parameter	CL	Setting range [Default]	Description
			2IKD	For terminal description see table ➷ *Table 102 "Assignment of selectable Combinations CAN 2 (Node 1-6) used for DI/DO/AI/AO: Combinations of the expansion modules" on page 454* above.
			3IKD	
			4IKD	
			P16D	
			P32D	
			P16D_16D	
			P16AI4AO	
			1IKD_ P16AI4AO	
			2IKD_ P16AI4AO	
			3IKD_ P16AI4AO	
			4IKD_ P16AI4AO	
			P16D_16AI4AO	
			P16D16AI4AO	
			P32D16AI4AO	
			2P16D_16AI4A O	
			P32D_16AI4AO	
			W16AI4AO	
			1IKD_W16AI4A O	
			2IKD_W16AI4A O	
			3IKD_W16AI4A O	
			4IKD_W16AI4A O	
			W16D	
			W32D	
			W16D16AI4AO	
			W32D16AI4AO	
15318	**Sequencer file-name**	2	**[Filename.seq]**	Filename of a special additional file to define external devices (see NOTE ➷ *Further information on page 452*). **Notes** This parameter takes only effect if parameter 15320 ➷ p. 457 is configured to "Ext.term.file". Please ask your Woodward partner for support / an offer.
15134	**Configure external devices**	2	Yes **[No]**	This parameter starts the configuration of external Phoenix expansion boards. **Notes** This parameter can only be used to configure Phoenix or Wago expansion boards as describe above. Refer to the IKD 1 Manual 37135 for configuring the IKD 1 expansion boards.

Changing the Node ID

Changing the Node ID of a Wago terminal which is still configured:

- Set the new NODE-ID via DIP switches
- Load default values (via a temporary change in number or kind of Wago modules-run configuration again.

Configurable Wago devices

If configurable WAGO devices are used, the mode of the terminal must be configured via the PC software WAGO I/O Check. These configuration cannot be done via the easYgen parameters. Be aware that the easYgen parameters for the corresponding channels must be consistent with the Wago configuration done with the WAGO I/O Check.

RTD device (750-451)

To use the 8 channel RTD device (750-451) the following process image must be configured via the Wago I/O-Check.

The following types are not supported: Ni1000 (high resolution), Ni1000 (TK5000), Pt1000 (EN 60751 high resolution), and 1200 Ohm.

Typ	Expected format
Pt100 (EN 60751)	default
Ni100 (EN 60751)	default
Pt500 (EN 60751)	default
Pt200 (EN 60751)	default
Ni1000 (TK6180, DN 43760)	default
Ni120 (Minco)	default
5000 Ohm	S5-FB250

Thermocouple device (750-458) for voltage measurement

There is no intuitive setting in the easYgen-XT if a channel of the Thermocouple (TC) device (750-458) is configured for voltage measurement. But nevertheless it is possible.

Therefore a special scaling of the easYgen-XT parameters “Sender value at display min.” and “Sender value at display max” is required like described in the table below:

Voltage measuring range	“Sender value at display min.”	“Sender value at display max.”
+/- 30 mV	-614.4	614.4
+/- 60 mV	-307.2	307.2
+/- 120 mV	-153.6	153.6

4.7.4.2.2 J1939 Interface

General notes

For additional information refer to ➪ Chapter 7.6 “ J1939 Protocol” on page 645.

Parameter 15102 “Device type ” allows to select an ECU either by name or - for even more flexibility - via an ECU file; then the name of the preferred ECU file must be entered into parameter 15167 “ECU file name”. Please ask your local Woodward partner for further information.

ID	Parameter	CL	Setting range [Default]	Description
15166	**J1939**	2	Off	The J1939 interface is disabled. No messages will be received or transmitted.
			[On]	The J1939 interface is enabled. The J1939 interface of this device may be operated with different engine control units or analog input devices. J1939 values (e.g. from an ECU) can be received and indicated
15102	**Device type**	2		The J1939 interface of this device may be operated with different engine control units or analog input devices. This parameter determines the type of the used ECU or that a special ECU file designed for an ECU which is not listed here shall be used. **Notes** A change of this parameter takes only effect after repowering the devices!
			ECU file	This is to support ECUs which are not represented by the selection. Enter file name with parameter 15167 *“ECU file name”* below.
			[Standard]	Standard J1939 coupling is enabled: J1939 data is displayed according to the SAE J1939 standard. This setting must be configured for all J1939 ECUs, which cannot be selected here (e.g. Deutz (EMR3 & EMR4), John Deere, Daimler, Perkins, Iveco, Caterpillar, Liebherr, etc.). Please refer to ➪ *Chapter 7.6 “ J1939 Protocol” on page 645* for details and/or ask your local Woodward partner for an offer.
			S6 Scania	The Scania EMS/S6, S8 ECU is enabled: J1939 data according to the SAE J1939 standard and some S6-specific data are considered.
			EMR2 Deutz	The Deutz EMR2 ECU is enabled: J1939 data according to the SAE J1939 standard and some EMR2-specific data are considered. This setting is also recommended for Volvo EDC4.
			EMS2 Volvo	The Volvo EMS2 ECU is enabled: J1939 data according to the SAE J1939 standard and some EMS2-specific data are considered. This setting is also recommended for Volvo EDC3 and EMS1.
			ADEC ECU7 MTU	The MTU ADEC ECU7 with SAM is enabled: J1939 data according to the SAE J1939 standard and some ADEC-specific data are considered.
			EGS Woodward	The Woodward EGS ECU or E3-series or E6-series are enabled: J1939 data according to the SAE J1939 standard and some EGS/E3/E6-specific data are considered.
			MFR/EDC7 MAN	The MAN MFR/EDC7 ECU is enabled: J1939 data according to the SAE J1939 standard and some EDC-specific data are considered.
			EEM SISU	The SISU EEM2/3 ECU is enabled: J1939 data according to the SAE J1939 standard and some EEM2/3-specific data are considered.
			Cummins	The Cummins ECU is enabled: J1939 data according to the SAE J1939 standard and some Cummins-specific data are considered. This setting is also recommended for Cummins CM570 and CM850.

ID	Parameter	CL	Setting range [Default]	Description
				Notes Some Cummins setups need a special value for "Governor Gain" otherwise they will shut down. In this cases please set the "Governor Gain" of the ECU to *"Internal"* instead of *"J1939"*.
			ADEC ECU8/ ECU9 MTU	The MTU ADEC ECU8 with SmartConnect or the MTU ADEC ECU9 is enabled: J1939 data according to the SAE J1939 standard and some ADEC-specific data are considered.
15167	**ECU file name**	2	[Filename.ecu]	If *"Device type"* ID15102 is *"ECU file"*, the easYgen can communicate with further ECUs. The correct file name with extension must be typed in and this xxx.ecu file must be available "inside" the easYgen (flashed). **Notes** Please contact your local Woodward partner to enable communication with your ECU (xxx.ecu file and ECU specific settings).
15106	**J1939 own address**	2	0 to 255 **[234]**	The easYgen sends J1939 request and control messages with this source address. It must be changed for different ECU types according to the following table. The ECU listens only to control messages, if they are sent to the correct address. ■ S6 Scania: 39 ■ EMR2 Deutz: 3 ■ EMS2 Volvo: 17 ■ ADEC ECU7 MTU: 1 ■ EGS Woodward: 234 ■ MFR/EDC7 MAN: 253 ■ EEM SISU: N/A ■ Cummins: 220 ■ ADEC ECU8/ECU9 MTU: 234 ■ Standard: Please refer to ⇨ *Chapter 7.6 "J1939 Protocol" on page 645* and to the manual of your J1939 ECU manufacturer. Details may be found in the manual of the genset control and in ⇨ *Chapter 7.6 "J1939 Protocol" on page 645*. **Notes** Changing this parameter becomes only effective after restarting the unit.
15107	**Engine control address**	2	0 to 255 **[0]**	Configures the address of the J1939 device, which is controlled. The easYgen sends J1939 request and control messages with this destination address. ■ S6 Scania: 0 ■ EMR2 Deutz: 0 ■ EMS2 Volvo: 0 ■ ADEC ECU7 MTU: 128 ■ EGS Woodward: 0 ■ MFR/EDC7 MAN: 39 ■ EEM SISU: 0/(1) ■ Cummins: 0 ■ ADEC ECU8/ECU9 MTU: 0 ■ Standard: Please refer to ⇨ *Chapter 7.6 "J1939 Protocol" on page 645* and to the manual of your J1939 ECU manufacturer. Details may be found in the manual of the genset control and in ⇨ *Chapter 7.6 "J1939 Protocol" on page 645*.
15108	**Reset previous act. DTCs - DM3**	2	Yes **[No]**	If this parameter is set to "Yes", a DM3 message "Acknowledge passive faults" is sent. After that this parameter is reset automatically to "No". As a result the alarms DTCs (Diagnostic Trouble Codes) of (DM2) which no longer apply are cleared.

ID	Parameter	CL	Setting range [Default]	Description
15133	**Reset act. DTCs - DM11**	2	Yes **[No]**	If this parameter is set to "Yes", a DM11 message "Acknowledge active faults" is sent. After that this parameter is reset automatically to "No". As a result the alarms DTCs (Diagnostic Trouble Codes) of (DM1) which no longer apply are cleared.
15103	**SPN version**	2	Version 1 / 2 / 3 **[Version 1]**	The J1939 protocol provides 4 different versions for the conversion method of the Suspect Parameter Number (SPN). This is important for a correct interpretation of the alarm messages (DM1 & DM2). This parameter defines the version of the conversion method: Version 1, Version 2 or Version 3. Version 4 is detected automatically. For details please refer to the manual of your J1939 ECU manufacturer.
15127	**ECU remote controlled**	2	On	The unit sends J1939 control messages to the ECU. Depending on the selected device type (parameter 15102 ⤷ p. 460), contains a specific selection of commands.
			[Off]	The ECU remote control via the J1939 protocol will be disabled.
				Notes The unit sends J1939 control messages to the ECU. Depending on the selected device type (parameter 15102 ⤷ p. 460), it contains a specific selection of commands. Available messages are speed deviation and droop for ECUs as well as engine start/stop, enable idle mode, rated speed switch and preglow for some ECUs. Refer to ⤷ *Chapter 7.6 " J1939 Protocol" on page 645* for more detailed information.
5537	**Speed deviation ECU**	2	0 to 1,400 rpm **[120 rpm]**	This parameter adjusts the range of the speed deviation around the rated speed, which is sent to the ECU. It relates to the engine rated speed (parameter 1601 ⤷ p. 438). There are two methods of sending the speed setpoint to the ECU: With a speed offset and a speed setpoint. The frequency and power control must be configured to "PID".
				Speed offset (S6 Scania, EMS2 Volvo, EGS Woodward, Cummins) The easYgen sends a speed offset with a range of 0 to 100% (every 20 ms). 50% = rated speed. There is also an internal speed offset configured in the ECU, this parameter determines what corresponds with 0% or 100%. If there is a positive and a negative speed offset, they should be symmetrical in the ECU. We recommend to have the same speed offset configured in the ECU and in this parameter here. A different setting will result in an additional "controller gain". How to test this parameter during commissioning: **Islanded operation** Disable the frequency controller and change parameter 5508 ⤷ p. 262 for the initial state between 0 and 100%, the engine should change the speed as follows: ■ 0 = rated speed – negative speed offset from ECU ■ 50 = rated speed ■ 100 = rated speed + positive speed offset from ECU **Mains parallel operation** Check with the setpoint in the display if the engine is able to deliver the full power.

ID	Parameter	CL	Setting range [Default]	Description
				Speed setpoint (EMR2 Deutz, ADEC MTU, EGS Woodward, EEM SISU, Standard) The easYgen sends a speed setpoint in rpm (every 10 ms) that varies around the rated speed in the range of +/- the speed deviation. How to test this parameter during commissioning: **Islanded operation** Disable the frequency controller and change parameter 5508 ➡ p. 262 for the initial state between 0 and 100%, the engine should change the speed as follows: ■ 0 = rated speed – speed deviation ECU e.g.: 1,500 – 120 = 1,380 rpm ■ 50 = rated speed e.g.: = 1,500 rpm ■ 100 = rated speed + speed deviation ECU e.g.: 1,500 + 120 = 1,620 rpm **Mains parallel operation** Check with the setpoint in the display if the engine is able to deliver the full power. Keep this value as small as possible, i.e. do not enter a speed deviation of 500, if the engine varies only between 1,400 and 1,600 rpm.
				Notes The Woodward EGS ECU supports both types of speed deviation control and may be configured either to "Speed offset" or "Speed setpoint". In mains parallel operation, the EGS can be configured to receive a real power setpoint from the easYgen to control the power. In this case, real power control must be disabled in the easYgen. This parameter is only visible if ECU remote controlled (parameter 15127 ➡ p. 462) is configured to "On".
4843	**ECU Application**	2	**[Continuous]**	Prepared for MTU - 3B mode
			Emergency	Prepared for MTU - 3D mode
				Notes For details please refer to the manual of your J1939 ECU manufacturer. This parameter is only visible if "Device type" (parameter 15102 ➡ p. 460) is configured to "ADEC ECU8 MTU" and "ECU remote controlled" (parameter 15127 ➡ p. 462) is configured to "On".
12939	**ECU Power Mode**	2	**[Low power mode]**	Prepared for MTU - Low mode
			High power mode	Prepared for MTU - High mode
				Notes For details please refer to the manual of your J1939 ECU manufacturer. This parameter is only visible if "Device type" (parameter 15102 ➡ p. 460) is configured to "ADEC ECU8 MTU" and "ECU remote controlled" (parameter 15127 ➡ p. 462) is configured to "On".
15164	**ECU seq. B_IN_1**	2	Determined by LogicsManager 86.31 **[(0 & 1) & 1]** = 11647	This LogicsManager is prepared to pass binary information to the ECU via J1939. If this LogicsManager is used by an ECU its function will be described in the manual of the corresponding J1939 ECU. For more information please see J1939 ECU description.
				Notes For information on the LogicsManager and its default settings see ➡ *Chapter 9.3.1 "LogicsManager Overview" on page 882.*

ID	Parameter	CL	Setting range [Default]	Description
15165	**ECU seq. B_IN_2**	2	Determined by LogicsManager 86.32 **[(0 & 1) & 1]** = 11648	This LogicsManager is prepared to pass binary information to the ECU via J1939. If this LogicsManager is used by an ECU its function will be described in the manual of the corresponding J1939 ECU. For more information please see J1939 ECU description. **Notes** For information on the LogicsManager and its default settings see ↪ *Chapter 9.3.1 "LogicsManager Overview" on page 882*.
15162	**AM ECU seq. A_IN_1**	2	Determined by AnalogManager 81.22 **[A1 = 10.01 ZERO]**	This AnalogManager is prepared to pass analog information to the ECU via J1939. If this AnalogManager is used by an ECU its function will be described in the manual of the corresponding J1939 ECU. For more information please see J1939 ECU description. **Notes** Refer to ↪ *Chapter 4.9 "Configure AnalogManager" on page 484* for explanation how to use the AnalogManager. Refer to ↪ *Chapter 9.4.1 "Data Sources AM" on page 933* for a list of all data sources.
15163	**AM ECU seq. A_IN_2**	2	Determined by AnalogManager 81.23 **[A1 = 10.01 ZERO]**	This AnalogManager is prepared to pass analog information to the ECU via J1939. If this AnalogManager is used by an ECU its function will be described in the manual of the corresponding J1939 ECU. For more information please see J1939 ECU description. **Notes** Refer to ↪ *Chapter 4.9 "Configure AnalogManager" on page 484* for explanation how to use the AnalogManager. Refer to ↪ *Chapter 9.4.1 "Data Sources AM" on page 933* for a list of all data sources.

Table 103: J1939 Settings

4.7.4.3 CAN Interface 3

General notes

The CAN bus is a field bus and subject to various disturbances. Therefore, it cannot be guaranteed that every request will be answered. We recommend to repeat a request, which is not answered within reasonable time.

COB-ID SYNC/TIME messages

Parameters 9104 ↪ p. 466 and 9105 ↪ p. 466 use synchronization and time messages that adhere to the following structure.

Bit number	Value	Meaning
31 (MSB)	X	N/A
30	0	Unit does not generate SYNC/TIME message

Bit number	Value	Meaning
	1	Unit generates SYNC/ TIME message
29	X	N/A
28-11	0	Always
10-0 (LSB)	X	Bits 10-0 of SYNC/TIME COB-ID

TIME synchronization message

CANopen master	COB-ID TIME	Time applied	Time trans-mitted
Off	Bit 30 = 0; Bit 31 = 0	No	No
	Bit 30 = 1; Bit 31 = 0	Yes	No
	Bit 30 = 0; Bit 31 = 1	Yes	No
	Bit 30 = 1; Bit 31 = 1	Yes	Yes
Default	Bit 30 = 0; Bit 31 = 0	No	No
	Bit 30 = 1; Bit 31 = 0	No	Yes
	Bit 30 = 0; Bit 31 = 1	Yes	No[1]
	Bit 30 = 1; Bit 31 = 1	Yes	Yes[1]
On	Bit 30 = 0; Bit 31 = 0	No	No
	Bit 30 = 1; Bit 31 = 0	No	Yes
	Bit 30 = 0; Bit 31 = 1	Yes	No
	Bit 30 = 1; Bit 31 = 1	Yes	Yes

[1] *If CANopen master (lowest Node-ID).*

ID	Parameter	CL	Setting range [Default]	Description
3143	**Baudrate**	2	20 / 50 / 100 / 125 / 250 / 500 / 800 / 1000 kBaud **[250 kBd]**	This parameter defines the used baud rate. Please note, that all participants on the CAN bus must use the same baud rate.
1895	**Align device no. with Node-ID**	2	No **[Yes]**	If this parameter is configured to "Yes" the parameter *"Node-ID CAN bus 3"* 8952 ⇘ p. 465 will be overwritten with the value of the *"Device number "*1702 ⇘ p. 159 and is not visible. If configured to "No", parameter *"Device number "* 1702 is visible and will not be overwritten. **Notes** This is to avoid CAN ID conflict in multi unit systems if using the same ID more than one time. This can cause CAN "Bus-Off" failure.
8952	**Node-ID CAN bus 3**	2	1 to 127 (dec) **[2]**	A number that is unique to the control must be set in this parameter so that this control unit can be correctly identified on the CAN bus. This address number may only be used once on the CAN bus. All additional addresses are calculated based on this unique device number.

ID	Parameter	CL	Setting range [Default]	Description
				Notes We recommend to configure the Node-IDs for units, which participate in load sharing, as low as possible to facilitate establishing of communication. For multiple genset applications please make sure to change parameter 1702 ↳ p. 159 as well
8995	**CANopen Master**	2		One bus participant must take over the network management and put the other participants into "operational" mode. The easYgen is able to perform this task.
			[Default Master]	The unit starts up in "operational" mode and sends a "Start_Remote_node" message after a short delay (the delay is the Node-ID (parameter 8952 ↳ p. 465) in seconds, i.e. if the Node-ID is configured to 2, the message will be sent after 2 seconds). If more than one easYgen is configured to Default Master, the unit with the lower Node-ID will take over control. Therefore, the CAN bus devices, which are intended to act as Default Master should be assigned a low Node-ID. No other device on the CAN bus (except the easYgens) may operate as Master).
			On	The unit is the CANopen Master and automatically changes into operational mode and transmits data.
			Off	The unit is a CANopen Slave. An external Master must change into operational mode.
				Notes If this parameter is configured to "Off", the Master controller (for example a PLC) must send a "Start_Remote_node" message to initiate the load share message transmission of the easYgen. If no "Start_Remote_node" message would be sent, the complete system would not be operational.
8953	**Producer heartbeat time**	2	0 to 65500 ms **[2000 ms]**	Independent from the CANopen Master configuration, the unit transmits a heartbeat message with this configured heartbeat cycle time. If the producer heartbeat time is equal 0, the heartbeat will only be sent as response to a remote frame request. The time configured here will be rounded up to the next 20 ms step.
8967	**COB-ID SYNC Message**	2	0 to FFFFFFFF hex **[80 hex]**	This parameter defines whether the unit generates the SYNC message or not. Complies with CANopen specification: object 1005, subindex 0; defines the COB-ID of the synchronization object (SYNC).
				Notes The structure of this object is shown in ↳ *"COB-ID SYNC/TIME messages" on page 464*
8968	**Producer SYNC Message time**	2	0 to 65000 ms **[20 ms]**	This is the cycle time of the SYNC message. If the unit is configured for this function it will send the SYNC message with this interval. The time configured here will be rounded up to the next 10 ms step.
9104	**COB-ID TIME Message**	2	1 to FFFFFFFF hex **[100 hex]**	This parameter defines whether the unit generates the TIME message or not. Complies with CANopen specification: object 1012, subindex 0; defines the COB-ID of the time object (TIME).
				Notes The structure of this object is shown in ↳ *"COB-ID SYNC/TIME messages" on page 464*
9105	**Cycle of TIME sync. message**	2	1.0 to 6500.0 s **[10.0 s]**	This is the cycle time of the TIME message. If the unit is configured for this function (parameter 9104 ↳ p. 466) it will send the TIME message with this interval.
				Notes The structure of this object is shown in ↳ *"TIME synchronization message" on page 465*
9127	**Password protection**	5	Off	Password protection for CAN 3 is **not active**.

ID	Parameter	CL	Setting range [Default]	Description
				Notes Take care for a protected access!
			[On]	Password protection for CAN 3 is active.

4.7.4.3.1 Receive PDO {x} (Process Data Object)

General notes

RPDO mapping is carried out as shown in (Fig. 198).

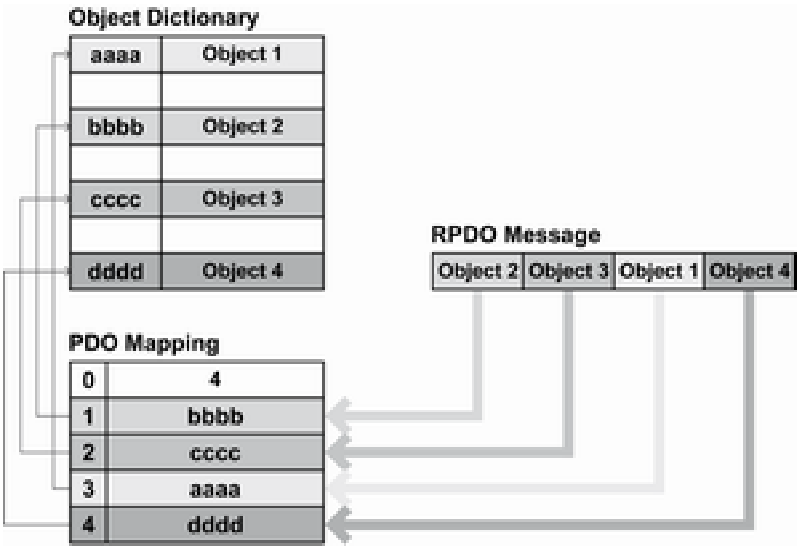


Fig. 198: RPDO mapping principle

COB-ID parameters

Parameters *12741 ⇘ p. 468/12751 ⇘ p. 468/12761 ⇘ p. 468/12771 ⇘ p. 468/12781 ⇘ p. 468 use communication parameters that adhere to the following structure.*

RPDO Objects can be remote signals (parameter 503; please refer to ⇘ "Remote control word 1" on page 875 for details), DI states and AI measured values.

UNSIGNED 32		MSB				LSB
Bits	Bits	31	30	29	28-11	10-0
11 bit ID	11 bit ID	0/1	X	X	000000000000000000	11 bit identifier

Bit number	Value	Meaning
31 (MSB)	0	PDO exists / is valid
	1	PDO does not exist / is not valid

Bit number	Value	Meaning
30	X	N/A
29	X	N/A
28-11	0	Always
10-0 (LSB)	X	Bits 10-0 of COB-ID

PDO valid / not valid allows to select, which PDOs are used in the operational state.

ID	Parameter	CL	Setting range [Default]	Description
12741 12751 12761 12771 12781	**COB-ID**	2	1 to FFFFFFFF hex **[80000000 hex]**	This parameter contains the communication parameters for the PDOs, the device is able to receive. Complies with CANopen specification: object 1400 hex (for RPDO 1, 1401 hex for RPDO 2, 1402 hex for RPDO 3, 1403 hex for RPDO 4, and 1404 hex for RPDO 5), subindex 1.
				Notes The structure of this object is shown in *"COB-ID parameters" on page 467.* Do not configure an RPDO or TPDO with a COB-ID higher than 580 hex or lower than 180 hex. These IDs are reserved for internal purposes.
12742 12752 12762 12772 12782	**Event-timer**	2	0 to 65500 ms **[2000 ms]**	This parameter configures the time, from which this PDO is marked as "not existing". The time configured here will be rounded up to the next 5 ms step. Received messages are processed by the control unit every 20 ms. Messages, which are sent faster, will be discarded. We recommend to configure ten times the cycle time of the received data here.
				Notes Complies with CANopen specification: object 1400 (for RPDO 1, 1401 hex for RPDO 2, 1402 hex for RPDO 3, 1403 hex for RPDO 4, and 1404 hex for RPDO 5), subindex 5
12743 12753 12763 12773 12783	**Selected Data Protocol**	2	0 to 65535 **[0]**	A data protocol may be selected by entering the data protocol ID here. If 0 is configured here, the message assembled by the mapping parameters is used. If an unknown data protocol ID is configured here, a failure is indicated by the CAN status bits. Possible data protocol IDs are:
			65000	IKD 1 – external DIs/DOs 1 through 8
			65001	IKD 1 – external DIs/DOs 9 through 16
			65002	IKD 1 – external DIs/DOs 17 through 24
			65003	IKD 1 – external DIs/DOs 25 through 32
12744 12754 12764 12774 12784	**Number of Mapped Objects**	2	0 to 4 **[0]**	This parameter defines the number of valid entries within the mapping record. This number is also the number of the application variables, which shall be received with the corresponding PDO.
				Notes Complies with CANopen specification: object 1600 hex (for RPDO 1, 1601 hex for RPDO 2, 1602 hex for RPDO 3,1603 hex for RPDO 4, and 1604 hex for RPDO 5), subindex 0
12745 12755 12765 12775 12785	**1. Mapped Object**	2	0 to 65535 **[0]**	This parameter contains the information about the mapped application variables. These entries describe the PDO contents by their index. The sub-index is always 1. The length is determined automatically.
				Notes Complies with CANopen specification: object 1600 hex (for RPDO 1, 1601 hex for RPDO 2, 1602 hex for RPDO 3,1603 hex for RPDO 4, and 1604 hex for RPDO 5), subindex 1.

ID	Parameter	CL	Setting range [Default]	Description
12746 12756 12766 12776 12786	**2. Mapped Object**	2	0 to 65535 [0]	This parameter contains the information about the mapped application variables. These entries describe the PDO contents by their index. The sub-index is always 1. The length is determined automatically.
				Notes Complies with CANopen specification: object 1600 hex (for RPDO 1, 1601 hex for RPDO 2, 1602 hex for RPDO 3,1603 hex for RPDO 4, and 1604 hex for RPDO 5), subindex 2.
12747 12757 12767 12777 12787	**3. Mapped Object**	2	0 to 65535 [0]	This parameter contains the information about the mapped application variables. These entries describe the PDO contents by their index. The sub-index is always 1. The length is determined automatically.
				Notes Complies with CANopen specification: object 1600 hex (for RPDO 1, 1601 hex for RPDO 2, 1602 hex for RPDO 3,1603 hex for RPDO 4, and 1604 hex for RPDO 5), subindex 3.
12748 12758 12768 12778 12788	**4. Mapped Object**	2	0 to 65535 [0]	This parameter contains the information about the mapped application variables. These entries describe the PDO contents by their index. The sub-index is always 1. The length is determined automatically.
				Notes Complies with CANopen specification: object 1600 hex (for RPDO 1, 1601 hex for RPDO 2, 1602 hex for RPDO 3,1603 hex for RPDO 4, and 1604 hex for RPDO 5), subindex 4.

4.7.4.3.2 Transmit PDO {x} (Process Data Object)

General notes

TPDO mapping is carried out as shown in (Fig. 199).

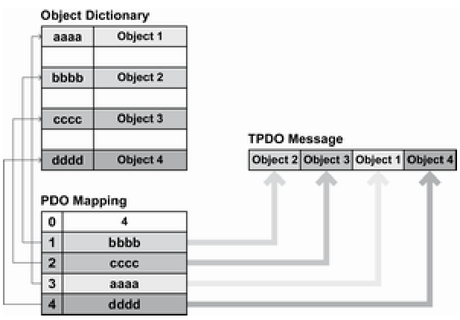


Fig. 199: TPDO mapping

CANopen allows to send 8 byte of data with each Transmit PDO. These may be defined separately if no pre-defined data protocol is used.

All data protocol parameters with a parameter ID may be sent as an object with a CANopen Transmit PDO.

The data length will be taken from the data byte column (see ⇨ "The following data protocols are implemented to be used" on page 685):

- *1,2 UNSIGNED16 or SIGNED16*
- *3,4 UNSIGNED16 or SIGNED16*
- *5,6 UNSIGNED16 or SIGNED16*
- *1,2,3,4 UNSIGNED32 or SIGNED32*
- *3,4,5,6 UNSIGNED32 or SIGNED32*
- *etc.*

The object ID is identical with the parameter ID when configuring via front panel or ToolKit.

COB-ID parameters

Parameters 12691 ⇨ p. 471/12701 ⇨ p. 471/12711 ⇨ p. 471/12721 ⇨ p. 471/12731 ⇨ p. 471 use communication parameters that adhere to the following structure.

UNSIGNED 32		MSB				LSB
Bits	Bits	31	30	29	28-11	10-0
11 bit ID	11 bit ID	0/1	X	X	0000000 0000000 0000	11 bit identifier

Bit number	Value	Meaning
31 (MSB)	0	PDO exists / is valid
	1	PDO does not exist / is not valid
30	X	N/A
29	X	N/A
28-11	0	Always
10-0 (LSB)	X	Bits 10-0 of COB-ID

PDO valid / not valid allows to select, which PDOs are used in the operational state.

Transmission types

Parameters *12693 ⇨ p. 471/12703 ⇨ p. 471/12713 ⇨ p. 471/12723 ⇨ p. 471/12733 ⇨ p. 471 are used to select one of the following transmission types.*

Transmission type	PDO transmission				
	Cyclic	Acyclic	Synchronous	Asynchronous	RTR only
0	Will not be sent				
1-240	X		X		
241-251	Will not be sent				
252	Will not be sent				
253	Will not be sent				
254				X	
255				X	

A value between 1 and 240 means that the PDO is transferred synchronously and cyclically. The transmission type indicating the number of SYNC, which are necessary to trigger PDO transmissions.

Receive PDOs are always triggered by the following SYNC upon reception of data independent of the transmission types 0 to 240. For TPDOs, transmission type 254 and 255 means, the application event is the event timer.

ID	Parameter	CL	Setting range [Default]	Description
12691 12701 12711 12721 12731	**COB-ID**	2	1 to FFFFFFFF hex **[80000000 hex]**	This parameter contains the communication parameters for the PDOs the unit is able to transmit. The unit transmits data (i.e. visualization data) on the CAN ID configured here. Complies with CANopen specification: object 1800 hex for (TPDO 1, 1801 hex for TPDO 2, 1802 hex for TPDO 3, 1803 hex for TPDO 4, and 1804 hex for TPDO 5), subindex 1.
				Notes The structure of this object is shown in *"COB-ID parameters" on page 469* Do not configure an RPDO or TPDO with a COB-ID higher than 580 hex or lower than 180 hex. These IDs are reserved for internal purposes. In case a LSG is part of CAN 1, do not configure COB-IDs 181 - 18E hex because legacy devices are using same IDs but cannot be switched.
12693 12703 12713 12723 12733	**Transmission type**	2	0 to 255 **[255]**	This parameter contains the communication parameters for the PDOs the unit is able to transmit. It defines whether the unit broadcasts all data automatically (value 254 or 255) or only upon request with the configured address of the COB-ID SYNC message (parameter 9100 p. 445).
				Notes Complies with CANopen specification: object 1800 hex (for TPDO 1, 1801 hex for TPDO 2, 1802 hex for TPDO 3, 1803 hex for TPDO 4, and 1804 hex for TPDO 5), subindex 2. The description of the transmission type is shown in *"Transmission types" on page 470*.
12694 12704 12714 12724 12734	**Event timer**	2	0 to 65535 ms **[20 ms]**	This parameter contains the communication parameters for the PDOs the unit is able to transmit. The broadcast cycle for the transmitted data is configured here. The time configured here will be rounded up to the next 5 ms step.
				Notes Complies with CANopen specification: object 1800 hex (for TPDO 1, 1801 hex for TPDO 2, 1802 hex for TPDO 3, 1803 hex for TPDO 4, and 1804 hex for TPDO 5), subindex 5
12692 12702 12712 12722 12732	**Selected Data Protocol**	2	0 to 65535 8962: **[5003]** 8963: **[5008]** 8964: **[0]** 8965: **[0]** 8966: **[0]**	A data protocol may be selected by entering the data protocol ID here. If 0 is configured here, the message assembled by the mapping parameters is used. If an unknown data protocol ID is configured here, a failure is indicated by the CAN status bits. Possible data protocol IDs are:
			65000	IKD 1 – external DIs/DOs 1 through 8
			65001	IKD 1 – external DIs/DOs 9 through 16
			65002	IKD 1 – external DIs/DOs 17 through 24
			65003	IKD 1 – external DIs/DOs 25 through 32
			5003	Data telegram (CAN and MODBUS)
			5005	Data telegram (CAN mains values)
			5010	Data telegram (MODBUS)
			5011	Data telegram (CAN alarm values)
			4103	Data telegram (CAN J1939)
			4104	Data telegram (CAN J1939 Scania S6)
			4105	Data telegram (CAN J1939 Deutz EMR2)
			4110	Data telegram (CAN J1939 MTU ADEC)
12695 12705 12715	**Number of Mapped Objects**	2	0 to 4 **[0]**	This parameter contains the mapping for the PDOs the unit is able to transmit. This number is also the number of the application variables, which shall be transmitted with the corresponding PDO.

ID	Parameter	CL	Setting range [Default]	Description
12725 12735				**Notes** Complies with CANopen specification: object 1A00 hex (for TPDO 1, 1A01 hex for TPDO 2, 1A02 hex for TPDO 3, 1A03 hex for TPDO 4, and 1A04 hex for TPDO 5), subindex 0
12696 12706 12716 12726 12736	**1. Mapped Object**	2	0 to 65535 **[0]**	This parameter contains the information about the mapped application variables. These entries describe the PDO contents by their index. The sub-index is always 1. The length is determined automatically.
				Notes Complies with CANopen specification: object 1A00 hex (for TPDO 1, 1A01 hex for TPDO 2, 1A02 hex for TPDO 3, 1A03 hex for TPDO 4, and 1A04 hex for TPDO 5), subindex 1
12697 12707 12717 12727 12737	**2. Mapped Object**	2	0 to 65535 **[0]**	This parameter contains the information about the mapped application variables. These entries describe the PDO contents by their index. The sub-index is always 1. The length is determined automatically.
				Notes Complies with CANopen specification: object 1A00 hex (for TPDO 1, 1A01 hex for TPDO 2, 1A02 hex for TPDO 3, 1A03 hex for TPDO 4, and 1A04 hex for TPDO 5), subindex 2
12698 12708 12718 12728 12738	**3. Mapped Object**	2	0 to 65535 **[0]**	This parameter contains the information about the mapped application variables. These entries describe the PDO contents by their index. The sub-index is always 1. The length is determined automatically.
				Notes Complies with CANopen specification: object 1A00 hex (for TPDO 1, 1A01 hex for TPDO 2, 1A02 hex for TPDO 3, 1A03 hex for TPDO 4, and 1A04 hex for TPDO 5), subindex 3
12699 12709 12719 12729 12739	**4. Mapped Object**	2	0 to 65535 **[0]**	This parameter contains the information about the mapped application variables. These entries describe the PDO contents by their index. The sub-index is always 1. The length is determined automatically.
				Notes Complies with CANopen specification: object 1A00 hex (for TPDO 1, 1A01 hex for TPDO 2, 1A02 hex for TPDO 3, 1A03 hex for TPDO 4, and 1A04 hex for TPDO 5), subindex 4

4.7.5 Ethernet Interfaces

General notes

The Ethernet network provides a fast communication capability to different devices, like remote panel, PLC or SCADA systems. The common protocol Modbus TCP is there for the preferred communication protocol. Additionally the Ethernet connection supports the Woodward protocol Servlink for ToolKit and other Woodward own monitoring tools (like remote panel and SCADA visualization tool). At least the easYgen provides a UDP protocol for system relevant and time discrete information exchange.

Do not connect the easYgen with the internet as long the security aspects are not considered. Consider an IP responsible person to discuss proper security procedures like placing routers and fire walls.

If the easYgen (or -system) shall be connected to an already existing Ethernet network, a network responsible person must arrange and allocate the IP Addresses. He takes care about IP-Address, the subnet mask, and when needed the gateway IP Address.

ID	Parameter	CL	Setting range [Default]	Description
7488 and 7489	**(Time needed to detect "connection missing")**	12	"7488" x "7489"	**Notes** Should not be changed - otherwise please ask your Woodward sales support partner for a temporary code level access. TKit Visible in ToolKit only. The "Transmission rate" (ID 7488) multiplied with the number of "Timeout cycles" (ID 7489) is the time it needs to detect a"connection missing".
7488	**Transmission rate**		**[80 ms]** 80 to 400 ms	The transmission rate defines the refresh rate (time) of the UDP messages, for example load share messages.
7489	**Timeout cycles**		**[5]** 2 to 10	The control monitors the expected amount of received UDP messages. This entry is the number of LDSS messages that can be lost before it is detected as "connection missing".
7485	**Modbus/TCP Slave ID**	2	**[1]** 1 to 255	Your local Modbus device address, which is used to identify the device via Modbus/TCP (Ethernet), must be entered here.
9129	**Password protection**	5	Off	Password protection for Ethernet is **not active**. **Notes** Take care for a protected access!
			[On]	Password protection for Ethernet is active.

4.7.5.1 Ethernet Network A

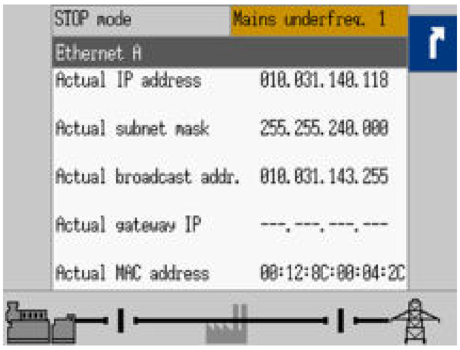


Fig. 200: Ethernet Network A screen

The actual IP address, subnet mask, gateway IP address (all hex values) can be viewed under Next Page (Status Menu) / Diagnostic / Interfaces / Ethernet / Ethernet A.

IP address

Each port within the Ethernet network must have its own network address. As long the Ethernet network is only used by the easYgen-XT system, the address range is free configurable. For better troubleshooting use the default Ethernet address range and configure the single IP addresses according to their device numbers.

> ***Device part: Restrictions***
>
> *The "device part" is the logical result of "IP Address" AND NOT "Network Mask". The bits (dual system $0_2/1_2$) of the device part must be different from being all the same - neither all zero 0_2 nor all 1_2 (broadcast).*
>
> *Please select your IP address accordingly.*

Gateway IP address

Fig. 201: Ethernet IP and gateway addresses

The gateway IP address defines a node within a local area network (LAN), which is directed to external networks. It is usually not needed in an easYgen Ethernet network. Refer to your network responsible contact person, if a gateway capability is required.

> ***HEX values***
>
> *The addresses and subnet masks are known as hex values but are displayed in HMI and ToolKit as decimal values.*

ID	Parameter	CL	Setting range [Default]	Description
5330 5331 5332 5333	**IP address**	2	[10, 31, 140, 0]	Field 1,2,3,4 for IP address Ethernet port A. This setting will be not valid automatically. The *"Set IP address"* parameter must be set to *[ON]* for enabling. **Notes** Device part bits are not allowed to be either **all** $00..._2$ or **all** $11..._2$ (broadcast).
7412	**Set IP address**	2	Off	Set IP-Address Ethernet port A.
5334 5335 5336 5337	**Subnet mask**	2	[255, 255, 240, 0]	Set byte 1,2,3,4 of the subnet mask Ethernet port A. This setting will be not valid automatically. The *"Set subnet mask"* parameter must be set to *[ON]* for enabling.
7413	**Set subnet mask**	2	Off	Set subnet mask Ethernet port A.

ID	Parameter	CL	Setting range [Default]	Description
5338 5339 5340 5341	**Gateway IP**	2	[0, 0, 0, 0]	Field 1,2,3,4 for gateway IP-Address for Ethernet port A. This setting will be not valid automatically. The *"Set IP address"* parameter must be set to *[ON]* for enabling. If 0.0.0.0 is set, the gateway's functionality is switched off.
5342	**Set Gateway IP address**	2	Off	Set Gateway IP Address for Ethernet port A

4.7.5.2 Ethernet Network B

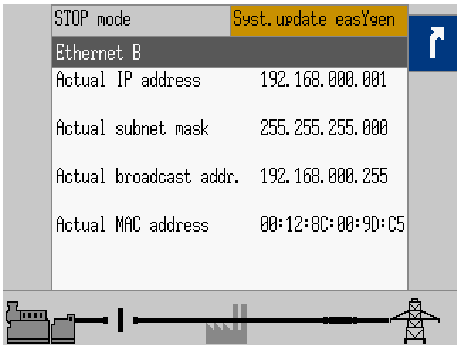


Fig. 202: Ethernet Network B screen

The actual IP address and subnet mask (all hex values) can be viewed under Next Page (Status Menu) / Diagnostic / Interfaces / Ethernet / Ethernet B.

IP address

Each port within the Ethernet network must have its own network address. As long the Ethernet network is only used by the easYgen-XT system, the address range is free configurable. For better troubleshooting use the default Ethernet address range and configure the single IP addresses according to their device numbers.

> ***Device part: Restrictions***
>
> *The "device part" is the logical result of "IP Address" AND NOT "Network Mask". The bits (dual system $0_2/1_2$) of the device part must be different from being all the same - neither all zero 0_2 nor all 1_2 (broadcast).*
>
> *Please select your IP address accordingly.*

HEX values

The addresses and subnet masks are known as hex values but are displayed in HMI and ToolKit as decimal values.

ID	Parameter	CL	Setting range [Default]	Description
5430 5431 5432 5433	**IP address**	2	[10, 31, 140, 0]	Field 1,2,3,4 for IP address Ethernet port B. This setting will be not valid automatically. The *"Set IP address"* parameter must be set to *[ON]* for enabling. **Notes** Device part bits are not allowed to be either **all** *00...$_2$* or **all** *11...$_2$* (broadcast).
7414	**Set IP address**	2	Off	Set IP-Address Ethernet port B.
5434 5435 5436 5437	**Subnet mask**	2	[255, 255, 240, 0]	Set byte 1,2,3,4 of the subnet mask Ethernet port B. This setting will be not valid automatically. The *"Set subnet mask"* parameter must be set to *[ON]* for enabling.
7415	**Set subnet mask**	2	Off	Set subnet mask Ethernet port B.

4.7.5.3 Ethernet Network C

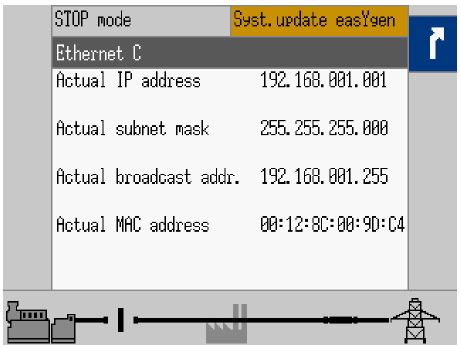


Fig. 203: Ethernet Network C screen

The actual IP address and subnet mask (all hex values) can be viewed under Next Page (Status Menu) / Diagnostic / Interfaces / Ethernet / Ethernet C.

IP address

Each port within the Ethernet network must have its own network address. As long the Ethernet network is only used by the easYgen-XT system, the address range is free configurable. For better troubleshooting use the default Ethernet address range and configure the single IP addresses according to their device numbers.

Device part: Restrictions

The "device part" is the logical result of "IP Address" AND NOT "Network Mask". The bits (dual system $0_2/1_2$) of the device part must be different from being all the same - neither all zero 0_2 nor all 1_2 (broadcast).

Please select your IP address accordingly.

> ***HEX values***
> *The addresses and subnet masks are known as hex values but are displayed in HMI and ToolKit as decimal values.*

ID	Parameter	CL	Setting range [Default]	Description
7418 7419 7420 7421	**IP address**	2	[10, 31, 140, 0]	Field 1,2,3,4 for IP address Ethernet port C. This setting will be not valid automatically. The *"Set IP address"* parameter must be set to *[ON]* for enabling. **Notes** Device part bits are not allowed to be either **all** $00..._2$ or **all** $11..._2$ (broadcast).
7416	**Set IP address**	2	Off	Set IP-Address Ethernet port C.
7422 7423 7424 7425	**Subnet mask**	2	[255, 255, 240, 0]	Set byte 1,2,3,4 of the subnet mask Ethernet port C. This setting will be not valid automatically. The *"Set subnet mask"* parameter must be set to *[ON]* for enabling.
7417	**Set subnet mask**	2	Off	Set subnet mask Ethernet port C.

4.7.5.4 SNTP

SNTP feature

The Simple Network Time Protocol (SNTP) is a common procedure to synchronize clocks in computer systems via packaged based communication networks. In this manner, the easYgen-XT can be configured as a SNTP client. The easYgen-XT is also usable as a SNTP server within the local area network by its own IP address.

The SNTP functionality can be configured for three modes:

- **External SNTP mode**
  The easYgen-XT requests time and date information from an external SNTP server, marked with an own IP address.
- **Load sharing mode**
  The easYgen-XT requests time and date information from the easYgen with the smallest device number, if the load sharing over Ethernet is enabled.
- **Internal clock mode**
  The SNTP client mechanism is disabled. The own real time clock determines clock and date.

> ***HEX values***
> *The addresses and subnet masks are known as hex values but are displayed in HMI and ToolKit as decimal values.*

ID	Parameter	CL	Setting range [Default]	Description
7780 7781 7782 7783	**SNTP address**	2	**[10, 14, 128, 128]** 0 to 255 (4x)	Set byte 1,2,3,4 of the IP address of the external SNTP-Server.
7784	**Rate**	2	**[1200s]** 60 to 6000	Set the time rate of the SNTP-Server request.
7785	**Timeout**	2	**[60s]** 30 to 600	Set the timeout of the SNTP-Server. This feature is prepared for the future and has currently no influence on the function.
7786	**Mode**	2	**[Internal clock]** External SNTP Load share	The device provides different SNTP modes. **Internal clock:** The clock information comes from the internal clock. The SNTP function is disabled. **External SNTP-Server:** The clock information is receipt by an external SNTP-Server. **Load share:** The clock information is generated within the easYgen system. A master (usually the device with the smallest device number) serves all easYgens with time and date information according to their request rate.

4.7.6 Load Share Parameters

ID	Parameter	CL	Setting range [Default]	Description
9921	**Transfer rate LS fast message** (CAN)	2	0.10 to 0.30 s **[0.10 s]**	The transfer rate defines the time delay between two fast CAN messages. In case of CAN systems with a high bus load (e.g. long distance between the units with low baud rate), a shorter transfer rate (higher time setting) helps to reduce the bus load.
9920	**Load Share CAN-ID**	2	2xx hex / 3xx hex / 4xx hex / 5xx hex **[5xx hex]**	The first digit of the CAN ID or the range (i.e. 2xx means 200 through 2FF hex) is configured here. The last two digits will be assigned by the control with the settings from the device number (parameter 1702 ➡ p. 159).

4.8 Configure LogicsManager

Logical symbols

The easYgen LogicsManager screens show logical symbols according to the IEC standard by default. However, it is also possible to change the LogicsManager screens to ASA standard.

ID	Parameter	CL	Setting range [Default]	Description
4117	**Use ASA symbols**	2	Yes	Symbols according to the ASA standard are used in LogicsManager screens.
			[No]	Symbols according to the IEC standard are used in LogicsManager screens.

Refer to ↬ Chapter 9.3.3 "Logical Symbols" on page 918 for a table of symbols according to the different standards.

Refer to ↬ Chapter 9.3.1 "LogicsManager Overview" on page 882for an introduction how a LogicsManager works.

Internal flags

Internal flags within the LogicsManager logical outputs may be programmed and used for multiple functions.

Flag {x}	Flag 1	Flag 2	Flag 3	Flag 4	Flag 5	Flag 6	Flag 7	Flag 8
Parameter ID {yyyyy}	12230	12240	12250	12260	12270	12280	12290	12300
Result	10700	10701	10702	10702	10704	10705	10706	10707

Table 104: Flag parameter IDs (1 to 8)

Flag {x}	Flag 9	Flag 10	Flag 11	Flag 12	Flag 13	Flag 14	Flag 15	Flag 16
Parameter ID {yyyyy}	12910	12911	12912	12913	12914	12915	12916	12917
Result	11609	11610	11611	11612	11613	11614	11615	11616

Table 105: Flag parameter IDs (9 to 16)

Flag {x}	Flag 17	Flag 18	Flag 19	Flag 20	Flag 21	Flag 22	Flag 23	Flag 24
Parameter ID {yyyyy}	12231	12233	12235	12237	12241	12243	12245	12247
Result	12232	12234	12236	12238	12242	12244	12246	12248

Table 106: Flag parameter IDs (17 to 24)

Flag {x}	Flag 25	Flag 26	Flag 27	Flag 28	Flag 29	Flag 30	Flag 31	Flag 32
Parameter ID {yyyyy}	12251	12253	12255	12257	12261	12263	12265	12267
Result	12252	12254	12256	12258	12262	12264	12266	12268

Table 107: Flag parameter IDs (25 to 32)

ID	Parameter	CL	Setting range **[Default]**	Description
{yyyyy}	**Flag {x}**	2	Determined by LogicsManager {XX.XX} **[(0 & 1) & 1]** = {nnnnn}	The flags may be used as auxiliary flags for complex combinations by using the logical output of these flags as command variable for other logical outputs. **Notes** Flag 1 is also used as placeholder in other logical combinations. Flag 8 is preset with a timer start and shows different default values. {XX.XX} is a placeholder for the LogicsManager number {nnnnn} is a placeholder for the parameter ID of the logical output of the LogicsManager equation

For conditions and explanation of programming please refer to *↬ Chapter 9.3.1 “LogicsManager Overview” on page 882.*

LS-5 related command flags

In systems of easYgen together with LS-5 the LS-5 command flags described below may be configured via easYgen LogicsManager to send binary information to the LS-5 LogicsManager system. Within the LS-5 these commands appear as LogicsManager command variables as well.

LS5 command {x}	LS5 command 1	LS5 command 2	LS5 command 3	LS5 command 4	LS5 command 5	LS5 command 6
Parameter ID {yyyyy}	12979	12980	12981	12982	12983	12984
Not applicable for application mode	A08 A09 A11	A08 A09 A11	A10 A11	A10 A11	—	—

Table 108: LS5 command flag IDs

ID	Parameter	CL	Setting range [Default]	Description
{yyyyy}	**LS5 command {x}**	2	Determined by LogicsManager {XX.XX} **[(0 & 1) & 1]** = {nnnnn}	All these single command variables of all easYgen devices are offered in the connected LS-5 units. In the LS-5 the flags appear in two ways: ■ **aligned** (logical OR) and ■ **individually**. *See drawing below.* **Notes** The results can also be used within the easYgen own LogicsManager system (LM: 24.23 to 24.28). {XX.XX} is a placeholder for the LogicsManager number {nnnnn} is a placeholder for the parameter ID of the logical output of the LogicsManager equation

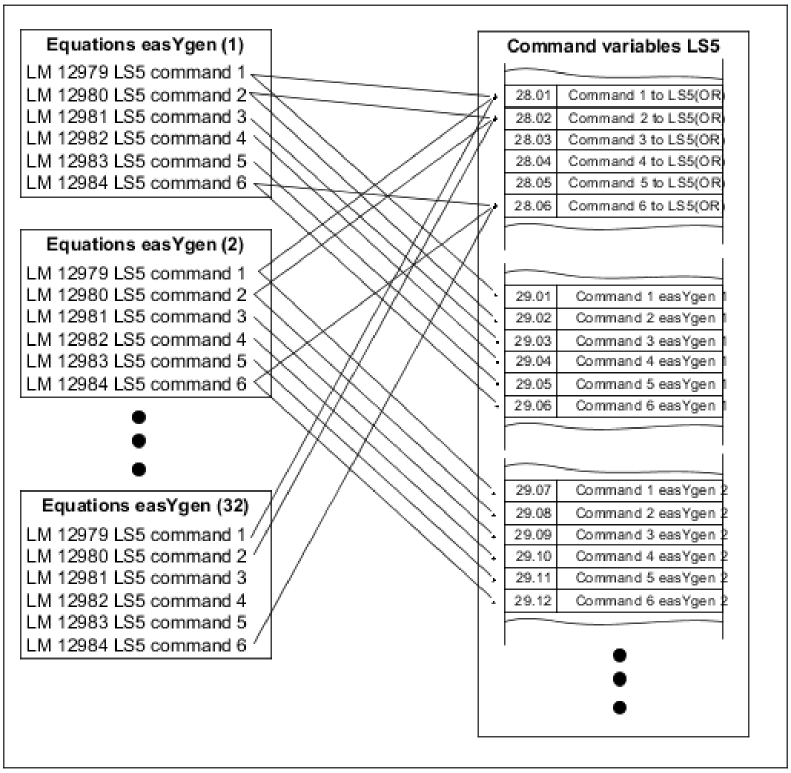


Fig. 204: LM flags of easYgen transferred to LS-5

For conditions and explanation of programming please refer to ⯑ Chapter 9.3.1 "LogicsManager Overview" on page 882.

LogicsManager Timers: Set timers

Daily time setpoints - Timer 1, 2

Utilizing the LogicsManager it is possible to establish specific times of the day that functions (i.e. generator exerciser) can be enabled.

The two daily time setpoints are activated each day at the configured time. Using the LogicsManager these setpoints may be configured individually or combined to create a time range.

Active time setpoint

Utilizing the LogicsManager it is possible to establish specific days (and/or hours, minutes, seconds) that functions (i.e. generator exerciser) can be enabled. The active switching point is activated only on a specified day (and/or hour, minute, second).

The setpoints may be configured individually or combined via the LogicsManager. You may configure for each month: daily, hourly, minutely, and/or even secondly time setpoints depending on how you combine the setpoints in the LogicsManager.

> ***Active week days - weekly time setpoint***
>
> *Utilizing the LogicsManager it is possible to establish specific days of the week that functions (i.e. generator exerciser) can be enabled.*
>
> *The weekly time setpoint is enabled during the indicated day from 0:00:00 hours to 23:59:59 hours.*

Daily time setpoints - Timer 1, 2

ID	Parameter	CL	Setting range [Default]	Description
1652 1657	**Timer {x}: Hour**	2	0 to 23 h 1652: **[8 h]** 1657: **[17 h]**	Enter the hour of the daily time setpoint here. **Example** ■ 0 = 0th hour of the day (midnight). ■ 23 = 23rd hour of the day (11pm).
1651 1656	**Timer {x}: Minute**	2	0 to 59 min **[0 min]**	Enter the minute of the daily time setpoint here. **Example** ■ 0 = 0th minute of the hour. ■ 59 = 59th minute of the hour.
1650 1655	**Timer {x}: Second**	2	0 to 59 s **[0 s]**	Enter the second of the daily time setpoint here. **Example** ■ 0 = 0th second of the minute. ■ 59 = 59th second of the minute.

Active time setpoint

ID	Parameter	CL	Setting range [Default]	Description
1663	**Active day**	2	Day 1 to 31 **[1]**	Enter the day of the active switch point here. The active time setpoint is enabled during the indicated day from 0:00:00 hours to 23:59:59 hours. **Example** ■ 01 = 1st day of the month. ■ 31 = 31st day of the month.
1662	**Active hour**	2	0 to 23 h **[12 h]**	Enter the hour of the active switch point here. The active time setpoint is enabled every day during the indicated hour from minute 0 to minute 59. **Example** ■ 0 = 0th hour of the day. ■ 23 = 23rd hour of the day.

ID	Parameter	CL	Setting range [Default]	Description
1661	**Active minute**	2	0 to 59 min **[0 min]**	Enter the minute of the active switch point here. The active time setpoint is enabled every hour during the indicated minute from second 0 to second 59. **Example** ■ 0 = 0th minute of the hour. ■ 59 = 59th minute of the hour.
1660	**Active second**	2	0 to 59 s **[0 s]**	Enter the second of the active switch point here. The active time setpoint is enabled every minute during the indicated second. **Example** ■ 0 = 0th second of the minute. ■ 59 = 59th second of the minute.

Active week days - weekly time setpoint

ID	Parameter	CL	Setting range [Default]	Description
				Please select each of the active weekdays.
1670	**Monday active**	2	**[Yes]**	The switch point is enabled every Monday.
			No	The switch point is disabled every Monday.
1671	**Tuesday active**	2	**[Yes]**	The switch point is enabled every Tuesday.
			No	The switch point is disabled every Tuesday.
1672	**Wednesday active**	2	**[Yes]**	The switch point is enabled every Wednesday.
			No	The switch point is disabled every Wednesday
1673	**Thursday active**	2	**[Yes]**	The switch point is enabled every Thursday.
			No	The switch point is disabled every Thursday.
1674	**Friday active**	2	**[Yes]**	The switch point is enabled every Friday.
			No	The switch point is disabled every Friday.
1675	**Saturday active**	2	Yes	The switch point is enabled every Saturday.
			[No]	The switch point is disabled every Saturday.
1676	**Sunday active**	2	Yes	The switch point is enabled every Sunday.
			[No]	The switch point is disabled every Sunday.

4.9 Configure AnalogManager

4.9.1 Operations

An AnalogManager (AM) is a flexible sub-system to process and/or generate both an analog output signal and a related digital output. It offers a set of functions (Type) to select the preferred signal processing. According to the selected function the AM computes up to two analog inputs and one constant for result. Up to two digital inputs enable to control the process (internal logic allows to adjust boolean signal).

Inputs:

- Up to 2 analog variables (A1, A2) and
- 1 direct configurable constant (C1)
  in conjunction with
- up to 2 Boolean information (L1, L2)*.

The AM processes the inputs listed above depending on the **selected "Type"**. The result is always provided in form of

- an analog value (AR) and
- a Boolean (BR).

There are two types of AnalogManagers:

- Freely usable AM to process signals and use the results for output as control.
- Dedicated AM which analog result is directly accepted by (fixed to) an according function (e.g. AO01).

For both freely and dedicated AM is valid:

- The analog result is accessible via the AnalogManager command variable pool.
- The resulting Boolean is accessible via the LogicsManager command variable pool.

Preferred AM Definition Procedure

1. Start with "Type"
   ⇨ Select AM type first to get the picture and the visual understanding of available inputs, outputs, function, and results.
2. Select analog inputs and set constant.

   > *Besides internal and measured values there are 16 "Free constants" available for more flexibility. Refer to ⇘ Chapter 4.9.2 "Analog-Manager Constants" on page 494for details.*

3. Prepare each digital input by selecting source (parameter) and logical function.
4. Enter with "Apply"
   ⇨ Press *[Apply]* button to send current settings to device.
5. Use analog and boolean result for intended (re)action.

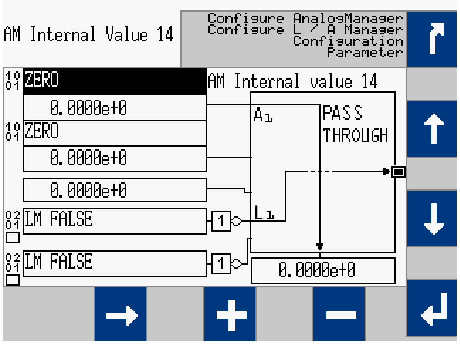


Fig. 205: Display (HMI) AM14

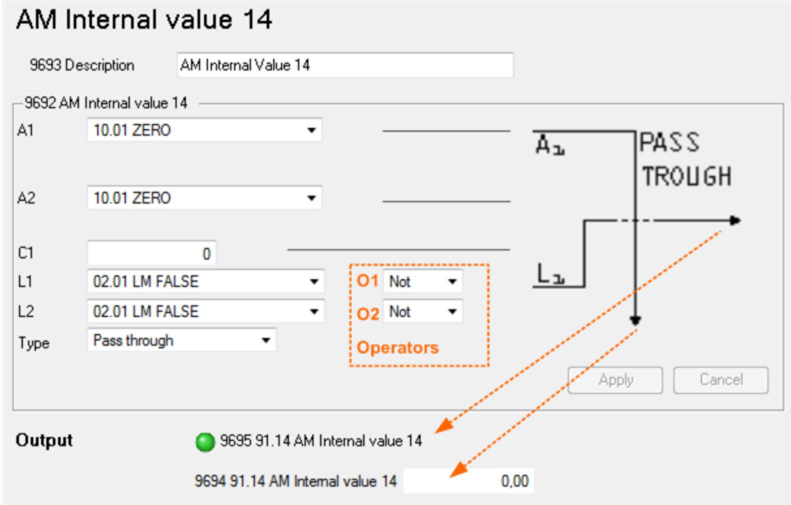


Fig. 206: ToolKit AM14

) Please be aware that the boolean information passes an operator. So the input for the Analog-Manager function block is **the result of this!*

AnalogManager Description

Acronym	Name	Value
A1	Analog input 1 (variable)	coming from selected analog parameter
A2	Analog input 2 (variable)	coming from selected analog parameter
C1	Analog **C**onstant input (constant)	defined via HMI, ToolKit, or other (remote) interface
		Notes
		TKit
		ToolKit can display input values between -9.9999e9 and +9.9999e9. Other values will be handled correctly by the device but display will be cropped
L1	Boolean (**L**ogic) input 1	coming from selected digital parameter
L2	Boolean (**L**ogic) input 2	coming from selected digital parameter
O1	Operator 1 (Operators-Unary 1)	selected via HMI, ToolKit, or other (remote) interface
O2	Operator 2 (Operators-Unary 2)	selected via HMI, ToolKit, or other (remote) interface
Type	AnalogManager type (operation)	selected via HMI, ToolKit, or other (remote) interface
BR	Boolean result	result/output of the boolean operation
		Notes
		Available as LogicsManager Variable ("result") e.g. as AM/LM input
AR	Analog result	result/output of the analog operation
		Notes
		Available as AnalogManager "result" e.g. as AM input

AnalogManager Internal Values 1 to 16

Internal values within the AnalogManager analogue and logical outputs may be programmed and used for multiple functions.

Flag {x}	Value 1	Value 2	Value 3	Value 4	Value 5	Value 6	Value 7	Value 8
Parameter ID {yyyyy}	9640	9644	9648	9652	9656	9660	9664	9668
Description	9641	9645	9649	9653	9657	9661	9665	9669

Table 109: Internal Values parameter IDs (1 to 8)

Value {x}	Value 9	Value 10	Value 11	Value 12	Value 13	Value 14	Value 15	Value 16
Parameter ID {yyyyy}	9672	9676	9680	9684	9688	9692	9696	9700
Description	9673	9677	9681	9685	9689	9683	9697	9701

Table 110: Internal Values parameter IDs (9 to 16)

Default values

Factory settings of the internal values come with Type = "Pass Through" so the analog result AR is same as analog input A1 (Default: A1 = 10.01 ZERO). The boolean result BR is "FALSE".

ID	Parameter	CL	Setting range [Default]	Description
{yyyyy}	**AM Internal Value {x}**	2	Determined by AnalogManager **[A1 = 10.01 ZERO]**	The data source may be selected from the available data sources. **Notes** Refer to ↪ *Chapter 9.4.1 "Data Sources AM" on page 933* for a list of all data sources.

ID	Parameter	CL	Setting range [Default]	Description
{yyyyy}	**Internal value {x}: Description**	2	user-defined (up 22 to characters) **[AM Internal Value {x}]**	The text may have 0 through 22 characters. **Notes** This parameter may only be configured using ToolKit. The max. number of characters depends on the numbers of Bytes for each character. Please verify the length on the display for best view.

The analog and/or logic result can be used via command variable 91.{x} AM Internal value {x}.

Examples

Calculating with an AnalogManager

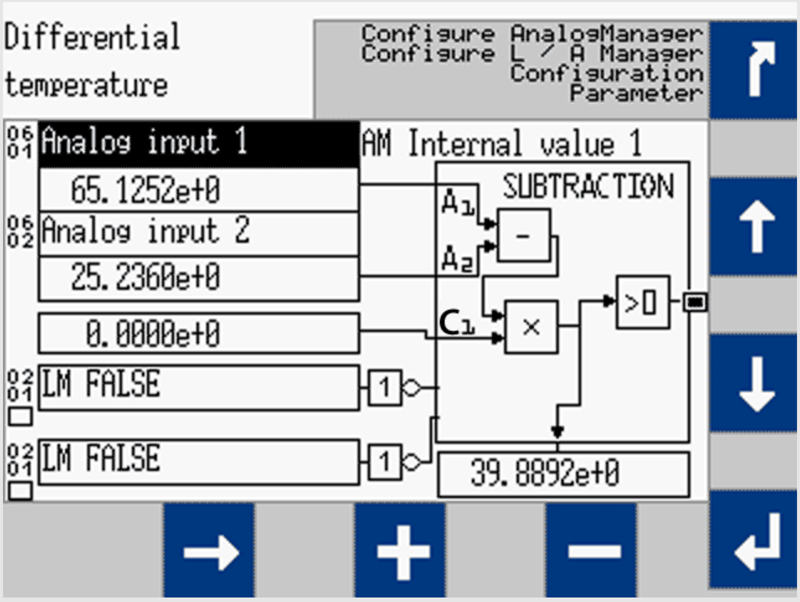


Fig. 207: screen shot HMI: AM subtraction sample

Acronym	Name	Value	
A1	Analog input 1	Number:	06.01
		Name:	Analog Input 1
		Value:	65.1252
A2	Analog input 2	Number:	06.02
		Name:	Analog Input 2
		Value:	25.2360
C1	Analog constant input	Value: 0	
L1	Boolean input 1	Number:	02.01
		Name:	LM FALSE
		Value:	0
L2	Boolean input 2	Number:	02.01
		Name:	LM FALSE
		Value:	0
O1	Operator 1	NOT [input will be inverted]	
O2	Operator 2	NOT [input will be inverted]	
Type	Operation type	SUBTRACTION	
BR	Boolean result	(A1 - A2) x C1 > 0 (available as boolean result *[91.01 AM Internal value 1]*)	
AR	Analog result	(A1 - A2) x C1 (available as analog result *[91.01 AM Internal value 1]*)	

Incrementing and comparing with an AnalogManager

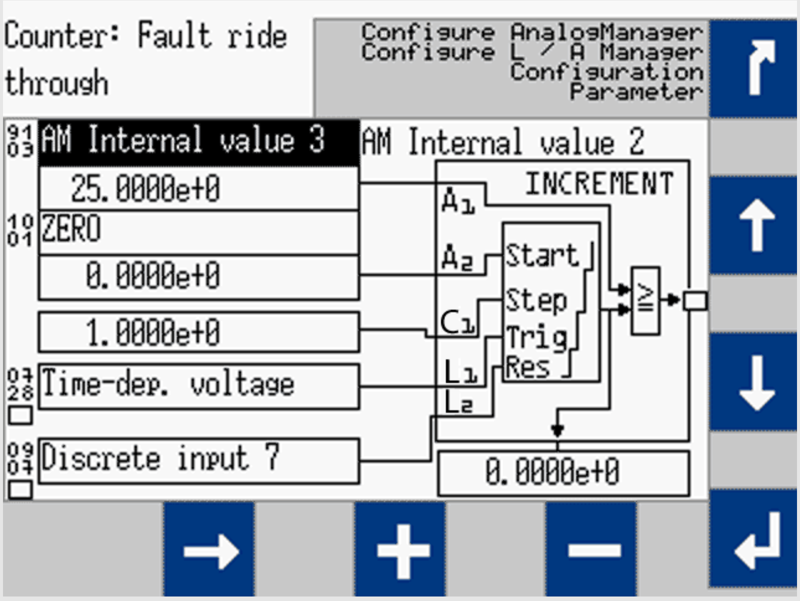
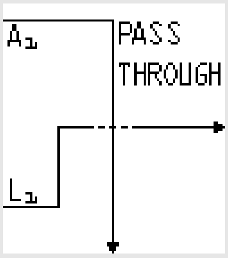
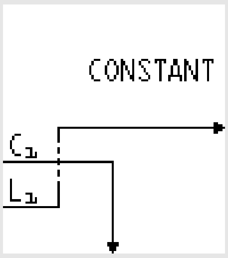
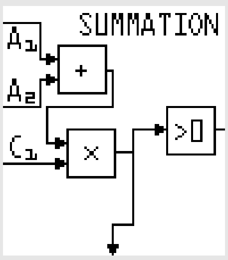
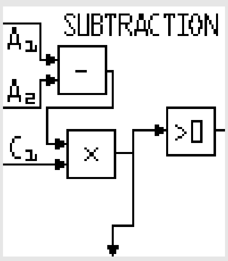


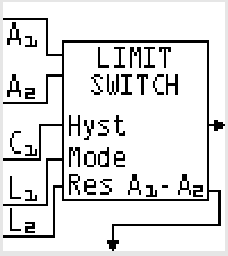
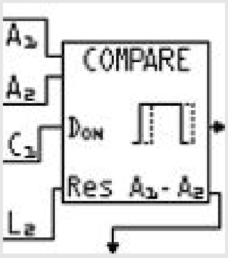
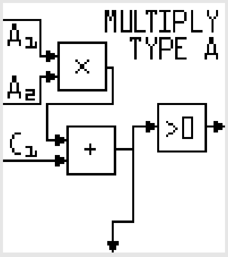
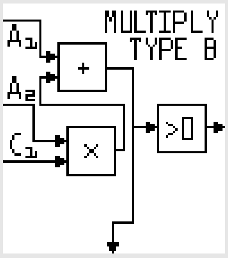
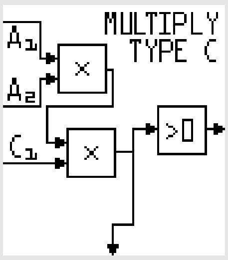
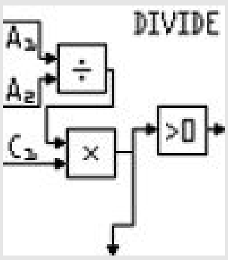
Fig. 208: screen shot HMI: AM increment sample

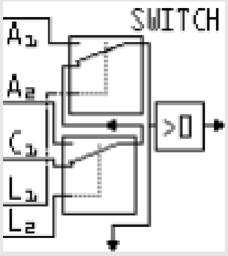
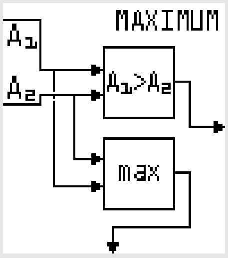
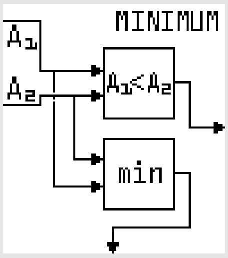
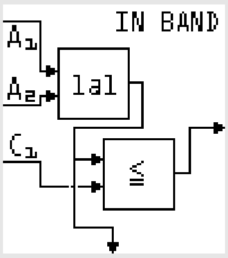
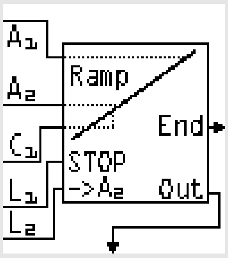
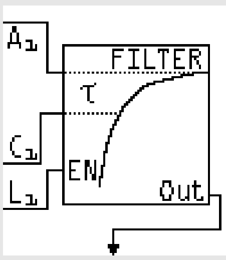
Acronym	Name	Value	
A1	Analog input 1	Number:	91.03
		Name:	Internal value 3
		Value:	25.0000
A2	Analog input 2	Number:	10.01
		Name:	ZERO
		Value:	0
C1	Analog constant input	Value: 1.000	
L1	Boolean input 1	Number:	07.28
		Name:	Time dependent voltage
		Value:	Result of LM 07.28
L2	Boolean input 2	Number:	09.07
		Name:	Discrete input 7
		Value:	Result of LM 09.07
O1	Operator 1	L1 [passed]	
O2	Operator 2	L2 [passed]	
Type	Operation type	INCREMENT	
BR	Boolean result	A1≧ A2 + (n[L1] x C1)* *) Reset if L2 = TRUE (available as boolean result *[91.02 AM Internal value 2]*)	
AR	Analog result	A2 + (n[L1] x C1)* *) Reset if L2 = TRUE (available as analog result *[91.02 AM Internal value 2]*)	

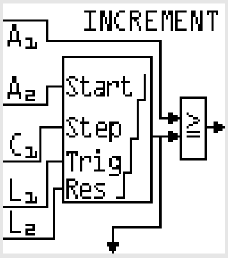
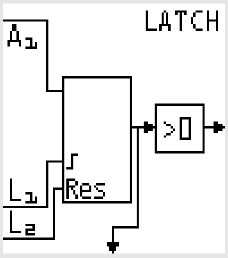
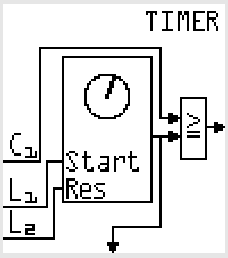
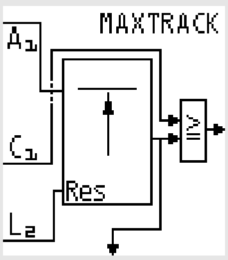
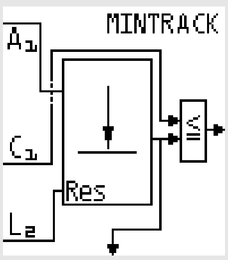
The following AnalogManager operations are available:

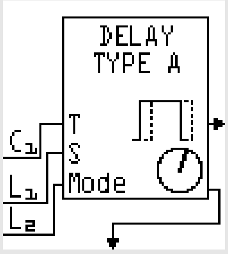
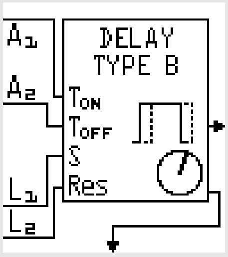
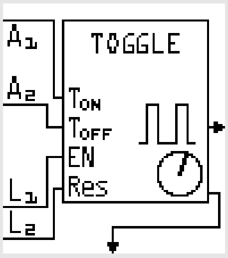
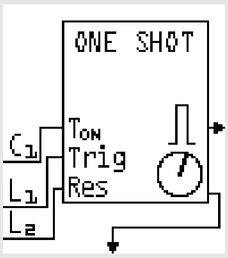
> ***New AnalogManager "Type" selected? Then: ...***
> *Please be aware that the input values stay "as is" (are NOT changed) if a new Type is selected. Check all input settings A1, A2, C1, L1, L2, O1, O2 before applying!*
>
> ***Example:***
>
> *If C1 = 0 and you select Type [Division], you would ask the AnalogManager to divide by zero ...*

AnalogManager Operation (Type)	Bitmap	Function (Output)
Pass through		Analog Result = A1 Boolean Result = L1
Constant		Analog Result = C1 Boolean Result = L1
Summation		Analog Result = (A1 + A2) * C1 Boolean Result goes TRUE, if Analog Result > 0
Subtraction		Analog Result = (A1 - A2) * C1 Boolean Result goes TRUE, if Analog Result > 0

AnalogManager Operation (Type)	Bitmap	Function (Output)
Limit Switch		Analog Result = (A1 - A2) **L1 = FALSE -> Overrun mode**: Boolean Result goes TRUE, if A1 > A2 Boolean Result goes FALSE, if A1 <= (A2 - C1) **L1 = TRUE -> Underrun mode**: Boolean Result goes TRUE, if A1 < A2 Boolean Result goes FALSE, if A1 >= (A2 + C1) C1 = Hysteresis L1 = TRUE = Underrun mode, otherwise Overrun mode L2 = Resets Hysteresis.
Compare with delay on		Analog Result = (A1 - A2) Boolean Result goes TRUE, if A1 > A2 for the duration of C1 time [ms], otherwise FALSE C1 = Time Delay to switch on [ms] L2 = Reset Time Delay. Absolute value of C1 is taken as time[ms] (no negative time). **Notes** Time is not latched, so C1 changes can be done during delay cycle.
Multiply Type A		Analog Result = (A1 * A2) + C1 Boolean Result goes TRUE, if Analog Result > 0
Multiply Type B		Analog Result = A1 + (A2 * C1) Boolean Result goes TRUE, if Analog Result > 0
Multiply Type C		Analog Result = A1 * A2 * C1 Boolean Result goes TRUE, if Analog Result > 0
Divide		Analog Result = (A1 / A2) * C1 Boolean Result goes TRUE, if Analog Result > 0

AnalogManager Operation (Type)	Bitmap	Function (Output)
Switch		Analog Result = A1, if L1 = TRUE Analog Result = A2, if L1 = FALSE AND L2 = TRUE Analog Result = C1, if L1 = FALSE AND L2 = FALSE Boolean Result goes TRUE, if Analog Result > 0 **Notes** Icon shows switch positions L1/L2 as FALSE. Common use could be to switch between A1 and A2: Set L2 = TRUE; use L1 to switch.
Maximum		Analog Result = MAX(A1 , A2) Boolean Result goes TRUE, if A1 > A2
Minimum		Analog Result = MIN(A1, A2) Boolean Result goes TRUE, if A1 < A2
In Band		Analog Result = ABS(A1 - A2) Boolean Result goes TRUE, if (ABS(A1 - A2) <= C1) C1 = maximum tolerance for being "in band"
Ramp		Analog Result = Ramp value Boolean Result goes TRUE, if Ramp value equal end position C1 determines rate/second. Absolute value of C1 is taken - no negative rate allowed L1 holds ramp: If L1 goes TRUE, the current ramp output is stopped L2 determines end value: If L2 goes TRUE, the end position is value A2, otherwise it is A1. **Notes** Rate/second is not latched, so C1 changes can be done during ramp cycles. Common use could be ramp up and down: Start ramping from A1 to A2 with gradient C1 if L1 goes TRUE; then switch to ramping down back to A1 with the same gradient if L2 goes TRUE.
Filter		Analog Result = Filtered value of A1 Boolean Result = FALSE. A1 = Value, which is to filter. A2 not used. C1 is filter time (time constant) in [ms] L1 switches the filter. If L1 goes TRUE, the filter function is enabled, otherwise the filter function is disabled and the Analog Result = A1 L2 not used. Absolute value of C1 is taken

AnalogManager Operation (Type)	Bitmap	Function (Output)
		Notes Time constant is not latched, so C1 changes can be done during filter cycles. Filter formula: OUT[i] = a*IN[i] + (1-a)*OUT[i-1] , where OUT[i] is current output, IN[i] is current input, and OUT[i-1] is previous output. a = (dT / (C1 + dT)), where dT is interval of input/output change (== RATEGROUP)
Increment		Analog Result = Analog Result + C1 on every L1 rising edge Boolean Result goes TRUE, if Analog Result > = Value A1 (Limit) A1 = Limit A2 = Start Value after RESET C1 = Increment per Step L1 = Trigger for Increment L2 = Reset to Start Value
Latch		Analog Result = A1 on every L1 rising edge Boolean Result goes TRUE, if Analog Result > 0 A1 = Value 1 L1 = Saves Analog Result with rising edge L2 = Resets Analog Result to 0 with rising edge
Timer		Analog Result = Elapsed time [ms] Boolean Result goes TRUE, if Analog Result > = C1 C1 = Timer Compare [ms] L1 = If L1 goes TRUE, timer starts or continues to run, otherwise timer is stopped L2 = Resets Analog Result to 0 with rising edge **Notes** Could be used e.g., for reading out values when a defined (failure) situation occurs
Maxtrack		Analog Result = If A1 > Analog Result, the new result is A1 Boolean Result goes TRUE, if Analog Result > = C1 A1 = Tracked Value A2 not used C1 = Limit L2 = Resets Analog Result to A2 with rising edge.
Mintrack		Analog Result = If A1 < Analog Result, the new result is A1 Boolean Result goes TRUE, if Analog Result < = C1 A1 = Tracked Value C1 = Limit L2 = Resets Analog Result to A2 with rising edge.

AnalogManager Operation (Type)	Bitmap	Function (Output)
Delay Type A		**Mode "Delay On":** Analog Result = Remaining time [ms] for Boolean Result to go to TRUE Boolean Result goes TRUE, if L1 = TRUE for at least C1[ms] time. **Mode "Delay Off:** Analog Result = Remaining time [ms] for Boolean Result to go to FALSE Boolean Result goes FALSE, if L1 = FALSE for at least C1[ms] time C1 = Absolute value of C1 is taken as time in [ms] (no negative time allowed) L1 = Switching signal. The boolean result is delayed according to the mode in L2 L2 = TRUE = Mode "Delay Off"; = FALSE = Mode "Delay On" **Notes** Time is not latched, so C1 changes can be done during delay cycle.
Delay Type B		Analog Result = Remaining time to switch Boolean Result Boolean Result = TRUE, if L1 was TRUE for at least A1 time [ms] Boolean Result = FALSE, if L1 was FALSE for at least A2 time [ms] A1 = Delay-On time [ms], no negative time allowed A2 = Delay-Off time [ms], no negative time allowed L1 = Switching signal. The boolean result is delayed according to the time A1 and A2 L2 = Resets Boolean result with rising edge **Notes** A1/A2 Time is not latched, so changes can be done during delay cycle.
Toggle		Analog Result = Remaining time to switch Boolean Result Boolean Result = Toggles with ON time = A1[ms] and OFF time = A2[ms] A1 = Delay-On time [ms], no negative time allowed A2 = Delay-Off time [ms], no negative time allowed L1 = Activates toggling, if TRUE. L2 = Resets remaining time to toggle with rising edge **Notes** A1/A2 Time is not latched, so changes can be done during delay cycle.
One Shot		Analog Result = Remaining time to fall back to FALSE [ms] Boolean Result = L1 rising edge forces TRUE state for C1 time [ms] C1 = Absolute value of C1 is taken as time in [ms] (no negative time allowed) L1 = Activates boolean result to TRUE with rising edge L2 = Resets remaining time for fall back with rising edge **Notes** Time is not latched, so C1 changes can be done during monoflop cycle.

4.9.2 AnalogManager Constants

General note

For even more flexibility and use of "self explaining" parameters 16 constants can be defined. These constants are available as AnalogManager input AM 13.01 to AM 13.16. Each parameter can be named individually and its value can be defined in a wide range:

AnalogManager Constants 1 to 16

AnalogManager values may be used for multiple functions.

AM Constant #	1	2	3	4	5	6	7	8
Description	15567	15568	15569	15570	15571	15572	15572	15574
Value	15551	15552	15553	15554	15555	15556	15557	15558
AM {xx.yy}	AM 13.01	AM 13.02	AM 13.03	AM 13.04	AM 13.05	AM 13.06	AM 13.07	AM 13.08

Table 111: AM Constant IDs (1 to 8)

AM Constant #	9	10	11	12	13	14	15	16
Description {mmmmm}	15575	15576	15577	15578	15003	15004	15005	15006
Value {nnnnn}	15559	15560	15561	15562	15563	15564	15565	15566
AM {xx.yy}	AM 13.09	AM 13.10	AM 13.11	AM 13.12	AM 13.13	AM 13.14	AM 13.15	AM 13.16

Table 112: AM Constant IDs (9 to 16)

Constant's name

The AM inputs selectable for A1 or A2 come with the predefined name of the Constant e.g. "13.01 Free constant 1" but not with the customizable AM Description e.g. the value of 15567 Description constant 1.

ID	Parameter	CL	Setting range [Default]	Description
{mmmmm}	**Description constant {#}**	2	user-defined (up 22 to characters) **[13.yy Free constant {#}]**	The text may have 0 through 22 characters. **Notes** This parameter may only be configured using ToolKit. The max. number of characters depends on the numbers of Bytes for each character. Please verify the length on the display for best view.
{nnnnn}	**13.yy Free constant {#}**	2	-21000.00 e3 to 21000.00 e3 **[1]**	Preset value to be used as AM 13.yy.

4.10 Configure Counters

General notes

The following chapters describe all available and configurable counters of the device.

The standard/basic counters - available in all devices of this product family - are described in the chapter *Chapter 4.10.1 "Generator Preset Values" on page 496*. For special counters please see the chapters following.

4.10.1 Generator Preset Values

General notes

Maintenance call

A maintenance call will be issued if the configured number of maintenance hours has expired or the configured number of days has expired since the last maintenance.

In case of a maintenance call, the display indicates "Mainten. days exceeded" or "Mainten. hours exceeded".

ID	Parameter	CL	Setting range [Default]	Description
2521	**Gen.pos.active energy preset**	2	000000.00 to 999999.00 MWh **[0 MWh]**	This parameter defines the number of MWh of the counter. The number entered here will overwrite the current displayed value after confirming with parameter 2510 ⤷ p. 496.
2510	**Gen.pos.active energy set**	2	Yes	The current value of this counter is overwritten with the value configured in "Gen.pos.active energy preset" (parameter 2521 ⤷ p. 496). After the counter has been (re)set, this parameter changes back to "No" automatically.
			[No]	The value of this counter is not changed.
2523	**Gen.pos.react. energy preset**	2	000000.00 to 999999.00 Mvarh **[0 Mvarh]**	This parameter defines the number of positive Mvarh of the counter. The number entered here will overwrite the current displayed value after confirming with parameter 2511 ⤷ p. 496.
2511	**Gen.pos.react. energy set**	2	Yes	The current value of this counter is overwritten with the value configured in "Gen.pos.react.energy preset" (parameter 2523 ⤷ p. 496). After the counter has been (re)set, this parameter changes back to "No" automatically.
			[No]	The value of this counter is not changed.
2527	**Gen.neg.react. energy preset**	2	000000.00 to 999999.00 Mvarh **[0 Mvarh]**	This parameter defines the number of negative Mvarh of the counter. The number entered here will overwrite the current displayed value after confirming with parameter 2513 ⤷ p. 496.
2513	**Gen.neg.react. energy set**	2	Yes	The current value of this counter is overwritten with the value configured in "Gen.neg.react.energy preset" (parameter 2527 ⤷ p. 496). After the counter has been (re)set, this parameter changes back to "No" automatically.
			[No]	The value of this counter is not changed.
2541	**Number of starts preset**	2	0 to 65535 **[0]**	This parameter defines the number of times the control unit registers a start of the generator set. The number entered here will overwrite the current displayed value after confirming with parameter 2542 ⤷ p. 496.
2542	**Number of starts set**	2	Yes	The current value of the start counter is overwritten with the value configured in "Number of starts preset" (parameter 2541 ⤷ p. 496). After the counter has been (re)set, this parameter changes back to "No" automatically.
			[No]	The value of this counter is not changed.

4.10.2 Service Reset Values

General notes

Maintenance call

A maintenance call will be issued if the configured number of maintenance hours has expired or the configured number of days has expired since the last maintenance.

In case of a maintenance call, the display indicates "Mainten. days exceeded" or "Mainten. hours exceeded".

Displaying hours: operation / period of use

*The easYgen device handles operating hours internally in floating format. To indicate the operating hours on a display or to provide it in the data protocol the value is transferred into an integer variable. This can cause display errors within 4*10-6 % in relation to the absolute value.*

ID	Parameter	CL	Setting range [Default]	Description
2550	**Maintenance hours**	2	0 to 9,999 h **[300 h]**	This parameter defines the remaining hours until the next maintenance call occurs. Once the generator has been operated for the number of hours configured here, a maintenance message is displayed. If the maintenance counter is reset either by the push-buttons at the front panel (refer to *Chapter 2.1 "Display And Status Indicators" on page 35*), or by configuring the parameter "Reset maintenance period hrs" to "Yes" (parameter 2562 p. 497), the maintenance counter is reset to the configured value.
				Notes To disable the "maintenance hours" counter configure "0" for this entry.
2562	**Reset maintenance period hrs**	2	Yes / No **[No]**	If this parameter is configured to "Yes" the maintenance "hours" counter is reset to the configured value. Once the counter "maintenance hours" has been reset, the control unit changes this parameter to "No".
				Notes When using a specific code level in parameter 2567 p. 498 to reset maintenance hours this parameter can be blocked.
				Notes HMI - menu path: *"Next page ➔ Configure counters ➔ (symbol: wrench)"*
2551	**Maintenance days**	2	0 to 999 d **[365 d]**	This parameter defines the remaining days until the next maintenance call occurs. Once the configured number of days has expired since the last maintenance, a maintenance message is displayed. If the maintenance counter is reset either by the push-buttons at the front panel (refer to *Chapter 2.1 "Display And Status Indicators" on page 35*), or by configuring the parameter "Reset maintenance period days" to "Yes" (parameter 2563 p. 497), the maintenance counter is reset to the configured value.
				Notes To disable the "maintenance days" counter configure "0" for this entry.
2563	**Reset maintenance period days**	2	Yes / No **[No]**	If this parameter is configured to "Yes" the "maintenance days" counter is reset to the configured value. Once the counter has been reset, the control unit changes this parameter to "No".

ID	Parameter	CL	Setting range [Default]	Description
				Notes When using a specific code level in parameter 2567 ➪ p. 498 to reset maintenance days this parameter can be blocked.
				Notes HMI - menu path: *"Next page ➔ Configure counters ➔ (symbol: wrench)"*
2567	**Code level for reset maint.**	2		This parameter determines the required code level for resetting the counter "Maintenance call in...". User with a lower code level may not access this function. The following code levels exist:
			0	Operator
			1	Service level
			[2]	Temporary commissioner
			3	Commissioner
				Notes The code level defined here only affects the access via the front panel (HMI).
15154	**Operation hours source**	2		This parameter configures the source for the operation hours.
			[Internal]	The operation hours are counted internal from the easYgen
			ECU/J1939	The operation hours are assumed from the connected ECU (via J1939 CAN protocol).
2509	**Operation hours preset**	0	0 to 999,999.99 **[0]**	When setting the operating hours counter (refer to parameter 2574 ➪ p. 498), the counter always will be set up to the value configured here.
2574	**Operation hours set**	0[1]	Yes	The current value of this counter is overwritten with the value configured in "Operation hours preset" (parameter 2509 ➪ p. 498). After the counter has been (re)set, this parameter changes back to "No" automatically.
			[No]	The value of this counter is not changed.
				Notes [1] The code level can be configured with "Codelevel set operation hours" (parameter 2573 ➪ p. 498). If your current code level does not match, this parameter is not visible.
2573	**Code level set operation hours**	5	0 to 5 **[2]**	This parameter defines which codelevel is necessary to set the operation hours (parameter 2574 ➪ p. 498).
2515	**Period of use preset**	2	0 to 999,999.99 **[0]**	When setting the period of use hours counter (refer to parameter 2579 ➪ p. 498), the counter always will be set up to the value configured here.
2579	**Period of use set**	0[1]	Yes	The current value of this counter is overwritten with the value configured in "Period of use preset" (parameter 2515 ➪ p. 498). After the counter has been (re)set, this parameter changes back to "No" automatically.
			[No]	The value of this counter is not changed.
				Notes [1] The code level can be configured with "Code level f. set period of use" (parameter 2581 ➪ p. 498). If your current code level does not match, this parameter is not visible.
2581	**Code level f. set period of use**	5	0 to 5 **[2]**	This parameter defines which codelevel is necessary to set the period of use hours (parameter 2579 ➪ p. 498).

5 Operation

In operation the genset controller can be manually or remote controlled.

Front panel access is described in chapter ➪ *Chapter 4.1 "Front Panel Access" on page 94*.

Access via ToolKit is described in chapter ➪ *Chapter 4.2.6 "View And Set Values In ToolKit" on page 129*.

Access via Remote Panel PR-3000XT is described in chapter and the Technical Manual *"37593 RP-3000XT"*.

Access via PLC depends on the interface and the data telegram used for communication.

For menu structure/menu tree see ➪ "Menu structure (menu tree)" on page 92.

5.1 Power ON

Behavior during starting easYgen-3000XT

The start-up procedure of the easYgen-XT device can be caused by the following reasons:

- Power ON
- Power cycling e.g. by 1701 ➪ p. 159 *" Set factory default values"*
- Power is back after voltage drop

This process is visualized by the HMI of the plastic housing version or the LEDs of the metal housing version.

Using the USB Service Port

With power ON and a PC/laptop connected via USB service port it can happen that the USB window that pops up doesn't show all files and/or the correct available free memory at the device: Please unplug/plug the USB connection after the easYgen finished starting.

With power ON and connected USB service port it can happen that a connected USB device is not detected correctly: Please unplug/plug the USB connection after the easYgen finished starting.

With power cycle of the easYgen-XT the USB connection is lost: Please unplug/plug and/or start USB connection again after the easYgen finished starting.

... starting plastic housing (HMI) version

Power ON from zero power

- Buttons are illuminated
- Start-up screen appears
  - the red bar at the bottom monitors the degree of fulfillment
- HOME screen appears with measured values and state information
  - Illumination of buttons is disabled according to the default settings STOP button still might be illuminated
  - WARNING triangle is blinking if there are unacknowledged alarm messages

Power cycling

- Warning LED is twinkling in a high frequency
- (afterwards the standard process of Power ON is executed:)
- Buttons are illuminated
- Start-up screen appears
  - the red bar at the bottom monitors the degree of fulfillment
- HOME screen appears with the same measured values and state information as before power cycling

... starting metal housing version

Power ON from zero power

- LEDs are twinkling
- LEDs are illuminated according to the state of the genset control

Power cycling

- Warning LED is twinkling in a high frequency
- (afterwards the standard process of Power ON is executed:)
- LEDs are twinkling
- LEDs are illuminated according to the state of the genset control

5.2 Change Operating Modes

Startup

The genset controls starts in the operating mode defined by parameter 1795 *[Startup in mode]*. Refer to ⇘ *Chapter 4.4.5 “Configure Operation Modes” on page 288* for details.

Select Operation Mode

Operation modes can be selected via

- front panel buttons (plastic housing variant or Remote Panel RP-3000XT or VNC client),
- HMI configuration (plastic housing variant or Remote Panel RP-3000XT or VNC client),
- remote settings via interfaces, or
- ToolKit

The following chapters describe the manually front panel access.

5.2.1 Operating Mode STOP

Usage

Use the STOP button to activate operating mode STOP.

Observe the notes on the system's reaction upon activation of operating mode STOP as listed below.

⇨ STOP LED is illuminated at the front panel; ToolKit home page shows STOP icon left beside the prime mover.

System reaction

In operating mode STOP neither the engine nor the GCB can be operated. Dependent on the application mode the power circuit breakers cannot be operated.

CAUTION!

Hazards due to improper use of operating mode STOP

Selecting the operating mode STOP is not the same as an EMERGENCY STOP.

In some cases the easYgen will perform additional logic functions, such as an engine cool down period, before the engine is stopped.

– For emergency stop functionality use an EMERGENCY STOP discrete input, programmed as an F class alarm.

If the operating mode STOP is selected while the engine was already stopped the following applies:

- The GCB will not be closed.
- The fuel solenoid relay will not be enabled.
- The start request is ignored.
- The start push buttons (softkeys) are disabled.
- The engine/generator monitoring remains activated (exception: all monitoring that is delayed by the engine speed).

If the operating mode STOP is selected while the engine was running the following applies:

- Dependent on the current application mode a soft shut down will be executed.
- Pressing the STOP button again opens the GCB.
- If the STOP button is pressed again, the cool down will be interrupted.

If the operating mode STOP is selected while the engine performs a cool down the following applies:

- Pressing the STOP button again causes an immediate stop of the cool down and stops the engine.

If the conditions of the LogicsManager function "Enable MCB" (parameter 12923 ⇘ p. 232/ ⇘ p. 929) are TRUE, the MCB will be closed again if it is open in STOP operating mode.

5.2.2 Operating Mode MANUAL

General usage

In the MANUAL operating mode (mode button *"MAN"* illuminated) both the engine circuit breaker and the power circuit breaker can be operated via the push buttons along the bottom of the display (softkeys). Additionally the Start(**I**)/Stop(O) buttons can be used to start or stop the engine.

Fig. 209: XT_MAN-buttons

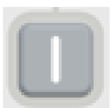
1 Mode button: MAN
2 START button: Engine
3 STOP button: Engine
4 .. 6 Soft buttons: Breaker OPEN/CLOSE

- Use the mode button *"MAN"* to activate operating mode MANUAL.
  - ⇨ The MAN button is illuminated

> **NOTICE!**
> The breakers will open immediately without power reduction.
>
> To open the breaker in a no-load condition, reduce the load manually in the setpoints screen (*Chapter 4.1.5 "Specialized Menu Screens" on page 103*).

Example for application mode A01

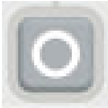
To start the engine:



- Press the button *[I]* below the MAN button.
  - ⇨ Success: The engine starts and the circular arrow and the eye symbol appear.

    Failure: No change in the display until the "start failure" message appears.

To stop the engine:

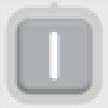
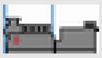
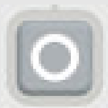
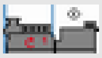
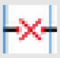
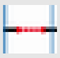
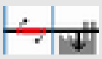
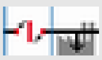
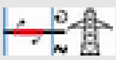


➜ Press the button *[0]* right below the MAN button.

⇨ Success: The engine stops and the circular arrow and the eye symbol disappear.

Failure: No change in the display until the "stop failure" message appears.

Overview

Function/ Status	Symbol	Available in application mode										
		A01	A02	A03	A04	A05	A06	A07	A08	A09	A10	A11
Start/running engine	 / 	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Stop/stand still engine	 / 	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Breaker open command is issued or a closure of the breaker is blocked			✓									
No defined breaker state			✓									
Open the GCB				✓	✓	✓	✓	✓	✓	✓	✓	✓
Close the GCB				✓	✓	✓	✓	✓	✓	✓	✓	✓
Open the GGB[1]						✓	✓			✓	✓	✓
Close the GGB[1]						✓	✓			✓	✓	✓
Open the MCB					✓		✓		✓	✓		✓
Close the MCB					✓		✓		✓	✓		✓

[1] The GGB can not be operated via softkey.

Symbol	Description
	Generator or mains rotating field moves clockwise.
	Generator or mains rotating field moves counter-clockwise.
	Power is detected at the respective measuring point (generator, busbar, or mains).
	Indicates that the engine delayed monitoring has expired and the monitoring functions are enabled.
	Power is imported (at mains interchange).
	Power is exported (at mains interchange).

Table 113: Status symbols

5.2.3 Operating Mode AUTOMATIC

General usage

In the AUTOMATIC operating mode (*"AUTO"*), all engine, GCB, and/or MCB functions are operated via an interface, or automatically by the control unit (i.e. a mains failure).

> *The function of the easYgen depends on the configuration of the unit and how the external signals are used.*

→ Use the button *[AUTO]* to activate operating mode AUTOMATIC.

⇨ If mode change was successful the button *[AUTO]* is illuminated.

> *For a more detailed description of the start/stop sequence of the engine and the associated parameters refer to ✎ Chapter 4.4.5.2 "Operation Mode AUTO - Automatic Run" on page 289.*
>
> *The main functions are briefly described in the following sections.*

Start engine

The engine is started via a remote start signal.

Prerequisites:

- The AUTOMATIC operating mode is enabled.
- The start request is enabled by the LogicsManager "Start req. in AUTO".
- No shut down alarm is present. (for explanation of the alarm classes refer to ✎ *Chapter 9.5.1 "Alarm Classes" on page 965*).
- The engine is ready for operation.
- The GCB is open.

Auto mains failure operation (AMF)

Auto mains failure operation is available in application mode A04, A06, A07, A08, A09 *and* A11.

If the AUTOMATIC operating mode is enabled and the mains fail, the engine and the power circuit breakers will be operated according to the current application mode.

Prerequisites:

- The AUTOMATIC operating mode is enabled.
- The parameter "Emergency power" is configured to "On".
- The configured mains failure limits are reached.
- The configured delay times have expired.
- No shut down alarm is present. (for explanation of the alarm classes refer to ↬ *Chapter 9.5.1 "Alarm Classes" on page 965*).
- The engine is ready for operation.

5.2.4 Operating Mode TEST

General usage

The operating mode (*"TEST"*) usually is a temporary operating mode. The idea is to test the genset.

TEST operating mode always starts the engine, when changing into this mode independent on an AUTOMATIC start order. Additionally the TEST operating mode supports the emergency and critical run as well (if a mains failure occurs during the test run). The operating mode TEST supports different sub modes so the operator can choose if the breakers shall be closed during test run or whether the operating mode is changed after the test run.

The function of the easYgen depends on the configuration of the unit and how the external signals are used.

Use the button *[TEST]* to activate operating mode TEST.

⇨ If mode change was successful the button *[TEST]* is illuminated.

The illumination of the button becomes twinkling a short time before TEST run is over.

For a more detailed description of the start/stop sequence of the engine and the associated parameters refer to ↬ Chapter 4.4.5.3 "Operation Mode TEST" on page 291.

The main functions are briefly described in the following sections.

5.3 Restore Language Setting via HMI, Buttons and Softkeys

In order to change the language setting via HMI, press the (soft)keys in the following order:

Language parameter is on code level "0", so the instruction will work with each code level.

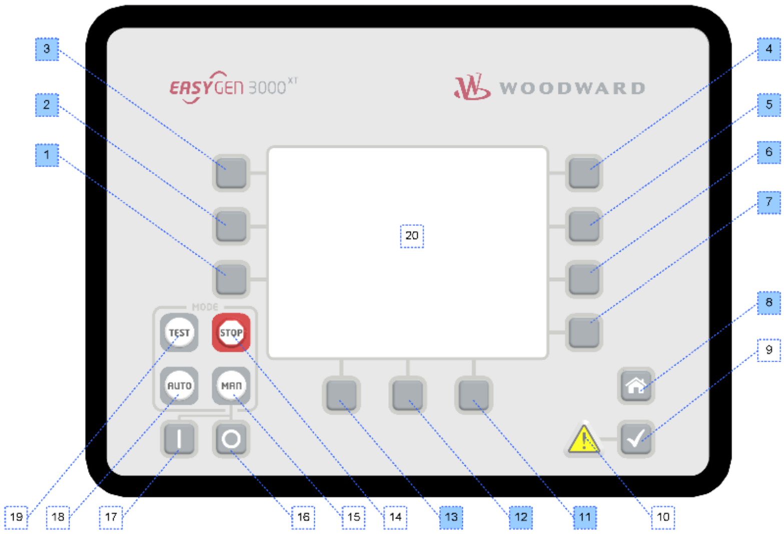


Fig. 210: Front panel and display

1. Press button *[HOME]* once to return to the start screen
2. Press softkey *[6]* once to access the "Parameter" screen
3. Press softkey *[3]* once to access the "Configure language / clock" screen
4. Press softkey *[7]* once to edit the language setting
5. Press softkeys *[11]* or *[12]* to select the desired language.
6. Press softkey *[7]* once to commit the language setting.

⇨ The desired display language is restored.

6 Application Field

Device status

The following applications are described for devices with status "factory settings". This is mandatory because parameters not changed during sample setup may have influence to the devices' behavior!

Live test requirement

If you want to use the same setup as described with the sample, please ensure factory settings status of the device before changing it.

Otherwise you have to take care that the changes you did before do not "disturb" sample settings!

Application Modes

For application modes overview see chapter *↳ Chapter 2.2 "Application Modes Overview" on page 35.*

6.1 Basic Applications

6.1.1 Application Mode A01 (None)

This application mode (A01) may be used, where the breaker control is done external. In this case, the easYgen will function as an engine control with generator and engine protection. The control does not operate any breaker. Emergency mode (AMF operation) is not supported in this application mode.

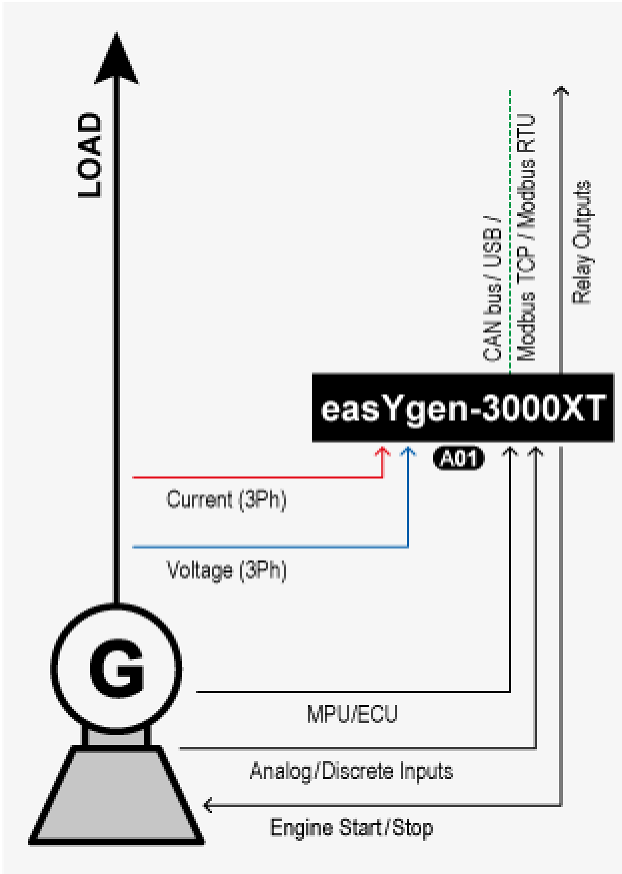


Fig. 211: Application mode A01 (schematic)

> *The easYgen requires the feedback reply from GCB and MCB in this application mode. These replies are used to define, whether the easYgen controls frequency, shares the load with other gen-sets or performs active load control.*

The following feedback signals are used in this application mode and fixed to the respective discrete inputs:

- DI 7 "Reply MCB" (mains parallel)
- DI 8 "Reply GCB" (normally closed (break) contact)

> *If the easYgen is intended to be operated in parallel with the mains, the mains voltage measuring inputs must be connected.*
>
> *If an external mains decoupling is performed, jumpers between busbar and mains voltage measuring inputs may be installed.*

Engine operation in AUTOMATIC (basic function)

Engine starts, if

- The LogicsManager "Start req. in AUTO" is fulfilled (TRUE) AND
- A shut down alarm is not present AND
- The engine is ready for operation

Engine stops, if

- The reply GCB is open AND the LogicsManager "Start req. in AUTO" is not fulfilled (FALSE) OR
- A shut down alarm occurs

Being parallel to mains or to other generator, the generator power will be reduced before.

> *Refer to* *Chapter 4.4.5.2 "Operation Mode AUTO - Automatic Run" on page 289 for details.*

6.1.2 Application Mode A02 (GCB open)

This application mode (A02) may be used for islanded operation applications.

In this case, the easYgen will function as an engine control with generator and engine protection. The control unit can only open the GCB. Emergency mode (AMF operation) is not supported in this application mode.

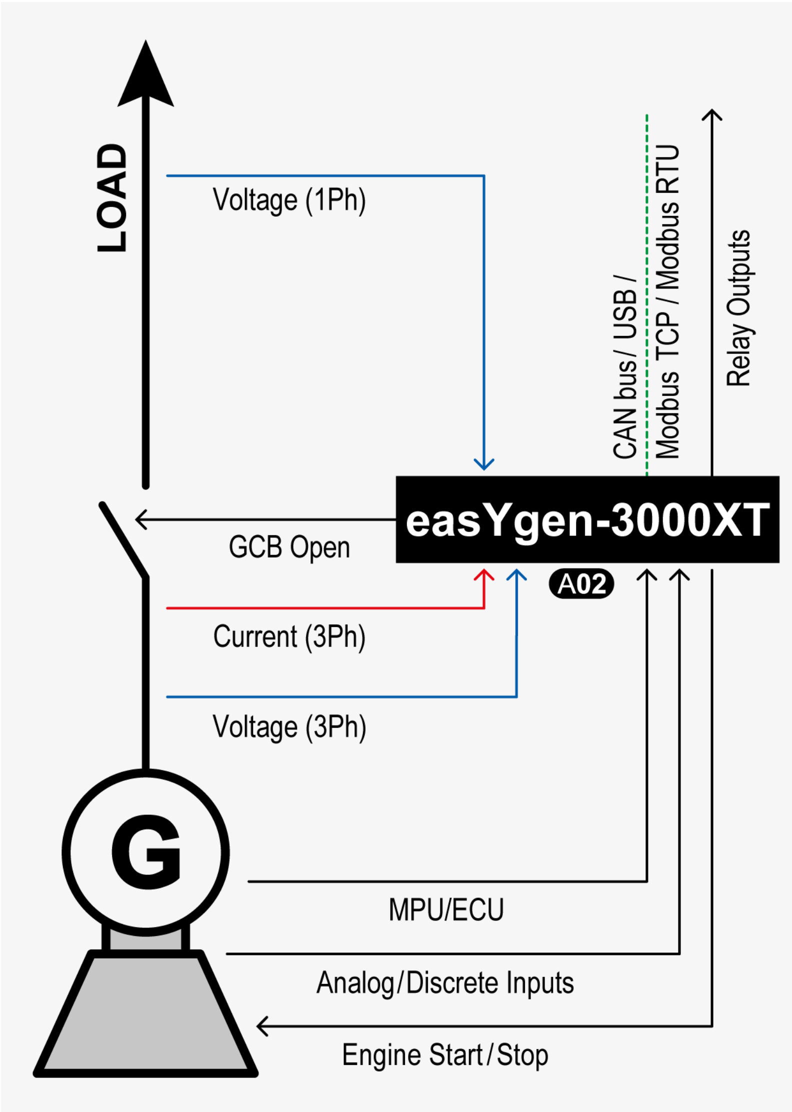


Fig. 212: Application mode A02 (schematic)

The easYgen requires the feedback reply from GCB and MCB in this application mode. These replies are used to define, whether the easYgen controls frequency, shares the load with other gensets or performs active load control.

The following feedback signals and commands are used in this application mode and fixed to the respective discrete inputs and outputs:

- DI 7 "Reply MCB" (mains parallel)
- DI 8 "Reply GCB" (normally closed (break) contact)
- DO 7 "Command: GCB open"

If the easYgen is intended to be operated in parallel with the mains, the mains voltage measuring inputs must be connected.

If an external mains decoupling is performed, jumpers between busbar and mains voltage measuring inputs may be installed.

Engine operation in AUTOMATIC (basic function)

Engine starts, if

- The LogicsManager "Start req. in AUTO" is fulfilled (TRUE) AND
- A shut down alarm is not present AND
- The engine is ready for operation

With successful start the GCB closure is released.

Engine stops, if

- The reply GCB is open AND the LogicsManager "Start req. in AUTO" is not fulfilled (FALSE) OR
- A shut down alarm occurs

Being parallel to mains or to other generator, the generator power will be reduced before.

Refer to ↬ Chapter 4.4.5.2 "Operation Mode AUTO - Automatic Run" on page 289 for details.

6.1.3 Application Mode A03 (GCB)

This application mode (A03) may be used in applications, where only the GCB is operated by the easYgen.

If it is used for islanded or mains parallel operations, mains decoupling should be performed by the GCB or an external provision.

The easYgen will function as an engine control with generator and engine protection. The control unit can open and close the GCB. Emergency mode (AMF operation) is not supported in this application mode.

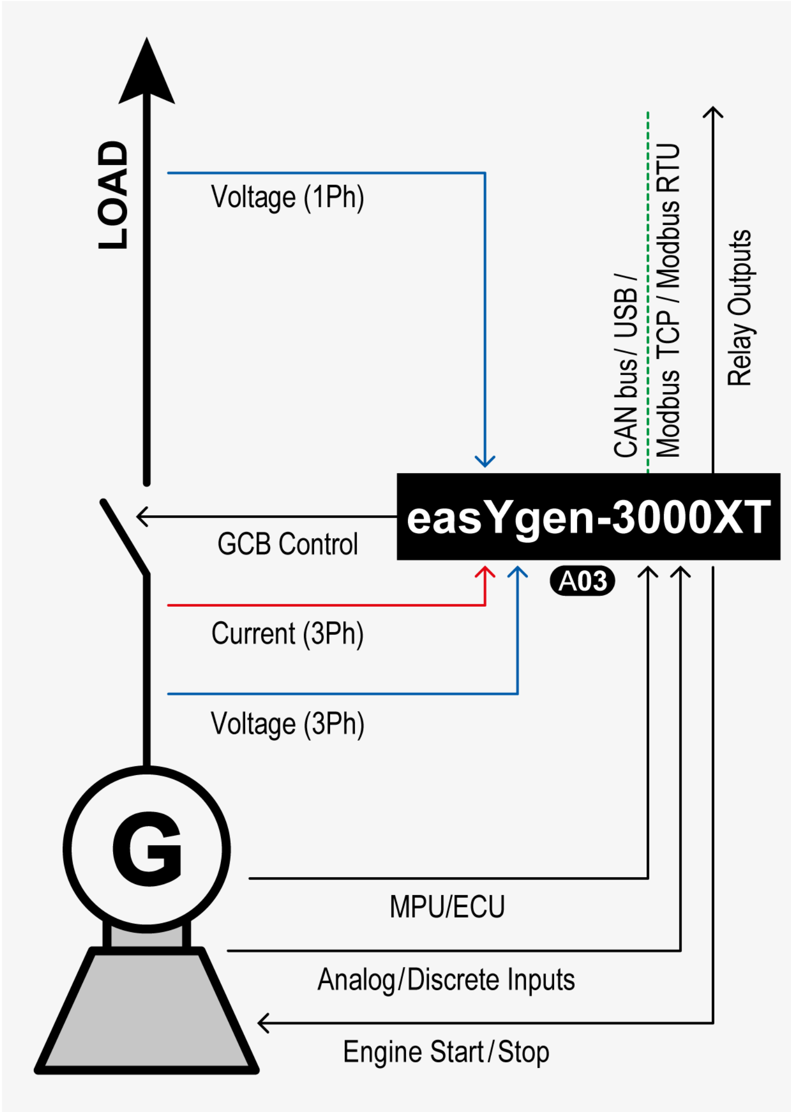


Fig. 213: Application mode A03 (schematic)

The easYgen requires the feedback reply from GCB and MCB in this application mode. These replies are used to define, whether the easYgen controls frequency, shares the load with other gen-sets or performs active load control.

The following feedback signals and commands are used in this application mode and fixed to the respective discrete inputs and outputs:

- DI 7 "Reply MCB" (mains parallel)
- DI 8 "Reply GCB" (normally closed (break) contact)
- DO 6 "Command: GCB close"
- DO 7 "Command: GCB open" (optionally)

If the easYgen is intended to be operated in parallel with the mains, the mains voltage measuring inputs must be connected.

If an external mains decoupling is performed, jumpers between busbar and mains voltage measuring inputs may be installed.

Engine operation in AUTOMATIC (basic function)

Engine starts, if

- The LogicsManager "Start req. in AUTO" is fulfilled (TRUE) AND
- A shut down alarm is not present AND
- The engine is ready for operation

With successful start the GCB closure is executed.

- If the voltage of generator and generator busbar is in range, the GCB will be synchronized

If the voltage of generator is in range, and the ***generator busbar*** *is dead, and no other GCB is closed,* ***and the MCB is closed*** *the GCB will* ***not*** *be closed but an "operating range failure" occurs.*

Engine stops, if

- The LogicsManager "Start req. in AUTO" is not fulfilled (FALSE) OR
- A shut down alarm occurs

Being parallel to mains or to other generator, the generator power will be reduced, before the GCB will be opened.

Refer to ↳ Chapter 4.4.5.2 "Operation Mode AUTO - Automatic Run" on page 289 for details.

6.1.4 Application Mode A04 (GCB/MCB)

This application mode (A04) may be used for mains parallel operation. In this case, the easYgen will function as an engine control with generator, mains and engine protection.

The control unit can open and close the GCB and the MCB. The breaker transition modes "Open Transition", "Closed Transition", "Interchange" and "Parallel" are possible.

The Emergency mode (AMF operation) is supported in this application mode.

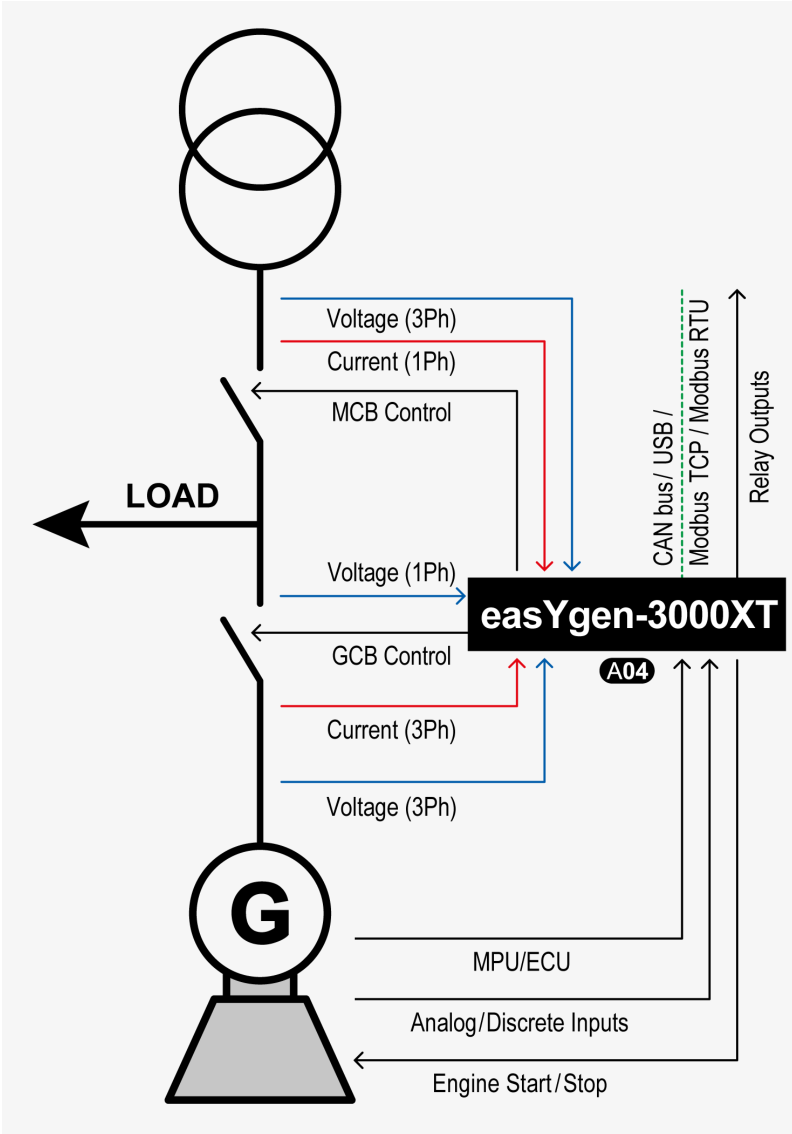


Fig. 214: Application mode A04 (schematic)

> *The easYgen requires the feedback reply from both circuit breakers in this application mode. These replies are used to define, whether the easYgen controls frequency, shares the load with other gensets or performs active load control.*

The following feedback signals and commands are used in this application mode and fixed to the respective discrete inputs and outputs:

- DI 7 "Reply MCB" (mains parallel)
- DI 8 "Reply GCB" (normally closed (break) contact)
- DO 6 "Command: GCB close"
- DO 7 "Command: GCB open" (optionally)
- DO 8 "Command: MCB close"
- DO 9 "Command: MCB open"

Engine operation in AUTOMATIC (basic function)

Engine starts, if

- The LogicsManager "Start req. in AUTO" is fulfilled (TRUE) AND
- A shut down alarm is not present AND
- The engine is ready for operation

According to the current active breaker transition mode the GCB and MCB will be operated.

Engine stops, if

- The LogicsManager "Start req. in AUTO" is not fulfilled (FALSE) OR
- A shut down alarm occurs

According to the current active breaker transition mode the GCB and MCB will be operated.

Refer to *Chapter 4.4.5.2 "Operation Mode AUTO - Automatic Run" on page 289* *for details.*

Auto mains failure operation (AMF) in AUTOMATIC (basic function)

Engine starts, if

- The configured mains failure limits are reached AND
- A shut down alarm is not present AND
- The engine is ready for operation

With successful start the MCB will be opened and the GCB will be closed.

Engine stops, if

- The mains values are back in range AND
- The mains settling time is expired

According to the current active breaker transition mode the GCB and MCB will be operated.

6.1.5 Application Mode A05 (GCB/GGB)

This application mode (A05) may be used in applications, where a common generator group breaker connects the generator busbar with the load. The GGB is closed, if a configured generator power is available. The GGB opens, if the last GCB is opened. The application can be an isolated operation or a parallel to mains operation.

In this case, the easYgen will function as an engine control with generator, mains and engine protection. The control unit can open and close the GCB and the GGB.

The Emergency mode (AMF operation) is not supported in this application.

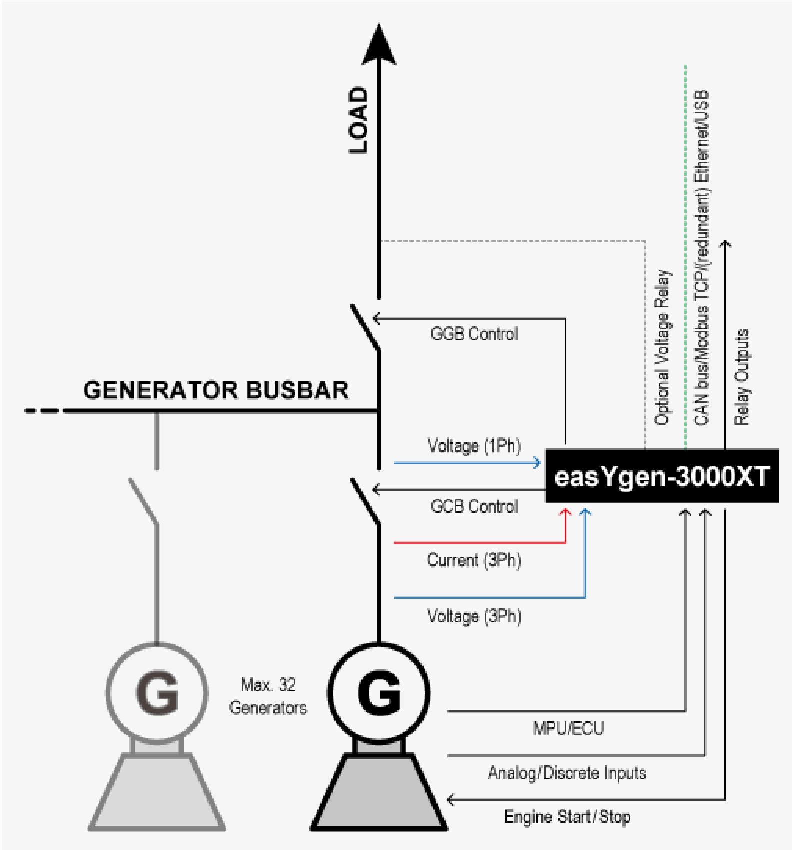


Fig. 215: Application mode A05 (schematic)

The easYgen requires the feedback reply from the GCB, GGB and MCB in this application mode. Load busbar connected to mains is signalized as "reply MCB". These replies are used to define, whether the easYgen controls frequency, shares the load with other gensets or performs active load control.

The following feedback signals and commands are used in this application mode and fixed to the respective discrete inputs and outputs:

- DI 7 "Reply MCB" (mains parallel)
- DI 8 "Reply GCB" (normally closed (break) contact)
- DO 6 "Command: GCB close"
- DO 7 "Command: GCB open"
- DO 10 "Command: GGB close"
- DO 11 "Command: GGB open"

Engine operation in AUTOMATIC (basic function)

Engine starts, if

- The LogicsManager "Start req. in AUTO" is fulfilled (TRUE) AND
- A shut down alarm is not present AND
- The engine is ready for operation

With successful start the GCB closure is executed.

- If the voltage of generator and generator busbar is in range, the GCB will be synchronized
- If the voltage of generator is in range and the **generator busbar** is dead and no other GCB is closed, the GCB will be closed

With configured generator power matched, the GGB closure is executed.

- If the voltage of generator and load busbar is in range the GGB will be synchronized
- If the voltage of generator is in range and the **load busbar** is dead, the GGB will be closed

Engine stops, if

- The LogicsManager "Start req. in AUTO" is not fulfilled (FALSE) OR
- A shut down alarm occurs

Being parallel to mains or to other generator, the own generator power will be reduced, before the GCB will be opened.

The GGB will be opened, if no GCB is closed anymore.

Refer to Chapter 4.4.5.2 “Operation Mode AUTO - Automatic Run” on page 289 for details.

6.1.6 Application Mode A06 (GCB/GGB/MCB)

This application mode (A06) may be used for mains parallel operation, where a common generator group breaker connects the generator busbar with the load. In this case, the easYgen will function as an engine control with generator, mains and engine protection.

The control unit can open and close the GCB, GGB and the MCB. The GGB is closed, if a configured generator power is available. The GGB opens, if the last GCB is opened. The breaker transition modes “Open Transition”, “Closed Transition”, “Interchange” and “Parallel” are possible.

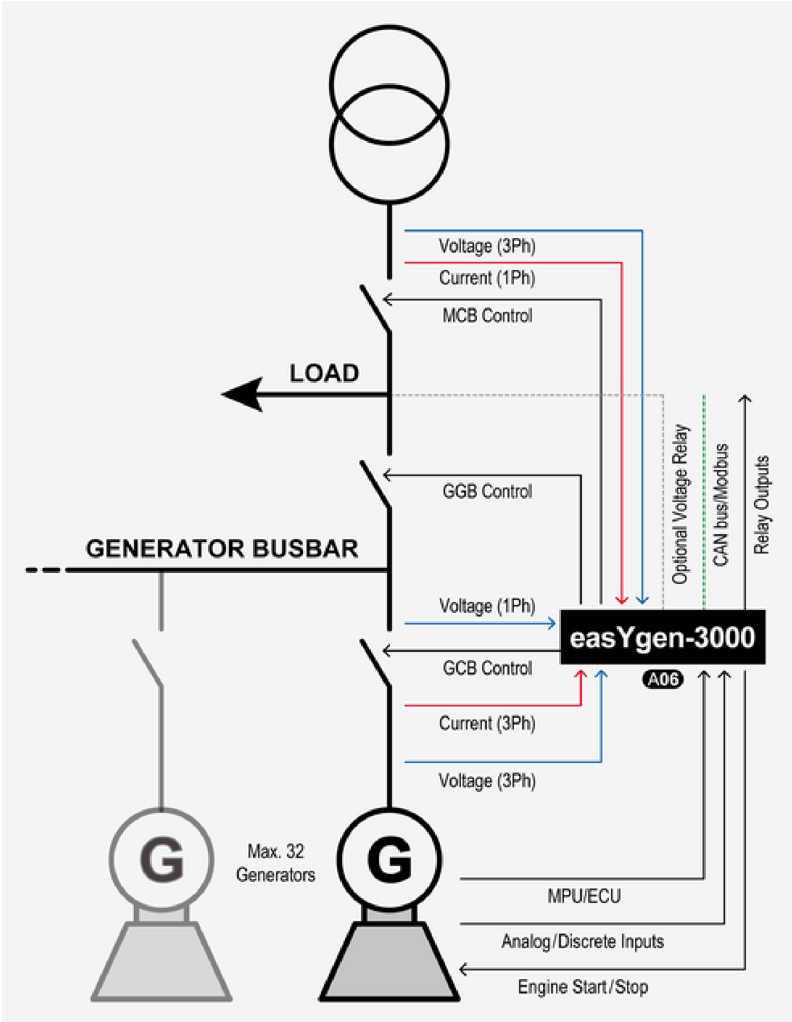


Fig. 216: Application mode A06 (schematic)

> *The easYgen requires the feedback reply from GCB, GGB and MCB in this application mode. These replies are used to define, whether the easYgen controls frequency, shares the load with other gensets or performs active load control.*

The following feedback signals and commands are used in this application mode and fixed to the respective discrete inputs and outputs:

- DI 7 "Reply MCB" (mains parallel)
- DI 8 "Reply GCB" (normally closed (break) contact)
- DI 9 "Reply GGB" (normally closed (break) contact)
- DO 6 "Command: GCB close"
- DO 7 "Command: GCB open" (optionally)
- DO 8 "Command: MCB close"
- DO 9 "Command: MCB open"
- DO 10 "Command: GGB close"
- DO 11 "Command: GGB open"

Engine operation in AUTOMATIC (basic function)

Engine starts, if

- The LogicsManager "Start req. in AUTO" is fulfilled (TRUE) AND
- A shut down alarm is not present AND
- The engine is ready for operation

With successful start the GCB closure is executed.

- If the voltage of generator and generator busbar is in range, the GCB will be synchronized
- If the voltage of generator is in range and the **generator busbar** is dead and no other GCB is closed, the GCB will be closed

With configured generator power matched, the GGB and MCB will be operated according to the current active breaker transition mode.

Engine stops, if

- The LogicsManager "Start req. in AUTO" is not fulfilled (FALSE) OR
- A shut down alarm occurs

If all units stopped to the same time, the load will be transferred back to mains according to the current active breaker transition mode.

Being parallel to mains or to other generator, the own generator power will be reduced, before the GCB will be opened.

The GGB will be opened, if no GCB is closed anymore.

Refer to ➪ Chapter 4.4.5.2 “Operation Mode AUTO - Automatic Run” on page 289 for details.

Auto mains failure operation (AMF) in AUTOMATIC (basic function)

Engine starts, if

- The configured mains failure limits are reached AND
- A shut down alarm is not present AND
- The engine is ready for operation

With successful start the GCB closure is executed.

- If the voltage of generator and generator busbar is in range, the GCB will be synchronized
- If the voltage of generator is in range and the **generator busbar** is dead, no other GCB is closed and the GGB is open, the GCB will be closed

With configured generator power matched, the GGB and MCB will be operated according to the current active breaker transition mode.

Engine stops, if

- The mains values are back in range AND
- The mains settling time is expired

The load will be transferred back to mains according to the current active breaker transition mode.

The GGB will be opened, if no GCB is closed anymore.

6.1.7 Application Mode A07 (GCB/LS5)

This application mode (A07) may be used in applications, where several breakers as incoming mains breaker, generator group breaker or tie breaker must be operated. In this case, the easYgen will function as an engine control with generator and engine protection.

The control unit can open and close the GCB. The CAN connected LS-5 system operates all other breakers in the system. The application can be an isolated operation or a parallel to mains operation. The LS-5 system runs independent on the easYgen (application mode “LS5”). The mains protection (mains decoupling) is executed by the LS-5 at the interchange point(s).

The Emergency mode (AMF operation) is supported and depends on configured segments which are monitored for “out of operating range”. The LS-5 at the interchange point can provide the easYgen with active power and reactive power measurement.

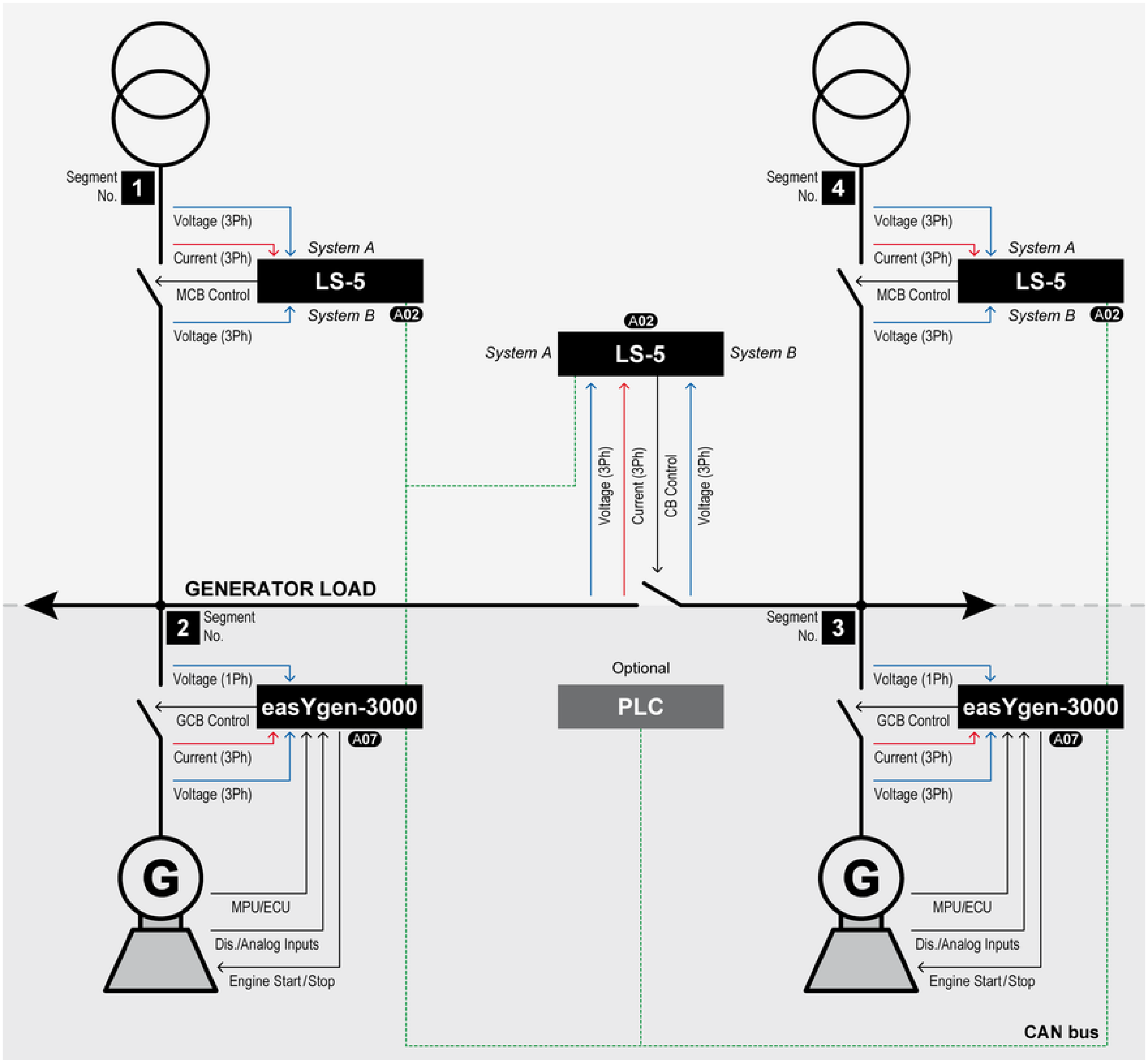


Fig. 217: Application mode A07 (schematic)

Please note that the measured power of all LS-5s in the same segment are accumulated if there a several mains interchange points. The import/ export control is based on this accumulated power. It is not possible to individually control the power at the single mains interchange points in the same segment.

The easYgen requires only the feedback reply from the GCB in this application mode. The other breaker replies are connected at the particular LS-5. The LS-5 system informs the easYgen so, that the easYgen can control frequency, share load with other gensets or perform active load control.

The following feedback signals and commands are used in this application mode and fixed to the respective discrete inputs and outputs:

- DI 8 "Reply GCB" (normally closed (break) contact)
- DO 6 "Command: GCB close"
- DO 7 "Command: GCB open" (optionally)

If a mains decoupling shall be executed via GCB, the mains measurement must be wired to the easYgen.

Refer to the LS-5 Manual 37527 for details on the easYgen/LS-5 system configuration.

Engine operation in AUTOMATIC (basic function)

Engine starts, if

- The LogicsManager "Start req. in AUTO" is fulfilled (TRUE) AND
- A shut down alarm is not present AND
- The engine is ready for operation

With successful start the GCB closure is executed.

- If the voltage of generator and generator busbar is in range, the GCB will be synchronized
- If the voltage of generator is in range and the **generator busbar** is dead and no other GCB is closed, the GCB will be closed

Engine stops, if

- The LogicsManager "Start req. in AUTO" is not fulfilled (FALSE) OR
- A shut down alarm occurs

Being parallel to mains or to other generator, the generator power will be reduced, before the GCB will be opened.

Refer to *Chapter 4.4.5.2 "Operation Mode AUTO - Automatic Run" on page 289* *for details.*

Auto mains failure operation (AMF) in AUTOMATIC (basic function)

Engine starts, if

- Minimum one configured segment is out of range AND
- A shut down alarm is not present AND
- The engine is ready for operation

With successful start the GCB closure is executed.[1]

- If the voltage of generator and generator busbar is in range, the GCB will be synchronized
- If the voltage of generator is in range and the **generator busbar** is dead, no other GCB is closed and the generator busbar is not connected to mains, the GCB will be closed

Engine stops, if

- The mains values are back in range AND
- The mains settling time is expired[2]

The generator power will be reduced, before the GCB will be opened.

[1] The LS-5 at the interchange point has to open the MCB, if the mains fail.

[2] The mains settling time runs in the LS-5 at the interchange point. The easYgen indicates a running mains settling time.

6.1.8 Application Mode A08 (GCB/L-MCB)

This application mode (A08) may be used for mains parallel operation. In this case, the easYgen will function as an engine control with generator and engine protection.

The control unit can open and close the GCB. The easYgen operates the MCB with a LS-5 unit, running in a slave mode (application mode "L-MCB"). The breaker transition modes "Open Transition", "Closed Transition", "Interchange" and "Parallel" are possible. The mains protection (mains decoupling) is executed by the LS-5.

The Emergency mode (AMF operation) is supported in this application mode. The LS-5 can provide the easYgen with active power and reactive power measurement.

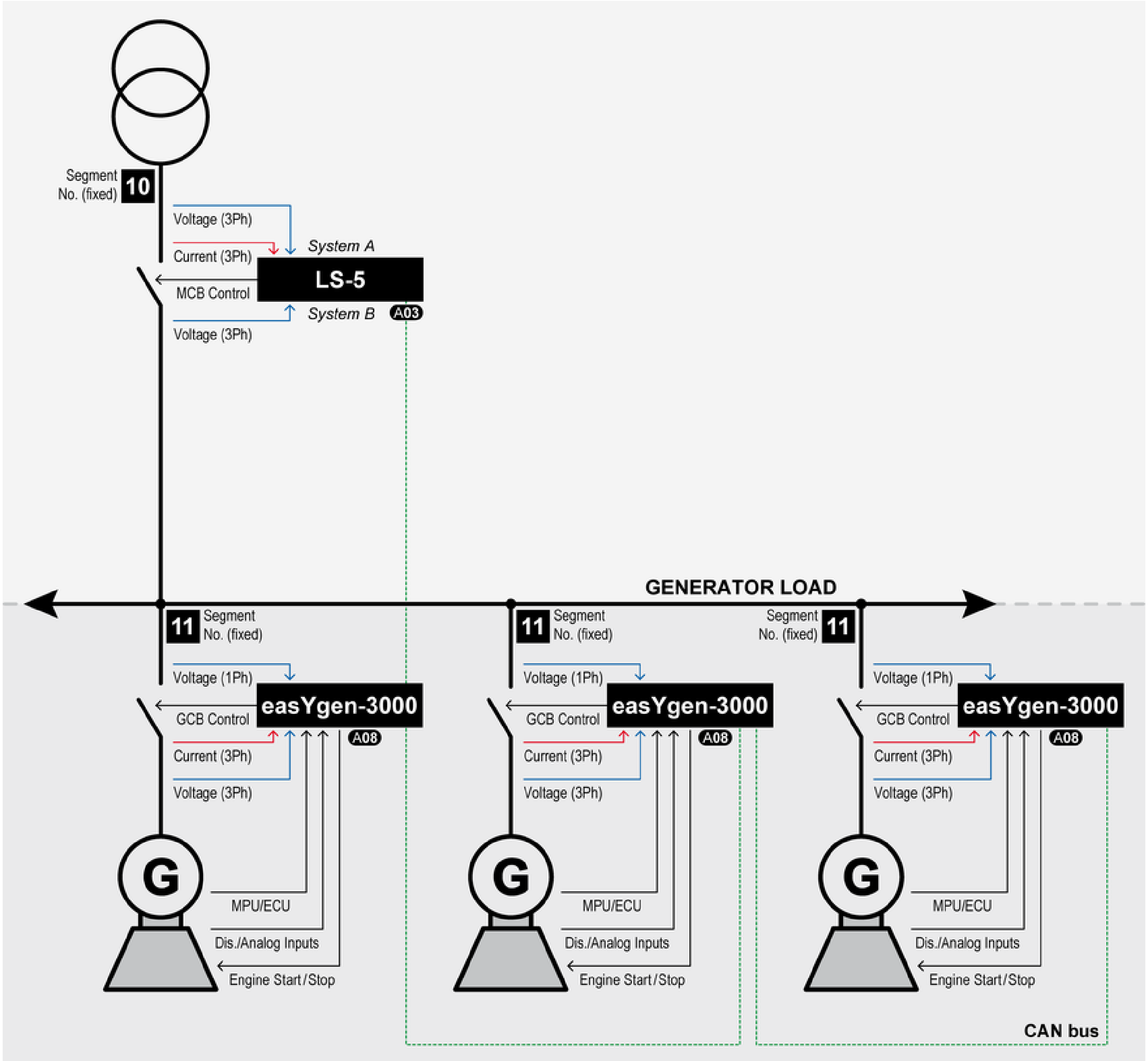


Fig. 218: Application mode A08 (schematic)

> *The easYgen requires only the feedback reply from the GCB in this application mode. The MCB feedback reply is connected at the LS-5. The LS-5 informs the easYgen so, that the easYgen(s) can control frequency, share load with other gensets or perform active load control.*

The following feedback signals and commands are used in this application mode and fixed to the respective discrete inputs and outputs:

- DI 8 "Reply GCB" (normally closed (break) contact)
- DO 6 "Command: GCB close"
- DO 7 "Command: GCB open" (optionally)

If a mains decoupling shall be executed via GCB, the mains measurement must be wired to the easYgen.

Refer to the LS-5 Manual 37527 for details on the easYgen/LS-5 system configuration.

Engine operation in AUTOMATIC (basic function)

Engine starts, if

- The LogicsManager "Start req. in AUTO" is fulfilled (TRUE) AND
- A shut down alarm is not present AND
- The engine is ready for operation

According to the current active breaker transition mode the GCB and MCB will be operated.[1]

Engine stops, if

- The LogicsManager "Start req. in AUTO" is not fulfilled (FALSE) OR
- A shut down alarm occurs

According to the current active breaker transition mode the GCB and MCB will be operated.

Refer to ➪ Chapter 4.4.5.2 "Operation Mode AUTO - Automatic Run" on page 289 for details.

Auto mains failure operation (AMF) in AUTOMATIC (basic function)

Engine starts, if

- The configured mains failure limits are reached AND[2]
- A shut down alarm is not present AND
- The engine is ready for operation

With successful start the MCB will be opened and the GCB will be closed.

Engine stops, if

- The mains values are back in range AND[2]
- The mains settling time is expired[3]

According to the current active breaker transition mode the GCB and MCB will be operated.

[1] The MCB is operated by the LS-5. The LS-5 itself must be free of any alarm class C and E.

[2] The mains failure limits are configured in the LS-5 (operating range system A).

[3] The mains settling time runs in the LS-5 at the interchange point. The easYgen indicates a running mains settling time.

6.1.9 Application Mode A09 (GCB/GGB/L-MCB)

This application mode (A09) may be used for mains parallel operation, where a common GGB shall be operated by the easYgen and a MCB shall be operated far away. In this case, the easYgen will function as an engine control with generator and engine protection.

The control unit can open and close the GCB and the GGB. The GGB is closed, if a configured generator power is available. The GGB opens, if the last GCB is opened. The breaker transition modes “Open Transition”, “Closed Transition”, “Interchange” and “Parallel” are possible. The easYgen operates the MCB with a LS-5 unit, running in a slave mode (application mode “L-MCB”). The mains protection (mains decoupling) is executed by the LS-5.

The Emergency mode (AMF operation) is supported in this application mode. The LS-5 can provide the easYgen(s) with active power and reactive power measurement.

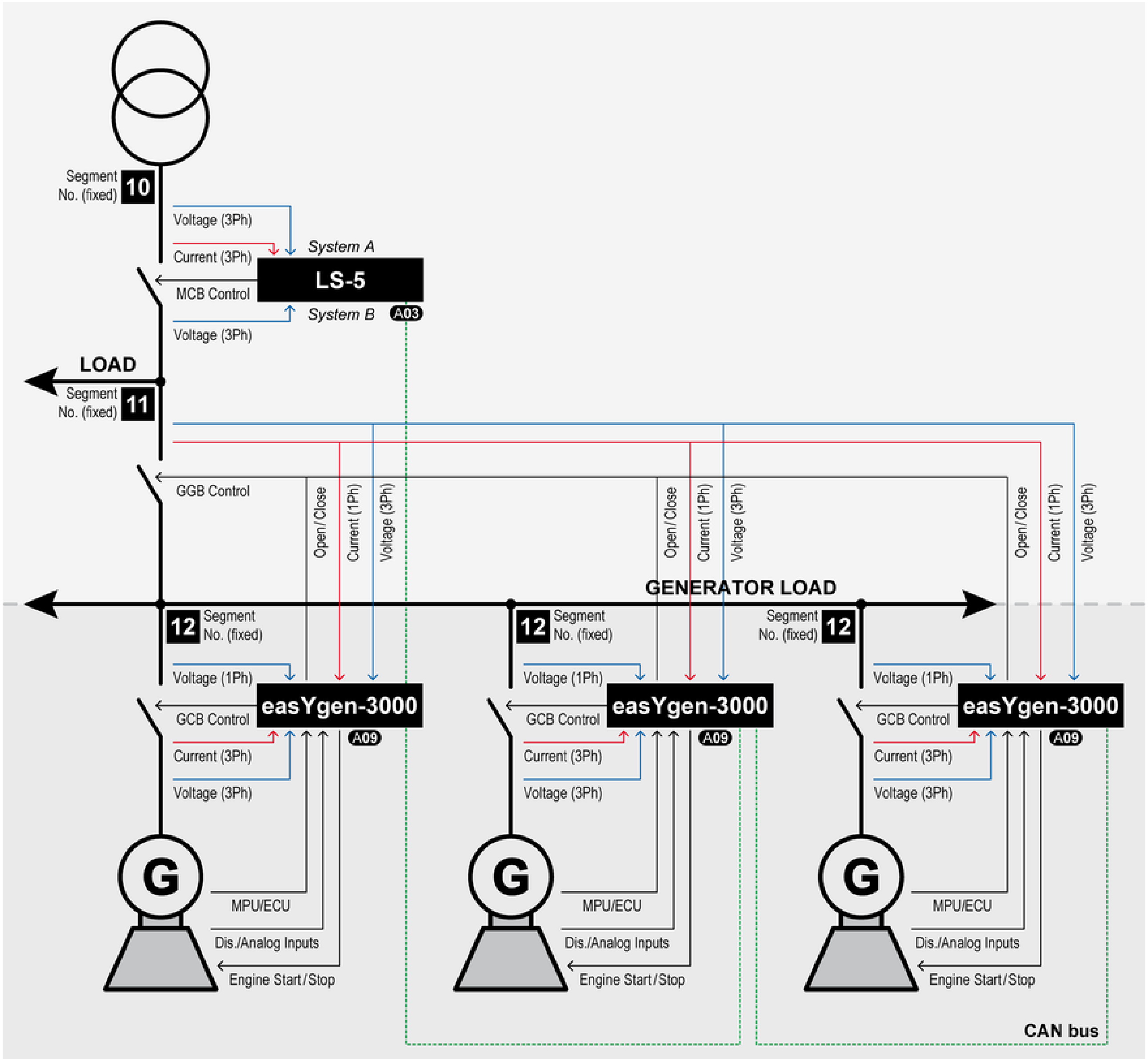


Fig. 219: Application mode A09 (schematic)

The easYgen requires the feedback reply from the GCB and GGB in this application mode. The MCB feedback reply is connected at the LS-5. The LS-5 informs the easYgen so, that the easYgen(s) can control frequency, share load with other gensets or perform active load control.

The following feedback signals and commands are used in this application mode and fixed to the respective discrete inputs and outputs:

- DI 8 "Reply GCB" (normally closed (break) contact)
- DI 9 "Reply GGB" (normally closed (break) contact)
- DO 6 "Command: GCB close"
- DO 7 "Command: GCB open" (optionally)
- DO 10 "Command: GGB close"
- DO 11 "Command: GGB open"

The easYgen uses in this application mode the mains voltage measuring to measure the load busbar voltage. All measured values shown as “mains” voltage are here in real the load busbar.

If a mains decoupling shall be executed via GCB, the mains measurement must be wired to the easYgen.

Refer to the LS-5 Manual 37527 for details on the easYgen/LS-5 system configuration.

Engine operation in AUTOMATIC (basic function)

Engine starts, if

- The LogicsManager "Start req. in AUTO" is fulfilled (TRUE) AND
- A shut down alarm is not present AND
- The engine is ready for operation

With successful start the GCB closure is executed.

- If the voltage of generator and generator busbar is in range, the GCB will be synchronized
- If the voltage of generator is in range and the **generator busbar** is dead, no other GCB is closed and the GGB is open, the GCB will be closed

With configured generator power matched, the GGB and MCB will be operated according to the current active breaker transition mode.[1]

Engine stops, if

- The LogicsManager "Start req. in AUTO" is not fulfilled (FALSE) OR
- A shut down alarm occurs

If all units stopped to the same time, the load will be transferred back to mains according to the current active breaker transition mode.

Being parallel to mains or to other generator, the own generator power will be reduced, before the GCB will be opened.

The GGB will be opened, if no GCB is closed anymore.

Refer to ➪ Chapter 4.4.5.2 "Operation Mode AUTO - Automatic Run" on page 289 for details.

Auto mains failure operation (AMF) in AUTOMATIC (basic function)

Engine starts, if

- The configured mains failure limits are reached AND[2]
- A shut down alarm is not present AND
- The engine is ready for operation

With successful start the GCB closure is executed.

- If the voltage of generator and generator busbar is in range, the GCB will be synchronized
- If the voltage of generator is in range and the **generator busbar** is dead, no other GCB is closed and the GGB is open, the GCB will be closed

With configured generator power matched, the GGB and MCB will be operated according to the current active breaker transition mode.

Engine stops, if

- The mains values are back in range AND[2]
- The mains settling time is expired[3]

The load will be transferred back to mains according to the current active breaker transition mode.

The GGB will be opened, if no GCB is closed anymore.

[1] The MCB is operated by the LS-5. The LS-5 itself must be free of any alarm class C and E.

[2] The mains failure limits are configured in the LS-5 (operating range system A).

[3] The mains settling time runs in the LS-5 at the interchange point. The easYgen indicates a running mains settling time.

6.1.10 Application Mode A10 (GCB/L-GGB)

This application mode (A10) may be used in applications, where a common generator group breaker connects the generator busbar with the load. In this case, the easYgen will function as an engine control with generator and engine protection.

The control unit can open and close the GCB. The easYgen operates the GGB with a LS-5 unit, running in a slave mode (application mode “L-GGB”). The GGB is closed, if a configured generator power is available. The GGB opens, if the last GCB is opened. The application must be an isolated operation.

The Emergency mode (AMF operation) is not supported in this application mode.

This application mode supports only single- or multiple generators, which run permanent in isolated operation.

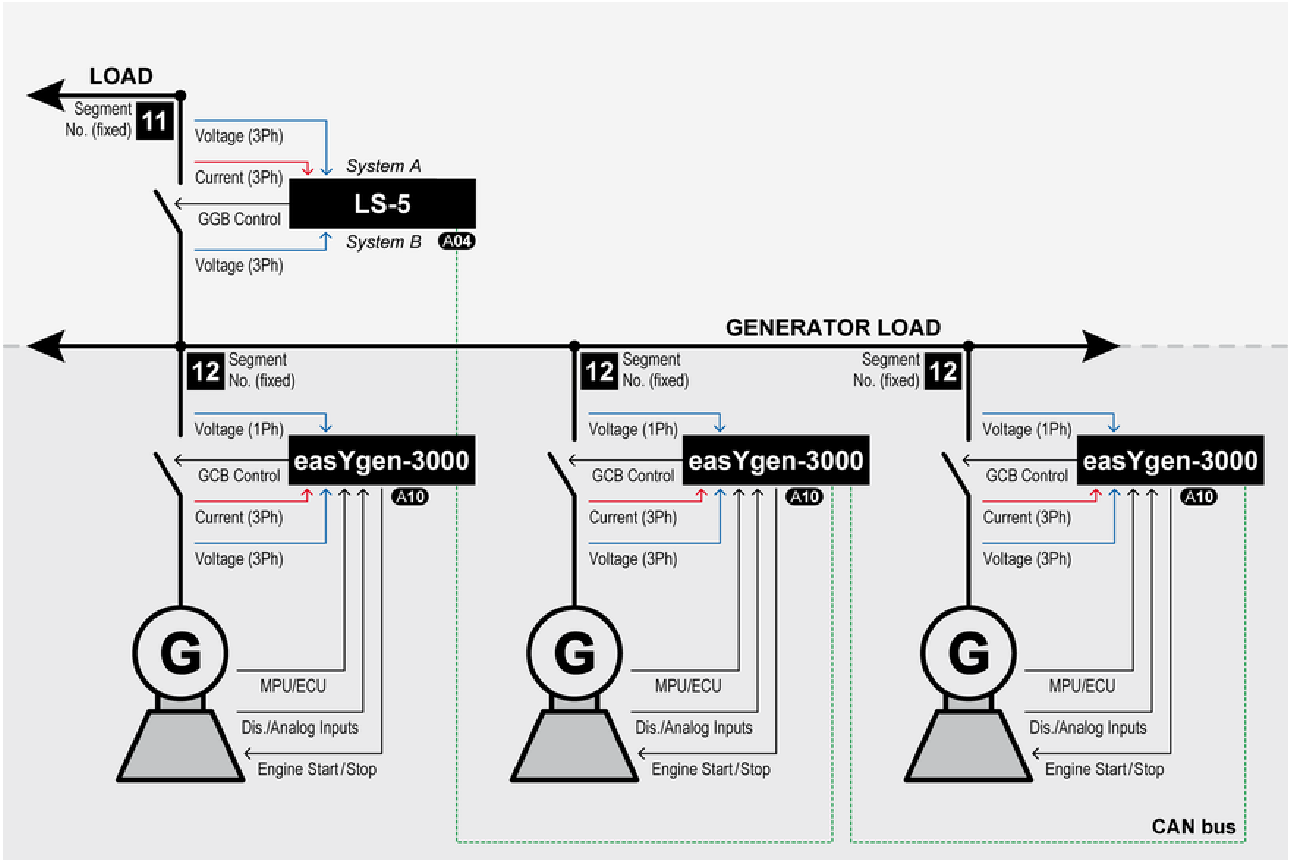


Fig. 220: Application mode A10 (schematic)

The easYgen requires the feedback reply of the GCB and GGB in this application mode. These replies are used to define, whether the easYgen controls frequency or shares the load.

The following feedback signals and commands are used in this application mode and fixed to the respective discrete inputs and outputs:

- DI 8 "Reply GCB" (normally closed (break) contact)
- DO 6 "Command: GCB close"
- DO 7 "Command: GCB open" (optionally)

> *Refer to the LS-5 Manual 37527 for details on the easYgen/LS-5 system configuration.*

Engine operation in AUTOMATIC (basic function)

Engine starts, if

- The LogicsManager "Start req. in AUTO" is fulfilled (TRUE) AND
- A shut down alarm is not present AND
- The engine is ready for operation

With successful start the GCB closure is executed.

- If the voltage of generator and generator busbar is in range, the GCB will be synchronized
- If the voltage of generator is in range and the **generator busbar** is dead and no other GCB is closed, the GCB will be closed

With configured generator power matched, the GGB closure is executed.

Engine stops, if

- The LogicsManager "Start req. in AUTO" is not fulfilled (FALSE) OR
- A shut down alarm occurs

Being parallel to mains or to other generator, the generator power will be reduced, before the GCB will be opened.

The GGB will be opened, if no GCB is closed anymore.

> *Refer to ✎ Chapter 4.4.5.2 “Operation Mode AUTO - Automatic Run” on page 289 for details.*

6.1.11 Application Mode A11 (GCB/L-GGB/L-MCB)

This application mode (A11) may be used for mains parallel operation, where a common GGB and a MCB shall be operated by LS-5. In this case, the easYgen will function as an engine control with generator and engine protection.

The control unit can open and close the GCB. The GGB is closed, if a configured generator power is available. The GGB opens, if the last GCB is opened. The breaker transition modes “Open Transition”, “Closed Transition”, “Interchange” and “Parallel” are possible. The easYgen operates the GGB with a LS-5 unit, running in a slave mode (application mode “L-GGB”). The easYgen operates the MCB with a LS-5 unit, running in a slave mode (application mode “L-MCB”). The mains protection (mains decoupling) is executed by the LS-5 of the MCB.

The Emergency mode (AMF operation) is supported in this application mode. The LS-5 of the MCB can provide the easYgen with active power and reactive power measurement.

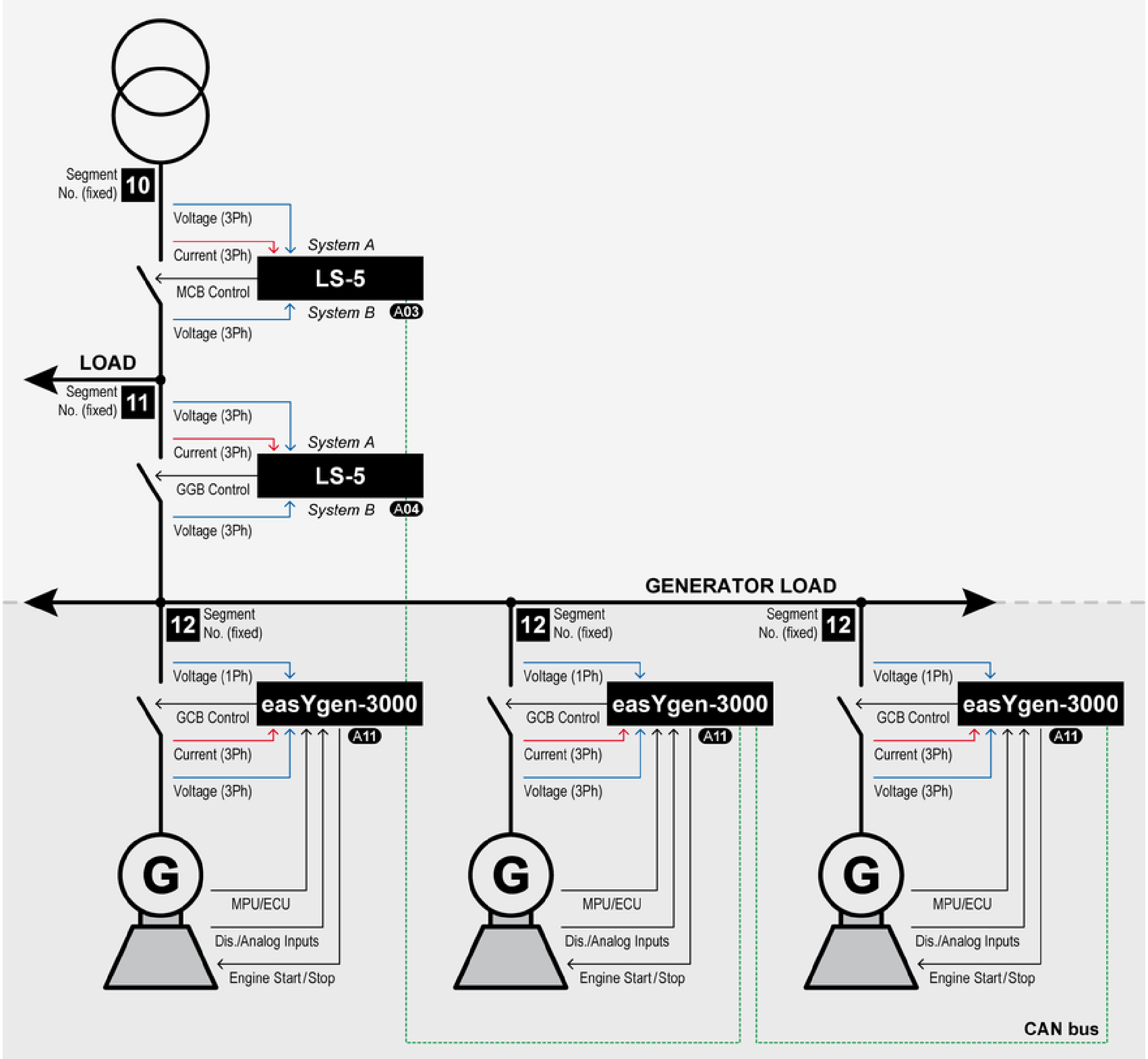


Fig. 221: Application mode A11 (schematic)

> *The easYgen requires the feedback reply of the GCB in this application mode. The GGB and MCB feedback replies are connected at the particular LS-5. The both LS-5 inform the easYgen so, that the unit can control frequency, share load with other gensets or perform active load control.*

The following feedback signals and commands are used in this application mode and fixed to the respective discrete inputs and outputs:

- DI 8 "Reply GCB" (normally closed (break) contact)
- DO 6 "Command: GCB close"
- DO 7 "Command: GCB open" (optionally)

If a mains decoupling shall be executed via GCB, the mains measurement must be wired to the easYgen.

Refer to the LS-5 Manual 37527 for details on the easYgen/LS-5 system configuration.

Engine operation in AUTOMATIC (basic function)

Engine starts, if

- The LogicsManager "Start req. in AUTO" is fulfilled (TRUE) AND
- A shut down alarm is not present AND
- The engine is ready for operation

With successful start the GCB closure is executed.

- If the voltage of generator and generator busbar is in range, the GCB will be synchronized
- If the voltage of generator is in range and the **generator busbar** is dead, no other GCB is closed and the GGB is open, the GCB will be closed

With configured generator power matched, the GGB and MCB will be operated according to the current active breaker transition mode.[1]

Engine stops, if

- The LogicsManager "Start req. in AUTO" is not fulfilled (FALSE) OR
- A shut down alarm occurs

If all units stopped to the same time, the load will be transferred back to mains according to the current active breaker transition mode.

Being parallel to mains or to other generator, the own generator power will be reduced, before the GCB will be opened.

The GGB will be opened, if no GCB is closed anymore.

Refer to ➪ Chapter 4.4.5.2 “Operation Mode AUTO - Automatic Run” on page 289 for details.

Auto mains failure operation (AMF) in AUTOMATIC (basic function)

Engine starts, if

- The configured mains failure limits are reached AND[2]
- A shut down alarm is not present AND
- The engine is ready for operation

With successful start the GCB closure is executed.

- If the voltage of generator and generator busbar is in range, the GCB will be synchronized
- If the voltage of generator is in range and the **generator busbar** is dead, no other GCB is closed and the GGB is open, the GCB will be closed

With configured generator power matched, the GGB and MCB will be operated according to the current active breaker transition mode.

Engine stops, if

- The mains values are back in range AND[2]
- The mains settling time is expired[3]

The load will be transferred back to mains according to the current active breaker transition mode.

The GGB will be opened, if no GCB is closed anymore.

[1] The GGB and MCB are operated by particular LS-5. Both LS-5 must be free of any alarm class C and E.

[2] The mains failure limits are configured in the LS-5 (operating range system A).

[3] The mains settling time runs in the LS-5 at the interchange point. The easYgen indicates a running mains settling time.

6.1.12 Application Mode A12 (GCB/L-GGBMCB)

This application mode (A12) may be used to operate the breakers GCB, GGB and MCB like in mode GCB/GGB/MCB (A08). But instead operating the GGB and MCB directly over relays the unit commands a single LS-5x2 (two breaker LS-5, series II) to operate the GGB and MCB. The LS-5x2 acts as slave for the easYgen in this mode.

These are dedicated modes for the easYgen-3500XT and the LS-5x2. The LS-5x2 is to configure on:

- "CBA/CBB"
  AND
- "L-GGBMCB" mode.

No other LS-5 is allowed to be installed in this application mode. The bus segmenting is fixed through the application mode. If other breakers are available (other GGBs, MCBs, or tie-breakers) refer to GCB/LS5 mode.

In comparison to the GCB/GGB/MCB mode:

- The customer can save wiring effort
- The export/import control can be provided with a 3-phase power measurement

Like in the GCB/GGB/MCB mode the GGB is closed, if a configured generator power is available on the busbar. The GGB opens, if the last GCB is opened. The breaker transition modes “Open Transition”, “Closed Transition”, “Interchange” and “Parallel” are possible. The mains protection (mains decoupling) is maintained by the LS-5x2. If a mains decoupling according to VDE-AR-N 4105 is required refer to chapter ↳ *Chapter 4.5.3.4.1 “Setup Grid Code AR-–4105” on page 365* for more insight.

The emergency mode (AMF operation) is also supported in this application mode. The LS-5x2 provides the easYgen-XT with active power and reactive power measurement. The online diagram of the easygen-XT shows the condition of the engine, the own GCB, the GGB, and the MCB.

As long as no mains decoupling for the GCB is required, the mains measurement of the easYgen-XT must not be wired. The feedback of the GGB and the MCB are detected by the LS-5 and the information is transferred to the easYgen-XT.

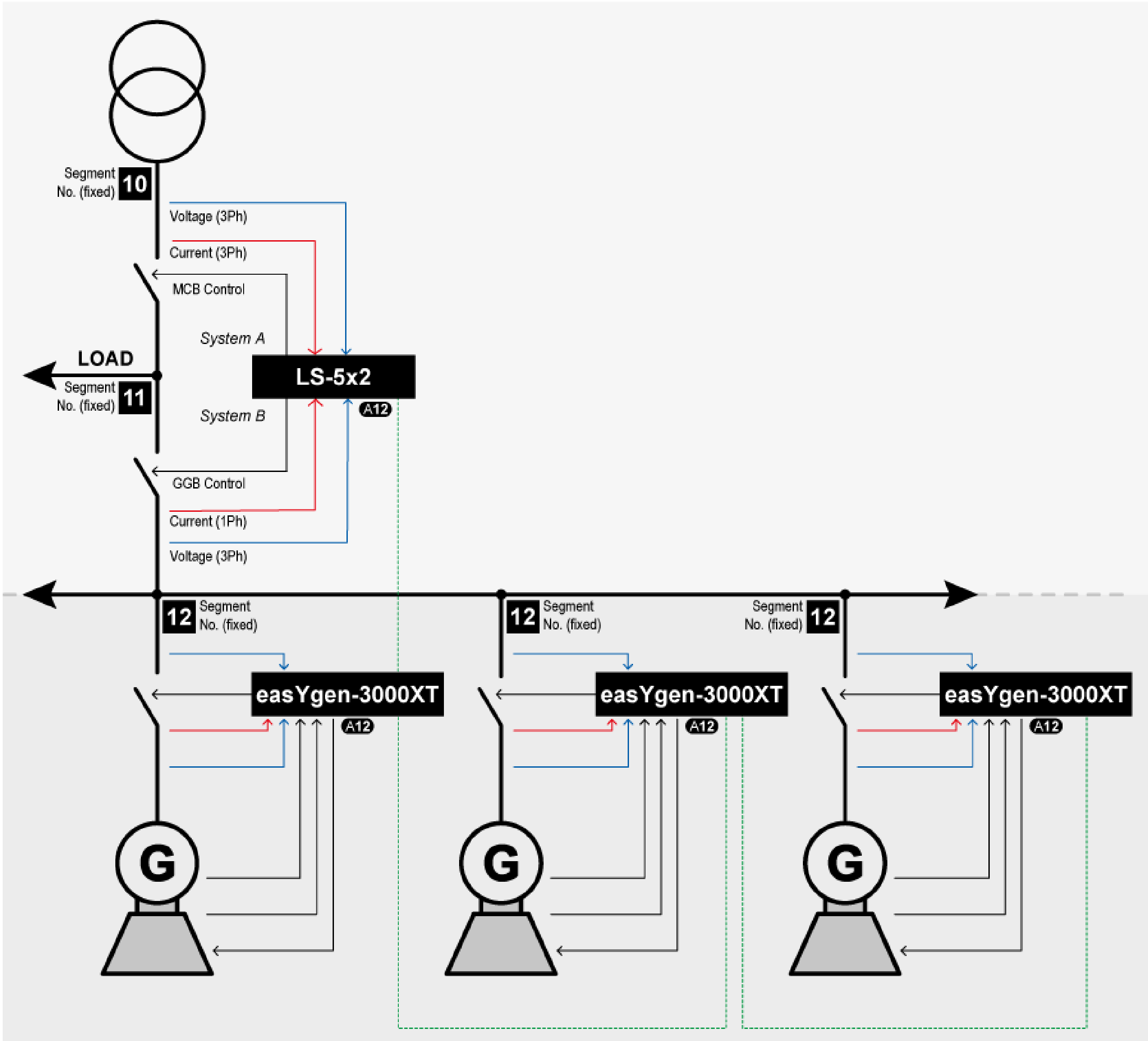


Fig. 222: Application mode A12 (schematic)

> *The easYgen requires the feedback reply of the GCB in this application mode. The GGB and MCB feedback replies are connected at the LS-5x2. The LS-5 informs the easYgen so, that the unit can control frequency, share load with other gensets or perform active load control.*

The following feedback signals and commands are used in this application mode and fixed to the respective discrete inputs and outputs:

- DI 8 "Reply GCB" (normally closed (break) contact)
- DO 6 "Command: GCB close"
- DO 7 "Command: GCB open" (optionally)

If a mains decoupling shall be executed via GCB, the mains measurement must be wired to the easYgen.

Refer to the LS-5 II-series Manual 37649/37650 for details on the easYgen/LS-5 system configuration.

Engine operation in AUTOMATIC (basic function)

Engine starts, if

- The LogicsManager "Start req. in AUTO" is fulfilled (TRUE) AND
- A shut down alarm is not present AND
- The engine is ready for operation

With successful start the GCB closure is executed.

- If the voltage of generator and generator busbar is in range, the GCB will be synchronized
- If the voltage of generator is in range and the **generator busbar** is dead, no other GCB is closed and the GGB is open, the GCB will be closed

With configured generator power matched, the GGB and MCB will be operated according to the current active breaker transition mode.[1]

Engine stops, if

- The LogicsManager "Start req. in AUTO" is not fulfilled (FALSE) OR
- A shut down alarm occurs

If all units stopped to the same time, the load will be transferred back to mains according to the current active breaker transition mode.

Being parallel to mains or to other generator, the own generator power will be reduced, before the GCB will be opened.

The GGB will be opened, if no GCB is closed anymore.

Refer to ↳ Chapter 4.4.5.2 "Operation Mode AUTO - Automatic Run" on page 289 for details.

Auto mains failure operation (AMF) in AUTOMATIC (basic function)

Engine starts, if

- The configured mains failure limits are reached
  AND[2]
- A shut down alarm is not present
  AND
- The engine is ready for operation

With successful start the GCB closure is executed.

- If the voltage of generator and generator busbar is in range, the GCB will be synchronized
- If the voltage of generator is in range and the **generator busbar** is dead, no other GCB is closed and the GGB is open, the GCB will be closed

With configured generator power matched, the GGB and MCB will be operated according to the current active breaker transition mode.

Engine stops, if

- The mains values are back in range
  AND[2]
- The mains settling time is expired[3]

The load will be transferred back to mains according to the current active breaker transition mode.

The GGB will be opened, if no GCB is closed anymore.

[1] The GGB and MCB are operated by particular LS-5. Both LS-5 must be free of any alarm class C and E.

[2] The mains failure limits are configured in the LS-5 (operating range system A).

[3] The mains settling time runs in the LS-5 at the interchange point. The easYgen indicates a running mains settling time.

6.2 Multiple Genset Applications

Overview

In a multiple-unit mains parallel application, all easYgens need the same signals for:

- Mains voltage and current
- Reply and release signal of the MCB

The open and close contacts from all controls must be wired in parallel.

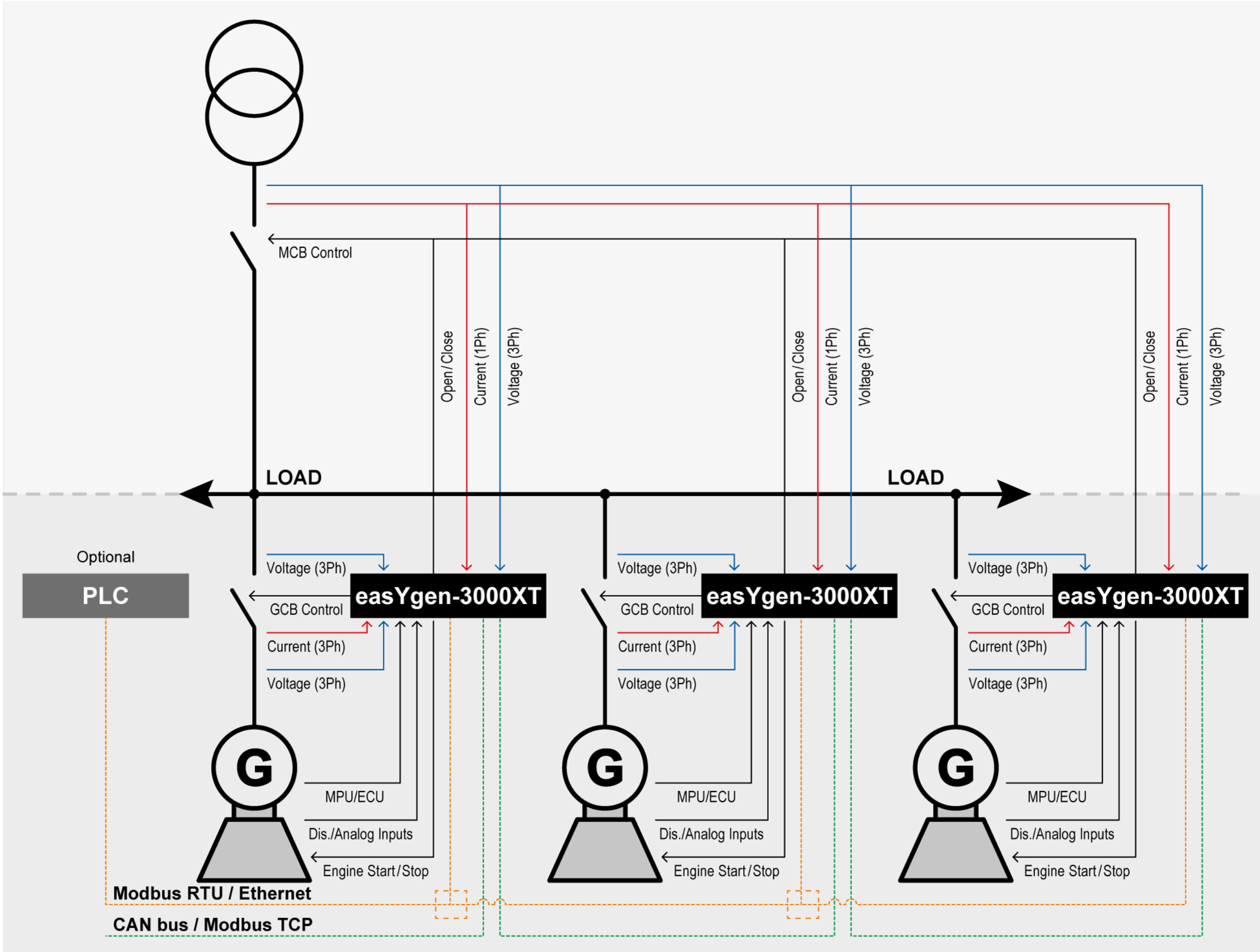


Fig. 223: Multiple genset application (schematic)

6.2.1 Configuration Example: Multiple Genset

Configuration example

The following example describes the configuration of a typical mains parallel operation with import/export power control at the interchange point and load-dependent start/stop.

Multiple generators are to be operated in parallel to the mains maintaining a stable power at the interchange point. The generators shall be started depending on the momentary load at the plant. An emergency operation in case of a mains failure is also intended.

The load dependent start/stop function (LDSS) shall be enabled with a remote start request. LDSS shall depend on the reserve power on the busbar. In case of a dead busbar (caused by a mains failure) all capable generators shall be started and operated with their minimum running time.

No generator priority is considered. Generator selection shall be performed depending on the operating hours.

The following assumptions are valid for the example:

- 3 generators, each with 80 kW rated power, are available.
- The recommended minimum load for the generators is 40 kW.
- The minimum running time is 180 s.

6.2.1.1 Configuring Load-Dependent Start/Stop

1. Either on the front panel or using ToolKit navigate to menu *“ Parameter ➔ Configuration ➔ Configure application ➔ Configure application modes ➔ Load dependent start/stop ➔ General LDSS settings”*.
2. Configure the parameters below.

ID	Parameter	Value	Comment
5752	Start stop mode	Reserve power	The reserve power at the interchange point is to be considered for LDSS
5753	Dead busbar start mode	All	All generators shall start in case of a dead busbar (mains failure)
5751	Base priority	5	The base priority for the genset is 5
5754	Fit size of engine	No	The generator rated power is not considered for LDSS
5755	Fit service hours	Equal	The remaining hours until next service are considered for LDSS
5756	Changes of engines	Off	No engine change will be performed
5777	LDSS sort pri-ority always	Off	LDSS priority follows settings without permanently refreshing.
5759	Minimum run-ning time	180 s	The minimum running time is 180 seconds
12930	LD start stop	LM 86.86: TRUE	Enables function LDSS

Table 114: General LDSS parameters

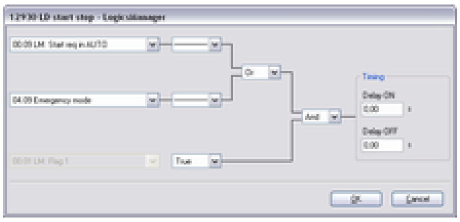


Fig. 224: LogicsManager function "LD start stop"

3. Configure the LogicsManager 86.86 function *[12930 LD start stop]* as shown in (*Chapter 6.2 “Multiple Genset Applications” on page 534*) to enable LDSS if a start request in automatic operating mode or emergency mode are enabled.

LDSS parameters for mains parallel operation

Additional assumptions are valid for mains parallel operation (MOP):

- The first generator is only started if it is able to operate at a minimum load of 40 kW.
- A hysteresis of 20 kW is required to avoid frequent starts and stops.
- A reserve power of 10 kW on the busbar shall be maintained, i.e. at least 10 kW of generator capacity are available for short load peaks.
  Higher load peaks are supported by the mains.
- The delay for adding another generator shall be 30 seconds.
- The delay for adding another generator shall be reduced to 10 seconds if a generator at the busbar is operating above its rated load (accelerated start of the next generator).
- The delay for removing a generator from the busbar shall be 60 seconds.

1. Either on the front panel or using ToolKit navigate to menu *" Load dependent start/stop ➔ Mains parallel operation"*.
2. Configure the parameters listed below.

ID	Parameter	Value	Comment
5767	MOP Minimum load	40 kW	The minimum load in mains parallel operation is 40 kW
5769	MOP Hysteresis	20 kW	The reserve power hysteresis in mains parallel operation is 20 kW
5768	MOP Reserve power	10 kW	The reserve power in mains parallel operation is 10 kW
5772	MOP Add on delay	30 s	The add on delay in mains parallel operation is 20 seconds
5773	MOP Add on delay at rated load	10 s	The add on delay at rated load in mains parallel operation is 10 seconds
5774	MOP Add off delay	60 s	The add off delay in mains parallel operation is 60 seconds

Table 115: Parameter configuration for LDSS (MOP)

LDSS parameters for islanded operation

Additional assumptions are valid for islanded operation (IOP), i.e. in case of an mains failure (emergency) operation:

- A reserve power of 80 kW on the busbar shall be maintained, i.e. at least 2 generators are available in islanded operation for redundancy because no supporting mains are present.
- A hysteresis of 20 kW is required to avoid frequent starts and stops.
- The delay for adding another generator shall be 10 seconds.
- The delay for adding another generator shall be reduced to 3 seconds if a generator at the busbar is operating above its rated load (accelerated start of the next generator).
- The delay for removing a generator from the busbar shall be 180 seconds.

1. Either on the front panel or using ToolKit navigate to menu *"Parameter ➔ Configuration ➔ Configure application ➔ Configure application modes ➔ Load dependent start/stop ➔ islanded operation"*.
2. Configure the parameters listed below.

ID	Parameter	Value	Comment
5760	IOP Reserve power	80 kW	The reserve power in islanded operation is 80 kW
5761	IOP Hysteresis	20 kW	The reserve power hysteresis in islanded operation is 20 kW
5764	IOP Add on delay	10 s	The add on delay in islanded operation is 10 seconds
5765	IOP Add on delay at rated load	3 s	The add on delay at rated load in islanded operation is 3 seconds
5766	IOP Add off delay	180 s	The add off delay in islanded operation is 180 seconds

Table 116: Parameter configuration for LDSS (IOP)

6.2.1.2 Configuring Automatic Operation

1. Either on the front panel or using ToolKit navigate to menu *"PARAMETER ➔ Configuration ➔ Configure application ➔ Configure operation modes ➔ Operation mode AUTO"*.

2. Configure the LogicsManager 86.90 function *[12120 Start req in AUTO]* as shown in (Fig. 225) to start the generator in Automatic operating mode if discrete input [DI 02] ("09.02 Discrete input 2") is energized or a remote start request ("04.13 Remote request" = start via interface) is issued.

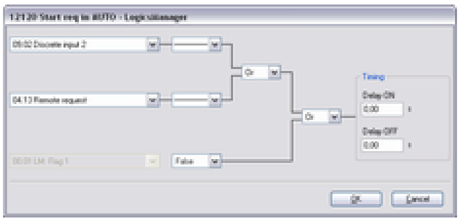


Fig. 225: LogicsManager function "Start req in AUTO"

6.2.1.3 Configuring Emergency Operation

Configure emergency operation to be initiated if the mains fails for at least 3 seconds or the MCB cannot be closed.

Configure the parameters listed below.

ID	Parameter	Value	Comment
2802	On/Off	On	Emergency operation is enabled
2800	Mains fail delay time	3.00 s	Emergency operation is initiated if the mains fail for a t least 3 seconds
3408	Emerg. start with MCB failure	Yes	Emergency operation is initiated if the MCB fails to close

Table 117: Parameter configuration for emergency run

See *Chapter 4.4.6 "Emergency Run" on page 312* *for further settings possibilities.*

6.2.1.4 Configuring Power Control

Configure the power controller to use the internal power setpoint 1, which must be set to 0 kW import power.

1. Either on the front panel or using ToolKit navigate to menu *"Configure load control"*.

2. Configure the parameters listed below .

ID	Parameter	Value	Comment
5539	AM ActPower SP1 [W]	Determined by AnalogManager 81.05: **[A1 = 05.54. Internal P setp1 [W]]**	The internal power setpoint 1 is used as load setpoint 1
5526	Load setpoint 1	Import	The internal power setpoint 1 is a import power value
5520	Int. load control setpoint 1	0 kW	The internal power setpoint 1 is configured to 0 kW

Table 118: Parameter configuration for import/export power control

6.3 Special Applications

6.3.1 Generator Excitation Protection

The easYgen controller provides the user with power factor monitoring. These monitoring functions permit for protection of the generator over- and under-excitation. The power factor monitoring consists of a warning alarm and/or a shutdown alarm when enabled.

An alarm and the specified action will be initiated if the monitored power factor surpasses the defined limits. Typically the generator is monitored for loss of excitation and/or over excitation in a mains parallel application.

When a generator plant is paralleled against a utility, it is possible to control the power factor at a desired reference. When the plant is operated in an island mode or islanded parallel application, it is not possible to control the power factor. The load will dictate what the power factor is due to the reactive nature of the load.

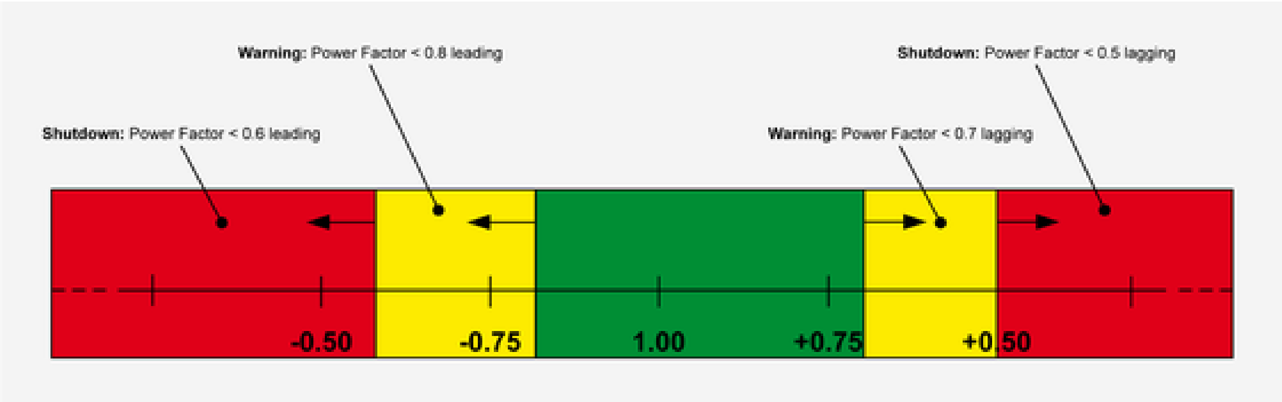


Fig. 226: Example - generator excitation protection

Fig. 226 shows a typical power factor (generator excitation) protection range, where the desired range of operation (green area) is from 0.7 lagging (inductive) to 0.8 leading (capacitive).

When the power factor exceeds either of these limits by entering the yellow shaded areas starting at 0.7 lagging or 0.8 leading for more than 30 seconds, a class B warning alarm is initiated.

If the power factor exceeds the desired range further and enters the red shaded areas starting at 0.5 lagging or 0.6 leading for 1 second, a class E alarm is initiated and the generator is shut down.

Configuration

In order to achieve the described protection, the power factor monitoring parameters (*Chapter 4.5.1.6.1.1 "Generator Lagging Power Factor (Level 1 & 2)" on page 341* or *Chapter 4.5.1.6.1.2 "Generator Leading Power Factor (Level 1 & 2)" on page 342*) have to be configured as shown below.

Generator power factor lagging level 1				Generator power factor lagging level 2		
ID	**Text**	**Setting**		**ID**	**Text**	**Setting**
2325	Monitoring	On		2331	Monitoring	On
2329	Limit	+0.700		2335	Limit	+0.500
2330	Delay	30.00 s		2336	Delay	1.00 s
2326	Alarm class	B		2332	Alarm class	E
2327	Self acknowledge	No		2333	Self acknowledge	No
2328	87.70 LM:Eng.mon	Yes		2334	87.70 LM:Eng.mon	Yes

Generator power factor leading level 1				Generator power factor leading level 2		
ID	**Text**	**Setting**		**ID**	**Text**	**Setting**
2375	Monitoring	On		2381	Monitoring	On
2379	Limit	-0.800		2385	Limit	-0.600
2380	Delay	30.00 s		2386	Delay	1.00 s
2376	Alarm class	B		2382	Alarm class	E
2377	Self acknowledge	No		2383	Self acknowledge	No
2378	87.70 LM:Eng.mon	Yes		2384	87.70 LM:Eng.mon	Yes

6.3.2 Configuring A Setpoint Control Via Analog Input

The following example illustrates how to configure an easYgen to use an external load setpoint via analog input [AI 03].

The external setpoint may be enabled using a switch, wired to discrete input [DI 09].

An analog 0 to 20 mA input is to be used where 4 mA corresponds with 0 % power (0 MW), 12 mA corresponds with 50 % power (1 MW), and 20 mA corresponds with 100 % power (2 MW).

Configuring the rated generator power

1. Either on the front panel or using ToolKit navigate to menu *"Configure measurement"*.
2. Configure the parameter listed in *Table 119 "Parameters for rated generator power" on page 540*.

ID	Parameter	Value	Comment
1752	Gen. rated active power [kW]	2000	Generator rated power of 2 MW

Table 119: Parameters for rated generator power

Configuring the analog input for real power setpoint

1. Either on the front panel or using ToolKit navigate to menu *"Configure analog inputs ➔ Analog input 3"*.
2. Configure the parameters listed below.

ID	Parameter	Value	Comment
1100	Type	Linear	A user-defined linear characteristic curve is to be used
1101	User defined min display value	+0.00e0	A value of 0.00 is displayed at the minimum of the input range
1102	User defined max display value	+2000.00e3	A value of 2000.00e3 is displayed at the maximum of the input range
1139	Sender value at display min.	4	The sender value at minimum display is 4 mA
1140	Sender value at display max.	20	The sender value at maximum display is 20 mA
1120	Sender type	0 - 20 mA	A 0 to 20 mA sender is used on the analog input
10116	Filter time constant	Off	No filter time constant is applied to the analog signal
1135	Exponent for protocol	0	The value of the analog input 3 is multiplied by 10^0=1.
1103	Monitoring wire break	Low	If the analog signal falls below 2 mA, a wire break is indicated
1104	Wire break alarm class	Class B	An alarm of class B will be issued in case of a wire break
1105	Self acknowledge wire break	No	A wire break is not automatically cleared after it has been repaired
3636	Bargraph minimum	+0.00	The start value for the bargraph display of the analog input is 0.00
3637	Bargraph maximum	+2000.00	The end value for the bargraph display of the analog input is 2000.00

3. Configure the following parameters using ToolKit. They facilitate a more detailed display of the analog value.

ID	Parameter	Value	Comment
1125	Description	ActivePower SP	Analog input [AI 03] is labeled with "ActivePower SP (%)" on the display
1134	Unit	%	The unit "%" is shown on the display.

Configuring the load controller

The load controller is to be configured that it uses a fixed load setpoint 1 of 2 MW unless a switch energizes discrete input [DI 04] for enabling a variable load setpoint 2, which is controlled by analog input [AI 03].

1. Either on the front panel or using ToolKit navigate to menu *“Configure load control”*.
2. Configure the parameters listed below.

ID	Parameter	Value	Comment
5539	AM ActPower SP1 [W]	Determined by AnalogManager 81.05 **[A1 = 05.54. Internal P setp1 [W]]**	The internal power setpoint 1 is used as load setpoint 1
5526	Load setpoint 1	Import	The internal power setpoint 1 is a import power value
5520	Int. load control setpoint 1	2000.0 kW	The internal power setpoint 1 is configured to 2 MW
5540	AM ActPower SP2 [W]	Path Through of: 06.03 Analog input 3	Analog input 3 is used as load setpoint 2
5527	Load setpoint 2	Steady	The internal power setpoint 1 is a import power value
5521	Int. load control setpoint 2	1000.0 kW	The internal power setpoint 1 is configured to 1 MW
12919	Setp. 2 load	FALSE	LogicsManager is not enabling load setpoint 2

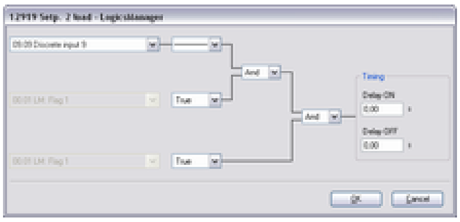


Fig. 227: LogicsManager function "Setp. 2 load"

3. Configure the LogicsManager function 12919 "Setp. 2 load" as shown in (Fig. 227) to enable load setpoint 2 if discrete input [DI 09] is energized.
4. Continue similarly with setpoint 3 and setpoint 4

Viewing the load setpoint on the easYgen

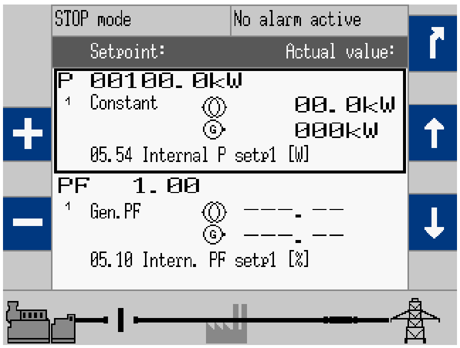


Fig. 228: Screen "Setpoint"

1. After the unit is configured as described above, the "Setpoint" screen may be viewed from the main screen by selecting *“Next page ➔ Setpoints ➔ Setpoints generator”*.

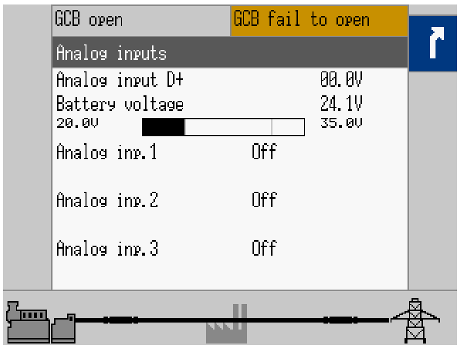


Fig. 229: Screen "Analog inputs"

2. The "Analog inputs" screen may be viewed from the main screen by selecting *"Next page ➔ Measured values ➔ Analog inputs/outputs"*.

6.3.3 Creating Self-Toggling (Pulsing) Relays

> *This function is set up with the LogicsManager.*

This is a simple example of a relay output that toggles from energized to de-energized in automatic mode with adjustable on and off time.

This pulsing relay may be combined with a flexible limit, which can be programmed with a function like low battery voltage to get a blinking warning light.

- Relay 2 is the discrete output [DO 2] and Flag 5 is used as an auxiliary flag.
- Relay 2 will be ON (energized) for 2 seconds and then OFF (de-energized) for 2 seconds as long as the easYgen is in automatic mode.

Configuring "Flag 5" for a pulsing relay

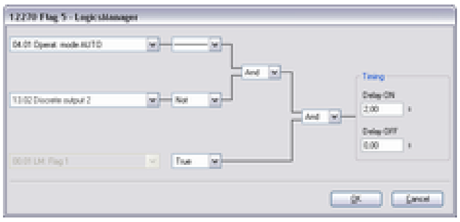


Fig. 230: LogicsManager function "Flag 5"

Configure the LogicsManager function "Flag 5" as shown in (Fig. 230).

⇨ In this example is the Delay ON time in the LogicsManager of Flag 5 indicates how long the pause is. The Delay OFF time of Relay 2 is the pulse duration.

Configuring "Relay 2" for a pulsing relay

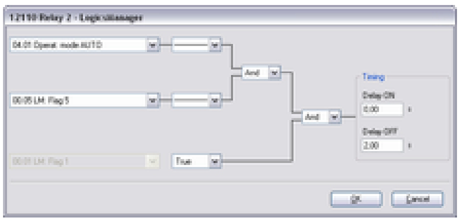


Fig. 231: LogicsManager function "Relay 2"

Configure the LogicsManager function "Relay 2" as shown in (Fig. 231).

6.3.4 Changing A Starter Battery Set

This function is set up with the LogicsManager.

The following programming example shows how two relay outputs are energized in turns when discrete input 9 is energized.

At first discrete output 11 will be energized, then, discrete output 12 will be energized, then discrete output 11 and so on.

This logic may be used to change between two starter battery sets for each starting cycle.

Configuration

Configure Relay 11 and Relay 12 as well as the Flags 2, 3, 4, and 5 as shown in the following example.

You may also use the discrete input, which starts the engine by default [DI 02] or any other input command instead of discrete input 9; for example the command variable 03.06 "Engine released".

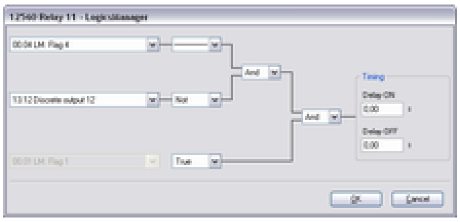


Fig. 232: LogicsManager function "Relay 11"

1. Configure the LogicsManager function "Relay 11" as shown in (Fig. 232).

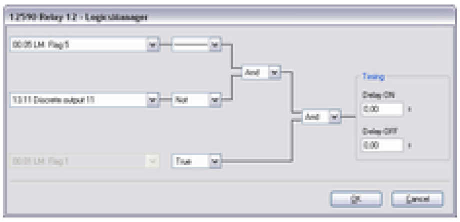


Fig. 233: LogicsManager function "Relay 12"

2. Configure the LogicsManager function "Relay 12" as shown in (Fig. 233).

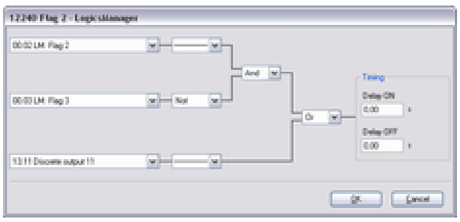


Fig. 234: LogicsManager function "Flag 2"

3. Configure the LogicsManager function "Flag 2" as shown in (Fig. 234).

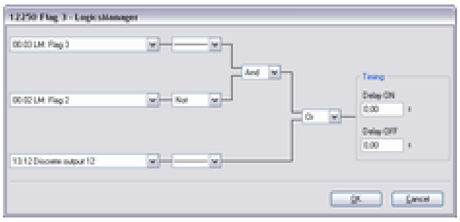


Fig. 235: LogicsManager function "Flag 3"

4. Configure the LogicsManager function "Flag 3" as shown in (Fig. 235).

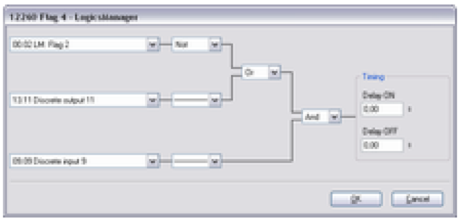


Fig. 236: LogicsManager function "Flag 4"

5. Configure the LogicsManager function "Flag 4" as shown in (Fig. 236).

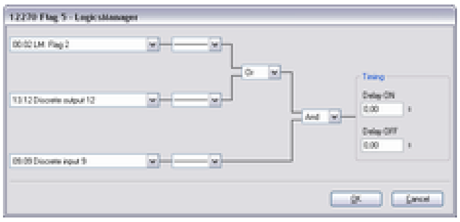


Fig. 237: LogicsManager function "Flag 5"

6. Configure the LogicsManager function "Flag 5" as shown in (Fig. 237).

6.3.5 Performing Remote Start/Stop And Acknowledgment

The easYgen controller may be configured to perform start/stop/shutdown/Acknowledgment functions remotely through the CAN bus or Modbus. The required procedure is detailed in the following steps.

Refer to *Chapter 4.1.1 "Basic Navigation" on page 94* *for a detailed description of the navigation through the various display screens.*

A detailed description of the individual parameters may be found in *Chapter 4.4.5.2 "Operation Mode AUTO - Automatic Run" on page 289.*

Be sure to enter the password for code level 2 or higher to be able to access the required configuration screens.

Refer to *Chapter 4.2.1 "Install ToolKit" on page 121* *for a description of the installation, configuration and usage of the ToolKit visualization and configuration application.*

> ***Preliminary Conditions***
>
> *We recommend to reset the unit to factory settings before proceeding.*
>
> *Refer to ⇘ Chapter 4.3.5 “System Management” on page 158 for reference.*
>
> *The LogicsManager factory settings are shown in ⇘ Chapter 9.3.5 “Factory Settings” on page 926.*

6.3.5.1 Operating Modes

Two operating modes may be used with remote control:

- AUTOMATIC
- STOP

It is possible to fix the operating mode using the LogicsManager function 86.16 "Operat. mode AUTO" (parameter 12510 ⇘ p. 288/ ⇘ p. 928).

AUTOMATIC

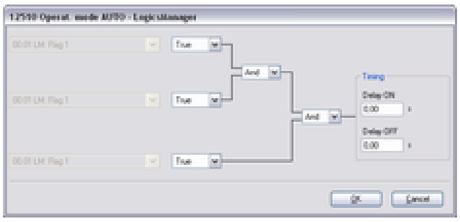


Fig. 238: LogicsManager function "Operat. mode AUTO"

→ The LogicsManager function "Operat. mode AUTO" (parameter 12510 ⇘ p. 288/⇘ p. 928) can be configured as shown in (Fig. 238).

⇨ AUTOMATIC operation mode is always enabled.

If an alarm of alarm class C through F occurs in AUTOMATIC operating mode, the control does not return to STOP operating mode. If the alarm is cleared after Acknowledgment a restart is initiated.

It is also possible to configure a discrete input for controlling the operating mode using the LogicsManager function 86.16 "Operat. mode AUTO" (parameter 12510 ⇘ p. 288/⇘ p. 928) and 86.18 "Operat. mode STOP" (parameter 12530 ⇘ p. 289/⇘ p. 928).

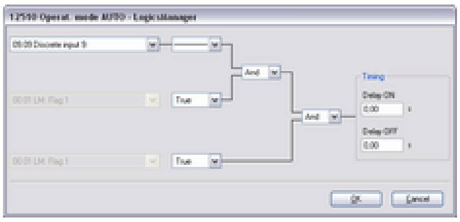


Fig. 239: LogicsManager function "Operat. mode AUTO"

→ The LogicsManager function "Operat. mode AUTO" (parameter 12510 ⇘ p. 288/⇘ p. 928) can be configured as shown in (Fig. 239).

⇨ AUTOMATIC operation mode is enabled as soon as discrete input 9 is energized.

STOP

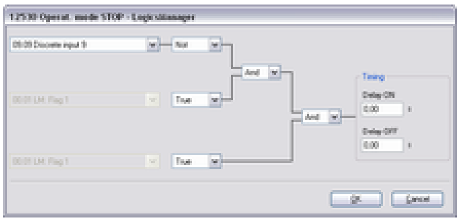


Fig. 240: LogicsManager function "Operat. mode STOP"

The LogicsManager function "Operat. mode STOP" (parameter 12530 ↳ p. 289/↳ p. 928) can be configured as shown in (Fig. 240).

⇨ STOP operation mode is enabled as soon as discrete input 9 is de-energized.

6.3.5.2 Setting Up A Test With Or Without Load

There are a lot of different opinions of the behavior of a proper test mode. The easYgen controller is supporting the following two modes:

- Test with load
- Test without load

> ***Alternatives to the operation mode TEST***
>
> *In cases the dedicated TEST operation mode shall be not taken, the following procedure can be taken to execute an TEST run in the operation mode AUTOMATIC.*

Test with load

This is the LogicsManager function "Start req. in AUTO" (parameter 12120 ↳ p. 290/↳ p. 927). No special message appears on the display.

If the mains fail during start in auto, the unit keeps running until the mains return and the mains settling time is expired or the conditions for "Start req. in AUTO" are FALSE again. The result depends on which condition is active longer.

Test without load

This is the LogicsManager function "Start w/o load" (parameter 12540 ↳ p. 290/↳ p. 928/↳ p. 928). If the conditions for this LogicsManager function are TRUE, the engine will provide an automatic starting sequence and keep the generator running until this function is FALSE again.

Then the unit will perform an automatic stop sequence and remain in standby in auto mode.

The message "Start w/o load" is displayed during the test without load. If the mains fails during test without load and the emergency mode is enabled, the unit will take over the load.

The unit will open the MCB and close the GCB. When the mains return, it will transfer the load back to the mains according to the configured breaker transition mode after the mains settling timer has expired. The engine will keep running until the conditions for "Start w/o load" are FALSE again.

Example for test without load

The engine shall start once a month and run for one hour without overtaking the load. The test day shall be every fifteenth of a month (with flag 2). A relay output can be configured to indicate if this test is running, e.g. for a signal lamp.

1. Configure the parameters listed below to set up the timer.

ID	Parameter	Value	Comment
1663	Active day	15	The active day is enabled every fifteenth of the month
1662	Active hour	10	The active hour is enabled between 10:00 and 11:00 am every day

Table 120: Timer configuration

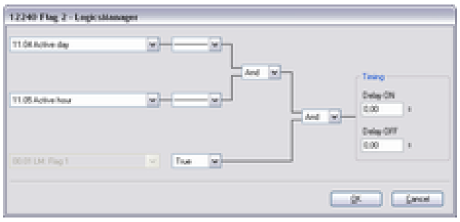


Fig. 241: LogicsManager function "Flag 2"

2. Configure the LogicsManager function "Flag 2" (parameter 10701 ⤷ p. 480/⤷ p. 915/⤷ p. 919) as shown in (Fig. 241).

   ⇨ Flag 2 becomes TRUE as soon as the configured active day and active time is reached.

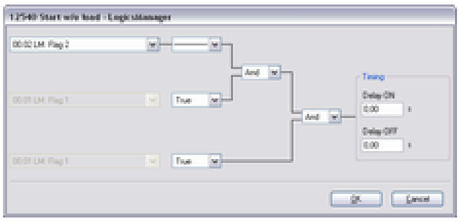


Fig. 242: LogicsManager function "Start without load"

3. The LogicsManager function "Start without load" (parameter 12540 ⤷ p. 290/⤷ p. 928/⤷ p. 928) can be configured as shown in (Fig. 242).

   ⇨ Start without load mode is enabled as soon as Flag 2 becomes TRUE.

6.3.5.3 Remote Start/Stop, Shutdown, And Acknowledgment

The easYgen may be start, stop, shut down, or acknowledged alarms with Modbus or CAN protocol via the interface.

Therefore, two logical command variables (04.13 and 04.14) have to be configured with the LogicsManager. 03.40 can handle Remote shutdown only.

- 04.13 Remote request
- 04.14 Remote acknowledge
- 03.40 Remote shutdown

A Remote shutdown 03.40 can be configured via LogicsManager internal flag (e.g.12230 Flag 1) combined with a free alarm LogicsManager (e.g. Free alarm 1) configured with shutdown alarm class.

How to handle a Remote request 04.13 and a Remote acknowledge 04.14 is described below in detail.

Start request in AUTOMATIC operating mode

1. Either on the front panel or using ToolKit navigate to menu *"PARAMETER: ➔ Configuration ➔ Configure application ➔ Configure operation modes ➔ Operation mode AUTO"*.
2. Open the LogicsManager 12120 for entry "Start req in AUTO".

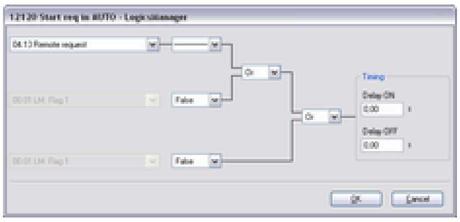


Fig. 243: LogicsManager function "Start req in AUTO"

3. Configure the LogicsManager function "Start req in AUTO" as shown in (Fig. 243).

   ⇨ With this setting, the "Start req in AUTO" LogicsManager output becomes TRUE as soon as the remote request signal is enabled.

> *The LogicsManager commands 2 and 3 may be used to configure additional conditions like discrete inputs, which must be energized to be able to issue the remote start request.*

External Acknowledgment

1. Either on the front panel or using ToolKit navigate to menu *"PARAMETER ➔ Configuration ➔ Configure monitoring ➔ Miscellaneous ➔ General monitoring settings"*.
2. Open the LogicsManager 86.15 for entry "Ext. acknowledge".
3. Configure the LogicsManager function "Ext. acknowledge" as shown in (Fig. 244).

   ⇨ With this setting, the "Ext. acknowledge" LogicsManager output becomes TRUE as soon as the remote acknowledge signal is enabled.

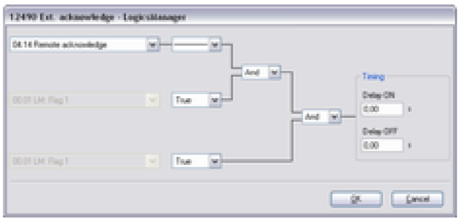


Fig. 244: LogicsManager function "Ext. acknowledge"

> *The LogicsManager commands 2 and 3 may be used to configure additional conditions like discrete inputs, which must be energized to be able to issue the remote acknowledge command.*

Please refer to ↳ *Chapter 6.5 "Modbus Applications" on page 614* for a description of how to configure the LogicsManager functions via Modbus.

> *All interfaces access the same bits. The command variable "04.13 Remote request" remains enabled in the easYgen until a new command is sent or the power supply failed or is removed.*

Remote start:

- The command variable "04.13 Remote request" changes to "1" (high) if the start bit (ID 503, bit 0) changes from "0" to "1".
- The command variable "04.13 Remote request" changes to "0" (low) if the stop bit (ID 503, bit 1) changes from "0" to "1" (Fig. 245).

Acknowledgment:

- The command variable "04.14 Remote acknowledge" reflects the Acknowledgment bit (ID 503, bit 4).
- An Acknowledgment is generally performed twice:
  - 1st change of the logical output "External acknowledge" from "0" to "1":
    Silence horn
  - 2nd change of the logical output "External acknowledge" from "0" to "1":
    Acknowledges all inactive alarms

System reaction

> *The easYgen does NOT react on the disabling of the start bit, but only on the enabling of the stop bit.*
>
> *This has the advantage that it is not required to maintain the connection established for the whole time in case of a remote start.*

The following figure shows the reaction of the command variable on the various changes of the bits:

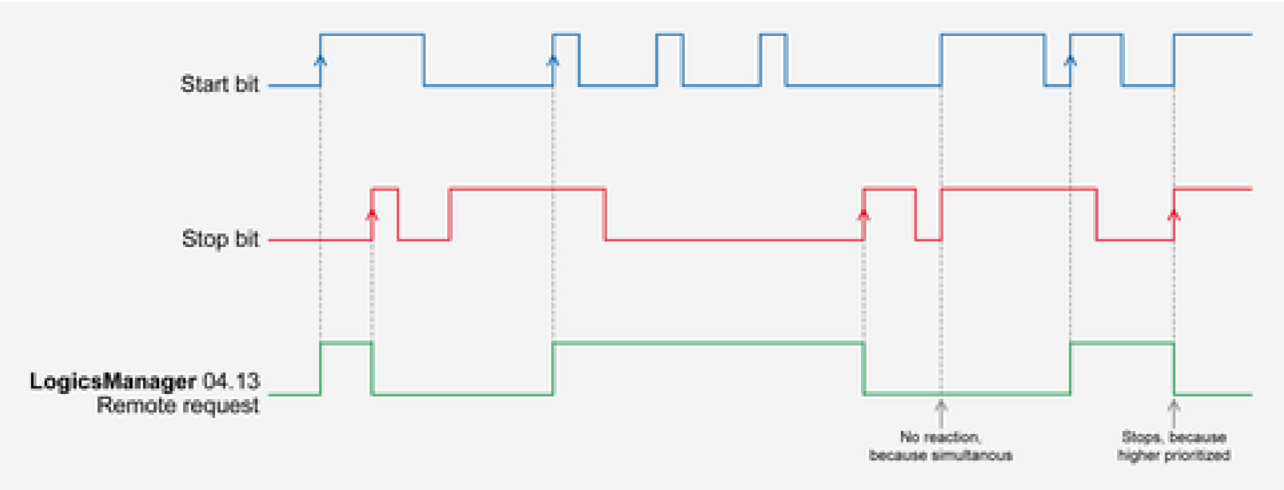


Fig. 245: Command variable

Enabling the bits may be performed with the following methods:

- Bit Enabling via Modbus Protocol and RS-485 Interface
- Bit Enabling via CANopen Protocol and CAN Interface 1

Bit enabling via Modbus protocol and RS-485 interface

The parameter Modbus Slave ID must be configured.

The control bits are sent on address 503 for a start via Modbus:

- Bit 0: Start
- Bit 1: Stop
- Bits 2 and 3: must be "0" (for the watchdog).
- Bit 4: Acknowledgment
- Bit 9: Shutdown command

Please refer to ↪ Chapter 6.5 "Modbus Applications" on page 614 for a description of how to enable control bits via Modbus.

Bit enabling via CANopen protocol and CAN interface 1

*For further information on the CANopen protocol refer to ↪ Chapter 7.5 "CANopen Protocol" on page 643 and the CANopen file *.eds, which is delivered with the unit.*

Please refer to ↪ Chapter 6.5 "Modbus Applications" on page 614 for a description of how to enable control bits via Modbus.

Remote Shutdown

For controlling the device with Remote Shutdown 03.40 please run setup as described above but with 03.40 instead of 04.14 and using Bit 9 instead of Bit 0, 1, and 4.

Additionally

- define a free LM flag for 03.40 Remote Shutdown and
- take it as input for a Free alarm
- with a shutdown alarm class.

6.3.6 Connecting An IKD 1 On CAN Bus

We recommend to connect external expansion boards, like the Woodward IKD 1 to CAN bus 2. This CAN bus offers preconfigured settings for operating several expansion boards including the IKD 1.

However, it is also possible to connect an IKD 1 to CAN bus 1.

Refer to the ↪ *Chapter 4.7.4.1.3 "Transmit PDO {x} (Process Data Object)" on page 449* and ↪ *Chapter 4.7.4.1.2 "Receive PDO {x} (Process Data Object)" on page 447* for the configuration of the parameters concerned.

Refer also to ↪ *Chapter 7.5 "CANopen Protocol" on page 643* for a description of the data objects.

The easYgen may either be configured directly using the front panel or externally using the ToolKit software.

Transmit PDO

The easYgen must be configured for sending to data protocol 65000 (external DOs 1 to 8) and CAN ID 181 (hex) every 20 ms on TPDO1.

> ***LSG connected on CAN 1***
>
> *The upper described ID 181 (hex) can not be used if a LSG and a legacy device like GCP 30, GCP 20, MFR-2 are connected on CAN 1! The legacy devices are using IDs 181 - 18E (hex) but can not be switched to another ID.*

TPDO is used to send messages to an external device.

→ Configure TPDO1 as shown below.

ID	Parameter	Value	Comment
9600	COB-ID	181 (hex) / 385 (dec)	The COB-ID is configured to 181 (hex) or 385 (dec)
9602	Transmission type	255	Data is automatically broadcasted (transmission type 255)
9604	Event timer	20 ms	The event timer is configured to 20 ms
8962	Selected Data Protocol	65000	Data protocol 65000 is selected

Table 121: TPDO1 configuration

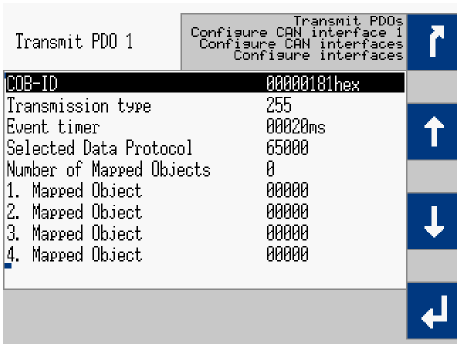


Fig. 246: TPDO configuration for IKD 1 (example HMI)

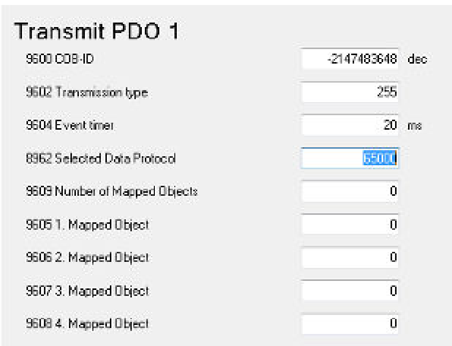


Fig. 247: TPDO configuration for IKD 1 (example ToolKit)

⇨ (Fig. 246) and (*Table 121 "TPDO1 configuration" on page 552*) display the example TPDO configuration for IKD 1.

Receive PDO

The easYgen must be configured for receiving data on an RPDO. The data received on CAN ID 201h is interpreted as data protocol 65000 (external DIs 1 to 8).

Configure RPDO1 as shown below.

ID	Parameter	Value	Comment
9300	COB-ID	201 (hex) / 513 (dec)	The COB-ID is configured to 201 (hex) or 513 (dec)
9121	Event timer	2000 ms	The event timer is configured to 2000 ms
8970	Selected Data Protocol	65000	Data protocol 65000 is selected

Table 122: RPDO1 configuration

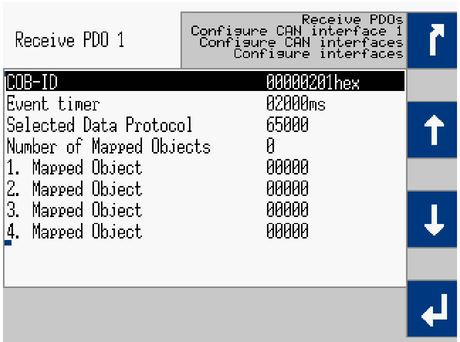


Fig. 248: RPDO configuration for IKD 1 (example HMI)

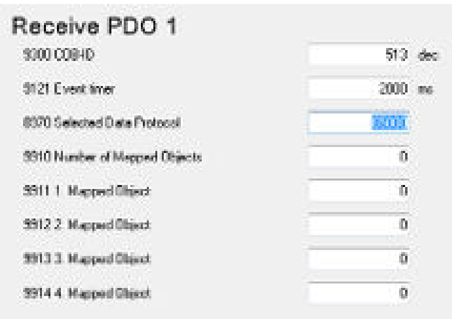


Fig. 249: RPDO configuration for IKD 1 (example ToolKit)

⇨ (Fig. 248) and (*Further information on page 553*) display the example RPDO configuration for IKD 1.

6.3.6.1 Configuring an IKD 1 Expansion Module

General notes

The IKD 1 is an Woodward I/O expansion board. It can be connected via CAN bus to Woodward easYgen generator controllers or DTSC 200 Automatic Transfer Switch Controllers. The configuration of the IKD 1 can be done with the IKD Configuration Tool running on a PC/laptop, connected via serial interface to the IKD 1.

IKD Configuration Tool (P/N: 9927-2094) is a tool to quickly configure an IKD for connection with the easYgen series or DTSC 200. It will check the parametrization of the IKD 1 and allows to set it to one of the four different connection modes. The IKD Configuration Tool replaces the LeoPC configuration tool.

6.3.6.1.1 Installation

Prerequisites

The following items are necessary before installing the software:

- PC with Windows operating system
- To connect the IKD to a serial port (RS232) on the PC
  - Woodward DPC cable RS-232 (P/N: 5417-557)
- To connect the IKD to a USB port on the PC
  - USB/RS-232 adaptor and a Woodward DPC cable RS-232 (P/N: 5417-557)
  - Woodward DPC cable USB/RS-232 (P/N: 5417-1251)

Installation

The following steps needs to be performed for installing the IKD Configuration Tool

1. Uninstall any previous installation of IKD Configuration Tool
2. If software is not available on product CD-ROM: Please download from Woodward web site
3. Unzip the *.zip file on your PC
   ⇨ You should get a directory named “publish”
4. Run the “setup.exe” from this directory
5. Follow the instructions given during installation
6. After installation the directory “publish” can be deleted

6.3.6.1.2 Quick Configuration

How to use Configuration Tool

The following steps allow push-button configuration of IKD 1

1. Connect the IKD 1 to the PC/laptop as described above and power it
2. Start the already installed IKD Configuration Tool
3. Select the COM port IKD 1 is connected to the PC/laptop
4. Press button “Connect” to connect to the IKD 1
5. Select CAN baud rate
6. Press one of the four preconfigured mode buttons (“IKD 1 on Node-ID x”)
   ⇨ Settings will be transferred to the IKD 1

The Program Dialog Box

On start of the configuration software, you should get the following screen with fields, buttons and selectors available:

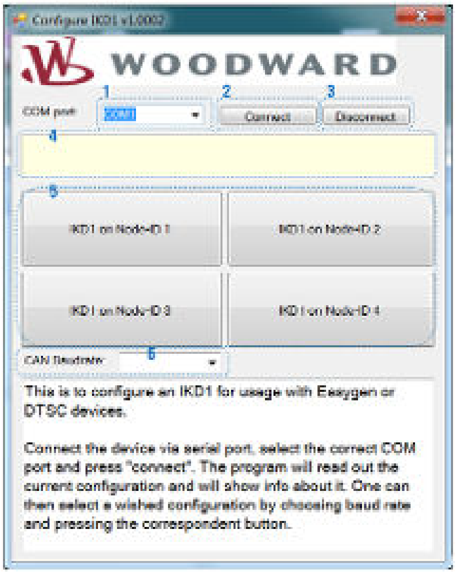


Fig. 250: IKD Configuration Tool

1. *"COM port"*

⇨ Select between all serial ports your PC is providing. If there is no serial port available, then this field is empty. Select the COM port to which the IKD is connected. ("COM1" for example)

2. *"Connect"*

⇨ Opens the selected serial port and tries to connect to the IKD. If successful, it will read out the data from the IKD but it won't change any data on the IKD. It will populate the "CAN Baud rate" field with the CAN baud rate the IKD is currently configured. If the IKD is already configured to one of the four different CAN node-IDs usable for an easYgen, the corresponding button "IKD 1 on Node-ID x" will be colored green.

3. *"Disconnect"*

⇨ Closes the serial port if it was opened. Must be used, if accidentally the wrong COM port was selected and connected

4. *"Status field"* (yellow background)

⇨ Shows messages about the status of the connection

5. *"IKD on Node-ID X"*

⇨ Each of these four buttons has two functionalities:

1) After connecting, if the IKD 1 is already configured to one of the four different CAN node-IDs usable for an easYgen, the corresponding button will be colored green.

2) By pressing the button the program will configure the IKD 1 to the selected node-ID and CAN baud rate. After that it will read it out for check.

6. *"CAN Baud rate"*

⇨ This button has two functionalities:

1) After connecting it shows the currently configured CAN baud rate of the IKD.

2) It can also be used to select the CAN baud rate. For the easYgen configuration only 125 kBaud, 250 kBaud and 500 kBaud is permissible.

6.3.6.2 Configuration for a second IKD 1

To connect a second IKD 1 to the easYgen:

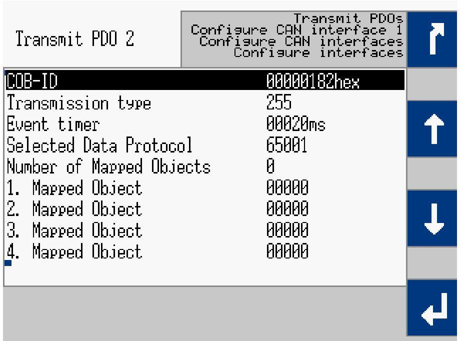


Fig. 251: TPDO configuration for 2nd IKD 1 (example HMI)

1. Set up TPDO2 for the easYgen on the front panel as shown in (*“ Transmit PDO” on page 551*).

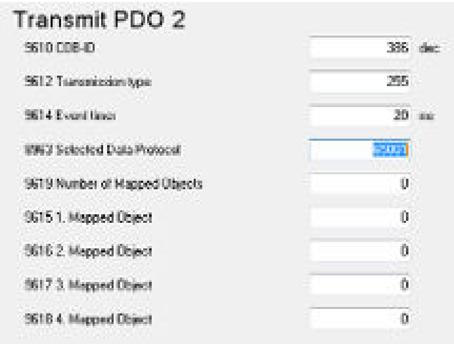


Fig. 252: TPDO configuration for 2nd IKD 1 (example ToolKit)

⇨ Set up TPDO2 for the easYgen in ToolKit as shown in (*“ Transmit PDO” on page 551*).

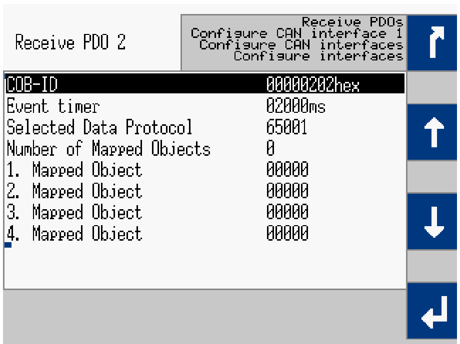


Fig. 253: RPDO configuration for 2nd IKD 1 (example HMI)

2. Set up RPDO2 for the easYgen on the front panel as shown in (*“ Receive PDO” on page 552*).

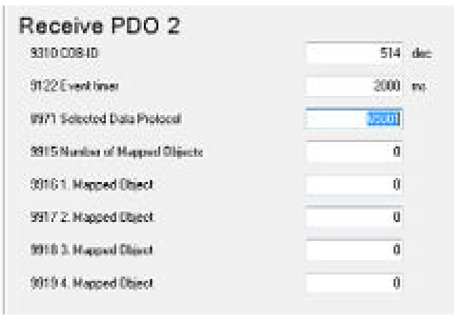


Fig. 254: RPDO configuration for 2nd IKD 1 (example ToolKit)

⇨ Set up RPDO2 for the easYgen in ToolKit as shown in (*“ Receive PDO” on page 552*).

6.3.7 Configuring A PWM Duty Cycle For A CAT ADEM Controller

If a PWM signal shall be used with a CAT ADEM speed controller, the duty cycle must be limited between 10% and 85%.

For this, the following settings must be made to the respective analog output

> *The following parameter IDs and figures refer to analog output 1.*
>
> *Note, that another analog output may also be used.*

Configure the parameters as shown below.

ID	Parameter	Value	Comment
5200	Data source	[11.03] Speed bias %	A speed signal will be output
5201	Selected hard-ware type	PWM	A PWM hardware type will be used
5208	Minimum hard-ware level	10.00%	The minimum output value is 10%
5209	Maximum hard-ware level	85.00%	The minimum output value is 85%
5210	PWM output level	10.00 V	The PWM output level is configured to 10 V

Table 123: PWM duty cycle configuration

⇨ The finished configuration in ToolKit is shown in (Fig. 255).

Fig. 255: PWM duty cycle for a CAT ADEM controller (example ToolKit)

6.3.8 Wiring Self Powered Discrete Inputs

In order to create self-powered discrete inputs with plastic housing variant:

1. Connect battery negative (B-) to ground and PE (terminal 61).

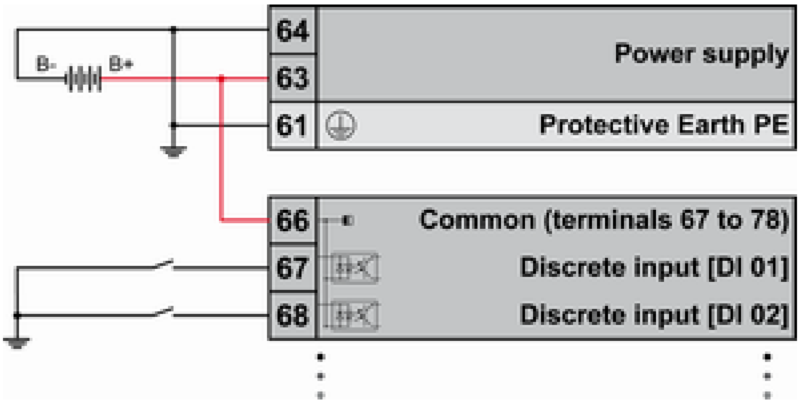


Fig. 256: Wiring self-powered discrete inputs

2. Connect DI common (terminal 66) to power supply 12/24 V (terminal 63, minimum wire size 0.5 mm² (20 AWG)).

   ⇨ This enables to energize the discrete inputs against ground.

The Protective Earth terminal 61 is not connected on the sheet metal housing.

– *Use the protective earth (PE) connector located at the bottom center of the sheet metal housing instead.*

6.3.9 Connecting Analog Inputs In Series

The analog inputs of the easYgen-3000XT series are galvanically isolated to the power supply. This allows for example to share a power setpoint 0/4 to 20 mA with up to three devices.

Make sure that the source can drive the resulting burden.

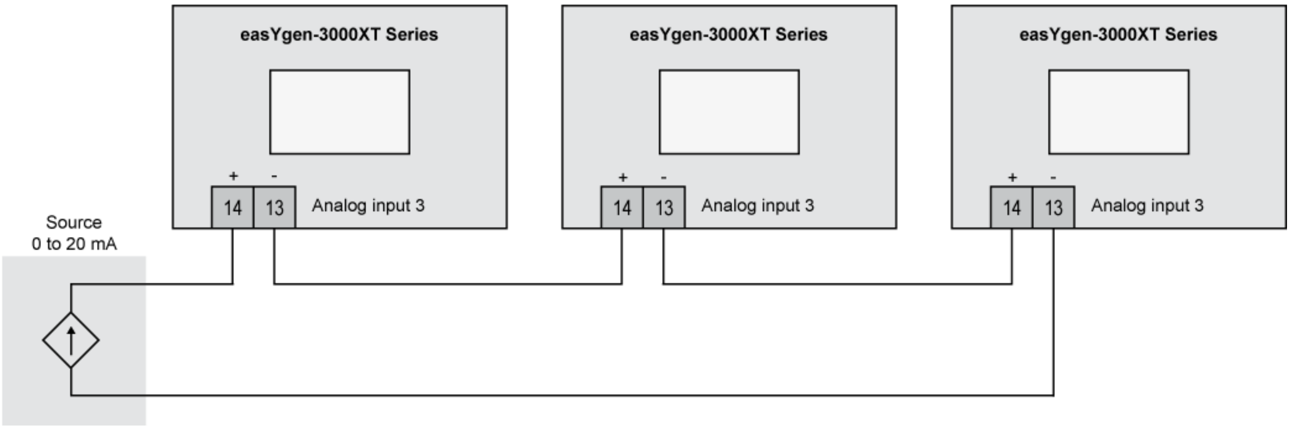


Fig. 257: Connecting analog inputs in series

The graphic above shows the terminal numbers for the analog input 3, but in principle it works for all analog inputs which support a 0/4 to 20 mA signal.

6.3.10 Setup Expansion Modules at CAN 2

General notes

The easYgen is supporting several expansion modules for external analog and digital terminals. It is possible to connect up to four Woodward IKDs for digital inputs and outputs and some third party devices e.g. from Phoenix or WAGO for analog and digital inputs and outputs. Also a combination of the devices listed is possible.

Configuring easYgen for expansion modules is split in two parts:

- One part is located at the external analog/digital inputs/outputs pages and defines how many inputs/outputs are used and the scaling of the analog types. Refer to chapters ➪ *Chapter 4.4.2.4 “Analog Inputs” on page 190* for reference.
- The other part is located at the CAN2 interface pages and defines the Node IDs and the types of external devices. Refer to chapter ➪ *Chapter 4.7.4.2.1 “Expansion Modules at CAN-open Interface” on page 452* for reference.

Additionally the external device must be configured to the correct baud rate and Node ID. This could be done via DIP switches at Phoenix and WAGO, for the IKD with a Woodward IKD configuration tool.

Supported external modules

Phoenix ...				
Bus coupler	**Discrete outputs**	**Discrete inputs**	**Analog outputs**	**Analog inputs**
IL CAN BK	IB IL 24 DO 2	IB IL 24 DI 2	IB IL AO 2/SF	IB IL AI 2/SF
	IB IL 24 DO 8	IB IL 24 DI 4		IB IL TEMP 2 UTH
	IB IL 24 DO 16	IB IL 24 DI 8		IB IL TEMP 2 RTD
	IB IL 24 DO 32	IB IL 24 DI 16		
	IB IL 24/230 DOR4/W	IB IL 24 DI 32		

There is a maximum of three Phoenix bus couplers on the CAN bus. There is also a maximum of 16AI 4AO 32DI and 32DO, which must not exceeded in all possible combinations.

WAGO ...	
Field bus coupler for CAN	**Interface/Connector**
750-337 (MCS)	Terminals/clamps
750-338 (SUB-D)	SUB-D

WAGO Analog Inputs (2 x AI or 4 x AI)				
Type	**P/N two channel version**	**P/N four channel version**	**"Wire break" detection**	**TYPE: Settings**
(SE = Single ended, Diff = Differential)				
Pt100	750-461	750-460/0001	T >849 °C: Overrun T < -200 °C: Underrun	Pt DIN(R0) Sender type: R0 = 100
Pt 1000	750-461/0003	750-460/0003	T >849 °C: Overrun T < -200 °C: Underrun	Pt DIN(R0) Sender type: R0 = 1000
Ni 100	750-461/0004		T >250 °C: Overrun T < -60 °C: Underrun	Ni DIN(R0) Sender type: R0 = 100
Ni 1000 TK6180	750-461/0005		T >250 °C Overrun T < -60 °C: Underrun	Ni DIN(R0) Sender type: R0 = 100
10-1200	750-461/000-002		no	Linear or table Sender type: 0-1200 Ohm
10-5000 Ohms	750-461/000-007		no	Linear or table Sender type: 0-5000 Ohms
4-20 mA (SE)	750-466	750-455	Underrun	Linear or table Sender type: 4-20 mA
0-20 mA (SE)	750-465	750-453	no	Linear or table Sender type: 0-20 mA
0-20 mA (Diff)	750-452		no	Linear or table Sender type: 0-20 mA
4-20 mA (Diff)	750-454		Underrun	Linear or table Sender type: 4-20 mA
+/-10 V (Diff)	750-456		no	Linear or table Sender type: +/-10 V
0-10 V (SE)	750-467	750-468	no	Linear or table Sender type: 0..10 V
Thermocouple (K, T, J, E, S, L)	750-469xxx (standard format)		Overrun Underrun: (approx. -49.8 °C)	TC Type x Sender type: Thermocouple

WAGO Analog Inputs (2 x AI or 4 x AI)				
Type	**P/N two channel version**	**P/N four channel version**	**"Wire break" detection**	**TYPE: Settings**
				Notes If adjustable variant (750-469/003-000) is used: use “Wago-I/O-CHECK” to adjust (default Type is "K"). For details refer to ✎ *“Configurable WAGO devices” on page 562*
+/- 120 mV	750-469/000-003		no	Linear or table Sender type: Thermocouple

WAGO Analog Inputs (8 x AI)			
Type	**P/N eight channel version**	**"Wire break" detection**	**TYPE: Settings**
RTD	750-451	depends on the configured type	TYPE and Sender type: according to the type configured by “Wago-I/O-CHECK” Use “Wago-I/O-CHECK ” to configure the different channels (Default type is PT100). For details refer to ✎ *“Configurable WAGO devices” on page 562*.
0/4 – 20 mA	750-496	4-20 mA: underrun 0-20 mA: no detection	TYPE: Linear or table Sender type: 4-20 mA or 0-20 mA Use “Wago-I/O-CHECK ” to configure the different channels (Default type is 4-20 mA). For details refer to ✎ *“Configurable WAGO devices” on page 562*.
Thermocouple	750-458	Overrun Underrun (approx. -49.8 °C)	TYPE: depends on the configured type Sender type: depends on the configured type Note: if adjustable variant (750-469/003-000) is used use “Wago-I/O-CHECK ” to adjust (Default type is K). For details refer to ✎ *“Configurable WAGO devices” on page 562*.

WAGO Analog Outputs (2 x AO or 4 x AO)				
Type	**P/N two channel version**	**P/N four channel version**	**Comments**	**Settings**
0-20 mA	750-552	750-553		Selected Hardware type = mA
0-10 V	750-560, [10 bit (100 mW)] 750-550	750-559		Selected Hardware type = "V"

WAGO Digital Inputs/Outputs (2 ... 16 x DI/DO)				
# of DIs	2 x DI	4 x DI	8 X DI	16 X DI
P/N	750-400	750-402	750-430	750-1405
# of DOs	2 x DO	4 x DO	8 X DO	16 X DO
P/N	750-501	750-504	750-530	750-1504

There is a maximum of 16 WAGO analog inputs and up to 4 WAGO analog outputs with up to 32 WAGO digital inputs and 32 WAGO digital outputs or up to 4 IKDs.

For all configurations with WAGO devices at least one WAGO CANopen fieldbus coupler 750-337 is required!

Configurable WAGO devices

If configurable WAGO devices are used, the mode of the terminal must be configured via the PC software *"Wago I/O Check"*. This configuration cannot be done via easYgen parameters. The easYgen parameters for the corresponding channels must be consistent with the Wago configuration!

RTD device (750-451)

Configure this 8 channel device RTD (750-451) via the *"Wago I/O-Check"* with the following process image:

The following types are not supported: Ni1000 (high resolution), Ni1000 (TK5000), Pt1000 (EN 60751 high resolution), and 1200 Ohms.

Typ	Expected format
Pt100 (EN 60751)	default
Ni100 (EN 60751)	default
Pt500 (EN 60751)	default
Pt200 (EN 60751)	default
Ni1000 (TK6180, DN 43760)	default
Ni120 (Minco)	default
5000 Ohms	S5-FB250

Thermocouple device (750-458) for voltage measurement

There is no intuitive setting in the easYgen if a channel of the TC device (750-458) is configured for voltage measurement. A special scaling of the easYgen parameters "Sender value at display min." and "Sender value at display max" like in the table below is required.

WAGO device Voltage range	Configure the according easYgen parameter	
	"Sender value at display min."	"Sender value at display max."
+/- 30 mV	-614.4	614.4
+/- 60 mV	-307.2	307.2
+/- 120 mV	-153.6	153.6

Combinations of modules

All combinations of external terminals up to the maximum of 16AI, 4AO, 32DI, and 32DO are possible.

Selection is done by parameter *"Select external terminals "*15320 ↪ p. 457.

> *There is a maximum of three bus couplers on the CAN bus for PHOENIX modules but (for the moment) only one bus coupler on the CAN bus for WAGO modules.*
>
> *So WAGO devices must use one and the same CAN address only.*

The following table shows the possible configuration combination of the "Type" settings (parameter 5851 ↪ p. 203) and the "Sender type" setting (parameter 5856 ↪ p. 203) for Phoenix devices.

Parameter Type	Sender Type	0 - 10V	±10V	0 - 20mA	±20mA	4 - 20mA	0 - 400 Ohm	0 - 4000 Ohm	Thermocouple	R0=100	R0=10	R0=20	R0=30	R0=50	R0=120	R0=150	R0=200	R0=240	R0=300	R0=400	R0=500	R0=1000	R0=1500	R0=2000	R0=3000
OFF																									
Linear		X	X	X	X	X	X	X	X																
Table A		X	X	X	X	X	X	X	X																
Table B		X	X	X	X	X	X	X	X																
Thermo couple type K									X																
Thermo couple type J									X																
Thermo couple type E									X																
Thermo couple type R									X																
Thermo couple type S									X																
Thermo couple type T									X																
Thermo couple type B									X																
Thermo couple type N									X																
Thermo couple type U									X																
Thermo couple type L									X																
Thermo couple type C									X																
Thermo couple type W									X																
Thermo couple type HK									X																
Pt DIN(R0)										X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Pt SAMA(R0)										X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Ni DIN(R0)										X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Ni SAMA(R0)										X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Cu10																									
Cu50																									
Cu53																									
Ni 1000(Landis)																									
Ni 500(Viessm.)																									
KTY 81-110																									
KTY 84																									

Don't care

NOT ALLOWED

RIGHT CONFIGURATION

Fig. 258: Supported Phoenix sender types

> *If Thermocouple is configured together with "Table A", "Table B", or "Linear" the input works with a range from -15 mV to 85mV. In this case the values for parameters "Sender value at display min./max." must be entered in [mV] (e.g.: min: 0.00, max: 85.00).*

Configuration process help

The following flow charts step-by-step guide you through the configuration of external CANopen devices.

> ***Configuration is the same for Phoenix/WAGO***
> *The flow charts below use "P..." for Phoenix external interfaces but it works similar with "W..." for WAGO devices.*

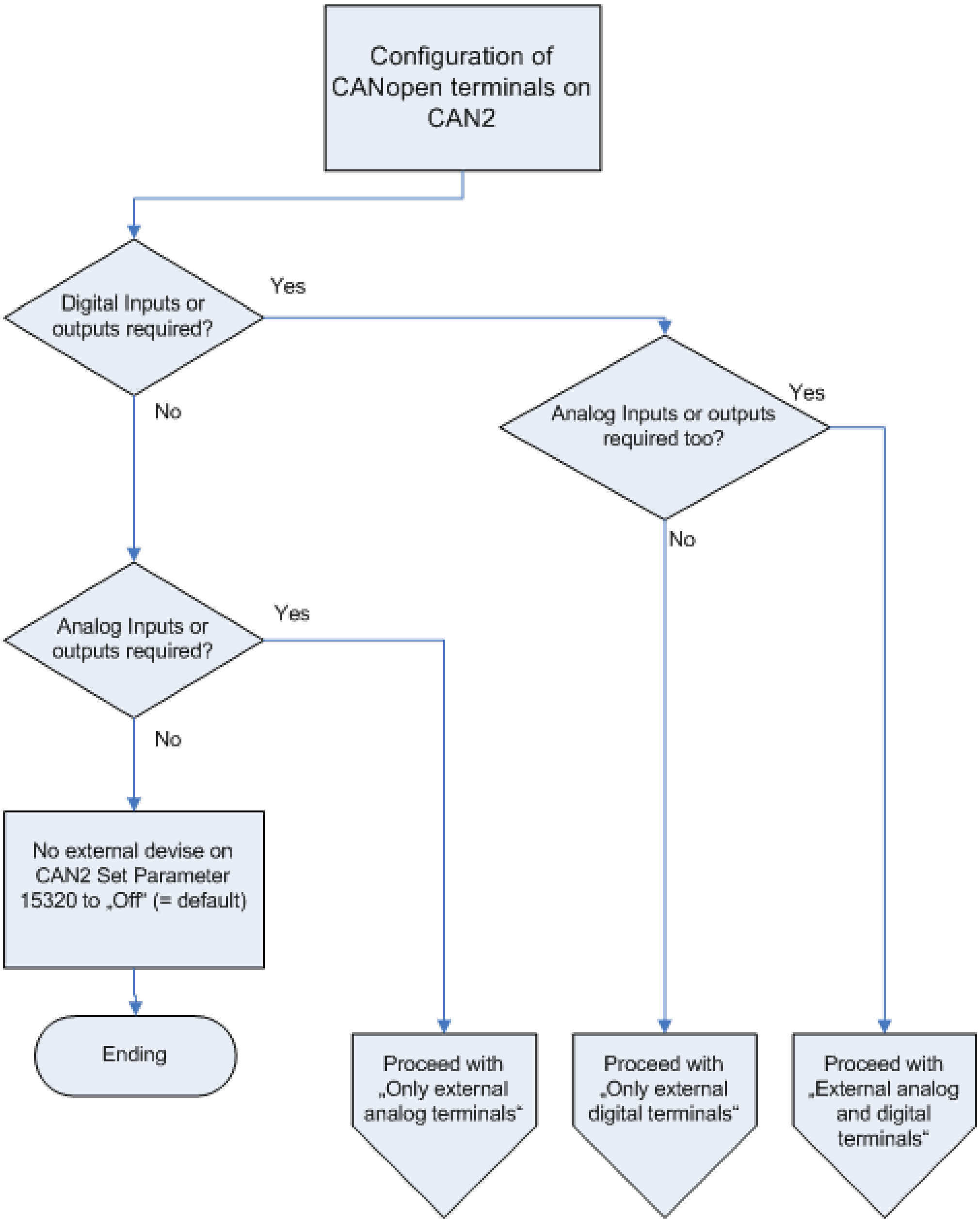


Fig. 259: Configure expansion boards part 1

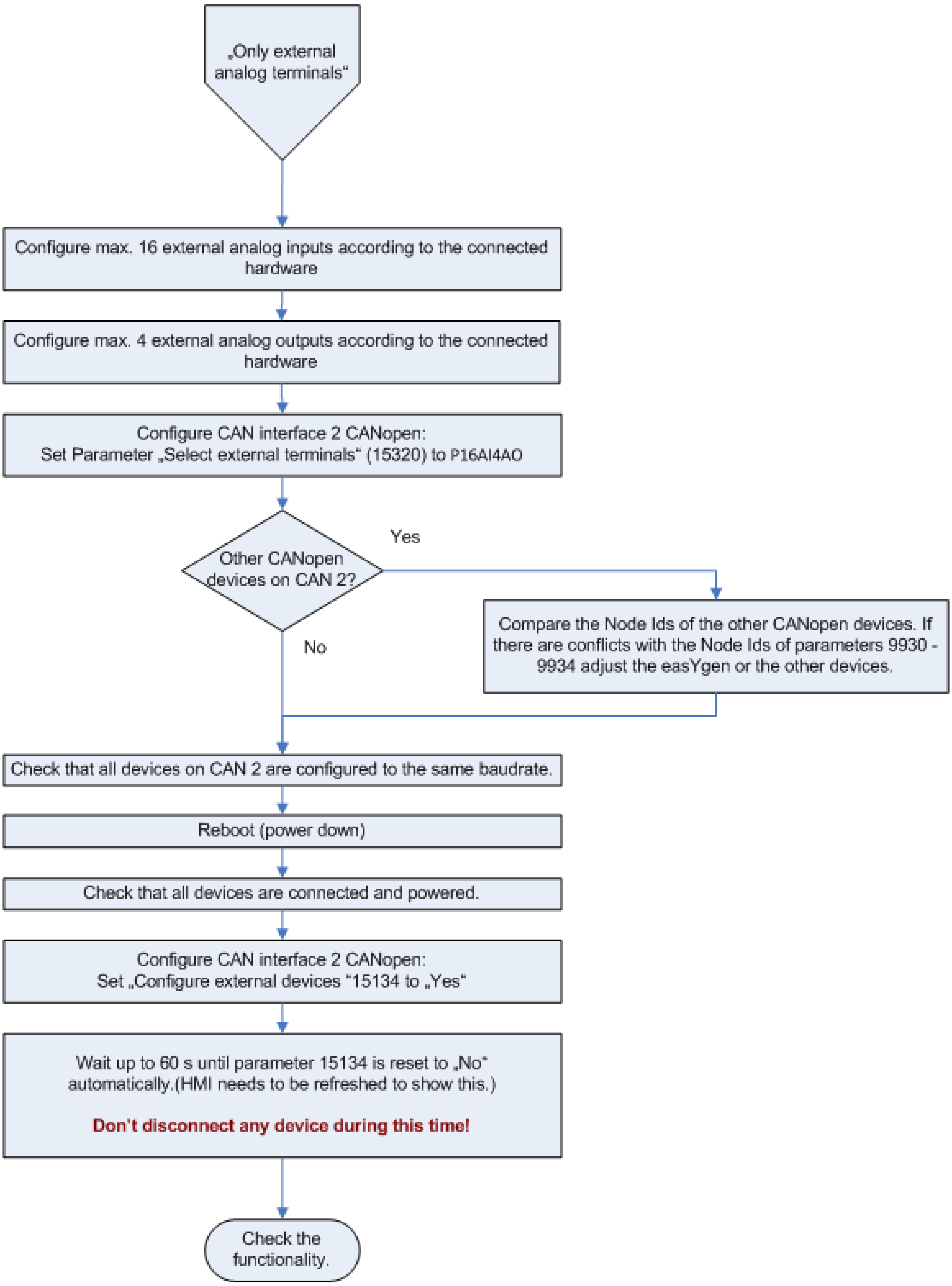


Fig. 260: Configure expansion boards part 2

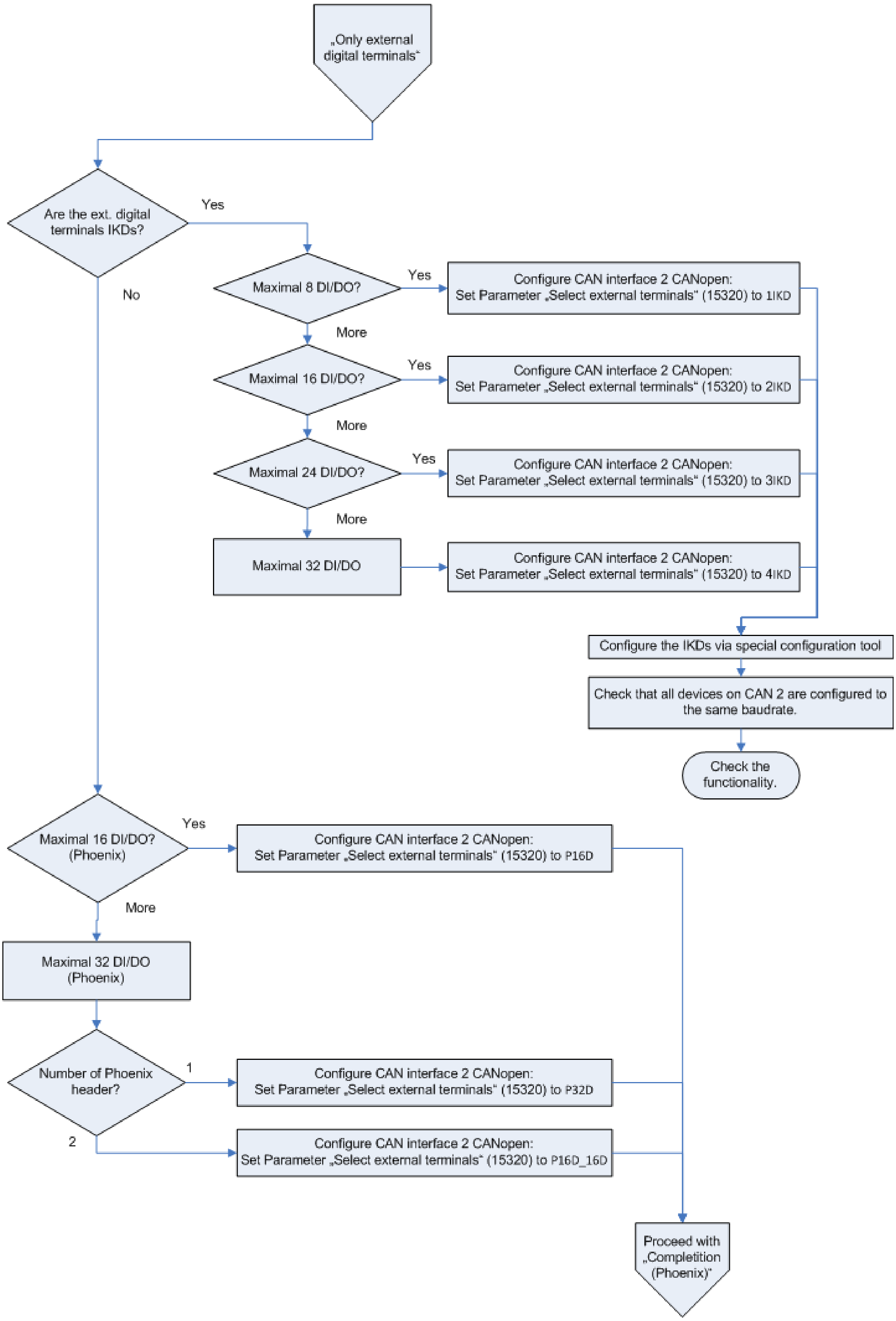


Fig. 261: Configure expansion boards part 3

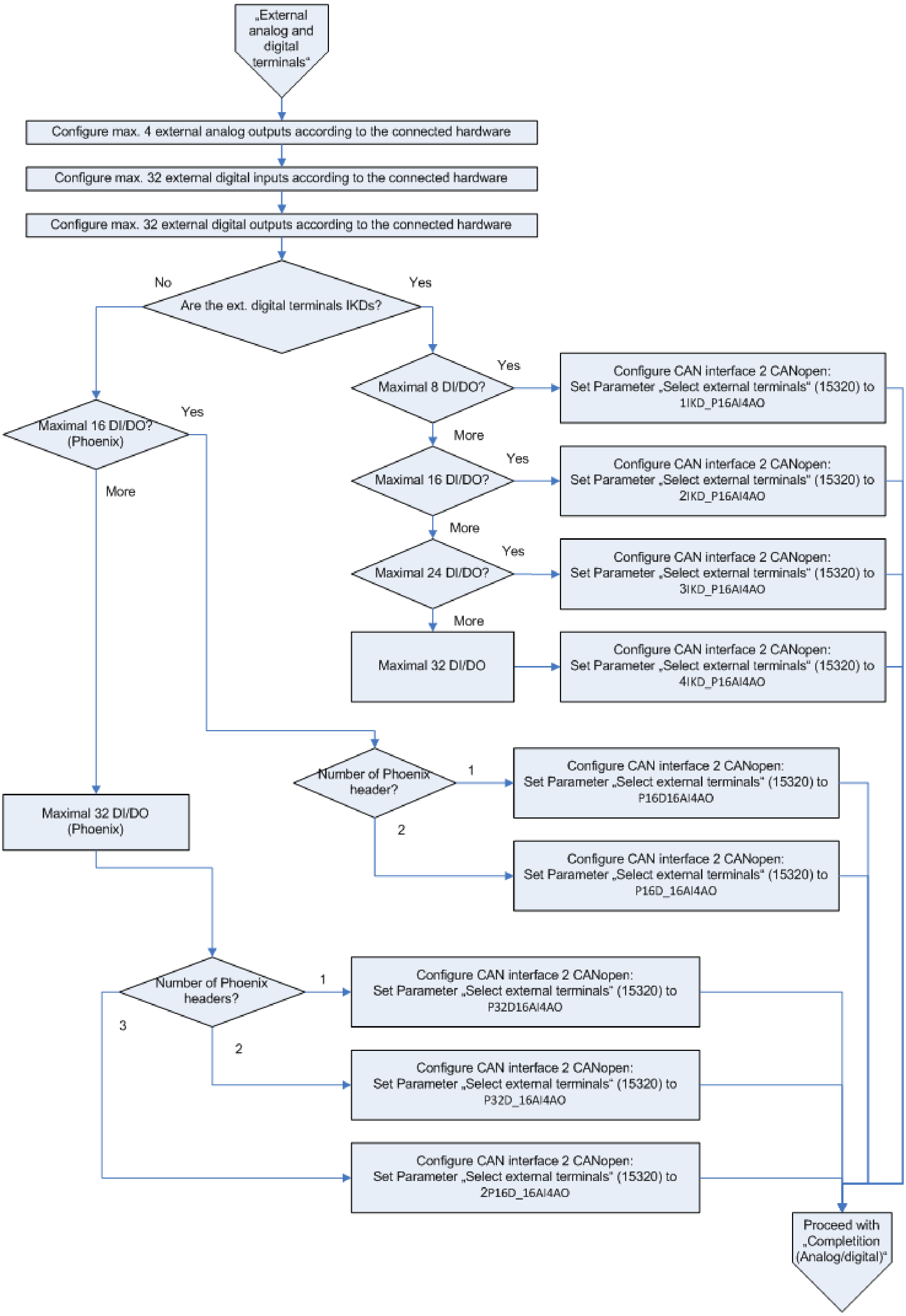


Fig. 262: Configure expansion boards part 4

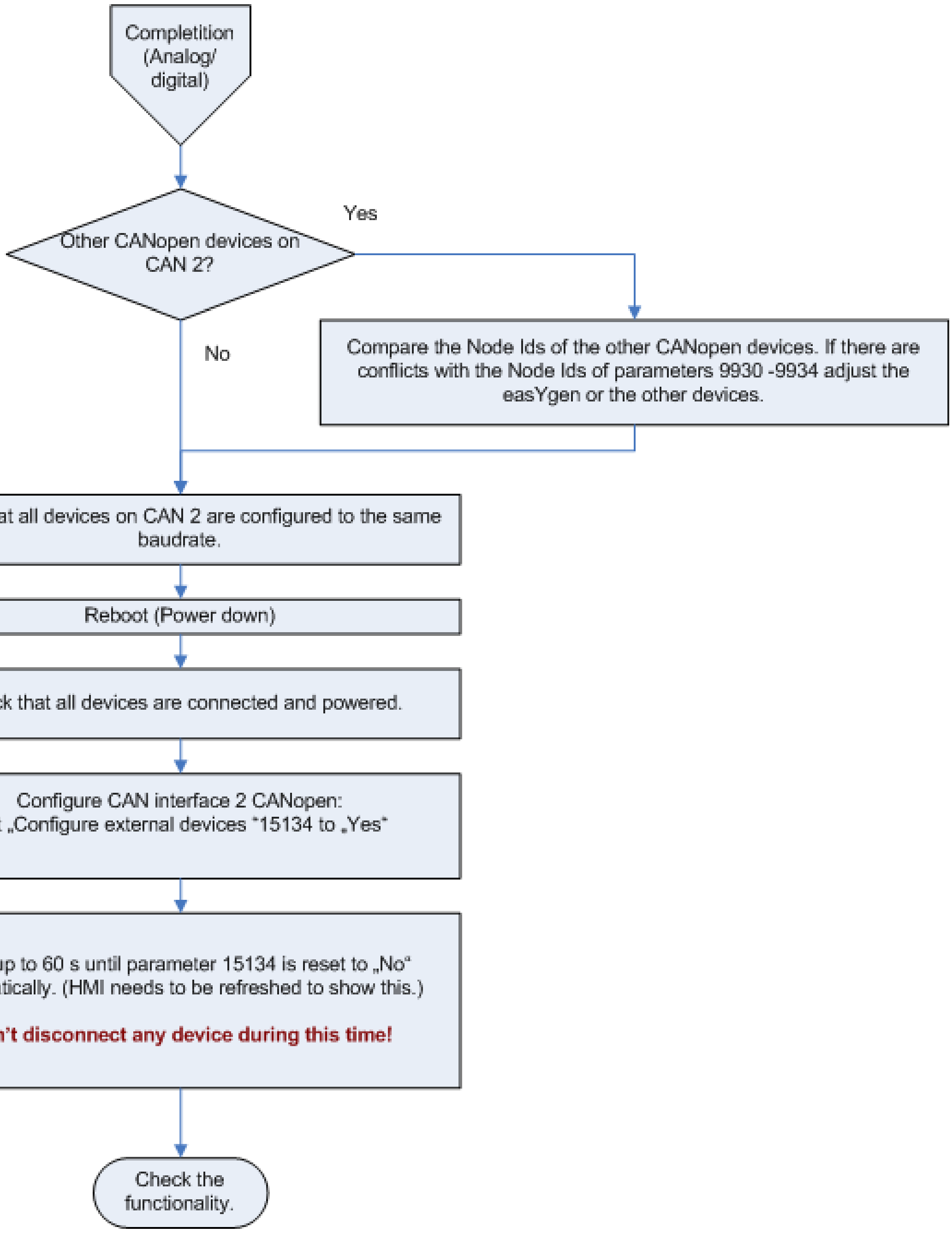


Fig. 263: Configure expansion boards part 5

6.3.11 Phase Angle Compensation

WARNING!
Check parameters!
Erroneous synchronization settings can destroy the generator with destructive power!

Ensure the parameters are configured correctly! Incorrect wiring of the system cannot be compensated for with this parameter.

General notes

This feature allows the easYgen to adapt the phase angle measurement system according to the transformer type. The phase angle of the "generator to busbar" and the "busbar to mains" measurement can be compensated . The phase angle compensation is activated with the parameters "Phase angle compensation GCB" (parameter 8825 ↳ p. 225) and "Phase angle compensation MCB" (parameter 8841 ↳ p. 231) .

The controller provides an adjustment for a phase angle deviation in a range of +/-180.0°. The range can be configured with the parameters "Phase angle GCB" (parameter 8824 ↳ p. 225) and "Phase angle MCB" (parameter 8842 ↳ p. 231). This parameters compensate the phase angle deviation, which can be caused by transformers (i.e. a delta to wye transformer) located within the electrical system.

Example – phase angle compensation GCB

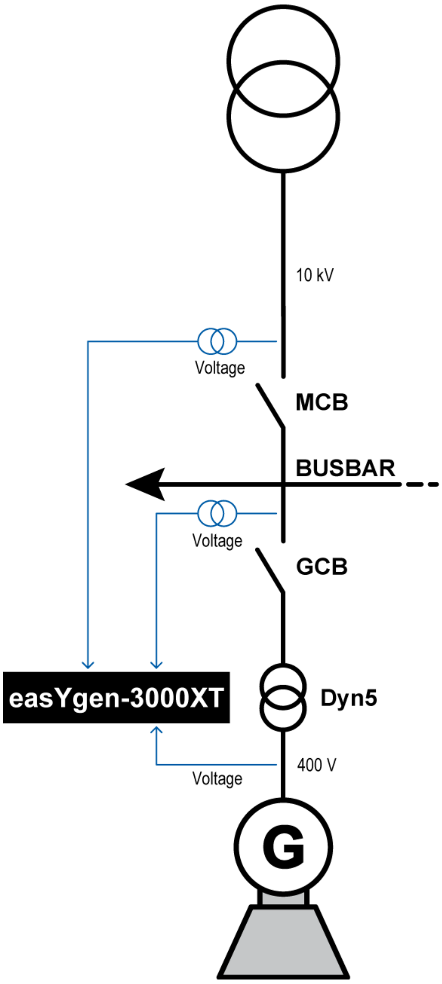


Fig. 264: Phase angle compensation GCB

The easYgen generator voltage is connected to the low voltage side of a transformer with the vector group **Dyn5**. The easYgen busbar voltage is connected to the high voltage side. Because of the transformer, the phase angles between generator and busbar differs due the closed GCB. The synchronization function of the easYgen can be compensated by a configurable phase angle deviation.

Using vector group 5 (Dyn5) implies: α = 5 x 30° = 150°. Since 150° < 180° and the easYgen busbar measurement is connected to the high voltage side, this results into "α" to be used as phase difference. Configure parameter "Phase angle GCB" (parameter 8824 ↳ p. 225) to "150°" to compensate the phase difference between generator/busbar.

Example – phase angle compensation MCB

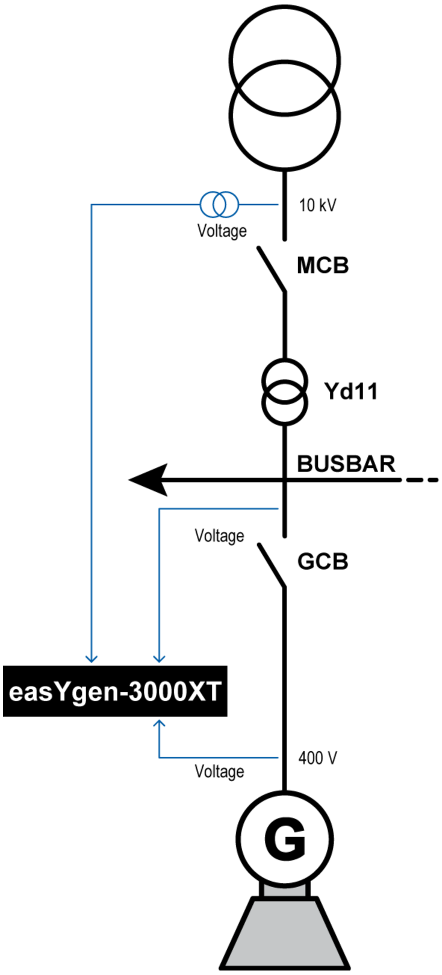


Fig. 265: Phase angle compensation MCB

The easYgen mains voltage is connected to the high voltage side of a transformer with the vector group **Yd11**. The easYgen busbar voltage is connected to the low voltage side. Because of the transformer, the phase angles between mains and busbar differs due the closed MCB. The synchronization function of the easYgen can be compensated by a configurable phase angle deviation.

Using vector group 11 (Yd11) implies: α = 11 x 30° = 330°. Since 330° > 180° and the easYgen mains measurement is connected to the high voltage side, this results into "-360° - α" to be used as phase difference. Configure parameter "Phase angle MCB" (parameter 8842 ➪ p. 231) to "-30°" to compensate the phase difference between mains/busbar.

6.3.12 Start/Stop Logic Mode "Off"

General notes

The start/stop sequence in the easYgen is completely disabled. This function is needed in applications where the control of the start/stop logic is completely done by an external device (e.g. PLC).

The LogicsManager "Release engine monitoring" (parameter 12999 ➪ p. 173/➪ p. 930) has a special function, if the "Start/stop logic mode" (parameter 3321 ➪ p. 160) is configured to "Off". When the LogicsManager becomes TRUE, the delayed monitoring function alarms are triggered, which are delayed by the engine speed. If they become FALSE all engine speed related monitoring functions are switched off. The LogicsManager "Start req. in AUTO" (parameter 12120 ➪ p. 290/ ➪ p. 927) gets a special function if the "Start/stop logic mode" (parameter 3321 ➪ p. 160) is configured to "Off". When the LogicsManager becomes TRUE the operational mode begins. With becoming FALSE the operational mode will be left.

To operate the easYgen in this configuration correctly, the following needs to be done:

- The easYgen requires an external feedback, that the drive system will be started. That is the precondition for the easYgen to trigger the delayed monitoring function, which activates, after a delay time, the speed related monitoring functions. (underspeed, underfrequency, undervoltage, etc.)
- The easYgen requires an external feedback, that the drive system will be stopped. That is the precondition for the easYgen to deactivate the speed related monitoring functions. This avoids upcoming alarms due the drive system is stopped.
- The easYgen must be directed to switch into the active operational mode or to exit this operational mode. The operational mode proceeds with the actions according to the configured application and transition modes.

Example

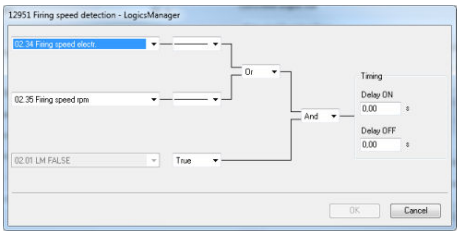


Fig. 266: LogicsManager function "Firing speed"

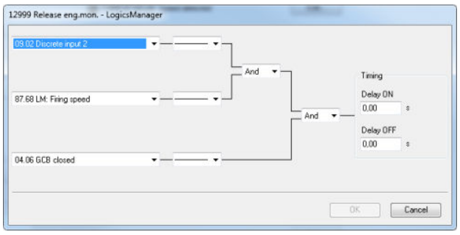


Fig. 267: LogicsManager function "Release engine monitoring"

The following section shows a practical example, to explain in detail the described above configuration.

Fig. 266 shows the LogicsManager “Release engine monitoring” (parameter 12999 ↳ p. 173/↳ p. 930). The LogicsManager must be configured as follows:

- The external start/stop device gives an feedback to the easYgen via discrete input [DI 02] ("09.02 Discrete input 2") that the drive system will be started or already is started.
- When simultaneously the firing speed ("87.68 LM: Firing speed") is reached, the equation becomes TRUE and the delayed monitoring function will be triggered.
- For security reasons a closed GCB ("04.06 GCB closed") forces the monitoring too.

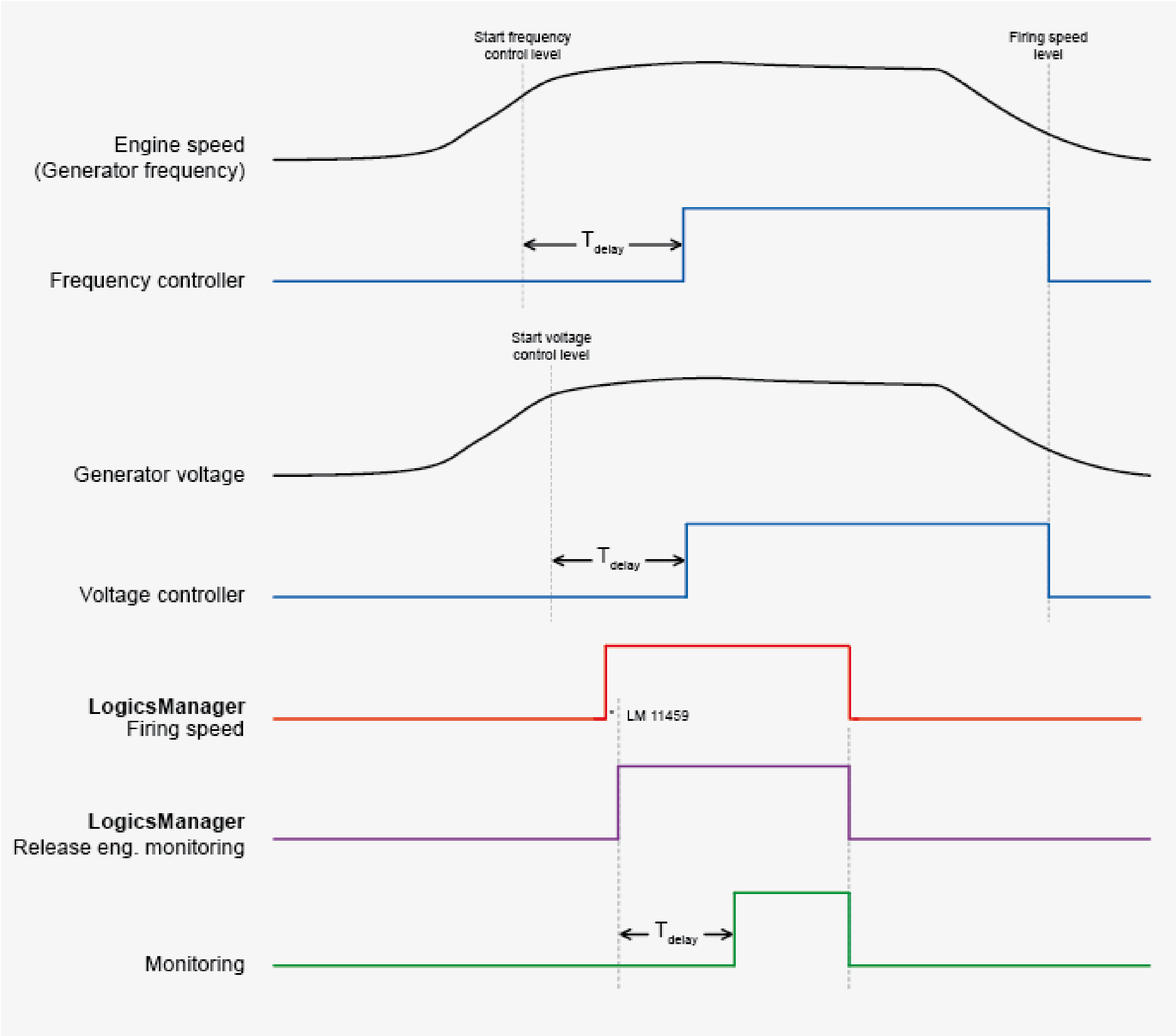


Fig. 268: Start/Stop sequence - LogicsManager "Firing speed"

Drawing above shows the following:

- The frequency controller is triggered, if the engine speed (generator frequency) reaches the "Start frequency control level" (parameter 5516 ➡ p. 265) and after the expired "Start frequency control delay" (parameter 5517 ➡ p. 265) time. The frequency controller is switched off, if the engine speed (generator frequency) falls below the “Release engine monitoring” (parameter 12999 ➡ p. 173/➡ p. 930) level.
- The voltage controller is triggered, if the generator reaches the "Start value" (parameter 5616 ➡ p. 241) and after the expired "Start delay" (parameter 5617 ➡ p. 241) time. The voltage controller is switched off, if the engine speed (generator frequency) falls below the “Release engine monitoring” (parameter 12999 ➡ p. 173/➡ p. 930) level.
- The delayed monitoring function is triggered when LogicsManager "Release engine monitoring" (parameter 12999 ➡ p. 173/➡ p. 930) becomes TRUE and after the "Engine monitoring delay time" (parameter 3315 ➡ p. 171). The delayed monitoring function is switched off when LogicsManager "Release engine monitoring" (parameter 12999 ➡ p. 173/➡ p. 930) becomes FALSE.

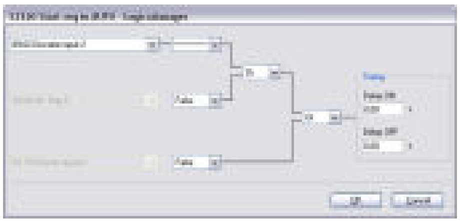


Fig. 269: LogicsManager function "Start req. in AUTO"

To activate the operational mode in the easYgen, discrete input [DI 02] ("09.02 Discrete input 2") is used in the LogicsManager "Start req. in AUTO" (parameter 12120 ⇘ p. 290/⇘ p. 927) .

With removing the start request in AUTOMATIC the operational mode will be left.

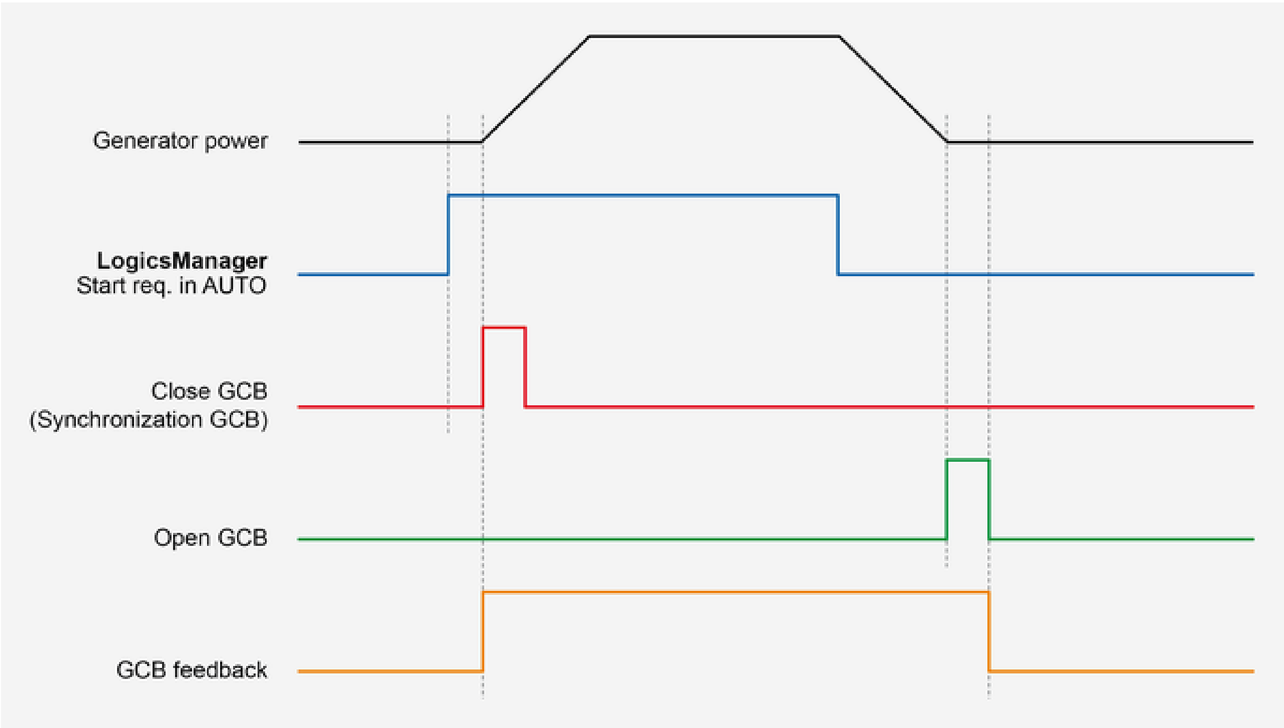


Fig. 270: Start/Stop sequence - LogicsManager "Start req. in AUTO"

Fig. 270 shows the following:

- The closing (synchronization) of the GCB is triggered when LogicsManager "Start req. in AUTO" (parameter 12120 ⇘ p. 290/⇘ p. 927) becomes TRUE.
- The opening (including power down ramping) of the GCB is triggered when LogicsManager "Start req. in AUTO" (parameter 12120 ⇘ p. 290/⇘ p. 927) becomes FALSE.

6.3.13 Ripple Control Receiver

General notes

Decentralized energy producers can be obliged by power supply companies to equip plants with a technical and operational provision for remote-controlled reduction of the feed-in power to stabilize mains. Ripple control is one form of power limitation and is used in many countries around the world.

Functionality

The energy supply company provides a signal to the ripple control receiver to reduce the feed-in power of the generating plant. The ripple control receiver switches four relay contacts according to the required energy power level. This relay contacts correspond for example to the following energy power levels:

- 100% (full feed-in) - Step 1
- 60% - Step 2
- 30% - Step 3
- 0% (no feed-in) - Step 4

The respective contact is closed for the duration of the reduction.

The reduction of the feed-in power must be established within a certain time frame (depending on national regulations).

Derating of power

The power reduction is realized by using the LogicsManager "Free derating" (parameter 15146 ➪ p. 283/➪ p. 930). This function is using an analog signal. For this reason the relay outputs of the ripple control receiver must be converted into a corresponding analog signal. We recommend a resistor array like shown in Fig. 271 to convert the relay outputs into a analog signal (0 to 500 Ohms).

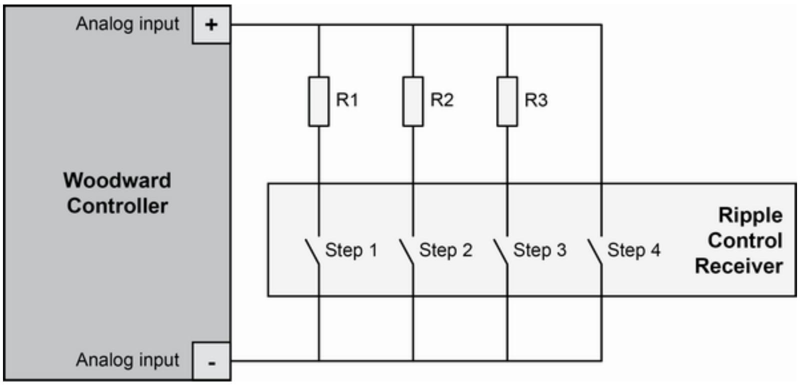


Fig. 271: Ripple control receiver wiring

R1 = 500 Ohms (or 560 parallel 4.7 k)
R2 = 300 Ohms (or 330 parallel 3.3 k)
R3 = 150 Ohms

Max. power [% of rated]	Switched relay ripple control receiver	Corresponding analog value	Derating [% of rated]
100%	Relay - Step 1	500 Ohms	0%
60%	Relay - Step 2	300 Ohms	40%
30%	Relay - Step 3	150 Ohms	70%
0%	Relay - Step 4	0 Ohms	100%

Configuring the analog input for a ripple control receiver

1. Either on the front panel or using ToolKit navigate to menu *"Configure analog inputs ➔ Analog input 1"*.
2. Configure the parameters listed below.

ID	Parameter	Value	Comment
1000	Type	Linear	A user-defined linear characteristic curve is to be used
1001	User defined min display value	+100.00	A value of 100 is displayed at the minimum of the input range
1002	User defined max display value	+0.00	A value of 0 is displayed at the maximum of the input range
1039	Sender value at display min.	0.000	The sender value at minimum display is 0 Ohms
1040	Sender value at display max.	500.000	The sender value at maximum display is 500 Ohms
1020	Sender type	0 - 2000 Ohm	A 0 to 2000 Ohms sender is used on the analog input
10113	Filter time constant	3	Filter time depending on the ambient conditions
3632	Bargraph minimum	+0.00	The start value for the bargraph display of the analog input is 0
3633	Bargraph maximum	+100.00	The end value for the bargraph display of the analog input is 100 and indicates the derating

3. Configure the following parameters using ToolKit. They facilitate a more detailed display of the analog value.

ID	Parameter	Value	Comment
1025	Description	Derating	Analog input [AI 01] is labeled with "Derating" on the display
1034	Unit	%	Text "%" is displayed for the unit
1035	Exponent for protocol	0	Value displayed "as is" (without exponent)

Configuring the derating of power

1. Either on the front panel or using ToolKit navigate to menu *"Configure load control ➔ Derating of power"*.
2. Configure the parameters listed below.

ID	Parameter	Value	Comment
15149	Direct derating	On	Only the analog source is used for the derating
15147	AM Derating source	Determined by AnalogManager 81.21 **[A1 = 06.01 Analog input 1]**	Defines *[06.01 Analog Input AI 1]* as the analog source which controls the derating function Select "Pass through"
15142	J1939 derating	Off	The derate command via ECU is ignored

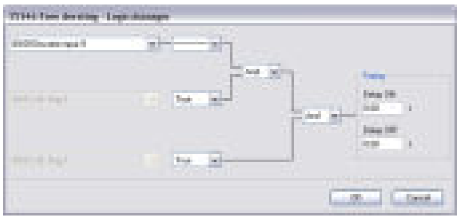


Fig. 272: LogicsManager function "Free derating"

3. Configure the LogicsManager function *"87.60 Free derating"* as shown in (Fig. 272) to enable derating of power if discrete input [DI 09] is energized.

> *Please configure "Alarm class" (parameter 1362 ↬ p. 187) of discrete input [DI 09] to "Control".*

Maximal power setpoint

After the unit is configured as described above, the maximal power setpoint looks like shown in Fig. 273.

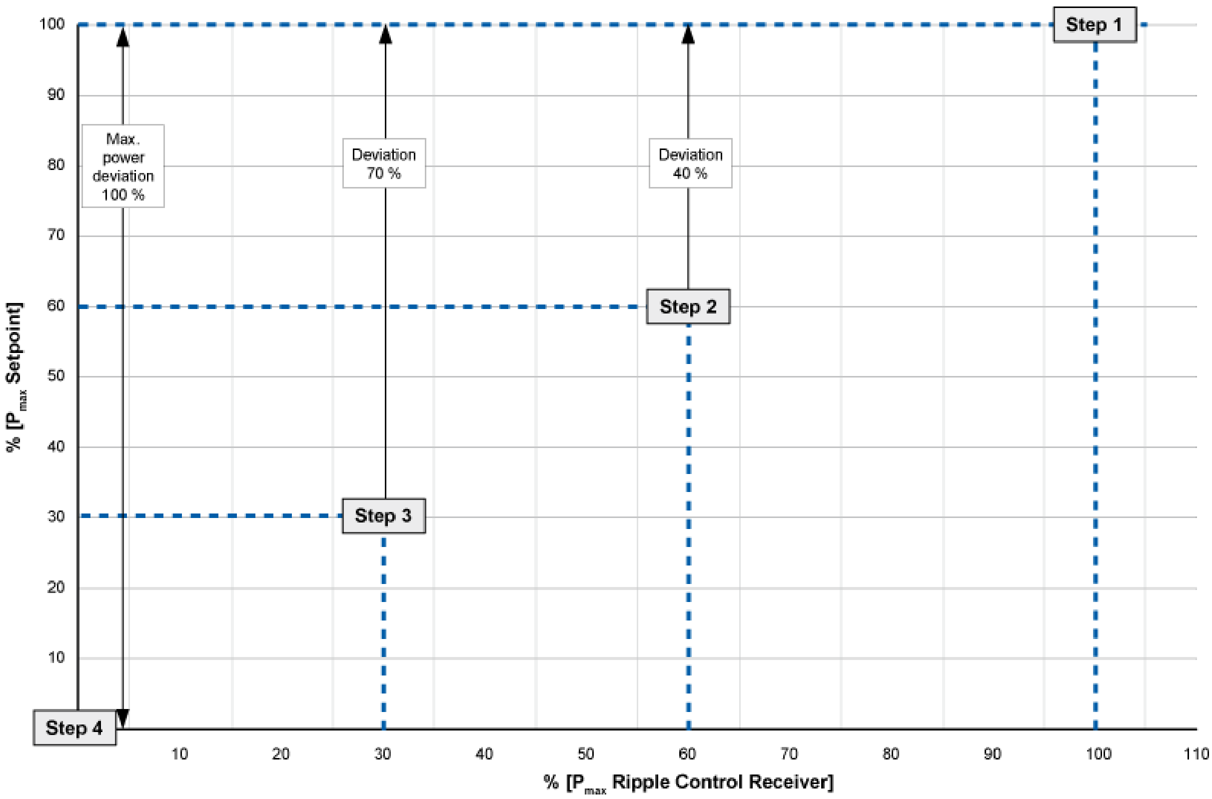


Fig. 273: Maximal power setpoint

6.3.14 Neutral Interlocking

General Notes

The Neutral Interlocking function controls in multiple-gen applications the Neutral Contactor (NC) of each generator. The contactor bridges the Neutral with the PE. The rule is that only one neutral of the running generators in the same segment are bridged to earth.

The Logic ensures that with changing of generators or a lacking neutral breaker the neutral link is passed over to another active running generator. This requires information exchange between the genset controls. The load share protocol in the easYgen provides the according information.

Application Examples

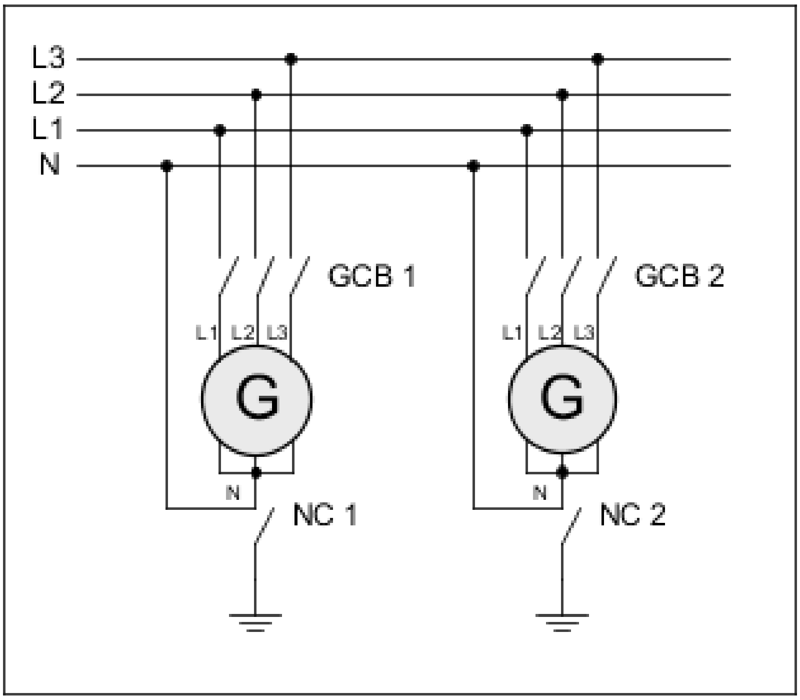


Fig. 274: Wiring neutral Interlocking: GCB 3-pole

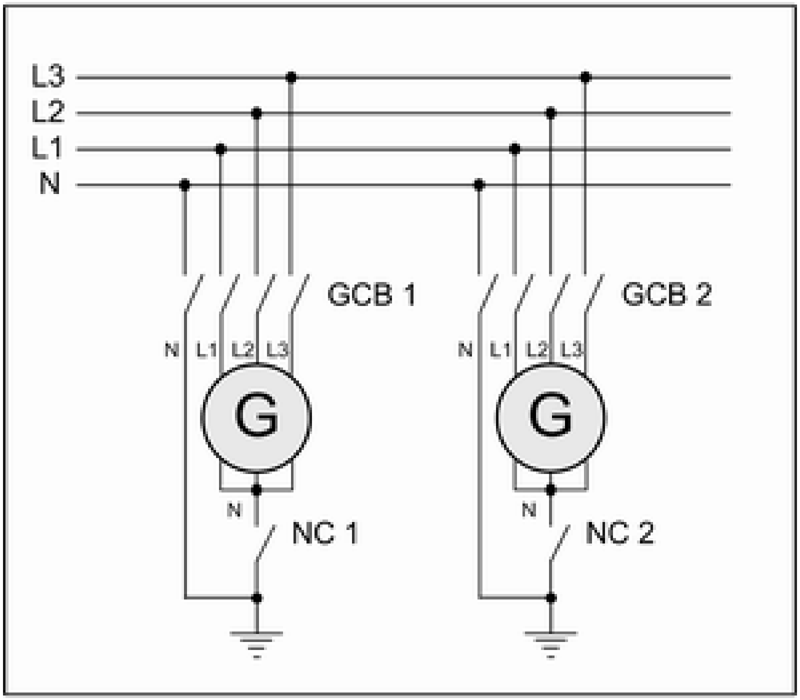


Fig. 275: Wiring neutral Interlocking: GCB 4-pole

Function

Start and operating

The genset control closes principally after each successful start (firing speed reached) the NC. The genset control proceeds with closing the GCB, if the NC has been closed successfully. If the NC closure was not successful the easYgen issues an alarm. The NC and GCB closure procedure is blocked from now on, until the alarm is acknowledged.

When the GCB is closed the genset control begins to figure out, whether the own NC can remain closed or must be opened. This monitoring is done continuously.

As long the GCB is closed, the NC remains closed or is closed, if:

- No connection to mains is active
  AND
- one of the following is TRUE
  - the own NC is the only closed NC in the same segment
    OR
  - there is minimum one other NC in the same segment closed but the own generator has a higher neutral interlocking priority
    OR
  - there is minimum one other NC in the same segment closed which has the same neutral interlocking priority but the own genset control has a lower device number

In all other cases the NC is opened!

Running Generator without closed GCB

As long the engine/generator is running and the GCB is open the NC will be closed or remains closed until the engine/generator is stopped.

Neutral Contactor (NC) Feedback

The discrete input 12 (DI 12) is used as feedback of the Neutral contactor and cannot be configured onto another discrete input. If the input is energized, the neutral contactor is recognized as closed.

Monitoring NC Feedback

The monitoring of the NC feedback is performed always, if the Neutral Interlocking is enabled. The monitor checks, if the feedback behaves according to the NC command. With a configurable delay time the alarm is activated with a general alarm text. Open or closure failure are not differentiated. The issued Alarm text is: "N-cont. reply mism." (Neutral contactor has a reply mismatch).

Event logger and NC Feedback

If the Neutral Interlocking is enabled, following event entries shall take place:

- Neutral cont. opened (with +)
- Neutral cont. closed (with +)

Priority for Closing NC

The priority for closing GCB is configurable. This priority is independent from the LDSS priority. The customer can freely decide which generator shall get which priority.

> *The advantage of this determination is that the application is not fixed with rated power settings. Maybe there are other circumstances which shall determine the neutral interlocking priority.*

Two LogicsManager variables give further information:

- 03.39 Close neutral contactor - status
- 08.37 Neutral contactor reply mismatch

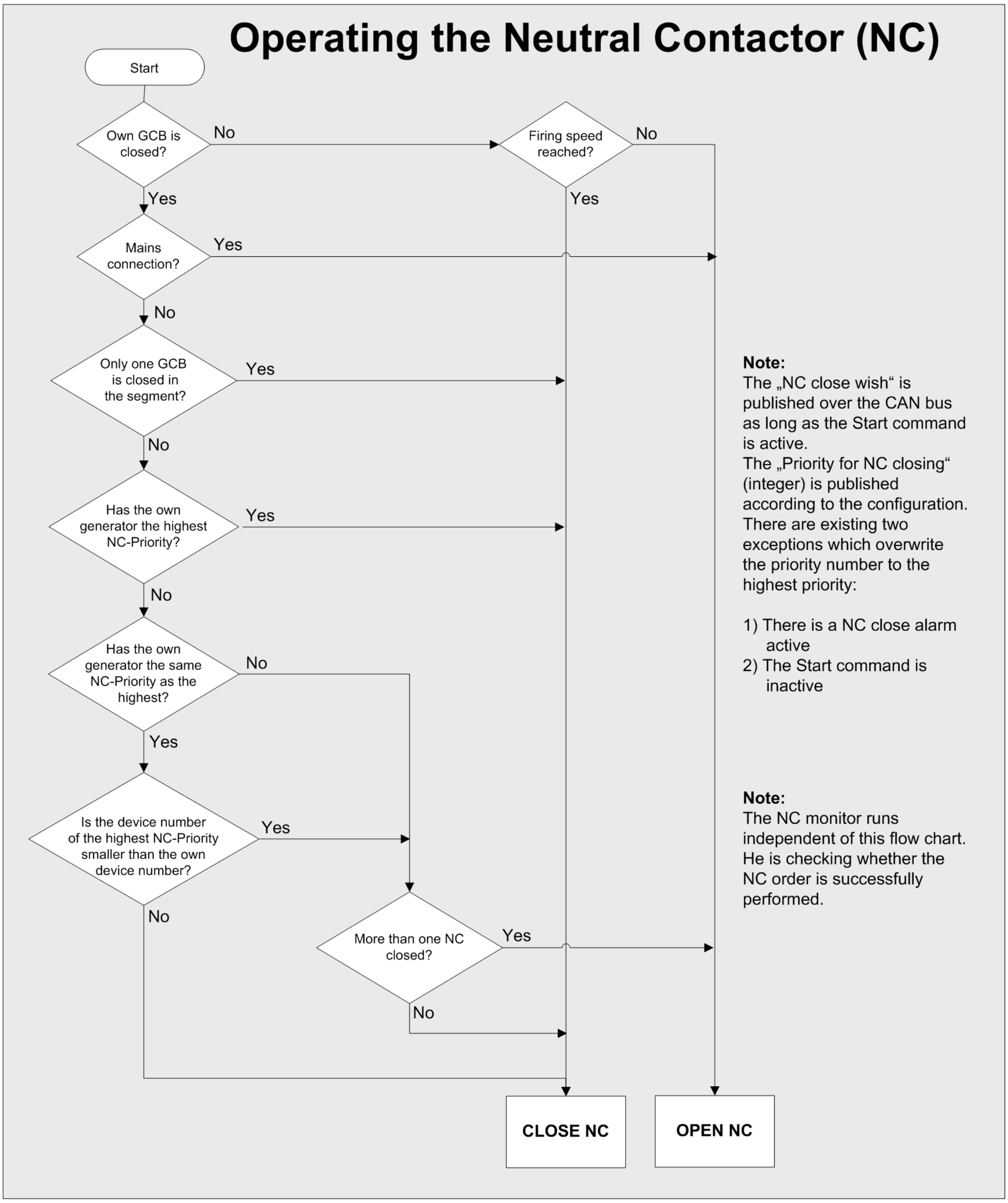


Fig. 276: Flow Chart Neutral-Interlocking

6.3.15 Run-Up Synchronization

The generators are paralleled together by closing their circuit breakers during the engine start sequence. Then after a certain speed is achieved the voltage regulators are enabled and the generators will produce voltage. The run-up synchronization method is used to get several synchronous generators onto load in a very short time. This time is determined by the engine start time and the AVR on-excitation.

Another application for using run-up synchronization is the excitation of power transformers. In some cases the in-rush current of a transformer may be more than one generator can supply when closing the live generator to the dead transformer. Using this run-up synchronization method allows the generator and transformer to build up voltage gradually through the start without the large in-rush.

The run-up synchronization supports also a GCB closure for magnetizing a power transformer under defined circumstances, if the prime mover is not controlled by the device.

General notes

- The run-up synchronization is generally released by configuration.
- The run-up synchronization is supported in dedicated application Modes and breaker transition modes.
- To get the run-up synchronization procedure active the LogicsManager "Run-up Synchronization" has to be set on TRUE.
- When run-up synchronization is enabled the easYgen evaluates before each start an open connection to mains. For the case the generator would be connected to mains during run-up synchronization the unit would automatically open the connection to mains before start.
- The run-up synchronization requires an rpm speed source (MPU or J1939).
- With enabling the run-up synchronization the command variable 03.24 "Excitation AVR" is usable. The activation can be checked in the online diagram.
- The excitation can be simultaneous or individual. The simultaneous excitation can reduce the cross currents between generators in some critical situations.
- The run-up synchronization can be executed in two modes:
  - Mode GCB: With starting the engines the GCB will be closed.
  - Mode GCB/GGB: With starting the engines the GCB and GGB will be closed.

Multiple Genset Run-Up

Run-up synchronization can be interrupted by an "Undelayed close" request!

Woodward strongly recommends to configure all gensets of a run-up synchronization system similarly to run-up synchronization to suppress aborting input.

Example applications

The run-up synchronization can be applied in different applications. The following figures show some examples.

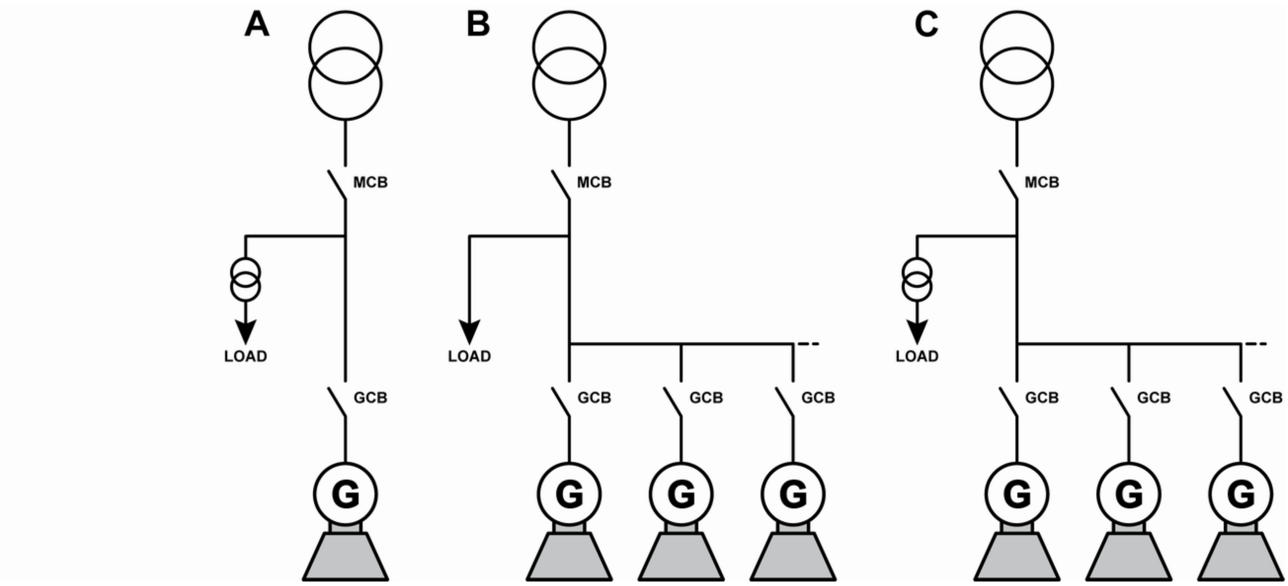


Fig. 277: Run-up synchronization examples

A Single generator with power transformer without GGB
B Multiple generators with load on busbar without GGB
C Multiple generators with large transformer on busbar without GGB

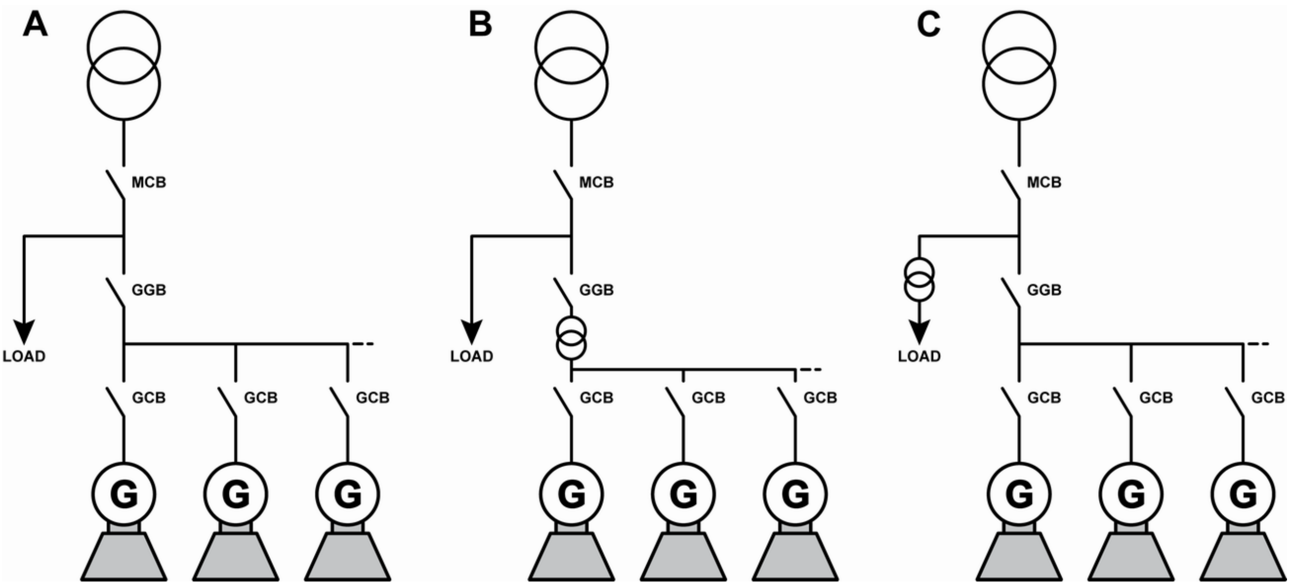


Fig. 278: Run-up synchronization examples

A Multiple generators with large load on busbar with GGB
B Multiple generators with common transformer and GGB
C Multiple generators with large transformer load on busbar and GGB

6.3.15.1 Configuration

Breaker modes

The run-up synchronization can be used in following breaker modes.

- Application mode GCB A03
- Application Mode GCB/MCB A04 (GCB/L-MCB A08)
  - Parallel
  - Interchange
  - Closed Transition
  - Open Transition
- Application mode GCB/GGB A05 (GCB/L-GGB A10)
- Application mode GCB/GGB/MCB A06 (GCB/L-GGB/L-MCB A11)
  - Parallel
  - Open Transition
  - Closed transition
  - Interchange
- Application mode GCB/LS5 A07 (GCB/GGB/L-MCB A09)

Preconditions

The following preconditions must be fulfilled to use the run-up synchronization.

- The run-up synchronization is enabled AND
- The MPU input is enabled AND
- The operating mode AUTOMATIC is active AND
- The LogicsManager “Run-up synchronization” is energized AND
- An engine start command is active AND
- The unit recognizes a generator dead busbar situation AND
- No shutdown alarm is present

Interrupt conditions

The run-up synchronization is interrupted by following conditions.

- The run-up synchronization is disabled OR
- The LogicsManager „Run-up synchronization“ is not TRUE OR
- A shutdown failure (alarm class C, D, E or F) is active OR
- An engine start command is not active OR
- The „Generator Group Breaker is closed” AND the run-up synchronization mode does not allow this

Behavior of the biasing signals

During the run-up synchronization the frequency controller, the voltage controller and the load sharing are disabled. To avoid a reverse power condition shortly after activation of the excitation, the biasing signals of the easYgen will behave with a droop (static) curve.

The droop settings for the frequency f (parameter 5504 p. 265) and voltage V (parameter 5604 p. 241) are used for this calculation.

The initial state frequency decreases as active power increases according to this formula:

- Initial State Frequency Deviation = Initial State Frequency*Active Power [%]*Droop f [%]

The initial state voltage decreases as reactive power increases according to this formula:

- Initial State Voltage Deviation = Initial State Voltage*Reactive Power [%]*Droop V [%]

The frequency and voltage biasing is switched on, when the excitation is activated and the following triggered “Monitoring delay time” (parameter 3315 ↳ p. 171) has expired.

6.3.15.2 Procedures

6.3.15.2.1 Application Mode GCB

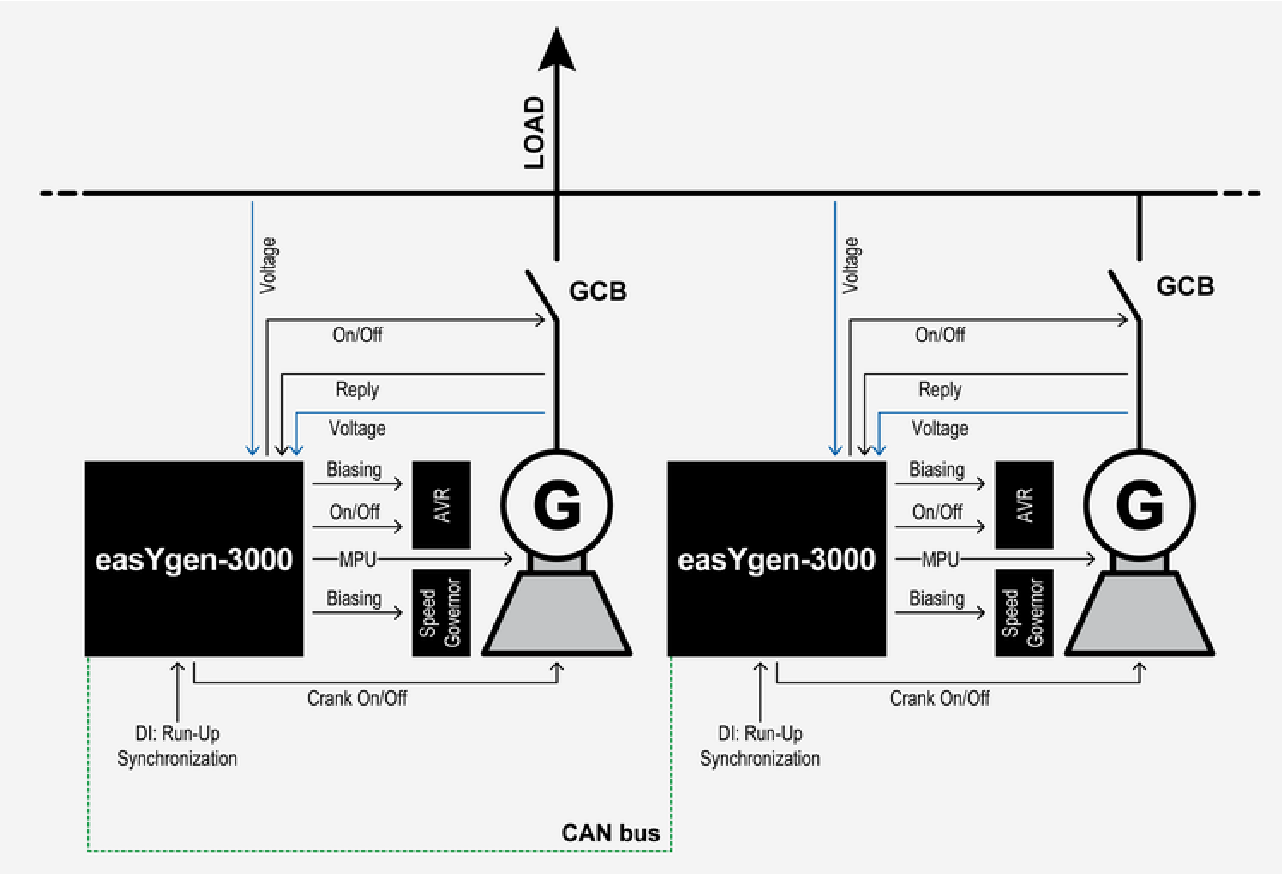


Fig. 279: Application mode GCB

Run-up synchronization GCB

ID	Parameter	Setting range	Proposal
3435	Run-up synchronization mode	Off / with GCB / with GCB/GGB	with GCB
3436	Minimum speed for close GCB	0 to 4,000 rpm	350 rpm
3437	Speed for excitation start	0 to 4,000 rpm	700 rpm
3438	Time of participation	1 to 180 s	7 s
3442	Simultaneous excitation	On / Off	Off
12937	Run up sync.	LogicsManager	DI 11

Table 124: Run-up synchronization

Preconditions for run-up synchronization:

- GCB open
- MCB open (no mains connection)

- Engine(s) are stopped
- Run-up synchronization is released (LogicsManager)

With the start command the easYgen sets the solenoid valve, the starter and closes the GCB. The unit displays "Run-up synchronization". If the engine reaches the 700 rpm (speed for excitation start) the easYgen activates the excitation. From now on monitoring delay time is decremented from start value "Engine monitoring delay time" (parameter 3315 ✎ p. 171) until it is expired; then:

- The underfrequency / overfrequency monitoring is activated
- The undervoltage monitoring is activated
- The pickup/frequency monitoring is activated
- The frequency and voltage controller is activated

Run-up synchronization acting on GCB and GGB is not applicable in this application mode. The run-up synchronization is inhibited.

6.3.15.2.2 Application Mode GCB/GGB

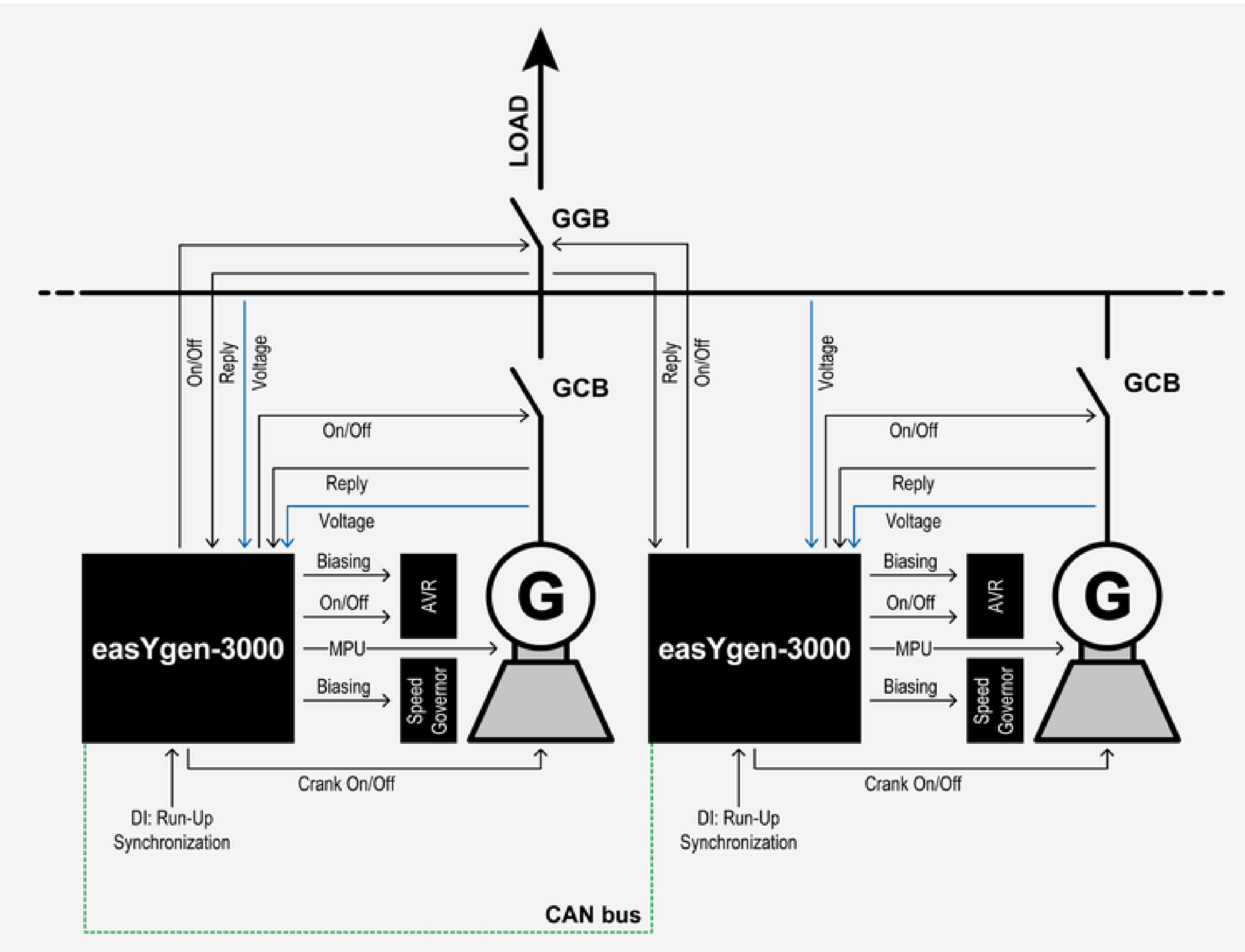


Fig. 280: Application mode GCB/GGB

Run-up synchronization GCB

ID	Parameter	Setting range	Proposal
3435	Run-up synchronization mode	Off / with GCB / with GCB/GGB	with GCB
3436	Minimum speed for close GCB	0 to 4,000 rpm	350 rpm
3437	Speed for excitation start	0 to 4,000 rpm	700 rpm
3438	Time of participation	1 to 180 s	7 s
3442	Simultaneous excitation	On / Off	Off
12937	Run up sync.	LogicsManager	DI 11

Table 125: Run-up synchronization

ID	Parameter	Setting range	Proposal
3440	Min. Generator power	0.00 to 327.67 MW	0.10 MW
12936	Bypass min. Pgen.	LogicsManager	—
3441	Voltage monitoring load busbar	On / Off	Off

Table 126: GGB control

Preconditions for run-up synchronization:

- GCB open
- GGB open
- MCB open
- Engine(s) are stopped
- Run-up synchronization is released (LogicsManager)

With the start command the easYgen sets the solenoid valve, the starter and closes the GCB. The unit displays "Run-up synchronization". If the engine reaches the 700 rpm (speed for excitation start) the easYgen activates the excitation. From now on monitoring delay time is decremented from start value "Engine monitoring delay time" (parameter 3315 ➪ p. 171) until it is expired; then:

- The underfrequency / overfrequency monitoring is activated
- The undervoltage monitoring is activated
- The pickup/frequency monitoring is activated
- The frequency and voltage controller is activated
- The closing of the GGB will be executed, if enough generator power is available on generator busbar

Run-up synchronization GCB and GGB

ID	Parameter	Setting range	Proposal
3435	Run-up synchronization mode	Off / with GCB / with GCB/GGB	with GCB/GGB

Table 127: Run-up synchronization

Preconditions for run-up synchronization:

- GCB open
- GGB open

- MCB open
- Engine(s) are stopped
- Run-up synchronization is released (LogicsManager)

With the start command the easYgen sets the solenoid valve, the starter and closes the GCB and GGB. The unit displays "Run-up synchronization". If the engine reaches the 600 rpm (speed for excitation start) the easYgen activates the excitation. From now on monitoring delay time is decremented from start value "Engine monitoring delay time" (parameter 3315 p. 171) until it is expired; then:

- The underfrequency / overfrequency monitoring is activated
- The undervoltage monitoring is activated
- The pickup/frequency monitoring is activated
- The frequency and voltage controller is activated

6.3.15.2.3 Application Mode GCB/MCB

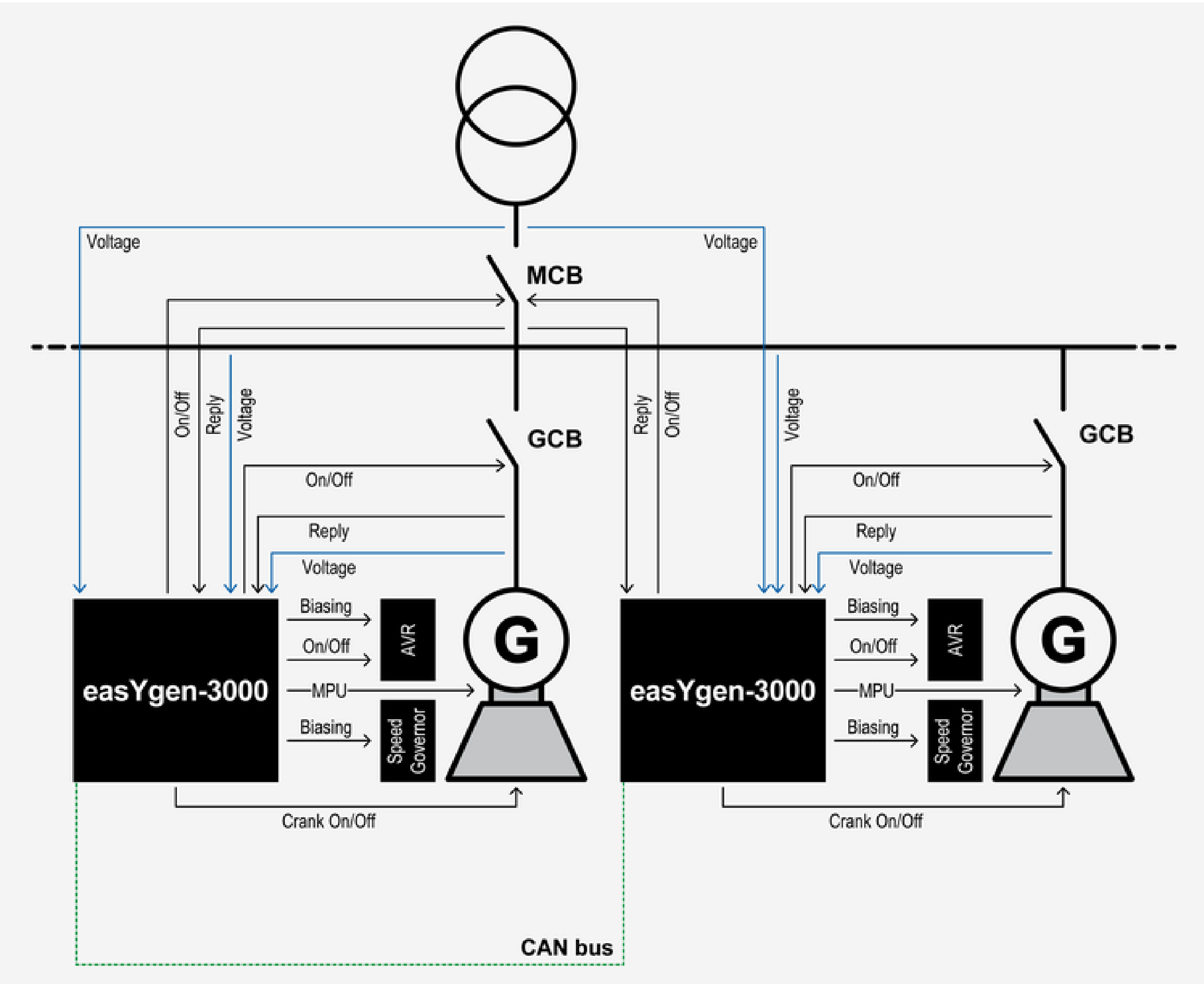


Fig. 281: Application mode GCB/MCB

The breaker transition mode makes no difference during the run-up synchronization.

Run-up synchronization GCB

ID	Parameter	Setting range	Proposal
3435	Run-up synchronization mode	Off / with GCB / with GCB/GGB	with GCB
3436	Minimum speed for close GCB	0 to 4,000 rpm	000 rpm
3437	Speed for excitation start	0 to 4,000 rpm	600 rpm
3438	Time of participation	1 to 180 s	7 s
3442	Simultaneous excitation	On / Off	Off
12937	Run up sync.	LogicsManager	Emergency run

Table 128: Run-up synchronization

Preconditions for run-up synchronization in emergency run:

- Mains OK
- GCB open
- Engine(s) are stopped
- Run-up synchronization is released (LogicsManager)

In this example the run-up synchronization shall be executed, if the emergency start (AMF) becomes active. With the start command the easYgen evaluates the condition of the MCB. If the MCB is closed, the unit opens at first the MCB. After successful opening the MCB the unit sets the solenoid valve, the starter and closes the GCB. The unit displays "Run-up synchronization". If the engine reaches the 600 rpm (speed for excitation start) the easYgen activates the excitation. From now on monitoring delay time is decremented from start value "Engine monitoring delay time" (parameter 3315 ➷ p. 171) until it is expired; then:

- The underfrequency / overfrequency monitoring is activated
- The undervoltage monitoring is activated
- The pickup/frequency monitoring is activated
- The frequency and voltage controller is activated

> *Run-up synchronization acting on GCB and GGB is not applicable in this application mode. The run-up synchronization is inhibited.*

6.3.15.2.4 Application Mode GCB/GGB/MCB

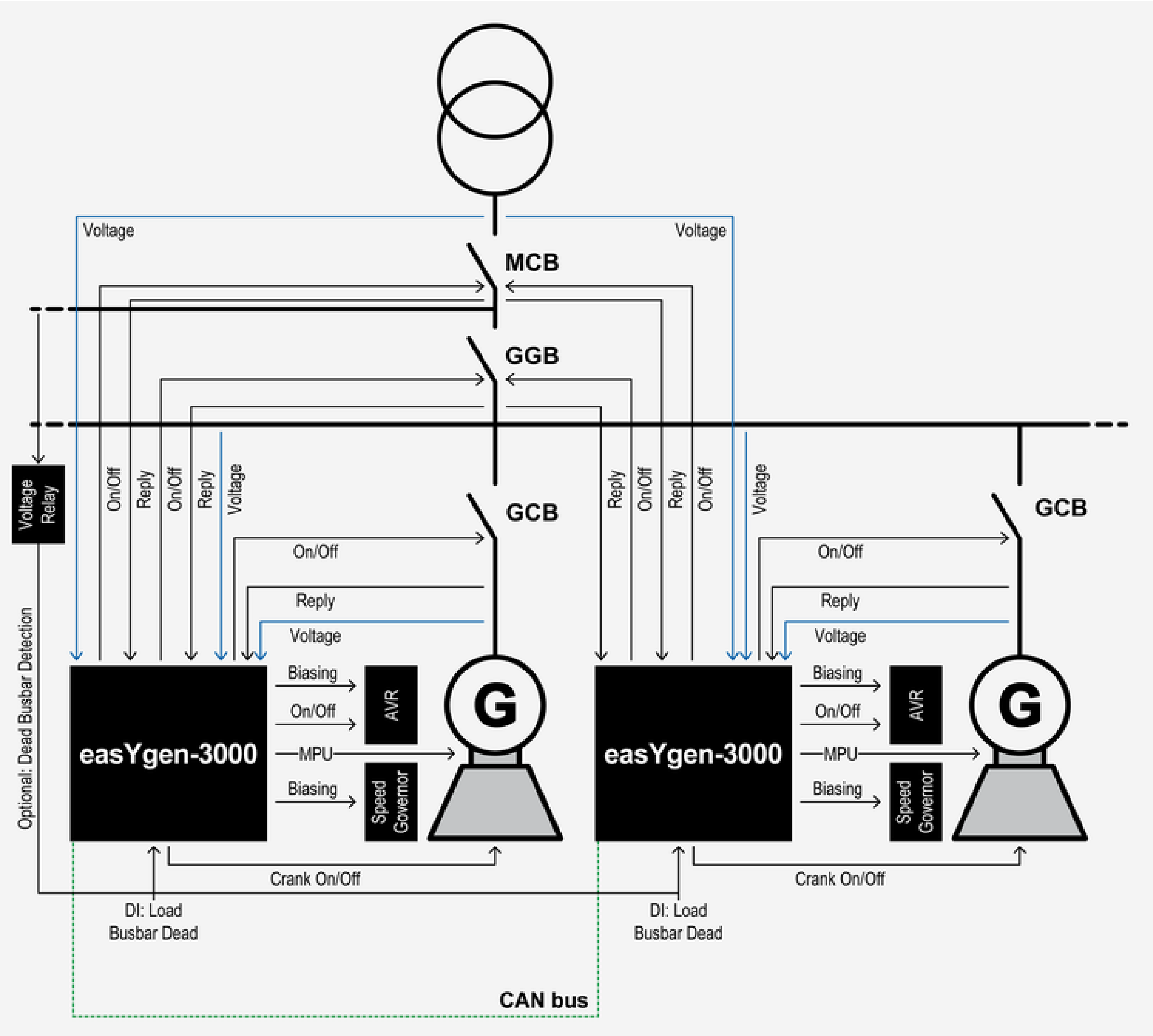


Fig. 282: Application mode GCB/GGB/MCB

The breaker transition mode makes no difference during the run-up synchronization.

Run-up synchronization GCB

ID	Parameter	Setting range	Proposal
3435	Run-up synchroni-zation mode	Off / with GCB / with GCB/GGB	with GCB
3436	Minimum speed for close GCB	0 to 4,000 rpm	350 rpm
3437	Speed for excita-tion start	0 to 4,000 rpm	700 rpm
3438	Time of participa-tion	1 to 180 s	7 s

ID	Parameter	Setting range	Proposal
3442	Simultaneous excitation	On / Off	Off
12937	Run up sync.	LogicsManager	Emergency run

Table 129: Run-up synchronization

ID	Parameter	Setting range	Proposal
3440	Min. Generator power	0.00 to 327.67 MW	—
12936	Bypass min. Pgen.	LogicsManager	—
3441	Voltage monitoring load busbar	On / Off	On

Table 130: GGB control

Preconditions for run-up synchronization in emergency run:

- Mains OK
- GGB open
- GGB open
- Engine(s) are stopped
- Run-up synchronization is released (LogicsManager)

In the example here the run-up synchronization shall be executed, if the emergency start (AMF) becomes active. With the start command the easYgen sets the solenoid valve, the starter and closes the GCB. The unit displays "Run-up synchronization". If the engine reaches the 600 rpm (speed for excitation start) the easYgen activates the excitation. From now on monitoring delay time is decremented from start value "Engine monitoring delay time" (parameter 3315 ↳ p. 171) until it is expired; then:

- The underfrequency / overfrequency monitoring is activated
- The undervoltage monitoring is activated
- The pickup/frequency monitoring is activated
- The frequency and voltage controller is activated
- The load will be transferred according to the configured breaker transition mode

Run-up synchronization GCB and GGB

ID	Parameter	Setting range	Proposal
3435	Run-up synchronization mode	Off / with GCB / with GCB/GGB	with GCB/GGB
3436	Minimum speed for close GCB	0 to 4,000 rpm	350 rpm
3437	Speed for excitation start	0 to 4,000 rpm	700 rpm
3438	Time of participation	1 to 180 s	7 s
3442	Simultaneous excitation	On / Off	Off
12937	Run up sync.	LogicsManager	Emergency run

Table 131: Run-up synchronization

ID	Parameter	Setting range	Proposal
3440	Min. Generator power	0.00 to 327.67 MW	0.10 MW
12936	Bypass min. Pgen.	LogicsManager	—
3441	Voltage monitoring load busbar	On / Off	On

Table 132: GGB control

Preconditions for run-up synchronization in emergency run:

- Mains OK
- GCB open
- GGB open
- Engine(s) are stopped
- Run-up synchronization is released (LogicsManager)

In this example the run-up synchronization shall be executed, if the emergency start (AMF) becomes active. With the start command the easYgen evaluates the condition of the MCB. If the MCB is closed, the unit opens at first the MCB. After successful opening the MCB the unit sets the solenoid valve, the starter and closes the GCB and GGB. The unit displays "Run-up synchronization". If the engine reaches the 600 rpm (speed for excitation start) the easYgen activates the excitation. From now on monitoring delay time is decremented from start value "Engine monitoring delay time" (parameter 3315 ↳ p. 171) until it is expired; then:

- The underfrequency / overfrequency monitoring is activated
- The undervoltage monitoring is activated
- The pickup/frequency monitoring is activated
- The frequency and voltage controller is activated

6.3.15.3 Parameter Information

The “Minimum speed for close GCB” (parameter 3435) is 0 rpm:

The GCB (GGB) will be closed from the beginning on during the run-up synchronization start. The advantage of this solution is a clear defined start condition for all participating engines. It is recommended for cases where all gensets are needed for the run-up synchronization and no reserve genset is available.

The “Minimum speed for close GCB” (parameter 3435) is higher than 0 rpm:

The GCB (GGB) will be closed, when the starter has turned the crankshaft successfully. The level is usually set between 100 rpm and under the firing speed level (450 rpm). The advantage of this solution is to save time during the run-up procedure, if more gensets are started as needed. It is recommended for cases where more gensets are available as needed for the run-up synchronization.

The “Speed for excitation” (parameter 3437):

If the engine reaches the speed for excitation the excitation output will be issued. The speed for excitation must be higher than the firing speed of the engine to make sure the start will be successful.

The “Simultaneous excitation” (parameter 3442):

If the simultaneous excitation is enabled, all participating units, which match the speed limit for excitation will issue their excitation command to the AVRs at the same time.

If the simultaneous excitation is disabled, all participating units, which match the speed limit for excitation will issue their excitation command to the AVRs independent of their neighbors.

The advantage of a simultaneous excitation is to minimize cross currents between the generators during the run-up synchronization. The disadvantage of a simultaneous excitation is the demand of a little bit more time until all units are available for excitation.

The simultaneous excitation makes sense, when high cross currents are expected between the generators during run-up synchronization.

The “Time of participation” (parameter 3438):

The time of participation is the maximum time an engine is accepted during the common run-up synchronization. When the time is over, the single unit interrupts the run-up synchronization and opens the GCB (GGB).

Recommendation:

- The time of participation should be never longer than the starter time (parameter 3306 🔗 p. 171)
- The time of participation should be long enough that the engines can reach their speed for excitation in that time band

The “Engine monitoring delay time” (parameter 3315):

The Engine monitoring delay time is also used in the run-up synchronization. There is a time to wait between activate the excitation and monitoring the voltage and frequency. Usually the closing of a GGB shall only be executed, when the monitoring delay time is expired. In some cases like emergency run this time can be bypassed to get the GGB faster closed.

6.3.15.4 Commissioning Checklist

The following checklist is guideline to commission the run-up synchronization mode.

- Select the right application mode according to your application. Note that the feedback of the GCB, GGB and MCB is always used according to the chosen application mode. The “Enable MCB" LogicsManager must be considered in case of running mains parallel.
- Select in case of the application mode GCB/MCB A04 or GCB/GGB/MCB A06 the desired transition mode.
- Check at first all breaker feedbacks.
- In case of a GCB/MCB A04, GCB/GGB/MCB A06, GCB/L-MCB A08, GCB/GGB/L-MCB A09 or GCB/L-GGB/L-MCB A11 application mode it is recommended to use the optional voltage relay discrete input. Check the voltage relay input (**dead** load busbar shall energize the input).
- Make sure that your emergency stop button works.
- Before trying any run-up synchronization function, check each unit with a normal start by setting FALSE the LogicsManager “Run-up synchronization”.

- Do a single start (without run-up synchronization) for each engine to check:
  - Starter
  - Solenoid valve
  - MPU input (speed)
  - Excitation command
  - Generator voltage measurement
  - Optional voltage relay input
  - Busbar voltage measurement
  - Mains voltage measurement (depending on application mode)
  - Generator breaker control
  - Generator group breaker control (depending on application mode)
  - Mains breaker control (depending on application mode)
- Check the synchronization of GCB, GGB and MCB by each unit with single runs.
- Check the frequency, voltage, active power and power factor control by each unit with single runs.
- Check the load share function with all units.
- Check the CAN communication between the single easYgens. Make sure that each unit has its own device identifier and an own Node-ID (usually ID 1, 2, 3 etc. and node identifier 1, 2, 3 etc.). The sequencing window gives you an overview.
- Before you begin with the run-up synchronization make sure, that the physical connection to mains is really open. Later on, if the easYgen shall open the MCB check this again.
- Before you do the first tries with run-up synchronization read this manual and especially the chapter describing your especially application.
- Consider, if you like a GCB closed before issue the crank command (parameter 3437 ➪ p. 177 is set to 0) or after the engine crank shaft is definitely turning (parameter 3437 ➪ p. 177 > 0).
- Consider, if you like simultaneously excitation (parameter 3442 ➪ p. 178 = On] or not. Simultaneously excitation sequence is a little bit longer but can avoid reverse power on the engines, if they very differently come on speed.
- Consider the time of participation (parameter 3438 ➪ p. 177), because the time determines when a member will be removed from the others to continue with a normal start.

6.4 CANopen Applications

6.4.1 Remote Control

6.4.1.1 Remote Start/Stop, Shutdown, And Acknowledgment

> *Refer to ➪ Chapter 6.3.5 “Performing Remote Start/Stop And Acknowledgment” on page 545 for detailed information.*

The easYgen may start, stop, shut down, or acknowledge alarms with CAN/Modbus. Therefore, two logical command variables (04.13 and 04.14) have to be configured with the LogicsManager. 03.40 can handle Remote shutdown only.

- 04.13 Remote request
- 04.14 Remote acknowledge
- 03.40 Remote shutdown

A Remote Shutdown 03.40 can be configured via LogicsManager internal flag (e.g.12230 Flag 1) combined with a free alarm LogicsManager (e.g. Free alarm 1) configured with shutdown alarm class.

Two different methods to perform a remote start/stop/Acknowledgment using 04.13 Remote request and 04.14 Remote acknowledge are detailed in the below.

These are "Remote start/stop/Acknowledgment via RPDO" and "Remote start/stop/Acknowledgment via default SDO communication channel". The advantages and the disadvantages of these two methods are as follows.

RPDO	Default SDO communication channel
Classical communication for CANopen devices	Configuration process
One message	Two messages
No validation of the received answer	Validation answer, if message has been received by the unit
Only working in operational mode	May take longer in case of communication with two messages

Table 133: Comparison

6.4.1.1.1 RPDO

Configure CAN interface 1

CANopen Master (parameter 8993 p. 445) must be enabled, if there is no PLC taking over the master function.

1. Either on the front panel or using ToolKit navigate to menu *"Configure CAN interface ➔ Configure CAN interface 1"*.
2. Configure the parameter listed below.

ID	Parameter	Value	Comment
8993	CANopen Master	On	CANopen Master is enabled.

Configure RPDO

1. Either on the front panel or using ToolKit navigate to menu *"Configure CAN interface 1 ➔ Receive PDO 1"*.
2. Configure the parameters listed below.

ID	Parameter	Value	Comment
9300	COB-ID	00000201 (hex)	COB-ID set to 00000201.
9910	Number of Mapped Objects	1	One mapped object is configured
9911	1. Mapped Object	00503	The 1st mapped object is set to control parameter 503.

⇨

Setting the COB-ID to 201 (hex) is exemplary; usually, the PDOs are in the range of 181 (hex) to 57F (hex).

With this setting, the Receive PDO is configured to overtake the received data coming in by COB-ID 201 into the ID 503. The number of mapped objects is here 1.

Refer to Chapter 9.2.18 "Additional Data Identifier" on page 874 for a list of additional parameter groups.

CANopen message

The following table shows four data examples the device is receiving on the CANopen bus. These data are sent as TPDO to the device (COB-ID 201). The settings above map the received data to the easYgen address ID 503.

ID (hex)	Description	Data (hex)
201	Remote Start	01 00
201	Remote Stop	02 00
201	Remote Acknowledge	sequence of: 0000, 10 00; 0000, 1000 **Notes** The message 1000hex must be sent twice to acknowledge an alarm completely. The first rising edge (0000hex followed by 1000hex) disables the horn and the second rising edge resets the alarm.
201	Remote Shutdown	00 02

6.4.1.1.2 Default SDO Communication Channel

Another possibility for a remote start/stop/Acknowledgment is to send the request via default SDO communication channel. The device listens to the CAN ID 600 (hex) + Node-ID internally to perform the desired control, the reply is on CAN ID 580 (hex) + Node-ID.

The following examples show the request format on CANopen with different Node-IDs.

The request on the bus is sent via the control parameter ID 503 of the device.

The value 2000 (hex) is calculated internally:

- 503 (dec) -- 1F7 (hex)
- 1F7+2000 (hex) = 21F7 (hex)

> *Please note that high and low bytes are exchanged in the sent address. The data (hex) shows the state of parameter 503 to achieve the required control.*

Node-ID 1 (standard value)

The following table shows exemplary request data for the device on the CANopen bus.

Identifier	Description	Data (hex)
601	Remote Start	2B F7 21 01 01 00 00 00
601	Remote Stop	2B F7 21 01 02 00 00 00
601	Remote Acknowledge	sequence of: 2B F7 21 01 00 00 00 00, 2B F7 21 01 10 00 00 00; 2B F7 21 01 00 00 00 00, 2B F7 21 01 10 00 00 00; **Notes** The message 2B F7 21 01 10 00 00 00 must be sent twice to acknowledge an alarm completely. The first rising edge (2B F7 21 01 00 00 00 00 followed by 2B F7 21 01 10 00 00 00) disables the horn and the second rising edge resets the alarm.
601	Remote Shutdown	2B F7 21 01 00 02 00 00

Node-ID (not standard value)

If the Node-ID of the device is intended to be different from the standard value, the parameter "Node-ID CAN bus 1" (parameter 8950 ⤷ p. 445) must be configured accordingly. Node-ID 2 is used in the following example.

1. Either on the front panel or using ToolKit navigate to menu *“Configure CAN interface ➔ Configure CAN interface 1”*.
2. Configure the parameter listed below.

ID	Parameter	Value	Comment
8950	Node-ID CAN bus 1	002 (hex)	Node-ID set to 002.

⇨ With this setting, the Node-ID of the CAN interface 1 is set to 002.

The request on the bus is sent via the control parameter 503 of the device.

The hexadecimal value 2000 is calculated internally:

- 503 (dec) -- 1F7 (hex)
- 1F7 (hex) + 2000 (hex) = 21F7 (hex)

Please note that high and low bytes are exchanged in the sent address.

The data (hex) shows the state of parameter 503 to achieve the required control.

The following table shows exemplary request data for the device on the CANopen bus.

Identifier	Description	Data (hex)
602	Remote Start	2B F7 21 01 01 00 00 00
602	Remote Stop	2B F7 21 01 02 00 00 00
602	Remote Acknowledge	sequence of: 2B F7 21 01 00 00 00 00, 2B F7 21 01 10 00 00 00; 2B F7 21 01 00 00 00 00, 2B F7 21 01 10 00 00 00; **Notes** The message 2B F7 21 01 10 00 00 00 must be sent twice to acknowledge an alarm completely. The first rising edge (2B F7 21 01 00 00 00 00 followed by 2B F7 21 01 10 00 00 00) disables the horn and the second rising edge resets the alarm.
602	Remote Shutdown	2B F7 21 01 00 02 00 00

Additional SDO communication channels

It is also possible to allow several PLCs to start/stop/acknowledge the unit in addition to the default SDO communication channel. Four additional SDO communication channels are provided for this. The additional SDO 127 (dec) is used in the following example.

1. Either on the front panel or using ToolKit navigate to menu *"Configure CAN interface 1 ➔ Additional Server SDOs"*.
2. Configure the parameters listed below.

ID	Parameter	Value	Comment
12801	2. Node-ID	127 (dec) = 7F (hex)	SDO communication channel is configured to 127

⇨ With this setting, an additional SDO communication channel is configured to 127.

The control request is equal to the request via default SDO communication channel, but the device will listen to messages including the configured address as well.

The device listens to the CAN ID 600 (hex) + 2. Node-ID internally to perform the desired control, the reply from the easYgen is sent on CAN ID 580 (hex) + 2. Node-ID.

- Receive CAN ID 67F (hex) (600 (hex) + 7F (hex))
- Receive CAN ID 5FF (hex) (580 (hex) + 7F (hex))

The same is valid for the additional SDO communication channels 3, 4, and 5.

The following table shows exemplary request data for the device on the CANopen bus.

Identifier	Description	Data (hex)
67F	Remote Start	2B F7 21 01 01 00 00 00
67F	Remote Stop	2B F7 21 01 02 00 00 00
67F	Remote Acknowledge	2B F7 21 01 10 00 00 00
67F	Remote Shutdown	2B F7 21 01 00 02 00 00

If parameters are written or read via two or more SDO communication channels at the same time (before the first has answered), the second one will be refused.

6.4.1.2 Transmitting A Frequency Setpoint

It is possible to transmit a frequency setpoint value via the CANopen protocol. Prerequisite for the use of a frequency setpoint via an interface is the configuration of the frequency setpoint sources with AnalogManager 5518 p. 264/ p. 956 for frequency setpoint 1 or AnalogManager 5519 p. 264/ p. 956 for frequency setpoint 2. Refer to *Chapter 4.4.4.4 "Frequency Control" on page 261* for detailed information.

The respective frequency setpoint source is to be configured to 05.53 "Interface f setp [Hz]".

Using absolute values but NOT % values

With "...-XT" the former used parameters 5518 and 5519 became AnalogManagers with the same ID but changed from [%] to [Hz]. AnalogManagers whose Analog result is an absolute value need absolute input(s). For this example, both "Analog input" and "Analog result" must be the same type: [Hz].

With "...-XT" the former used 05.03 "Interface freq.setp." became a % value 05.03 "Interface f setp [%]" and so cannot be used for setpoint transmission because an absolute value is mandatory! The parameter of the absolute value of the interface frequency setpoint is 05.53 "Interface f setp [Hz]".

Two different methods to transmit a frequency setpoint via CANopen are detailed below.

These are "Transmitting a frequency setpoint via RPDO" and "Transmitting a frequency setpoint via default SDO communication channel". The advantages and the disadvantages of these two methods are as follows.

RPDO	Default SDO communication channel
Classical communication for CANopen devices	Configuration process
One message	Two messages
No validation of the received answer	Validation answer, if message has been received by the unit
Only working in operational mode	May take longer in case of communication with two messages

Table 134: Comparison

6.4.1.2.1 RPDO

Configure CAN interface 1

CANopen Master (parameter 8993 ↪ p. 445) must be enabled, if there is no PLC taking over the master function.

1. Either on the front panel or using ToolKit navigate to menu *"Configure CAN interface ➔ Configure CAN interface 1"*.
2. Configure the parameter listed below.

ID	Parameter	Value	Comment
8993	CANopen Master	On	CANopen Master is enabled.

Configure RPDO

1. Either on the front panel or using ToolKit navigate to menu *"Configure CAN interface 1 ➔ Receive PDO 1"*.
2. Configure the parameters listed below.

ID	Parameter	Value	Comment
9300	COB-ID	00000321 (hex)	COB-ID set to 00000321.
9910	Number of Mapped Objects	1	One mapped object is configured
9911	1. Mapped Object	00509	The 1st mapped object is set to control parameter 509.

⇨

Setting the COB-ID to 321 (hex) is exemplary; usually, the PDOs are in the range of 181 (hex) to 57F (hex).

With this setting, the Receive PDO is set to the address, for which the device is listening on the bus. The number of mapped objects is 1 since 1 mapped object is used. The request on the bus is sent with the control parameter 509 of the device as mapped object 1.

Refer to ↪ Chapter 9.2.18 "Additional Data Identifier" on page 874 for a list of additional parameter groups.

CANopen message

The following table shows exemplary send data for the device on the CANopen bus.

A frequency setpoint of 50.60 Hz is transmitted:

- 5060 (dec) = 13C4 (hex) → C4 13 according to the CANopen protocol

ID (hex)	Description	Data (hex)
321	Remote F setpoint	C4 13

6.4.1.2.2 Default SDO Communication Channel

Another possibility for transmitting a frequency setpoint is to send the value via default SDO communication channel. The device listens to the CAN ID 600 (hex) + Node-ID internally to perform the desired control, the reply is on CAN ID 580 (hex) + Node-ID.

The following example shows the send format on CANopen with Node-ID 1.

The value is sent on the bus via the control parameter 509 of the device.

The hexadecimal value 2000 is calculated internally:

- 509 (dec) -- 1FD (hex)
- 1FD (hex) + 2000 (hex) = 21FD (hex)

Please note that high and low bytes are exchanged in the sent value.

The data (hex) shows the state of parameter 509 to achieve the required control.

The following table shows exemplary send data for the device on the CANopen bus.

Identifier	Description	Data (hex)
601	Remote F setpoint	2B FD 21 01 C4 13 00 00

6.4.1.3 Transmitting A Voltage Setpoint

It is possible to transmit a voltage setpoint value via the CANopen protocol. Prerequisite for the use of a voltage setpoint via an interface is the configuration of the voltage setpoint sources with AnalogManager 5618 p. 240/ p. 958 for voltage setpoint 1 or AnalogManager 5619 p. 240/ p. 958 for voltage setpoint 2 .

Refer to *Chapter 4.4.4.1 “Voltage Control” on page 238* for detailed information.

The respective voltage setpoint source is to be configured to 05.59 "Interface V setp [V]".

Using absolute values but NOT % values

With "...-XT" the former used parameters 5618 and 5619 became AnalogManagers with the same ID but changed from [%] to [V]. AnalogManagers whose Analog result is an absolute value need absolute input(s). For this example, both "Analog input" and "Analog result" must be the same type: [Hz].

With "...-XT" the former used 05.09 "Interface volt.setp." became a % value 05.09 "Interface v setp [%]" and so cannot be used for setpoint transmission because an absolute value is mandatory! The parameter of the absolute value of the interface frequency setpoint is 05.59 "Interface v setp [V]".

Two different methods to transmit a voltage setpoint setpoint via CANopen are detailed below.

These are "Transmitting a voltage setpoint via RPDO" and "Transmitting a voltage setpoint via default SDO communication channel". The advantages and the disadvantages of these two methods are as follows.

RPDO	Default SDO communication channel
Classical communication for CANopen devices	Configuration process
One message	Two messages
No validation of the received answer	Validation answer, if message has been received by the unit
Only working in operational mode	May take longer in case of communication with two messages

Table 135: Comparison

6.4.1.3.1 RPDO

Configure CAN interface 1

CANopen Master (parameter 8993 p. 445) must be enabled, if there is no PLC taking over the master function.

1. Either on the front panel or using ToolKit navigate to menu *"Configure CAN interface ➔ Configure CAN interface 1"*.
2. Configure the parameter listed below.

ID	Parameter	Value	Comment
8993	CANopen Master	On	CANopen Master is enabled.

Configure RPDO

1. Either on the front panel or using ToolKit navigate to menu *"Configure CAN interface 1 ➔ Receive PDO 1"*.
2. Configure the parameters listed below.

ID	Parameter	Value	Comment
9300	COB-ID	00000321 (hex)	COB-ID set to 00000321.
9910	Number of Mapped Objects	1	One mapped object is configured
9911	1. Mapped Object	00510	The 1st mapped object is set to control parameter 510.

⇨

Setting the COB-ID to 321 (hex) is exemplary; usually, the PDOs are in the range of 181 (hex) to 57F (hex).

With this setting, the Receive PDO is set to the address, for which the device is listening on the bus. The number of mapped objects is 1 since 1 mapped object is used. The request on the bus is sent with the control parameter 510 of the device as mapped object 1.

Refer to Chapter 9.2.18 "Additional Data Identifier" on page 874 for a list of additional parameter groups.

CANopen message

The following table shows exemplary send data for the device on the CANopen bus in line 1.

A voltage setpoint of 412 V is transmitted:

- 412 (dec) = 019C (hex) → 9C 01 according to the CANopen protocol

ID (hex)	Description	Data (hex)
321	Remote V setpoint	9C 01 00 00

6.4.1.3.2 Default SDO Communication Channel

Another possibility for transmitting a voltage setpoint is to send the value via default SDO communication channel. The device listens to the CAN ID 600 (hex) + Node ID internally to perform the desired control, the reply is on CAN ID 580 (hex) + Node ID.

The following example shows the send format on CANopen with Node ID 1.

The value is sent on the bus via the control parameter 510 of the device.

The hexadecimal value 2000 is calculated internally:

- 510 (dec) - 1FE (hex)
- 1FE (hex) + 2000 (hex) = 21FE (hex)

Please note that high and low bytes are exchanged in the sent value.

ID (hex)	Description	Data (hex)
601	Remote V setpoint	23 FE 21 01 9C 01 00 00

The data (hex) shows the state of parameter 510 to achieve the required control.

6.4.1.4 Transmitting A Power Factor Setpoint

It is possible to transmit a power factor setpoint value via the CANopen protocol. Prerequisite for the use of a power factor setpoint via an interface is the configuration of the power factor setpoint source (parameter 5638 ↳ p. 244/↳ p. 957 for power factor setpoint 1 source or parameter 5639 ↳ p. 245/↳ p. 958 for power factor setpoint 2 source)

Refer to ↳ *Chapter 4.4.4.2 "Power Factor Control" on page 241* for detailed information.

The respective power factor setpoint source is to be configured to 05.12 "Interface PF setp.".

Two different methods to transmit a power factor setpoint via CANopen are detailed below.

These are "Transmitting a power factor setpoint via RPDO" and "Transmitting a power factor setpoint via default SDO communication channel". The advantages and the disadvantages of these two methods are as follows.

RPDO	Default SDO communication channel
Classical communication for CANopen devices	Configuration process
One message	Two messages
No validation of the received answer	Validation answer, if message has been received by the unit
Only working in operational mode	May take longer in case of communication with two messages

Table 136: Comparison

6.4.1.4.1 RPDO

Configure CAN interface 1

CANopen Master (parameter 8993 ↳ p. 445) must be enabled, if there is no PLC taking over the master function.

1. Either on the front panel or using ToolKit navigate to menu *"Configure CAN interface ➔ Configure CAN interface 1"*.
2. Configure the parameter listed below.

ID	Parameter	Value	Comment
8993	CANopen Master	On	CANopen Master is enabled.

Configure RPDO

1. Either on the front panel or using ToolKit navigate to menu *"Configure CAN interface 1 ➔ Receive PDO 1"*.
2. Configure the parameters listed below.

ID	Parameter	Value	Comment
9300	COB-ID	00000321 (hex)	COB-ID set to 00000321.
9910	Number of Mapped Objects	1	One mapped object is configured
9911	1. Mapped Object	00508	The 1st mapped object is set to control parameter 508.

⇨ *Setting the COB-ID to 321 (hex) is exemplary; usually, the PDOs are in the range of 181 (hex) to 57F (hex).*

With this setting, the Receive PDO is set to the address, for which the device is listening on the bus. The number of mapped objects is 1 since 1 mapped object is used. The request on the bus is sent with the control parameter 508 of the device as mapped object 1.

Refer to *Chapter 9.2.18 "Additional Data Identifier" on page 874* *for a list of additional parameter groups.*

CANopen message

The following table shows exemplary send data for the device on the CANopen bus. A power factor setpoint of 0.85 capacitive/leading is transmitted (64689 (dec) [65536-850] = FCAE (hex) → AE FC according to the CANopen protocol) in line 1. Please note that negative (capacitive or leading) power factor values are deducted from 65536 (dec) or FFFF (hex).

A power factor setpoint of 0.9 inductive/lagging is transmitted in line 2:

- 900 (dec) = 0384 (hex) → 84 03 according to the CANopen protocol.

A power factor setpoint of 1.0 is transmitted in line 3:

- 1000 (dec) = 03E8 (hex) → E8 03 according to the CANopen protocol

ID (hex)	Description	Data (hex)
321	Remote PF Ld 085	AE FC
321	Remote PF LG 090	84 03
321	Remote PF 1.00	E8 03

6.4.1.4.2 Default SDO Communication Channel

Another possibility for transmitting a power factor setpoint is to send the value via default SDO communication channel. The device listens to the CAN ID 600 (hex) + Node-ID internally to perform the desired control, the reply is on CAN ID 580 (hex) + Node-ID.

The following example shows the send format on CANopen with Node-ID 1.

The value is sent on the bus via the control parameter 508 of the device.

The hexadecimal value 2000 is calculated internally:

- 508 (dec) -- 1FC (hex)
- 1FC (hex) + 2000 (hex) = 21FC (hex)

Please note that high and low bytes are exchanged in the sent value.

The data (hex) shows the state of parameter 508 to achieve the required control.

The following table shows exemplary send data for the device on the CANopen bus.

Identifier	Description	Data (hex)
601	Remote PF Ld 085	2B FC 21 01 AE FC 00 00
601	Remote PF LG 090	2B FC 21 01 84 03 00 00
601	Remote PF 1.00	2B FC 21 01 E8 03 00 00

6.4.1.5 Transmitting A Power Setpoint

It is possible to transmit a power setpoint value via the CANopen protocol. Prerequisite for the use of a power setpoint via an interface is the configuration of the power setpoint sources with AnalogManager 5539 ↳ p. 272/↳ p. 956 for power setpoint 1 or AnalogManager 5540 ↳ p. 273/↳ p. 542/↳ p. 956 for power setpoint 2.

Refer to ↳ *Chapter 4.4.4.5 “Load Control” on page 266* for detailed information).

The respective power setpoint source is to be configured to 05.56 "Interface P setp [W]".

Using absolute values but NOT % values

With "...-XT" the former used parameters 5539 and 5540 became AnalogManagers with the same ID but changed from [%] to [W]. AnalogManagers whose Analog result is an absolute value need absolute input(s). For this example, both "Analog input" and "Analog result" must be the same type: [W].

With "...-XT" the former used 05.06 "Interface pow. setp." became a % value 05.06 "Interface P setp [%]" and so cannot be used for setpoint transmission because an absolute value is mandatory! The parameter of the absolute value of the interface power setpoint is 05.56 "Interface P setp [W]".

Please note that the type of the power setpoint (Steady, Import, or Export) must also be defined (parameter 5526 ⇘ p. 272 for load setpoint 1 or parameter 5527 ⇘ p. 273/⇘ p. 542 for load setpoint 2).

Two different methods to transmit a power setpoint via CANopen are detailed below.

These are "Transmitting a power setpoint via RPDO" and "Transmitting a power setpoint via default SDO communication channel". The advantages and the disadvantages of these two methods are as follows.

RPDO	Default SDO communication channel
Classical communication for CANopen devices	Configuration process
One message	Two messages
No validation of the received answer	Validation answer, if message has been received by the unit
Only working in operational mode	May take longer in case of communication with two messages

Table 137: Comparison

6.4.1.5.1 RPDO

Configure CAN interface 1

CANopen Master (parameter 8993 ⇘ p. 445) must be enabled, if there is no PLC taking over the master function.

1. Either on the front panel or using ToolKit navigate to menu *"Configure CAN interface ➔ Configure CAN interface 1"*.
2. Configure the parameter listed below.

ID	Parameter	Value	Comment
8993	CANopen Master	On	CANopen Master is enabled.

Configure RPDO

1. Either on the front panel or using ToolKit navigate to menu *"Configure CAN interface 1 ➔ Receive PDO 1"*.
2. Configure the parameters listed below.

ID	Parameter	Value	Comment
9300	COB-ID	00000321 (hex)	COB-ID set to 00000321.
9910	Number of Mapped Objects	1	One mapped object is configured
9911	1. Mapped Object	00507	The 1st mapped object is set to control parameter 507.

⇨

Setting the COB-ID to 321 (hex) is exemplary; usually, the PDOs are in the range of 181 (hex) to 57F (hex).

With this setting, the Receive PDO is set to the address, for which the device is listening on the bus. The number of mapped objects is 1 since 1 mapped object is used. The request on the bus is sent with the control parameter 507 of the device as mapped object 1.

Refer to *Chapter 9.2.18 "Additional Data Identifier" on page 874* *for a list of additional parameter groups.*

CANopen message

The following table shows exemplary send data for the device on the CANopen bus in line 1.

A power setpoint of 1000.0 kW is transmitted:

- 10000 (dec) = 2710 (hex) → 10 27 according to the CANopen protocol

ID (hex)	Description	Data (hex)
321	Remote P setpoint	10 27 00 00

6.4.1.5.2 Default SDO Communication Channel

Another possibility for transmitting a power setpoint is to send the value via default SDO communication channel. The device listens to the CAN ID 600 (hex) + Node-ID internally to perform the desired control, the reply is on CAN ID 580 (hex) + Node-ID.

The following example shows the send format on CANopen with Node-ID 1.

The value is sent on the bus via the control parameter 507 of the device.

The hexadecimal value 2000 is calculated internally:

- 507 (dec) -- 1FB (hex)
- 1FB (hex) + 2000 (hex) = 21FB (hex)

Please note that high and low bytes are exchanged in the sent value.

ID (hex)	Description	Data (hex)
601	Remote P setpoint	23 FB 21 01 10 27 00 00

The data (hex) shows the state of parameter 507 to achieve the required control.

The table above shows exemplary send data for the device on the CANopen bus in line 2.

6.4.1.6 Transmitting Multiple Setpoints

A single RPDO can transmit multiple objects. The receive PDO can be used for four objects with 16 bits (2 bytes).

If larger objects - for example 32 bits (4 bytes), like for voltage and power setpoints - are used, the maximum number of objects is reduced.

Configure RPDO

1. Either on the front panel or using ToolKit navigate to menu *"Configure CAN interface 1 ➔ Receive PDO 1"*.
2. Configure the parameters listed below.

ID	Parameter	Value	Comment
9300	COB-ID	00000321 (hex)	COB-ID set to 00000321.
9910	Number of Mapped Objects	3	Three mapped objects are configured
9911	1. Mapped Object	00509	The 1st mapped object is set to control parameter 509.
9912	2. Mapped Object	00507	The 2nd mapped object is set to control parameter 507.
9913	3. Mapped Object	00508	The 3rd mapped object is set to control parameter 508.

⇨

Setting the COB-ID to 321 (hex) is exemplary; usually, the PDOs are in the range of 181 (hex) to 57F (hex).

With this setting, the Receive PDO is set to the address, for which the device is listening on the bus. The number of mapped objects is 1 since 1 mapped object is used. The request on the bus is sent with the control parameters 509, 507, and 508 of the device as mapped object 1.

Refer to ↳ Chapter 9.2.18 "Additional Data Identifier" on page 874 for a list of additional parameter groups.

CANopen message

The following table shows exemplary send data for the device on the CANopen bus in line 1. The following setpoints are transmitted:

- Frequency 50.6 Hz (5060 (dec) = 13C4 (hex) → C4 13 according to the CANopen protocol)
- Power 1000 kW (10000 (dec) = 2710 (hex) → 10 27 according to the CANopen protocol)
- Power factor 0.9 lagging (900 (dec) = 0384 (hex) → 84 03 according to the CANopen protocol)

ID (hex)	Description	Data (hex)
321	Remote F P PF setpoint	C4 13 10 27 00 00 84 03

6.4.1.7 Remotely Changing The Setpoint

It is possible to remotely switch between pre-defined setpoints. This is available for active power, power factor, frequency, and voltage.

The bits 4 to 7 of parameter 504 (*Chapter 9.2.18 "Additional Data Identifier" on page 874*) are carrying the settings and are available in CAN bus and Modbus protocols. Each bit may be used as input of the according setpoint switching LogicsManager.

ID	Parameter	Setting range	Data type
504	Remote control word 2	Yes / No	UNSIGNED 16

Table 138: Remote Control word "504": switching between setpoints

In order to switch to another setpoint, the respective bit of object 21F8 (hex), i.e. parameter 504, must be enabled. The following bits are used for this:

Bit "x" of Parameter 504 ...	... remotely requests to switch to	... is available as LogicsManager command variable	... uses LogicsManager "y" to switch
Bit 4	Voltage setpoint 2	04.37 "Remote voltage setpoint 2"	12920; 86.86 LM: "Setp. 2 voltage"
Bit 5	Frequency setpoint 2	04.38 "Remote frequency setpoint 2"	12918; 86.81 LM: "Setpoint 2 freq."
Bit 6	Power factor setpoint 2	04.39 "Remote PF setpoint 2"	12921: 86.84 LM: "Setp. 2 pwr.factor"
Bit 7	Active power setpoint 2	04.40 "Remote power setpoint 2"	12919; 86.82 LM: "Setp. 2 load"
			12998; 86.67 LM: "Setp. 3 load"
			12969; 86.75 LM: "Setp. 4 load"
			Notes This LogicsManager command variable can be used to switch to each available load setpoint.

Additionally/alternatively to remotely changing the control setpoints, it is possible to use "remote" set-points (values) defined via interface instead of the internal setpoints as data source in the respective controller. For example, use data source "05.53 ***Interface*** *f setp [Hz]" instead of "05.51* ***Internal*** *f setp1 [Hz]" in AnalogManager 5518 ⇘ p. 264/ ⇘ p. 956 (Freq. setpoint 1) to transmit a frequency setpoint via interface.*

Two different methods for remotely switch between setpoints via CANopen are detailed below.

These are switching between setpoints via *"RPDO"* or *"Default SDO communication channel"*. The advantages and the disadvantages of these two methods are as follows:

RPDO	Default SDO communication channel
Classical communication for CANopen devices	Configuration process
One message	Two messages
No validation of the received answer	Validation answer, if message has been received by the unit
Only working in operational mode	May take longer in case of communication with two messages

Table 139: Comparison CANopen methods

6.4.1.7.1 RPDO

Configure CAN interface 1

CANopen Master (parameter 8993 ⇘ p. 445) must be enabled, if there is no PLC taking over the master function.

1. Either on the front panel or using ToolKit navigate to menu *"Configure CAN interface ➔ Configure CAN interface 1"*.
2. Configure the parameter listed below.

ID	Parameter	Value	Comment
8993	CANopen Master	On	CANopen Master is enabled.

Configure RPDO

1. Either on the front panel or using ToolKit navigate to menu *"Configure CAN interface 1 ➔ Receive PDO 1"*.

2. Configure the parameters listed below.

ID	Parameter	Value	Comment
9300	COB-ID	00000321 (hex)	COB-ID set to 00000321.
9910	Number of Mapped Objects	1	One mapped object is configured
9911	1. Mapped Object	00504	The 1st mapped object is set to control parameter 504.

⇨

Setting the COB-ID to 321 (hex) is exemplary; usually, the PDOs are in the range of 181 (hex) to 57F (hex).

With this setting, the Receive PDO is set to the address, for which the device is listening on the bus. The number of mapped objects is 1 since 1 mapped object is used. The request on the bus is sent with the control parameter 504 of the device as mapped object 1.

CANopen message

The following table shows exemplary send data for the device on the CANopen bus. The respective bits are enabled by sending the data of the respective lines.

ID (hex)	Description	Data (hex)
321	Remote P setpoint 2	80 00
321	Remote PF setpoint 2	40 00
321	Remote F setpoint 2	20 00
321	Remote V setpoint 2	10 00

6.4.1.7.2 Default SDO Communication Channel

Another possibility for changing a setpoint is to enable the bit via default SDO communication channel. The device listens to the CAN ID 600 (hex) + Node-ID internally to perform the desired control, the reply is on CAN ID 580 (hex) + Node-ID.

The following example shows the send format on CANopen with Node-ID 1.

The value is sent on the bus via the control parameter ID 504 of the device.

The hexadecimal value 2000 is calculated internally:

- 504 (dec) -- 1F8 (hex)
- 1F8 (hex) + 2000 (hex) = 21F8 (hex)

Please note that high and low bytes are exchanged in the sent value.

The data (hex) shows the state of parameter 504 to achieve the required control.

The following table shows exemplary send data for the device on the CANopen bus.

Identifier	Description	Data (hex)
601	Remote P setpoint 2	2B F8 21 01 80 00 00 00
601	Remote PF setpoint 2	2B F8 21 01 40 00 00 00
601	Remote F setpoint 2	2B F8 21 01 20 00 00 00
601	Remote V setpoint 2	2B F8 21 01 10 00 00 00

6.4.1.8 Transmitting A Remote Control Bit

It is possible to transmit a remote control bit via the CANopen protocol. Such a remote control bit can be sent by a PLC to remotely control the easYgen if this remote control bit is used as a command variable in a LogicsManager function.

Configure RPDO

1. Either on the front panel or using ToolKit navigate to menu *"Configure CAN interface 1 ➔ Receive PDO 1"*.
2. Configure the parameters listed below.

ID	Parameter	Value	Comment
9300	COB-ID	00000334 (hex)	COB-ID set to 00000334.
9910	Number of Mapped Objects	1	One mapped object is configured
9911	1. Mapped Object	00505	The 1st mapped object is set to control parameter 505.

⇨

Setting the COB-ID to 334 (hex) is exemplary; usually, the PDOs are in the range of 181 (hex) to 57F (hex).

With this setting, the Receive PDO is set to the address, for which the device is listening on the bus. The number of mapped objects is 1 since 1 mapped object is used. The request on the bus is sent with the control parameter 505 of the device as mapped object 1.

Refer to *Chapter 9.2.18 "Additional Data Identifier" on page 874* *for a list of additional parameter groups.*

CANopen message

The following table shows exemplary send data for the device on the CANopen bus.

Remote control bit 1 is set:

- 1 (dec) = 0001 (hex) → 01 00 according to the CANopen protocol

ID (hex)	Description	Data (hex)
334	Remote Control Bit 1 (PDO)	01 00

6.4.1.8.1 Default SDO Communication Channel

Another possibility for transmitting a power setpoint is to send the value via default SDO communication channel. The device listens to the CAN ID 600 (hex) + Node-ID internally to perform the desired control, the reply is on CAN ID 580 hex) + Node-ID.

The following example shows the send format on CANopen with Node-ID 1.

The value is sent on the bus via the control parameter 249 of the device.

The hexadecimal value 2000 is calculated internally:

- 249 (dec) -- 1F9 (hex)
- 1FB (hex) + 2000 (hex) = 21F9 (hex)

Please note that high and low bytes are exchanged in the sent value.

ID (hex)	Description	Data (hex)
601	Remote Control Bit 1 (SDO)	2B F9 21 01 01 00 00 00

The data (hex) shows the state of parameter 249 to achieve the required control.

The table above shows exemplary sends data for the device on the CANopen bus in line 2.

6.4.2 Sending A Data Protocol via TPDO

This is a configuration example for sending an object (data protocol 5003) on CAN ID 2AE (hex) every 20 ms on TPDO1. For this, TPDO1 must be configured as follows:

1. Either on the front panel or using ToolKit navigate to menu *"Configure CAN interface 1 ➔ Transmit PDO 1"*.
2. Configure the parameters listed below.

ID	Parameter	Value	Comment
9600	COB-ID	000002AE (hex)	COB-ID set to 000002AE.
9602	Transmission type	255	The number of required sync messages is set to 255.
9604	Event timer	20 ms	Object is sent every 20 ms.
8962	Selected data protocol	5003	Data protocol 5003 is used.
9609	Number of Mapped Objects	0	No mapped object is configured

The data to be sent (Mapped Objects) may be provided on request by configuring the Sync Message (parameter 9100 ➪ p. 445) and the Transmission Type (parameter 9602 ➪ p. 451, 9612 ➪ p. 451, 9622 ➪ p. 451, 9632 ➪ p. 451, or 12793 ➪ p. 451) of a TPDO. The unit is requested to send its data by sending a Sync Message.

The number of required Sync Messages is determined by the setting of the Transmission Type.

If the data is to be sent on request, Bit 30 of the Sync Message (parameter 9100 ➪ p. 445) must be configured to "0" and the CANopen Master (parameter 8993 ➪ p. 445) function must be configured to "Off".

Additional example

The Transmission Type of TPDO 1 (parameter 9602 ➪ p. 451) is configured to "2" in the following example. This means that a message of the configured TPDO is sent by the unit after two Sync Messages have been sent to the unit.

1. Either on the front panel or using ToolKit navigate to menu *"Configure CAN interface 1 ➔ Transmit PDO 1"*.
2. Configure the parameters listed below.

ID	Parameter	Value	Comment
9600	COB-ID	000002AE (hex)	COB-ID set to 000002AE.
9602	Transmission type	2	The number of required sync messages is set to 2.
9604	Event timer	20 ms	Object is sent every 20 ms.
8962	Selected data protocol	5003	Data protocol 5003 is used.
9609	Number of Mapped Objects	0	No mapped object is configured

The recorded data shows that the data of the Mapped Object (in this example Mux 5) is sent (➪ *Table 140 "Cyclical sending of data - sync message request" on page 614*) after sending the Sync Message twice (➪ *Table 141 "Cyclical sending of data - reply" on page 614*).

ID (hex)	Description	Data (hex)
80	-	-

Table 140: Cyclical sending of data - sync message request

No.	Count	ID (hex)	Data (hex)
1	2	80	-
2	1	2AE	8B 13

Table 141: Cyclical sending of data - reply

6.4.3 Troubleshooting

General diagnosis

Error	Possible diagnosis
Connected device (Phoenix I/O board) cannot be configured	Are all LEDs at the expansion modules illuminated green (i.e. correctly connected)?
	Are all modules detected (i.e. no blinking expansion module)?

CAN interface 1 (guidance level) diagnosis

Error	Possible diagnosis
No data is sent by the Woodward controller	Is the unit in operational mode (heartbeat - CAN ID 700 (hex) + Node-ID has the content 5 (hex)?
	Are the TPDOs correctly configured (CAN ID, mapping, parameter)?
No data is received by the Woodward controller	Is the unit in operational mode (heartbeat - CAN ID 700 (hex) + Node-ID has the content 5 (hex)?
	Are the RPDOs correctly configured (CAN ID, mapping, parameter)?
No monitoring bit data is received on the RPDO	Is the CAN bus connected correctly?
	Is the baud rate configured correctly?
	Is the CAN ID assigned more than once?
	Is the unit in operational mode? If not, start it via another device or put in NMT Master (parameter 8993 ↳ p. 445).
	No SDOs (configuration messages) are received by the unit
No SDOs (configuration messages) are received by the unit	Is the CAN ID assigned more than once?
	Is the CAN ID 600 (hex) + Node-ID of the easYgen already used in a PDO (COB-ID)?
	Are RPDOs or TPDOs higher then 580 (hex) or lower than 180 (hex) used?

6.5 Modbus Applications

> ***Data Format(s)***
> *Modbus registers are read and written according to the Modbus standard as Big-endian.*
>
> *Composite data types like LOGMAN, ANALOGMANAGER, and TEXT use separate descriptions.*

6.5.1 Remote Control

6.5.1.1 Remote Start/Stop, Shutdown, And Acknowledgment

The Woodward controller may be configured to perform start/stop/ Acknowledgment functions remotely through the Modbus protocol. The required procedure is detailed in the following steps.

Please find remote control parameter 505 described at: *"Remote control word 3" on page 877**. It works similar like 503 described below.*

The following descriptions refer to the remote control parameter 503 as described in *Chapter 9.2.18 "Additional Data Identifier" on page 874**.*

It may be necessary to shift the address by 1 depending on the used PC software. In this case, the address would be 504 for example.

Be sure to check both possibilities in case of remote control problems.

ID	Parameter	Setting range	Data type
503	Remote control word 1	0 to 65535	UNSIGNED 16

- Modbus address = 40000 + (Par. ID +1) = 40504
- Modbus length = 1 (UNSIGNED 16)

In order to issue a command, the respective bit of object 21F7 (hex), i.e. parameter 503, must be enabled. The following bits are used for this:

- Bit 0 Start bit:
  This bit activates the LogicsManager command variable 04.13 "Remote request" and enables a remote start.
- Bit 1 Stop bit:
  This bit deactivates the LogicsManager command variable 04.13 "Remote request" and disables a remote start.
- Bit 4 Acknowledgment bit:
  This bit activates the LogicsManager command variable 04.14 "Remote acknowledge". This bit must be set and reset twice to acknowledge an alarm completely. The first rising edge disables the horn and the second rising edge resets the alarm.
- Bit 9 Shutdown Command bit:
  This bit activates the LogicsManager command variable 03.40 "Remote Shutdown-Status". With this function the engine is immediately shut down without auxiliary service and cool down. This works independent from beaker conditions.

The following Modscan32 screenshot (Fig. 283) shows the configurations made to remote control parameter 503. It is possible to set the format to binary to view single bits using the "display options".

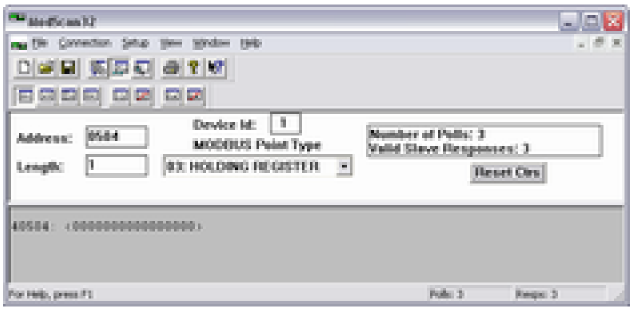


Fig. 283: Modbus - remote control parameter 503

Example 1: Start Request

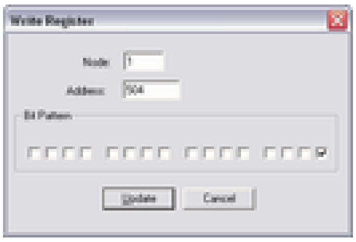


Fig. 284: Modbus - write register - start request

By double-clicking the address, a Write Register command may be issued.

Fig. 284 shows how bit 0 is set using the ModScan32 Software.

Example 2: Stop Request

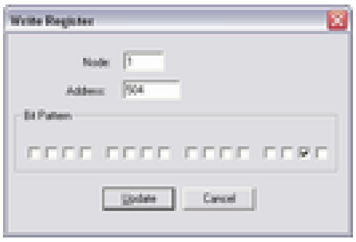


Fig. 285: Modbus - write register - stop request

By double-clicking the address, a Write Register command may be issued.

Fig. 285 shows how bit 1 is set using the ModScan32 Software.

Example 3: External Acknowledge

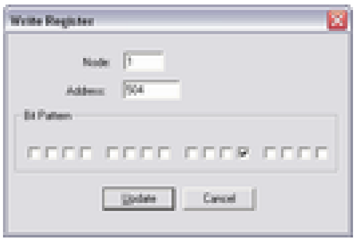


Fig. 286: Modbus - write register - external acknowledge

By double-clicking the address, a Write Register command may be issued.

Fig. 286 shows how bit 4 is set using the ModScan32 Software.

Example 4: Shutdown Command

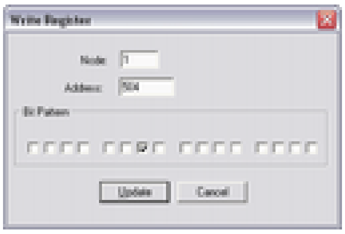


Fig. 287: Modbus - write register - shutdown command

By double-clicking the address, a Write Register command may be issued.

Fig. 286 shows how bit 9 is set using the ModScan32 Software.

Sample for Free alarm 1

This (remote) shutdown request can be taken by LogicsManager equation 12230 to set Flag 1 (see Fig. 288). To perform an immediately shutdown, the free alarm has to be configured as alarm class F. Free alarm 1 configuration Fig. 289 shows how the Monitoring source LM 8120 ↳ p. 408 *"Free alarm 1"* is set to Flag 1 and the Alarm class 8121 is set to Class F.

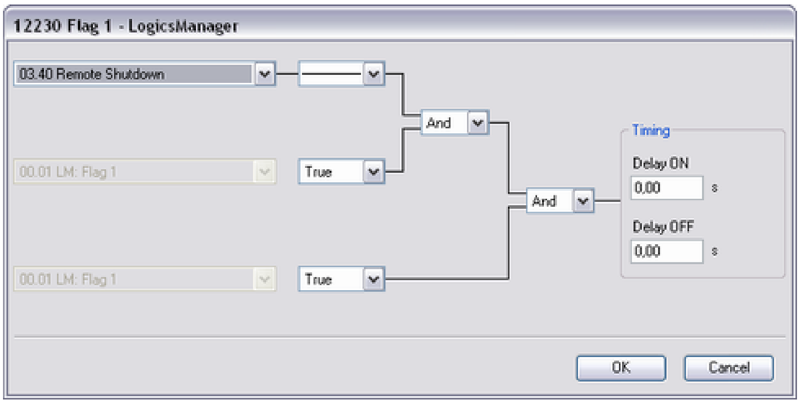


Fig. 288: LM 12230 Flag1

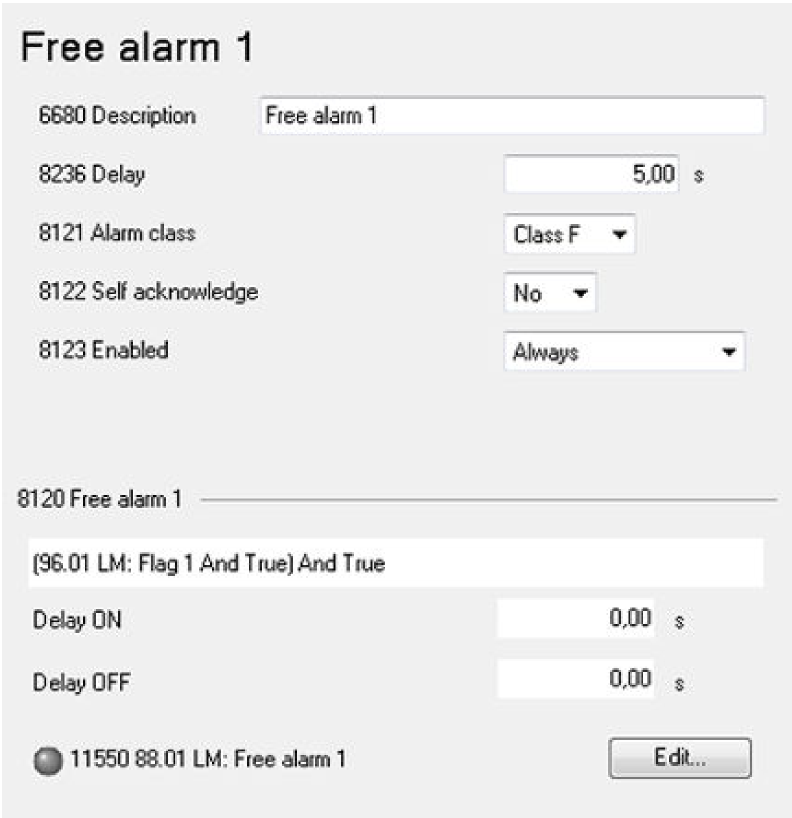


Fig. 289: LM Free-Alarms

6.5.1.2 Setpoint Setting

Fig. 290: Setpoint source selection

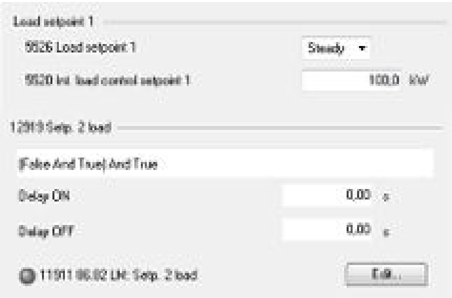


Fig. 291: Setpoint configuration

For a remote setting of the control setpoints, it is necessary to use the interface setpoints instead of the internal setpoints.

For example, use data source 05.56 "Interface P setp [W]" in AnalogManager 5539 ↳ p. 272/↳ p. 956 (AM ActPower SP1 [W]) to transmit a load setpoint via interface. No password is required to write this value.

Screen shots beside show an exemplary configuration of the load setpoint 1 source. All other setpoint sources are configured accordingly.

The interface setpoints may be set using the objects for active power, power factor, frequency, and voltage (refer to ↳ *Chapter 9.2.18 “Additional Data Identifier” on page 874* for detailed information).

ID	Parameter	Setting range	Unit	Data type	Data source
507	Active Power Setpoint	0 to 999999	1/10 kW	INTEGER 32	05.56
508	Power Factor Setpoint	-710 to 1000 to 710	-	INTEGER 16	05.12
509	Frequency Setpoint	0 to 7000	1/100 Hz	UNSIGNED 16	05.53
510	Voltage Setpoint	50 to 650000	V	UNSIGNED 32	05.59

Example 1: Active power interface setpoint

The active power setpoint value must be written to object 21FB (hex), i.e. parameter 507.

A power value of 50 kW = 500 (dec) = 01F4 (hex) is to be transmitted.

- Modbus address = 40000 + (Par. ID + 1) = 40508
- Modbus length = 2 (INTEGER 32)

The high word must be written to the lower address and the low word must be written to the higher address.

To set the parameter address in ModScan32:

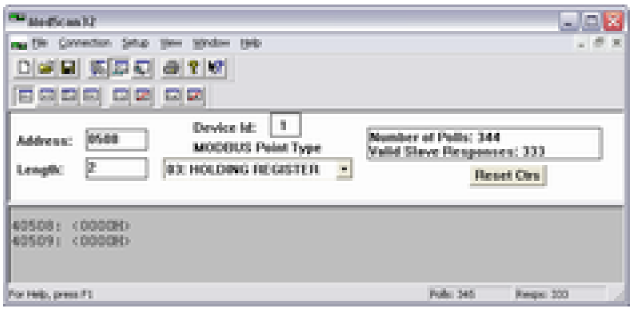


Fig. 292: Modscan32 at address 40508

1. Open the "Preset Multiple Registers" dialog by selecting *"Setup ➔ Extended ➔ Preset Regs"* from the menu.
2. Select *"OK"* and enter the desired values.

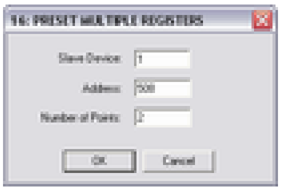


Fig. 293: "Preset Multiple Registers" dialog 1

3. Select *"Update"* to confirm the entered values.

⇨ The dialog closes and the values are changed.

Fig. 294: "Preset Multiple Registers" dialog 2

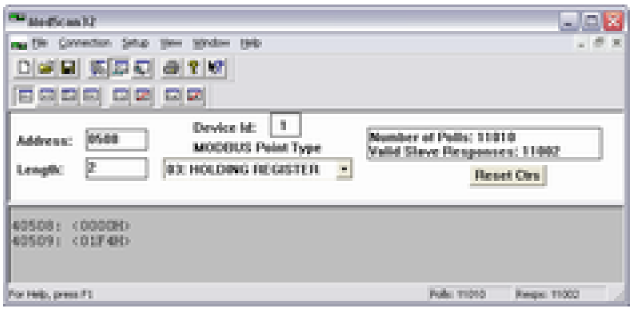


Fig. 295: Modscan32 at address 40508

Example 2: Power factor interface setpoint

The power factor setpoint value must be written to object 21FC (hex), i.e. parameter 508.

A power factor of 1 = 1000 (dec) = 03E8 (hex) is to be transmitted.

- Modbus address = 40000 + (Par. ID + 1) = 40509
- Modbus length = 1 (UNSIGNED 16)

To set the parameter address in ModScan32:

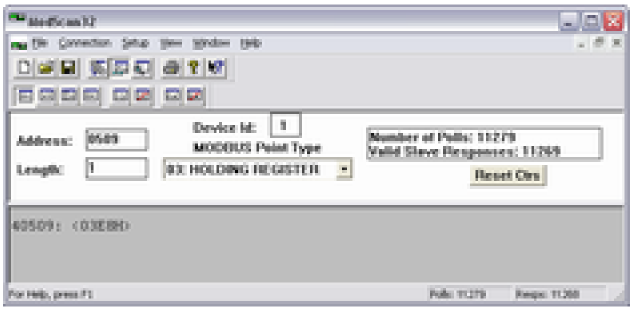


Fig. 296: Modscan32 at address 40509

Analogous to *Further information on page 618* set the parameter address as shown in (Fig. 296).

Example 3: Frequency interface setpoint

The frequency setpoint value must be written to object 21FD (hex), i.e. parameter 509.

A frequency value of 50.00 Hz = 5000 (dec) = 1388 (hex) is to be transmitted.

- Modbus address = 40000 + (Par. ID + 1) = 40510
- Modbus length = 1 (UNSIGNED 16)

To set the parameter address in ModScan32:

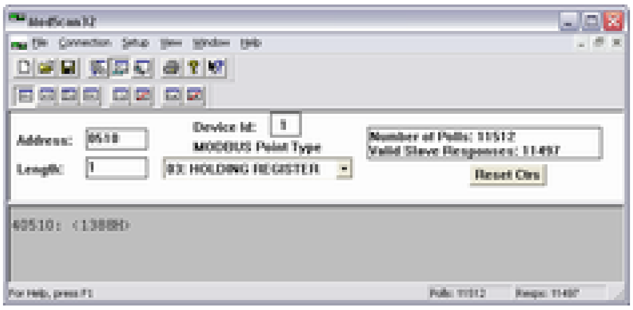


Fig. 297: Modscan32 at address 40510

Analogous to *Further information on page 618* set the parameter address as shown in (Fig. 297).

Example 4: Voltage interface setpoint

The voltage setpoint value must be written to object 21FE (hex), i.e. parameter 510.

A voltage value of 400 V = 400 (dec) = 0190 (hex) is to be transmitted.

- Modbus address = 40000 + (Par. ID + 1) = 40511
- Modbus length = 2 (UNSIGNED 32)

The high word must be written to the lower address and the low word must be written to the higher address.

To set the parameter address in ModScan32:

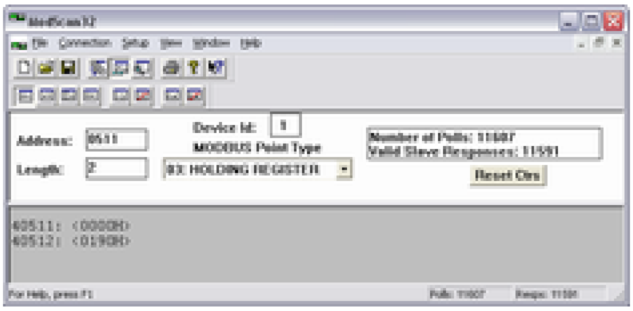


Fig. 298: Modscan32 at address 40511

→ Analogous to *Further information on page 618* set the parameter address as shown in (Fig. 298).

6.5.1.3 Remotely Changing The Setpoint

It is possible to remotely switch between pre-defined setpoints. This is available for active power, power factor, frequency, and voltage.

The bits 4 to 7 of parameter 504 (*Chapter 9.2.18 "Additional Data Identifier" on page 874*) are carrying the settings and are available in CAN bus and Modbus protocols. Each bit may be used as input of the according setpoint switching LogicsManager.

ID	Parameter	Setting range	Data type
504	Remote control word 2	Yes / No	UNSIGNED 16

Table 142: Remote Control word "504": switching between setpoints

In order to switch to another setpoint, the respective bit of object 21F8 (hex), i.e. parameter 504, must be enabled. The following bits are used for this:

Bit "x" of Parameter 504 ...	... remotely requests to switch to	... is available as LogicsManager command variable	... uses LogicsManager "y" to switch
Bit 4	Voltage setpoint 2	04.37 "Remote voltage setpoint 2"	12920; 86.86 LM: "Setp. 2 voltage"
Bit 5	Frequency setpoint 2	04.38 "Remote frequency setpoint 2"	12918; 86.81 LM: "Setpoint 2 freq."
Bit 6	Power factor setpoint 2	04.39 "Remote PF setpoint 2"	12921: 86.84 LM: "Setp. 2 pwr.factor"
Bit 7	Active power setpoint 2	04.40 "Remote power setpoint 2"	12919; 86.82 LM: "Setp. 2 load"
			12998; 86.67 LM: "Setp. 3 load"
			12969; 86.75 LM: "Setp. 4 load"
			Notes This LogicsManager command variable can be used to switch to each available load setpoint.

Example

Fig. 299: Remotely switch Setp. 2 load

The active power setpoint 2 is to be enabled. Therefore LM 12919 is prepared using 04.40 (see beside).

The switching signal than comes remotely e.g. as described below:

- Modbus address = 40000 + (Par. ID + 1) = 40505
- Modbus length = 1 (UNSIGNED 16)

To set the bits in ModScan32:

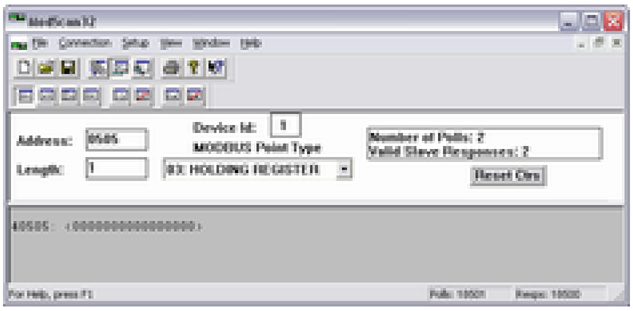


Fig. 300: ModScan32 single bit view

1. Using the "display options" set the format to binary to view single bits (Fig. 300).

2. Double-click the address to issue a `Write Register` command.

⇨ Fig. 301 shows how bit 7 is set to enable the active power setpoint 2.

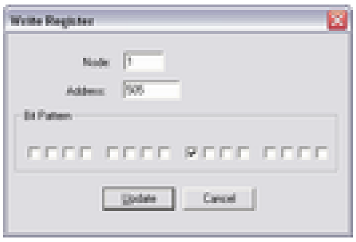


Fig. 301: Active power setpoint

Fig. 302 shows how bit 6 would be set to enable the power factor setpoint 2.

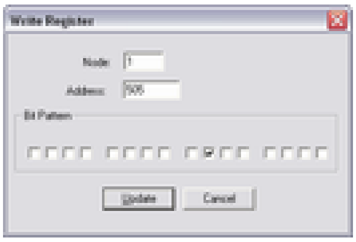


Fig. 302: Power factor setpoint

Fig. 303 shows how bit 5 would be set to enable the frequency setpoint 2.

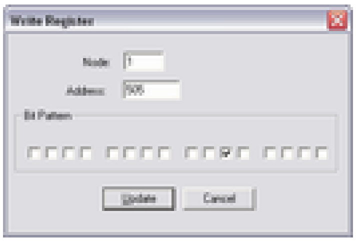


Fig. 303: Frequency setpoint

Fig. 304 shows how bit 4 would be set to enable the voltage setpoint 2.

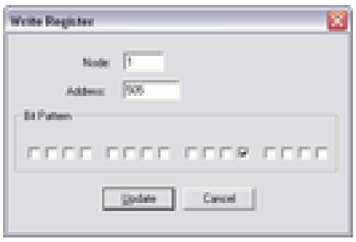


Fig. 304: Voltage setpoint

Additionally/alternatively to remotely changing the control setpoints, it is possible to use "remote" setpoints (values) defined via interface instead of the internal setpoints as data source in the respective controller. For example, use data source "05.53 ***Interface*** *f setp [Hz]" instead of "05.51* ***Internal*** *f setp1 [Hz]" in AnalogManager 5518* *↳ p. 264/ ↳ p. 956* *(Freq. setpoint 1) to transmit a frequency setpoint via interface.*

6.5.2 Changing Parameter Settings

6.5.2.1 Parameter Setting

The example tables below are excerpts. Refer to the following chapters for the complete parameter lists:

– *Chapter 4.3.4 "Enter Password" on page 143*
– *Chapter 4.6 "Configure Measurement" on page 429*

Be sure to enter the password for the code level that is needed to get access for changing parameter settings via the preferred interface.

The new entered value must comply with the parameter setting range when changing the parameter setting.

Example 1: Addressing the generator rated voltage

ID	Parameter	Setting range	Data type
1766	Generator rated voltage	50 to 650000 V	UNSIGNED 32

Example

- Modbus address = 40000 + (Par. ID + 1) = 41767
- Modbus length = 2 (UNSIGNED 32)

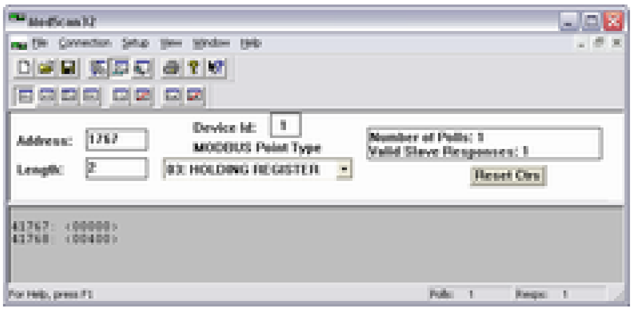


Fig. 305: Modscan32 at address 41767

Set the configuration to address parameter 1766 as shown in (Fig. 305).

Example 2: Addressing the generator voltage measuring

ID	Parameter	Setting range	Data type
1851	Generator voltage measuring	3Ph 4W 3Ph 3W 1Ph 2W 1Ph 3W	UNSIGNED 16

Example

- Modbus address = 40000 + (Par. ID + 1) = 41852
- Modbus length = 1 (UNSIGNED 16)

If the setting range contains a list of parameter settings like in this example, the parameter settings are numbered and start with 0 for the first parameter setting. The number corresponding with the respective parameter setting must be configured.

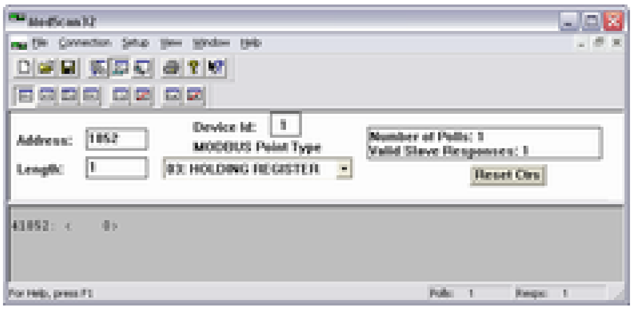


Fig. 306: Modscan32 at address 41852

Set the configuration to address parameter 1851 as shown in (Fig. 306).

⇨ The parameter is configured to "3Ph 4W".

6.5.2.2 Configuration Of LogicsManager Functions

Next to HMI and ToolKit, LogicsManager can also be configured via Modbus.

- The complete LogicsManager instruction set is available for Modbus control.
- Hex code equivalents are defined for all LogicsManager settings.
- The Modbus definition for a LogicsManager equation consists of 7 data words following a well defined sequence.

Word 0	Word 1	Word 2	Word 3	Word 4	Word 5	Word 6
Delay ON	Delay OFF	Logic equation 1	Logic equation 2	Command 1	Command 2	Command 3

Table 143: 7 words Modbus message

To send a LogicsManager function via Modbus follow these steps:

1. Define your LogicsManager equation
2. Describe the LogicsManager equation as "command chain" in hex code
3. Send the message via Modbus

Describe the LogicsManager equation as "command chain" in hex code (step 2)

The LogicsManager screens below show parts of the command chain. How to generate hex code words is described for each part of the Modbus message.

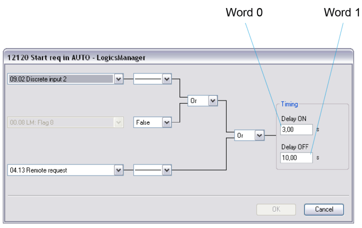


Fig. 307: LogicsManager command chain words 0 and 1

Word 0 and word 1 contain the hex code of the Delay times but in the reverse order of double-byte words, i.e. low byte before high byte.

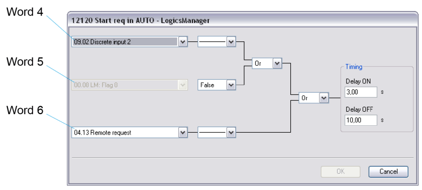


Fig. 308: LogicsManager command chain words 4, 5, and 6

Words 4, 5, and 6 contain the hex codes of the respective command variable ID's decimal value but in the reverse order of double-byte words, i.e. low byte before high byte.

The command variable prefix e.g., "04.13" is the number of the command variable not it's ID.

Refer to ✎ Chapter 9.3.2 "Logical Command Variables" on page 885 for the command variable IDs.

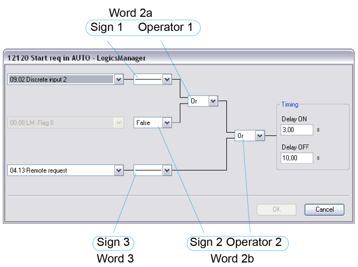


Fig. 309: LogicsManager command chain words 2 and 3

Words 2 and 3 contain a sequence of nibbles each representing a sign or operator of the equation.

The Data words table below shows the sequence how to arrange the LogicsManager setting that build the command chain.

Word 2				**Word 3**			
Sign 1	Operator 1	Sign 2	Operator 2	Sign 3	not used	not used	not used

Table 144: Data words 2 and 3 - details of the logic equations

Please find the hex code equivalents on the table below:

Signs		**Operators**	
"NOT"	0	"AND"	0
"—"	1	"NAND"	1
"TRUE"	2	"OR"	2
"FALSE"	3	"NOR"	3
		"XOR"	4
		"NOT-XOR"	5

Table 145: Hex code equivalents of the logic equations' nibbles

The hex code of words 2 and 3 is taken "as is" — don't swap high byte an d low byte.

Write the Modbus message (step 3)

It may be necessary to shift the address by 1 depending on the software you use for Modbus communication.

Copy the complete message of 7 words to the address [parameter number +1] in one step.

Word 0		Word 1		Word 2				Word 3				Word 4		Word 5		Word 6	
Delay ON		Delay OFF		Logic equation 1				Logic equation 2				Command 1		Command 2		Command 3	
low byte	high byte	low byte	high byte	Sign 1	Oper-ator 1	Sign 2	Oper-ator 2	Sign 3	0x00	0x00	0x00	low byte	high byte	low byte	high byte	low byte	high byte

Table 146: 7 words Modbus message in detail

Example

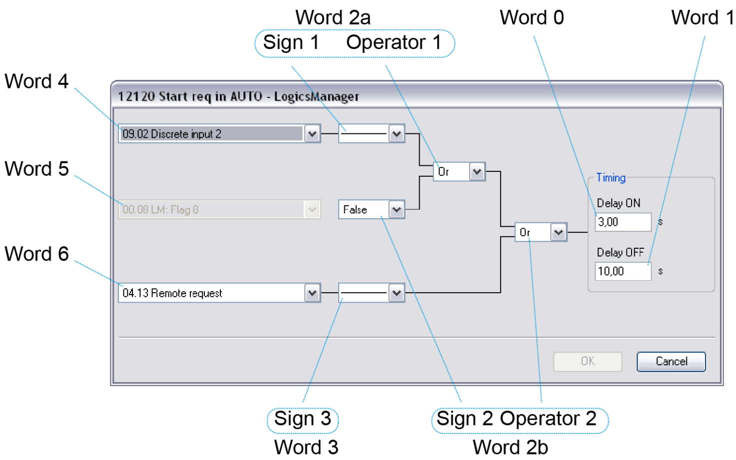


Fig. 310: LogicsManager command chain sample 12120

Word 0		Word 1		Word 2				Word 3				Word 4		Word 5		Word 6	
Delay ON		Delay OFF		Logic equation 1				Logic equation 2				Command 1		Command 2		Command 3	
3.00 sec		10.00 sec		—	Or	False	Or	—	-/-	-/-	-/-	No. 09.02 ID = 520 dec, 0208 hex		No. 00.08 ID = 7 dec, 0007 hex		No. 04.13 ID = 251 dec, 00FB hex	
low byte	high byte	low byte	high byte	Sign 1	Oper-ator 1	Sign 2	Oper-ator 2	Sign 3	0x00	0x00	0x00	low byte	high byte	low byte	high byte	low byte	high byte
2C	01	E8	03	1	2	3	2	1	0	0	0	08	02	07	00	FB	00

Table 147: 7 words Modbus message sample 12120 in detail

The Modbus message for the LogicsManager equation used for description above is 2C01 / E803 / 1232 / 1000 / 0802 / 0700 / FB00 (hex).

6.5.2.3 Configuration Of LogicsManager Functions For Remote Access

6.5.2.3.1 Basic remote control functions

The following chapters describe how to parametrize the LogicsManager via Modbus for the following basic remote control functions:

- Change to AUTOMATIC mode: 12510 Operat. mode AUTO
- Remote request start/stop: 12120 Start req. in AUTO
- Remote acknowledge: 12490 Ext. acknowledge
- Remote shutdown: 11669 Remote Shutdown-status
- Start without load: 12540 Start w/o load

6.5.2.3.2 Configuration of the LogicsManager "Operation mode AUTO"

To fix the operating mode use the LogicsManager function 86.16 "Operat. mode AUTO" (parameter 10715 ➪ p. 910/➪ p. 920).

The operating mode AUTO LogicsManager function (parameter 12510 ➪ p. 288/➪ p. 928) can be configured in two different ways:

- 1. Automatic operating mode is always enabled
- 2. Automatic operating mode is enabled via discrete input

Refer to ➪ Chapter 6.3.5 “Performing Remote Start/Stop And Acknowledgment” on page 545 for a detailed configuration of the LogicsManager via HMI or ToolKit.

Example

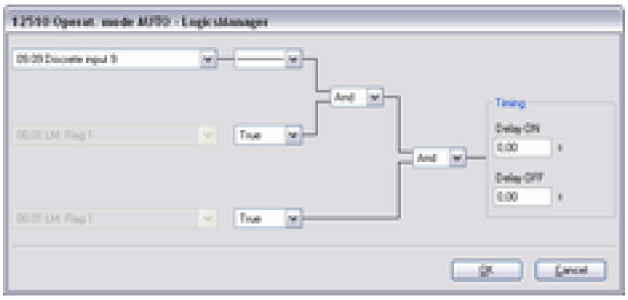


Fig. 311: LogicsManager function sample 12510

To configure the "Operat. mode AUTO" LogicsManager function (parameter 12510 ➪ p. 288/➪ p. 928) as indicated in (Fig. 311) the following Modbus message must be sent to the easYgen:

<table>
<tr><th>Word 0</th><th>Word 1</th><th colspan="4">Word 2</th><th colspan="4">Word 3</th><th>Word 4</th><th>Word 5</th><th>Word 6</th></tr>
<tr><td rowspan="2">Delay ON</td><td rowspan="2">Delay OFF</td><td colspan="4">Logic equation 1*</td><td colspan="4">Logic equation 2*</td><td rowspan="2">Command 1</td><td rowspan="2">Command 2</td><td rowspan="2">Command 3</td></tr>
<tr><td>Sign 1</td><td>Operator 1</td><td>Sign 2</td><td>Operator 2</td><td>Sign 3</td><td>-/-</td><td>-/-</td><td>-/-</td></tr>
</table>

Word 0		Word 1		Word 2				Word 3				Word 4		Word 5		Word 6	
0.00 sec		0.00 sec		—	And	True	And	Tru e	00	00	00	No. 09.09 ID = 527 dec		No. 96.01 ID = 0 dec		No. 96.01 ID = 0 dec	
0000 (hex)		0000 (hex)		1	0	2	0	2	0	0	0	020F (hex)		0000 (hex)		0000 (hex)	
low byt e	high byte	low byt e	high byte	"as is"				"as is"				low byt e	high byte	low byt e	high byte	low byt e	high byte
0000 (hex)		0000 (hex)		1020 (hex)				2000 (hex)				0F02 (hex)		0000 (hex)		0000 (hex)	

** see ➪ Table 145 “Hex code equivalents of the logic equations' nibbles” on page 626 for reference*

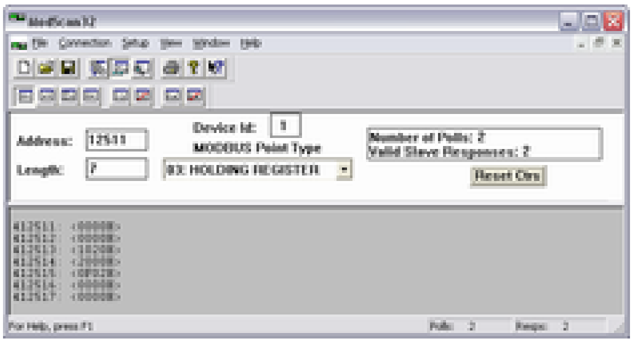


Fig. 312: Modscan32 at address 12511

➔ Copy the complete message of 7 words to address 12511 ff (12510+1) in one step.

This is shown in (Fig. 312) using the ModScan32 software.

If an shutdown alarm of alarm class C through F occurs in AUTOMATIC operating mode, the control does not return to STOP operating mode if the alarm is cleared after acknowledgment. This means that a restart is initiated.

6.5.2.3.3 Configuration Of Remote Start/Stop, Shutdown, And Acknowledgment

Refer to ➪ Chapter 6.3.5 “Performing Remote Start/Stop And Acknowledgment” on page 545 for a detailed configuration of the LogicsManager via HMI or ToolKit.

The easYgen may start, stop, shut down, or acknowledge alarms with CAN/Modbus. Therefore, two logical command variables (04.13 and 04.14) have to be configured with the LogicsManager. 03.40 can handle Remote shutdown only.

- 04.13 Remote request
- 04.14 Remote acknowledge
- 04.30 Remote shutdown

6.5.2.3.4 Configuration Of LogicsManager Function "Start Request in AUTO"

The "Start req. in AUTO" LogicsManager function (parameter 12120 ↳ p. 290/↳ p. 927) can be configured in a way that a start request in AUTOMATIC operating mode is enabled as soon as a remote request is issued.

Refer to ↳ *Chapter 6.3.5 "Performing Remote Start/Stop And Acknowledgment" on page 545* for a detailed configuration of the LogicsManager via HMI or ToolKit.

The remote request may be enabled by setting bit 0 (start) of the remote control word 503 to HIGH and may be disabled by setting bit 1 (stop) of the remote control word 503 to HIGH (refer to ↳ *Chapter 9.2.18 "Additional Data Identifier" on page 874*).

Example

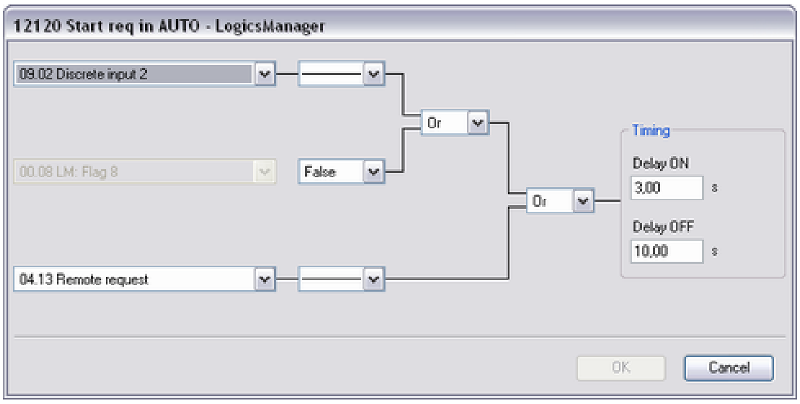


Fig. 313: LogicsManager function sample 12120

To configure the "Start req. in AUTO" LogicsManager function (parameter 12120 ↳ p. 290/↳ p. 927) as indicated in (Fig. 313) the following Modbus message must be sent to the easYgen:

Word 0	Word 1	Word 2				Word 3				Word 4	Word 5	Word 6
Delay ON	Delay OFF	Logic equation 1*				Logic equation 2*				Command 1	Command 2	Command 3
		Sign 1	Oper-ator 1	Sign 2	Oper-ator 2	Sign 3	-/-	-/-	-/-			
3.00 sec	10.00 sec	—	Or	False	Or	—	00	00	00	No. 09.02 ID = 520 dec	No. 96.08 ID = 7 dec	No. 04.13 ID = 251 dec
012c (hex)	03E8 (hex)	1	2	3	2	1	0	0	0	0208 (hex)	0007 (hex)	00FB (hex)

Word 0		Word 1		Word 2	Word 3	Word 4		Word 5		Word 6	
low byte	high byte	low byte	high byte	"as is"	"as is"	low byte	high byte	low byte	high byte	low byte	high byte
2C01 (hex)		E803 (hex)		1232 (hex)	1000 (hex)	0802 (hex)		0700 (hex)		FB00 (hex)	

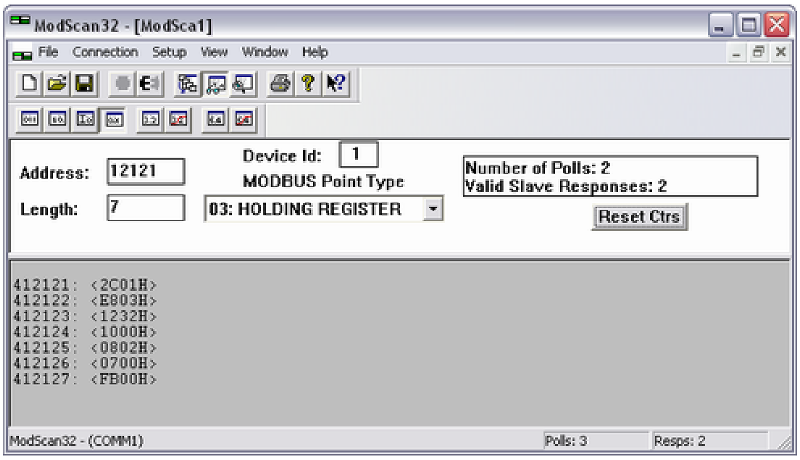


Fig. 314: Modscan32 at address 12121

- Copy the complete message of 7 words to address 12121 ff (12120+1) in one step.

  This is shown in (Fig. 314) using the ModScan32 software.

6.5.2.3.5 Configuration Of LogicsManager Function "External Acknowledge"

The "Ext. acknowledge" LogicsManager function (parameter 12490 ➪ p. 407/➪ p. 928) can be configured in a way that an external acknowledgment is performed as soon as the remote acknowledge signal is enabled.

Refer to ➪ *Chapter 6.3.5 "Performing Remote Start/Stop And Acknowledgment" on page 545* for a detailed configuration of the LogicsManager via HMI or ToolKit.

External acknowledge may be enabled by setting bit 4 (external acknowledge) of the remote control word 503 to HIGH (refer to ➪ *Chapter 9.2.18 "Additional Data Identifier" on page 874*).

Example

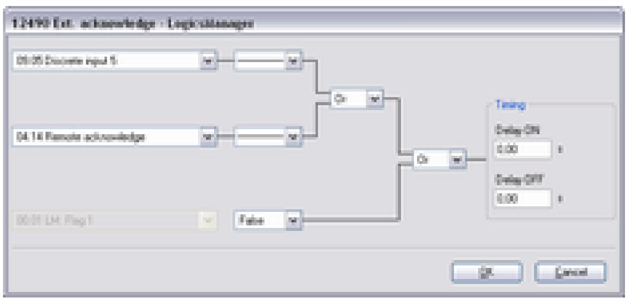


Fig. 315: LogicsManager function sample 12490

To configure the "External acknowledge" LogicsManager function (parameter 12490 ➷ p. 407/➷ p. 928) as indicated in (Fig. 315) the following Modbus message must be sent to the easYgen:

<table>
<tr><th colspan="2">Word 0</th><th colspan="2">Word 1</th><th colspan="4">Word 2</th><th colspan="4">Word 3</th><th colspan="2">Word 4</th><th colspan="2">Word 5</th><th colspan="2">Word 6</th></tr>
<tr><td colspan="2" rowspan="2">Delay ON</td><td colspan="2" rowspan="2">Delay OFF</td><td colspan="4">Logic equation 1*</td><td colspan="4">Logic equation 2*</td><td colspan="2" rowspan="2">Command 1</td><td colspan="2" rowspan="2">Command 2</td><td colspan="2" rowspan="2">Command 3</td></tr>
<tr><td>Sign 1</td><td>Operator 1</td><td>Sign 2</td><td>Operator 2</td><td>Sign 3</td><td>-/-</td><td>-/-</td><td>-/-</td></tr>
<tr><td colspan="2">0.00 sec</td><td colspan="2">0.00 sec</td><td>—</td><td>Or</td><td>—</td><td>Or</td><td>False</td><td>00</td><td>00</td><td>00</td><td colspan="2">No. 09.05 ID =
523 dec</td><td colspan="2">No. 04.14 ID =
252 dec</td><td colspan="2">No. 96.01 ID =
0 dec</td></tr>
<tr><td colspan="2">0000 (hex)</td><td colspan="2">0000 (hex)</td><td>1</td><td>2</td><td>1</td><td>2</td><td>3</td><td>0</td><td>0</td><td>0</td><td colspan="2">020B (hex)</td><td colspan="2">00FC (hex)</td><td colspan="2">0000 (hex)</td></tr>
<tr><td>low byte</td><td>high byte</td><td>low byte</td><td>high byte</td><td colspan="4">"as is"</td><td colspan="4">"as is"</td><td>low byte</td><td>high byte</td><td>low byte</td><td>high byte</td><td>low byte</td><td>high byte</td></tr>
<tr><td colspan="2">0000 (hex)</td><td colspan="2">0000 (hex)</td><td colspan="4">1212 (hex)</td><td colspan="4">3000 (hex)</td><td colspan="2">0B02 (hex)</td><td colspan="2">FC00 (hex)</td><td colspan="2">0000 (hex)</td></tr>
</table>

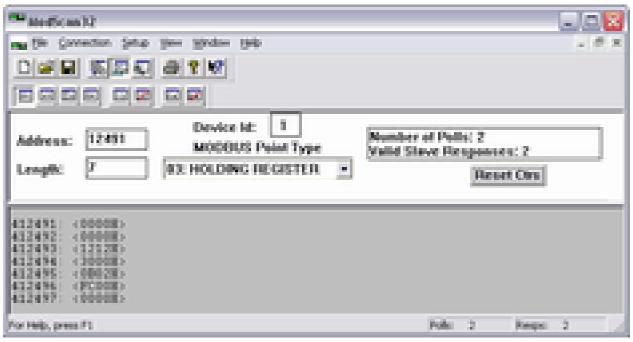


Fig. 316: Modscan32 at address 12491

- Copy the complete message of 7 words to address 12491 ff (12490+1) in one step.

  This is shown in (Fig. 316) using the ModScan32 software.

6.5.2.3.6 Configuration Of LogicsManager Function "Start w/o Load"

The Start w/o load LogicsManager function (parameter 12540 ➷ p. 290/➷ p. 928/➷ p. 928) can be configured in a way that it is always enabled.

Refer to ➷ *Chapter 6.3.5 “Performing Remote Start/Stop And Acknowledgment” on page 545* for a detailed configuration of the LogicsManager via HMI or ToolKit.

Example

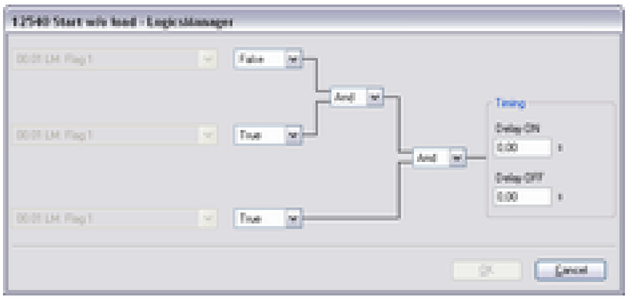


Fig. 317: LogicsManager function sample 12540

To configure the "Start w/o Load" LogicsManager function (parameter ID 12540 ⇘ p. 290/⇘ p. 928/⇘ p. 928) as indicated in (Fig. 317) the following Modbus message must be sent to the easYgen:

Word 0		Word 1		Word 2				Word 3				Word 4		Word 5		Word 6	
Delay ON		Delay OFF		Logic equation 1*				Logic equation 2*				Command 1		Command 2		Command 3	
				Sign 1	Oper-ator 1	Sign 2	Oper-ator 2	Sign 3	-/-	-/-	-/-						
0.00 sec		0.00 sec		False	And	True	And	True	00	00	00	No. 00.01 ID = 0 dec		No. 96.01 ID = 0 dec		No. 96.01 ID = 0 dec	
0000 (hex)		0000 (hex)		3	0	2	0	2	0	0	0	0000 (hex)		0000 (hex)		0000 (hex)	
low byte	high byte	low byte	high byte	"as is"				"as is"				low byte	high byte	low byte	high byte	low byte	high byte
0000 (hex)		0000 (hex)		3020 (hex)				2000 (hex)				0000 (hex)		0000 (hex)		0000 (hex)	

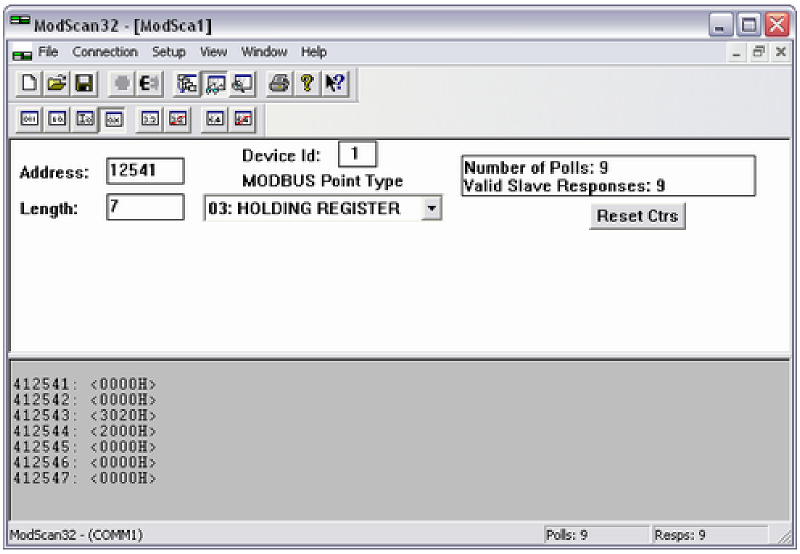


Fig. 318: Modscan32 at address 12541

→ Copy the complete message of 7 words to address 12541 ff (12540+1) in one step.

This is shown in (Fig. 318) using the ModScan32 software.

6.5.2.4 Remotely Acknowledge Single Alarm Messages

Single alarm messages can be acknowledged remotely through the Modbus by sending the respective parameter ID of the alarm to be acknowledged on parameter 522. The required procedure is detailed in the following steps.

ID	Parameter	Setting range	Data type
522	Reset alarm list	0 to 65535	UNSIGNED 16

The parameter ID of the alarm to be acknowledged must be written to object 220A (hex), i.e. parameter 522.

Example

A "Mains undervoltage 1" alarm (ID 3012) shall be acknowledged (refer to ⇘ *Chapter 9.5.4.2 “Alarm Messages” on page 971*).

- Modbus address = 40000 + (Par. ID + 1) = 40523
- Modbus length = 1 (UNSIGNED 16)

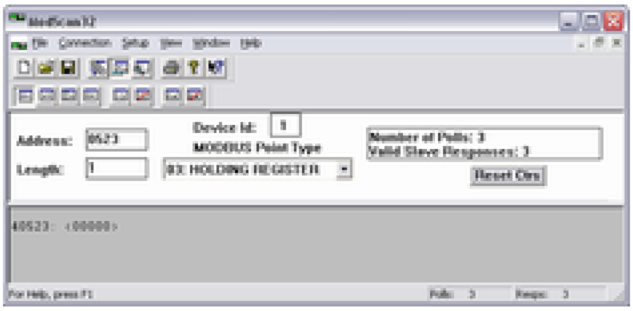


Fig. 319: ModScan32 at address 40523

1. Use the "display options" to set the format to decimal view.
2. Double-click the address to issue a `Write Register` command.

   ⇨ Fig. 320 shows how the parameter ID of the alarm to be acknowledged is written using the ModScan32 Software.

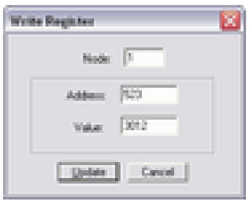


Fig. 320: Write register - acknowledge alarm message

6.5.2.5 Remotely Clearing The Event History

The event history can be cleared remotely through the Modbus. The required procedure is detailed in the following steps.

ID	Parameter	Setting range	Data type
1706	Clear eventlog	Yes / No	UNSIGNED 16

In order to clear the event history, bit 0 of object 26AA (hex), i.e. parameter 1706, must be enabled.

Remotely clearing event history

- Modbus address = 40000 + (Par. ID + 1) = 41707
- Modbus length = 1 (UNSIGNED 16)

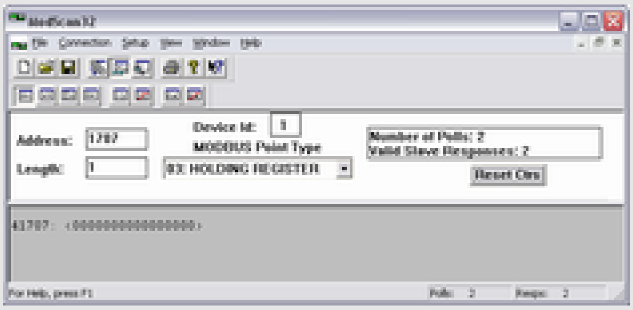


Fig. 321: Modscan32 at address 41707

1. Use the "display options" to set the value format to binary.
2. Double-click the address to issue a `Write Register` command.

   ⇨ Fig. 322 shows how bit 0 is enabled using the Mod-Scan32 Software.

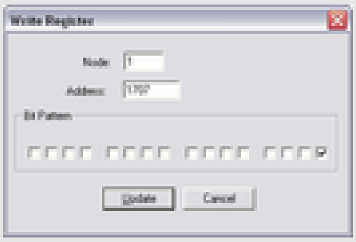


Fig. 322: Write register - clear event history

6.5.2.6 Remotely Resetting The Default Values

ID	Parameter	Setting range	Data type
10417	Factory settings	Yes / No	UNSIGNED 16
1701	Reset factory default values	Yes / No	UNSIGNED 16

In order to enable the resetting procedure, parameter 10417 must be enabled.

Example 1 (enable resetting)

The resetting procedure shall be enabled.

- Modbus address = 40000 + (Par. ID + 1) = 410418
- Modbus length = 1 (UNSIGNED 16)

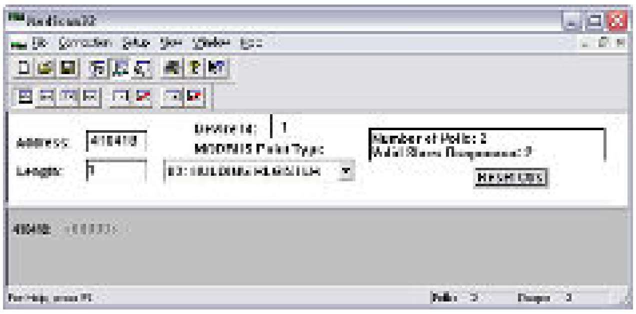


Fig. 323: Modscan32 at address 410418

1. Use the "display options" to set the value format to decimal.
2. Double-click the address to issue a `Write Register` command.

⇨ Fig. 324 shows how the parameter is enabled using the ModScan32 Software. The value must be set to "1" to enable the parameter.

Fig. 324: Write register - enable the resetting procedure

Example 2 (reset to default)

In order to reset the default values, parameter 1701 ↬ p. 159 must be enabled.

> **CAUTION!**
> **Set factory default settings causes easYgen power cycle!**
> Don't run 1701 ↬ p. 159 *"Set factory default values"* during controlling a genset because it causes a power cycle of the easYgen control.

The default values shall be reset.

- Modbus address = 40000 + (Par. ID + 1) = 41702
- Modbus length = 1 (UNSIGNED 16)

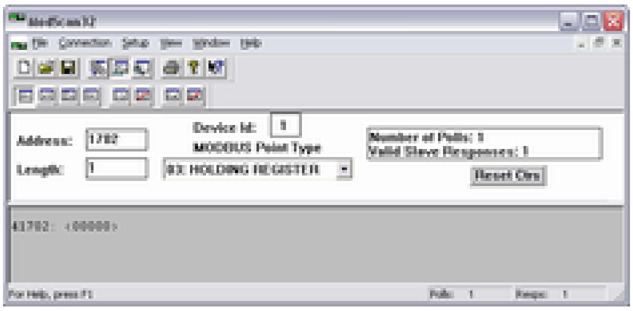


Fig. 325: Modscan32 at address 410418

1. Use the "display options" to set the value format to decimal.
2. Double-click the address to issue a `Write Register` command.

   ⇨ Fig. 326 shows how the parameter is enabled using the ModScan32 Software. The value must be set to "1" to enable the parameter.

Fig. 326: Write register - resetting the default values

6.5.3 Exception Responses

The Modbus protocol has multiple exception responses to show that a request could not be executed. Exception responses can be recognized if the response telegram contains the request function code with an offset of 128 (0x80 hex).

Table 148 "Modbus - exception responses" on page 637 explains possible reasons for an exception response that occurred.

Modbus exception responses		
Code	**Name**	**Reason**
01	ILLEGAL FUNCTION	The sent request function code is not supported by the Modbus protocol.
02	ILLEGAL ADDRESS	Permission to read/write the parameter is denied. The amount of requested registers is wrong to read/write this registers.
03	ILLEGAL DATA VALUE	The data value exceeds the min. and max. limitations of the parameter upon a write request. There is no parameter on the requested address.

Table 148: Modbus - exception responses

7 Interfaces And Protocols

7.1 Interfaces Overview

Interfaces and protocols

The easYgen-3100XT-P1/3200XT-P1(-LT) provide the following interfaces, which are supporting different protocols.

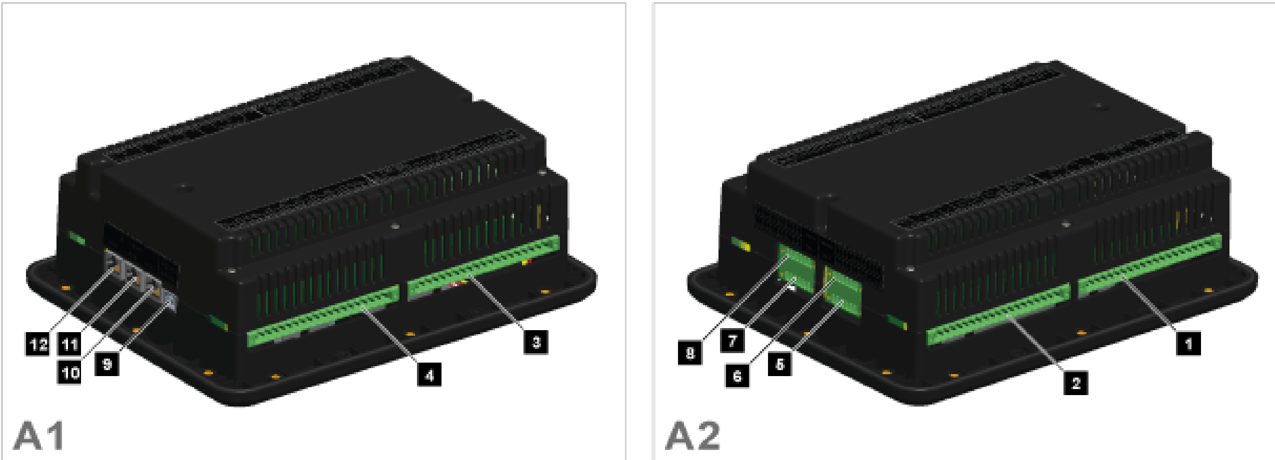


Fig. 327: easYgen-3500XT-P1 Series

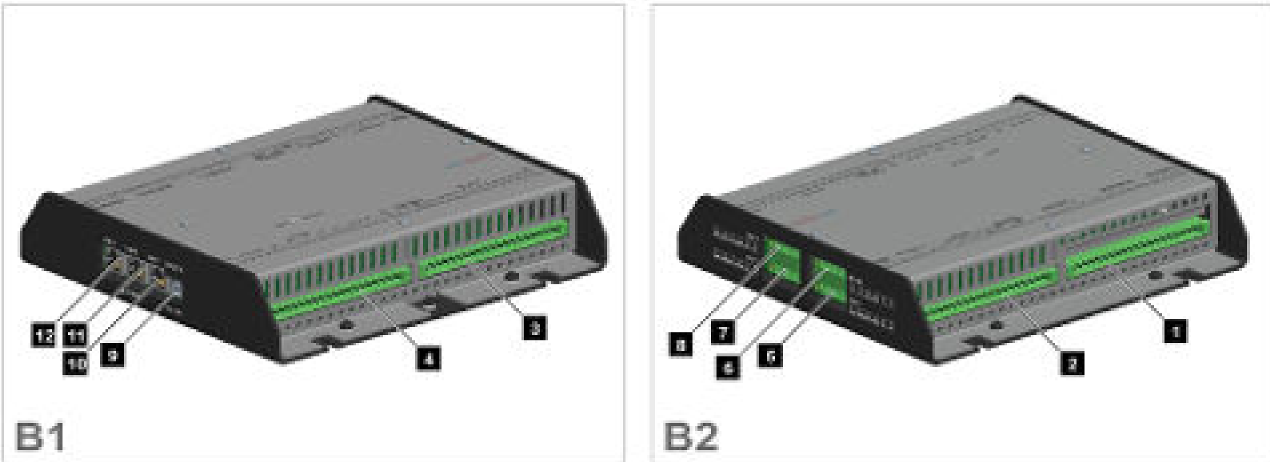


Fig. 328: easYgen-3400XT-P1 Series

A easYgen-3500XT-P1(-LT) (plastic housing with display)
B easYgen-3400XT-P1 (sheet metal housing)
1 Mains/generator/busbar PT terminal
2 Analog inputs/outputs, generator CT, and mains/GND current terminal
3 Discrete inputs, MPU, power supply, and D+ terminal
4 Relay outputs terminal
5 CAN bus interface connector CAN #2
6 RS-485 interface connector RS-485 #1
7 CAN bus interface connector CAN #1
8 CAN bus interface connector CAN #3
9 USB interface connector (2.0, slave) SERVICE port
10 ETHERNET interface connector (RJ-45) LAN C
11 ETHERNET interface connector (RJ-45) LAN B
12 ETHERNET interface connector (RJ-45) LAN A

> *Auxiliary excitation D+ and MPU input (speed input) are connected via terminals.*

External interfaces

easYgen-3400XT-P1/3500XT-P1(-LT)	(Package P1)
External discrete inputs / outputs via CANopen (maximum)	32 / 32
External analog inputs / outputs via CANopen (maximum)	16 / 4

7.2 CAN Interfaces

7.2.1 CAN Interface 1 (Guidance level)

The CAN interface 1 is a freely configurable CANopen interface with 5 RPDOs (receive messages), 5 TPDOs (send messages) and 4 additional Server SDOs.

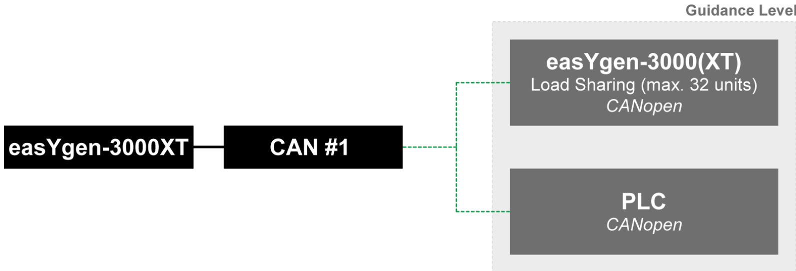


Fig. 329: CAN interface 1

7.2.2 CAN Interface 2 (Engine level)

The CAN interface 2 supports the CANopen and J1939 protocol simultaneously. It supports the connection of a wide range of engine control units (ECUs) and J1939 analog input extension modules, which comply with the J1939 standard (e.g. Axiomatic). CANopen extension modules are also supported.

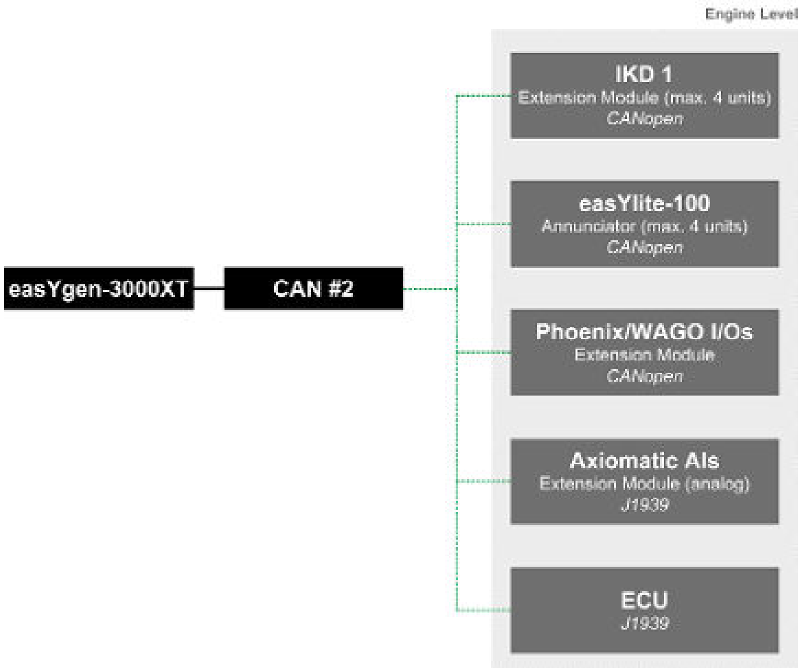


Fig. 330: CAN interface 2

CAN interface 2 is pre-configured for several expansion units. These include the I/O expansion boards Woodward IKD 1, several combinations of the expansion boards of the Phoenix Inline Modular (IL) series, and the support of Wago terminals.

It is possible to connect several combinations of up to four Woodward IKD 1s and/or Phoenix Inline Modular (IL) modules and/or WAGO modules with up to

- 32 discrete inputs/outputs, 16 analog inputs, and 4 analog outputs.
- P2: 16 discrete inputs/outputs.

7.2.3 CAN Interface 3 (System level)

The CAN interface 3 is used for load sharing and the LS-5 communication.

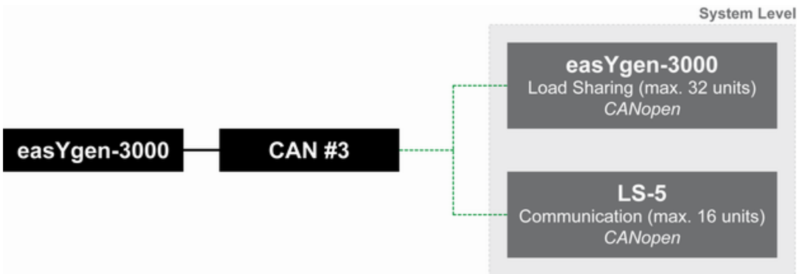


Fig. 331: CAN interface 3

7.3 Ethernet Interfaces

General notes

The Ethernet network provides a fast communication capability to different devices, like remote panel, PLC or SCADA systems. The common protocol Modbus TCP is there for the preferred communication protocol. Additionally the Ethernet connection supports the Woodward protocol Servlink for ToolKit and other Woodward own monitoring tools (like remote panel and SCADA visualization tool). At least the easYgen provides a UDP protocol for system relevant and time discrete information exchange.

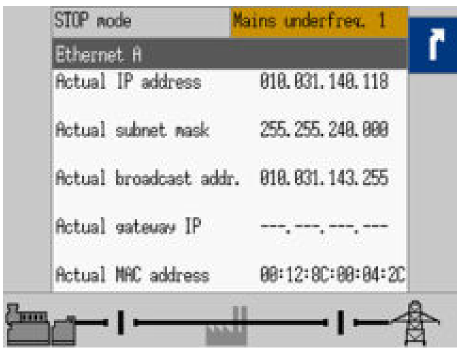


Fig. 332: Ethernet Network A screen

The actual IP address in Network A, subnet mask and gateway IP address can be viewed under Next Page (Status Menu) / Diagnostic / Interfaces / Ethernet / Ethernet A.

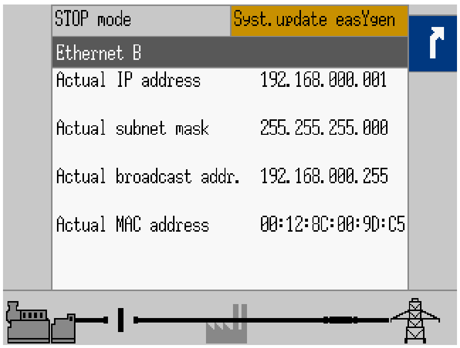


Fig. 333: Ethernet Network B screen

The actual IP address in Network B and the subnet mask can be viewed under Next Page (Status Menu) / Diagnostic / Interfaces / Ethernet / Ethernet B.

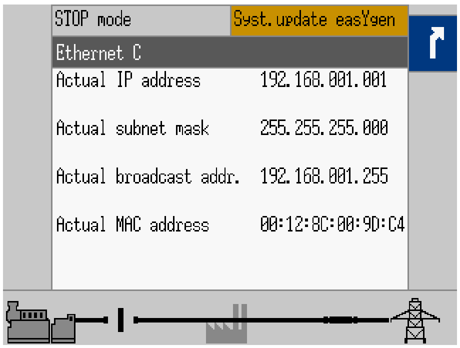


Fig. 334: Ethernet Network C screen

The actual IP address in Network C and the subnet mask can be viewed under Next Page (Status Menu) / Diagnostic / Interfaces / Ethernet / Ethernet C.

7.4 Serial Interfaces

7.4.1 RS-485 Interface (Serial Interface 2)

A freely configurable RS-485 Modbus RTU Slave interface is provided to add PLC connectivity. It is also possible to configure the unit, visualize measured data and alarm messages, and control the unit remotely.

Fig. 335: RS-485 interface

7.4.2 USB interface (USB 2.0, slave)

> ***Service port***
>
> *The USB interface follows the USB 2.0 standard but is - as a service port - reserved for ToolKit and special Woodward usage.*

7.5 CANopen Protocol

CANopen is a communication protocol and device profile specification for embedded systems used in automation. The CANopen standard consists of an addressing scheme, several small communication protocols and an application layer defined by a device profile. The communication protocols have support for network management, device monitoring and communication between nodes, including a simple transport layer for message segmentation/desegmentation.

Protocol description

If a data protocol is used, a CAN message looks like this:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
MUX	Data byte	Data byte	Data byte	Data byte	Data byte	Data byte	Internal

The MUX byte is counted up, the meaning of the data byte changes according to the value of the MUX byte.

In the protocol tables is listed which parameter at which MUX on which position is transmitted. The meaning of the parameter can be taken by means of the number of the parameter description (For details refer to ⇘ *"The following data protocols are implemented to be used" on page 685*).

Example

MUX	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
1	118				147		Internal

In MUX 1 (byte 0 has got value 1) the value of parameter 118 is included in the byte 1 up to byte 4 (mains voltage 1-2). In byte 6 up to byte 6 the value of parameter 147 is included (mains frequency). Byte 7 includes internal definitions and can be ignored.

Data format "Unsigned Integer"

UNSIGNED type data has positive integers as values. The range is between 0 and 2n-1. The data is shown by the bit sequence of length n.

- Bit sequence:
  $b = b_0$ to b_{-1}
- Value shown:
  $UNSIGNEDn(b) = b_{-1} * 2^{-1} + ... + b_1 * 2^1 + b_0 * 2^0$

Please note that the bit sequence starts on the left with the least significant byte.

Example: Value 266 = 10A hex of type UNSIGNED16 is transmitted on the bus in two octets, first 0A hex and then 01 hex.

The following UNSIGNED data types are transmitted as follows:

Octet Number	1.	2.	3.	4.	5.	6.	7.	8.
UNSIGNED8	b_7 to b_0							
UNSIGNED16	b_7 to b_0	b_{15} to b_8						
UNSIGNED24	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}					
UNSIGNED32	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}				
UNSIGNED40	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}			
UNSIGNED48	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}	b_{47} to b_{40}		
UNSIGNED56	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}	b_{47} to b_{40}	b_{55} to b_{48}	
UNSIGNED64	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}	b_{47} to b_{40}	b_{55} to b_{48}	b_{63} to b_{56}

Table 149: Transfer syntax for data type UNSIGNEDn

Data format "Signed Integer"

SIGNED type data has integers as values. The range is between 0 and 2^{-1}. The data is shown by the bit sequence of length n.

- Bit sequence:
  $b = b_0$ to b_{-1}
- Value shown:
  $SIGNEDn(b) = b_{-2} * 2^{-2} + ... + b_1 * 2^1 + b_0 * 2^0$
  if $b_{-1} = 0$
- And with two's complement:
  SIGNEDn(b) = SIGNEDn(^b)-1
  if $b_{-1} = 1$

Please note that the bit sequence starts on the left with the least significant byte.

Example: The value -266 = FEF6 hex of type SIGNED16 is transmitted in two octets, first F6 hex and then FE hex.

Octet Number	1.	2.	3.	4.	5.	6.	7.	8.
SIGNED8	b_7 to b_0							
SIGNED16	b_7 to b_0	b_{15} to b_8						
SIGNED24	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}					
SIGNED32	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}				
SIGNED40	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}			
SIGNED48	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}	b_{47} to b_{40}		
SIGNED56	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}	b_{47} to b_{40}	b_{55} to b_{48}	
SIGNED64	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}	b_{47} to b_{40}	b_{55} to b_{48}	b_{63} to b_{56}

Table 150: Transfer syntax for data type INTEGER

7.6 J1939 Protocol

The J1939 protocol is using an extended CAN identifier and can be used via CAN bus interface parallel to the CANopen protocol and ToolKit. All devices connected to the CAN bus interface must use the same baud rate independent of the selected protocol.

Most of the J1939 data is standardized and has a SPN (Suspect Parameter Number), which describes the data (e.g. SPN 110 is representing the value of the current “Engine Coolant Temperature”). The SPNs are packed in different PGNs (Parameter Group Numbers). The PGN is a part of the CAN ID and is representing one CAN message (e.g. SPN 110 is packed in PGN 65263). J1939 defines several hundred SPNs. However, only a small part is important for most of the applications. For this reason only a part of the SPNs is supported by the J1939 devices and by the easYgen.

'SAE J1939' also allows manufacturer-specific data areas, so called proprietary data, which are not defined in the standard. In most cases, these proprietary data is used for remote control purposes (like start/stop, speed setpoint) of ECUs (Engine Control Unit). Some manufacturers also issue specific error messages using manufacturer-specific data. Besides important standardized data, the easYgen is also supporting some proprietary data for the different ECUs. Please refer to *Chapter 7.6.2 “Supported J1939 ECUs & Remote Control Messages” on page 649* for details.

7.6.1 Displayed Messages (Visualization)

Visualization messages like "Engine Coolant Temperature" of a device (for example an ECU) are received on the CAN bus according to J1939 protocol and are shown on the device display and the ToolKit configuration software. In most cases the visualization works with standard messages.

The easYgen is able to display all values listed in the table *“Standard visualization messages” on page 646* if they are supported by the connected device as well.

If a message is used but its sensor/signal is damaged HMI and ToolKit display [ERROR].

Unused messages/SPN are monitored by ToolKit with [Missing] but HMI doesn't display unused messages/SPN (neither message/SPN nor status).

Diagnostic trouble codes (DM1/DM2)

In the J1939 status screen the first 10 active alarm messages (Active Diagnostic Trouble Codes - DM1) and the first 10 unacknowledged alarm messages (Previously Active Diagnostic Trouble Codes - DM2) with text, SPN, FMI, and OC are displayed.

The state of the lamps (amber/red) is always displayed.

- SPN (= Suspect Parameter Number) indicates the measured value that the alarm code is referring (e.g. SPN = 100 corresponds to oil pressure).
- FMI (= Failure Mode Indicator) specifies the alarm more precisely (e.g. FMI = 3 means: value is above predefined limits)
- OC (Occurrence Count) indicates how often an alarm occurred.

Refer to the J1939 specification for a list of all SPNs.

Standard visualization messages

In case of ...

- *... defective sensor: "**Error**" is displayed.*
- *... missing sensor: "**Missing**" is displayed.*

SPN	PGN	Description	Resol.	Data range J1939	Index
38	65276	Fuel level 2	0.1 %	0 to 100 %	12017
52	65262	Engine intercooler temperature	1 °C	-40 to 210 °C	15217
91	61443	Throttle position	0.1 %	0 to 100 %	15207
92	61443	Load at current speed	1 %	0 to 250 %	15208
94	65263	Fuel delivery pressure	1 kPa	0 to 1000 kPa	15218
95	65276	Fuel filter difference pressure	1 kPa	0 to 500 kPa	15219
96	65276	Fuel level 1	0.1 %	0 to 100 %	12016
98	65263	Engine oil level	0.1 %	0 to 100 %	15210
100	65263	Engine oil pressure	1 kPa	0 to 1000 kPa	15205
101	65263	Crankcase pressure	1 kPa	-250 to 251 kPa	15220
102	65270	Boost pressure	1 kPa	0 to 500 kPa	15214
105	65270	Intake manifold temperature	1 °C	-40 to 210 °C	15215
106	65270	Turbo air inlet pressure	1 kPa	0 to 500 kPa	15221
107	65270	Air filter 1 difference pressure	0.01 kPa	0 to 12.5 kPa	15222
108	65269	Barometric pressure	0.1 kPa	0 to 125 kPa	15212
109	65263	Coolant pressure	1 kPa	0 to 500 kPa	15223
110	65262	Engine coolant temperature	1 °C	-40 to 210 °C	15202
111	65263	Coolant level	0.1 %	0 to 100 %	15206
127	65272	Transmission oil pressure	1 kPa	0 to 4000 kPa	15224
157	65243	Fuel rail pressure	0.1 MPa	0 to 251 Mpa	15225
158	65271	Battery potential switched	0.1 V	0 to 3212.75 V	15312
171	65269	Ambient air temperature	0.1 °C	-273 to 1735 °C	15226
172	65269	Air inlet temperature	1 °C	-40 to 210 °C	15213
173	65270	Exhaust gas temperature	0.1 °C	-273 to 1735 °C	15216
174	65262	Fuel temperature	1 °C	-40 to 210 °C	15203
175	65262	Engine oil temperature	0.1 °C	-273 to 1735 °C	15309
176	65262	Turbo oil temperature	0.1 °C	-273 to 1735 °C	15227
177	65272	Transmission oil temperature	0.1 °C	-273 to 1735 °C	15228
183	65266	Fuel rate	0.1 l/h	0 to 3212.75 l/h	15307
190	61444	Engine speed	1 rpm	0 to 8031.875 rpm	15308
247	65253	Total engine hours[1]	1 h	0 to 210554060 h	15201

SPN	PGN	Description	Resol.	Data range J1939	Index
250	65257	Total fuel used	0.5 l	0 to 2105540608 l	15319
441	65164	Auxiliary temperature 1	1 °C	-40 to 210 °C	15229
442	65164	Auxiliary temperature 2	1 °C	-40 to 210 °C	15230
513	61444	Actual engine torque	1 %	-125 to 125 %	15209
1122	65191	Alternator bearing 1 temperature	1 °C	-40 to 210 °C	15231
1123	65191	Alternator bearing 2 temperature	1 °C	-40 to 210 °C	15232
1124	65191	Alternator winding 1 temperature	1 °C	-40 to 210 °C	15233
1125	65191	Alternator winding 2 temperature	1 °C	-40 to 210 °C	15234
1126	65191	Alternator winding 3 temperature	1 °C	-40 to 210 °C	15235
1131	65189	Intake manifold 2 temperature	1 °C	-40 to 210 °C	15236
1132	65189	Intake manifold 3 temperature	1 °C	-40 to 210 °C	15237
1133	65189	Intake manifold 4 temperature	1 °C	-40 to 210 °C	15238
1134	65262	Engine thermostat	0.1 %	0 to 100 %	15239
1135	65188	Engine oil temperature 2	0.1 °C	-273 to 1735 °C	15240
1136	65188	Engine ECU temperature	0.1 °C	-273 to 1735 °C	15241
1137	65187	Exhaust gas port 1 temperature	0.1 °C	-273 to 1735 °C	15242
1138	65187	Exhaust gas port 2 temperature	0.1 °C	-273 to 1735 °C	15243
1139	65187	Exhaust gas port 3 temperature	0.1 °C	-273 to 1735 °C	15244
1140	65187	Exhaust gas port 4 temperature	0.1 °C	-273 to 1735 °C	15245
1141	65186	Exhaust gas port 5 temperature	0.1 °C	-273 to 1735 °C	15246
1142	65186	Exhaust gas port 6 temperature	0.1 °C	-273 to 1735 °C	15247
1143	65186	Exhaust gas port 7 temperature	0.1 °C	-273 to 1735 °C	15248
1144	65186	Exhaust gas port 8 temperature	0.1 °C	-273 to 1735 °C	15249
1145	65185	Exhaust gas port 9 temperature	0.1 °C	-273 to 1735 °C	15250
1146	65185	Exhaust gas port 10 temperature	0.1 °C	-273 to 1735 °C	15251
1147	65185	Exhaust gas port 11 temperature	0.1 °C	-273 to 1735 °C	15252
1148	65185	Exhaust gas port 12 temperature	0.1 °C	-273 to 1735 °C	15253
1149	65184	Exhaust gas port 13 temperature	0.1 °C	-273 to 1735 °C	15254
1150	65184	Exhaust gas port 14 temperature	0.1 °C	-273 to 1735 °C	15255
1151	65184	Exhaust gas port 15 temperature	0.1 °C	-273 to 1735 °C	15256
1152	65184	Exhaust gas port 16 temperature	0.1 °C	-273 to 1735 °C	15257
1153	65183	Exhaust gas port 17 temperature	0.1 °C	-273 to 1735 °C	15258
1154	65183	Exhaust gas port 18 temperature	0.1 °C	-273 to 1735 °C	15259
1155	65183	Exhaust gas port 19 temperature	0.1 °C	-273 to 1735 °C	15260
1156	65183	Exhaust gas port 20 temperature	0.1 °C	-273 to 1735 °C	15261
1157	65182	Main bearing 1 temperature	0.1 °C	-273 to 1735 °C	15262
1158	65182	Main bearing 2 temperature	0.1 °C	-273 to 1735 °C	15263
1159	65182	Main bearing 3 temperature	0.1 °C	-273 to 1735 °C	15264
1160	65182	Main bearing 4 temperature	0.1 °C	-273 to 1735 °C	15265
1161	65181	Main bearing 5 temperature	0.1 °C	-273 to 1735 °C	15266
1162	65181	Main bearing 6 temperature	0.1 °C	-273 to 1735 °C	15267
1163	65181	Main bearing 7 temperature	0.1 °C	-273 to 1735 °C	15268

SPN	PGN	Description	Resol.	Data range J1939	Index
1164	65181	Main bearing 8 temperature	0.1 °C	-273 to 1735 °C	15269
1165	65180	Main bearing 9 temperature	0.1 °C	-273 to 1735 °C	15270
1166	65180	Main bearing 10 temperature	0.1 °C	-273 to 1735 °C	15271
1167	65180	Main bearing 11 temperature	0.1 °C	-273 to 1735 °C	15272
1172	65178	Turbo 1 compressor inlet temperature	0.1 °C	-273 to 1735 °C	15273
1173	65178	Turbo 2 compressor inlet temperature	0.1 °C	-273 to 1735 °C	15274
1174	65178	Turbo 3 compressor inlet temperature	0.1 °C	-273 to 1735 °C	15275
1175	65178	Turbo 4 compressor inlet temperature	0.1 °C	-273 to 1735 °C	15276
1176	65177	Turbo 1 compressor inlet pressure	1 kPa	-250 to 251 kPa	15277
1177	65177	Turbo 2 compressor inlet pressure	1 kPa	-250 to 251 kPa	15278
1178	65177	Turbo 3 compressor inlet pressure	1 kPa	-250 to 251 kPa	15279
1179	65177	Turbo 4 compressor inlet pressure	1 kPa	-250 to 251 kPa	15280
1180	65176	Turbo 1 inlet temperature	0.1 °C	-273 to 1735 °C	15281
1181	65176	Turbo 2 inlet temperature	0.1 °C	-273 to 1735 °C	15282
1182	65176	Turbo 3 inlet temperature	0.1 °C	-273 to 1735 °C	15283
1183	65176	Turbo 4 inlet temperature	0.1 °C	-273 to 1735 °C	15284
1184	65175	Turbo 1 outlet temperature	0.1 °C	-273 to 1735 °C	15285
1185	65175	Turbo 2 outlet temperature	0.1 °C	-273 to 1735 °C	15286
1186	65175	Turbo 3 outlet temperature	0.1 °C	-273 to 1735 °C	15287
1187	65175	Turbo 4 outlet temperature	0.1 °C	-273 to 1735 °C	15288
1203	65172	Engine auxiliary coolant pressure	1 kPa	0 to 1000 kPa	15289
1208	65170	Pre-filter oil pressure	1 kPa	0 to 1000 kPa	15290
1212	65172	Engine auxiliary coolant temperature	1 °C	-40 to 210 °C	15291
1382	65130	Fuel filter difference pressure	1 kPa	0 to 500 kPa	15292
1761	65110	Aftertreatment 1 Exhaust Tank1 Level	0.1%	0 to 100%	15313
1800	65104	Battery 1 temperature	1 °C	-40 to 210 °C	15293
1801	65104	Battery 2 temperature	1 °C	-40 to 210 °C	15294
1802	65189	Intake manifold 5 temperature	1 °C	-40 to 210 °C	15295
1803	65189	Intake manifold 6 temperature	1 °C	-40 to 210 °C	15296
2433	65031	Right exhaust gas temperature	0.1 °C	-273 to 1735 °C	15297
2434	65031	Left exhaust gas temperature	0.1 °C	-273 to 1735 °C	15298
2629	64979	Turbo 1 compr. outlet tmp.	0.1 °C	-273 to 1736 °C	15310
3031	65110	Aftertreatment 1 Exhaust Tank1 Temperature	1 °C	-40 to 210 °C	15314
3644	64914	Engine derate request	0.1%	0 to 100%	15311
4151	64851	Exhaust Gas Temp. Avr.	0.1 °C	-273 to 1734 °C	12807
4152	64851	Exh. Gas Temp. Avr. B2	0.1 °C	-273 to 1734 °C	12812
4153	64851	Exh. Gas Temp. Avr. B1	0.1 °C	-273 to 1734 °C	12809
4367	64829	Aftertreatment 1 Exhaust Tank2 Level	0.1%	0 to 100%	15315
4368	64829	Aftertreatment 1 Exhaust Tank2 Temperature	1 °C	-40 to 210 °C	15316

[1] If the total engine hours sent by the ECU exceed 419,000 hrs, the display in the unit is not correct anymore

Data transmission engine control unit (ECU)

- If the sent values exceed the limits of the specification, the displayed value is not defined.
- If a value of the ECU is not sent or sent as not available or defective, the value will be displayed as indicated in the table before.

Special Deutz EMR2/Volvo EDC4 messages

Suspect parameter number	Parameter group number	Description
Engine stop	65301 (FF15h)	0 to 250

Please refer to the ECU manual for the engine specific stop codes.

Special Scania S6 messages

Suspect parameter number	Parameter group number	Description	Display in unit	Display in ToolKit
DLN2-Proprietary	65409 (FF81h)	Assessed messages:		
		■ Low engine oil level	No	No
		■ High engine oil level	Missing	Missing
		■ Low oil pressure	Yes	Yes
		■ High coolant temperature		

7.6.2 Supported J1939 ECUs & Remote Control Messages

The following table lists all ECUs, which are supported by the easYgen beyond the J1939 standard with the appropriate settings. We recommend device type (parameter 15102 ➡ p. 460) "Standard" for all ECUs, which are **not listed** here. All other parameters shall be clarified with the ECU manufacturer.

ECU	Device type (15102)	J1939 own address (15106)	Engine control address (15107)	SPN version (15103)	Comment
Standard ECUs	Standard	N/A	N/A	N/A	Please refer to ➡ *Chapter 7.6.3 "Device Type Standard" on page 652* for more details.
Woodward EGS	EGS Woodward	234	0	N/A	
MTU ADEC ECU7	ADEC ECU7 MTU	1	128	N/A	The easYgen is connected with the SAM via CAN. The SAM communicates with the ADEC using an own bus.
Deutz EMR2 Volvo EDC4	EMR2 Deutz	3	0	Version 1	

ECU	Device type (15102)	J1939 own address (15106)	Engine control address (15107)	SPN version (15103)	Comment
Deutz EMR3 Deutz EMR4 (EDC 17)	Standard	3	0	N/A	
Volvo EMS2 Volvo EMS1 Volvo EDC3	EMS2 Volvo	17	0	N/A	The rated speed of the EMS1 and EDC3 cannot be switched via the easYgen.
Scania S6	S6 Scania	39	0	N/A	
MAN MFR/EDC7	MFR/EDC7 MAN	253	39	N/A	The easYgen is connected with the MFR via CAN. The MFR communicates with the EDC7 using an own bus.
SISU EEM2/3	EEM SISU	N/A	0 / (1)	N/A	
Cummins	Cummins	220	0	N/A	**Notes** Some Cummins setups need a special value for “Governor Gain” otherwise they will shut down. In this cases please set the “Governor Gain” of the ECU to *“Internal”* instead of *“J1939”*.
MTU ADEC ECU8/ ECU9	ADEC ECU8 MTU	234	0	N/A	The easYgen is connected with the MTU system: ADEC ECU8 & SmartConnect or ADEC ECU9.

The addresses listed here are only valid, if the ECU is not configured to other values. In case of doubt, please check the corresponding settings of the ECU with the service tool.

The following data is only transmitted to the corresponding ECU, if parameter "ECU remote controlled" is configured to "On", and parameter "Device type" is configured to one of the available ECU modes (if "Off" is configured, no J1939 remote control messages will be sent as well).

Please note that some ECU manufacturers require that this functionality must be enabled first. In some cases, this is only possible by the manufacturer. Please consider this when ordering the ECU.

Supported ECUs

1 - Woodward EGS
2 - Scania S6
3 - Deutz EMR2/EMR3 / Volvo EDC4
4 - Volvo EMS2
5 - Volvo EMS1/EDC3
6 - MTU ADEC ECU7
7 - MAN MFR/EDC7
8 - Standard
9 - SISU EEM 2/3
10 - Cummins
11 - MTU ADEC ECU8/ECU9

Remote control parameter	**Availability with supported ECU number ...**											**Comment**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	
Engine Start	No	Yes	No	Yes	Yes	Yes	Yes	No	No / Yes	Yes	Yes	If an engine start command is initiated by the easYgen, this information is transmitted in the form of a J1939 message bit to an ECU. If ignition speed is reached, this bit will be reset (LogicsManager command variable 03.02. "Starter").
Engine Stop	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No / Yes	Yes	Yes	This J1939 bit information is set, if a "Stop" command in automatic or manual mode is present in the easYgen. The "Stop" bit information remains set, until ignition speed is fallen below. After ignition speed has been fallen below, the "Stop" bit will be reset (LogicsManager command variable 03.27. "Stop solenoid").
Droop mode	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes / Yes	Yes	No	This J1939 bit information is set, if a "Start" command in automatic or manual mode is initiated by the easYgen. The bit remains set until the engine has been stopped. **Notes** This message is only sent, if the LogicsManager output 86.25 "Frequency droop active" is TRUE.
Idle Mode	No	Yes	No[1]	Yes	Yes	No	No[1]	No[1]	No / No	Yes	Yes	This J1939 bit information is set, if "Idle" mode is active (LogicsManager command variable 04.15. "Idle run active" is TRUE). The bit will be reset, if "Idle" mode is no longer active (LogicsManager command variable 04.15. "Idle run active" is FALSE).
50/60 Hz switch	Yes	Yes	No	Yes[2]	No	Yes	No[1]	No	No / No	Yes	Yes	The J1939 information for 50 or 60 Hz mode is sent to the ECU depending on the "Rated system frequency" parameter setting (1750 ⤷ p. 429) within the easYgen .
Speed bias	Yes	Yes offset	Yes absolute	Yes offset	Yes absolute	Yes absolute	Yes absolute	Yes absolute	Yes / Yes absolute	Yes offset	Yes offset	Refer to parameter 5537 ⤷ p. 462 for detailed information.

Remote control parameter	Availability with supported ECU number ...											Comment
	1	2	3	4	5	6	7	8	9	10	11	
	offset/absolute											**Notes** Analog signal only
Preglow	No	No	No	Yes	Yes	No	No	No	No / No	No	No	This J1939 bit information is set, if the easYgen is in "Preglow" mode (LogicsManager command variable 03.04. "Preglow/Ignition" is TRUE). The bit will be reset, if the "Preglow" phase has been expired or aborted.
Override	No	Yes	No	Yes	No	Yes	No	Yes	No / No	Yes	Yes	This J1939 bit information is set, if the easYgen is in critical mode (LogicsManager command variable 04.27. "Critical mode" is TRUE). The bit will be reset, if the critical mode has been expired or aborted.
Engine power mode	No	No	No	No	No	No	No	No	No	No	Yes	This message is generated according to parameter "ECU power mode" (parameter 12939 ➡ p. 463).
Engine selected application	No	No	No	No	No	No	No	No	No	No	Yes	This message is generated according to parameter "ECU application" (parameter 4843 ➡ p. 463).

[1] Please contact manufacturer to clarify whether both frequencies (50/60 Hz) may be controlled by the speed bias.

[2] In case the rated speed of the easYgen and the ECU don't match, please make sure that the CAN connections works and change parameter 1750 ➡ p. 429 of the easYgen once.

7.6.3 Device Type Standard

General notes

If the used ECU is not specific listed in the chapter ➡ *Chapter 7.6 "J1939 Protocol" on page 645* (e.g. Deutz (EMR3 & EMR4), John Deere, Daimler, Perkins, Iveco, Caterpillar, Liebherr, etc.) we recommend to configure the "Device type" (parameter 15102 ➡ p. 460) to the setting "Standard". Visualization via J1939 is working with every J1939 ECU. Concerning remote control most ECUs are also supporting the speed offset via J1939 standard message TSC1. This chapter supplies you with the details of the device type standard, to help you to clarify with the manufacturer how the ECU is supported.

Displayed messages (visualization)

In standard mode, the easYgen is able to display all values listed in the table ➡ *"Standard visualization messages" on page 646* if they are supported by the connected ECU.

Diagnostic trouble codes (DM1/ DM2)

In standard mode, the easYgen diagnostic messages DM1 (Active Diagnostic Trouble Codes) and DM2 (Previously Active Diagnostic Trouble Codes) are displayed. It is also possible to reset DM1 and DM2 failure codes via DM3 and DM11 messages.

Remote control messages

The following table shows the transmitted remote control messages. These messages are only transmitted if the parameter "ECU remote controlled" (parameter 15127 ➪ p. 462) is configured to "On".

All listed messages are according to J1939 standard protocol.

Not all SPNs of the supported PGNs are listed here, in such case the easYgen transmits “Not available”.

PGN		Acronym	Name	SPN	Description	Rate [ms]
Dec	Hex					
0	0000	TSC1	Torque/Speed Control 1	695	Engine Override Control Mode (fixed to “Speed Control”)	10
				696	Requested Speed Control Conditions (fixed to “Transient Optimized”)	
				897	Override Control Mode Priority (fixed to “Highest Priority”)	
				898	Engine Requested Speed/Speed Limit	
61441	F001	EBC1	Electronic Brake Controller 1	970	Engine Auxiliary Shutdown Switch	100
61470	F01E	GC2	Generator Control 2	3938	Generator Governing Bias	20
65029	FE05	GTACP	Generator Total AC Power	2452	Generator Total Real Power	100
64913	FD91	ACS	AC Switching Device Status	3545	Generator Circuit Breaker Status	250
				3546	Utility Circuit Breaker Status	
64971	FDCB	OHECS	Off-Highway Engine Control Selection	2881	Engine Alternate Droop Accelerator 1 Select	500
					Notes If droop shall be active (LogicsManager 86.25 = TRUE) the easYgen is transmitting “Normal Droop” else “Alternate Droop Setting 1".	
65265	FEF1	CCVS	Cruise Control/Vehicle Speed	1237	Engine Shutdown Override Switch	100
59904	EA00	—	Request (specific)	247	Engine Total Hours of Operation (at PGN FEE5)	10,000
				—	DM11 Diagnostic Data Clear/Reset For Active DTCs (at PGN FED3)	
				—	DM3 Diagnostic Data Clear/Reset Of Previously Active DTCs (at PGN FECE)	
					Notes DM3 and DM11 are only transmitted if triggered.	

PGN		Acronym	Name	SPN	Description	Rate [ms]
Dec	Hex					
59904	EA(FF)	—	Request (global)	—	DM2 Previously diagnostic trouble codes (at PGN FECB)	2,000
				—	DM11 Diagnostic Data Clear/Reset For Active DTCs (at PGN FED3)	
				—	DM3 Diagnostic Data Clear/Reset Of Previously Active DTCs (at PGN FECE)	
				441	Auxiliary Temperature 1 (at PGN FE8C)	
				442	Auxiliary Temperature 2 (at PGN FE8C)	
					Notes DM3 and DM11 are only transmitted if triggered.	

Configure J1939 addresses

For the visualization the “J1939 own address” (parameter 15106 ⤷ p. 461) and the “Engine control address” (parameter 15103 ⤷ p. 462) are not relevant. But for remote control e.g. speed biasing these addresses must be configured correctly. Please refer to your ECU manual for the correct address. Normally the “Engine control address” (parameter 15103 ⤷ p. 462) is “0” and the “J1939 own address” (parameter 15106 ⤷ p. 461) is often "234" or "3".

7.7 Modbus Protocol

Modbus is a serial communications protocol published by Modicon in 1979 for use with its programmable logic controllers (PLCs). It has become a de facto standard communications protocol in industry, and is now the most commonly available means of connecting industrial electronic devices.

The Woodward controller supports

- a **Modbus RTU Slave** module for RS-485 connections
  and
- a **Modbus/TCP Server** module for clients connected to the Ethernet port.

The Modbus RTU Slave expects that a Master node polls the controller slave node. Modbus RTU can also be multi-dropped, or in other words, multiple Slave devices can exist on one Modbus RTU network, assuming that the serial interface is a RS-485.

The Modbus/TCP Server fulfills the same role as Modbus client for RTU mode. Also here it is possible to have one client connected to many servers.

> ***Temporary restriction***
> *With the current easYgen-XT one server can handle only one client at a time.*

Detailed information about the Modbus protocol is available on the following website:

- http://www.modbus.org/specs.php

There are also various tools available on the internet. We recommend using ModScan32 which is a Windows application designed to operate as a Modbus Master device for accessing data points in a connected Modbus Slave device. It is designed primarily as a testing device for verification of correct protocol operation in new or existing systems.

A trial version download is available from the following website:

- *http://www.win-tech.com/html/modscan32.htm*

Address range

The controller Modbus Slave module distinguishes between visualization data and configuration & remote control data. The different data is accessible over a split address range and can be read via the "Read Holding Register" function.

Furthermore, controller parameters and remote control data can be written with the "Preset Single Registers" function or "Preset Multiple Registers" (Fig. 336)

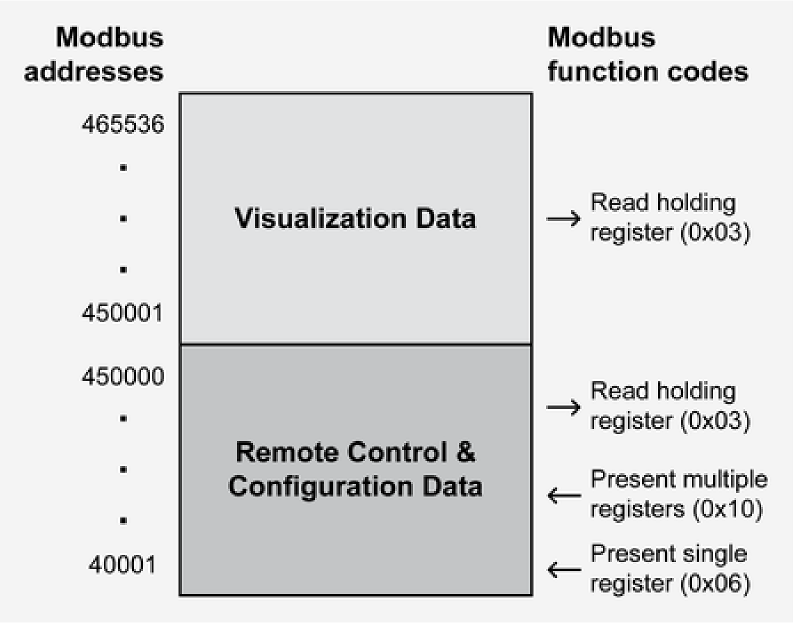


Fig. 336: Address range

All addresses in this document comply with the Modicon address convention. Some PLCs or PC programs use different address conventions depending on their implementation. Then the address must be increased and the leading 4 may be omitted.

Please refer to your PLC or program manual for more information. This determines the address sent over the bus in the Modbus telegram. The Modbus starting address 450001 of the visualization data may become bus address 50000 for example.

Visualization

The visualization over Modbus is provided in a very fast data protocol where important system data like alarm states, AC measurement data, switch states and various other information may be polled.

According to the Modbus addressing range, the visualization protocol can be reached on addresses starting at 450001. On this address range it is possible to do block reads from 1 up to 128 Modbus registers at a time.

Modbus read addresses	Description	Multiplier	Units
450001	Protocol-ID, always 5010		–
450002	Scaling Power (16 bits) Exponent 10x W (5;4;3;2)		
....	....	.....	.....
	....		
....	....	.....	.....
450445	Total engine hours (j1939-HOURS)	1	h

Table 151: Address range block read

↳ Chapter 4.7.3 “Modbus Protocol” on page 440 is only an excerpt of the data protocol. It conforms to the data protocol 5010.

The easYgen has an additional combined CANopen/Modbus protocol 5003.

Please refer to the Data Protocols chapter . ↳ “The following data protocols are implemented to be used” on page 685

The following ModScan32 screenshot shows the configurations made to read the visualization protocol with a block read of 128 registers.

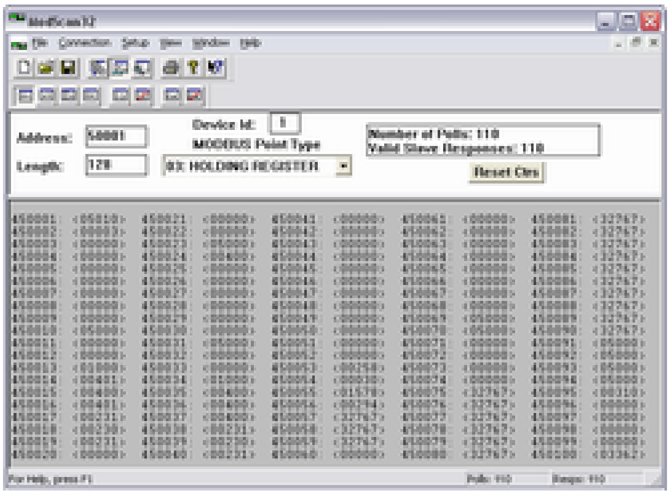


Fig. 337: Visualization configurations

Data Format(s)

Modbus registers are read and written according to the Modbus standard as Big-endian.

Composite data types like LOGMAN, ANALOG-MANAGER, and TEXT use separate descriptions.

Configuration

The Modbus interface can be used to read/write parameters. According the Modbus addressing range for the configuration addresses, the range starts at 40,001 and ends at 450,000. You can always access only one parameter of the system in this address range. The Modbus address can be calculated depending on the parameter ID as illustrated below:

	Parameter ID < 10,000	Parameter ID >= 10,000
Modbus address =	40,000 + (Par. ID+1)	400,000 + (Par. ID+1)

Table 152: Address calculation

Block reads in this address range depend on the data type of the parameter. This makes it important to set the correct length in Modbus registers which depends on the data type (UNSIGNED 8, INTEGER 16, etc.).

Refer to ↳ *Table 153 "Data types" on page 657* for more information.

Types	Modbus registers	Remarks
UNSIGNED 8	1	
UNSIGNED 16	1	
INTEGER 16	1	
UNSIGNED 32	2	
INTEGER 32	2	
LOGMAN	7	Little-endian is used for LogicsManager to be compatible with (non-XT) easYgen series
ANALOGMAN-AGER	7	Big-endian is used for AnalogManager because it is the regular format for Modbus
TEXT/X	X/2	

Table 153: Data types

The Modbus RTU response time can increase under certain conditions (display versions / plastic housing only):

– ***without*** *CAN (J1939 protocol) connected -> max. 2 seconds*
– ***with*** *CAN (J1939 protocol) connected -> max. 3 seconds*

Woodward recommends to make a break time of 10 ms after receiving the data of the last Modbus request.

7.8 Load Sharing

General information

The maximum number of participating easYgen-3000XT Series devices for load sharing is 32. Both CAN and Ethernet interfaces can handle load share. Load share via Ethernet interface uses UDP broadcast messages.

Multi-master principle

It is important to know that the load share and load-dependent start/stop functionality is subject to a multi-master principle. This means that there is no dedicated master and slave function. Each easYgen decides for itself how it has to behave.

The benefit is that there is no master control, which may cause a complete loss of this functionality in case it fails. Each control is also responsible for controlling common breakers like a mains circuit or generator group breaker.

Load share monitoring

The easYgen provides LDSS parameters for monitoring load sharing:

- **Multi-unit parameter alignment**
  The multi-unit parameter alignment functionality requires that the relevant parameters are all configured identically at all participating units. For additional information refer to ⇘ *Chapter 4.5.6.12 "Multi-Unit Parameter Alignment" on page 419*.
- **Multi-unit missing members**
  The multi-unit missing members monitoring function checks whether all participating units are available (sending data on the load share line). For additional information refer to ⇘ *Chapter 4.5.6.13 "Multi-Unit Missing easYgen" on page 420*.

Load share communication

The following parameters allows to select the interface for load share communication. Refer to ⇘ *Chapter 4.4.4.3.5 "Load-Share Interface" on page 252* for detailed information.

ID	Text	Setting range	Default value
9924	Load share Interface	**CAN** Off Ethernet A CAN/EthA by LM* Ethernet B/C	CAN
		Notes * CAN or Ethernet A depending on 11986 ⇘ p. 659 (described below)	

ID	Text	Setting range	Default value
11986	LS interface Ethernet A (LM 86.13: LS interf. EthA = 11987)	**FALSE** TRUE	FALSE
		Notes Switches the load share interface between ■ FALSE: CAN ■ TRUE: Ethernet A	

Woodward recommends to configure the Node-IDs (parameter 8950 ⇘ p. 445) for units, which participate in load sharing, as low as possible to facilitate a fast establishing of communication.

7.8.1 Load Share via CAN

Bus load

The bus load increases with the number of units participating in load sharing.

The following parameters affect the bus load:

- Number of CAN participants
- Baud rate
- Transfer rate of load share messages
- Transfer rate of visualization protocols

We recommend to consider whether all data has to be sent on the CAN bus when planning the CAN bus. It is also possible to send visualization data via RS-485 for example.

Measures to reduce the bus load

If you need to reduce the bus load of the load share CAN bus, the following methods may be used:

- Increase the baud rate (parameter 3156 ⇘ p. 445) under consideration of the bus length (refer to ⇘ *Chapter 3.4.4 "CAN Bus Interfaces" on page 85*).
- Reduce the transfer rate of the load share message (parameter 9921 ⇘ p. 478).
- Reduce the transfer rate of the visualization message, i.e. the event timer (parameter 9604 ⇘ p. 451).
- Disable the transmission visualization data on the CAN bus and use the RS-485 interface to transmit visualization data.
- Disable SYNC message (parameter 9100 ⇘ p. 445) and/or TIME message (parameter 9101 ⇘ p. 446) and/or the producer heartbeat time SYNC message (parameter 9120 ⇘ p. 445), if possible.

CAN load share configuration

The following parameters are available for configuring the CAN bus interfaces. Refer to ⇘ *Chapter 4.7.6 "Load Share Parameters" on page 478* for detailed information.

Open menu path *"Parameter ➔ Configuration ➔ Configure interfaces ➔ Configure CAN interfaces ➔ Configure CAN load share"*. Refer to ⇘ *Chapter 4.4.4.3.6 " Load Sharing" on page 252.*

ID	Text	Setting range	Default value
9921	Transfer rate LS fast message	0.10 to 0.30 s	0.10 s
9920	Load Share CAN-ID	2xx Hex / 3xx Hex / 4xx Hex / 5xx Hex	5xx Hex

7.8.2 Load Share via UDP Broadcast Messages (Ethernet)

Load Share UDP

Load share and other system relevant messages are handled with UDP messages. The construction of the UDP messages allows (load share) communication with other Woodward devices.

For configuration of the Ethernet interface see chapters ↬ *Chapter 4.7.5 "Ethernet Interfaces" on page 472* and ↬ *Chapter 7.3 "Ethernet Interfaces" on page 641*.

8 Technical Specifications

8.1 Technical Data

Product label

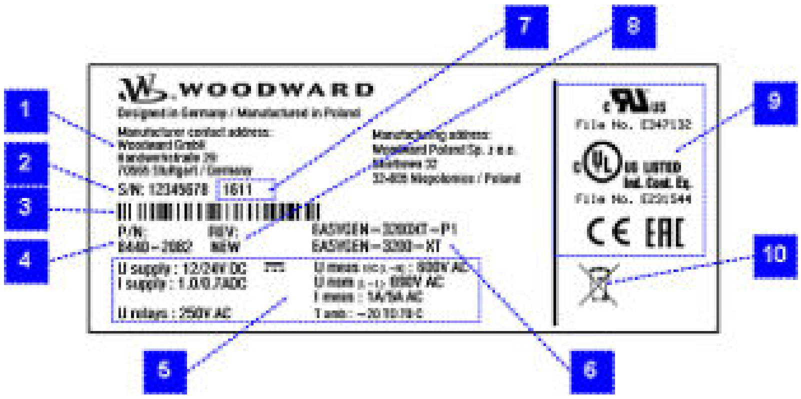


Fig. 338: Product label

Number	Name	Description
1	Address	Manufacturer and manufacturing addresses
2	S/N	Serial number (numerical)
3	S/N	Serial number (barcode)
4	P/N	Item number
5	Type Description	Description (product name)
6	Details	Technical data
7	S/N	Date of production (year-month)
8	REV	Item revision number
9	Approval	Approvals
10	Environment	Separate collection symbol

Battery inside

Fig. 339: Waste Disposal

This device contains a battery, and therefore it is labeled with the symbol shown beside according to the EU Directive 2006/66/EC.

> **WARNING!**
> Batteries can be harmful to the environment. Damaged or unusable batteries must be disposed of in a container specially reserved for this purpose.
>
> In general, appropriate local guidelines and regulations must be followed when disposing of electrical devices and batteries.

8.1.1 Measuring Values

Voltages

Measuring values, voltages	
Measuring voltages ⅄ / △	**398/690 V_{AC}**
: Range rated value ($V_{LLrated}$)	100 V_{AC} up to 690 V_{AC}

: Maximum value (V_{LLmax})	max. 897 V_{AC}
: Rated voltage phase – ground	600 V_{AC}
: Rated surge voltage	6.0 kV
Input resistance per path	2.5 MΩ
Maximum power consumption per path	< 0.15 W
Linear measuring range	1.3 × V_{rated}
Measuring frequency	50/60 Hz (30.0 to 85.0 Hz)

Currents

With External CT

For correct measuring with external CT the input has to be one side grounded by the customer.

Measuring values, currents		Galvanically isolated
Measuring current	Rated value (I_{rated})	../1 A or ../5 A
Linear measuring range	Generator	3.0 × I_{rated}
	Mains/ground current	approx. 1.5 × I_{rated}
Maximum power consumption per path		< 0.10 VA
Rated short-time current (1 s)		50.0 A

Battery Voltage

Measuring values, battery voltage	Galvanically isolated
Input voltage range	8 to 40 V_{DC}

8.1.2 Ambient Variables

CAUTION!

Device Operating Voltage

Connect the unit only to a DC power source that complies with the safety extra-low voltage (SELV) requirements.

Power supply	12/24 V_{DC} (8 to 40.0 V_{DC}), SELV
Intrinsic consumption	max. 27 W
Degree of pollution	2
Maximum elevation	4,000 m ASL
Insulation voltage	100 V_{DC} Marine applications: 40 V_{DC}

Overvoltage (≤ 2 min)	80 V_{DC}
Reverse voltage protection	Over the full supply range
Input capacitance	5,000 µF
Unit Power Supply	Negative potential grounded or positive potential grounded or ungrounded

8.1.3 Inputs/Outputs

Discrete inputs 'DI xx'

Discrete inputs	Galvanically isolated
Input range ($V_{cont.\ dig.\ input}$)	Rated voltage 12/24 V_{DC} (8 to 40.0 V_{DC})
Input resistance	approx. 20 kΩ

Discrete outputs 'R xx' (relay outputs)

Discrete/relay outputs	Potential free Configurable via LogicsManager	Galvanically isolated
Contact material		AgCdO
General purpose (GP) ($V_{cont,\ relays}$)	AC	2.00 A_{AC}@250 V_{AC}
	DC	2.00 A_{DC}@24 V_{DC}
		0.36 A_{DC}@125 V_{DC}
		0.18 A_{DC}@250 V_{DC}

Analog inputs 'AI 01-03' (Type 1: 0/4 to 20 mA | 0 to 2000 Ω | 0 to 1 V)

Analog inputs	FlexIn™	Freely scalable
Maximum permissible voltage against Engine Ground		9 V
Maximum permissible voltage between Engine Ground & PE		100 V
Resolution		16 Bit
0/4 to 20 mA input	Internal load	~50 Ω
0 to 2000 Ω input	Load current	≤ 2.3 mA
0 to 1V input	Input resistance	approx. ~91 kΩ

Analog outputs 'AO 01' "Speed Biasing" (Type 1: ±20 mA | ±10 V | PWM)

Analog output	Freely scalable Pre-configured to "11.03 Speed bias [%]"	Galvanically isolated
Resolution		min. 12 bit
Configurable as	(bipolar)	±20 mA, ±10 V_{DC}
PWM output		±10 V_{DC}, 500 Hz duty cycle

Shunt resistor		max. 500 Ω
Galvanically isolation to PE		min. 100 V_{AC}

Analog outputs 'AO 02' "Voltage Biasing" (Type 1: ±20 mA | ±10 V | PWM)

Analog output	Freely scalable Pre-configured to "11.02 Voltage bias [%]"	Galvanically isolated
Resolution		min. 12 bit
Configurable as	(bipolar)	±20 mA, ±10 V_{DC}
PWM output		±10 V_{DC}, 500 Hz duty cycle
Shunt resistor		max. 500 Ω
Basic isolation to PE		500 V_{RMS}
Reinforced isolation to PE		300 V_{RMS}

Auxiliary excitation (D+) input/ output

Auxiliary excitation (D+) input/output	Galvanically isolated
Output current	approx. 100 mA@12/24 V_{DC}
Voltage monitoring range (input)	8 to 40 V_{DC}

Magnetic pickup input (MPU)

Magnetic pickup input	Capacitively isolated
Input impedance	min. 17 kΩ (decoupled by capacitors)
Voltage range (input)	800 mV_{pp} to 100 V_{pp} Refer to Fig. 340
Proximity Probe Leakage Current	≲100 µA
Response time (max. unloaded engine acceleration)	≲1000 rpm per second
Minimum rated rpm	100 (rpm)

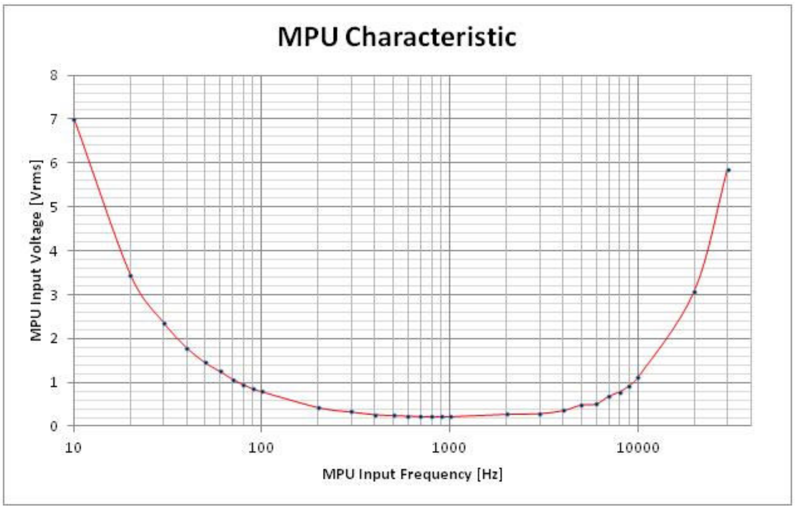


Fig. 340: MPU - characteristic

8.1.4 Interfaces

USB (slave)

USB 2.0 interface	Galvanically isolated
Type	USB 2.0 standard; slave (Type B)
Data rate	max. 12 Mbit/s
Insulation	Galvanically isolated
Bus Voltage	5 V
Current consumption	approx. 10 mA

RS-485 interface

RS-485 interface	Galvanically isolated
Insulation voltage (continuously)	100 V_{AC}
Insulation test voltage (1 s)	1700 V_{DC}
Version	RS-485 Standard

CAN bus interface

CAN bus interface	Galvanically isolated
Insulation voltage (continuously)	100 V_{AC}
Insulation test voltage (1 s)	1700 V_{DC}
Version	CAN bus
Internal line termination	Not available

Ethernet interface

Ethernet bus interface	Galvanically isolated Only one MAC ID is required
Insulation voltage (continuously)	100 V_{AC}
Insulation test voltage (1 s)	1700 V_{DC}
Version	Ethernet 10/100Base-T/TX
Ethernet plug socket	RJ45 standard, shielded 2 LEDs to indicate communication.
Ethernet cable	CAT 5 or 5e (class D) Shielding: F/UTP according to ISO/IEC 11801 (foil overall shielding, pairs unshielded)
Green LED	Indicates link activity (blinking during data transmission)
Yellow LED	Indicates link status (regarding speed): 10 Mb/s: LED switched-off 100 Mb/s: LED switched-on
Internal shield termination	Available

8.1.5 Real Time Clock Battery

Type	Lithium
Life span (operation without power supply)	approx. 5 years
Battery field replacement	Not allowed. Please contact your Woodward service partner.

8.1.6 Display (plastic housing variant, only)

Type	LCD display
Size	Diagonal: 5,7’’ (144.8 mm)
Resolution	320 x 240 pixel
Picture quality	up to 8 bad dots allowed
Backlight luminance	550 cd/m^2 (max)
Temperature threshold (Heater ON/OFF)	-20 °C ambient (for "...-LT" variants, only)

8.1.7 Housing

Housing type

Type	**Plastic**	**Sheet metal**
	easYpack	Custom
Dimensions (W × H × D)	282 × 216 × 96.3 mm	250 × 227 × 50 mm
Front cutout (W × H)	249 [+1.1] × 183 [+1.0] mm	-/-
Weight	approx. 1,850 g	approx. 1,750 g
Wiring	Screw-plug-terminals 2.5 mm²	
Recommended locked torque	4 inch pounds / 0.5 Nm. Use 90 °C copper wire or better. Use class 1 wire only or equivalent.	

Protection

Protection system	Plastic	IP54 in the front with clamp fasteners
		IP66 in the front with screw kit
		IP20 on the rear side
	Sheet metal	IP20
Front foil (plastic housing)		Insulating surface

8.1.8 Approvals

EMC test (CE)	Tested according to applicable EMC standards. Refer to ➪ *Chapter 8.2 "Environmental Data" on page 667* for details	
Listings	CE marking UL, Ordinary Locations, File No.: E231544 UL recognized component, category FTPM2/8, File No.: E347132 cUL CSA EAC BDEW (Dynamic mains stabilization) VDE-AR-N 4105 (Mains decoupling and single failure proof feature)	
Marine	Type approval	Lloyds Register (LR)
	Type approval	American Bureau of Shipping (ABS)

8.2 Environmental Data

Vibration

Frequency range - sine sweep	5 Hz to 100 Hz
Acceleration	4 G
Standards	IEC 60068-2-6, Fc
	Lloyd's Register, Vibration Test2
	SAEJ1455 Chassis Data
Frequency range - random	10 Hz to 2000 Hz
Power intensity	0.04 G²/Hz
RMS value	8.2 Grms
Standards	MIL-STD 202F, M214A, SAE J1455

Shock

Shock	40 G, Saw tooth pulse, 11 ms
Standards	MIL-STD 810F, M516.5, Procedure 1

Temperature

Housing type			*"...-LT"* version, only
Plastic	Cold, Dry Heat (storage)	-30 °C (-22 °F) / 80 °C (176 °F)	-30 °C (-22 °F) / 80 °C (176 °F)
	Cold, Dry Heat (operating)	-20 °C (-4 °F) / 70 °C (158 °F)	-40 °C (-40 °F) / 70 °C (158 °F)
Sheet metal	Cold, Dry Heat (storage)	-40 °C (-40 °F) / 80 °C (176 °F)	
	Cold, Dry Heat (operating)	-40 °C (-40 °F) / 70 °C (158 °F)	
Standards	IEC 60068-2-2, Test Bb and Bd		
	IEC 60068-2-1, Test Ab and Ad		

Released

Humidity

Humidity	60 °C, 95% RH, 5 days
Standards	IEC 60068-2-30, Test Db

Marine environmental categories

Marine environmental categories	Lloyd’s Register of Shipping (LRS): ENV1, ENV2, ENV3 and ENV4

Electromagnetic Compatibility

EN 61000-6-2	2005 - Electromagnetic compatibility (EMC). Generic standards. Immunity for industrial environment
EN 61000-6-4	2007 + A1: 2011 - Electromagnetic compatibility (EMC). Generic standards. Emission standard for industrial environments
EN 61326-1	2013 - Electrical equipment for measurement, control and laboratory use. EMC requirements. General requirements (according to industrial electromagnetic environment)

8.3 Accuracy

The accuracy declaration is defined by the according measurement ranges. The rated maximum of the single ranges are taken as 100%.

This results in the definitions:

- Range 1: 69/120 V rated = 100%
- Range 2: 277/480 V rated = 100%
- Range 3: 400/690 V rated = 100%

Measuring value	Display	Accuracy	Measuring start	Notes
Frequency				
Generator	15.0 to 85.0 Hz	0.1% (of 85 Hz)	5% (of PT secondary voltage setting)[1]	
Mains	30.0 to 85.0 Hz			
Voltage				
Wye generator / mains / busbar	0 to 650 kV	0.5% , Class 0.5 [2] related to: 69/277/400 V (Wye) 120/480/690 V (Delta)	1.5% (of PT secondary voltage setting)[1]	
Delta generator / mains / busbar			2% (of PT secondary voltage setting)[1]	
Power supply/Battery	0 to 40 V_{DC}	±0.5% related to 40 V	Related on the measurement range 8 to 40 V	0.5% equals 0.2 V (±0.2 V)
Current				
Generator	0 to 32,000 A	0.5% (of 1/5 A)[3] Class 0.5	1% (of 1.3/6.5 A)[3]	
Max. value				
Mains/ground current				
Real power				

Measuring value	Display	Accuracy	Measuring start	Notes
Actual total real power value	-2 to 2 GW	1% (of 69/277/400 V x 1/5 A)[2/3]	Measuring starts with detecting the zero passage of current/voltage	
Reactive power				
Actual value in L1, L2, L3	-2 to 2 Gvar	1% (of 69/277/400 V x 1/5 A)[2/3]	Measuring starts with detecting the zero passage of current/voltage	
Power factor				
Actual value power factor L1	lagging 0.000 to 1.000 to leading 0.000	1%	1% (of 1.3/6.5 A)[3]	1.000 is displayed for measuring values below the measuring start
Miscellaneous				
Real energy	0 to 4,200 GWh		0.36% (of 1.3/6.5 A)[3]	Not calibrated
Operating hours	Max. 1 × 10^6 h			
Maintenance call hours	0 to 9,999 h			
Maintenance call days	0 to 999 d			
(Engine) Start counter	0 to 65,535			
Battery voltage	8 to 40 V	±0.5% (of measurement range 0 to 40 V_{DC})		
Auxiliary excitation (D+) input/output		1%		
Pickup speed	f_{rated} +/- 40%	0,1% of f_{rated} +/- 1 rpm		
Phase angle	-180 to 180°	± 1 degree	1.25% (of PT secondary volt. setting)	180° is displayed for measuring values below measuring start
Analog Inputs				
0 to 20 mA	Freely scalable	±0.5% related to 20 mA		2 wire input. 0.5% equals 0.1 mA ⇒ ± 0.1 mA)
0 to 2000 Ω	Freely scalable	±0.5% related to 2000 Ω		1 wire input (related to engine ground)[4]
0 to 1 V	Freely scalable	±0.5% related to 1 V		2 wire input. 0.5% equals 0.005 V⇒ ± 0.005 V)
Analog Outputs				
Type 1: ±20 mA | ±10 V | PWM	Freely scalable	≤1%		

[1] Setting of the parameter for the PT secondary rated voltage

[2] Depending on the used measuring range (120/480/690 V)

[3] Depending on the CT input definition (1/5 A) by customer settings. easYgen-XT hardware covers both 1 A and 5 A ranges.

[4] Some senders, like the VDO senders, are operating in the working range 0 to 200 Ohms. For sure, the 0.5% accuracy cannot be directly assigned to these senders. Therefore the accuracy percentage tolerance will be expanded accordingly. On the other hand, measurements have shown that under usual circumstances (at 20°C, no EMC surge or burst present) an accuracy of 1% for such senders can be kept.

Reference conditions

The reference conditions for measuring the accuracy are listed below.

Input voltage	Sinusoidal rated voltage
Input current	Sinusoidal rated current
Frequency	Rated frequency
Power supply	Rated voltage ± 2%
Power factor (cos φ)	1.000
Ambient temperature	23 °C ± 2 K
Warm-up period	20 minutes

8.4 Protection (ANSI)

"ANSI Code" related Protection Functions

Protection		related ANSI #
Generator:	Voltage / frequency	59 / 27 / 81O / 81U
	Overload, reverse/reduced power	32 / 32R / 32F
	Unbalanced load	46
	Synch Check	25
	Instantaneous overcurrent	50
	Time-overcurrent (IEC 255 compliant)	51 / 51 V
	Ground fault (measured ground current)	50G
	Power factor	55
	Rotation field	

Protection		related ANSI #
Engine:	Overspeed / underspeed	12 / 14
	Speed / frequency mismatch	
	D+ auxiliary excitation failure	
	Cylinder temperature	
Mains:	Voltage / frequency	59 / 27 / 81O / 81U /25
	Phase shift / rotation field / ROCOF (df/dt)	78
Busbar	Voltage	
	Frequency	

9 Appendix

9.1 Characteristics

9.1.1 Triggering Characteristics

Time-dependent overshoot monitoring

This triggering characteristic is used for time-dependent overcurrent monitoring.

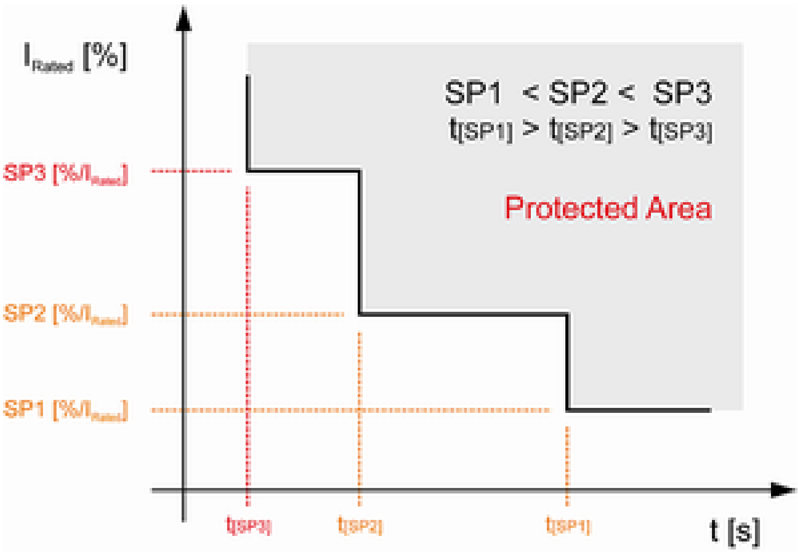


Fig. 341: Three-level time-dependent overshoot monitoring

Two-level overshoot monitoring

This triggering characteristic is used for generator, mains and battery overvoltage, generator and mains overfrequency, overload IOP and MOP and engine overspeed monitoring.

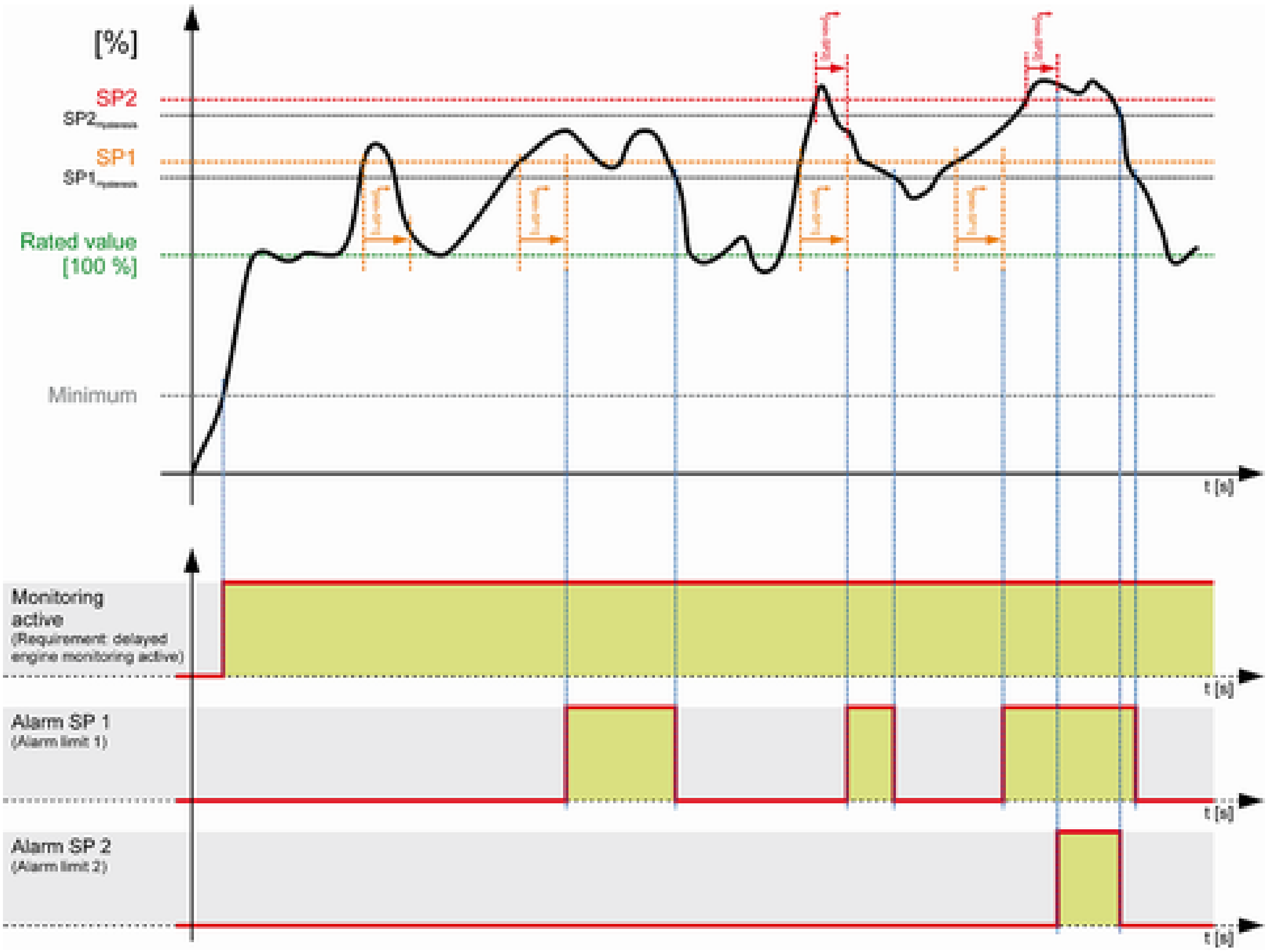


Fig. 342: Two-level overshoot monitoring

Two-level undershoot monitoring

This triggering characteristic is used for generator, mains and battery undervoltage, generator and mains underfrequency, and engine underspeed monitoring.

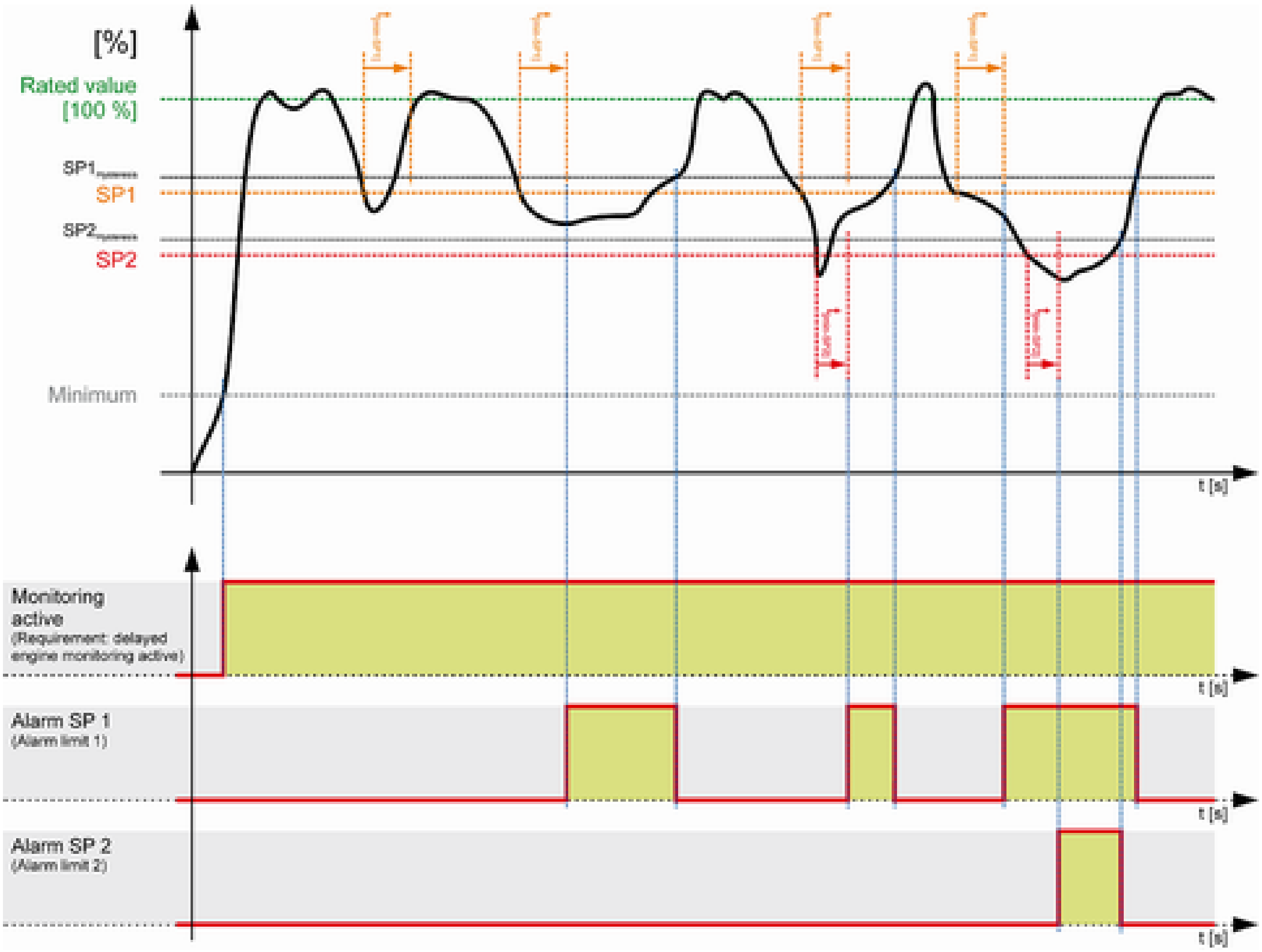


Fig. 343: Two-level undershoot monitoring

Two-level reversed/reduced load monitoring

This triggering characteristic is used for generator reversed/ reduced load monitoring.

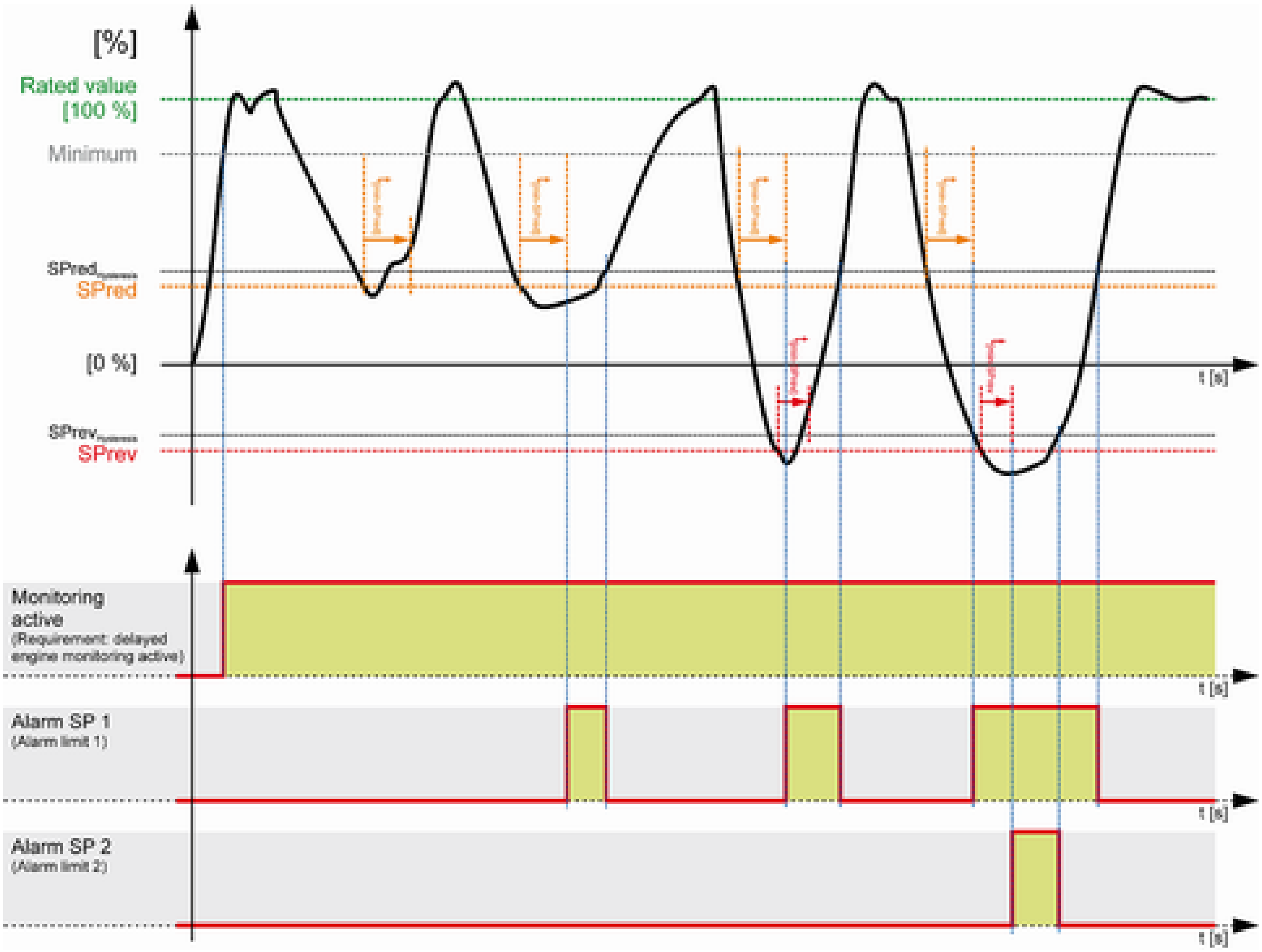


Fig. 344: Two-level reversed/reduced load monitoring

Two-level unbalanced load monitoring

This triggering characteristic is used for generator unbalanced load monitoring.

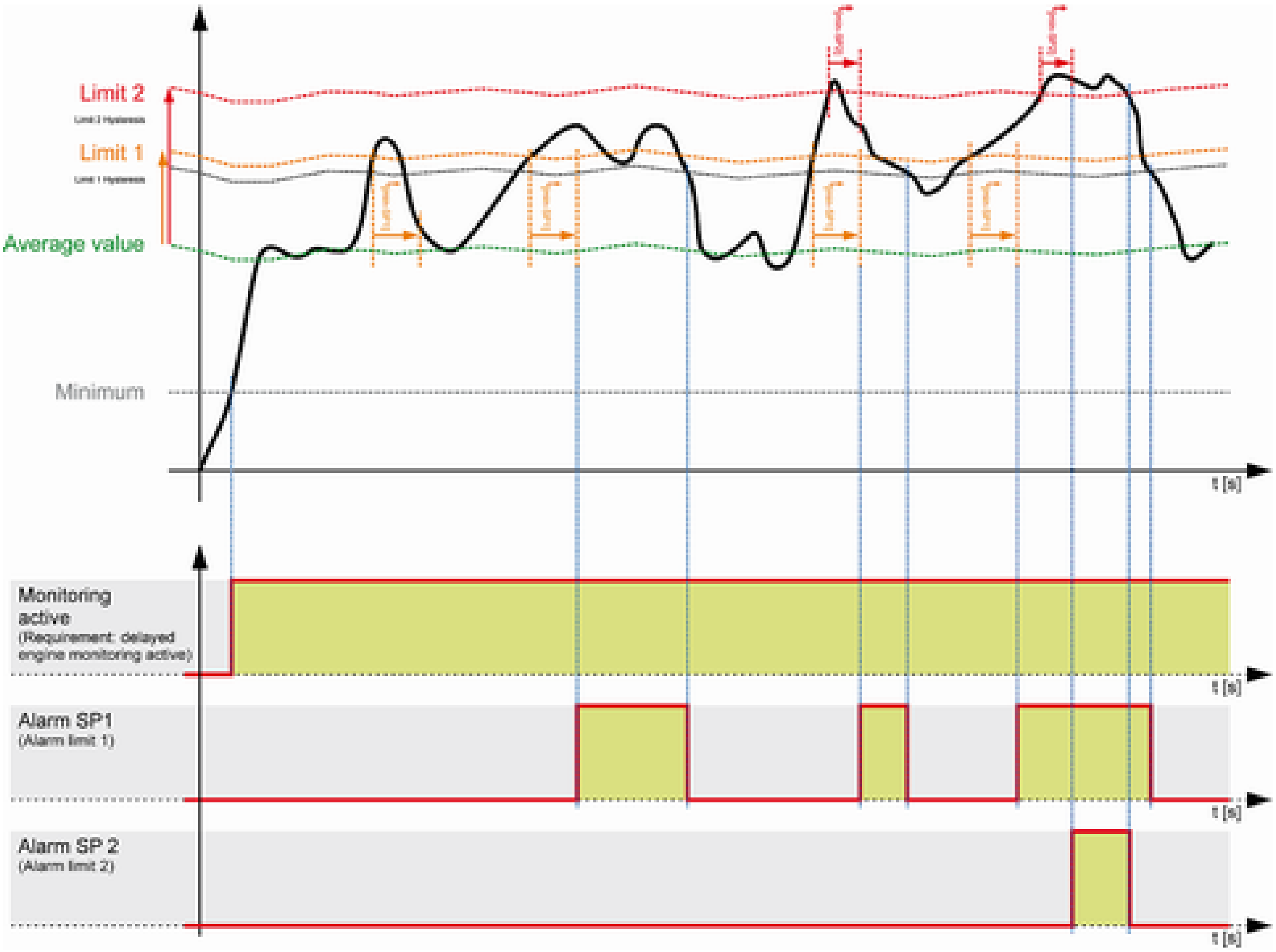


Fig. 345: Two-level unbalanced load monitoring

One-level asymmetry monitoring

This triggering characteristic is used for generator voltage asymmetry monitoring.

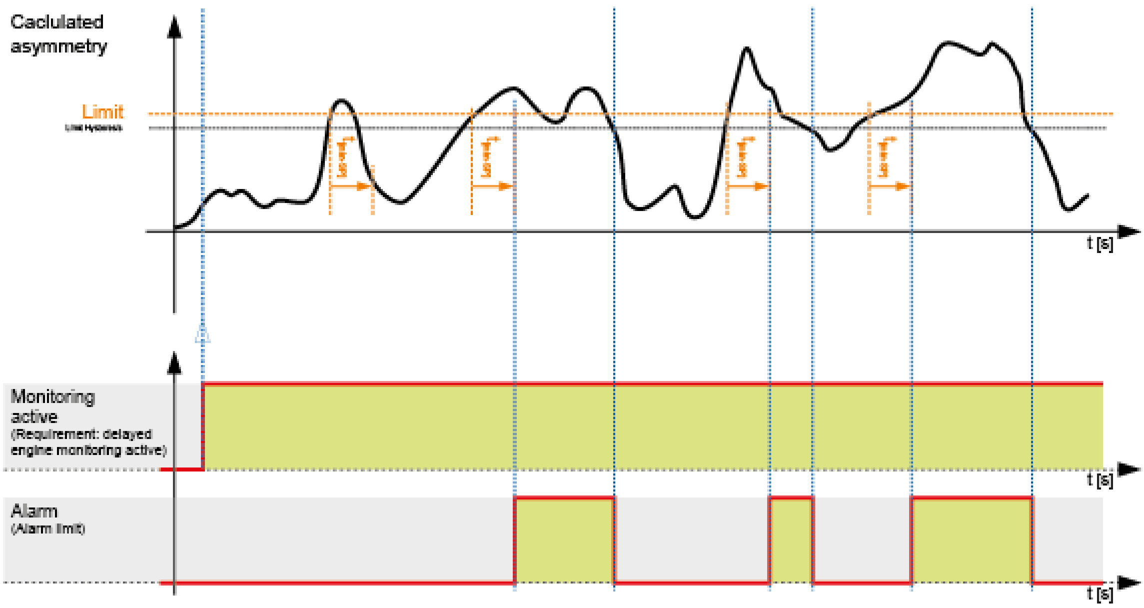


Fig. 346: One-level asymmetry monitoring

9.1.2 VDO Inputs Characteristics

Since VDO sensors are available in different types, the index numbers of the characteristic curve tables are listed.

Always order VDO sensors with the correct characteristic curve. Manufacturers of VDO sensors usually list these tables in their catalogs.

9.1.2.1 VDO Input "Pressure"

0 to 5 bar/0 to 72 psi - Index "III"

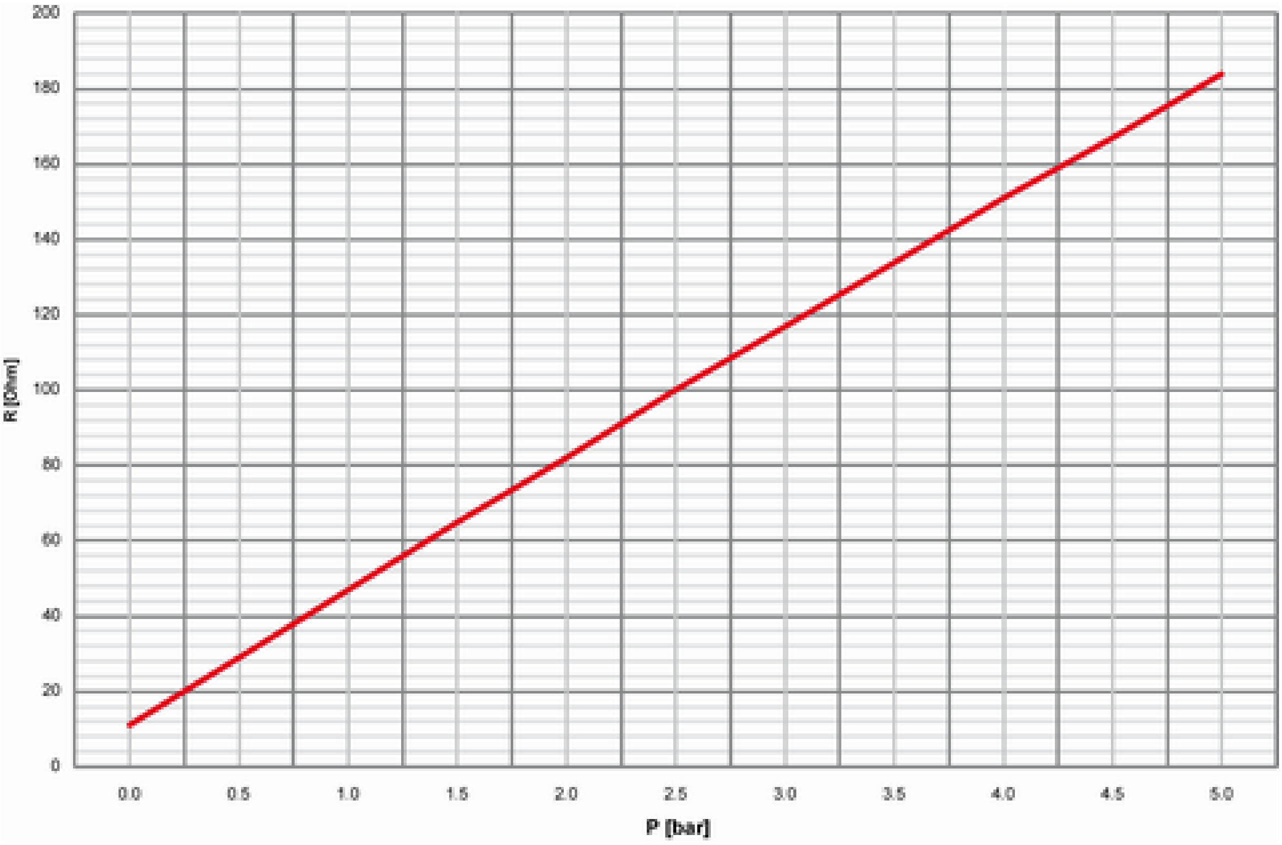


Fig. 347: Characteristics diagram VDO 0 to 5 bar, Index "III"

P [bar]	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
P [psi]	0	7.25	14.50	21.76	29.00	36.26	43.51	50.76	58.02	65.27	72.52
R [Ohm]	11	29	47	65	82	100	117	134	151	167	184

0 to 10 bar/0 to 145 psi - Index "IV"

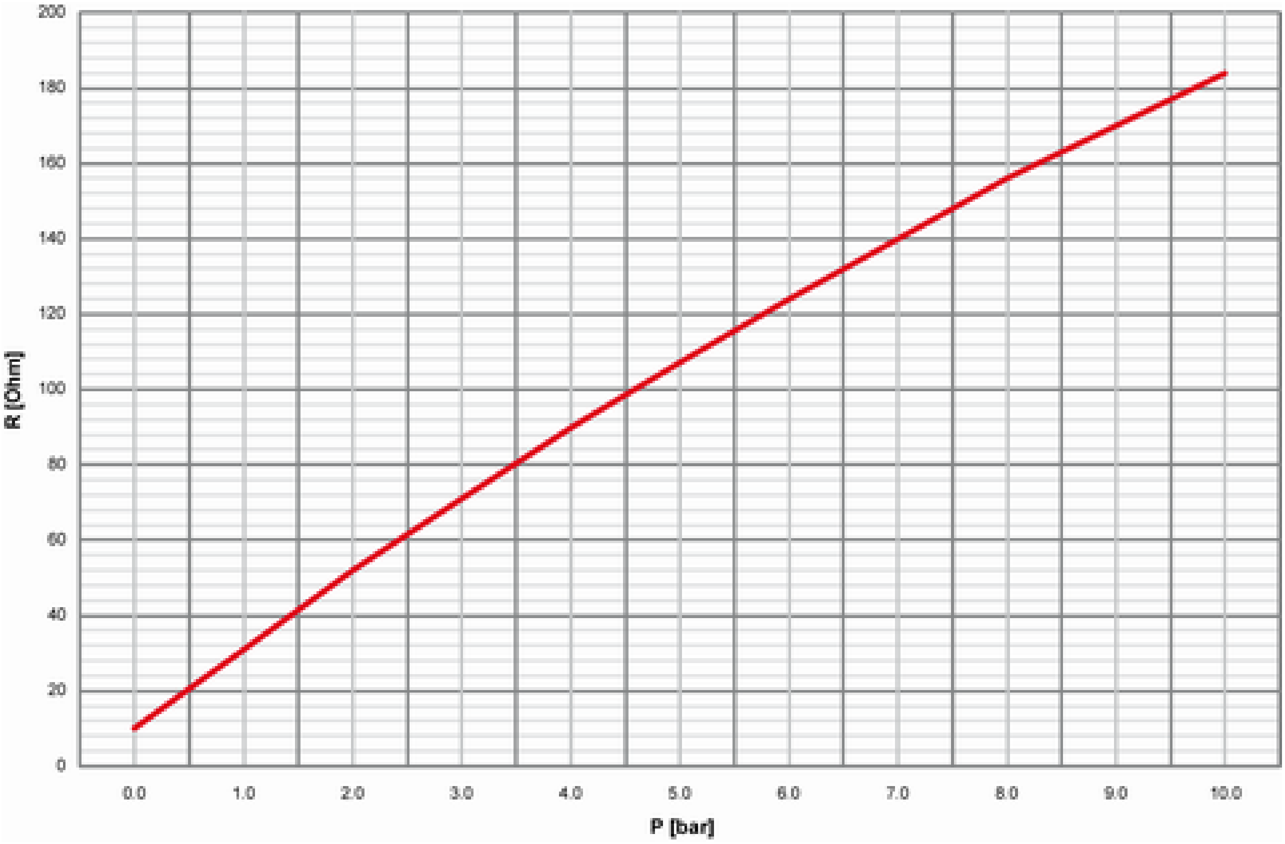


Fig. 348: Characteristics diagram VDO 0 to 10 bar, Index "IV"

P [bar]	0	0.5	1	1.5	2	3	4	5	6	7	8	8.5	9	10
P [psi]	0	7.25	14.50	21.76	29.00	43.51	58.02	72.52	87.02	101.53	116.03	123.28	130.53	145.04
R [Ohm]	10	21	31	42	52	71	90	107	124	140	156	163	170	184

9.1.2.2 VDO Input "Temperature"

40 to 120 °C/104 to 248 °F - Index "92-027-004"

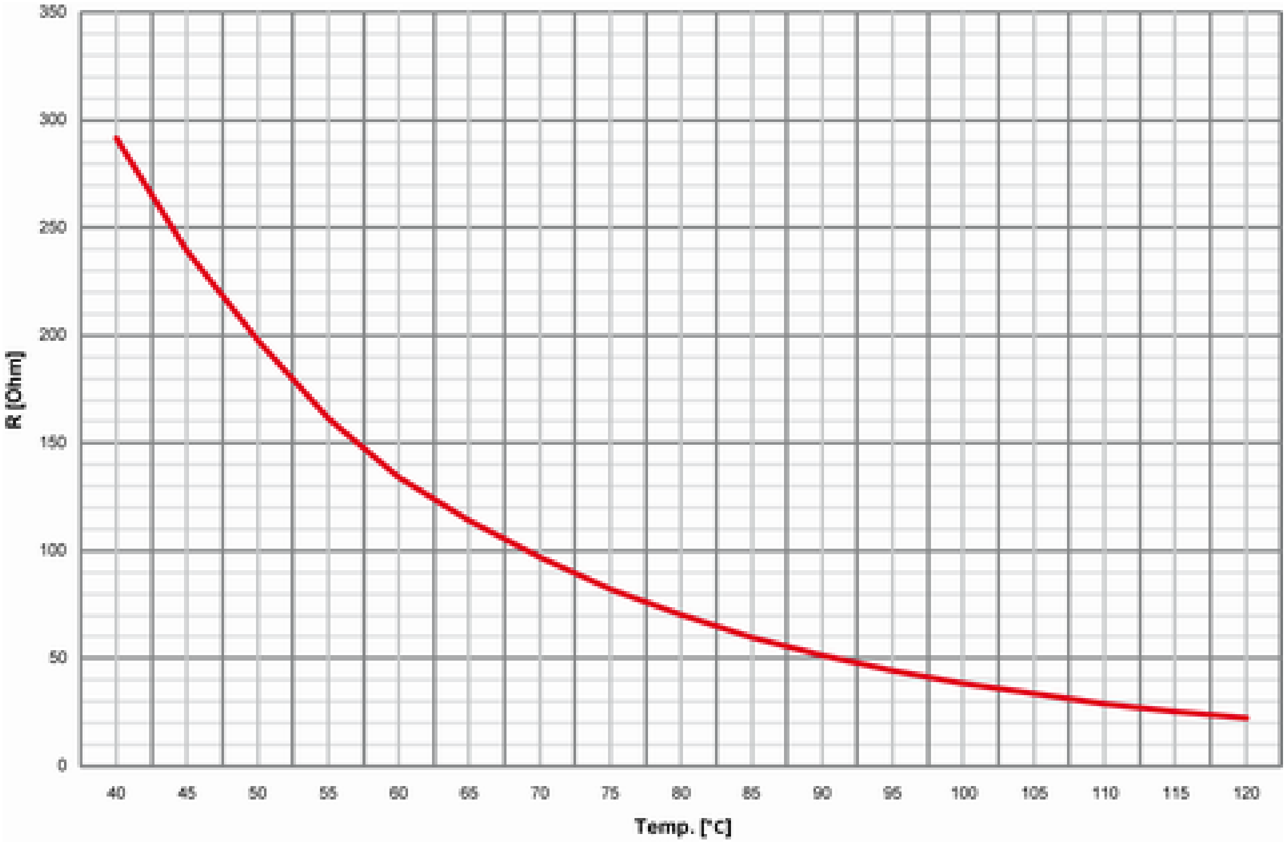


Fig. 349: Characteristics diagram VDO 40 to 120 °C - detail, Index "92-027-004"

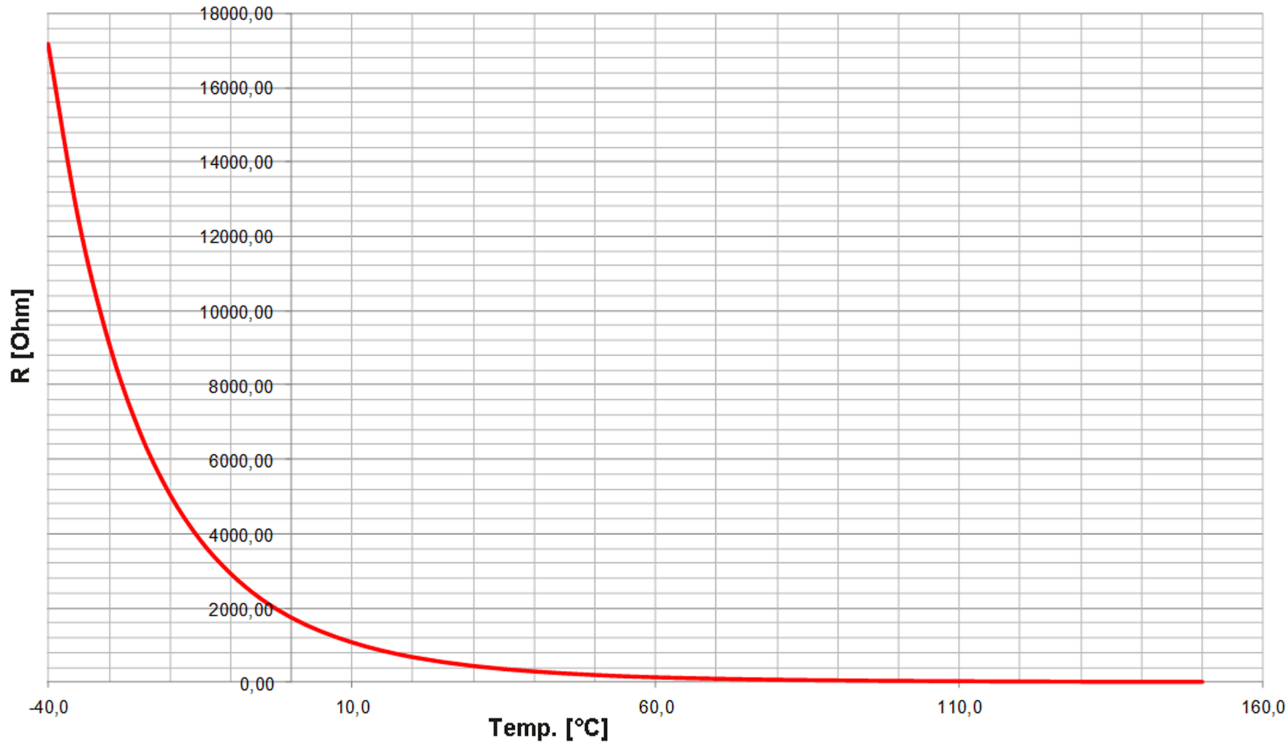


Fig. 350: Characteristics diagram VDO -40 to 120 °C - full range, Index "92-027-004"

Temp. [°C]	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
Temp. [°F]	-40	-31	-22	-13	-4	5	14	23	32	41	50
R [Ohm]	17162.4	12439.5	9134.5	6764.5	5067.6	3833.9	2929.9	2249.4	1743.1	1364.0	1075.6
... continued with further points:											
Temp. [°C]	15	20	25	30	35	40	45	50	55	60	65
Temp. [°F]	59	68	77	86	95	104	113	122	131	140	149
R [Ohm]	850.1	677.0	543.5	439.3	356.6	291.5	239.6	197.3	161.5	134.0	114.0
... continued with further points:											
Temp. [°C]	70	75	80	85	90	95	100	105	110	115	120
Temp. [°F]	158	167	176	185	194	203	212	221	230	239	248
R [Ohm]	97.1	82.4	70.1	59.7	51.2	44.3	38.5	33.4	29.1	25.5	22.4
... and finally continued with further points:											
Temp. [°C]	125	130	135	140	145	150					
Temp. [°F]	257	266	275	284	293	302					
R [Ohm]	19.75	17.44	15.46	13.75	12.26	10.96					

50 to 150 °C/122 to 302 °F - Index "92-027-006"

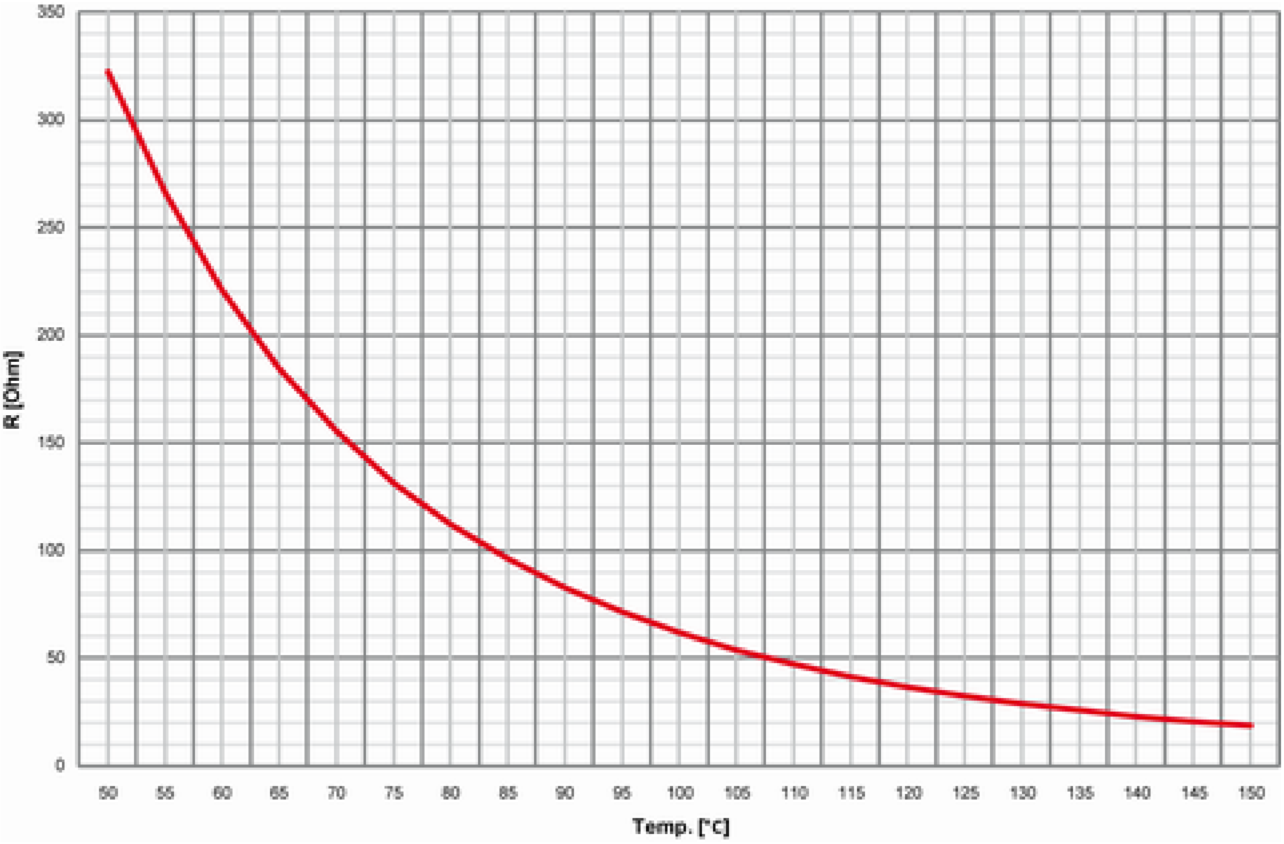


Fig. 351: Characteristics diagram VDO 50 to 150 °C - detail, Index "92-027-006"

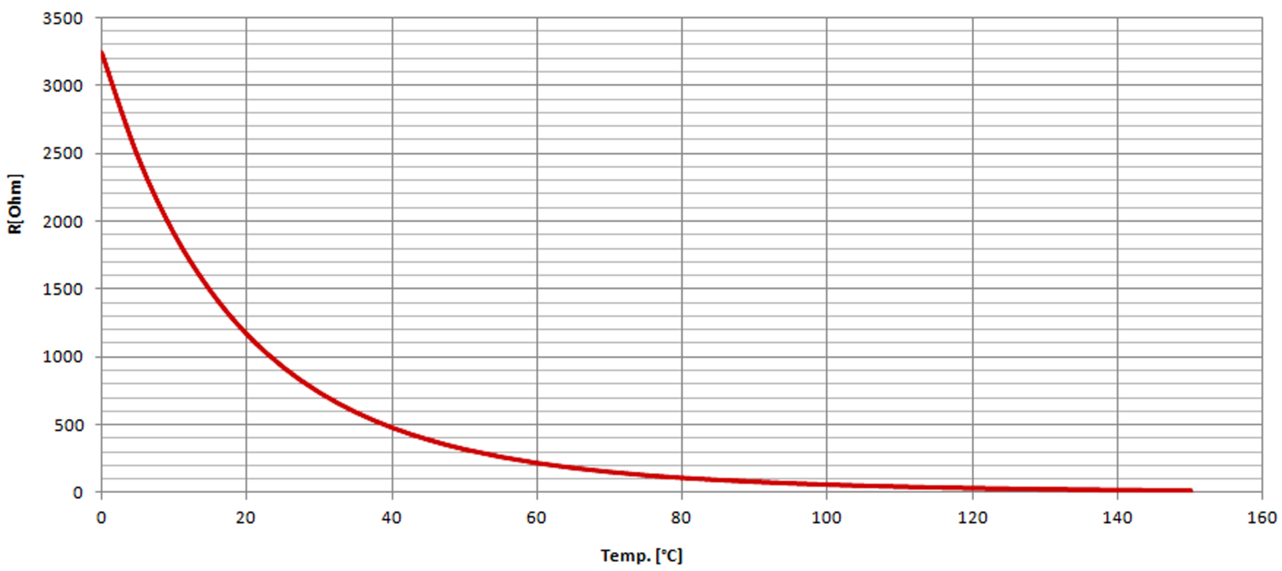


Fig. 352: Characteristics diagram VDO 0 to 120 °C - full range, Index "92-027-006"

Temp. [°C]	0	5	10	15	20	25	30	35	40	45	50
Temp. [°F]	32	41	50	59	68	77	86	95	104	113	122
R [Ohm]	3240.18	2743.6	1905.87	1486.65	1168.64	926.71	739.98	594,9	481,53	392.57	322.17

Temp. [°C]	55	60	65	70	75	80	85	90	95	100	105
Temp. [°F]	131	140	149	158	167	176	185	194	203	212	221
R [Ohm]	266.19	221.17	184.72	155.29	131.38	112.08	96.40	82.96	71.44	61.92	54.01

Temp. [°C]	110	115	120	125	130	135	140	145	150	
Temp. [°F]	230	239	248	257	266	275	284	293	302	
R [Ohm]	47.24	41.42	36.51	32.38	28.81	25.70	23.00	20.66	18.59	

9.1.2.3 Pt100 RTD

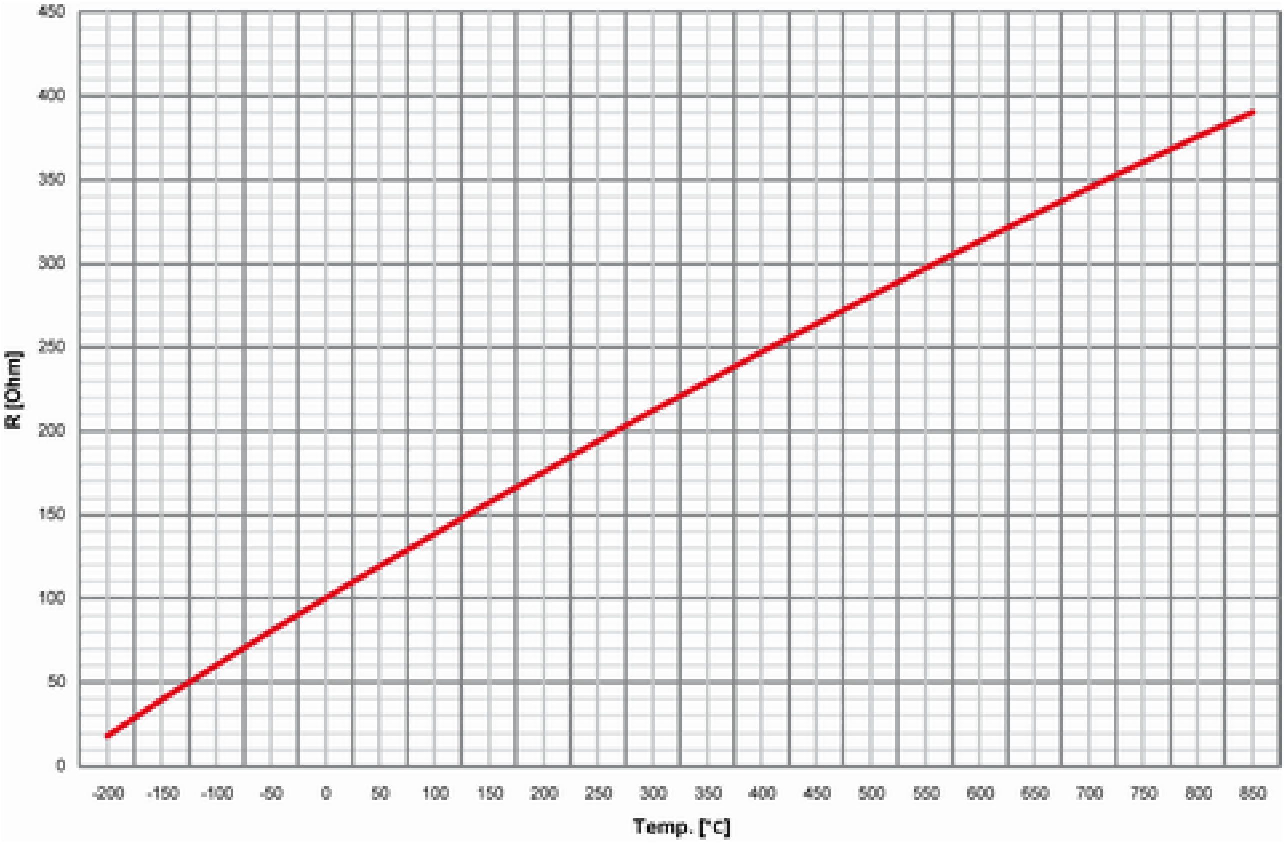


Fig. 353: Characteristics diagram Pt100

Temp. [°C]	-200	-150	-100	-50	0	10	20	30	40	50	60
Temp. [°F]	-328	-238	-148	-58	32	50	68	86	104	122	140
R [Ohm]	18.5	39.7	60.25	80.7	100	103.9	107.8	111.7	115.5	119.4	123.2

Temp. [°C]	70	80	90	100	125	150	175	200	225	250	300
Temp. [°F]	158	176	194	212	257	302	347	392	437	482	572
R [Ohm]	127.1	130.9	134.7	138.5	147.9	157.3	166.6	175.8	188.6	194.1	212.0

Temp. [°C]	350	400	450	500	550	600	650	700	750	800	850
Temp. [°F]	662	752	842	932	1022	1112	1202	1292	1382	1472	1562
R [Ohm]	229.7	247.0	264.1	280.9	297.4	313.6	329.5	345.1	360.5	375.5	390.25

9.1.2.4 Pt1000 RTD

The characteristic of the Pt1000 temperature sender accords the characteristic diagram Pt100 at which the R value is to multiply with 10. Refer to *Chapter 9.1.2.3 "Pt100 RTD" on page 684* for details.

9.1.2.5 NTC-Sender "AB_94099" (AB-Elektronik Sachsen GmbH)

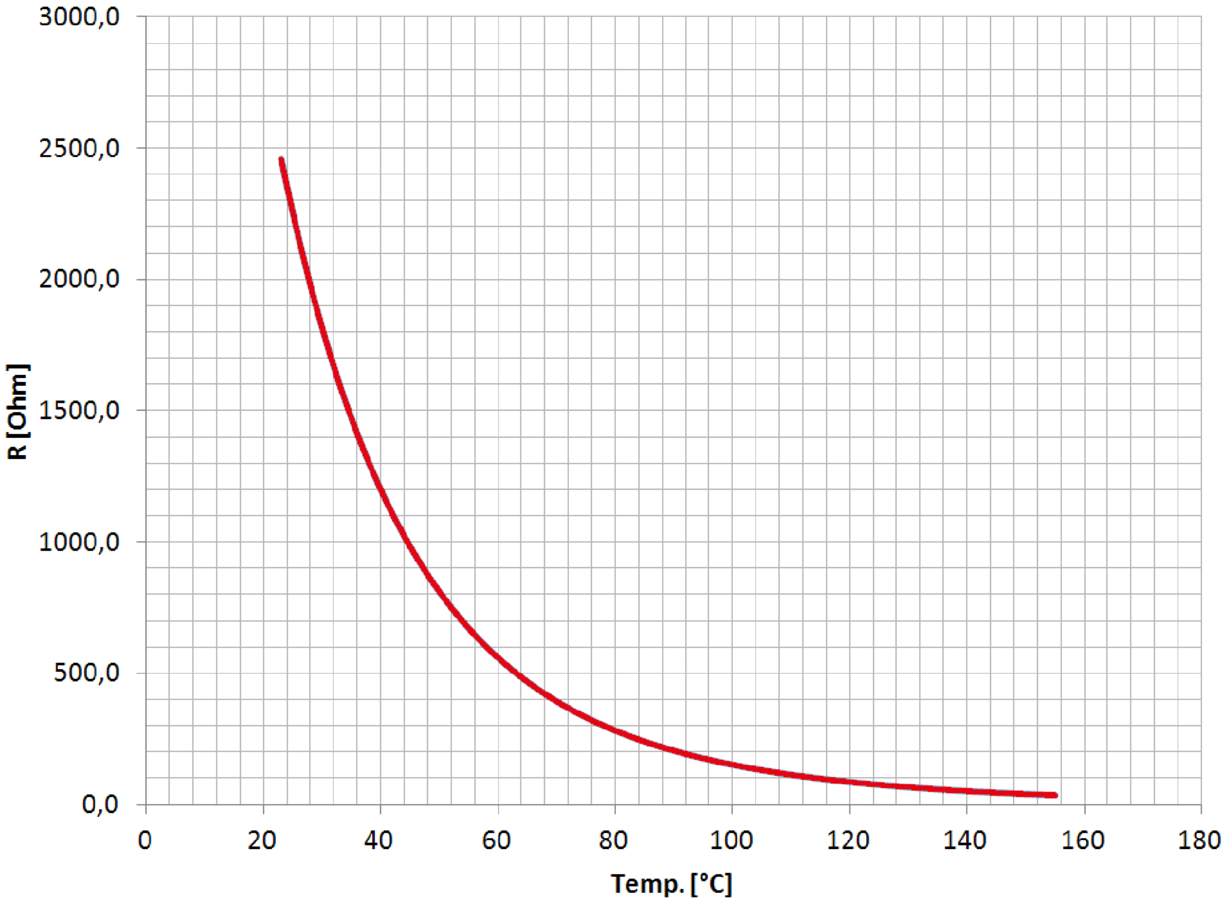


Fig. 354: Characteristic diagram "AB_94099"

9.2 Data Protocols

General note

The following data protocols / data telegrams are describing the currently defined full set of data for each protocol. Please ignore data your device does not support.

The following data protocols are implemented to be used

CANopen/Modbus

- 5003: Basic Visualization
  supported for easYgen-3000 series compatibility
- 5014: Basic Visualization (based on 5003)

CANopen

- 5004: Generator Values Visualization
  supported for easYgen-3000 series compatibility
- 5005: Mains Values Visualization
  supported for easYgen-3000 series compatibility
- 5011: Alarm Values Visualization
  supported for easYgen-3000 series compatibility
- 5018: Special data 1
- 5019: Special data 2
- 5020: Special data 3
- 5021: Special data 4
- 6000: Load Share Message
- 6003: LS-5 Communication
- 65000: External Discrete I/O 1 to 8
- 65001: External Discrete I/O 9 to 16
- 65002: External Discrete I/O 17 to 24
- 65003: External Discrete I/O 25 to 32

Modbus

- 5010: Basic Visualization
  supported for easYgen-3000 series compatibility
- 5016: Basic Visualization (based on 5010)

Protocol tables

Please find the data protocol tables additionally as

- *separate MS Excel files at*
  - *the CD-ROM*
  - *Woodward web site (search for "Reference: Data Protocols")*

9.2.1 Protocol 5003 (Basic Visualization)

Value size meets Modbus address

Row "Data byte" in the table below lists the CAN bus data bytes but is an indicator for the number of Bytes of the current address, too. Each number stands for one Byte.

The Modbus standard address space is two Bytes.

- *A 16-bit value (word) fits directly: See "Start addr." 450003 > 45004.*
- *Some data types need four Bytes (32-bit value, double word). The next available Modbus address then is the next but one: See "Start addr." 450004 > 450006.*

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Valid for:
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
450001	450000	0	1,2		Protocol-ID, always 5003		–	EG3000
450002	450001		3,4	10100	Pickup speed	1	rpm	EG3000
450003	450002	0	5,6	-	Control mode (STOP/AUTO/MANUALLY/(XT only:) TEST)	Mask:000Fh	(enum.)	EG3000/3000XT
450004	450003	1	1,2	160	Gen. powerfactor	0.001		EG3000
450005	450004		3,4,5,6	170	Av. Gen. Wye-Voltage	0.1	V	EG3000
450007	450006	2	1,2	144	Gen. frequency	0.01	Hz	EG3000
450008	450007		3,4,5,6	171	Av. Gen. Delta-Voltage	0.1	V	EG3000
450010	450009	3	1,2	147	Mains frequency	0.01	Hz	EG3000
450011	450010		3,4,5,6	173	Av. Mains Wye-Voltage	0.1	V	EG3000
450013	450012	4	1,2	208	Mains power factor	0.001		EG3000
450014	450013		3,4,5,6	174	Av. Mains Delta-Voltage	0.1	V	EG3000
450016	450015	5	1,2	209	Busbar 1: Frequency	0.01	Hz	EG3000
450017	450016		3,4,5,6	216	Av. Busbar 1 Delta-Voltage	0.1	V	EG3000
450019	450018	6	1,2		internal			
450020	450019		3,4		internal			
450021	450020		5,6		internal			
450022	450021	7	1,2	10110	Battery voltage	0.1	V	EG3000

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Valid for:
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
450023	450022		3,4,5, 6	207	Av. Mains Current	0.001	A	EG3000
450025	450024	8	1,2	10111	Analog input 1	changeable		EG3000
450026	450025		3,4,5, 6	185	Av. Gen. Current	0.001	A	EG3000
450028	450027	9	1,2	10112	Analog input 2	changeable		EG3000
450029	450028		3,4,5, 6	161	Meas. ground current	0.001	A	EG3000
450031	450030	10	1,2	10115	Analog input 3	changeable		EG3000
450032	450031		3,4,5, 6	159	Calculated ground current	0.001	A	EG3000
450034	450033	11	1,2	10117	Analog input 4	changeable		EG3500-P2
450035	450034		3,4,5, 6	111	Gen. current 1	0.001	A	EG3000
450037	450036	12	1,2	10151	Analog input 5	changeable		EG3500-P2
450038	450037		3,4,5, 6	112	Gen. current 2	0.001	A	EG3000
450040	450039	13	1,2	10152	Analog input 6	changeable		EG3500-P2
450041	450040		3,4,5, 6	113	Gen. current 3	0.001	A	EG3000
450043	450042	14	1,2	10153	Analog input 7	changeable		EG3500-P2
450044	450043		3,4,5, 6	134	Mains current L1	0.001	A	EG3000
450046	450045	15	1,2	10154	Analog input 8	changeable		EG3500-P2
450047	450046		3,4		internal			
450048	450047		5,6		internal			
450049	450048	16	1,2	10155	Analog input 9	changeable		EG3500-P2
450050	450049		3,4		internal			
450051	450050		5,6		internal			
450052	450051	17	1,2	10156	Analog input 10	changeable		EG3500-P2
450053	450052		3,4,5, 6	135	Total gen. power	1	W	EG3000
450055	450054	18	1,2		internal			
450056	450055		3,4,5, 6	140	Total mains power	1	W	EG3000
450058	450057	19	1,2		internal			
450059	450058		3,4,5, 6	136	Total gen. reactive power	1	var	EG3000
450061	450060	20	1,2	10159	AI Auxiliary excitation D+	0.1	V	EG3000

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Valid for:
Modicon start addr.	**Start addr. (*1)**	**Data byte 0 (Mux)**	**Data byte**					
450062	450061		3,4,5,6	150	Total mains reactive power	1	var	EG3000
450064	450063	21	1,2	10133	Overspeed 1 latched	Mask: 8000h	Bit	EG3000
					Overspeed 2 latched	Mask: 4000h	Bit	EG3000
					Underspeed 1 latched	Mask: 2000h	Bit	EG3000
					Underspeed 2 latched	Mask: 1000h	Bit	EG3000
					Unintended stop latched	Mask: 0800h	Bit	EG3000
					Speed det. alarm latched	Mask: 0400h	Bit	EG3000
					Shutdwn malfunct. latched	Mask: 0200h	Bit	EG3000
					GCB fail to close latched	Mask: 0100h	Bit	EG3000
					GCB fail to open latched	Mask: 0080h	Bit	EG3000
					MCB fail to close latched	Mask: 0040h	Bit	EG3000
					MCB fail to open latched	Mask: 0020h	Bit	EG3000
					CAN-Fault J1939 latched	Mask: 0010h	Bit	EG3000
					Start fail latched	Mask: 0008h	Bit	EG3000
					Mainten. days exceeded latched	Mask: 0004h	Bit	EG3000
					Mainten. hours exceeded latched	Mask: 0002h	Bit	EG3000
					CANopen error at CAN Interface 1	Mask: 0001h	Bit	EG3000
450065	450064		3,4,5,6	182	Busbar 1: voltage L1-L2	0.1	V	EG3000
450067	450066	22	1,2	10149	GCB syn. timeout latched	Mask: 8000h	Bit	EG3000
					MCB syn. timeout latched	Mask: 4000h	Bit	EG3000
					GGB Timeout latched	Mask: 2000h	Bit	reserved
					Charge alt. low voltage (D+) latched	Mask: 1000h	Bit	EG3000
					Idle mode OR Ramp to rated active (suppresses undervolt., underfrequ., ...)	Mask: 0800h	Bit	EG3000 not EG3000XT
					no data receive at RPDO3 at CAN Interface 1	Mask: 0400h		EG3000
					no data receive at RPDO2 at CAN Interface 1	Mask: 0200h		EG3000

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Valid for:
Mod-icon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
					no data receive at RPDO1 at CAN Interface 1	Mask: 0100h		EG3000
					no data receive at RPDO2 (function 1) at CAN Interface 2	Mask: 0080h		EG3000
					no data receive at RPDO1 (function 1) at CAN Interface 2	Mask: 0040h		EG3000
					CANopen error at CAN Interface 2	Mask: 0020h	Bit	EG3000
					Parameter Alignment	Mask: 0010h	Bit	EG3000
					Missing members on CAN	Mask: 0008h	Bit	EG3000
					EEPROM failure latched	Mask: 0004h	Bit	EG3000 not EG3000XT
					Red stop lamp latched	Mask: 0002h	Bit	EG3000
					Amber warning lamp latched	Mask: 0001h	Bit	EG3000
450068	450067		3,4		internal			
450069	450068		5,6		internal			
450070	450069	23	1,2	10286	GAP alarm set 1 alarm 16 latched	Mask: 8000h	Bit	reserved
					GAP alarm set 1 alarm 15 latched	Mask: 4000h	Bit	reserved
					Free alarm 4	Mask: 2000h	Bit	EG3000
					Free alarm 3	Mask: 1000h	Bit	EG3000
					Free alarm 2	Mask: 0800h	Bit	EG3000
					Free alarm 1	Mask: 0400h	Bit	EG3000
					Max. starts per time	Mask: 0200h	Bit	K36
					Neutral contactor reply mismatch	Mask: 0100h	Bit	EG3000
					Decoupling GCB<->MCB latched	Mask: 0080h	Bit	EG3000
					Meas.difference 4105 VDE-AR-N 4105 latched	Mask: 0040h	Bit	EG3000
					Parameter alignment VDE-AR-N 4105 latched	Mask: 0020h	Bit	EG3000
					Missing member VDE-AR-N 4105 latched	Mask: 0010h	Bit	EG3000
					Busbar monitoring latched	Mask: 0008h	Bit	EG3500 Marine EG3000XT

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Valid for:
Mod-icon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
					Plausibility GCB feedback latched	Mask: 0004h	Bit	EG3500 Marine
					Reactive load sharing mismatch latched	Mask: 0002h	Bit	EG3500 Marine EG3000XT
					Active load sharing mismatch latched	Mask: 0001h	Bit	EG3500 Marine EG3000XT
450071	450070		3,4		internal			reserved
450072	450071		5,6		internal			reserved
450073	450072	24	1,2	10134	Gen.overfreq. 1 latched	Mask: 8000h	Bit	EG3000
					Gen.overfreq. 2 latched	Mask: 4000h	Bit	EG3000
					Gen.underfreq. 1 latched	Mask: 2000h	Bit	EG3000
					Gen.underfreq. 2 latched	Mask: 1000h	Bit	EG3000
					Gen.overvolt. 1 latched	Mask: 0800h	Bit	EG3000
					Gen.overvolt. 2 latched	Mask: 0400h	Bit	EG3000
					Gen.undervolt. 1 latched	Mask: 0200h	Bit	EG3000
					Gen.undervolt. 2 latched	Mask: 0100h	Bit	EG3000
					Gen. overcurr. 1 latched	Mask: 0080h	Bit	EG3000
					Gen. overcurr. 2 latched	Mask: 0040h	Bit	EG3000
					Gen. overcurr. 3 latched	Mask: 0020h	Bit	EG3000
					Gen. Rv/Rd pow.1 latched	Mask: 0010h	Bit	EG3000
					Gen. Rv/Rd pow.2 latched	Mask: 0008h	Bit	EG3000
					Gen. Overload IOP 1 latched	Mask: 0004h	Bit	EG3000
					Gen. Overload IOP 2 latched	Mask: 0002h	Bit	EG3000
					internal	Mask: 0001h	Bit	reserved
450074	450073		3,4,5,6	108	Gen. voltage L1-L2	0.1	V	
450076	450075	25	1,2	10138	Unbal. load 1 latched	Mask: 8000h	Bit	EG3000

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Valid for:
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
					Unbal. load 2 latched	Mask: 4000h	Bit	EG3000
					Gen. Asymmetry latched	Mask: 2000h	Bit	EG3000
					Ground fault 1 latched	Mask: 1000h	Bit	EG3000
					Ground fault 2 latched	Mask: 0800h	Bit	EG3000
					Gen. phase rot. misw. Latched	Mask: 0400h	Bit	EG3000
					Gen act.pwr mismatch Latched	Mask: 0200h	Bit	EG3000
					Gen. unloading fault Latched	Mask: 0100h	Bit	EG3000
					Inv.time ov.curr. Latched	Mask: 0080h	Bit	EG3000
					Operating range failed, latched	Mask: 0040h	Bit	EG3000
					Gen. Overload MOP 1 latched	Mask: 0020h	Bit	EG3000
					Gen. Overload MOP 2 latched	Mask: 0010h	Bit	EG3000
					Gen. overexcited 1 latched	Mask: 0008h	Bit	EG3000
					Gen. overexcited 2 latched	Mask: 0004h	Bit	EG3000
					Gen. underexcited 1 latched	Mask: 0002h	Bit	EG3000
					Gen. underexcited 2 latched	Mask: 0001h	Bit	EG3000
450077	450076		3,4,5,6	114	Gen. voltage L1-N	0.1	V	EG3000
450079	450078	26	1,2	10135	Mains ov.freq. 1 latched	Mask: 8000h	Bit	EG3000
					Mains ov.freq. 2 latched	Mask: 4000h	Bit	EG3000
					Mains un.freq. 1 latched	Mask: 2000h	Bit	EG3000
					Mains un.freq. 2 latched	Mask: 1000h	Bit	EG3000
					Mains ov.volt. 1 latched	Mask: 0800h	Bit	EG3000
					Mains ov.volt. 2 latched	Mask: 0400h	Bit	EG3000
					Mains un.volt. 1 latched	Mask: 0200h	Bit	EG3000
					Mains un.volt. 2 latched	Mask: 0100h	Bit	EG3000
					Mains phaseshift latched	Mask: 0080h	Bit	EG3000

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Valid for:
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
					Mains decoupling latched	Mask: 0040h	Bit	EG3000
					internal	Mask: 0020h	Bit	reserved
					internal	Mask: 0010h	Bit	reserved
					internal	Mask: 0008h	Bit	reserved
					Mains phase rot. Miswired latched	Mask: 0004h	Bit	EG3000
					internal	Mask: 0002h	Bit	reserved
					internal	Mask: 0001h	Bit	reserved
450080	450079		3,4,5,6	109	Gen. voltage L2-L3	0.1	V	EG3000
450082	450081	27	1,2	10278	Mains import power 1 latched	Mask: 8000h	Bit	EG3000
					Mains import power 2 latched	Mask: 4000h	Bit	EG3000
					Mains export power 1 latched	Mask: 2000h	Bit	EG3000
					Mains export power 2 latched	Mask: 1000h	Bit	EG3000
					Mains overexcited 1 latched	Mask: 0800h	Bit	EG3000
					Mains overexcited 2 latched	Mask: 0400h	Bit	EG3000
					Mains underexcited 1 latched	Mask: 0200h	Bit	EG3000
					Mains underexcited 2 latched	Mask: 0100h	Bit	EG3000
					Mains df/dt	Mask: 0080h	Bit	EG3000
					Mns act.pwr mismatch latched	Mask: 0040h	Bit	EG3000
					Mains. Time dep. Voltage	Mask: 0020h	Bit	EG3000
					internal	Mask: 0010h	Bit	reserved
					Mains Voltage Increase	Mask: 0008h	Bit	EG3000
					internal	Mask: 0004h	Bit	reserved
					Mains QV Monitoring step 1	Mask: 0002h	Bit	EG3000
					Mains QV Monitoring step 2	Mask: 0001h	Bit	EG3000
450083	450082		3,4,5,6	115	Gen. voltage L2-N	0.1	V	EG3000

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Valid for:
Mod-icon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
450085	450084	28	1,2	10132	State Digital Input 1 latched	Mask: 8000h	Bit	EG3000
					State Digital Input 2 latched	Mask: 4000h	Bit	EG3000
					State Digital Input 3 latched	Mask: 2000h	Bit	EG3000
					State Digital Input 4 latched	Mask: 1000h	Bit	EG3000
					State Digital Input 5 latched	Mask: 0800h	Bit	EG3000
					State Digital Input 6 latched	Mask: 0400h	Bit	EG3000
					State Digital Input 7 latched	Mask: 0200h	Bit	EG3000
					State Digital Input 8 (reply GCB)	Mask: 0100h	Bit	EG3000
					State Digital Input 9 latched	Mask: 0080h	Bit	EG3000
					State Digital Input 10 latched	Mask: 0040h	Bit	EG3000
					State Digital Input 11 latched	Mask: 0020h	Bit	EG3000
					State Digital Input 12 latched	Mask: 0010h	Bit	EG3000
					internal	Mask: 0008h	Bit	reserved
					internal	Mask: 0004h	Bit	reserved
					internal	Mask: 0002h	Bit	reserved
					internal	Mask: 0001h	Bit	reserved
450086	450085		3,4,5,6	110	Gen. voltage L3-L1	0.1	V	EG3000
450088	450087	29	1,2	10283	State Digital Input 13 latched	Mask: 8000h	Bit	EG3500 P2
					State Digital Input 14 latched	Mask: 4000h	Bit	EG3500 P2
					State Digital Input 15 latched	Mask: 2000h	Bit	EG3500 P2
					State Digital Input 16 latched	Mask: 1000h	Bit	EG3500 P2
					State Digital Input 17 latched	Mask: 0800h	Bit	EG3500 P2
					State Digital Input 18 latched	Mask: 0400h	Bit	EG3500 P2
					State Digital Input 19 latched	Mask: 0200h	Bit	EG3500 P2
					State Digital Input 20 latched	Mask: 0100h	Bit	EG3500 P2

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Valid for:
Mod-icon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
					State Digital Input 21 latched	Mask: 0080h	Bit	EG3500 P2
					State Digital Input 22 latched	Mask: 0040h	Bit	EG3500 P2
					State Digital Input 23 latched	Mask: 0020h	Bit	EG3500 P2
					internal	Mask: 0010h	Bit	reserved
					internal	Mask: 0008h	Bit	reserved
					internal	Mask: 0004h	Bit	reserved
					internal	Mask: 0002h	Bit	reserved
					internal	Mask: 0001h	Bit	reserved
450089	450088		3,4,5,6	116	Gen. voltage L3-N	0.1	V	EG3000
450091	450090	30	1,2	16377	State external Digital Input 16 latched	Mask: 8000h	Bit	EG3000
					State external Digital Input 15 latched	Mask: 4000h	Bit	EG3000
					State external Digital Input 14 latched	Mask: 2000h	Bit	EG3000
					State external Digital Input 13 latched	Mask: 1000h	Bit	EG3000
					State external Digital Input 12 latched	Mask: 0800h	Bit	EG3000
					State external Digital Input 11 latched	Mask: 0400h	Bit	EG3000
					State external Digital Input 10 latched	Mask: 0200h	Bit	EG3000
					State external Digital Input 9 latched	Mask: 0100h	Bit	EG3000
					State external Digital Input 8 latched	Mask: 0080h	Bit	EG3000
					State external Digital Input 7 latched	Mask: 0040h	Bit	EG3000
					State external Digital Input 6 latched	Mask: 0020h	Bit	EG3000
					State external Digital Input 5 latched	Mask: 0010h	Bit	EG3000
					State external Digital Input 4 latched	Mask: 0008h	Bit	EG3000
					State external Digital Input 3 latched	Mask: 0004h	Bit	EG3000
					State external Digital Input 2 latched	Mask: 0002h	Bit	EG3000
					State external Digital Input 1 latched	Mask: 0001h	Bit	EG3000

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Valid for:
Mod-icon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
450092	450091		3,4,5, 6	118	Mains voltage L1-L2	0.1	V	EG3000
450094	450093	31	1,2	10279	Alarm flexible limit 16 latched	Mask: 8000h	Bit	EG3000
					Alarm flexible limit 15 latched	Mask: 4000h	Bit	EG3000
					Alarm flexible limit 14 latched	Mask: 2000h	Bit	EG3000
					Alarm flexible limit 13 latched	Mask: 1000h	Bit	EG3000
					Alarm flexible limit 12 latched	Mask: 0800h	Bit	EG3000
					Alarm flexible limit 11 latched	Mask: 0400h	Bit	EG3000
					Alarm flexible limit 10 latched	Mask: 0200h	Bit	EG3000
					Alarm flexible limit 9 latched	Mask: 0100h	Bit	EG3000
					Alarm flexible limit 8 latched	Mask: 0080h	Bit	EG3000
					Alarm flexible limit 7 latched	Mask: 0040h	Bit	EG3000
					Alarm flexible limit 6 latched	Mask: 0020h	Bit	EG3000
					Alarm flexible limit 5 latched	Mask: 0010h	Bit	EG3000
					Alarm flexible limit 4 latched	Mask: 0008h	Bit	EG3000
					Alarm flexible limit 3 latched	Mask: 0004h	Bit	EG3000
					Alarm flexible limit 2 latched	Mask: 0002h	Bit	EG3000
					Alarm flexible limit 1 latched	Mask: 0001h	Bit	EG3000
450095	450094		3,4,5, 6	121	Mains voltage L1-N	0.1	V	EG3000
450097	450096	32	1,2	10280	Alarm flexible limit 32 latched	Mask: 8000h	Bit	EG3000
					Alarm flexible limit 31 latched	Mask: 4000h	Bit	EG3000
					Alarm flexible limit 30 latched	Mask: 2000h	Bit	EG3000
					Alarm flexible limit 29 latched	Mask: 1000h	Bit	EG3000
					Alarm flexible limit 28 latched	Mask: 0800h	Bit	EG3000
					Alarm flexible limit 27 latched	Mask: 0400h	Bit	EG3000
					Alarm flexible limit 26 latched	Mask: 0200h	Bit	EG3000

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Valid for:
Mod-icon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
					Alarm flexible limit 25 latched	Mask: 0100h	Bit	EG3000
					Alarm flexible limit 24 latched	Mask: 0080h	Bit	EG3000
					Alarm flexible limit 23 latched	Mask: 0040h	Bit	EG3000
					Alarm flexible limit 22 latched	Mask: 0020h	Bit	EG3000
					Alarm flexible limit 21 latched	Mask: 0010h	Bit	EG3000
					Alarm flexible limit 20 latched	Mask: 0008h	Bit	EG3000
					Alarm flexible limit 19 latched	Mask: 0004h	Bit	EG3000
					Alarm flexible limit 18 latched	Mask: 0002h	Bit	EG3000
					Alarm flexible limit 17 latched	Mask: 0001h	Bit	EG3000
450098	450097		3,4,5,6	119	Mains voltage L2-L3	0.1	V	EG3000
450100	450099	33	1,2	10281	internal	Mask: 8000h	Bit	reserved
					internal	Mask: 4000h	Bit	reserved
					internal	Mask: 2000h	Bit	reserved
					internal	Mask: 1000h	Bit	reserved
					internal	Mask: 0800h	Bit	reserved
					internal	Mask: 0400h	Bit	reserved
					internal	Mask: 0200h	Bit	reserved
					internal	Mask: 0100h	Bit	reserved
					Alarm flexible limit 40 latched	Mask: 0080h	Bit	EG3000
					Alarm flexible limit 39 latched	Mask: 0040h	Bit	EG3000
					Alarm flexible limit 38 latched	Mask: 0020h	Bit	EG3000
					Alarm flexible limit 37 latched	Mask: 0010h	Bit	EG3000
					Alarm flexible limit 36 latched	Mask: 0008h	Bit	EG3000
					Alarm flexible limit 35 latched	Mask: 0004h	Bit	EG3000
					Alarm flexible limit 34 latched	Mask: 0002h	Bit	EG3000

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Valid for:
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
					Alarm flexible limit 33 latched	Mask: 0001h	Bit	EG3000
450101	450100		3,4,5,6	122	Mains voltage L2-N	0.1	V	EG3000
450103	450102	34	1,2	10136	Batt.overvolt.2 latched	Mask: 0008h	Bit	EG3000
					Batt.undervolt.2 latched	Mask: 0004h	Bit	EG3000
					Batt.overvolt.1 latched	Mask: 0002h	Bit	EG3000
					Batt.undervolt.1 latched	Mask: 0001h	Bit	EG3000
450104	450103		3,4,5,6	120	Mains voltage L3-L1	0.1	V	EG3000
450106	450105	35	1,2	10131	internal	Mask: 0040h	Bit	reserved
					Alarm class F latched	Mask: 0020h	Bit	EG3000
					Alarm class E latched	Mask: 0010h	Bit	EG3000
					Alarm class D latched	Mask: 0008h	Bit	EG3000
					Alarm class C latched	Mask: 0004h	Bit	EG3000
					Alarm class B latched	Mask: 0002h	Bit	EG3000
					Alarm class A latched	Mask: 0001h	Bit	EG3000
450107	450106		3,4,5,6	123	Mains voltage L3-N	0.1	V	EG3000
450109	450108	36	1,2	10137	internal	Mask: 0001h	Bit	reserved
					Analog inp. 1, wire brake	Mask: 0002h	Bit	EG3000
					Analog inp. 2, wire brake	Mask: 0004h	Bit	EG3000
					Analog inp. 3, wire brake	Mask: 0008h	Bit	EG3000
					Analog inp. 4, wire break or shortcut latched	Mask: 0010h	Bit	EG3500 P2
					Analog inp. 5, wire break or shortcut latched	Mask: 0020h	Bit	EG3500 P2
					Analog inp. 6, wire break or shortcut latched	Mask: 0040h	Bit	EG3500 P2
					Analog inp. 7, wire break or shortcut latched	Mask: 0080h	Bit	EG3500 P2
					Analog inp. 8, wire break or shortcut latched	Mask: 0100h	Bit	EG3500 P2
					Analog inp. 9, wire break or shortcut latched	Mask: 0200h	Bit	EG3500 P2

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Valid for:
Mod-icon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
					Analog inp. 10, wire break or shortcut latched	Mask: 0400h	Bit	EG3500 P2
					internal	Mask: 0800h	Bit	reserved
					internal	Mask: 1000h	Bit	reserved
					internal	Mask: 2000h	Bit	reserved
					internal	Mask: 4000h	Bit	reserved
					internal	Mask: 8000h	Bit	reserved
450110	450109		3,4	15310	Turbocharger 1 Compressor Outlet Temperature	0.1	°C	EG3000
450111	450110		5,6	10285	Ext. analog inp. 16, wire break	Mask: 8000h	Bit	
					Ext. analog inp. 15, wire break	Mask: 4000h	Bit	
					Ext. analog inp. 14, wire break	Mask: 2000h	Bit	
					Ext. analog inp. 13, wire break	Mask: 1000h	Bit	
					Ext. analog inp. 12, wire break	Mask: 0800h	Bit	
					Ext. analog inp. 11, wire break	Mask: 0400h	Bit	
					Ext. analog inp. 10, wire break	Mask: 0200h	Bit	
					Ext. analog inp. 9, wire break	Mask: 0100h	Bit	
					Ext. analog inp. 8, wire break	Mask: 0080h	Bit	
					Ext. analog inp. 7, wire break	Mask: 0040h	Bit	
					Ext. analog inp. 6, wire break	Mask: 0020h	Bit	
					Ext. analog inp. 5, wire break	Mask: 0010h	Bit	
					Ext. analog inp. 4, wire break	Mask: 0008h	Bit	
					Ext. analog inp. 3, wire break	Mask: 0004h	Bit	
					Ext. analog inp. 2, wire break	Mask: 0002h	Bit	
					Ext. analog inp. 1, wire break	Mask: 0001h	Bit	EG3200P2 EG3500P1 EG3000XT
450112	450111	37	1,2	10107	Digital outputs 1 to 12			
					Relay-Output 1 (inverted)	Mask: 8000h	Bit	EG3000
					Relay-Output 2	Mask: 4000h	Bit	EG3000
					Relay-Output 3	Mask: 2000h	Bit	EG3000
					Relay-Output 4	Mask: 1000h	Bit	EG3000
					Relay-Output 5	Mask: 0800h	Bit	EG3000
					Relay-Output 6	Mask: 0400h	Bit	EG3000

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Valid for:
Mod-icon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
					Relay-Output 7	Mask: 0200h	Bit	EG3000
					Relay-Output 8	Mask: 0100h	Bit	EG3000
					Relay-Output 9	Mask: 0080h	Bit	EG3000
					Relay-Output 10	Mask: 0040h	Bit	EG3000
					Relay-Output 11	Mask: 0020h	Bit	EG3000
					Relay-Output 12	Mask: 0010h	Bit	EG3000
					internal	Mask: 0008h	Bit	reserved
					internal	Mask: 0004h	Bit	reserved
					internal	Mask: 0002h	Bit	reserved
					internal	Mask: 0001h	Bit	reserved
450113	450112		3,4	10109	Digital outputs 13 to 22			
					Relay-Output 13	Mask: 8000h	Bit	EG3500 P2
					Relay-Output 14	Mask: 4000h	Bit	EG3500 P2
					Relay-Output 15	Mask: 2000h	Bit	EG3500 P2
					Relay-Output 16	Mask: 1000h	Bit	EG3500 P2
					Relay-Output 17	Mask: 0800h	Bit	EG3500 P2
					Relay-Output 18	Mask: 0400h	Bit	EG3500 P2
					Relay-Output 19	Mask: 0200h	Bit	EG3500 P2
					Relay-Output 20	Mask: 0100h	Bit	EG3500 P2
					Relay-Output 21	Mask: 0080h	Bit	EG3500 P2
					Relay-Output 22	Mask: 0040h	Bit	EG3500 P2
					internal	Mask: 0020h	Bit	reserved
					internal	Mask: 0010h	Bit	reserved
					internal	Mask: 0008h	Bit	reserved
					internal	Mask: 0004h	Bit	reserved
					Open Collector Output 2	Mask: 0002h	Bit	EG3500 P2

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Valid for:
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
					Open Collector Output 1	Mask: 0001h	Bit	EG3500 P2
450114	450113		5,6	8005	Output to external CAN-I/O Relay 16	Mask: 8000h	Bit	EG3000
					Output to external CAN-I/O Relay 15	Mask: 4000h	Bit	EG3000
					Output to external CAN-I/O Relay 14	Mask: 2000h	Bit	EG3000
					Output to external CAN-I/O Relay 13	Mask: 1000h	Bit	EG3000
					Output to external CAN-I/O Relay 12	Mask: 0800h	Bit	EG3000
					Output to external CAN-I/O Relay 11	Mask: 0400h	Bit	EG3000
					Output to external CAN-I/O Relay 10	Mask: 0200h	Bit	EG3000
					Output to external CAN-I/O Relay 9	Mask: 0100h	Bit	EG3000
					Output to external CAN-I/O Relay 8	Mask: 0080h	Bit	EG3000
					Output to external CAN-I/O Relay 7	Mask: 0040h	Bit	EG3000
					Output to external CAN-I/O Relay 6	Mask: 0020h	Bit	EG3000
					Output to external CAN-I/O Relay 5	Mask: 0010h	Bit	EG3000
					Output to external CAN-I/O Relay 4	Mask: 0008h	Bit	EG3000
					Output to external CAN-I/O Relay 3	Mask: 0004h	Bit	EG3000
					Output to external CAN-I/O Relay 2	Mask: 0002h	Bit	EG3000
					Output to external CAN-I/O Relay 1	Mask: 0001h	Bit	EG3000
450115	450114	38	1,2	10310	Analog output 1	0.01	%	EG3000
450116	450115		3,4	10311	Analog output 2	0.01	%	EG3000
450117	450116		5,6		internal			reserved
450118	450117	39	1,2	10318	Analog output 4	0.01	%	EG3500 P2
450119	450118		3,4	10319	Analog output 5	0.01	%	EG3500 P2
450120	450119		5,6	10320	Analog output 6	0.01	%	EG3500 P2

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Valid for:
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
450121	450120	40	1,2	10298	4685 = TEST Mode 14353 = AUTO Mode 13200 = Auxiliary services postrun 13201 = Aux. services prerun 13202 = Critical mode 13203 = Engine Stop 13204 = Cool down 13205 = Mains settling 13206 = Engine Start 13207 = Start - Pause 13208 = Preglow 13209 = GCB dead bus close 13210 = MCB dead bus close 13211 = Emergency run 13212 = Turning 13213 = Ignition 13214 = Crank protect 13215 = Emergency/Critical 13216 = Idle run active 13250 = Gen. stable time 13251 = In operation 13252 = Power limited prerun 13253 = AUTO mode ready 13254 = Ramp to rated 13255 = GCB open 13256 = Unloading generator 13257 = MCB open 13258 = Loading generator 13259 = Synchronization GCB 13260 = Synchronization MCB 13261 = GCB -> MCB Delay 13262 = MCB -> GCB Delay 13263 = Start w/o Load 13264 = Unloading mains 13265 = Synchronization permissive 13266 = Synchronization check 13267 = Synchronization off 13268 = GGB open 13269 = Synchronization GGB 13270 = GGB dead busbar closure 13271 = Run-up synchronization 13272 = GGB -> MCB Delay 13273 = MCB -> GGB Delay 13281 = Derating active		(enum.)	EG3000

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Valid for:
Mod-icon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
					13282 = Unloading LS5			
					13283 = Synchronization LS5			
					13284 = Inhibit cranking			
					13285 = Set change			
					13287 = Uprating active			
					13288 = Gen excitation lim.			
					13309 = P(V) derating			
					13311 = Inh.dead bus closure			
					14354 = STOP Mode			
					14355 = MAN Mode			
					14763 = System update			
					14775 = Keypad locked			
450122	450121		3,4,5, 6	2520	Gen. real energy	0.01	MWh	EG3000
450124	450123	41	1,2	2540	Engine, number of start requests	1		EG3000
450125	450124		3,4,5, 6	2522	Gen. positive reactive energy	0.01	Mvarh	EG3000
450127	450126	42	1,2	2558	Hours until next maintenance	1	h	EG3000
450128	450127		3,4,5, 6	2568	Gen. hours of operation	0.01	h	EG3000
450130	450129	43	1,2	5541	Setpoint frequency	0.01	Hz	EG3000
450131	450130		3,4,5, 6	5542	Setpoint active power	0.1	kW	EG3000
450133	450132	44	1,2,3, 4	5640	Setpoint voltage	1	V	EG3000
450135	450134		5,6	5641	Setpoint power factor	0.001		EG3000
450136	450135	45	1,2	4153	Idle mode monitoring (suppresses undervolt, underfreq,...)	Mask: 8000h	Bit	EG3000
					Idle mode active	Mask: 4000h	Bit	EG3000
					Start without closing GCB	Mask: 2000h	Bit	EG3000
					Internal	Mask: 1000h	Bit	reserved
					A manual START has been requested	Mask: 0800h	Bit	EG3000
					A manual STOP has been requested	Mask: 0400h	Bit	EG3000
					Cooldown is active	Mask: 0200h	Bit	EG3000
					Auxiliary services generally active	Mask: 0100h	Bit	EG3000
					Engine Monitoring delay timer has expired	Mask: 0080h	Bit	EG3000

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Valid for:
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
					Breaker delay timer has expired	Mask: 0040h	Bit	EG3000
					Engine start is requested	Mask: 0020h	Bit	EG3000
					Critical mode is active in automatic mode	Mask: 0010h	Bit	EG3000
					Engine is released (speed governor is enabled)	Mask: 0008h	Bit	EG3000
					Auxiliary services prerun is active	Mask: 0004h	Bit	EG3000
					Auxiliary services postrun is active	Mask: 0002h	Bit	EG3000
					Lamp test is active	Mask: 0001h	Bit	EG3000
450137	450136		3,4	4154	Crank (Starter) is active	Mask: 8000h	Bit	EG3000
					Operating Magnet / Gasrelay is active	Mask: 4000h	Bit	EG3000
					Preglow / Ignition is active	Mask: 2000h	Bit	EG3000
					Mains settling timer is running	Mask: 1000h	Bit	EG3000
					Emergency mode is currently active	Mask: 0800h	Bit	EG3000
					Internal	Mask: 0400h	Bit	reserved
					Free PID Controller 3: Lower Command	Mask: 0200h	Bit	EG3200P2 EG3500 EG3000XT
					Free PID Controller 3: Raise Command	Mask: 0100h	Bit	
					Free PID Controller 2: Lower Command	Mask: 0080h	Bit	
					Free PID Controller 2: Raise Command	Mask: 0040h	Bit	
					Stopping Magnet is active	Mask: 0020h	Bit	EG3000
					Excitation AVR (Run-up synchronization)	Mask: 0010h	Bit	EG3500
					The genset runs mains parallel	Mask: 0008h	Bit	EG3000
					Free PID Controller 1: Lower Command	Mask: 0004h	Bit	EG3200P2 EG3500 EG3000XT
					Free PID Controller 1: Raise Command	Mask: 0002h	Bit	
					Increment Engine Start Counter	Mask: 0001h	Bit	EG3000
450138	450137		5,6	4155	3-Position Controller Freq./Power raise	Mask: 8000h	Bit	EG3000

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Valid for:
Mod-icon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
					3-Position Controller Freq./Power lower	Mask: 4000h	Bit	EG3000
					3-Position Controller Volt./ReactPow raise	Mask: 2000h	Bit	EG3000
					3-Position Controller Volt./ReactPow lower	Mask: 1000h	Bit	EG3000
					GCB is closed	Mask: 0800h	Bit	EG3000
					MCB is closed	Mask: 0400h	Bit	EG3000
					Derating active	Mask: 0200h	Bit	EG3000
					Synchronisation GCB is active	Mask: 0100h	Bit	EG3000
					Opening GCB is active	Mask: 0080h	Bit	EG3000
					Closing GCB is active	Mask: 0040h	Bit	EG3000
					Synchronisation MCB is active	Mask: 0020h	Bit	EG3000
					Opening MCB is active	Mask: 0010h	Bit	EG3000
					Closing MCB is active	Mask: 0008h	Bit	EG3000
					Unloading generator is active	Mask: 0004h	Bit	EG3000
					Unloading mains is active	Mask: 0002h	Bit	EG3000
					Power limited prerun	Mask: 0001h	Bit	EG3000
450139	450138	46	1,2	4156	GGB is closed	Mask: 8000h	Bit	EG3500
					GGB is released	Mask: 4000h	Bit	EG3500
					Synchronisation GGB is active	Mask: 2000h	Bit	EG3500
					Opening GGB is active	Mask: 1000h	Bit	EG3500
					Closing GGB is active	Mask: 0800h	Bit	EG3500
					Dead busbar closure request for GCB or MCB or GGB	Mask: 0400h	Bit	EG3000
					Active power load share is active	Mask: 0200h	Bit	EG3000
					Reactive power load share is active	Mask: 0100h	Bit	EG3000
					Generator with a closed GCB is requested	Mask: 0080h	Bit	EG3000
					LDSS: The Engine shall start	Mask: 0040h	Bit	EG3000

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Valid for:
Mod-icon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
					LDSS: The Engine shall stop	Mask: 0020h	Bit	EG3000
					LDSS: The Engine shall stop, if possible	Mask: 0010h	Bit	EG3000
					LDSS: Minimum Running Time is active	Mask: 0008h	Bit	EG3000
					LDSS: The LDSS function is active	Mask: 0004h	Bit	EG3000
					The Critical Mode Postrun is active	Mask: 0002h	Bit	EG3000
					AUTOMATIC Run: Switch to Operating Mode STOP	Mask: 0001h	Bit	EG3000
450140	450139		3,4	4150	internal	Mask: 8000h	Bit	EG3000
					internal	Mask: 4000h	Bit	EG3000
					internal	Mask: 2000h	Bit	EG3000
					internal	Mask: 1000h	Bit	EG3000
					internal	Mask: 0800h	Bit	EG3000
					internal	Mask: 0400h	Bit	EG3000
					internal	Mask: 0200h	Bit	EG3000
					internal	Mask: 0100h	Bit	EG3000
					internal	Mask: 0080h	Bit	EG3000
					internal	Mask: 0040h	Bit	EG3000
					internal	Mask: 0020h	Bit	EG3000
					internal	Mask: 0010h	Bit	EG3000
					internal	Mask: 0008h	Bit	EG3000
					Parameter set 1-7 selection Bit 3	Mask: 0004h	Bit	EG3500 P1 Rental
					Parameter set 1-7 selection Bit 2	Mask: 0002h	Bit	EG3500 P1 Rental
					Parameter set 1-7 selection Bit 1	Mask: 0001h	Bit	EG3500 P1 Rental
450141	450140		5,6	10284	State external Digital Input 32 latched	Mask: 8000h	Bit	EG3200 P2 EG3500 P1 EG3000XT

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Valid for:
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
					State external Digital Input 31 latched	Mask: 4000h	Bit	
					State external Digital Input 30 latched	Mask: 2000h	Bit	
					State external Digital Input 29 latched	Mask: 1000h	Bit	
					State external Digital Input 28 latched	Mask: 0800h	Bit	
					State external Digital Input 27 latched	Mask: 0400h	Bit	
					State external Digital Input 26 latched	Mask: 0200h	Bit	
					State external Digital Input 25 latched	Mask: 0100h	Bit	
					State external Digital Input 24 latched	Mask: 0080h	Bit	
					State external Digital Input 23 latched	Mask: 0040h	Bit	
					State external Digital Input 22 latched	Mask: 0020h	Bit	
					State external Digital Input 21 latched	Mask: 0010h	Bit	
					State external Digital Input 20 latched	Mask: 0008h	Bit	
					State external Digital Input 19 latched	Mask: 0004h	Bit	
					State external Digital Input 18 latched	Mask: 0002h	Bit	
					State external Digital Input 17 latched	Mask: 0001h	Bit	
450142	450141	47	1,2	8009	Output to external CAN-I/O Relay 32	Mask: 8000h	Bit	EG3200 P2 EG3500 P1 EG3000XT
					Relay 31	Mask: 4000h	Bit	
					Relay 30	Mask: 2000h	Bit	
					Relay 29	Mask: 1000h	Bit	
					Relay 28	Mask: 0800h	Bit	
					Relay 27	Mask: 0400h	Bit	
					Relay 26	Mask: 0200h	Bit	
					Relay 25	Mask: 0100h	Bit	
					Relay 24	Mask: 0080h	Bit	
					Relay 23	Mask: 0040h	Bit	
					Relay 22	Mask: 0020h	Bit	
					Relay 21	Mask: 0010h	Bit	
					Relay 20	Mask: 0008h	Bit	
					Relay 19	Mask: 0004h	Bit	
					Relay 18	Mask: 0002h	Bit	
					Relay 17	Mask: 0001h	Bit	
450143	450142		3,4	10170	External Analog input 1	changeable		EG3200 P2 EG3500 P1 EG3000XT
450144	450143		5,6	10171	External Analog input 2	changeable		
450145	450144	48	1,2	10172	External Analog input 3	changeable		

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Valid for:
Mod-icon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
450146	450145		3,4	10173	External Analog input 4	changeable		
450147	450146		5,6	10174	External Analog input 5	changeable		
450148	450147	49	1,2	10175	External Analog input 6	changeable		
450149	450148		3,4	10176	External Analog input 7	changeable		
450150	450149		5,6	10177	External Analog input 8	changeable		
450151	450150	50	1,2	10178	External Analog input 9	changeable		
450152	450151		3,4	10179	External Analog input 10	changeable		
450153	450152		5,6	10180	External Analog input 11	changeable		
450154	450153	51	1,2	10181	External Analog input 12	changeable		
450155	450154		3,4	10182	External Analog input 13	changeable		
450156	450155		5,6	10183	External Analog input 14	changeable		
450157	450156	52	1,2	10184	External Analog input 15	changeable		
450158	450157		3,4	10185	External Analog input 16	changeable		
450159	450158		5,6	10245	External Analog Output 1	0.01	%	
450160	450159	53	1,2	10255	External Analog Output 2	0.01	%	
450161	450160		3,4	10265	External Analog Output 3	0.01	%	
450162	450161		5,6	10275	External Analog Output 4	0.01	%	
450163	450162	54	1,2		internal			reserved
450164	450163		3,4,5,6	2580	Period of use counter			EG3500 Rental
450166	450165	55	1,2	10190	GGB fail to close latched	Mask: 8000h	Bit	EG3500
					GGB fail to open latched	Mask: 4000h	Bit	EG3500
						Mask: 2000h	Bit	reserved
						Mask: 1000h	Bit	reserved
					Temperature deviation level 1	Mask: 0800h	Bit	EG3000
					Temperature deviation level 2	Mask: 0400h	Bit	EG3000
					Temperature deviation wire break	Mask: 0200h	Bit	EG3000
						Mask: 0100h	Bit	reserved
						Mask: 0080h	Bit	reserved
						Mask: 0040h	Bit	reserved
						Mask: 0020h	Bit	reserved
						Mask: 0010h	Bit	reserved

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Valid for:
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
						Mask: 0008h	Bit	reserved
						Mask: 0004h	Bit	reserved
						Mask: 0002h	Bit	reserved
						Mask: 0001h	Bit	reserved
450167	450166		3,4,5,6	219	Nominal active power in system (in own segment)	1	kW	EG3000
450169	450168	56	1,2	4157	Command to CB-control 1 (OR)	Mask: 8000h	Bit	EG3000
					Command to CB-control 2 (OR)	Mask: 4000h	Bit	EG3000
					Command to CB-control 3 (OR)	Mask: 2000h	Bit	EG3000
					Command to CB-control 4 (OR)	Mask: 1000h	Bit	EG3000
					Command to CB-control 5 (OR)	Mask: 0800h	Bit	EG3000
					Command to CB-control 6 (OR)	Mask: 0400h	Bit	EG3000
					Gen excitation limit active	Mask: 0200h	Bit	EG3000
					Neutral interlocking closed NC	Mask: 0100h	Bit	EG3000
					Uprating active	Mask: 0080h	Bit	EG3500 Marine EG3000XT
					Extended Busbar F okay	Mask: 0040h	Bit	EG3500 Marine
					Extended Busbar V okay	Mask: 0020h	Bit	EG3500 Marine
					Extended Busbar F/V okay	Mask: 0010h	Bit	EG3500 Marine
					Extended Busbar is dead	Mask: 0008h	Bit	EG3500 Marine
					Phaseangle MNS/BUS okay	Mask: 0004h	Bit	EG3500 Marine
					Phaseangle GEN/BUS okay	Mask: 0002h	Bit	EG3500 Marine
					Inhibit cranking	Mask: 0001h	Bit	EG3500 Marine
450170	450169		3,4,5,6	218	Active real power in system (in own segment)	1	kW	EG3000

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Valid for:
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
450172	450171	57	1,2	10277	Diff. outlet-inlet temp. (ANIN10-ANIN9)	1	°C	EG3500-P2 K36
450173	450172		3,4,5,6	217	Active power reserve in system (in own segment)	1	kW	EG3000
450175	450174	58	1,2	15109	J1939 MTU ADEC ECU Failure Codes	1		EG3000
450176	450175		3,4	239	System act.nom.pwr.	0.01	%	EG3000
450177	450176		5,6	240	Syst.total real pwr.	0.01	%	EG3000
450178	450177	59	1,2	15304	Engine Stop Information (extracted from DEUTZ-specific J1939-Message) **Notes** Please see Deutz documentation for correct data! We know ... Motorstopinformation: 0 = Keine Abschaltung 1 = Motorschutz 2 = CAN Botschaft Engine Stop Request 3 = Öldruck zu niedrig 4 = Ölstand zu niedrig 5 = Kühlmitteltemperatur zu hoch 6 = Kühlmittelstand zu niedrig 7 = Ladelufttemperatur 8 = reserviert (Abstellung über SAE-J1587) 9 = reserviert (Abstellung über VP2) FEFFh = Sensorfehler FFFFh = Nicht erreichbar	1	(enum.)	EG3000
450179	450178		3,4	241	Syst.res.real power	0.01	%	EG3000
450180	450179		5,6	15311	Engine Derate Request	0.1	%	EG3000
450181	450180	60	1,2	15305	J1939 DLN2-Message Scania S6			EG3000
					Engine Coolant Temperature			EG3000
					J1939-Message not available	Mask 8000h		EG3000
					Sensor fault	Mask 4000h		EG3000
					High Temperature.	Mask 2000h		EG3000
					NOT High Temperature	Mask 1000h		EG3000
					Engine Oil Pressure			EG3000
					J1939-Message not available	Mask 0800h		EG3000

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Valid for:
Mod-icon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
					Sensor fault	Mask 0400h		EG3000
					Low Pressure	Mask 0200h		EG3000
					NOT Low Pressure	Mask 0100h		EG3000
					High Engine Oil Level			EG3000
					J1939-Message not available	Mask 0080h		EG3000
					Sensor fault	Mask 0040h		EG3000
					High Level	Mask 0020h		EG3000
					NOT High Level	Mask 0010h		EG3000
					Low Engine Oil Level			EG3000
					J1939-Message not available	Mask 0008h		EG3000
					Sensor fault	Mask 0004h		EG3000
					Low Level	Mask 0002h		EG3000
					NOT Low Level	Mask 0001h		EG3000
450182	450181		3,4	15313	Aftertreatment 1 Diesel Exhaust Fluid Tank Level	0.1	%	EG3000
450183	450182		5,6	15312	Battery Potential, Switched	0.1	V	EG3000
					1. Active Diagnostic Trouble Code (DM1)			EG3000
450184	450183	61	1,2,3,4	15400	SPN			EG3000
450186	450185		5,6	15401	FMT	Mask FF00h		EG3000
				15402	OC	Mask 00FFh		EG3000
					2. Active Diagnostic Trouble Code (DM1)			EG3000
450187	450186	62	1,2,3,4	15403	SPN			EG3000
450189	450188		5,6	15404	FMT	Mask FF00h		EG3000
				15405	OC	Mask 00FFh		EG3000
					3. Active Diagnostic Trouble Code (DM1)			EG3000
450190	450189	63	1,2,3,4	15406	SPN			EG3000

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Valid for:
Mod-icon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
450192	450191		5,6	15407	FMT	Mask FF00h		EG3000
				15408	OC	Mask 00FFh		EG3000
					4. Active Diagnostic Trouble Code (DM1)			EG3000
450193	450192	64	1,2,3,4	15409	SPN			EG3000
450195	450194		5,6	15410	FMT	Mask FF00h		EG3000
				15411	OC	Mask 00FFh		EG3000
					5. Active Diagnostic Trouble Code (DM1)			EG3000
450196	450195	65	1,2,3,4	15412	SPN			EG3000
450198	450197		5,6	15413	FMT	Mask FF00h		EG3000
				15414	OC	Mask 00FFh		EG3000
					6. Active Diagnostic Trouble Code (DM1)			EG3000
450199	450198	66	1,2,3,4	15415	SPN			EG3000
450201	450200		5,6	15416	FMT	Mask FF00h		EG3000
				15418	OC	Mask 00FFh		EG3000
					7. Active Diagnostic Trouble Code (DM1)			EG3000
450202	450201	67	1,2,3,4	15419	SPN			EG3000
450204	450203		5,6	15420	FMT	Mask FF00h		EG3000
				15421	OC	Mask 00FFh		EG3000
					8. Active Diagnostic Trouble Code (DM1)			EG3000
450205	450204	68	1,2,3,4	15422	SPN			EG3000
450207	450206		5,6	15423	FMT	Mask FF00h		EG3000
				15424	OC	Mask 00FFh		EG3000
					9. Active Diagnostic Trouble Code (DM1)			EG3000
450208	450207	69	1,2,3,4	15425	SPN			EG3000
450210	450209		5,6	15426	FMT	Mask FF00h		EG3000

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Valid for:
Mod-icon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
				15427	OC	Mask 00FFh		EG3000
					10. Active Diagnostic Trouble Code (DM1)			EG3000
450211	450210	70	1,2,3,4	15428	SPN			EG3000
450213	450212		5,6	15429	FMT	Mask FF00h		EG3000
				15430	OC	Mask 00FFh		EG3000
					1. Previously Active Diagnostic Trouble Code (DM2)			EG3000
450214	450213	71	1,2,3,4	15450	SPN			EG3000
450216	450215		5,6	15451	FMT	Mask FF00h		EG3000
				15452	OC	Mask 00FFh		EG3000
					2. Previously Active Diagnostic Trouble Code (DM2)			EG3000
450217	450216	72	1,2,3,4	15453	SPN			EG3000
450219	450218		5,6	15454	FMT	Mask FF00h		EG3000
				15455	OC	Mask 00FFh		EG3000
					3. Previously Active Diagnostic Trouble Code (DM2)			EG3000
450220	450219	73	1,2,3,4	15456	SPN			EG3000
450222	450221		5,6	15457	FMT	Mask FF00h		EG3000
				15458	OC	Mask 00FFh		EG3000
					4. Previously Active Diagnostic Trouble Code (DM2)			EG3000
450223	450222	74	1,2,3,4	15459	SPN			EG3000
450225	450224		5,6	15460	FMT	Mask FF00h		EG3000
				15461	OC	Mask 00FFh		EG3000
					5. Previously Active Diagnostic Trouble Code (DM2)			EG3000
450226	450225	75	1,2,3,4	15462	SPN			EG3000
450228	450227		5,6	15463	FMT	Mask FF00h		EG3000
				15464	OC	Mask 00FFh		EG3000

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Valid for:
Mod-icon start addr.	**Start addr. (*1)**	**Data byte 0 (Mux)**	**Data byte**					
					6. Previously Active Diagnostic Trouble Code (DM2)			EG3000
450229	450228	76	1,2,3,4	15465	SPN			EG3000
450231	450230		5,6	15466	FMT	Mask FF00h		EG3000
				15467	OC	Mask 00FFh		EG3000
					7. Previously Active Diagnostic Trouble Code (DM2)			EG3000
450232	450231	77	1,2,3,4	15468	SPN			EG3000
450234	450233		5,6	15469	FMT	Mask FF00h		EG3000
				15470	OC	Mask 00FFh		EG3000
					8. Previously Active Diagnostic Trouble Code (DM2)			EG3000
450235	450234	78	1,2,3,4	15471	SPN			EG3000
450237	450236		5,6	15472	FMT	Mask FF00h		EG3000
				15473	OC	Mask 00FFh		EG3000
					9. Previously Active Diagnostic Trouble Code (DM2)			EG3000
450238	450237	79	1,2,3,4	15474	SPN			EG3000
450240	450239		5,6	15475	FMT	Mask FF00h		EG3000
				15476	OC	Mask 00FFh		EG3000
					10. Previously Active Diagnostic Trouble Code (DM2)			EG3000
450241	450240	80	1,2,3,4	15477	SPN			EG3000
450243	450242		5,6	15478	FMT	Mask FF00h		EG3000
				15479	OC	Mask 00FFh		EG3000
450244	450243	81	1,2	15395	DM1 Lamp Status			
					Malfunction Lamp			
					internal	Mask 8000h		reserved
					internal	Mask 4000h		reserved
					On	Mask 2000h		EG3000
					Off	Mask 1000h		EG3000

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Valid for:
Mod-icon start addr.	**Start addr. (*1)**	**Data byte 0 (Mux)**	**Data byte**					
					Red Stop Lamp			
					internal	Mask 0800h		reserved
					internal	Mask 0400h		reserved
					On	Mask 0200h		EG3000
					Off	Mask 0100h		EG3000
					Amber Warning Lamp			
					internal	Mask 0080h		reserved
					internal	Mask 0040h		reserved
					On	Mask 0020h		EG3000
					Off	Mask 0010h		EG3000
					Protect Lamp			
					internal	Mask 0008h		reserved
					internal	Mask 0004h		reserved
					On	Mask 0002h		EG3000
					Off	Mask 0001h		EG3000
450245	450244		3,4	15445	DM2 Lamp Status			
					Malfunction Lamp			
					internal	Mask 8000h		reserved
					internal	Mask 4000h		reserved
					On	Mask 2000h		EG3000
					Off	Mask 1000h		EG3000
					Red Stop Lamp			
					internal	Mask 0800h		reserved
					internal	Mask 0400h		reserved
					On	Mask 0200h		EG3000
					Off	Mask 0100h		EG3000
					Amber Warning Lamp			

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Valid for:
Mod-icon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
					internal	Mask 0080h		reserved
					internal	Mask 0040h		reserved
					On	Mask 0020h		EG3000
					Off	Mask 0010h		EG3000
					Protect Lamp			
					internal	Mask 0008h		reserved
					internal	Mask 0004h		reserved
					On	Mask 0002h		EG3000
					Off	Mask 0001h		EG3000
450246	450245		5,6	15314	Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature	1	°C	EG3000
450247	450246	82	1,2,3,4	15200	Engine Speed (j1939-EEC1) **Notes** Value for Error indicator: 429496729,4 Value for Not available: 429496729,5	0.1	rpm	EG3000
450249	450248		5,6	15202	Engine Coolant Temperature (J1939-ET1) **Notes** Value for Error indicator: 32766 Value for Not available: 32767 signed	1	°C	EG3000
450250	450249	83	1,2,3,4	15201	Total engine hours (j1939-HOURS) **Notes** Value for Error indicator: 4294967294 Value for Not available: 4294967295	1	h	EG3000
450252	450251		5,6	15203	Fuel temperature (j1939-ET1) **Notes** Value for Error indicator: 32766 Value for Not available: 32767 signed	1	°C	EG3000
450253	450252	84	1,2,3,4	15204	Engine Oil Temperature (j1939-ET1) **Notes** Value for Error indicator: 21474836,46 Value for Not available: 21474836,47 signed	0.01	°C	EG3000
450255	450254		5,6	15205	Engine Oil Pressure (j1939-EFL/P1) **Notes** Value for Error indicator: 65534 Value for Not available: 65535	1	kPa	EG3000
450256	450255	85	1,2,3,4	15211	Fuel Rate (j1939-LFE)	0.01	L/h	EG3000

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Valid for:
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
					Notes Value for Error indicator: 42949672,94 Value for Not available: 42949672,95			
450258	450257		5,6	15206	Coolant Level (j1939-EFL/P1)	0.1	%	EG3000
					Notes Value for Error indicator: 6553,4 Value for Not available: 6553,5			
450259	450258	86	1,2	15207	Throttle position (j1939-EEC2)	0.1	%	EG3000
					Notes Value for Error indicator: 6553,4 Value for Not available: 6553,5			
450260	450259		3,4	15208	Load at current Speed (j1939-EEC2)	1	%	EG3000
					Notes Value for Error indicator: 65534 Value for Not available: 65535			
450261	450260		5,6	15210	Engine oil level (j1939-EFL/P1)	0.1	%	EG3000
					Notes Value for Error indicator: 6553,4 Value for Not available: 6553,5			
450262	450261	87	1,2	15214	Boost pressure (j1939-IC1)	1	kPa	EG3000
					Notes Value for Error indicator: 65534 Value for Not available: 65535			
450263	450262		3,4	15215	Intake Manifold Temp (j1939-IC1)	1	°C	EG3000
					Notes Value for Error indicator: 32766 Value for Not available: 32767 signed			
450264	450263		5,6	15212	Barometric Pressure (j1939-AMB)	0.1	kPa	EG3000
					Notes Value for Error indicator: 6553,4 Value for Not available: 6553,5			
450265	450264	88	1,2	15213	Air inlet temperature (j1939-AMB)	1	°C	EG3000
					Notes Value for Error indicator: 32766 Value for Not available: 32767 signed			
450266	450265		3,4	15209	Actual engine torque (j1939-EEC1)	1	%	EG3000
					Notes Value for Error indicator: 32766 Value for Not available: 32767 signed			
450267	450266		5,6	15315	Aftertreatment 1 Diesel Exhaust Fluid Tank 2 Level	0.1	%	EG3000

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Valid for:
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte					
450268	450267	89	1,2,3,4	15216	Exhaust Gas Temp.(J1939-IC1) **Notes** Value for Error indicator: 21474836,46 Value for Not available: 21474836,47 signed	0.01	°C	EG3000
450270	450269		5,6	15316	Aftertreatment 1 Diesel Exhaust Fluid Tank 2 Temperature	1	°C	EG3000

9.2.2 Protocol 5004 (Generator Values Visualization)

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
0	1,2		Protocol ID, always 5004		–
0	3,4	10100	Pickup speed	1	rpm
0	5,6	-	internal		
1	1,2	160	Gen. power factor	0.001	
1	3,4,5,6	170	Av. Gen. Wye-Voltage	0.1	V
2	1,2	144	Gen. frequency	0.01	Hz
2	3,4,5,6	171	Av. Gen. Delta-Voltage	0.1	V
3	1,2	10310	Analog output 1	0,01	%
3	3,4,5,6	185	Av. Gen. Current	0.001	A
4	1,2	10311	Analog output 2	0,01	%
4	3,4,5,6	161	Meas. ground current	0.001	A
5	1,2	2112	Overspeed 1 latched	Mask: 8000h	Bit
		2113	Overspeed 2 latched	Mask: 4000h	Bit
		2162	Underspeed 1 latched	Mask: 2000h	Bit
		2163	Underspeed 2 latched	Mask: 1000h	Bit
		2652	Unintended stop latched	Mask: 0800h	Bit
		2457	Speed det. alarm latched	Mask: 0400h	Bit
		2504	Shutdown malfunction latched	Mask: 0200h	Bit
		2603	GCB fail to close latched	Mask: 0100h	Bit
		2604	GCB fail to open latched	Mask: 0080h	Bit
		2623	MCB fail to close latched	Mask: 0040h	Bit
		2624	MCB fail to open latched	Mask: 0020h	Bit
		10017	CAN-Fault J1939 latched	Mask: 0010h	Bit
		3325	Start fail latched	Mask: 0008h	Bit
		2560	Maintenance days exceeded latched	Mask: 0004h	Bit
		2561	Maintenance hours exceeded latched	Mask: 0002h	Bit
		10087	CANopen error at CAN Interface 1	Mask: 0001h	Bit
5	3,4,5,6	159	Calculated ground current	0.001	A

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
6	1,2	3064	GCB syn. timeout latched	Mask: 8000h	Bit
		3074	MCB syn. timeout latched	Mask: 4000h	Bit
		3084	GGB Timeout latched	Mask: 2000h	Bit
		4056	Charge alt. low volt latched	Mask: 1000h	Bit
		2944	Ph.rotation mismatch latched	Mask: 0800h	Bit
		10084	no data receive at RPDO3 at CAN Interface 1	Mask: 0400h	Bit
		10083	no data receive at RPDO2 at CAN Interface 1	Mask: 0200h	Bit
		10082	no data receive at RPDO1 at CAN Interface 1	Mask: 0100h	Bit
		10086	no data receive at RPDO2 (function 1) at CAN Interface 2	Mask: 0080h	Bit
		10085	no data receive at RPDO1 (function 1) at CAN Interface 2	Mask: 0040h	Bit
		10088	CANopen error at CAN Interface 2	Mask: 0020h	Bit
		4073	Parameter Alignment	Mask: 0010h	
		4064	Missing members on CAN	Mask: 0008h	
		1714*	EEPROM failure latched *) easYgen-3000 only, not easYgen-3000XT series	Mask: 0004h	Bit
		15125	Red stop lamp latched	Mask: 0002h	Bit
		15126	Amber warning lamp latched	Mask: 0001h	Bit
6	3,4,5,6	111	Gen. current 1	0.001	A
7	1,2,3,4	112	Gen. current 2	0.001	A
7	5,6	-	internal		
8	1,2,3,4	113	Gen. current 3	0.001	A
8	5,6	-	internal		
9	1,2,3,4	135	Total gen. power	1	W
9	5,6	1912	Gen.overfreq. 1 latched	Mask: 8000h	Bit
		1913	Gen.overfreq. 2 latched	Mask: 4000h	Bit
		1962	Gen.underfreq. 1 latched	Mask: 2000h	Bit
		1963	Gen.underfreq. 2 latched	Mask: 1000h	Bit
		2012	Gen.overvolt. 1 latched	Mask: 0800h	Bit
		2013	Gen.overvolt. 2 latched	Mask: 0400h	Bit
		2062	Gen.undervolt. 1 latched	Mask: 0200h	Bit
		2063	Gen.undervolt. 2 latched	Mask: 0100h	Bit
		2218	Gen. overcurr. 1 latched	Mask: 0080h	Bit
		2219	Gen. overcurr. 2 latched	Mask: 0040h	Bit
		2220	Gen. overcurr. 3 latched	Mask: 0020h	Bit
		2262	Gen. Rv/Rd pow.1 latched	Mask: 0010h	Bit
		2263	Gen. Rv/Rd pow.2 latched	Mask: 0008h	Bit
		2314	Gen. Overload IOP 1 latched	Mask: 0004h	Bit
		2315	Gen. Overload IOP 2 latched	Mask: 0002h	Bit
		-	internal	Mask: 0001h	
10	1,2,3,4	136	Total gen. reactive power	1	var

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
10	5,6	10138	Unbal. load 1 latched	Mask: 8000h	Bit
			Unbal. load 2 latched	Mask: 4000h	Bit
			Gen. Asymmetry latched	Mask: 2000h	Bit
			Ground fault 1 latched	Mask: 1000h	Bit
			Ground fault 2 latched	Mask: 0800h	Bit
			Gen. phase rot. misw. Latched	Mask: 0400h	Bit
			Gen act.pwr mismatch Latched	Mask: 0200h	Bit
			Gen. unloading fault Latched	Mask: 0100h	Bit
			Inv.time ov.curr. Latched	Mask: 0080h	Bit
			Operating range failure	Mask: 0040h	Bit
			Gen. Overload MOP 1 latched	Mask: 0020h	Bit
			Gen. Overload MOP 2 latched	Mask: 0010h	Bit
			Gen. overexcited 1 latched	Mask: 0008h	Bit
			Gen. overexcited 2 latched	Mask: 0004h	Bit
			Gen. underexcited 1 latched	Mask: 0002h	Bit
			Gen. underexcited 2 latched	Mask: 0001h	Bit
11	1,2,3,4	108	Gen. voltage L1-L2	0.1	V
11	5,6	10131	control class latched	Mask: 0040h	Bit
			Alarm class F latched	Mask: 0020h	Bit
			Alarm class E latched	Mask: 0010h	Bit
			Alarm class D latched	Mask: 0008h	Bit
			Alarm class C latched	Mask: 0004h	Bit
			Alarm class B latched	Mask: 0002h	Bit
			Alarm class A latched	Mask: 0001h	Bit
12	1,2	4153	Idle mode OR Ramp to rated state is active (suppresses undervolt, underfreq, ...)	Mask: 8000h	
			Idle mode active	Mask: 4000h	
			Start without closing GCB	Mask: 2000h	
			internal	Mask: 1000h	
			A manual START has been requested	Mask: 0800h	
			A manual START has been requested	Mask: 0400h	
			Cooldown is active	Mask: 0200h	
			Auxiliary services generally active	Mask: 0100h	
			Engine monitoring delay timer has expired	Mask: 0080h	
			Breaker delay timer has expired	Mask: 0040h	
			Engine start is requested	Mask: 0020h	
			Critical mode is active in automatic mode	Mask: 0010h	
			Engine is released (speed governor is enabled)	Mask: 0008h	
			Auxiliary services prerun is active	Mask: 0004h	
			Auxiliary services postrun is active	Mask: 0002h	

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
			Lamp test is active	Mask: 0001h	
12	3,4,5,6	114	Gen. voltage L1-N	0.1	V
13	1,2,3,4	109	Gen. voltage L2-L3	0.1	V
13	5,6	-	internal		
14	1,2,3,4	115	Gen. voltage L2-N	0.1	V
14	5,6	-	internal		
15	1,2,3,4	110	Gen. voltage L3-L1	0.1	V
15	5,6	-	internal		
16	1,2,3,4	116	Gen. voltage 3-N	0.1	V
16	5,6	-	internal		
17	1,2,3,4	2522	Positive reactive generator energy	0,01	Mvar h
17	5,6	-	internal		
18	1,2	5541	Frequency setpoint	0,01	Hz
18	3,4,5,6	5542	Active Power setpoint	0,1	kW
19	1,2,3,4	5640	Voltage setpoint	1	V
19	5,6	5641	Power Factor setpoint	0,001	
20	1,2	4154	Crank (Starter) is active	Mask: 8000h	
			Operating Magnet / Gas relay is active	Mask: 4000h	
			Preglow / Ignition is active	Mask: 2000h	
			Mains settling timer is running	Mask: 1000h	
			Emergency mode is currently active	Mask: 0800h	
			internal	Mask: 0400h	
			PID 3 lower	Mask: 0200h	
			PID 3 raise	Mask: 0100h	
			PID 2 lower	Mask: 0080h	
			PID 2 raise	Mask: 0040h	
			Stopping Magnet is active	Mask: 0020h	
			Excitation AVR	Mask: 0010h	
			The genset runs mains parallel	Mask: 0008h	
			PID 1 lower	Mask: 0004h	
			PID 1 raise	Mask: 0002h	
			Increment Engine Start Counter	Mask: 0001h	
20	3,4	4155	3-Position Controller Freq./Power raise	Mask: 8000h	
			3-Position Controller Freq./Power lower	Mask: 4000h	
			3-Position Controller Volt./ReactPow raise	Mask: 2000h	
			3-Position Controller Volt./ReactPow lower	Mask: 1000h	
			GCB is closed	Mask: 0800h	
			MCB is closed	Mask: 0400h	
			Derating active	Mask: 0200h	
			Synchronization GCB is active	Mask: 0100h	

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
			Opening GCB is active	Mask: 0080h	
			Closing GCB is active	Mask: 0040h	
			Synchronization MCB is active	Mask: 0020h	
			Opening MCB is active	Mask: 0010h	
			Closing MCB is active	Mask: 0008h	
			Unloading generator is active	Mask: 0004h	
			Unloading mains is active	Mask: 0002h	
			Power limited prerun	Mask: 0001h	
20	5,6	4156	GGB is closed	Mask: 8000h	
			GGB is released	Mask: 4000h	
			Synchronisation GGB is active	Mask: 2000h	
			Opening GGB is active	Mask: 1000h	
			Closing GGB is active	Mask: 0800h	
			Dead busbar closure request for GCB or MCB	Mask: 0400h	
			Active power load share is active	Mask: 0200h	
			Reactive power load share is active	Mask: 0100h	
			Generator with a closed GCB is requested	Mask: 0080h	
			LDSS will start this engine	Mask: 0040h	
			LDSS will stop this engine	Mask: 0020h	
			LDSS will stop this engine if possible	Mask: 0010h	
			LDSS Minimum Running Time is active	Mask: 0008h	
			LDSS is active	Mask: 0004h	
			Critical Mode Postrun is active	Mask: 0002h	
			internal	Mask: 0001h	

9.2.3 Protocol 5005 (Mains Values Visualization)

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
0	1,2	-	Protocol ID (always 5005)		–
0	3,4	10100	Pickup speed	1	rpm
0	5,6	-	internal		
1	1,2	147	Mains frequency	0.01	Hz
1	3,4,5,6	173	Av. Mains Wye-Voltage	0.1	V
2	1,2	208	Mains power factor	0.001	
2	3,4,5,6	174	Av. Mains Delta-Voltage	0.1	V
3	1,2,3,4	207	Av. Mains Current	0.1	V
3	5,6	-	internal		
4	1,2	10111	Analog input 1	(changeable)	

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
4	3,4,5,6	134	Mains current L1	0.001	A
5	1,2	10112	Analog input 2	(changeable)	
5	3,4,5,6	140	Total mains power	1	W
6	1,2	10115	Analog input 3	(changeable)	
6	3,4,5,6	150	Total mains reactive power	1	var
7	1,2	2862	Mains ov.freq. 1 latched	Mask: 8000h	Bit
		2863	Mains ov.freq. 2 latched	Mask: 4000h	Bit
		2912	Mains un.freq. 1 latched	Mask: 2000h	Bit
		2913	Mains un.freq. 2 latched	Mask: 1000h	Bit
		2962	Mains ov.volt. 1 latched	Mask: 0800h	Bit
		2963	Mains ov.volt. 2 latched	Mask: 0400h	Bit
		3012	Mains un.volt. 1 latched	Mask: 0200h	Bit
		3013	Mains un.volt. 2 latched	Mask: 0100h	Bit
		3057	Mains phase shift latched	Mask: 0080h	Bit
		3114	Mains decoupling latched	Mask: 0040h	Bit
		-	internal	Mask: 0020h	Bit
		-	internal	Mask: 0010h	Bit
		-	internal	Mask: 0008h	Bit
		3975	Mains phase rot. miswired latched	Mask: 0004h	Bit
		-	internal	Mask: 0002h	Bit
		-	internal	Mask: 0001h	Bit
7	3,4	3217	Mains import power 1 latched	Mask: 8000h	Bit
		3218	Mains import power 2 latched	Mask: 4000h	Bit
		3241	Mains export power 1 latched	Mask: 2000h	Bit
		3242	Mains export power 2 latched	Mask: 1000h	Bit
		2985	Mains overexcited 1 latched	Mask: 0800h	Bit
		2986	Mains overexcited 2 latched	Mask: 0400h	Bit
		3035	Mains underexcited 1 latched	Mask: 0200h	Bit
		3036	Mains underexcited 2 latched	Mask: 0100h	Bit
		3106	Mains df/dt latched	Mask: 0080h	Bit
		2934	Mains act.pwr mismatch latched	Mask: 0040h	Bit
		4958	Mains. Time dep. Voltage latched	Mask: 0020h	Bit
		-	internal	Mask: 0010h	Bit
		8834	Mains Voltage Increase latched	Mask: 0008h	Bit
		-	internal	Mask: 0004h	Bit
		3288	Mains QV Monitoring step 1 latched	Mask: 0002h	Bit
		3289	Mains QV Monitoring step 2 latched	Mask: 0001h	Bit
7	5,6	-	internal		
8	1,2,3,4	118	Mains voltage L1-L2	0.1	V
8	5,6	-	internal		

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
9	1,2,3,4	121	Mains voltage L1-N	0.1	V
9	5,6	-	internal		
10	1,2,3,4	119	Mains voltage L2-L3	0.1	V
10	5,6	-	internal		
11	1,2,3,4	122	Mains voltage L2-N	0.1	V
11	5,6	-	internal		
12	1,2,3,4	120	Mains voltage L3-L1	0.1	V
12	5,6	-	internal		
13	1,2,3,4	123	Mains voltage L3-N	0.1	V
13	5,6	-	internal		

9.2.4 Protocol 5010 (Basic Visualization)

"P1 P2 only: ..." applies to easYgen-XXXX Package P2 only.

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
450001	450000		Protocol-ID, always 5010		–
450002	450001	3181	Scaling Power (16 bits) Exponent 10x W (5;4;3;2)		
450003	450002	3182	Scaling Volts (16 bits) Exponent 10x V (2;1;0;-1)		
450004	450003	3183	Scaling Amps (16 bits) Exponent 10x A (0;-1)		
450005	450004		reserved		
450006	450005		reserved		
450007	450006		reserved		
450008	450007		reserved		
450009	450008		reserved		
AC Generator And Busbar Values					
450010	450009	144	Generator frequency	0.01	Hz
450011	450010	246	Total generator power	scaled defined by index 3181 (modicon Address 450002)	W
450012	450011	247	Total generator reactive power	scaled defined by index 3181 (modicon Address 450002)	var
450013	450012	160	Generator power factor	0.001	

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
450014	450013	248	Generator voltage L1-L2	scaled defined by index 3182 (modicon Address 450003)	V
450015	450014	249	Generator voltage L2-L3	scaled defined by index 3182 (modicon Address 450003)	V
450016	450015	250	Generator voltage L3-L1	scaled defined by index 3182 (modicon Address 450003)	V
450017	450016	251	Generator voltage L1-N	scaled defined by index 3182 (modicon Address 450003)	V
450018	450017	252	Generator voltage L2-N	scaled defined by index 3182 (modicon Address 450003)	V
450019	450018	253	Generator voltage L3-N	scaled defined by index 3182 (modicon Address 450003)	V
450020	450019	255	Generator current 1	scaled defined by index 3183 (modicon Address 450004)	A
450021	450020	256	Generator current 2	scaled defined by index 3183 (modicon Address 450004)	A
450022	450021	257	Generator current 3	scaled defined by index 3183 (modicon Address 450004)	A
450023	450022	209	Busbar 1: Frequency	0.01	Hz
450024	450023	254	Busbar 1: voltage L1-L2	scaled defined by index 3182 (modicon Address 450003)	V
450025	450024		reserved		
450026	450025		reserved		
450027	450026		reserved		
450028	450027		reserved		
450029	450028	5541	Setpoint frequency	1	Hz
450030	450029	5641	Setpoint power factor (cosphi)	1	
AC Mains Values					
450031	450030	147	Mains frequency	0.01	Hz
450032	450031	258	Total mains power	scaled defined by index 3181 (modicon Address 450002)	W
450033	450032	259	Total mains reactive power	scaled defined by index 3181 (modicon Address 450002)	var
450034	450033	208	Mains power factor	0.001	
450035	450034	260	Mains voltage L1-L2	scaled defined by index 3182 (modicon Address 450003)	V
450036	450035	261	Mains voltage L2-L3	scaled defined by index 3182 (modicon Address 450003)	V

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
450037	450036	262	Mains voltage L3-L1	scaled defined by index 3182 (modicon Address 450003)	V
450038	450037	263	Mains voltage L1-N	scaled defined by index 3182 (modicon Address 450003)	V
450039	450038	264	Mains voltage L2-N	scaled defined by index 3182 (modicon Address 450003)	V
450040	450039	265	Mains voltage L3-N	scaled defined by index 3182 (modicon Address 450003)	V
450041	450040	266	Mains current L1	scaled defined by index 3183 (modicon Address 450004)	A
450042	450041		reserved		
450043	450042		reserved		
450044	450043				
450045	450044				
AC System Values					
450046	450045	239	Nominal real power in system	0.01	% (Reference value parameter 1825 ⇘ p. 429.)
450047	450046	240	Real power in system	0.01	% (Reference value parameter 1825 ⇘ p. 429.)
450048	450047	241	Reserve real power in system	0.01	% (Reference value parameter 1825 ⇘ p. 429.)
450049	450048				
450050	450049				
450051	450050				
DC Analogue Values (Engine Values)					
450052	450051	10100	Engine Pickup speed	1	rpm
450053	450052	10110	Battery voltage	0.1	V
450054	450053	10159	AI Auxiliary excitation D+	0.1	V
450055	450054	2540	Engine, number of start requests	1	
450056	450055	2558	Hours until next maintenance	1	h

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
450057	450056	10111	Analog input 1	changeable	
450058	450057	10112	Analog input 2	changeable	
450059	450058	10115	Analog input 3	changeable	
450060	450059	10117	Analog input 4	changeable	
450061	450060	10151	Analog input 5	changeable	
450062	450061	10152	Analog input 6	changeable	
450063	450062	10153	Analog input 7	changeable	
450064	450063	10154	Analog input 8	changeable	
450065	450064	10155	Analog input 9	changeable	
450066	450065	10156	Analog input 10	changeable	
450067	450066		reserved		
450068	450067		reserved		
450069	450068	10310	Analog output 1	0,01	%
450070	450069	10311	Analog output 2	0,01	%
450071	450070		reserved		
450072	450071	10318	Analog output 4	0,01	%
450073	450072	10319	Analog output 5	0,01	%
450074	450073	10320	Analog output 6	0,01	%
450075	450074	10170	External Analog input 1	changeable	
450076	450075	10171	External Analog input 2	changeable	
450077	450076	10172	External Analog input 3	changeable	
450078	450077	10173	External Analog input 4	changeable	
450079	450078	10174	External Analog input 5	changeable	
450080	450079	10175	External Analog input 6	changeable	
450081	450080	10176	External Analog input 7	changeable	
450082	450081	10177	External Analog input 8	changeable	
450083	450082	10178	External Analog input 9	changeable	
450084	450083	10179	External Analog input 10	changeable	
450085	450084	10180	External Analog input 11	changeable	
450086	450085	10181	External Analog input 12	changeable	
450087	450086	10182	External Analog input 13	changeable	
450088	450087	10183	External Analog input 14	changeable	
450089	450088	10184	External Analog input 15	changeable	
450090	450089	10185	External Analog input 16	changeable	
450091	450090	10245	External Analog Output 1	0,01	%
450092	450091	10255	External Analog Output 2	0,01	%
450093	450092	10265	External Analog Output 3	0,01	%
450094	450093	10275	External Analog Output 4	0,01	%
450095	450094	2556	Days until next maintenance	1	days
450096	450095		reserved		

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
450097	450096		reserved		
450098	450097		reserved		
450099	450098		reserved		
Control And Status					
450100	450099	1735	Control mode (STOP/AUTO/MANUAL/ TEST)	Mask: 000Fh 1 = AUTO 2 = STOP 4 = MANUAL	(enum.)
450101	450100	10202	State Display	ID description refer to *Chapter 9.5.3 "Status Messages" on page 966*	(enum.)
450102	450101		reserved		
450103	450102	4153	ControlBits 1		
			Idle mode monitoring (suppresses under-volt,...)	Mask: 8000h	Bit
			Idle mode active	Mask: 4000h	Bit
			Start without closing GCB	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			A manual START has been requested	Mask: 0800h	Bit
			A manual STOP has been requested	Mask: 0400h	Bit
			Cooldown is active	Mask: 0200h	Bit
			Auxiliary services generally active	Mask: 0100h	Bit
			Engine Monitoring delay timer has expired	Mask: 0080h	Bit
			Breaker delay timer has expired	Mask: 0040h	Bit
			Engine start is requested	Mask: 0020h	Bit
			Critical mode is active in automatic mode	Mask: 0010h	Bit
			Engine is released (speed governor is enabled)	Mask: 0008h	Bit
			Auxiliary services prerun is active	Mask: 0004h	Bit
			Auxiliary services postrun is active	Mask: 0002h	Bit
			internal activation of Lamp test	Mask: 0001h	Bit
450104	450103	4154	ControlBits 2		
			Crank (Starter) is active	Mask: 8000h	Bit
			Operating Magnet / Gasrelay is active	Mask: 4000h	Bit
			Preglow / Ignition is active	Mask: 2000h	Bit
			Mains settling timer is running	Mask: 1000h	Bit
			Emergency mode is currently active	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
				Mask: 0200h	Bit
				Mask: 0100h	Bit
				Mask: 0080h	Bit
				Mask: 0040h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			Stopping Magnet is active	Mask: 0020h	Bit
				Mask: 0010h	Bit
			The genset runs mains parallel	Mask: 0008h	Bit
				Mask: 0004h	Bit
				Mask: 0002h	Bit
			Increment Engine Start Counter	Mask: 0001h	Bit
450105	450104	4155	ControlBits 3		
			3-Position Controller Freq./Power raise	Mask: 8000h	Bit
			3-Position Controller Freq./Power lower	Mask: 4000h	Bit
			3-Position Controller Volt./ReactPow raise	Mask: 2000h	Bit
			3-Position Controller Volt./ReactPow lower	Mask: 1000h	Bit
			GCB is closed	Mask: 0800h	Bit
			MCB is closed	Mask: 0400h	Bit
			Power Derating is active	Mask: 0200h	Bit
			Synchronization GCB is active	Mask: 0100h	Bit
			Opening GCB is active	Mask: 0080h	Bit
			Closing GCB is active	Mask: 0040h	Bit
			Synchronization MCB is active	Mask: 0020h	Bit
			Opening MCB is active	Mask: 0010h	Bit
			Closing MCB is active	Mask: 0008h	Bit
			Unloading generator is active	Mask: 0004h	Bit
			Unloading mains is active	Mask: 0002h	Bit
			Power limited prerun	Mask: 0001h	Bit
450106	450105	4156	ControlBits 4		
				Mask: 8000h	Bit
				Mask: 4000h	Bit
				Mask: 2000h	Bit
				Mask: 1000h	Bit
				Mask: 0800h	Bit
			Dead busbar closure request for GCB or MCB or GGB	Mask: 0400h	Bit
			Active power load share is active	Mask: 0200h	Bit
			Reactive power load share is active	Mask: 0100h	Bit
			Generator with a closed GCB is requested	Mask: 0080h	Bit
			LDSS: The Engine shall start	Mask: 0040h	Bit
			LDSS: The Engine shall stopped	Mask: 0020h	Bit
			LDSS: The Engine shall stopped, if possible	Mask: 0010h	Bit
			LDSS: Minimum Running Time is active	Mask: 0008h	Bit
			LDSS: The LDSS function is active	Mask: 0004h	Bit
			The Critical Mode Postrun is active	Mask: 0002h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			AUTOMATIC Run: Switch to Operating Mode STOP	Mask: 0001h	Bit
450107	450106		reserved		
450108	450107		reserved		
Discrete Outputs					
450109	450108	10107	Relay Outputs 1		
			Relay-Output 1 (inverted)	Mask: 8000h	Bit
			Relay-Output 2	Mask: 4000h	Bit
			Relay-Output 3	Mask: 2000h	Bit
			Relay-Output 4	Mask: 1000h	Bit
			Relay-Output 5	Mask: 0800h	Bit
			Relay-Output 6	Mask: 0400h	Bit
			Relay-Output 7	Mask: 0200h	Bit
			Relay-Output 8	Mask: 0100h	Bit
			Relay-Output 9	Mask: 0080h	Bit
			Relay-Output 10	Mask: 0040h	Bit
			Relay-Output 11	Mask: 0020h	Bit
			Relay-Output 12	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450111	450110	8005	Relay Outputs 3		
			External Discrete Output DO 16	Mask: 8000h	Bit
			External Discrete Output DO 15	Mask: 4000h	Bit
			External Discrete Output DO 14	Mask: 2000h	Bit
			External Discrete Output DO 13	Mask: 1000h	Bit
			External Discrete Output DO 12	Mask: 0800h	Bit
			External Discrete Output DO 11	Mask: 0400h	Bit
			External Discrete Output DO 10	Mask: 0200h	Bit
			External Discrete Output DO 09	Mask: 0100h	Bit
			External Discrete Output DO 08	Mask: 0080h	Bit
			External Discrete Output DO 07	Mask: 0040h	Bit
			External Discrete Output DO 06	Mask: 0020h	Bit
			External Discrete Output DO 05	Mask: 0010h	Bit
			External Discrete Output DO 04	Mask: 0008h	Bit
			External Discrete Output DO 03	Mask: 0004h	Bit
			External Discrete Output DO 02	Mask: 0002h	Bit
			External Discrete Output DO 01	Mask: 0001h	Bit
450112	450111	8009	Relay Outputs 4		
			External Discrete Output DO 32	Mask: 8000h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			External Discrete Output DO 31	Mask: 4000h	Bit
			External Discrete Output DO 30	Mask: 2000h	Bit
			External Discrete Output DO 29	Mask: 1000h	Bit
			External Discrete Output DO 28	Mask: 0800h	Bit
			External Discrete Output DO 27	Mask: 0400h	Bit
			External Discrete Output DO 26	Mask: 0200h	Bit
			External Discrete Output DO 25	Mask: 0100h	Bit
			External Discrete Output DO 24	Mask: 0080h	Bit
			External Discrete Output DO 23	Mask: 0040h	Bit
			External Discrete Output DO 22	Mask: 0020h	Bit
			External Discrete Output DO 21	Mask: 0010h	Bit
			External Discrete Output DO 20	Mask: 0008h	Bit
			External Discrete Output DO 19	Mask: 0004h	Bit
			External Discrete Output DO 18	Mask: 0002h	Bit
			External Discrete Output DO 17	Mask: 0001h	Bit
450113	450112	4157	Command to CB-Control 1 (OR)	Mask: 8000h	Bit
			Command to CB-Control 2 (OR)	Mask: 4000h	Bit
			Command to CB-Control 3 (OR)	Mask: 2000h	Bit
			Command to CB-Control 4 (OR)	Mask: 1000h	Bit
			Command to CB-Control 5 (OR)	Mask: 0800h	Bit
			Command to CB-Control 6 (OR)	Mask: 0400h	Bit
			Gen excitation limit active	Mask: 0200h	Bit
			Neutral Interlocking	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450114	450113		reserved		
Alarm Management					
General					
450115	450114	10131	Alarm Class Latched		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			Alarm class F latched	Mask: 0020h	Bit
			Alarm class E latched	Mask: 0010h	Bit
			Alarm class D latched	Mask: 0008h	Bit
			Alarm class C latched	Mask: 0004h	Bit
			Alarm class B latched	Mask: 0002h	Bit
			Alarm class A latched	Mask: 0001h	Bit
450116	450115	10149	Alarms 2 latched (unacknowledged)		
		3064	GCB sync. Timeout	Mask: 8000h	Bit
		3074	MCB sync. Timeout	Mask: 4000h	Bit
		3084	GGB sync. Timeout	Mask: 2000h	Bit
		4056	Charge alt. low voltage (D+)	Mask: 1000h	Bit
		2944	Phase rotation mismatch	Mask: 0800h	Bit
		10089	CAN bus overload	Mask: 0400h	Bit
		10083	internal	Mask: 0200h	Bit
		10082	internal	Mask: 0100h	Bit
		10086	internal	Mask: 0080h	Bit
		10085	internal	Mask: 0040h	Bit
		10088	CANopen error at CAN Interface 2	Mask: 0020h	Bit
		4073	Parameter Alignment	Mask: 0010h	Bit
		4064	Missing members on CAN	Mask: 0008h	Bit
		1714*	EEPROM failure *) easYgen-3000 only, not easYgen-3000XT series	Mask: 0004h	Bit
		15125	Red stop lamp DM1	Mask: 0002h	Bit
		15126	Amber warning lamp DM1	Mask: 0001h	Bit
450117	450116	-	Alarms 2 active (reserved)		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450118	450117	10190	Alarms 3 latched (unacknowledged)		
		3089	internal	Mask: 8000h	Bit
		3090	GGB fail to open	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
		14575	Temperature deviation level 1	Mask: 0800h	Bit
		14576	Temperature deviation level 2	Mask: 0400h	Bit
		14584	Temperature deviation wire break	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450119	450118	-	Alarms 3 active (reserved)		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450120	450119		reserved		
Engine					
450121	450120	10133	Alarms 1 latched (unacknowledged)		
		2112	Overspeed 1	Mask: 8000h	Bit
		2113	Overspeed 2	Mask: 4000h	Bit
		2162	Underspeed 1	Mask: 2000h	Bit
		2163	Underspeed 2	Mask: 1000h	Bit
		2652	Unintended stop	Mask: 0800h	Bit
		2457	Speed det. Alarm	Mask: 0400h	Bit
		2504	Shutdown malfunct.	Mask: 0200h	Bit
		2603	GCB fail to close	Mask: 0100h	Bit
		2604	GCB fail to open	Mask: 0080h	Bit
		2623	MCB fail to close	Mask: 0040h	Bit
		2624	MCB fail to open	Mask: 0020h	Bit
		10017	CAN-Fault J1939	Mask: 0010h	Bit
		3325	Start fail	Mask: 0008h	Bit
		2560	Mainten. days exceeded	Mask: 0004h	Bit
		2561	Mainten. hours exceeded	Mask: 0002h	Bit
		10087	CANopen error at CAN Interface 1	Mask: 0001h	Bit
450122	450121	-	Alarms 1 active (reserved)		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450123	450122	10136	Alarms Analog Inputs 1 latched (unacknowl-edged)		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
		1008	Batt. overvolt.2	Mask: 0008h	Bit
		1007	Batt. undervolt.2	Mask: 0004h	Bit
		1006	Batt. overvolt.1	Mask: 0002h	Bit
		1005	Batt. undervolt.1	Mask: 0001h	Bit
450124	450123	-	Alarms Analog Inputs 1 active (reserved)		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450125	450124		reserved		
450126	450125		reserved		

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
Generator					
450127	450126	10134	Alarms Generator latched (unacknowl-edged)		
		1912	Gen. overfreq. 1	Mask: 8000h	Bit
		1913	Gen. overfreq. 2	Mask: 4000h	Bit
		1962	Gen. underfreq. 1	Mask: 2000h	Bit
		1963	Gen. underfreq. 2	Mask: 1000h	Bit
		2012	Gen. overvolt. 1	Mask: 0800h	Bit
		2013	Gen. overvolt. 2	Mask: 0400h	Bit
		2062	Gen. undervolt. 1	Mask: 0200h	Bit
		2063	Gen. undervolt. 2	Mask: 0100h	Bit
		2218	Gen. overcurr. 1	Mask: 0080h	Bit
		2219	Gen. overcurr. 2	Mask: 0040h	Bit
		2220	Gen. overcurr. 3	Mask: 0020h	Bit
		2262	Gen. Rv/Rd pow.1	Mask: 0010h	Bit
		2263	Gen. Rv/Rd pow.2	Mask: 0008h	Bit
		2314	Gen. Overload IOP 1	Mask: 0004h	Bit
		2315	Gen. Overload IOP 2	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450128	450127	-	Alarms Generator active (reserved)		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450129	450128	10138	Alarms Generator 1 latched (unacknowl-edged)		
		2412	Unbal. load 1	Mask: 8000h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
		2413	Unbal. load 2	Mask: 4000h	Bit
		3907	Gen. Asymmetry	Mask: 2000h	Bit
		3263	Ground fault 1	Mask: 1000h	Bit
		3264	Ground fault 2	Mask: 0800h	Bit
		3955	Gen. phase rot. misw.	Mask: 0400h	Bit
		2924	Gen act. pwr mismatch	Mask: 0200h	Bit
		3124	Gen. unloading fault	Mask: 0100h	Bit
		4038	Inv. time ov.curr.	Mask: 0080h	Bit
		2664	Operating range failed,	Mask: 0040h	Bit
		2362	Gen. Overload MOP 1	Mask: 0020h	Bit
		2363	Gen. Overload MOP 2	Mask: 0010h	Bit
		2337	Gen. overexcited 1	Mask: 0008h	Bit
		2338	Gen. overexcited 2	Mask: 0004h	Bit
		2387	Gen. underexcited 1	Mask: 0002h	Bit
		2388	Gen. underexcited 2	Mask: 0001h	Bit
450130	450129	-	Alarms Generator 1 active (reserved)		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450131	450130		reserved		
450132	450131		reserved		
Mains					
450133	450132	10135	Alarms Mains latched (unacknowledged)		
		2862	Mains ov.freq. 1	Mask: 8000h	Bit
		2863	Mains ov.freq. 2	Mask: 4000h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
		2912	Mains un.freq. 1	Mask: 2000h	Bit
		2913	Mains un.freq. 2	Mask: 1000h	Bit
		2962	Mains ov.volt. 1	Mask: 0800h	Bit
		2963	Mains ov.volt. 2	Mask: 0400h	Bit
		3012	Mains un.volt. 1	Mask: 0200h	Bit
		3013	Mains un.volt. 2	Mask: 0100h	Bit
		3057	Mains phaseshift	Mask: 0080h	Bit
		3114	Mains decoupling	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
		3975	Mains phase rot. Miswired	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450134	450133	-	Alarms Mains active (reserved)		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450135	450134	4189	Alarms Mains 1 latched (unacknowledged)		
		3217	Mains import power 1	Mask: 8000h	Bit
		3218	Mains import power 2	Mask: 4000h	Bit
		3241	Mains export power 1	Mask: 2000h	Bit
		3242	Mains export power 2	Mask: 1000h	Bit
		2985	Mains overexcited 1	Mask: 0800h	Bit
		2986	Mains overexcited 2	Mask: 0400h	Bit
		3035	Mains underexcited 1	Mask: 0200h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
		3036	Mains underexcited 2	Mask: 0100h	Bit
		3106	Mains df/dt	Mask: 0080h	Bit
		2934	Mns act. pwr mismatch	Mask: 0040h	Bit
				Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
		8834	Mains Voltage Increase	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
				Mask: 0002h	Bit
				Mask: 0001h	Bit
450136	450135	-	Alarms Mains 1 active (reserved)		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450137	450136		reserved		
450138	450137		reserved		
Digital Inputs					
450139	450138	10132	Alarms Digital Inputs 1 latched (unacknowl-edged)		
		10600	Digital Input 1	Mask: 8000h	Bit
		10601	Digital Input 2	Mask: 4000h	Bit
		10602	Digital Input 3	Mask: 2000h	Bit
		10603	Digital Input 4	Mask: 1000h	Bit
		10604	Digital Input 5	Mask: 0800h	Bit
		10605	Digital Input 6	Mask: 0400h	Bit
		10607	Digital Input 7	Mask: 0200h	Bit
		10608	Digital Input 8 (reply GCB)	Mask: 0100h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
		10609	Digital Input 9	Mask: 0080h	Bit
		10610	Digital Input 10	Mask: 0040h	Bit
		10611	Digital Input 11	Mask: 0020h	Bit
		10612	Digital Input 12	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450140	450139	-	Alarms Digital Inputs 1 active (reserved)		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450141	450140	16377	Alarms External Digital Inputs latched (unacknowledged)		
		16376	State external Digital Input 16	Mask: 8000h	Bit
		16375	External Digital Input 15	Mask: 4000h	Bit
		16374	External Digital Input 14	Mask: 2000h	Bit
		16373	External Digital Input 13	Mask: 1000h	Bit
		16372	External Digital Input 12	Mask: 0800h	Bit
		16371	External Digital Input 11	Mask: 0400h	Bit
		16370	External Digital Input 10	Mask: 0200h	Bit
		16369	External Digital Input 9	Mask: 0100h	Bit
		16368	External Digital Input 8	Mask: 0080h	Bit
		16367	External Digital Input 7	Mask: 0040h	Bit
		16366	External Digital Input 6	Mask: 0020h	Bit
		16365	External Digital Input 5	Mask: 0010h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
		16364	External Digital Input 4	Mask: 0008h	Bit
		16362	External Digital Input 3	Mask: 0004h	Bit
		16361	External Digital Input 2	Mask: 0002h	Bit
		16360	External Digital Input 1	Mask: 0001h	Bit
450142	450141	-	Alarms External Digital Inputs active (reserved)		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450143	450142	-	Alarm External Digital Inputs 1 latched (unacknowledged)		
		16352	internal	Mask: 8000h	Bit
		16342		Mask: 4000h	Bit
		16332		Mask: 2000h	Bit
		16322		Mask: 1000h	Bit
		16312		Mask: 0800h	Bit
		16302		Mask: 0400h	Bit
		16292		Mask: 0200h	Bit
		16282		Mask: 0100h	Bit
		16272		Mask: 0080h	Bit
		16262		Mask: 0040h	Bit
		16252		Mask: 0020h	Bit
		16242		Mask: 0010h	Bit
		16232		Mask: 0008h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
		16222		Mask: 0004h	Bit
		16212		Mask: 0002h	Bit
		16202		Mask: 0001h	Bit
450144	450143	-	Alarm External Digital Inputs 1 active (reserved)		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450145	450144	-	internal		
450146	450145	-	Alarms Digital Inputs 2 active (reserved)		
			reserved		
			reserved		
			reserved		
			reserved		
			reserved		
			reserved		
			reserved		
			reserved		
			reserved		
			reserved		
			reserved		
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450147	450146		reserved		
450148	450147		reserved		
450149	450148		reserved		
450150	450149		reserved		
Flexible Thresholds					
450151	450150	-	Alarms Flexible thresholds 1-16 latched (unacknowledged)		
		10033	Alarm flexible limit 16	Mask: 8000h	Bit
		10032	Alarm flexible limit 15	Mask: 4000h	Bit
		10031	Alarm flexible limit 14	Mask: 2000h	Bit
		10030	Alarm flexible limit 13	Mask: 1000h	Bit
		10029	Alarm flexible limit 12	Mask: 0800h	Bit
		10028	Alarm flexible limit 11	Mask: 0400h	Bit
		10027	Alarm flexible limit 10	Mask: 0200h	Bit
		10026	Alarm flexible limit 9	Mask: 0100h	Bit
		10025	Alarm flexible limit 8	Mask: 0080h	Bit
		10024	Alarm flexible limit 7	Mask: 0040h	Bit
		10023	Alarm flexible limit 6	Mask: 0020h	Bit
		10022	Alarm flexible limit 5	Mask: 0010h	Bit
		10021	Alarm flexible limit 4	Mask: 0008h	Bit
		10020	Alarm flexible limit 3	Mask: 0004h	Bit
		10019	Alarm flexible limit 2	Mask: 0002h	Bit
		10018	Alarm flexible limit 1	Mask: 0001h	Bit
450152	450151	-	Alarms Flexible thresholds 1-16 active (reserved)		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450153	450152	-	Alarms Flexible thresholds 17-32 latched (unacknowledged)		
		10049	Alarm flexible limit 32	Mask: 8000h	Bit
		10048	Alarm flexible limit 31	Mask: 4000h	Bit
		10047	Alarm flexible limit 30	Mask: 2000h	Bit
		10046	Alarm flexible limit 29	Mask: 1000h	Bit
		10045	Alarm flexible limit 28	Mask: 0800h	Bit
		10044	Alarm flexible limit 27	Mask: 0400h	Bit
		10043	Alarm flexible limit 26	Mask: 0200h	Bit
		10042	Alarm flexible limit 25	Mask: 0100h	Bit
		10041	Alarm flexible limit 24	Mask: 0080h	Bit
		10040	Alarm flexible limit 23	Mask: 0040h	Bit
		10039	Alarm flexible limit 22	Mask: 0020h	Bit
		10038	Alarm flexible limit 21	Mask: 0010h	Bit
		10037	Alarm flexible limit 20	Mask: 0008h	Bit
		10036	Alarm flexible limit 19	Mask: 0004h	Bit
		10035	Alarm flexible limit 18	Mask: 0002h	Bit
		10034	Alarm flexible limit 17	Mask: 0001h	Bit
450154	450153	-	Alarms Flexible thresholds 17-32 active (reserved)		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450155	450154		Alarms Flexible thresholds 33-40 latched (unacknowledged)		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
		10057	Alarm flexible limit 40	Mask: 0080h	Bit
		10056	Alarm flexible limit 39	Mask: 0040h	Bit
		10055	Alarm flexible limit 38	Mask: 0020h	Bit
		10054	Alarm flexible limit 37	Mask: 0010h	Bit
		10053	Alarm flexible limit 36	Mask: 0008h	Bit
		10052	Alarm flexible limit 35	Mask: 0004h	Bit
		10051	Alarm flexible limit 34	Mask: 0002h	Bit
		10050	Alarm flexible limit 33	Mask: 0001h	Bit
450156	450155		Alarms Flexible thresholds 33-40 active (reserved)		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450157	450156		reserved		
450158	450157		reserved		

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
450159	450158		reserved		
DC Analogue Values Wirebreak					
450160	450159	10137	Alarms Analog Inputs Wire Break latched (unacknowledged)		
			internal	Mask: 0001h	Bit
		10014	Analog inp. 1, wire break	Mask: 0002h	Bit
		10015	Analog inp. 2, wire break	Mask: 0004h	Bit
		10060	Analog inp. 3, wire break	Mask: 0008h	Bit
		10061	Analog inp. 4, wire break or shortcut, P2	Mask: 0010h	Bit
		10062	Analog inp. 5, wire break or shortcut, P2	Mask: 0020h	Bit
		10063	Analog inp. 6, wire break or shortcut, P2	Mask: 0040h	Bit
		10064	Analog inp. 7, wire break or shortcut, P2	Mask: 0080h	Bit
		10065	Analog inp. 8, wire break or shortcut, P2	Mask: 0100h	Bit
		10066	Analog inp. 9, wire break or shortcut, P2	Mask: 0200h	Bit
		10067	Analog inp. 10, wire break or shortcut, P2	Mask: 0400h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450161	450160		Alarms Analog Inputs Wire Break active (reserved)		
			internal	Mask: 0001h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			internal	Mask: 8000h	Bit
450162	450161	-	Alarms External Analog Inputs Wire Break latched (unacknowledged)		
		10221		Mask: 0001h	Bit
		10222		Mask: 0002h	Bit
		10223		Mask: 0004h	Bit
		10224		Mask: 0008h	Bit
		10225		Mask: 0010h	Bit
		10226		Mask: 0020h	Bit
		10227		Mask: 0040h	Bit
		10228		Mask: 0080h	Bit
		10229		Mask: 0100h	Bit
		10230		Mask: 0200h	Bit
		10231		Mask: 0400h	Bit
		10232		Mask: 0800h	Bit
		10233		Mask: 1000h	Bit
		10234		Mask: 2000h	Bit
		10235		Mask: 4000h	Bit
		10236		Mask: 8000h	Bit
450163	450162	-	Alarms External Analog Inputs Wire Break active (reserved)		
			internal	Mask: 0001h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
450164	450163		reserved		
450165	450164		reserved		
Alarms					
450166	450165	5195	internal	Mask: 8000h	Bit
		5189	internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
		5159	internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450167	450166	-	special Alarms active (reserved)		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
450168	450167		reserved		
450169	450168		reserved		
450170	450169		reserved		
450171	450170		reserved		
Engine Management					
Active Diagnostic Trouble Code (DM1)					
450172	450171	15400	SPN of 1. entry	low 16 bits of 19 bits of SPN	
450173	450172	15401 15402	FMI / OC of 1. entry	Hi-Byte: FMI Lo-Byte: OC	
450174	450173	15403	SPN of 2. entry	low 16 bits of 19 bits of SPN	
450175	450174	15404 15405	FMI / OC of 2. entry	Hi-Byte: FMI Lo-Byte: OC	
450176	450175	15406	SPN of 3. entry	low 16 bits of 19 bits of SPN	
450177	450176	15407 15408	FMI / OC of 3. entry	Hi-Byte: FMI Lo-Byte: OC	
450178	450177	15409	SPN of 4. entry	low 16 bits of 19 bits of SPN	
450179	450178	15410 15411	FMI / OC of 4. entry	Hi-Byte: FMI Lo-Byte: OC	
450180	450179	15412	SPN of 5. entry	low 16 bits of 19 bits of SPN	
450181	450180	15413 15414	FMI / OC of 5. entry	Hi-Byte: FMI Lo-Byte: OC	
450182	450181	15415	SPN of 6. entry	low 16 bits of 19 bits of SPN	
450183	450182	15416 15418	FMI / OC of 6. entry	Hi-Byte: FMI Lo-Byte: OC	
450184	450183	15419	SPN of 7. entry	low 16 bits of 19 bits of SPN	
450185	450184	15420 15421	FMI / OC of 7. entry	Hi-Byte: FMI Lo-Byte: OC	
450186	450185	15422	SPN of 8. entry	low 16 bits of 19 bits of SPN	
450187	450186	15423 15424	FMI / OC of 8. entry	Hi-Byte: FMI Lo-Byte: OC	
450188	450187	15425	SPN of 9. entry	low 16 bits of 19 bits of SPN	
450189	450188	15426 15427	FMI / OC of 9. entry	Hi-Byte: FMI Lo-Byte: OC	
450190	450189	15428	SPN of 10. entry	low 16 bits of 19 bits of SPN	
450191	450190	15429 15430	FMI / OC of 10. entry	Hi-Byte: FMI Lo-Byte: OC	
DM1 Lamp Status					
450192	450191	15395	J1939 Lamp Status DM1		
			internal	Mask 8000h	
			internal	Mask 4000h	
			On Malfunction Lamp	Mask 2000h	
			Off Malfunction Lamp	Mask 1000h	
			internal	Mask 0800h	
			internal	Mask 0400h	
			On Red Stop Lamp	Mask 0200h	
			Off Red Stop Lamp	Mask 0100h	
			internal	Mask 0080h	
			internal	Mask 0040h	
			On Amber Warning Lamp	Mask 0020h	
			Off Amber Warning Lamp	Mask 0010h	

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			internal	Mask 0008h	
			internal	Mask 0004h	
			On Protect Lamp	Mask 0002h	
			Off Protect Lamp	Mask 0001h	
DM2 Lamp Status					
450193	450192	15445	J1939 Lamp Status DM2		
			internal	Mask 8000h	
			internal	Mask 4000h	
			On Malfunction Lamp	Mask 2000h	
			Off Malfunction Lamp	Mask 1000h	
			internal	Mask 0800h	
			internal	Mask 0400h	
			On Red Stop Lamp	Mask 0200h	
			Off Red Stop Lamp	Mask 0100h	
			internal	Mask 0080h	
			internal	Mask 0040h	
			On Amber Warning Lamp	Mask 0020h	
			Off Amber Warning Lamp	Mask 0010h	
			internal	Mask 0008h	
			internal	Mask 0004h	
			On Protect Lamp	Mask 0002h	
			Off Protect Lamp	Mask 0001h	
Special Failure Codes					
450194	450193	15109	J1939 MTU ADEC ECU Failure Codes	1	
450195	450194		reserved		
450196	450195	15304	J1939 Engine Stop Information (e.g., DEUTZ-specific EMR2 J1939-Message). Please refer to specific ECU documentation for details.	"Missing" Value="65535" "Error" Value="65279" Engine stop information value is 0 to 250	
450197	450196		reserved		
450198	450197	15305	J1939 DLN2-Message Scania S6		
			Engine Coolant Temperature		
			J1939-Message not available	Mask 8000h	
			Sensor fault	Mask 4000h	
			High Temperature.	Mask 2000h	
			NOT High Temperature	Mask 1000h	
			Engine Oil Pressure		
			J1939-Message not available	Mask 0800h	
			Sensor fault	Mask 0400h	
			Low Pressure	Mask 0200h	
			NOT Low Pressure	Mask 0100h	

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			High Engine Oil Level		
			J1939-Message not available	Mask 0080h	
			Sensor fault	Mask 0040h	
			High Level	Mask 0020h	
			NOT High Level	Mask 0010h	
			Low Engine Oil Level		
			J1939-Message not available	Mask 0008h	
			Sensor fault	Mask 0004h	
			Low Level	Mask 0002h	
			NOT Low Level	Mask 0001h	
450199	450198		reserved		
450200	450199		reserved		
450201	450200		reserved		
Values					
450202	450201	15308	Engine Speed (SPN 190)	1	rpm
450203	450202	15202	Engine Coolant Temperature (SPN 110)	1	°C
450204	450203	15203	Fuel temperature (SPN 174)	1	°C
450205	450204	15309	Engine Oil Temperature 1 (SPN 175)	0,1	°C
450206	450205	15205	Engine Oil Pressure (SPN 100)	1	kPa
450207	450206	15307	Fuel Rate (SPN 183)	0,1	L/h
450208	450207	15206	Coolant Level (SPN 111)	0,1	%
450209	450208	15207	Throttle position (SPN 91)	0,1	%
450210	450209	15208	Load at current Speed (SPN 92)	1	%
450211	450210	15210	Engine oil level (SPN 98)	0,1	%
450212	450211	15214	Boost pressure (SPN 102)	1	kPa
450213	450212	15215	Intake Manifold 1 Temp (SPN 105)	1	°C
450214	450213	15212	Barometric Pressure (SPN 108)	0,1	kPa
450215	450214	15213	Air inlet temperature (SPN 172)	1	°C
450216	450215	15209	Actual engine torque (SPN 513)	1	%
450217	450216	15299	Exhaust Gas Temp.(SPN 173)	0,1	°C
450218	450217	15217	Engine Intercooler Temp (SPN52)	1	°C
450219	450218	15218	Fuel Delivery Pressure (SPN94)	1	kPa
450220	450219	15219	Fuel Filter Differential Pressure (SPN95)	1	kPa
450221	450220	15220	Crankcase Pressure (SPN101)	1	kPa
450222	450221	15221	Turbo Air Inlet Pressure (SPN106)	1	kPa
450223	450222	15222	Air Filter 1 Differential Pressure (SPN107)	0,01	kPa
450224	450223	15223	Coolant Pressure (SPN109)	1	kPa
450225	450224	15224	Transmission Oil Pressure (SPN127)	1	kPa
450226	450225	15225	Fuel Rail Pressure (SPN157)	0,1	MPa
450227	450226	15226	Ambient Air Temperature (SPN171)	0,1	°C

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
450228	450227	15227	Turbo Oil Temperature (SPN176)	0,1	°C
450229	450228	15228	Transmission Oil Temperature (SPN177)	0,1	°C
450230	450229	15229	Auxiliary Temperature 1 (SPN441)	1	°C
450231	450230	15230	Auxiliary Temperature 2 (SPN442)	1	°C
450232	450231	15209	Actual Engine Torque (SPN513)	1	%
450233	450232	15231	Alternator Bear. 1 Temperature (SPN1122)	1	°C
450234	450233	15232	Alternator Bear. 2 Temperature (SPN1123)	1	°C
450235	450234	15233	Alternator Wind. 1 Temperature (SPN1124)	1	°C
450236	450235	15234	Alternator Wind. 2 Temperature (SPN1125)	1	°C
450237	450236	15235	Alternator Wind. 3 Temperature (SPN1126)	1	°C
450238	450237	15236	Intake Manifold 2 Temperature (SPN1131)	1	°C
450239	450238	15237	Intake Manifold 3 Temperature (SPN1132)	1	°C
450240	450239	15238	Intake Manifold 4 Temperature (SPN1133)	1	°C
450241	450240	15239	Engine Intercooler Thermostat Opening (SPN1134)	0,1	%
450242	450241	15240	Engine Oil Temperature 2 (SPN1135)	0,1	°C
450243	450242	15241	Engine ECU Temperature (SPN1136)	0,1	°C
450244	450243	15242	Exhaust Gas Port 1 Temperatures (SPN1137)	0,1	°C
450245	450244	15243	Exhaust Gas Port 2 Temperatures (SPN1138)	0,1	°C
450246	450245	15244	Exhaust Gas Port 3 Temperatures (SPN1139)	0,1	°C
450247	450246	15245	Exhaust Gas Port 4 Temperatures (SPN1140)	0,1	°C
450248	450247	15246	Exhaust Gas Port 5 Temperatures (SPN1141)	0,1	°C
450249	450248	15247	Exhaust Gas Port 6 Temperatures (SPN1142)	0,1	°C
450250	450249	15248	Exhaust Gas Port 7 Temperatures (SPN1143)	0,1	°C
450251	450250	15249	Exhaust Gas Port 8 Temperatures (SPN1144)	0,1	°C
450252	450251	15250	Exhaust Gas Port 9 Temperatures (SPN1145)	0,1	°C
450253	450252	15251	Exhaust Gas Port 10 Temperatures (SPN1146)	0,1	°C
450254	450253	15252	Exhaust Gas Port 11 Temperatures (SPN1147)	0,1	°C
450255	450254	15253	Exhaust Gas Port 12 Temperatures (SPN1148)	0,1	°C
450256	450255	15254	Exhaust Gas Port 13 Temperatures (SPN1149)	0,1	°C
450257	450256	15255	Exhaust Gas Port 14 Temperatures (SPN1150)	0,1	°C
450258	450257	15256	Exhaust Gas Port 15 Temperatures (SPN1151)	0,1	°C

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
450259	450258	15257	Exhaust Gas Port 16 Temperatures (SPN1152)	0,1	°C
450260	450259	15258	Exhaust Gas Port 17 Temperatures (SPN1153)	0,1	°C
450261	450260	15259	Exhaust Gas Port 18 Temperatures (SPN1154)	0,1	°C
450262	450261	15260	Exhaust Gas Port 19 Temperatures (SPN1155)	0,1	°C
450263	450262	15261	Exhaust Gas Port 20 Temperatures (SPN1156)	0,1	°C
450264	450263	15262	Main Bearing 1 Temperatures (SPN1157)	0,1	°C
450265	450264	15263	Main Bearing 2 Temperatures (SPN1158)	0,1	°C
450266	450265	15264	Main Bearing 3 Temperatures (SPN1159)	0,1	°C
450267	450266	15265	Main Bearing 4 Temperatures (SPN1160)	0,1	°C
450268	450267	15266	Main Bearing 5 Temperatures (SPN1161)	0,1	°C
450269	450268	15267	Main Bearing 6 Temperatures (SPN1162)	0,1	°C
450270	450269	15268	Main Bearing 7 Temperatures (SPN1163)	0,1	°C
450271	450270	15269	Main Bearing 8 Temperatures (SPN1164)	0,1	°C
450272	450271	15270	Main Bearing 9 Temperatures (SPN1165)	0,1	°C
450273	450272	15271	Main Bearing 10 Temperatures (SPN1166)	0,1	°C
450274	450273	15272	Main Bearing 11 Temperatures (SPN1167)	0,1	°C
450275	450274	15273	Turbo 1 Compressor Inlet Temperatures (SPN1172)	0,1	°C
450276	450275	15274	Turbo 2 Compressor Inlet Temperatures (SPN1173)	0,1	°C
450277	450276	15275	Turbo 3 Compressor Inlet Temperatures (SPN1174)	0,1	°C
450278	450277	15276	Turbo 4 Compressor Inlet Temperatures (SPN1175)	0,1	°C
450279	450278	15277	Turbo 1 Compressor Inlet Pressure (SPN1176)	1	kPa
450280	450279	15278	Turbo 2 Compressor Inlet Pressure (SPN1177)	1	kPa
450281	450280	15279	Turbo 3 Compressor Inlet Pressure (SPN1178)	1	kPa
450282	450281	15280	Turbo 4 Compressor Inlet Pressure (SPN1179)	1	kPa
450283	450282	15281	Turbo 1 Turbine Inlet Temperature (SPN1180)	0,1	°C
450284	450283	15282	Turbo 2 Turbine Inlet Temperature (SPN 1181)	0,1	°C
450285	450284	15283	Turbo 3 Turbine Inlet Temperature (SPN 1182)	0,1	°C
450286	450285	15284	Turbo 4 Turbine Inlet Temperature (SPN1183)	0,1	°C
450287	450286	15285	Turbo 1 Turbine Outlet Temperature (SPN1184)	0,1	°C
450288	450287	15286	Turbo 2 Turbine Outlet Temperature (SPN1185)	0,1	°C

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
450289	450288	15287	Turbo 3 Turbine Outlet Temperature (SPN 1186)	0,1	°C
450290	450289	15288	Turbo 4 Turbine Outlet Temperature (SPN1187)	0,1	°C
450291	450290	15289	Engine Aux. Coolant Pressure (SPN1203)	1	kPa
450292	450291	15290	Pre-filter Oil Pressure (SPN1208)	1	kPa
450293	450292	15291	Engine Aux. Coolant Temperature (SPN1212)	1	°C
450294	450293	15292	Fuel Filter Differential Pressure (SPN1382)	1	kPa
450295	450294	15293	Battery 1 Temperature (SPN1800)	1	°C
450296	450295	15294	Battery 2 Temperature (SPN1801)	1	°C
450297	450296	15295	Intake Manifold 5 Temperature (SPN1802)	1	°C
450298	450297	15296	Intake Manifold 6 Temperature (SPN1803)	1	°C
450299	450298	15297	Right Exhaust Gas Temperature (SPN2433)	0.1	°C
450300	450299	15298	Left Exhaust Gas Temperature (SPN2434)	0.1	°C
450301	450300	15310	Engine Turbocharger 1 Compressor Outlet Temperature (SPN2629)	0.1	°C
450302	450301	15311	Engine Derate Request (SPN3644)	0.1	%
450303	450302	15312	Batterie Potential (SPN0158)	0.1	V
450304	450303	15313	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Level (SPN1761)	0.1	%
450305	450304	15314	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Temperature (SPN3031)	1	°C
450306	450305	15315	Aftertreatment 1 Diesel Exhaust Fluid Tank 2 Level (SPN4367)	0.1	%
450307	450306	15316	Aftertreatment 1 Diesel Exhaust Fluid Tank 2 Temperature (SPN4368)	1	°C
450308	450307	12807	Exhaust Gas Temperature Average(SPN 4151)	0.1	%
450309	450308	12809	Exhaust Gas Temperature Average Bank 1 (SPN 4153)	0.1	%
450310	450309	12812	Exhaust Gas Temperature Average Bank 2 (SPN 4152)	0.1	%
450311	450310		reserved		
450312	450311		reserved		
450313	450312		reserved		
450314	450313		reserved		
450315	450314		reserved		
450316	450315		reserved		
450317	450316		reserved		
450318	450317		reserved		
450319	450318		reserved		
450320	450319		reserved		
450321	450320		reserved		
450322	450321		reserved		

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
AC Generator And Busbar Values (Long - 32 bits)					
450323	450322	135	Total gen. power	1	W
450325	450324	136	Total gen. reactive power	1	var
450327	450326	137	Total gen. apparent power	1	VA
450329	450328	170	Av. Gen. Wye-Voltage	0.1	V
450331	450330	171	Av. Gen. Delta-Voltage	0.1	V
450333	450332	216	Av. Busbar 1 Delta-Voltage	0.1	V
450335	450334	185	Av. Gen. Current	0.001	A
450337	450336	111	Gen. current 1	0.001	A
450339	450338	112	Gen. current 2	0.001	A
450341	450340	113	Gen. current 3	0.001	A
450343	450342	161	Meas. ground current	0.001	A
450345	450344	159	Calculated ground current	0.001	A
450347	450346	108	Gen. voltage L1-L2	0.1	V
450349	450348	109	Gen. voltage L2-L3	0.1	V
450351	450350	110	Gen. voltage L3-L1	0.1	V
450353	450352	114	Gen. voltage L1-N	0.1	V
450355	450354	115	Gen. voltage L2-N	0.1	V
450357	450356	116	Gen. voltage L3-N	0.1	V
450359	450358	125	Gen. active power 1-N	1	W
450361	450360	126	Gen. active power 2-N	1	W
450363	450362	127	Gen. active power 3-N	1	W
450365	450364	182	Busbar 1: voltage L1-L2	0.1	V
450367	450366	2520	Gen. real energy	0,01	MWh
450369	450368	2522	Gen. positive reactive energy	0,01	Mvarh
450371	450370	2568	Gen. hours of operation	0,01	h
450373	450372	5542	Setpoint active power	0,1	kW
450375	450374	5640	Setpoint voltage	1	V
450377	450376		reserved		
450379	450378		reserved		
450381	450380		reserved		
450383	450382		reserved		
AC Mains Values (Long - 32 bits)					
450385	450384	140	Total mains power	1	W
450387	450386	150	Total mains reactive power	1	var
450389	450388	173	Av. Mains Wye-Voltage	0.1	V
450391	450390	174	Av. Mains Delta-Voltage	0.1	V
450393	450392	207	Av. Mains Current	0.001	A
450395	450394	134	Mains current L1	0.001	A
450397	450396		reserved		

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
450399	450398		reserved		
450401	450400	118	Mains voltage L1-L2	0.1	V
450403	450402	119	Mains voltage L2-L3	0.1	V
450405	450404	120	Mains voltage L3-L1	0.1	V
450407	450406	121	Mains voltage L1-N	0.1	V
450409	450408	122	Mains voltage L2-N	0.1	V
450411	450410	123	Mains voltage L3-N	0.1	V
AC System Values (Long - 32 bits)					
450413	450412	217	Reserve real power in system (only valid if LDSS is on)	1	kW
450415	450414	218	Real power in system (only valid if LDSS is on)	1	kW
450417	450416	219	Nominal real power in system (only valid if LDSS is on)	1	kW
450419	450418		reserved		
450421	450420		reserved		
450423	450422		reserved		
Engine Management (Long - 32 bits)					
Active Diagnostic Trouble Code (DM1)					
450425	450424	15400	SPN of 1. entry	full 19 bits of SPN	
450427	450426	15403	SPN of 2. entry	full 19 bits of SPN	
450429	450428	15406	SPN of 3. entry	full 19 bits of SPN	
450431	450430	15409	SPN of 4. entry	full 19 bits of SPN	
450433	450432	15412	SPN of 5. entry	full 19 bits of SPN	
450435	450434	15415	SPN of 6. entry	full 19 bits of SPN	
450437	450436	15419	SPN of 7. entry	full 19 bits of SPN	
450439	450438	15422	SPN of 8. entry	full 19 bits of SPN	
450441	450440	15425	SPN of 9. entry	full 19 bits of SPN	
450443	450442	15428	SPN of 10. entry	full 19 bits of SPN	
Values					
450445	450444	15201	Total engine hours (j1939-HOURS)	1	h
450447	450446		reserved		
450449	450448		reserved		
450451	450450		reserved		
450453	450452		reserved		
LS5 (Long - 32 bits)					
450455	450454				
450457	450456				
450459	450458				
450461	450460				

9.2.5 Protocol 5011 (Alarm Values Visualization)

"P2 only: ..." applies to easYgen-xxxxXT Package P2 only.

Some alarms change too fast!
Some Command Variables for active alarms (e.g. "Unintended Stop", breaker failures) are only active for a very short time. For this reason they could not be catched reliably via the interfaces. Nevertheless they can be used to ensure that the alarm is not active and could be acknowledged.

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
0	1,2		Protocol-ID, always 5011		–
Generator					
0	3,4	4161	Alarms Generator active		
			Gen.overfreq. 1	Mask: 8000h	Bit
			Gen.overfreq. 2	Mask: 4000h	Bit
			Gen.underfreq. 1	Mask: 2000h	Bit
			Gen.underfreq. 2	Mask: 1000h	Bit
			Gen.overvolt. 1	Mask: 0800h	Bit
			Gen.overvolt. 2	Mask: 0400h	Bit
			Gen.undervolt. 1	Mask: 0200h	Bit
			Gen.undervolt. 2	Mask: 0100h	Bit
			Gen. overcurr. 1	Mask: 0080h	Bit
			Gen. overcurr. 2	Mask: 0040h	Bit
			Gen. overcurr. 3	Mask: 0020h	Bit
			Gen. Rv/Rd pow.1	Mask: 0010h	Bit
			Gen. Rv/Rd pow.2	Mask: 0008h	Bit
			Gen. Overload IOP 1	Mask: 0004h	Bit
			Gen. Overload IOP 2	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
0	5,6	10134	Alarms Generator latched (unacknowledged)		
			Gen.overfreq. 1	Mask: 8000h	Bit
			Gen.overfreq. 2	Mask: 4000h	Bit
			Gen.underfreq. 1	Mask: 2000h	Bit
			Gen.underfreq. 2	Mask: 1000h	Bit

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
			Gen.overvolt. 1	Mask: 0800h	Bit
			Gen.overvolt. 2	Mask: 0400h	Bit
			Gen.undervolt. 1	Mask: 0200h	Bit
			Gen.undervolt. 2	Mask: 0100h	Bit
			Gen. overcurr. 1	Mask: 0080h	Bit
			Gen. overcurr. 2	Mask: 0040h	Bit
			Gen. overcurr. 3	Mask: 0020h	Bit
			Gen. Rv/Rd pow.1	Mask: 0010h	Bit
			Gen. Rv/Rd pow.2	Mask: 0008h	Bit
			Gen. Overload IOP 1	Mask: 0004h	Bit
			Gen. Overload IOP 2	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
1	1,2	4163	Alarms Generator 1 active		
			Unbal. load 1	Mask: 8000h	Bit
			Unbal. load 2	Mask: 4000h	Bit
			Gen. Asymmetry	Mask: 2000h	Bit
			Ground fault 1	Mask: 1000h	Bit
			Ground fault 2	Mask: 0800h	Bit
			Gen. phase rot. misw.	Mask: 0400h	Bit
			Gen act.pwr mismatch	Mask: 0200h	Bit
			Gen. unloading fault	Mask: 0100h	Bit
			Inv.time ov.curr.	Mask: 0080h	Bit
			Operating range failed,	Mask: 0040h	Bit
			Gen. Overload MOP 1	Mask: 0020h	Bit
			Gen. Overload MOP 2	Mask: 0010h	Bit
			Gen. overexcited 1	Mask: 0008h	Bit
			Gen. overexcited 2	Mask: 0004h	Bit
			Gen. underexcited 1	Mask: 0002h	Bit
			Gen. underexcited 2	Mask: 0001h	Bit
1	3,4	10138	Alarms Generator 1 latched (unacknowledged)		
			Unbal. load 1	Mask: 8000h	Bit
			Unbal. load 2	Mask: 4000h	Bit
			Gen. Asymmetry	Mask: 2000h	Bit
			Ground fault 1	Mask: 1000h	Bit
			Ground fault 2	Mask: 0800h	Bit
			Gen. phase rot. misw.	Mask: 0400h	Bit

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
			Gen act.pwr mismatch	Mask: 0200h	Bit
			Gen. unloading fault	Mask: 0100h	Bit
			Inv.time ov.curr.	Mask: 0080h	Bit
			Operating range failed	Mask: 0040h	Bit
			Gen. Overload MOP 1	Mask: 0020h	Bit
			Gen. Overload MOP 2	Mask: 0010h	Bit
			Gen. overexcited 1	Mask: 0008h	Bit
			Gen. overexcited 2	Mask: 0004h	Bit
			Gen. underexcited 1	Mask: 0002h	Bit
			Gen. underexcited 2	Mask: 0001h	Bit
1	5,6	10131	Alarm classes latched (unacknowledged)		
			Control	Mask: 0040h	Bit
			Class F	Mask: 0020h	Bit
			Class E	Mask: 0010h	Bit
			Class D	Mask: 0008h	Bit
			Class C	Mask: 0004h	Bit
			Class B	Mask: 0002h	Bit
			Class A	Mask: 0001h	Bit
Mains					
2	1,2	4188	Alarms Mains active		
			Mains ov.freq. 1	Mask: 8000h	Bit
			Mains ov.freq. 2	Mask: 4000h	Bit
			Mains un.freq. 1	Mask: 2000h	Bit
			Mains un.freq. 2	Mask: 1000h	Bit
			Mains ov.volt. 1	Mask: 0800h	Bit
			Mains ov.volt. 2	Mask: 0400h	Bit
			Mains un.volt. 1	Mask: 0200h	Bit
			Mains un.volt. 2	Mask: 0100h	Bit
			Mains phaseshift	Mask: 0080h	Bit
			Mains decoupling	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			Mains phase rot. Miswired	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
2	3,4	10135	Alarms Mains latched (unacknowledged)		

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
			Mains ov.freq. 1	Mask: 8000h	Bit
			Mains ov.freq. 2	Mask: 4000h	Bit
			Mains un.freq. 1	Mask: 2000h	Bit
			Mains un.freq. 2	Mask: 1000h	Bit
			Mains ov.volt. 1	Mask: 0800h	Bit
			Mains ov.volt. 2	Mask: 0400h	Bit
			Mains un.volt. 1	Mask: 0200h	Bit
			Mains un.volt. 2	Mask: 0100h	Bit
			Mains phaseshift	Mask: 0080h	Bit
			Mains decoupling	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			Mains phase rot. Miswired	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
2	5,6		reserved		
3	1,2	4187	Alarms Mains 1 active		
			Mains import power 1	Mask: 8000h	Bit
			Mains import power 2	Mask: 4000h	Bit
			Mains export power 1	Mask: 2000h	Bit
			Mains export power 2	Mask: 1000h	Bit
			Mains overexcited 1	Mask: 0800h	Bit
			Mains overexcited 2	Mask: 0400h	Bit
			Mains underexcited 1	Mask: 0200h	Bit
			Mains underexcited 2	Mask: 0100h	Bit
			Mains df/dt	Mask: 0080h	Bit
			Mns act.pwr mismatch	Mask: 0040h	Bit
			Mains. Time dep. Voltage	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			Mains Voltage Increase	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			Mains QV Monitoring step 1	Mask: 0002h	Bit
			Mains QV Monitoring step 2	Mask: 0001h	Bit
3	3,4	10278	Alarms Mains 1 latched (unacknowledged)		
			Mains import power 1	Mask: 8000h	Bit

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
			Mains import power 2	Mask: 4000h	Bit
			Mains export power 1	Mask: 2000h	Bit
			Mains export power 2	Mask: 1000h	Bit
			Mains overexcited 1	Mask: 0800h	Bit
			Mains overexcited 2	Mask: 0400h	Bit
			Mains underexcited 1	Mask: 0200h	Bit
			Mains underexcited 2	Mask: 0100h	Bit
			Mains df/dt	Mask: 0080h	Bit
			Mns act.pwr mismatch	Mask: 0040h	Bit
			Mains. Time dep. Voltage	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			Mains Voltage Increase	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			Mains QV Monitoring step 1	Mask: 0002h	Bit
			Mains QV Monitoring step 2	Mask: 0001h	Bit
3	5,6		reserved		
Engine					
4	1,2	4167	Alarms 1 active		
			Overspeed 1	Mask: 8000h	Bit
			Overspeed 2	Mask: 4000h	Bit
			Underspeed 1	Mask: 2000h	Bit
			Underspeed 2	Mask: 1000h	Bit
			Unintended stop	Mask: 0800h	Bit
			Speed det. alarm	Mask: 0400h	Bit
			Shutdown malfunct.	Mask: 0200h	Bit
			GCB fail to close	Mask: 0100h	Bit
			GCB fail to open	Mask: 0080h	Bit
			MCB fail to close	Mask: 0040h	Bit
			MCB fail to open	Mask: 0020h	Bit
			CAN-Fault J1939	Mask: 0010h	Bit
			Start fail	Mask: 0008h	Bit
			Mainten. days exceeded	Mask: 0004h	Bit
			Mainten. hours exceeded	Mask: 0002h	Bit
			CANopen error at CAN Interface 1	Mask: 0001h	Bit
4	3,4	10133	Alarms 1 latched (unacknowledged)		
			Overspeed 1	Mask: 8000h	Bit

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
			Overspeed 2	Mask: 4000h	Bit
			Underspeed 1	Mask: 2000h	Bit
			Underspeed 2	Mask: 1000h	Bit
			Unintended stop	Mask: 0800h	Bit
			Speed det. Alarm	Mask: 0400h	Bit
			Shutdown malfunct.	Mask: 0200h	Bit
			GCB fail to close	Mask: 0100h	Bit
			GCB fail to open	Mask: 0080h	Bit
			MCB fail to close	Mask: 0040h	Bit
			MCB fail to open	Mask: 0020h	Bit
			CAN-Fault J1939	Mask: 0010h	Bit
			Start fail	Mask: 0008h	Bit
			Mainten. days exceeded	Mask: 0004h	Bit
			Mainten. hours exceeded	Mask: 0002h	Bit
			CANopen error at CAN Interface 1	Mask: 0001h	Bit
4	5,6	4193	Alarms 3 active		
			GGB fail to close	Mask: 8000h	Bit
			GGB fail to open	Mask: 4000h	Bit
			05.18 Cylinder temperature level 1	Mask: 0800h	Bit
			05.19 Cylinder temperature level 2	Mask: 0400h	Bit
			05.20 Cylinder temperature wire break	Mask: 0200h	Bit
5	1,2	4169	Alarms 2 active		
			GCB sync. Timeout	Mask: 8000h	Bit
			MCB sync. Timeout	Mask: 4000h	Bit
			GGB sync.Timeout	Mask: 2000h	Bit
			Charge alt. low voltage (D+)	Mask: 1000h	Bit
			Phase rotation mismatch (not supported with operating range failure 'error 12')	Mask: 0800h	Bit
			CPU overload	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			CANopen error at CAN Interface 2	Mask: 0020h	Bit
			Parameter Alignment	Mask: 0010h	Bit
			08.27 Missing easYgen	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
			Red stop lamp DM1	Mask: 0002h	Bit
			Amber warning lamp DM1	Mask: 0001h	Bit
5	3,4	10149	Alarms 2 latched (unacknowledged)		
			GCB sync. Timeout	Mask: 8000h	Bit
			MCB sync. Timeout	Mask: 4000h	Bit
			GGB sync. Timeout	Mask: 2000h	Bit
			Charge alt. low voltage (D+)	Mask: 1000h	Bit
			Phase rotation mismatch (not supported with operating range failure 'error 12')	Mask: 0800h	Bit
			CPU overload	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			CANopen error at CAN Interface 2	Mask: 0020h	Bit
			Parameter Alignment	Mask: 0010h	Bit
			08.27 Missing easYgen	Mask: 0008h	Bit
			EEPROM failure *) easYgen-3000 only, not easYgen-3000XT series	Mask: 0004h	Bit
			Red stop lamp DM1	Mask: 0002h	Bit
			Amber warning lamp DM1	Mask: 0001h	Bit
5	5,6	10190	Alarms 3 latched (unacknowledged)		
			GGB fail to close	Mask: 8000h	Bit
			GGB fail to open	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			Cylinder temperature level 1	Mask: 0800h	Bit
			Cylinder temperature level 2	Mask: 0400h	Bit
			Cylinder Temperature wire break	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
Alarms					
6	1,2	5197	Alarms active		
			Free alarm 4	Mask: 2000h	Bit
			Free alarm 3	Mask: 1000h	Bit
			Free alarm 2	Mask: 0800h	Bit
			Free alarm 1	Mask: 0400h	Bit
			Max. starts per time	Mask: 0200h	Bit
			Neutral contactor failure	Mask: 0100h	Bit
			Decoupling GCB↔MCB	Mask: 0080h	Bit
			Meas.difference 4105 VDE-AR-N 4105	Mask: 0040h	Bit
			Parameter alignment VDE-AR-N 4105	Mask: 0020h	Bit
			Missing member VDE-AR-N 4105	Mask: 0010h	Bit
			Busbar monitoring latched, Marine version only	Mask: 0008h	Bit
			Plausibility GCB feedback latched, Marine version only	Mask: 0004h	Bit
			Reactive load sharing mismatch latched, Marine version only	Mask: 0002h	Bit
			Active load sharing mismatch latched, Marine version only	Mask: 0001h	Bit
6	3, 4	10286	Alarms latched (unacknowledged)		
			Free alarm 4	Mask: 2000h	Bit
			Free alarm 3	Mask: 1000h	Bit
			Free alarm 2	Mask: 0800h	Bit
			Free alarm 1	Mask: 0400h	Bit
			Max. starts per time (K36)	Mask: 0200h	Bit
			Neutral contactor failure	Mask: 0100h	Bit
			Decoupling GCB↔MCB	Mask: 0080h	Bit
			Meas.difference 4105 VDE-AR-N 4105	Mask: 0040h	Bit
			Parameter alignment VDE-AR-N 4105	Mask: 0020h	Bit
			Missing member VDE-AR-N 4105	Mask: 0010h	Bit
			Busbar monitoring latche (Marine version only)	Mask: 0008h	Bit
			Plausibility GCB feedback latched (Marine version only)	Mask: 0004h	Bit
			Reactive load sharing mismatch latched, Marine version only	Mask: 0002h	Bit
			Active load sharing mismatch latched, Marine version only	Mask: 0001h	Bit
6	5,6		reserved		
Flexible Thresholds					
7	1,2	4175	Alarms Flexible thresholds 1-16 active		

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
			Alarm flexible limit 16	Mask: 8000h	Bit
			Alarm flexible limit 15	Mask: 4000h	Bit
			Alarm flexible limit 14	Mask: 2000h	Bit
			Alarm flexible limit 13	Mask: 1000h	Bit
			Alarm flexible limit 12	Mask: 0800h	Bit
			Alarm flexible limit 11	Mask: 0400h	Bit
			Alarm flexible limit 10	Mask: 0200h	Bit
			Alarm flexible limit 9	Mask: 0100h	Bit
			Alarm flexible limit 8	Mask: 0080h	Bit
			Alarm flexible limit 7	Mask: 0040h	Bit
			Alarm flexible limit 6	Mask: 0020h	Bit
			Alarm flexible limit 5	Mask: 0010h	Bit
			Alarm flexible limit 4	Mask: 0008h	Bit
			Alarm flexible limit 3	Mask: 0004h	Bit
			Alarm flexible limit 2	Mask: 0002h	Bit
			Alarm flexible limit 1	Mask: 0001h	Bit
7	3,4	10279	Alarms Flexible thresholds 1-16 latched (unacknowledged)		
			Alarm flexible limit 16	Mask: 8000h	Bit
			Alarm flexible limit 15	Mask: 4000h	Bit
			Alarm flexible limit 14	Mask: 2000h	Bit
			Alarm flexible limit 13	Mask: 1000h	Bit
			Alarm flexible limit 12	Mask: 0800h	Bit
			Alarm flexible limit 11	Mask: 0400h	Bit
			Alarm flexible limit 10	Mask: 0200h	Bit
			Alarm flexible limit 9	Mask: 0100h	Bit
			Alarm flexible limit 8	Mask: 0080h	Bit
			Alarm flexible limit 7	Mask: 0040h	Bit
			Alarm flexible limit 6	Mask: 0020h	Bit
			Alarm flexible limit 5	Mask: 0010h	Bit
			Alarm flexible limit 4	Mask: 0008h	Bit
			Alarm flexible limit 3	Mask: 0004h	Bit
			Alarm flexible limit 2	Mask: 0002h	Bit
			Alarm flexible limit 1	Mask: 0001h	Bit
7	5,6		reserved		
8	1,2	4177	Alarms Flexible thresholds 17-32 active		
			Alarm flexible limit 32	Mask: 8000h	Bit

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
			Alarm flexible limit 31	Mask: 4000h	Bit
			Alarm flexible limit 30	Mask: 2000h	Bit
			Alarm flexible limit 29	Mask: 1000h	Bit
			Alarm flexible limit 28	Mask: 0800h	Bit
			Alarm flexible limit 27	Mask: 0400h	Bit
			Alarm flexible limit 26	Mask: 0200h	Bit
			Alarm flexible limit 25	Mask: 0100h	Bit
			Alarm flexible limit 24	Mask: 0080h	Bit
			Alarm flexible limit 23	Mask: 0040h	Bit
			Alarm flexible limit 22	Mask: 0020h	Bit
			Alarm flexible limit 21	Mask: 0010h	Bit
			Alarm flexible limit 20	Mask: 0008h	Bit
			Alarm flexible limit 19	Mask: 0004h	Bit
			Alarm flexible limit 18	Mask: 0002h	Bit
			Alarm flexible limit 17	Mask: 0001h	Bit
8	3,4	10280	Alarms Flexible thresholds 17-32 latched (unacknowledged)		
			Alarm flexible limit 32	Mask: 8000h	Bit
			Alarm flexible limit 31	Mask: 4000h	Bit
			Alarm flexible limit 30	Mask: 2000h	Bit
			Alarm flexible limit 29	Mask: 1000h	Bit
			Alarm flexible limit 28	Mask: 0800h	Bit
			Alarm flexible limit 27	Mask: 0400h	Bit
			Alarm flexible limit 26	Mask: 0200h	Bit
			Alarm flexible limit 25	Mask: 0100h	Bit
			Alarm flexible limit 24	Mask: 0080h	Bit
			Alarm flexible limit 23	Mask: 0040h	Bit
			Alarm flexible limit 22	Mask: 0020h	Bit
			Alarm flexible limit 21	Mask: 0010h	Bit
			Alarm flexible limit 20	Mask: 0008h	Bit
			Alarm flexible limit 19	Mask: 0004h	Bit
			Alarm flexible limit 18	Mask: 0002h	Bit
			Alarm flexible limit 17	Mask: 0001h	Bit
8	5,6		reserved		
9	1,2	4179	Alarms Flexible thresholds 33-40 active		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			Alarm flexible limit 40	Mask: 0080h	Bit
			Alarm flexible limit 39	Mask: 0040h	Bit
			Alarm flexible limit 38	Mask: 0020h	Bit
			Alarm flexible limit 37	Mask: 0010h	Bit
			Alarm flexible limit 36	Mask: 0008h	Bit
			Alarm flexible limit 35	Mask: 0004h	Bit
			Alarm flexible limit 34	Mask: 0002h	Bit
			Alarm flexible limit 33	Mask: 0001h	Bit
9	3,4	1028	Alarms Flexible thresholds 33-40 latched (unacknowledged)		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			Alarm flexible limit 40	Mask: 0080h	Bit
			Alarm flexible limit 39	Mask: 0040h	Bit
			Alarm flexible limit 38	Mask: 0020h	Bit
			Alarm flexible limit 37	Mask: 0010h	Bit
			Alarm flexible limit 36	Mask: 0008h	Bit
			Alarm flexible limit 35	Mask: 0004h	Bit
			Alarm flexible limit 34	Mask: 0002h	Bit
			Alarm flexible limit 33	Mask: 0001h	Bit
9	5,6		0 (reserve)		
10	1,2	4194	Free Alarms active		
			Free Alarm 16	Mask: 8000h	Bit
			Free Alarm 15	Mask: 4000h	Bit
			Free Alarm 14	Mask: 2000h	Bit

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
			Free Alarm 13	Mask: 1000h	Bit
			Free Alarm 12	Mask: 0800h	Bit
			Free Alarm 11	Mask: 0400h	Bit
			Free Alarm 10	Mask: 0200h	Bit
			Free Alarm 9	Mask: 0100h	Bit
			Free Alarm 8	Mask: 0080h	Bit
			Free Alarm 7	Mask: 0040h	Bit
			Free Alarm 6	Mask: 0020h	Bit
			Free Alarm 5	Mask: 0010h	Bit
			Free Alarm 4 (is also at MUX 5 to be compatibel to release 8)	Mask: 0008h	Bit
			Free Alarm 3 (is also at MUX 5 to be compatibel to release 8)	Mask: 0004h	Bit
			Free Alarm 2 (is also at MUX 5 to be compatibel to release 8)	Mask: 0002h	Bit
			Free Alarm 1 (is also at MUX 5 to be compatibel to release 8)	Mask: 0001h	Bit
10	3,4	10282	Free Alarms latched (unacknowledged)		
			Free Alarm 16	Mask: 8000h	Bit
			Free Alarm 15	Mask: 4000h	Bit
			Free Alarm 14	Mask: 2000h	Bit
			Free Alarm 13	Mask: 1000h	Bit
			Free Alarm 12	Mask: 0800h	Bit
			Free Alarm 11	Mask: 0400h	Bit
			Free Alarm 10	Mask: 0200h	Bit
			Free Alarm 9	Mask: 0100h	Bit
			Free Alarm 8	Mask: 0080h	Bit
			Free Alarm 7	Mask: 0040h	Bit
			Free Alarm 6	Mask: 0020h	Bit
			Free Alarm 5	Mask: 0010h	Bit
			Free Alarm 4 (is also at MUX 5 to be compatibel to release 8)	Mask: 0008h	Bit
			Free Alarm 3 (is also at MUX 5 to be compatibel to release 8)	Mask: 0004h	Bit
			Free Alarm 2 (is also at MUX 5 to be compatibel to release 8)	Mask: 0002h	Bit
			Free Alarm 1 (is also at MUX 5 to be compatibel to release 8)	Mask: 0001h	Bit
10	5,6		reserved		
Internal DC Analogue Values Wirebreak					
11	1,2	4171	Alarms Analog Inputs 1 active		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			Batt.overvolt.2	Mask: 0008h	Bit
			Batt.undervolt.2	Mask: 0004h	Bit
			Batt.overvolt.1	Mask: 0002h	Bit
			Batt.undervolt.1	Mask: 0001h	Bit
11	3,4	10136	Alarms Analog Inputs 1 latched (unacknowledged)		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			Batt.overvolt.2	Mask: 0008h	Bit
			Batt.undervolt.2	Mask: 0004h	Bit
			Batt.overvolt.1	Mask: 0002h	Bit
			Batt.undervolt.1	Mask: 0001h	Bit
11	5,6		reserved		
12	1,2	4173	Alarms Analog Inputs Wire Break active		
			internal	Mask: 0001h	Bit
			Analog inp. 1, wire break	Mask: 0002h	Bit
			Analog inp. 2, wire break	Mask: 0004h	Bit
			Analog inp. 3, wire break	Mask: 0008h	Bit

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
			Analog inp. 4, wire break or shortcut, P2	Mask: 0010h	Bit
			Analog inp. 5, wire break or shortcut, P2	Mask: 0020h	Bit
			Analog inp. 6, wire break or shortcut, P2	Mask: 0040h	Bit
			Analog inp. 7, wire break or shortcut, P2	Mask: 0080h	Bit
			Analog inp. 8, wire break or shortcut, P2	Mask: 0100h	Bit
			Analog inp. 9, wire break or shortcut, P2	Mask: 0200h	Bit
			Analog inp. 10, wire break or shortcut, P2	Mask: 0400h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
12	3, 4	10137	Alarms Analog Inputs Wire Break latched (unacknowledged)		
			internal	Mask: 0001h	Bit
			Analog inp. 1, wire break	Mask: 0002h	Bit
			Analog inp. 2, wire break	Mask: 0004h	Bit
			Analog inp. 3, wire break	Mask: 0008h	Bit
			Analog inp. 4, wire break or shortcut, P2	Mask: 0010h	Bit
			Analog inp. 5, wire break or shortcut, P2	Mask: 0020h	Bit
			Analog inp. 6, wire break or shortcut, P2	Mask: 0040h	Bit
			Analog inp. 7, wire break or shortcut, P2	Mask: 0080h	Bit
			Analog inp. 8, wire break or shortcut, P2	Mask: 0100h	Bit
				Mask: 0200h	Bit
				Mask: 0400h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
12	5, 6		reserved		
Internal Digital Inputs					
13	1,2	4181	Alarms Digital Inputs 1 active		
			Digital Input 1	Mask: 8000h	Bit
			Digital Input 2	Mask: 4000h	Bit
			Digital Input 3	Mask: 2000h	Bit
			Digital Input 4	Mask: 1000h	Bit

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
			Digital Input 5	Mask: 0800h	Bit
			Digital Input 6	Mask: 0400h	Bit
			Digital Input 7	Mask: 0200h	Bit
			Digital Input 8 (reply GCB)	Mask: 0100h	Bit
			Digital Input 9	Mask: 0080h	Bit
			Digital Input 10	Mask: 0040h	Bit
			Digital Input 11	Mask: 0020h	Bit
			Digital Input 12	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
13	3,4	10132	Alarms Digital Inputs 1 latched (unacknowledged)		
			Digital Input 1	Mask: 8000h	Bit
			Digital Input 2	Mask: 4000h	Bit
			Digital Input 3	Mask: 2000h	Bit
			Digital Input 4	Mask: 1000h	Bit
			Digital Input 5	Mask: 0800h	Bit
			Digital Input 6	Mask: 0400h	Bit
			Digital Input 7	Mask: 0200h	Bit
			Digital Input 8 (reply GCB)	Mask: 0100h	Bit
			Digital Input 9	Mask: 0080h	Bit
			Digital Input 10	Mask: 0040h	Bit
			Digital Input 11	Mask: 0020h	Bit
			Digital Input 12	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
13	5,6		0 (reserve)		
14	1,2	4183	Alarms Digital Inputs 2 active		
			Digital Input 13, P2	Mask: 8000h	Bit
			Digital Input 14, P2	Mask: 4000h	Bit
			Digital Input 15, P2	Mask: 2000h	Bit
			Digital Input 16, P2	Mask: 1000h	Bit
			Digital Input 17, P2	Mask: 0800h	Bit

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
			Digital Input 18, P2	Mask: 0400h	Bit
			Digital Input 19, P2	Mask: 0200h	Bit
			Digital Input 20, P2	Mask: 0100h	Bit
			Digital Input 21, P2	Mask: 0080h	Bit
			Digital Input 22, P2	Mask: 0040h	Bit
			Digital Input 23, P2	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
14	3,4	10283	Alarms Digital Inputs 2 latched (unacknowledged)		
			Digital Input 13, P2	Mask: 8000h	Bit
			Digital Input 14, P2	Mask: 4000h	Bit
			Digital Input 15, P2	Mask: 2000h	Bit
			Digital Input 16, P2	Mask: 1000h	Bit
			Digital Input 17, P2	Mask: 0800h	Bit
			Digital Input 18, P2	Mask: 0400h	Bit
			Digital Input 19, P2	Mask: 0200h	Bit
			Digital Input 20, P2	Mask: 0100h	Bit
			Digital Input 21, P2	Mask: 0080h	Bit
			Digital Input 22, P2	Mask: 0040h	Bit
			Digital Input 23, P2	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
14	5,6		reserved		
External Digital Inputs					
15	1,2	4185	Alarms External Digital Inputs active		
			External Digital Input 16	Mask: 8000h	Bit
			External Digital Input 15	Mask: 4000h	Bit
			External Digital Input 14	Mask: 2000h	Bit
			External Digital Input 13	Mask: 1000h	Bit
			External Digital Input 12	Mask: 0800h	Bit

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
			External Digital Input 11	Mask: 0400h	Bit
			External Digital Input 10	Mask: 0200h	Bit
			External Digital Input 9	Mask: 0100h	Bit
			External Digital Input 8	Mask: 0080h	Bit
			External Digital Input 7	Mask: 0040h	Bit
			External Digital Input 6	Mask: 0020h	Bit
			External Digital Input 5	Mask: 0010h	Bit
			External Digital Input 4	Mask: 0008h	Bit
			External Digital Input 3	Mask: 0004h	Bit
			External Digital Input 2	Mask: 0002h	Bit
			External Digital Input 1	Mask: 0001h	Bit
15	3,4	16377	Alarms External Digital Inputs latched (unacknowledged)		
			External Digital Input 16	Mask: 8000h	Bit
			External Digital Input 15	Mask: 4000h	Bit
			External Digital Input 14	Mask: 2000h	Bit
			External Digital Input 13	Mask: 1000h	Bit
			External Digital Input 12	Mask: 0800h	Bit
			External Digital Input 11	Mask: 0400h	Bit
			External Digital Input 10	Mask: 0200h	Bit
			External Digital Input 9	Mask: 0100h	Bit
			External Digital Input 8	Mask: 0080h	Bit
			External Digital Input 7	Mask: 0040h	Bit
			External Digital Input 6	Mask: 0020h	Bit
			External Digital Input 5	Mask: 0010h	Bit
			External Digital Input 4	Mask: 0008h	Bit
			External Digital Input 3	Mask: 0004h	Bit
			External Digital Input 2	Mask: 0002h	Bit
			External Digital Input 1	Mask: 0001h	Bit
15	5,6		reserved		
16	1,2	4195	Alarm External Digital Inputs 1 active		
			P2 only: External Digital Input 32	Mask: 8000h	Bit
			P2 only: External Digital Input 31	Mask: 4000h	Bit
			P2 only: External Digital Input 30	Mask: 2000h	Bit
			P2 only: External Digital Input 29	Mask: 1000h	Bit
			P2 only: External Digital Input 28	Mask: 0800h	Bit
			P2 only: External Digital Input 27	Mask: 0400h	Bit

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
			P2 only: External Digital Input 26	Mask: 0200h	Bit
			P2 only: External Digital Input 25	Mask: 0100h	Bit
			P2 only: External Digital Input 24	Mask: 0080h	Bit
			P2 only: External Digital Input 23	Mask: 0040h	Bit
			P2 only: External Digital Input 22	Mask: 0020h	Bit
			P2 only: External Digital Input 21	Mask: 0010h	Bit
			P2 only: External Digital Input 20	Mask: 0008h	Bit
			P2 only: External Digital Input 19	Mask: 0004h	Bit
			P2 only: External Digital Input 18	Mask: 0002h	Bit
			P2 only: External Digital Input 17	Mask: 0001h	Bit
16	3,4	10284	Alarm External Digital Inputs 1 latched (unacknowledged)		
			P2 only: External Digital Input 32	Mask: 8000h	Bit
			P2 only: External Digital Input 31	Mask: 4000h	Bit
			P2 only: External Digital Input 30	Mask: 2000h	Bit
			P2 only: External Digital Input 29	Mask: 1000h	Bit
			P2 only: External Digital Input 28	Mask: 0800h	Bit
			P2 only: External Digital Input 27	Mask: 0400h	Bit
			P2 only: External Digital Input 26	Mask: 0200h	Bit
			P2 only: External Digital Input 25	Mask: 0100h	Bit
			P2 only: External Digital Input 24	Mask: 0080h	Bit
			P2 only: External Digital Input 23	Mask: 0040h	Bit
			P2 only: External Digital Input 22	Mask: 0020h	Bit
			P2 only: External Digital Input 21	Mask: 0010h	Bit
			P2 only: External Digital Input 20	Mask: 0008h	Bit
			P2 only: External Digital Input 19	Mask: 0004h	Bit
			P2 only: External Digital Input 18	Mask: 0002h	Bit
			P2 only: External Digital Input 17	Mask: 0001h	Bit
16	5,6		reserved		
External DC Analogue Values Wirebreak					
17	1,2	4196	Alarms External Analog Inputs Wire Break active		
			Ext. Analog Inp. 01, wire break	Mask: 0001h	Bit
			Ext. Analog Inp. 02, wire break	Mask: 0002h	Bit
			Ext. Analog Inp. 03, wire break	Mask: 0004h	Bit
			Ext. Analog Inp. 04, wire break	Mask: 0008h	Bit
			Ext. Analog Inp. 05, wire break	Mask: 0010h	Bit
			Ext. Analog Inp. 06, wire break	Mask: 0020h	Bit
			Ext. Analog Inp. 07, wire break	Mask: 0040h	Bit

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
			Ext. Analog Inp. 08, wire break	Mask: 0080h	Bit
			Ext. Analog Inp. 09, wire break	Mask: 0100h	Bit
			Ext. Analog Inp. 10, wire break	Mask: 0200h	Bit
			Ext. Analog Inp. 11, wire break	Mask: 0400h	Bit
			Ext. Analog Inp. 12, wire break	Mask: 0800h	Bit
			Ext. Analog Inp. 13, wire break	Mask: 1000h	Bit
			Ext. Analog Inp. 14, wire break	Mask: 2000h	Bit
			Ext. Analog Inp. 15, wire break	Mask: 4000h	Bit
			Ext. Analog Inp. 16, wire break	Mask: 8000h	Bit
17	3,4	10285	Alarms External Analog Inputs Wire Break latched (unacknowledged)		
			Ext. Analog Inp. 01, wire break	Mask: 0001h	Bit
			Ext. Analog Inp. 02, wire break	Mask: 0002h	Bit
			Ext. Analog Inp. 03, wire break	Mask: 0004h	Bit
			Ext. Analog Inp. 04, wire break	Mask: 0008h	Bit
			Ext. Analog Inp. 05, wire break	Mask: 0010h	Bit
			Ext. Analog Inp. 06, wire break	Mask: 0020h	Bit
			Ext. Analog Inp. 07, wire break	Mask: 0040h	Bit
			Ext. Analog Inp. 08, wire break	Mask: 0080h	Bit
			Ext. Analog Inp. 09, wire break	Mask: 0100h	Bit
			Ext. Analog Inp. 10, wire break	Mask: 0200h	Bit
			Ext. Analog Inp. 11, wire break	Mask: 0400h	Bit
			Ext. Analog Inp. 12, wire break	Mask: 0800h	Bit
			Ext. Analog Inp. 13, wire break	Mask: 1000h	Bit
			Ext. Analog Inp. 14, wire break	Mask: 2000h	Bit
			Ext. Analog Inp. 15, wire break	Mask: 4000h	Bit
			Ext. Analog Inp. 16, wire break	Mask: 8000h	Bit
17	5,6		reserved		

9.2.6 Protocol 6000 (Load Share Message)

General information

The load share message contains all data, which is required for load/var sharing, load-dependent start/stop and dead bus detection.

Further data, which is exchanged between the control units concerns time synchronization and parameter alignment. Parameter alignment is intended for those parameters, which must be configured identically for all units participating in load sharing, to ensure a proper operation of load sharing or load-dependent start/stop.

In order to lower the bus load, the messages are divided into "fast", "normal", and "slow" refreshed data. The mux is identified accordingly with "F", "N", and "S" (refer to the following tables). The load share message contains one fast, two normal, and four slow messages, which are made up as in *"Load share bus communication" on page 777*.

Timing

The time interval between two fast messages (TFast , i.e. the time for refreshing a fast message) is configured with the parameter "Transfer rate LS fast message" (parameter 9921 p. 478). The time intervals between refreshing a normal or slow messages depend on this parameter as well according to the following sequence:

- S0 – F – N0 – F – N1 – F – S1 – F – N0 – F – N1 – F – S2 – F – N0 – F – N1 – F – S3 – F – N0 – F – N1 – F
- T_{Fast} = time interval between refreshing the fast message
- T_{Normal} = time interval between refreshing a normal message = 3 x TFast
- T_{Slow} = time interval between refreshing a slow message = 12 x TFast

Example

- The parameter "Transfer rate LS fast message" (parameter 9921 p. 478) is configured to "0.10 s".
- The sequence of the sent messages for TFast = 100 ms (i.e. 0.10 s) is shown in *"Load share bus communication" on page 777*.
- This means that a new message is sent every 50 ms.

Time [ms]	0	50	100	150	200	250	300	350	400	450	500	550
Sent message	S0	F	N0	F	N1	F	S1	F	N0	F	N1	F
MUX #	0	3	1	3	2	3	4	3	1	3	2	3

Time [ms]	600	650	700	750	800	850	900	950	1000	1050	1100	1150
Sent message	S2	F	N0	F	N1	F	S3	F	N0	F	N1	F
MUX #	5	3	1	3	2	3	6	3	1	3	2	3

The maximum length of the CAN bus load share line depends on "Transfer rate LS fast message" (parameter 9921 p. 478).

The values in *Table 154 " Load share line - max. length (32 participants)" on page 776* are valid for 32 participants and a bus load of approx. 40 %.

TFast [ms]	TNormal [ms]	TSlow [ms]	Baud rate	Distance
100	300	1200	250 kBaud	250 m
200	600	2400	125 kBaud	500 m
300	900	3800	50 kBaud	1000 m

Table 154: Load share line - max. length (32 participants)

Load share bus communication

Load share bus communication - "fast" refreshed data				
MUX	**Byte**	**Bit**	**Function**	**Remark**
F	0		3	MUX identifier
	1		Generator real load capacity utilization rate, L-Byte	Integer [‰], signed
	2		Generator real load capacity utilization rate, H-Byte	
	3		Generator reactive load capacity utilization rate, L-Byte	Integer [‰], signed
	4		Generator reactive load capacity utilization rate, H-Byte	
	5	0	Active power load sharing is enabled	
		1	Reactive power load sharing is enabled	
		2	GCB is closed	
		3	MCB is closed	
		4	Reserved	
		5	Dead bus closure request is active	Dead bus detection
		6	Mains settling time is running	Back synchronization to mains
		7	Shutdown alarm is active (alarm class C,D,E,F)	
	6	0-4	Bus segment / node	Max. 32 nodes possible
		5	Not used	
		6	LDSS: add-on request enabled	Load dependent start / stop
		7	LDSS: add-off request enabled (reserved)	Load dependent start / stop
	7		Not used	

Load share bus communication - "normal" refreshed data				
Mux	**Byte**	**Bit**	**Function**	**Remark**
N0	0		1	Mux identifier
	1		Generator real load, L-Byte, L-Word	Long [W]
	2		Generator real load, H-Byte, L-Word	
	3		Generator real load, L-Byte, H-Word	
	4		Generator real load, H-Byte, H-Word	
	5	0-3	Real load control state	2: Static 3: Isochronous 4: Base load control 5: Export/import control 10:Load share 0, 1, 6, 7, 8, 9, 11, … : internal

Load share bus communication - "normal" refreshed data				
Mux	**Byte**	**Bit**	**Function**	**Remark**
		4-7	Reactive load control state	2: Static 3: Isochronous 4: Reactive load control 5: Import/export reactive load 10:Reactive load share 0, 1, 6, 7, 8, 9, 11, … : internal
	6	0-3	Engine state	1: Locked out 2: Off 3: Preglow 4: Crank 5: Run 6: Cool down 7: Spin down 8: Start pause 9: Idle 0, 10, 11, … : internal
		4,5	Operating mode	0: Not available 1: STOP 2: MANUAL 3: AUTOMATIC
		6	Generator request	Generator is in AUTOMATIC mode and able to produce rated active power
		7	Not used	
	7		Not used	

Load share bus communication - "normal" refreshed data				
MUX	**Byte**	**Bit**	**Function**	**Remark**
N1	0		2	MUX identifier
	1		Generator reactive load, L-Byte, L-Word	Long [var]
	2		Generator reactive load, H-Byte, L-Word	
	3		Generator reactive load, L-Byte, H-Word	
	4		Generator reactive load, H-Byte, H-Word	
	5	0	Generator voltage and frequency ok	
		1	Busbar voltage and frequency ok	
		2	Mains voltage and frequency ok	
		3	Fourth system voltage and frequency ok	
		4	Not used	
		5	Not used	
		6	Not used	
		7	Not used	

Load share bus communication - "normal" refreshed data				
MUX	**Byte**	**Bit**	**Function**	**Remark**
	6	0	Command 1 to CB control	
		1	Command 2 to CB control	
		2	Command 3 to CB control	
		3	Command 4 to CB control	
		4	Command 5 to CB control	
		5	Command 6 to CB control	
		6-7	Not used	
	7		Not used	

Load share bus communication - "slow" refreshed data				
MUX	**Byte**	**Bit**	**Function**	**Remark**
S0	0		0	MUX identifier
	1		Protocol-Identifier	
	2			
	3		Generator rated real power, L-Byte, L-Word	Long [0.1 kW]
	4		Generator rated real power, H-Byte, L-Word	
	5		Generator rated real power, L-Byte, H-Word	
	6		Generator rated real power, H-Byte, H-Word	
	7		Not used	
S1	0		4	MUX identifier
	1		Generator rated reactive power, L-Byte, L-Word	Long [0.1 kvar]
	2		Generator rated reactive power, H-Byte, L-Word	
	3		Generator rated reactive power, L-Byte, H-Word	
	4		Generator rated reactive power, H-Byte, H-Word	
	5	0-4	Base segment	Max. number of nodes: 32 / 64 with bit 5
		5	Extended bit for Base segment	
		6-7	Not used	
	6	0-4	Priority	Up to 32
		5-7	Not used	
	7		Not used	
S2	0		5	MUX identifier
	1		Operating hours L-Byte, L-Word	Long [h]
	2		Operating hours H-Byte, L-Word	
	3		Operating hours L-Byte, H-Word	
	4		Operating hours H-Byte, H-Word	
	5	0	Alarm class A occurred	
		1	Alarm class B occurred	

Load share bus communication - "slow" refreshed data				
MUX	**Byte**	**Bit**	**Function**	**Remark**
		2	Alarm class C occurred	
		3	Alarm class D occurred	
		4	Alarm class E occurred	
		5	Alarm class F occurred	
		6	Warning alarm class occurred	
		7	Not used	
	6		LSI connection	Load share interface
	7		Not used	
S3	0		6	MUX identifier
	1		Remaining days before maintenance, L-Byte	Integer [d]
	2		Remaining days before maintenance, H-Byte	
	3		Remaining operating hours before maintenance, L-Byte	Integer [h]
	4		Remaining operating hours before maintenance, H-Byte	
	5		Checksum parameters L-Byte	Load share and load-dependent start / stop parameters
	6		Checksum parameters H-Byte	
	7		Not used	

9.2.7 Protocol 6003 (LS-5 Communication)

General information

The LS-5 communication message contains all data, which is required to operate the LS-5 system. This communication protocol works parallel to the load share communication.

In order to lower the bus load, the messages are divided into "fast", "normal", and "slow" refreshed data. The mux is identified accordingly with "F", "N", and "S" (refer to the following tables). The load share message contains one fast, two normal, and four slow messages, which are made up as in *"LS-5 communication" on page 781*.

Timing

The time interval between two fast messages (TFast , i.e. the time for refreshing a fast message) is configured with the parameter "Transfer rate LS fast message" (parameter 9921 p. 478). The time intervals between refreshing a normal or slow messages depend on this parameter as well according to the following sequence:

- S0 – F – N0 – F – N1 – F – S1 – F – N0 – F – N1 – F – S2 – F – N0 – F – N1 – F – S3 – F – N0 – F – N1 – F
- T_{Fast} = time interval between refreshing the fast message
- T_{Normal} = time interval between refreshing a normal message = 3 x TFast
- T_{Slow} = time interval between refreshing a slow message = 12 x TFast

Example

- The parameter "Transfer rate LS fast message" (parameter 9921 ⯑ p. 478) is configured to "0.10 s".
- The sequence of the sent messages for TFast = 100 ms (i.e. 0.10 s) is shown in ⯑ *"LS-5 communication" on page 781*.
- This means that a new message is sent every 50 ms.

Time [ms]	0	50	100	150	200	250	300	350	400	450	500	550
Sent message	S0	F	N0	F	N1	F	S1	F	N0	F	N1	F
Mux #	0	3	1	3	2	3	4	3	1	3	2	3

Time [ms]	600	650	700	750	800	850	900	950	1000	1050	1100	1150
Sent message	S2	F	N0	F	N1	F	S3	F	N0	F	N1	F
Mux #	5	3	1	3	2	3	6	3	1	3	2	3

LS-5 communication

LS-5 communication - "fast" refreshed data				
Mux	**Byte**	**Bit**	**Function**	**Remark**
F	0		3	Mux identifier
	1		Frequency of connected mains or frequency to which is to synchronize	Frequency in 00.00 Hz
	2			
	3		Phase angle between system A and B	Phase angle [1/10°] Phase angle compensation is incorporated
	4			
	5	0	System A in range	
		1	System B in range	
		2	System A is black	
		3	System B is black	
		4	Breaker 1 closed	
		5	Isolation switch or breaker 2 closed	
		6	Synchronous networks detected	Between system A an B
		7	Not used	
	6	1	Wish to open the breaker	
		2	Wish to close the breaker	
		3	Wish is for breaker 0 = Breaker 1 1 = Breaker 2	
		4	Execution of wish	
		5	Variable system 0 = System A 1 = System B	

LS-5 communication - "fast" refreshed data				
Mux	**Byte**	**Bit**	**Function**	**Remark**
		6	Synchronizing mode 0 = Slip frequency 1 = Phase matching	
		7	Not used	
	7		Not used	

LS-5 communication - "normal" refreshed data				
Mux	**Byte**	**Bit**	**Function**	**Remark**
N0	0		1	Mux identifier
	1		Voltage setpoint	Voltage of the fixed system in the percentage format (000.00 %) of the rated voltage setting
	2			
	3		Active power system A	Long [W]
	4			
	5			
	6			
	7		Not used	

LS-5 communication - "normal" refreshed data				
Mux	**Byte**	**Bit**	**Function**	**Remark**
N1	0		2	Mux identifier
	1		Not used	
	2	0	Logic bit 1	
		1	Logic bit 2	
		2	Logic bit 3	
		3	Logic bit 4	
		4	Logic bit 5	
		5	Mains settling active	
		6-7	Not used	
	3		Reactive power system A	Long [var]
	4			
	5			
	6			
	7		Not used	

LS-5 communication - "slow" refreshed data				
Mux	**Byte**	**Bit**	**Function**	**Remark**
S0	0		0	Mux identifier
	1		Protocol-Identifier	6003
	2			
	3		Not used	
	4			
	5			
	6			
	7		Not used	
S1	0		4	Mux identifier
	1	0-1	Mains wiring 0 = No mains wiring 1 = Mains wiring at system A 2 = Mains wiring at system B 3 = Mains wiring at isolation switch	
		2-3	Isolation switch wiring 0 = Off 1 = System A 2 = System B 3 = Not used	
		4-6	Visualization message definition 0 = No valid information 1 = Average delta voltage of mains (visualization message 1) and average wye voltage of mains (visualization message 2)	
		7	Mains power measurement valid	This means the power of system A is used for mains import/export control
	2	0-4	Segment number isolation switch	Max. 32 nodes possible
		5	Extended bit for segment number isolation switch	Max. 64 nodes possible
		6-7	Not used	
	3		Not used	
	4			
	5			
	6			
	7		Not used	
S2	0		5	Mux identifier
	1	0-4	Segment number system A	1 to 32
		5	Extended bit for segment number system A	Max. 64 nodes possible
		6-7	Not used	
	2	0-4	Segment number system B	Max. 32 nodes possible
		5	Extended bit for segment number system B	Max. 64 nodes possible

LS-5 communication - "slow" refreshed data				
Mux	**Byte**	**Bit**	**Function**	**Remark**
		6-7	Not used	
	3		Visualization message 1	Dependent on visualization message defined in mux "S1"
	4			
	5			
	6			
	7		Not used	
S3	0		6	Mux identifier
	1		Not used	
	2		Not used	
	3		Visualization message 2	Dependent of visualization message defined in "Slow 1"
	4			
	5			
	6			
	7		Not used	

9.2.8 Protocol 65000 (External Discrete I/O 1 to 8)

If this data protocol is addressed to an expansion board, it is used to issue a command to energize a discrete output of the expansion board (parameter 8005 is written).

If this data protocol is addressed to an easYgen, it is used to transmit the state of a discrete input of an expansion board (parameter 8014 is written).

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	**Data byte**				
1	1	-	Discrete Inputs/Outputs 1 to 8		--
			0: Discrete I/O 1		Bit
			1: Discrete I/O 2		Bit
			2: Discrete I/O 3		Bit
			3: Discrete I/O 4		Bit
			4: Discrete I/O 5		Bit
			5: Discrete I/O 6		Bit
			6: Discrete I/O 7		Bit
			7: Discrete I/O 8		Bit

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
	2	-	internal		
	3,4,5,6	-	internal		

9.2.9 Protocol 65001 (External Discrete I/O 9 to 16)

If this data protocol is addressed to an expansion board, it is used to issue a command to energize a discrete output of the expansion board (parameter 8005 is written).

If this data protocol is addressed to an easYgen, it is used to transmit the state of a discrete input of an expansion board (parameter 8014 is written).

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
1	1	-	Discrete Inputs/Outputs 9 to 16		--
			0: Discrete I/O 9		Bit
			1: Discrete I/O 10		Bit
			2: Discrete I/O 11		Bit
			3: Discrete I/O 12		Bit
			4: Discrete I/O 13		Bit
			5: Discrete I/O 14		Bit
			6: Discrete I/O 15		Bit
			7: Discrete I/O 16		Bit
	2	-	internal		
	3,4,5,6	-	internal		

9.2.10 Protocol 65002 (External Discrete I/O 17 to 24)

If this data protocol is addressed to an expansion board, it is used to issue a command to energize a discrete output of the expansion board (parameter 8009 is written).

If this data protocol is addressed to an easYgen, it is used to transmit the state of a discrete input of an expansion board (parameter 8015 is written).

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
1	1	-	Discrete Inputs/Outputs 17 to 24		--
			0: Discrete I/O 17		Bit
			1: Discrete I/O 18		Bit
			2: Discrete I/O 19		Bit
			3: Discrete I/O 20		Bit
			4: Discrete I/O 21		Bit
			5: Discrete I/O 22		Bit
			6: Discrete I/O 23		Bit
			7: Discrete I/O 24		Bit
	2	-	internal		
	3,4,5,6	-	internal		

9.2.11 Protocol 65003 (External Discrete I/O 25 to 32)

If this data protocol is addressed to an expansion board, it is used to issue a command to energize a discrete output of the expansion board (parameter 8009 is written).

If this data protocol is addressed to an easYgen, it is used to transmit the state of a discrete input of an expansion board (parameter 8015 is written).

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
1	1	-	Discrete Inputs/Outputs 25 to 32		--
			0: Discrete I/O 25		Bit
			1: Discrete I/O 26		Bit
			2: Discrete I/O 27		Bit

CAN		Parameter ID	Description	Multiplier	Units
Data byte 0 (Mux)	Data byte				
			3: Discrete I/O 28		Bit
			4: Discrete I/O 29		Bit
			5: Discrete I/O 30		Bit
			6: Discrete I/O 31		Bit
			7: Discrete I/O 32		Bit
	2	-	internal		
	3,4,5,6	-	internal		

9.2.12 Protocol 5014

Based on Protocol 5003 but with enhancements

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Model	Com-ment	Com-pared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen-3000XT		(BUS-data * Multiplier = real value)		easYgen		
450001	450000	0	1,2		Protocol-ID, always 5014		–	3000XT		
450002	450001	0	3,4	10100	Pickup speed	1	rpm	3000XT		
450003	450002	0	5,6	-	Control mode (STOP/AUTO/MANUAL/TEST)	Mask:000Fh 1=AUTO 2=STOP 4=MANUAL / 8=TEST	(enum.)	3000XT		TEST included
450004	450003	1	1,2	160	Gen. powerfactor	0.001		3000XT		
450005	450004	1	3,4,5,6	170	Average Gen. Wye-Voltage	0.1	V	3000XT		
450007	450006	2	1,2	144	Gen. frequency	0.01	Hz	3000XT		
450008	450007	2	3,4,5,6	171	Average Gen. Delta-Voltage	0.1	V	3000XT		
450010	450009	3	1,2	147	Mains frequency	0.01	Hz	3000XT		
450011	450010	3	3,4,5,6	173	Average Mains Wye-Voltage	0.1	V	3000XT		
450013	450012	4	1,2	208	Mains power factor	0.001		3000XT		
450014	450013	4	3,4,5,6	174	Average Mains Delta-Voltage	0.1	V	3000XT		
450016	450015	5	1,2	209	Busbar Frequency	0.01	Hz	3000XT		
450017	450016	5	3,4,5,6	216	Average Busbar Delta-Voltage	0.1	V	3000XT		New

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Model	Comment	Compared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen-3000XT		(BUS-data * Multiplier = real value)		easYgen		
450019	450018	6	1,2	4085	96.16 LM Internal Flag 16	Mask: 8000h	Bit	3000XT		New
					96.15 LM Internal Flag 15	Mask: 4000h	Bit	3000XT		New
					96.14 LM Internal Flag 14	Mask: 2000h	Bit	3000XT		New
					96.13 LM Internal Flag 13	Mask: 1000h	Bit	3000XT		New
					96.12 LM Internal Flag 12	Mask: 0800h	Bit	3000XT		New
					96.11 LM Internal Flag 11	Mask: 0400h	Bit	3000XT		New
					96.10 LM Internal Flag 10	Mask: 0200h	Bit	3000XT		New
					96.09 LM Internal Flag 9	Mask: 0100h	Bit	3000XT		New
					96.08 LM Internal Flag 8	Mask: 0080h	Bit	3000XT		New
					96.07 LM Internal Flag 7	Mask: 0040h	Bit	3000XT		New
					96.06 LM Internal Flag 6	Mask: 0020h	Bit	3000XT		New
					96.05 LM Internal Flag 5	Mask: 0010h	Bit	3000XT		New
					96.04 LM Internal Flag 4	Mask: 0008h	Bit	3000XT		New
					96.03 LM Internal Flag 3	Mask: 0004h	Bit	3000XT		New
					96.02 LM Internal Flag 2	Mask: 0002h	Bit	3000XT		New
					96.01 LM Internal Flag 1	Mask: 0001h	Bit	3000XT		New
450020	450019	6	3,4,5,6	234	Average Busbar Wye-Voltage	0.1	V	3500XT-P2		New
450022	450021	7	1,2	10110	Battery voltage	0.1	V	3000XT		
450023	450022	7	3,4,5,6	207	Av. Mains Current	0.001	A	3000XT		
450025	450024	8	1,2	10111	Analog input 1	changeable		3000XT		
450026	450025	8	3,4,5,6	185	Av. Gen. Current	0.001	A	3000XT		
450028	450027	9	1,2	10112	Analog input 2	changeable		3000XT		
450029	450028	9	3,4,5,6	161	Meas. ground current	0.001	A	3000XT		
450031	450030	10	1,2	10115	Analog input 3	changeable		3000XT		
450032	450031	10	3,4,5,6	159	Calculated ground current	0.001	A	3000XT		

Modbus		CAN		Param-eter ID easYgen-3000XT	Description	Multiplier (BUS-data * Multiplier = real value)	Units	Model easYgen	Com-ment	Com-pared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte							
450034	450033	11	1,2	10117	Analog input 4	changeable		3500XT-P2		
450035	450034	11	3,4,5,6	111	Gen. current 1	0.001	A	3000XT		
450037	450036	12	1,2	10151	Analog input 5	changeable		3500XT-P2		
450038	450037	12	3,4,5,6	112	Gen. current 2	0.001	A	3000XT		
450040	450039	13	1,2	10152	Analog input 6	changeable		3500XT-P2		
450041	450040	13	3,4,5,6	113	Gen. current 3	0.001	A	3000XT		
450043	450042	14	1,2	10153	Analog input 7	changeable		3500XT-P2		
450044	450043	14	3,4,5,6	134	Mains current L1	0.001	A	3000XT		
450046	450045	15	1,2	10154	Analog input 8	changeable		3500XT-P2		
450047	450046	15	3,4,5,6	231	Busbar Voltage L1-N	0.1	V	3500XT-P2		New
450049	450048	16	1,2	10155	Analog input 9	changeable		3500XT-P2		
450050	450049	16	3,4,5,6	232	Busbar Voltage L2-N	0.1	V	3500XT-P2		New
450052	450051	17	1,2	10156	Analog input 10	changeable		3500XT-P2		
450053	450052	17	3,4,5,6	135	Total gen. power	1	W	3000XT		
450055	450054	18	1,2		internal			reserved		
450056	450055	18	3,4,5,6	140	Total mains power	1	W	3000XT		
					External Mains kW value can be picked up through the according Analog Input.					
450058	450057	19	1,2	4086	Operating Range Monitoring Code Number	Mask FF00h		3000XT		New
					Operating range Error-Code ("0" means no failure is active or latched)					
					The current segment number	Mask 00FFh		3000XT		New
					One of 64 Segments possible					
450059	450058	19	3,4,5,6	136	Total gen. reactive power	1	var	3000XT		
450061	450060	20	1,2	10159	AI Auxiliary excitation D+	0.1	V	3000XT		
450062	450061	20	3,4,5,6	150	Total mains reactive power	1	var	3000XT		
					External Mains kW value can be picked up through the according Analog Input.					
450064	450063	21	1,2	10133	05.01 Engine Over speed 1 latched	Mask: 8000h	Bit	3000XT		
					05.02 Engine Over speed 2 latched	Mask: 4000h	Bit	3000XT		

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Model	Com-ment	Com-pared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen-3000XT		(BUS-data * Multiplier = real value)		easYgen		
					05.03 Engine under speed 1 latched	Mask: 2000h	Bit	3000XT		
					05.04 Engine under speed 2 latched	Mask: 1000h	Bit	3000XT		
					05.05 Unintended stop detected latched	Mask: 0800h	Bit	3000XT		
					05.07 Speed detection alarm latched	Mask: 0400h	Bit	3000XT		
					05.06 Shutdown malfunction detected latched	Mask: 0200h	Bit	3000XT		
					08.05 GCB fail to close latched	Mask: 0100h	Bit	3000XT		
					08.06 GCB fail to open latched	Mask: 0080h	Bit	3000XT		
					08.07 MCB fail to close latched	Mask: 0040h	Bit	3000XT		
					08.08 MCB fail to open latched	Mask: 0020h	Bit	3000XT		
					08.10 General CAN-J1939 fault latched	Mask: 0010h	Bit	3000XT		
					05.08 Start fail detected latched	Mask: 0008h	Bit	3000XT		
					05.09 Maintenance days exceeded latched	Mask: 0004h	Bit	3000XT		
					05.10 Maintenance hours exceeded latched	Mask: 0002h	Bit	3000XT		
					08.18 CANopen error at CAN Interface 1	Mask: 0001h	Bit	3000XT		
450065	450064	21	3,4,5,6	182	Busbar: Voltage L1-L2	0.1	V	3000XT		
450067	450066	22	1,2	4087	08.30 Timeout Synchronisation GCB latched	Mask: 8000h	Bit	3000XT		
					08.31 Timeout Synchronisation MCB latched	Mask: 4000h	Bit	3000XT		
					08.32 Timeout Synchronisation GGB latched	Mask: 2000h	Bit	3500XT		
					05.11 Charge fail (D+ functionality) latched	Mask: 1000h	Bit	3000XT		
					Operating range failure (error 12)	Mask: 0800h	Bit	3000XT		removed
					Internal	Mask: 0400h		reserved		removed
					Internal	Mask: 0200h		reserved		removed
					Internal	Mask: 0100h		reserved		
					Internal	Mask: 0080h		reserved		
					08.29 CANopen error at CAN Interface 3	Mask: 0040h	Bit	3500XT		New

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Model	Comment	Compared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen -3000XT		(BUS-data * Multiplier = real value)		easYgen		
					08.19 CANopen error at CAN Interface 2	Mask: 0020h	Bit	3000XT		
					08.16 Parameter Alignment LDSS	Mask: 0010h	Bit	3000XT		
					08.17 Missing members	Mask: 0008h	Bit	3000XT		
					Internal	Mask: 0004h	Bit	3000XT		
					05.13 ECU red lamp alarm latched	Mask: 0002h	Bit	3000XT		
					05.14 ECU yellow (amber) lamp alarm latched	Mask: 0001h	Bit	3000XT		
450068	450067	22	3,4,5,6	189	Busbar: Voltage L2-L3	0.1	V	3500XT-P2		
450070	450069	23	1,2	10286	Internal	Mask: 8000h	Bit	3000XT		
					Internal	Mask: 4000h	Bit	3000XT		
					Internal	Mask: 2000h	Bit	3000XT		
					Internal	Mask: 1000h	Bit	3000XT		
					Internal	Mask: 0800h	Bit	3000XT		
					Internal	Mask: 0400h	Bit	3000XT		
					Internal	Mask: 0200h	Bit	reserved		
					17.09 Neutral interl. reply mismatch latched	Mask: 0100h	Bit	3000XT		
					17.08 Decoupling GCB<->MCB latched	Mask: 0080h	Bit	3000XT		
					17.07 Measurement difference 4105 latched	Mask: 0040h	Bit	3000XT		
					17.06 Parameter alignment 4105 latched	Mask: 0020h	Bit	3000XT		
					17.05 Missing member 4105 latched	Mask: 0010h	Bit	3000XT		
					08.22 Busbar v/f not ok latched	Mask: 0008h	Bit	3000XT		New
					08.21 Feedback GCB mismatch latched	Mask: 0004h	Bit	reserved		
					17.02 Reactive load share mismatch latched	Mask: 0002h	Bit	3000XT		New
					17.01 Active load share mismatch latched	Mask: 0001h	Bit	3000XT		New
450071	450070	23	3,4,5,6	193	Busbar: Voltage L3-L1	0.1	V	3500XT-P2		New
450073	450072	24	1,2	10134	06.01 Generator over frequency 1 latched	Mask: 8000h	Bit	3000XT		

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Model	Comment	Compared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen-3000XT		(BUS-data * Multiplier = real value)		easYgen		
					06.02 Generator over frequency 2 latched	Mask: 4000h	Bit	3000XT		
					06.03 Generator under frequency 1 latched	Mask: 2000h	Bit	3000XT		
					06.04 Generator under frequency 2 latched	Mask: 1000h	Bit	3000XT		
					06.05 Generator over voltage 1 latched	Mask: 0800h	Bit	3000XT		
					06.06 Generator over voltage 2 latched	Mask: 0400h	Bit	3000XT		
					06.07 Generator under voltage 1 latched	Mask: 0200h	Bit	3000XT		
					06.08 Generator under voltage 2 latched	Mask: 0100h	Bit	3000XT		
					06.09 Generator over current 1 latched	Mask: 0080h	Bit	3000XT		
					06.10 Generator over current 2 latched	Mask: 0040h	Bit	3000XT		
					06.11 Generator over current 3 latched	Mask: 0020h	Bit	3000XT		
					06.12 Reverse / reduced power 1 latched	Mask: 0010h	Bit	3000XT		
					06.13 Reverse / reduced power 2 latched	Mask: 0008h	Bit	3000XT		
					06.14 Generator overload IOP 1 latched	Mask: 0004h	Bit	3000XT		
					06.15 Generator overload IOP 2 latched	Mask: 0002h	Bit	3000XT		
					internal	Mask: 0001h	Bit	reserved		
450074	450073	24	3,4,5,6	108	Gen. voltage L1-L2	0.1	V	3000XT		
450076	450075	25	1,2	10138	06.16 Generator unbalanced load 1 latched	Mask: 8000h	Bit	3000XT		
					06.17 Generator unbalanced load 2 latched	Mask: 4000h	Bit	3000XT		
					06.18 Generator voltage asymmetry latched	Mask: 2000h	Bit	3000XT		
					06.19 Ground fault 1 latched	Mask: 1000h	Bit	3000XT		
					06.20 Ground fault 2 latched	Mask: 0800h	Bit	3000XT		
					06.21 Gen. Phase Rotation mismatch Latched	Mask: 0400h	Bit	3000XT		
					06.29 Gen. active power mismatch Latched	Mask: 0200h	Bit	3000XT		
					06.30 Generator unloading mismatch Latched	Mask: 0100h	Bit	3000XT		
					06.22 Inverse time over current Latched	Mask: 0080h	Bit	3000XT		

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Model	Com-ment	Com-pared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen-3000XT		(BUS-data * Multiplier = real value)		easYgen		
					06.31 Operating Range failed latched	Mask: 0040h	Bit	3000XT		
					06.23 Generator overload MOP 1 latched	Mask: 0020h	Bit	3000XT		
					06.24 Generator overload MOP 2 latched	Mask: 0010h	Bit	3000XT		
					06.25 Gen.Power Factor lagging 1 latched	Mask: 0008h	Bit	3000XT		
					06.26 Gen.Power Factor lagging 2 latched	Mask: 0004h	Bit	3000XT		
					06.27 Gen.Power Factor leading 1 latched	Mask: 0002h	Bit	3000XT		
					06.28 Gen.Power Factor leading 2 latched	Mask: 0001h	Bit	3000XT		
450077	450076	25	3,4,5,6	114	Gen. voltage L1-N	0.1	V	3000XT		
450079	450078	26	1,2	10135	07.06 Mains over frequency 1 latched	Mask: 8000h	Bit	3000XT		
					07.07 Mains over frequency 2 latched	Mask: 4000h	Bit	3000XT		
					07.08 Mains under fre-quency 1 latched	Mask: 2000h	Bit	3000XT		
					07.09 Mains under fre-quency 2 latched	Mask: 1000h	Bit	3000XT		
					07.10 Mains over voltage 1 latched	Mask: 0800h	Bit	3000XT		
					07.11 Mains over voltage 2 latched	Mask: 0400h	Bit	3000XT		
					07.12 Mains under voltage 1 latched	Mask: 0200h	Bit	3000XT		
					07.13 Mains under voltage 2 latched	Mask: 0100h	Bit	3000XT		
					07.14 Mains Phase shift latched	Mask: 0080h	Bit	3000XT		
					07.25 Mains decoupling latched	Mask: 0040h	Bit	3000XT		
					internal	Mask: 0020h	Bit	reserved		
					internal	Mask: 0010h	Bit	reserved		
					internal	Mask: 0008h	Bit	reserved		
					07.05 Mains Phase rotation mismatch latched	Mask: 0004h	Bit	3000XT		
					internal	Mask: 0002h	Bit	reserved		
					internal	Mask: 0001h	Bit	reserved		
450080	450079	26	3,4,5,6	109	Gen. voltage L2-L3	0.1	V	3000XT		

Modbus		CAN		Param- eter ID	Description	Multiplier	Units	Model	Com- ment	Com- pared with "5003 "
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data- Byte	easYgen -3000XT		(BUS-data * Multiplier = real value)		easYg en		
450082	450081	27	1,2	10278	07.21 Mains import power 1 latched	Mask: 8000h	Bit	3000X T		
					07.22 Mains import power 2 latched	Mask: 4000h	Bit	3000X T		
					07.23 Mains export power 1 latched	Mask: 2000h	Bit	3000X T		
					07.24 Mains export power 2 latched	Mask: 1000h	Bit	3000X T		
					07.17 Mains PF lagging 1 latched	Mask: 0800h	Bit	3000X T		
					07.18 Mains PF lagging 2 latched	Mask: 0400h	Bit	3000X T		
					07.19 Mains PF leading 1 latched	Mask: 0200h	Bit	3000X T		
					07.20 Mains PF leading 2 latched	Mask: 0100h	Bit	3000X T		
					07.15 Mains df/dt latched	Mask: 0080h	Bit	3000X T		
					07.16 Mains active power mismatch latched	Mask: 0040h	Bit	3000X T		
					07.28 Mains Time-dep. Voltage (FRT) latched	Mask: 0020h	Bit	3000X T		
					internal	Mask: 0010h	Bit	reserve d		
					07.27 Mains slow voltage increase (10 min)	Mask: 0008h	Bit	3000X T		
					internal	Mask: 0004h	Bit	reserve d		
					07.29 QV Monitoring step 1 tripped	Mask: 0002h	Bit	3000X T		
					07.30 QV Monitoring step 2 tripped	Mask: 0001h	Bit	3000X T		
450083	450082	27	3,4,5, 6	115	Gen. voltage L2-N	0.1	V	3000X T		
450085	450084	28	1,2	10132	09.01 Discrete input 1 latched	Mask: 8000h	Bit	3000X T		
					09.02 Discrete input 2 latched	Mask: 4000h	Bit	3000X T		
					09.03 Discrete input 3 latched	Mask: 2000h	Bit	3000X T		
					09.04 Discrete input 4 latched	Mask: 1000h	Bit	3000X T		
					09.05 Discrete input 5 latched	Mask: 0800h	Bit	3000X T		
					09.06 Discrete input 6 latched	Mask: 0400h	Bit	3000X T		
					09.07 Discrete input 7 latched	Mask: 0200h	Bit	3000X T		
					09.08 Discrete input 8 latched	Mask: 0100h	Bit	3000X T		

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Model	Comment	Compared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen-3000XT		(BUS-data * Multiplier = real value)		easYgen		
					09.09 Discrete input 9 latched	Mask: 0080h	Bit	3000XT		
					09.10 Discrete input 10 latched	Mask: 0040h	Bit	3000XT		
					09.11 Discrete input 11 latched	Mask: 0020h	Bit	3000XT		
					09.12 Discrete input 12 latched	Mask: 0010h	Bit	3000XT		
					internal	Mask: 0008h	Bit	reserved		
					internal	Mask: 0004h	Bit	reserved		
					internal	Mask: 0002h	Bit	reserved		
					internal	Mask: 0001h	Bit	reserved		
450086	450085	28	3,4,5,6	110	Gen. voltage L3-L1	0.1	V	3000		
450088	450087	29	1,2	10283	09.13 Discrete input 13 latched	Mask: 8000h	Bit	3500XT-P2		
					09.14 Discrete input 14 latched	Mask: 4000h	Bit	3500XT-P2		
					09.15 Discrete input 15 latched	Mask: 2000h	Bit	3500XT-P2		
					09.16 Discrete input 16 latched	Mask: 1000h	Bit	3500XT-P2		
					09.17 Discrete input 17 latched	Mask: 0800h	Bit	3500XT-P2		
					09.18 Discrete input 18 latched	Mask: 0400h	Bit	3500XT-P2		
					09.19 Discrete input 19 latched	Mask: 0200h	Bit	3500XT-P2		
					09.20 Discrete input 20 latched	Mask: 0100h	Bit	3500XT-P2		
					09.21 Discrete input 21 latched	Mask: 0080h	Bit	3500XT-P2		
					09.22 Discrete input 22 latched	Mask: 0040h	Bit	3500XT-P2		
					09.23 Discrete input 23 latched	Mask: 0020h	Bit	3500XT-P2		
					internal	Mask: 0010h	Bit	reserved		
					internal	Mask: 0008h	Bit	reserved		
					internal	Mask: 0004h	Bit	reserved		
					internal	Mask: 0002h	Bit	reserved		
					internal	Mask: 0001h	Bit	reserved		

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Model	Com-ment	Com-pared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen -3000XT		(BUS-data * Multiplier = real value)		easYgen		
450089	450088	29	3,4,5, 6	116	Gen. voltage L3-N	0.1	V	3000XT		
450091	450090	30	1,2	16377	12.16 External discrete input 16 latched	Mask: 8000h	Bit	3000XT		
					12.15 External discrete input 15 latched	Mask: 4000h	Bit	3000XT		
					12.14 External discrete input 14 latched	Mask: 2000h	Bit	3000XT		
					12.13 External discrete input 13 latched	Mask: 1000h	Bit	3000XT		
					12.12 External discrete input 12 latched	Mask: 0800h	Bit	3000XT		
					12.11 External discrete input 11 latched	Mask: 0400h	Bit	3000XT		
					12.10 External discrete input 10 latched	Mask: 0200h	Bit	3000XT		
					12.09 External discrete input 9 latched	Mask: 0100h	Bit	3000XT		
					12.08 External discrete input 8 latched	Mask: 0080h	Bit	3000XT		
					12.07 External discrete input 7 latched	Mask: 0040h	Bit	3000XT		
					12.06 External discrete input 6 latched	Mask: 0020h	Bit	3000XT		
					12.05 External discrete input 5 latched	Mask: 0010h	Bit	3000XT		
					12.04 External discrete input 4 latched	Mask: 0008h	Bit	3000XT		
					12.03 External discrete input 3 latched	Mask: 0004h	Bit	3000XT		
					12.02 External discrete input 2 latched	Mask: 0002h	Bit	3000XT		
					12.01 External discrete input 1 latched	Mask: 0001h	Bit	3000XT		
450092	450091	30	3,4,5, 6	118	Mains voltage L1-L2	0.1	V	3000XT		
450094	450093	31	1,2	10279	15.16 Flexible limit 16 latched	Mask: 8000h	Bit	3000XT		
					15.15 Flexible limit 15 latched	Mask: 4000h	Bit	3000XT		
					15.14 Flexible limit 14 latched	Mask: 2000h	Bit	3000XT		
					15.13 Flexible limit 13 latched	Mask: 1000h	Bit	3000XT		
					15.12 Flexible limit 12 latched	Mask: 0800h	Bit	3000XT		
					15.11 Flexible limit 11 latched	Mask: 0400h	Bit	3000XT		
					15.10 Flexible limit 10 latched	Mask: 0200h	Bit	3000XT		

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Model	Com-ment	Com-pared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen -3000XT		(BUS-data * Multiplier = real value)		easYgen		
					15.09 Flexible limit 9 latched	Mask: 0100h	Bit	3000XT		
					15.08 Flexible limit 8 latched	Mask: 0080h	Bit	3000XT		
					15.07 Flexible limit 7 latched	Mask: 0040h	Bit	3000XT		
					15.06 Flexible limit 6 latched	Mask: 0020h	Bit	3000XT		
					15.05 Flexible limit 5 latched	Mask: 0010h	Bit	3000XT		
					15.04 Flexible limit 4 latched	Mask: 0008h	Bit	3000XT		
					15.03 Flexible limit 3 latched	Mask: 0004h	Bit	3000XT		
					15.02 Flexible limit 2 latched	Mask: 0002h	Bit	3000XT		
					15.01 Flexible limit 1 latched	Mask: 0001h	Bit	3000XT		
450095	450094	31	3,4,5,6	121	Mains voltage L1-N	0.1	V	3000XT		
450097	450096	32	1,2	10280	15.32 Flexible limit 32 latched	Mask: 8000h	Bit	3000XT		
					15.31 Flexible limit 31 latched	Mask: 4000h	Bit	3000XT		
					15.30 Flexible limit 30 latched	Mask: 2000h	Bit	3000XT		
					15.29 Flexible limit 29 latched	Mask: 1000h	Bit	3000XT		
					15.28 Flexible limit 28 latched	Mask: 0800h	Bit	3000XT		
					15.27 Flexible limit 27 latched	Mask: 0400h	Bit	3000XT		
					15.26 Flexible limit 26 latched	Mask: 0200h	Bit	3000XT		
					15.25 Flexible limit 25 latched	Mask: 0100h	Bit	3000XT		
					15.24 Flexible limit 24 latched	Mask: 0080h	Bit	3000XT		
					15.23 Flexible limit 23 latched	Mask: 0040h	Bit	3000XT		
					15.22 Flexible limit 22 latched	Mask: 0020h	Bit	3000XT		
					15.21 Flexible limit 21 latched	Mask: 0010h	Bit	3000XT		
					15.20 Flexible limit 20 latched	Mask: 0008h	Bit	3000XT		
					15.19 Flexible limit 19 latched	Mask: 0004h	Bit	3000XT		
					15.18 Flexible limit 18 latched	Mask: 0002h	Bit	3000XT		

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Model	Com-ment	Com-pared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen-3000XT		(BUS-data * Multiplier = real value)		easYgen		
					15.17 Flexible limit 17 latched	Mask: 0001h	Bit	3000XT		
450098	450097	32	3,4,5,6	119	Mains voltage L2-L3	0.1	V	3000XT		
450100	450099	33	1,2	10281	internal	Mask: 8000h	Bit	reserved		
					internal	Mask: 4000h	Bit	reserved		
					internal	Mask: 2000h	Bit	reserved		
					internal	Mask: 1000h	Bit	reserved		
					internal	Mask: 0800h	Bit	reserved		
					internal	Mask: 0400h	Bit	reserved		
					internal	Mask: 0200h	Bit	reserved		
					internal	Mask: 0100h	Bit	reserved		
					15.40 Flexible limit 40 latched	Mask: 0080h	Bit	3000XT		
					15.39 Flexible limit 39 latched	Mask: 0040h	Bit	3000XT		
					15.38 Flexible limit 38 latched	Mask: 0020h	Bit	3000XT		
					15.37 Flexible limit 37 latched	Mask: 0010h	Bit	3000XT		
					15.36 Flexible limit 36 latched	Mask: 0008h	Bit	3000XT		
					15.35 Flexible limit 35 latched	Mask: 0004h	Bit	3000XT		
					15.34 Flexible limit 34 latched	Mask: 0002h	Bit	3000XT		
					15.33 Flexible limit 33 latched	Mask: 0001h	Bit	3000XT		
450101	450100	33	3,4,5,6	122	Mains voltage L2-N	0.1	V	3000XT		
450103	450102	34	1,2	4088	Internal	Mask: 8000h	Bit	3000XT		
					Internal	Mask: 4000h	Bit	3000XT		
					Internal	Mask: 2000h	Bit	3000XT		
					Internal	Mask: 1000h	Bit	3000XT		
					Internal	Mask: 0800h	Bit	3000XT		
					Internal	Mask: 0400h	Bit	3000XT		

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Model	Comment	Compared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen-3000XT		(BUS-data * Multiplier = real value)		easYgen		
					Internal	Mask: 0200h	Bit	3000XT		
					Internal	Mask: 0100h	Bit	3000XT		
					Internal	Mask: 0080h	Bit	3000XT		
					Internal	Mask: 0040h	Bit	3000XT		
					Internal	Mask: 0020h	Bit	reserved		
					Internal	Mask: 0010h	Bit	3000XT		
					08.02 Battery over voltage 2 latched	Mask: 0008h	Bit	3000XT		
					08.04 Battery under voltage 2 latched	Mask: 0004h	Bit	3000XT		
					08.01 Battery over voltage 1 latched	Mask: 0002h	Bit	3000XT		
					08.03 Battery under voltage 1 latched	Mask: 0001h	Bit	3000XT		
450104	450103	34	3,4,5,6	120	Mains voltage L3-L1	0.1	V	3000XT		
450106	450105	35	1,2	4089	01.11 New Alarm triggered	Mask: 8000h	Bit	3000XT		New
					internal	Mask: 4000h	Bit	reserved		
					internal	Mask: 2000h	Bit	reserved		
					internal	Mask: 1000h	Bit	reserved		
					internal	Mask: 0800h	Bit	reserved		
					internal	Mask: 0400h	Bit	reserved		
					internal	Mask: 0200h	Bit	reserved		
					internal	Mask: 0100h	Bit	reserved		
					internal	Mask: 0080h	Bit	reserved		
					internal	Mask: 0040h	Bit	reserved		
					01.06 Alarm class F latched	Mask: 0020h	Bit	3000XT		
					01.05 Alarm class E latched	Mask: 0010h	Bit	3000XT		
					01.04 Alarm class D latched	Mask: 0008h	Bit	3000XT		
					01.03 Alarm class C latched	Mask: 0004h	Bit	3000XT		

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Model	Comment	Compared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen-3000XT		(BUS-data * Multiplier = real value)		easYgen		
					01.02 Alarm class B latched	Mask: 0002h	Bit	3000XT		
					01.01 Alarm class A latched	Mask: 0001h	Bit	3000XT		
450107	450106	35	3,4,5,6	123	Mains voltage L3-N	0.1	V	3000XT		
450109	450108	36	1,2	10137	internal	Mask: 0001h	Bit	reserved		
					10.01 Analog input 1 wire break	Mask: 0002h	Bit	3000XT		
					10.02 Analog input 2 wire break	Mask: 0004h	Bit	3000XT		
					10.03 Analog input 3 wire break	Mask: 0008h	Bit	3000XT		
					10.04 Analog input 4 wire break	Mask: 0010h	Bit	3500XT-P2		
					10.05 Analog input 5 wire break	Mask: 0020h	Bit	3500XT-P2		
					10.06 Analog input 6 wire break	Mask: 0040h	Bit	3500XT-P2		
					10.07 Analog input 7 wire break	Mask: 0080h	Bit	3500XT-P2		
					10.08 Analog input 8 wire break	Mask: 0100h	Bit	3500XT-P2		
					10.09 Analog input 9 wire break	Mask: 0200h	Bit	3500XT-P2		
					10.10 Analog input 10 wire break	Mask: 0400h	Bit	3500XT-P2		
					internal	Mask: 0800h	Bit	reserved		
					internal	Mask: 1000h	Bit	reserved		
					internal	Mask: 2000h	Bit	reserved		
					internal	Mask: 4000h	Bit	reserved		
					internal	Mask: 8000h	Bit	reserved		
450110	450109	36	3,4	15310	Internal			reserved		
450111	450110	36	5,6	10285	25.16 Ext. analog input 16 wire break	Mask: 8000h	Bit	3000XT		
					25.15 Ext. analog input 15 wire break	Mask: 4000h	Bit	3000XT		
					25.14 Ext. analog input 14 wire break	Mask: 2000h	Bit	3000XT		
					25.13 Ext. analog input 13 wire break	Mask: 1000h	Bit	3000XT		
					25.12 Ext. analog input 12 wire break	Mask: 0800h	Bit	3000XT		

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Model	Comment	Compared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen-3000XT		(BUS-data * Multiplier = real value)		easYgen		
					25.11 Ext. analog input 11 wire break	Mask: 0400h	Bit	3000XT		
					25.10 Ext. analog input 10 wire break	Mask: 0200h	Bit	3000XT		
					25.09 Ext. analog input 9 wire break	Mask: 0100h	Bit	3000XT		
					25.08 Ext. analog input 8 wire break	Mask: 0080h	Bit	3000XT		
					25.07 Ext. analog input 7 wire break	Mask: 0040h	Bit	3000XT		
					25.06 Ext. analog input 6 wire break	Mask: 0020h	Bit	3000XT		
					25.05 Ext. analog input 5 wire break	Mask: 0010h	Bit	3000XT		
					25.04 Ext. analog input 4 wire break	Mask: 0008h	Bit	3000XT		
					25.03 Ext. analog input 3 wire break	Mask: 0004h	Bit	3000XT		
					25.02 Ext. analog input 2 wire break	Mask: 0002h	Bit	3000XT		
					25.01 Ext. analog input 1 wire break	Mask: 0001h	Bit	3000XT		
450112	450111	37	1,2	10107	13.01 Relay-Output 1 (Self-test-relay)	Mask: 8000h	Bit	3000XT		
					13.02 Relay-Output 2	Mask: 4000h	Bit	3000XT		
					13.03 Relay-Output 3	Mask: 2000h	Bit	3000XT		
					13.04 Relay-Output 4	Mask: 1000h	Bit	3000XT		
					13.05 Relay-Output 5	Mask: 0800h	Bit	3000XT		
					13.06 Relay-Output 6	Mask: 0400h	Bit	3000XT		
					13.07 Relay-Output 7	Mask: 0200h	Bit	3000XT		
					13.08 Relay-Output 8	Mask: 0100h	Bit	3000XT		
					13.09 Relay-Output 9	Mask: 0080h	Bit	3000XT		
					13.10 Relay-Output 10	Mask: 0040h	Bit	3000XT		
					13.11 Relay-Output 11	Mask: 0020h	Bit	3000XT		
					13.12 Relay-Output 12	Mask: 0010h	Bit	3000XT		
					internal	Mask: 0008h	Bit	reserved		
					internal	Mask: 0004h	Bit	reserved		

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Model	Com-ment	Com-pared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen -3000XT		(BUS-data * Multiplier = real value)		easYgen		
					internal	Mask: 0002h	Bit	reserved		
					internal	Mask: 0001h	Bit	reserved		
450113	450112	37	3,4	10109	13.13 Relay-Output 13	Mask: 8000h	Bit	3500XT-P2		
					13.14 Relay-Output 14	Mask: 4000h	Bit	3500XT-P2		
					13.15 Relay-Output 15	Mask: 2000h	Bit	3500XT-P2		
					13.16 Relay-Output 16	Mask: 1000h	Bit	3500XT-P2		
					13.17 Relay-Output 17	Mask: 0800h	Bit	3500XT-P2		
					13.18 Relay-Output 18	Mask: 0400h	Bit	3500XT-P2		
					13.19 Relay-Output 19	Mask: 0200h	Bit	3500XT-P2		
					13.20 Relay-Output 20	Mask: 0100h	Bit	3500XT-P2		
					13.21 Relay-Output 21	Mask: 0080h	Bit	3500XT-P2		
					13.22 Relay-Output 22	Mask: 0040h	Bit	3500XT-P2		
					internal	Mask: 0020h	Bit	reserved		
					internal	Mask: 0010h	Bit	reserved		
					internal	Mask: 0008h	Bit	reserved		
					internal	Mask: 0004h	Bit	reserved		
					13.34 Transistor output 2	Mask: 0002h	Bit	3500XT-P2		
					13.33 Transistor output 1	Mask: 0001h	Bit	3500XT-P2		
450114	450113	37	5,6	8005	98.16 LM External DO 16	Mask: 8000h	Bit	3000XT		
					98.15 LM External DO 15	Mask: 4000h	Bit	3000XT		
					98.14 LM External DO 14	Mask: 2000h	Bit	3000XT		
					98.13 LM External DO 13	Mask: 1000h	Bit	3000XT		
					98.12 LM External DO 12	Mask: 0800h	Bit	3000XT		
					98.11 LM External DO 11	Mask: 0400h	Bit	3000XT		
					98.10 LM External DO 10	Mask: 0200h	Bit	3000XT		

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Model	Comment	Compared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen-3000XT		(BUS-data * Multiplier = real value)		easYgen		
					98.09 LM External DO 9	Mask: 0100h	Bit	3000XT		
					98.08 LM External DO 8	Mask: 0080h	Bit	3000XT		
					98.07 LM External DO 7	Mask: 0040h	Bit	3000XT		
					98.06 LM External DO 6	Mask: 0020h	Bit	3000XT		
					98.05 LM External DO 5	Mask: 0010h	Bit	3000XT		
					98.04 LM External DO 4	Mask: 0008h	Bit	3000XT		
					98.03 LM External DO 3	Mask: 0004h	Bit	3000XT		
					98.02 LM External DO 2	Mask: 0002h	Bit	3000XT		
					98.01 LM External DO 1	Mask: 0001h	Bit	3000XT		
450115	450114	38	1,2	10310	Analog output 1	changeable		3000XT		
450116	450115	38	3,4	10311	Analog output 2	changeable		3000XT		
450117	450116	38	5,6	10317	Analog output 3	changeable		3500XT-P2		New
450118	450117	39	1,2	10318	Analog output 4	changeable		3500XT-P2		
450119	450118	39	3,4	10319	Analog output 5	changeable		3500XT-P2		
450120	450119	39	5,6	10320	Analog output 6	changeable		3500XT-P2		

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Model	Comment	Compared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen-3000XT		(BUS-data * Multiplier = real value)		easYgen		
450121	450120	40	1,2	10202	Operation modes 13200 = Auxiliary services postrun 13216 = Idle run active 13201 = Aux. services prerun 13250 = Gen. stable time 13202 = Critical mode 13251 = In operation 13203 = Motor Stop 13252 = Power limited prerun 13204 = Cool down 13253 = AUTO mode ready 13205 = Mains settling 13254 = Ramp to rated 13206 = Engine Start 13255 = GCB open 13207 = Start - Pause 13256 = Unloading generator 13208 = Preglow 13257 = MCB open 13209 = GCB dead bus close 13258 = Loading generator 13210 = MCB dead bus close 13259 = Synchronization GCB 13211 = Emergency run 13260 = Synchronization MCB 13212 = Turning 13261 = GCB -> MCB Delay 13213 = Ignition 13262 = MCB -> GCB Delay 13214 = Crank protect 13263 = Start w/o Load 13215 = Emergency/Critical 13264 = Unloading mains 13271 = Run-up synchronization 13281 = Derating active 13265 = Synchronization permissive 13266 = Synchronization check		(enum.)	3000XT		

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Model	Com-ment	Com-pared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen-3000XT		(BUS-data * Multiplier = real value)		easYgen		
					13267 = Synchronization off 13268 = GGB open 13269 = Synchronization GGB 13273 = MCB -> GGB Delay 13282 = Unloading LS5 13283 = Synchronization LS5 13284 = Inhibit cranking					
450122	450121	40	3,4,5,6	2520	Gen. real energy	0,01	MWh	3000XT		
450124	450123	41	1,2	2540	Engine, number of start requests	1		3000XT		
450125	450124	41	3,4,5,6	2522	Gen. positive reactive energy	0,01	Mvarh	3000XT		
450127	450126	42	1,2	2558	Hours until next maintenance	0,1	h	3000XT		
450128	450127	42	3,4,5,6	2568	Gen. hours of operation	0,01	h	3000XT		
450130	450129	43	1,2	5541	Setpoint frequency	0,01	Hz	3000XT		
450131	450130	43	3,4,5,6	5542	Setpoint active power	0,1	kW	3000XT		
450133	450132	44	1,2,3,4	5640	Setpoint voltage	1	V	3000XT		
450135	450134	44	5,6	5641	Setpoint power factor	0,001		3000XT		
450136	450135	45	1,2	4090	Idle mode OR Ramp to rated active (suppresses undervolt., underfreq., ...)	Mask: 8000h	Bit	3000XT		
					04.15 Idle run is active	Mask: 4000h	Bit	3000XT		
					04.12 Start without closing GCB	Mask: 2000h	Bit	3000XT		
					04.64 Key activation	Mask: 1000h	Bit	reserved		
					A manual START has been requested	Mask: 0800h	Bit	3000XT		
					A manual STOP has been requested	Mask: 0400h	Bit	3000XT		
					04.10 Cooldown is active	Mask: 0200h	Bit	3000XT		
					03.01 Auxiliary Services is active	Mask: 0100h	Bit	3000XT		
					03.07 Engine monitoring delay expired	Mask: 0080h	Bit	3000XT		
					03.08 Breaker delay timer has expired	Mask: 0040h	Bit	3000XT		
					03.25 Engine shall run	Mask: 0020h	Bit	3000XT		

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Model	Comment	Compared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen -3000XT		(BUS-data * Multiplier = real value)		easYgen		
					04.27 Critical mode is active	Mask: 0010h	Bit	3000XT		
					03.06 Engine release is active	Mask: 0008h	Bit	3000XT		
					03.30 Auxiliary services prerun is active	Mask: 0004h	Bit	3000XT		
					03.31 Auxiliary services postrun is active	Mask: 0002h	Bit	3000XT		
					04.61 Lamp test request	Mask: 0001h	Bit	3000XT		
450137	450136	45	3,4	4091	03.02 Starter / Crank is active	Mask: 8000h	Bit	3000XT		
					03.28 Operating Magnet / Gasrelay is active	Mask: 4000h	Bit	3000XT		
					03.04 Preglow or Ignition is active	Mask: 2000h	Bit	3000XT		
					04.11 Mains settling timer is running	Mask: 1000h	Bit	3000XT		
					04.09 Emergency mode is currently active	Mask: 0800h	Bit	3000XT		
					03.40 Remote Shutdown (ID503, Bit9)	Mask: 0400h	Bit	3000XT		New
					03.33 Free PID Controller 3: Lower Command	Mask: 0200h	Bit	3000XT		
					03.32 Free PID Controller 3: Raise Command	Mask: 0100h	Bit	3000XT		
					03.35 Free PID Controller 2: Lower Command	Mask: 0080h	Bit	3000XT		
					03.34 Free PID Controller 2: Raise Command	Mask: 0040h	Bit	3000XT		
					03.27 Stop solenoid is active	Mask: 0020h	Bit	3000XT		
					03.24 Excitation AVR (Run-up Synchronization)	Mask: 0010h	Bit	3500XT		
					The genset runs mains parallel	Mask: 0008h	Bit	3000XT		
					03.37 Free PID Controller 1: Lower Command	Mask: 0004h	Bit	3000XT		
					03.36 Free PID Controller 1: Raise Command	Mask: 0002h	Bit	3000XT		
					Increment Engine Start Counter	Mask: 0001h	Bit	3000XT		
450138	450137	45	5,6	4155	03.20 3-Pos. Controller Freq./Power raise	Mask: 8000h	Bit	3000XT		
					03.21 3-Pos. Controller Freq./Power lower	Mask: 4000h	Bit	3000XT		
					03.22 3-Pos. Controller Volt./ReactPow raise	Mask: 2000h	Bit	3000XT		
					03.23 3-Pos. Controller Volt./ReactPow lower	Mask: 1000h	Bit	3000XT		

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Model	Com-ment	Com-pared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen-3000XT		(BUS-data * Multiplier = real value)		easYgen		
					04.06 GCB is closed	Mask: 0800h	Bit	3000XT		
					04.07 MCB is closed	Mask: 0400h	Bit	3000XT		
					05.16 Derating active (J1939 or freely)	Mask: 0200h	Bit	3000XT		
					04.18 Synchronisation GCB procedure is active	Mask: 0100h	Bit	3000XT		
					04.19 Open command GCB is active	Mask: 0080h	Bit	3000XT		
					04.20 Close command GCB is active	Mask: 0040h	Bit	3000XT		
					04.21 Synchronisation MCB procedure is active	Mask: 0020h	Bit	3000XT		
					04.22 Open command MCB is active	Mask: 0010h	Bit	3000XT		
					04.23 Close command MCB is active	Mask: 0008h	Bit	3000XT		
					04.28 Unloading generator is active	Mask: 0004h	Bit	3000XT		
					04.29 Unloading mains is active	Mask: 0002h	Bit	3000XT		
					04.30 Power limited prerun	Mask: 0001h	Bit	3000XT		
450139	450138	46	1,2	4156	04.16 GGB is closed	Mask: 8000h	Bit	3500XT		
					04.17 GGB is released	Mask: 4000h	Bit	3500XT		
					04.24 Synchronisation GGB procedure is active	Mask: 2000h	Bit	3500XT		
					04.25 Open command GGB is active	Mask: 1000h	Bit	3500XT		
					04.26 Close command GGB is active	Mask: 0800h	Bit	3500XT		
					Dead busbar closure requ. for GCB,MCB or GGB	Mask: 0400h	Bit	3000XT		
					4.62 Active power load share is active	Mask: 0200h	Bit	3000XT		
					4.63 Reactive power load share is active	Mask: 0100h	Bit	3000XT		
					Generator with a closed GCB is requested	Mask: 0080h	Bit	3000XT		
					LDSS: The Engine shall start	Mask: 0040h	Bit	3000XT		
					LDSS: The Engine shall stop	Mask: 0020h	Bit	3000XT		
					LDSS: The Engine shall stop, if possible	Mask: 0010h	Bit	3000XT		
					LDSS: Minimum Running Time is active	Mask: 0008h	Bit	3000XT		

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Model	Comment	Compared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen-3000XT		(BUS-data * Multiplier = real value)		easYgen		
					04.43 The LDSS function is active	Mask: 0004h	Bit	3000XT		
					04.60 Critical mode postrun	Mask: 0002h	Bit	3000XT		
					AUTOMATIC Run: Switch to Operating Mode STOP	Mask: 0001h	Bit	3000XT		
450140	450139	46	3,4	4092	04.13 Remote Start request	Mask: 8000h	Bit	3000XT		New
					04.14 Remote acknowledge	Mask: 4000h	Bit	3000XT		New
					internal	Mask: 2000h	Bit	3000XT		
					86.25 LM Frequency Droop active	Mask: 1000h	Bit	3000XT		New
					86.26 LM Voltage Droop active	Mask: 0800h	Bit	3000XT		New
					Synchronization mode Check active	Mask: 0400h	Bit	3000XT		New
					Synchronization mode Permissive active	Mask: 0200h	Bit	3000XT		New
					Synchronization mode Run active	Mask: 0100h	Bit	3000XT		New
					86.85 LM Enable MCB	Mask: 0080h	Bit	3000XT		New
					internal	Mask: 0040h	Bit	reserved		
					internal	Mask: 0020h	Bit	reserved		
					internal	Mask: 0010h	Bit	reserved		
					internal	Mask: 0008h	Bit	reserved		
					Parameter set 1-7 selection Bit 3	Mask: 0004h	Bit	reserved		
					Parameter set 1-7 selection Bit 2	Mask: 0002h	Bit	reserved		
					Parameter set 1-7 selection Bit 1	Mask: 0001h	Bit	reserved		
450141	450140	46	5,6	10284	12.32 External discrete input 32 latched	Mask: 8000h	Bit	3000XT		
					12.31 External discrete input 31 latched	Mask: 4000h	Bit	3000XT		
					12.30 External discrete input 30 latched	Mask: 2000h	Bit	3000XT		
					12.29 External discrete input 29 latched	Mask: 1000h	Bit	3000XT		
					12.28 External discrete input 28 latched	Mask: 0800h	Bit	3000XT		
					12.27 External discrete input 27 latched	Mask: 0400h	Bit	3000XT		

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Model	Com-ment	Com-pared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen -3000XT		(BUS-data * Multiplier = real value)		easYgen		
					12.26 External discrete input 26 latched	Mask: 0200h	Bit	3000XT		
					12.25 External discrete input 25 latched	Mask: 0100h	Bit	3000XT		
					12.24 External discrete input 24 latched	Mask: 0080h	Bit	3000XT		
					12.23 External discrete input 23 latched	Mask: 0040h	Bit	3000XT		
					12.22 External discrete input 22 latched	Mask: 0020h	Bit	3000XT		
					12.21 External discrete input 21 latched	Mask: 0010h	Bit	3000XT		
					12.20 External discrete input 20 latched	Mask: 0008h	Bit	3000XT		
					12.19 External discrete input 19 latched	Mask: 0004h	Bit	3000XT		
					12.18 External discrete input 18 latched	Mask: 0002h	Bit	3000XT		
					12.17 External discrete input 17 latched	Mask: 0001h	Bit	3000XT		
450142	450141	47	1,2	8009	98.32 LM External DO 32	Mask: 8000h	Bit	3000XT		
					98.31 LM External DO 31	Mask: 4000h	Bit	3000XT		
					98.30 LM External DO 30	Mask: 2000h	Bit	3000XT		
					98.29 LM External DO 29	Mask: 1000h	Bit	3000XT		
					98.28 LM External DO 28	Mask: 0800h	Bit	3000XT		
					98.27 LM External DO 27	Mask: 0400h	Bit	3000XT		
					98.26 LM External DO 26	Mask: 0200h	Bit	3000XT		
					98.25 LM External DO 25	Mask: 0100h	Bit	3000XT		
					98.24 LM External DO 24	Mask: 0080h	Bit	3000XT		
					98.23 LM External DO 23	Mask: 0040h	Bit	3000XT		
					98.22 LM External DO 22	Mask: 0020h	Bit	3000XT		
					98.21 LM External DO 21	Mask: 0010h	Bit	3000XT		
					98.20 LM External DO 20	Mask: 0008h	Bit	3000XT		
					98.19 LM External DO 19	Mask: 0004h	Bit	3000XT		
					98.18 LM External DO 18	Mask: 0002h	Bit	3000XT		

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Model	Com-ment	Com-pared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen -3000XT		(BUS-data * Multiplier = real value)		easYgen		
					98.17 LM External DO 17	Mask: 0001h	Bit	3000XT		
450143	450142	47	3,4	10170	External Analog input 1	changeable		3000XT		
450144	450143	47	5,6	10171	External Analog input 2	changeable		3000XT		
450145	450144	48	1,2	10172	External Analog input 3	changeable		3000XT		
450146	450145	48	3,4	10173	External Analog input 4	changeable		3000XT		
450147	450146	48	5,6	10174	External Analog input 5	changeable		3000XT		
450148	450147	49	1,2	10175	External Analog input 6	changeable		3000XT		
450149	450148	49	3,4	10176	External Analog input 7	changeable		3000XT		
450150	450149	49	5,6	10177	External Analog input 8	changeable		3000XT		
450151	450150	50	1,2	10178	External Analog input 9	changeable		3000XT		
450152	450151	50	3,4	10179	External Analog input 10	changeable		3000XT		
450153	450152	50	5,6	10180	External Analog input 11	changeable		3000XT		
450154	450153	51	1,2	10181	External Analog input 12	changeable		3000XT		
450155	450154	51	3,4	10182	External Analog input 13	changeable		3000XT		
450156	450155	51	5,6	10183	External Analog input 14	changeable		3000XT		
450157	450156	52	1,2	10184	External Analog input 15	changeable		3000XT		
450158	450157	52	3,4	10185	External Analog input 16	changeable		3000XT		
450159	450158	52	5,6	10245	External Analog Output 1	0,01	%	3000XT		
450160	450159	53	1,2	10255	External Analog Output 2	0,01	%	3000XT		
450161	450160	53	3,4	10265	External Analog Output 3	0,01	%	3000XT		
450162	450161	53	5,6	10275	External Analog Output 4	0,01	%	3000XT		
450163	450162	54	1,2		Internal					
450164	450163	54	3,4,5,6	2580	Period of use counter	0.01	h	3000XT		
450166	450165	55	1,2	4093	08.34 GGB fail to close latched	Mask: 8000h	Bit	3500XT		
					08.35 GGB fail to open latched	Mask: 4000h	Bit	3500XT		
					Missing easYgen-3000	Mask: 2000h	Bit	3000XT		New

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Model	Com-ment	Com-pared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen-3000XT		(BUS-data * Multiplier = real value)		easYgen		
					Missing LS5	Mask: 1000h	Bit	3500XT		New
					05.18 Cylinder temperature level 1	Mask: 0800h	Bit	3000XT		
					05.19 Cylinder temperature level 2	Mask: 0400h	Bit	3000XT		
					05.20 Cylinder temperature wire break	Mask: 0200h	Bit	3000XT		
					Internal	Mask: 0100h	Bit	reserved		
					Internal	Mask: 0080h	Bit	reserved		
					Internal	Mask: 0040h	Bit	reserved		
					Internal	Mask: 0020h	Bit	reserved		
					Internal	Mask: 0010h	Bit	reserved		
					Internal	Mask: 0008h	Bit	reserved		
					Internal	Mask: 0004h	Bit	reserved		
					Internal	Mask: 0002h	Bit	reserved		
					Load share diagnostic: Own Unit is suspected	Mask: 0001h	Bit	3000XT		New
					The Load share Diagnostic function suspects the own device as not working properly					
450167	450166	55	3,4,5,6	219	Nominal active power in system (in own segment)	1	kW	3000XT		
450169	450168	56	1,2	4157	28.01 Command 1 to LS5 (OR)	Mask: 8000h	Bit	3500XT		
					28.02 Command 2 to LS5 (OR)	Mask: 4000h	Bit	3500XT		
					28.03 Command 3 to LS5 (OR)	Mask: 2000h	Bit	3500XT		
					28.04 Command 4 to LS5 (OR)	Mask: 1000h	Bit	3500XT		
					28.05 Command 5 to LS5 (OR)	Mask: 0800h	Bit	3500XT		
					28.06 Command 6 to LS5 (OR)	Mask: 0400h	Bit	3500XT		
					Gen excitation limit active	Mask: 0200h	Bit	3500XT		
					03.39 Neutral interlocking - Closed NC	Mask: 0100h	Bit	3000XT		
					05.17 Uprating active	Mask: 0080h	Bit	reserved		
					Internal	Mask: 0040h	Bit	reserved		

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Model	Com-ment	Com-pared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen -3000XT		(BUS-data * Multiplier = real value)		easYgen		
					Internal	Mask: 0020h	Bit	reserved		
					Internal	Mask: 0010h	Bit	reserved		
					Internal	Mask: 0008h	Bit	reserved		
					Internal	Mask: 0004h	Bit	reserved		
					Internal	Mask: 0002h	Bit	reserved		
					03.38 Inhibit cranking	Mask: 0001h	Bit	3000XT		New
450170	450169	56	3,4,5,6	218	Active real power in system (in own segment)	1	kW	3000XT		
450172	450171	57	1,2		Internal			reserved		
450173	450172	57	3,4,5,6	217	Active power reserve in system (in own segment)	1	kW	3000XT		
450175	450174	58	1,2		Internal			reserved		removed
450176	450175	58	3,4	239	System actual nominal power	0.01	%	3000XT		
450177	450176	58	5,6	240	System total real power	0.01	%	3000XT		
450178	450177	59	1,2		Internal			reserved		removed
450179	450178	59	3,4	241	System reserve active power	0.01	%	3000XT		
450180	450179	59	5,6	15311	Engine Derate Request	0.1	%	3000XT		
450181	450180	60	1,2		Internal			reserved		removed
450182	450181	60	3,4		Internal			reserved		removed
450183	450182	60	5,6		Internal			reserved		removed
450184	450183	61	1,2	2556	Days until next maintenance	1	d	3000XT		reestablished
450185	450184	61	3,4,5,6	233	Busbar: Voltage L3-N	0.1	V	3500XT-P2		reestablished
450187	450186	62	1,2	4094	02.03 Generator voltage in range	Mask: 8000h	Bit	3000XT		reestablished
					02.06 Busbar voltage in range	Mask: 4000h	Bit	3000XT		reestablished
					02.11 Mains voltage and frequency in range	Mask: 2000h	Bit	3000XT		reestablished

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Model	Com-ment	Com-pared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen-3000XT		(BUS-data * Multiplier = real value)		easYgen		
					02.21 Busbar is dead	Mask: 1000h	Bit	3000XT		rees-tab-lished
					86.27 LM External mains decoupling	Mask: 0800h	Bit	3000XT		rees-tab-lished
					87.70 LM Release engine monitoring	Mask: 0400h	Bit	3000XT		rees-tab-lished
					87.72 LM Disable mains monitoring	Mask: 0200h	Bit	3000XT		rees-tab-lished
					87.73 LM Mains decoupling MCB	Mask: 0100h	Bit	3000XT		rees-tab-lished
					87.74 LM Inhibit dead bus GCB	Mask: 0080h	Bit	3000XT		rees-tab-lished
					86.41 LDSS IOP Reserve power 2 ready	Mask: 0040h	Bit	3000XT		rees-tab-lished
					XX.XX LDSS IOP Reserve power 3 ready	Mask: 0020h	Bit	reserved	in prepa-ration	
					XX.XX LDSS IOP Reserve power 4 ready	Mask: 0010h	Bit	reserved	in prepa-ration	
					86.42 LDSS MOP Reserve power 2 ready	Mask: 0008h	Bit	3000XT		rees-tab-lished
					XX.XX LDSS MOP Reserve power 3 ready	Mask: 0004h	Bit	reserved	in prepa-ration	
					XX.XX LDSS MOP Reserve power 4 ready	Mask: 0002h	Bit	reserved	in prepa-ration	
					Internal	Mask: 0001h	Bit	reserved		
450188	450187	62	3,4,5,6	5642	Setpoint reactive power	0,1	kvar	3000XT		rees-tab-lished
450190	450189	63	1,2	4095	96.32 LM Internal Flag 32	Mask: 8000h	Bit	3000XT		rees-tab-lished
					96.31 LM Internal Flag 31	Mask: 4000h	Bit	3000XT		rees-tab-lished
					96.30 LM Internal Flag 30	Mask: 2000h	Bit	3000XT		rees-tab-lished
					96.29 LM Internal Flag 29	Mask: 1000h	Bit	3000XT		rees-tab-lished
					96.28 LM Internal Flag 28	Mask: 0800h	Bit	3000XT		rees-tab-lished

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Model	Comment	Compared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen-3000XT		(BUS-data * Multiplier = real value)		easYgen		
					96.27 LM Internal Flag 27	Mask: 0400h	Bit	3000XT		reestablished
					96.26 LM Internal Flag 26	Mask: 0200h	Bit	3000XT		reestablished
					96.25 LM Internal Flag 25	Mask: 0100h	Bit	3000XT		reestablished
					96.24 LM Internal Flag 24	Mask: 0080h	Bit	3000XT		reestablished
					96.23 LM Internal Flag 23	Mask: 0040h	Bit	3000XT		reestablished
					96.22 LM Internal Flag 22	Mask: 0020h	Bit	3000XT		reestablished
					96.21 LM Internal Flag 21	Mask: 0010h	Bit	3000XT		reestablished
					96.20 LM Internal Flag 20	Mask: 0008h	Bit	3000XT		reestablished
					96.19 LM Internal Flag 19	Mask: 0004h	Bit	3000XT		reestablished
					96.18 LM Internal Flag 18	Mask: 0002h	Bit	3000XT		reestablished
					96.17 LM Internal Flag 17	Mask: 0001h	Bit	3000XT		reestablished
450191	450190	63	3,4		Internal			reserved		reestablished
450192	450191	63	5,6	9642	Free AnalogManager Value 1			3000XT	9642 is long (for single access)	reestablished
450193	450192	64	1,2	9646	Free AnalogManager Value 2			3000XT	9646 is long (for single access)	reestablished
450194	450193	64	3,4	9650	Free AnalogManager Value 3			3000XT	9650 is long (for single access)	reestablished

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Model	Comment	Compared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen-3000XT		(BUS-data * Multiplier = real value)		easYgen		
450195	450194	64	5,6	9654	Free AnalogManager Value 4			3000XT	9654 is long (for single access)	reestablished
450196	450195	65	1,2	9658	Free AnalogManager Value 5			3000XT	9658 is long (for single access)	reestablished
450197	450196	65	3,4	9662	Free AnalogManager Value 6			3000XT	9662 is long (for single access)	reestablished
450198	450197	65	5,6	9666	Free AnalogManager Value 7			3000XT	9666 is long (for single access)	reestablished
450199	450198	66	1,2	9670	Free AnalogManager Value 8			3000XT	9670 is long (for single access)	reestablished
450200	450199	66	3,4	9674	Free AnalogManager Value 9			3000XT	9674 is long (for single access)	reestablished
450201	450200	66	5,6	9678	Free AnalogManager Value 10			3000XT	9678 is long (for single access)	reestablished
450202	450201	67	1,2	9682	Free AnalogManager Value 11			3000XT	9682 is long (for single access)	reestablished
450203	450202	67	3,4	9686	Free AnalogManager Value 12			3000XT	9686 is long (for single access)	reestablished
450204	450203	67	5,6	9690	Free AnalogManager Value 13			3000XT	9690 is long (for single access)	reestablished

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Model	Com-ment	Com-pared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen-3000XT		(BUS-data * Multiplier = real value)		easYgen		
450205	450204	68	1,2	9694	Free AnalogManager Value 14			3000XT	9694 is long (for single access)	reestablished
450206	450205	68	3,4,5,6	9698	Free AnalogManager Value 15 (long)			3000XT		reestablished
450208	450207	69	1,2		Internal			reserved		reestablished
450209	450208	69	3,4,5,6	9702	Free AnalogManager Value 16 (long)			3000XT		reestablished
450211	450210	70	1,2	8908 [°C] / 8910 [°F]	81.29 Engine Coolant Temperature (HMI)	1	°C/°F	3000XT		reestablished
					Unit depends on parameter 3631 (°C/°F).					
450212	450211	70	3,4	8904 [0.1bar] / 8909 [psi]	81.25 Engine Oil Pressure (HMI)	0.1bar/1psi	bar/psi	3000XT		reestablished
					Unit depends on parameter 3630 (bar/psi).					
450213	450212	70	5,6	4096	Monitored Number of easYgen communicating	Mask FF00h		3000XT	Load share Diagnostic	reestablished
					Number of easYgens currently communicating	Mask 00FFh		3000XT	Load share Diagnostic	reestablished
450214	450213	71	1,2	4097	Monitored Number of LS5 communicating	Mask FF00h		3500XT	LS-5 Diagnostic	reestablished
					Number of LS5 currently communicating	Mask 00FFh		3500XT	LS-5 Diagnostic	reestablished
450215	450214	71	3,4	4098	Device number of missing LS-5 (33-48)	Mask FFFFh		3500XT	LS-5 Diagnostic	reestablished
					LS-5 Device Nr. 48	Mask 8000h				reestablished
					LS-5 Device Nr. 47	Mask 4000h				reestablished
					LS-5 Device Nr. 46	Mask 2000h				reestablished
					LS-5 Device Nr. 45	Mask 1000h				reestablished
					LS-5 Device Nr. 44	Mask 0800h				reestablished

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Model	Comment	Compared with "5003 "
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen -3000XT		(BUS-data * Multiplier = real value)		easYg en		
					LS-5 Device Nr. 43	Mask 0400h				reestablished
					LS-5 Device Nr. 42	Mask 0200h				reestablished
					LS-5 Device Nr. 41	Mask 0100h				reestablished
					LS-5 Device Nr. 40	Mask 0080h				reestablished
					LS-5 Device Nr. 39	Mask 0040h				reestablished
					LS-5 Device Nr. 38	Mask 0020h				reestablished
					LS-5 Device Nr. 37	Mask 0010h				reestablished
					LS-5 Device Nr. 36	Mask 0008h				reestablished
					LS-5 Device Nr. 35	Mask 0004h				reestablished
					LS-5 Device Nr. 34	Mask 0002h				reestablished
					LS-5 Device Nr. 33	Mask 0001h				reestablished
450216	450215	71	5,6	4099	Device number of missing LS-5 (49-64)	Mask FFFFh		3500X T	LS-5 Diagnostic	reestablished
					LS-5 Device Nr. 64	Mask 8000h				reestablished
					LS-5 Device Nr. 63	Mask 4000h				reestablished
					LS-5 Device Nr. 62	Mask 2000h				reestablished
					LS-5 Device Nr. 61	Mask 1000h				reestablished
					LS-5 Device Nr. 60	Mask 0800h				reestablished
					LS-5 Device Nr. 59	Mask 0400h				reestablished
					LS-5 Device Nr. 58	Mask 0200h				reestablished

Modbus		CAN		Parameter ID	Description	Multiplier	Units	Model	Comment	Compared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen-3000XT		(BUS-data * Multiplier = real value)		easYgen		
					LS-5 Device Nr. 57	Mask 0100h				reestablished
					LS-5 Device Nr. 56	Mask 0080h				reestablished
					LS-5 Device Nr. 55	Mask 0040h				reestablished
					LS-5 Device Nr. 54	Mask 0020h				reestablished
					LS-5 Device Nr. 53	Mask 0010h				reestablished
					LS-5 Device Nr. 52	Mask 0008h				reestablished
					LS-5 Device Nr. 51	Mask 0004h				reestablished
					LS-5 Device Nr. 50	Mask 0002h				reestablished
					LS-5 Device Nr. 49	Mask 0001h				reestablished
450217	450216	72	1,2	10282	16.16 Free alarm 16 latched	Mask: 8000h	Bit	3000XT		reestablished
					16.15 Free alarm 15 latched	Mask: 4000h	Bit	3000XT		reestablished
					16.14 Free alarm 14 latched	Mask: 2000h	Bit	3000XT		reestablished
					16.13 Free alarm 13 latched	Mask: 1000h	Bit	3000XT		reestablished
					16.12 Free alarm 12 latched	Mask: 0800h	Bit	3000XT		reestablished
					16.11 Free alarm 11 latched	Mask: 0400h	Bit	3000XT		reestablished
					16.10 Free alarm 10 latched	Mask: 0200h	Bit	3000XT		reestablished
					16.09 Free alarm 9 latched	Mask: 0100h	Bit	3000XT		reestablished
					16.08 Free alarm 8 latched	Mask: 0080h	Bit	3000XT		reestablished
					16.07 Free alarm 7 latched	Mask: 0040h	Bit	reserved		reestablished

Modbus		CAN		Param-eter ID	Description	Multiplier	Units	Model	Com-ment	Com-pared with "5003"
Modicon start addr.	start addr. (*1)	Data Byte 0 (Mux)	Data-Byte	easYgen-3000XT		(BUS-data * Multiplier = real value)		easYgen		
					16.06 Free alarm 6 latched	Mask: 0020h	Bit	reserved		rees-tab-lished
					16.05 Free alarm 5 latched	Mask: 0010h	Bit	reserved		rees-tab-lished
					16.04 Free alarm 4 latched	Mask: 0008h	Bit	reserved		rees-tab-lished
					16.03 Free alarm 3 latched	Mask: 0004h	Bit	reserved		rees-tab-lished
					16.02 Free alarm 2 latched	Mask: 0002h	Bit	reserved		rees-tab-lished
					16.01 Free alarm 1 latched	Mask: 0001h	Bit	reserved		rees-tab-lished
450218	450217	72	3,4		Internal			reserved		rees-tab-lished
450219	450218	72	5,6		Internal			reserved		rees-tab-lished
450220	450219	73	1,2		Internal			reserved		rees-tab-lished
450221	450220	73	3,4		Internal			reserved		rees-tab-lished
450222	450221	73	5,6		Internal			reserved		rees-tab-lished
450223	450222	74	1,2		Internal			reserved		rees-tab-lished
450224	450223	74	3,4		Internal			reserved		rees-tab-lished
450225	450224	74	5,6		Internal			reserved		rees-tab-lished
450226	450225	75	1,2		Internal			reserved		rees-tab-lished
450227	450226	75	3,4		Internal			reserved		rees-tab-lished
450228	450227	75	5,6		Internal			reserved		rees-tab-lished
					75 Mux x 20ms = 1.5s refresh rate CANopen: Slightly improved refresh rate					

9.2.13 Protocol 5016 (Basic Visualization)

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
450001	450000	16 bits	signed		Protocoll-ID, always 5016		--		
450002	450001	16 bits		3181	Skaling Power (16 bits) Exponent 10x W (5;4;3;2)				
450003	450002	16 bits		3182	Skaling Volts (16 bits) Exponent 10x V (2;1;0;-1)				
450004	450003	16 bits		3183	Skaling Amps (16 bits) Exponent 10x A (0;-1)				
450005	450004				0 (reserve)				
450006	450005				0 (reserve)				
450007	450006				0 (reserve)				
450008	450007				0 (reserve)				
AC Generator and Busbar values									
450009	450008			283	Busbar Voltage L3-N	format defined by index 3182 (mod-icon Adress 450003)	V	EG3500XT-P2	
450010	450009	16 bits	signed	144	Generator frequency	0.01	Hz	EG3000XT	
450011	450010	16 bits	signed	246	Total generator power	format defined by index 3181 (mod-icon Adress 450002)	W	EG3000XT	
450012	450011	16 bits	signed	247	Total generator reactive power	format defined by index 3181 (mod-icon Adress 450002)	var	EG3000XT	
450013	450012	16 bits	signed	160	Generator power factor	0.001		EG3000XT	
450014	450013	16 bits	signed	248	Generator voltage L1-L2	format defined by index 3182 (mod-icon Adress 450003)	V	EG3000XT	
450015	450014	16 bits	signed	249	Generator voltage L2-L3	format defined by index 3182 (mod-icon Adress 450003)	V	EG3000XT	
450016	450015	16 bits	signed	250	Generator voltage L3-L1	format defined by index 3182 (mod-icon Adress 450003)	V	EG3000XT	
450017	450016	16 bits	signed	251	Generator voltage L1-N	format defined by index 3182 (mod-icon Adress 450003)	V	EG3000XT	
450018	450017	16 bits	signed	252	Generator voltage L2-N	format defined by index 3182 (mod-icon Adress 450003)	V	EG3000XT	
450019	450018	16 bits	signed	253	Generator voltage L3-N	format defined by index 3182 (mod-icon Adress 450003)	V	EG3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
450020	450019	16 bits	signed	255	Generator current L1	format defined by index 3183 (mod-icon Adress 450004)	A	EG3000XT	
450021	450020	16 bits	signed	256	Generator current L2	format defined by index 3183 (mod-icon Adress 450004)	A	EG3000XT	
450022	450021	16 bits	signed	257	Generator current L3	format defined by index 3183 (mod-icon Adress 450004)	A	EG3000XT	
450023	450022	16 bits	signed	209	Busbar Frequency	0.01	Hz	EG3000XT	
450024	450023	16 bits	signed	254	Busbar Voltage L1-L2	format defined by index 3182 (mod-icon Adress 450003)	V	EG3000XT	
450025	450024	16 bits	signed	279	Busbar Voltage L2-L3	format defined by index 3182 (mod-icon Adress 450003)	V	EG3500XT-P2	
450026	450025	16 bits	signed	280	Busbar Voltage L3-L1	format defined by index 3182 (mod-icon Adress 450003)	V	EG3500XT-P2	
450027	450026	16 bits	signed	281	Busbar Voltage L1-N	format defined by index 3182 (mod-icon Adress 450003)	V	EG3500XT-P2	
450028	450027	16 bits	signed	282	Busbar Voltage L2-N	format defined by index 3182 (mod-icon Adress 450003)	V	EG3500XT-P2	
450029	450028	16 bits	signed	5541	Setpoint frequency	1	Hz	EG3000XT	
450030	450029	16 bits	signed	5641	Setpoint power factor (cosphi)	1		EG3000XT	
AC Mains values									
450031	450030	16 bits	signed	147	Mains frequency	0.01	Hz	3000XT	
450032	450031	16 bits	signed	258	Total mains active power	format defined by index 3181 (mod-icon Address 450002)	W	3000XT	
450033	450032	16 bits	signed	259	Total mains reactive power	format defined by index 3181 (mod-icon Address 450002)	var	3000XT	
450034	450033	16 bits	signed	208	Mains power factor	0.001		3000XT	
450035	450034	16 bits	signed	260	Mains voltage L1-L2	format defined by index 3182 (mod-icon Address 450003)	V	3000XT	
450036	450035	16 bits	signed	261	Mains voltage L2-L3	format defined by index 3182 (mod-icon Address 450003)	V	3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
450037	450036	16 bits	signed	262	Mains voltage L3-L1	format defined by index 3182 (mod-icon Address 450003)	V	3000XT	
450038	450037	16 bits	signed	263	Mains voltage L1-N	format defined by index 3182 (mod-icon Address 450003)	V	3000XT	
450039	450038	16 bits	signed	264	Mains voltage L2-N	format defined by index 3182 (mod-icon Address 450003)	V	3000XT	
450040	450039	16 bits	signed	265	Mains voltage L3-N	format defined by index 3182 (mod-icon Address 450003)	V	3000XT	
450041	450040	16 bits	signed	266	Mains current L1	format defined by index 3183 (mod-icon Address 450004)	A	3000XT	
450042	450041	16 bits			0 (prepared mains current L2)	format defined by index 3183 (mod-icon Address 450004)	A	reserved	
450043	450042	16 bits			0 (prepared mains current L3)	format defined by index 3183 (mod-icon Address 450004)	A	reserved	
450044	450043	16 bits	signed	267	Average LS5 Delta Mains voltage L-L	format defined by index 3182	V	3500XT	
450045	450044	16 bits	signed	268	Average LS5 Wye Mains voltage L-N	format defined by index 3182	V	3500XT	
AC System values									
450046	450045	16 bits	signed	239	Nominal real power in system	0.01	%	3000XT	
450047	450046	16 bits	signed	240	Real power in system	0.01	%	3000XT	
450048	450047	16 bits	signed	241	Reserve real power in system	0.01	%	3000XT	
450049	450048	16 bits	signed	269	Active power LS5	format defined by index 3181	W	3500XT	
450050	450049	16 bits	signed	270	Reactive power LS5	format defined by index 3181	var	3500XT	
450051	450050	16 bits	signed	4608	Average LS5 Mains delta frequency L-L	0.01	Hz	3500XT	
DC Analogue Values (Engine Values)									
450052	450051	16 bits	signed	10100	Engine Pickup speed	1	rpm	3000XT	
450053	450052	16 bits	signed	10110	Battery voltage	0.1	V	3000XT	
450054	450053	16 bits	signed	10159	AI Auxiliary excitation D+	0.1	V	3000XT	
450055	450054	16 bits	signed	2540	Engine, number of start requests	1		3000XT	
450056	450055	16 bits	signed	2558	Hours until next mainte-nance	1	h	3000XT	
450057	450056	16 bits	signed	10111	Analog input 1	changeable		3000XT	
450058	450057	16 bits	signed	10112	Analog input 2	changeable		3000XT	
450059	450058	16 bits	signed	10115	Analog input 3	changeable		3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
450060	450059	16 bits	signed	10117	Analog input 4	changeable		3500XT	
450061	450060	16 bits	signed	10151	Analog input 5	changeable		3500XT-P2	
450062	450061	16 bits	signed	10152	Analog input 6	changeable		3500XT-P2	
450063	450062	16 bits	signed	10153	Analog input 7	changeable		3500XT-P2	
450064	450063	16 bits	signed	10154	Analog input 8	changeable		3500XT-P2	
450065	450064	16 bits	signed	10155	Analog input 9	changeable		3500XT-P2	
450066	450065	16 bits	signed	10156	Analog input 10	changeable		3500XT-P2	
450067	450066	16 bits	signed	10157	Analog input 11	changeable		reserved	
450068	450067	16 bits	signed	10158	Analog input 12	changeable		reserved	
450069	450068	16 bits	signed	10310	Analog output 1	changeable	%	3000XT	
450070	450069	16 bits	signed	10311	Analog output 2	changeable	%	3000XT	
450071	450070	16 bits	signed	10317	Analog output 3	changeable	%	3000XT	New
450072	450071	16 bits	signed	10318	Analog output 4	changeable	%	3500XT-P2	
450073	450072	16 bits	signed	10319	Analog output 5	changeable	%	3500XT-P2	
450074	450073	16 bits	signed	10320	Analog output 6	changeable	%	3500XT-P2	
450075	450074	16 bits	signed	10170	External Analog input 1	changeable		3000XT	
450076	450075	16 bits	signed	10171	External Analog input 2	changeable		3000XT	
450077	450076	16 bits	signed	10172	External Analog input 3	changeable		3000XT	
450078	450077	16 bits	signed	10173	External Analog input 4	changeable		3000XT	
450079	450078	16 bits	signed	10174	External Analog input 5	changeable		3000XT	
450080	450079	16 bits	signed	10175	External Analog input 6	changeable		3000XT	
450081	450080	16 bits	signed	10176	External Analog input 7	changeable		3000XT	
450082	450081	16 bits	signed	10177	External Analog input 8	changeable		3000XT	
450083	450082	16 bits	signed	10178	External Analog input 9	changeable		3000XT	
450084	450083	16 bits	signed	10179	External Analog input 10	changeable		3000XT	
450085	450084	16 bits	signed	10180	External Analog input 11	changeable		3000XT	
450086	450085	16 bits	signed	10181	External Analog input 12	changeable		3000XT	
450087	450086	16 bits	signed	10182	External Analog input 13	changeable		3000XT	
450088	450087	16 bits	signed	10183	External Analog input 14	changeable		3000XT	
450089	450088	16 bits	signed	10184	External Analog input 15	changeable		3000XT	
450090	450089	16 bits	signed	10185	External Analog input 16	changeable		3000XT	
450091	450090	16 bits	signed	10245	External Analog Output 1	0.01	%	3000XT	
450092	450091	16 bits	signed	10255	External Analog Output 2	0.01	%	3000XT	
450093	450092	16 bits	signed	10265	External Analog Output 3	0.01	%	3000XT	
450094	450093	16 bits	signed	10275	External Analog Output 4	0.01	%	3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
450095	450094	16 bits	signed	2556	Days until next mainte-nance	1	days	3000XT	
450096	450095	16 bits	signed	10277	0 (reserve)	changeable		reserved	
450097	450096	16 bits	signed	"_"	Engine Coolant Tempera-ture (HMI)	1	°C/°F	3000XT	New The same Value as shown in HMI
450098	450097	16 bits	signed	"-"	Engine Oil Pressure (HMI)	0.1bar/psi	bar/p si	3000XT	New The same Value as shown in HMI
450099	450098	16 bits			0 (reserve)				
Control and Status									
450100	450099	16 bits	bit array	"-"	Control mode (STOP/ AUTO/MANUAL/TEST)	Mask:000Fh 1=AUTO 2=STOP 4=MANUAL 8=TEST	enum .	3000XT	New TEST include d
450101	450100	16 bits	bit array	10202	State Display	Id description see operation manual status messages	enum .	3000XT	
450102	450101	16 bits			0 (reserve)				
450103	450102	16 bits	bit array	4153	ControlBits1				
					Idle mode OR Ramp to rated active	Mask: 8000h	Bit	3000XT	
					04.15 Idle run is active	Mask: 4000h	Bit	3000XT	
					04.12 Start without closing GCB	Mask: 2000h	Bit	3000XT	
					04.64 Key activation	Mask: 1000h	Bit	3000XT	
					A manual START has been requested	Mask: 0800h	Bit	3000XT	
					A manual STOP has been requested	Mask: 0400h	Bit	3000XT	
					04.10 Cooldown is active	Mask: 0200h	Bit	3000XT	
					03.01 Auxiliary Services is active	Mask: 0100h	Bit	3000XT	
					03.07 Engine monitoring delay expired	Mask: 0080h	Bit	3000XT	
					03.08 Breaker delay timer has expired	Mask: 0040h	Bit	3000XT	
					03.25 Engine shall run	Mask: 0020h	Bit	3000XT	
					04.27 Critical mode is active	Mask: 0010h	Bit	3000XT	
					03.06 Engine release is active	Mask: 0008h	Bit	3000XT	
					03.30 Auxiliary services prerun is active	Mask: 0004h	Bit	3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
					03.31 Auxiliary services postrun is active	Mask: 0002h	Bit	3000XT	
					04.61 Lamp test request	Mask: 0001h	Bit	3000XT	
450104	450103	16 bits	bit array	4154	ControlBits2				
					03.02 Starter / Crank is active	Mask: 8000h	Bit	3000XT	
					03.28 Operating Magnet / Gasrelay is active	Mask: 4000h	Bit	3000XT	
					03.04 Preglow or Ignition is active	Mask: 2000h	Bit	3000XT	
					04.11 Mains settling timer is running	Mask: 1000h	Bit	3000XT	
					04.09 Emergency mode is currently active	Mask: 0800h	Bit	3000XT	
					03.40 Remote Shutdown (ID503, Bit9)	Mask: 0400h	Bit	3000XT	New
					03.33 Free PID Controller 3: Lower Command	Mask: 0200h	Bit	3000XT	
					03.32 Free PID Controller 3: Raise Command	Mask: 0100h	Bit	3000XT	
					03.35 Free PID Controller 2: Lower Command	Mask: 0080h	Bit	3000XT	
					03.34 Free PID Controller 2: Raise Command	Mask: 0040h	Bit	3000XT	
					03.27 Stop solenoid is active	Mask: 0020h	Bit	3000XT	
					03.24 Excitation AVR (Run-up Synchronization)	Mask: 0010h	Bit	3500XT	
					The genset runs mains par-allel	Mask: 0008h	Bit	3000XT	
					03.37 Free PID Controller 1: Lower Command	Mask: 0004h	Bit	3000XT	
					03.36 Free PID Controller 1: Raise Command	Mask: 0002h	Bit	3000XT	
					Increment Engine Start Counter	Mask: 0001h	Bit	3000XT	
450105	450104	16 bits	bit array	4155	ControlBits3				
					03.20 3-Pos. Controller Freq./Power raise	Mask: 8000h	Bit	3000XT	
					03.21 3-Pos. Controller Freq./Power lower	Mask: 4000h	Bit	3000XT	
					03.22 3-Pos. Controller Volt./ReactPow raise	Mask: 2000h	Bit	3000XT	
					03.23 3-Pos. Controller Volt./ReactPow lower	Mask: 1000h	Bit	3000XT	
					04.06 GCB is closed	Mask: 0800h	Bit	3000XT	
					04.07 MCB is closed	Mask: 0400h	Bit	3000XT	
					05.16 Derating active (J1939 or freely)	Mask: 0200h	Bit	3000XT	
					04.18 Synchronisation GCB procedure is active	Mask: 0100h	Bit	3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
					04.19 Open command GCB is active	Mask: 0080h	Bit	3000XT	
					04.20 Close command GCB is active	Mask: 0040h	Bit	3000XT	
					04.21 Synchronisation MCB procedure is active	Mask: 0020h	Bit	3000XT	
					04.22 Open command MCB is active	Mask: 0010h	Bit	3000XT	
					04.23 Close command MCB is active	Mask: 0008h	Bit	3000XT	
					04.28 Unloading generator is active	Mask: 0004h	Bit	3000XT	
					04.29 Unloading mains is active	Mask: 0002h	Bit	3000XT	
					04.30 Power limited prerun	Mask: 0001h	Bit	3000XT	
450106	450105	16 bits	bit array	4156	ControlBits4				
					04.16 GGB is closed	Mask: 8000h	Bit	3500XT	
					04.17 GGB is released	Mask: 4000h	Bit	3500XT	
					04.24 Synchronisation GGB procedure is active	Mask: 2000h	Bit	3500XT	
					04.25 Open command GGB is active	Mask: 1000h	Bit	3500XT	
					04.26 Close command GGB is active	Mask: 0800h	Bit	3500XT	
					Dead busbar closure requ. for GCB,MCB or GGB	Mask: 0400h	Bit	3000XT	
					4.62 Active power load share is active	Mask: 0200h	Bit	3000XT	
					4.63 Reactive power load share is active	Mask: 0100h	Bit	3000XT	
					Generator with a closed GCB is requested	Mask: 0080h	Bit	3000XT	
					LDSS: The Engine shall start	Mask: 0040h	Bit	3000XT	
					LDSS: The Engine shall stop	Mask: 0020h	Bit	3000XT	
					LDSS: The Engine shall stop, if possible	Mask: 0010h	Bit	3000XT	
					LDSS: Minimum Running Time is active	Mask: 0008h	Bit	3000XT	
					04.43 The LDSS function is active	Mask: 0004h	Bit	3000XT	
					04.60 Critical mode postrun	Mask: 0002h	Bit	3000XT	
					AUTOMATIC Run: Switch to Operating Mode STOP	Mask: 0001h	Bit	3000XT	
450107	450106	16 bits	bit array	4150	ControlBits5				
					04.13 Remote Start request	Mask: 8000h	Bit	3000XT	New
					04.14 Remote acknowledge	Mask: 4000h	Bit	3000XT	New
					05.17 Uprating active	Mask: 2000h	Bit	3000XT	New
					86.25 LM Frequency Droop active	Mask: 1000h	Bit	3000XT	New

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
					86.26 LM Voltage Droop active	Mask: 0800h	Bit	3000XT	New
					Synchronization mode Check active	Mask: 0400h	Bit	3000XT	New
					Synchronization mode Per-missive active	Mask: 0200h	Bit	3000XT	New
					Synchronization mode Run active	Mask: 0100h	Bit	3000XT	New
					86.85 LM Enable MCB	Mask: 0080h	Bit	3000XT	New
					86.41 LDSS IOP Reserve power 2 ready	Mask: 0040h	Bit	3000XT	New
					86.42 LDSS MOP Reserve power 2 ready	Mask: 0020h	Bit	3000XT	New
					internal	Mask: 0010h	Bit	3000XT	New
					internal	Mask: 0008h	Bit	3000XT	New
					Parameter Set 1-7 Selec-tion Bit 3	Mask: 0004h	Bit	reserved	pre-pared for 3500XT Rental
					Parameter Set 1-7 Selec-tion Bit 2	Mask: 0002h	Bit	reserved	pre-pared for 3500XT Rental
					Parameter Set 1-7 Selec-tion Bit 1	Mask: 0001h	Bit	reserved	pre-pared for 3500XT Rental
450108	450107	16 bits	bit array	4084	ControlBits 21				
					02.03 Generator voltage in range	Mask: 8000h	Bit	3000XT	New
					02.06 Busbar voltage in range	Mask: 4000h	Bit	3000XT	New
					02.11 Mains voltage and frequency in range	Mask: 2000h	Bit	3000XT	New
					02.21 Busbar is dead	Mask: 1000h	Bit	3000XT	New
					86.27 LM Mains failure by external device	Mask: 0800h	Bit	3000XT	New
					87.70 LM Release engine monitoring	Mask: 0400h	Bit	3000XT	New
					87.72 LM Disable mains monitoring	Mask: 0200h	Bit	3000XT	New
					87.73 LM Mains decoupling MCB	Mask: 0100h	Bit	3000XT	New
					87.74 LM Inhibit dead bus GCB	Mask: 0080h	Bit	3000XT	New
					Load share diagnostic: Own Unit is suspected	Mask: 0040h	Bit	3000XT	New
					Internal	Mask: 0020h	Bit	reserved	
					Internal	Mask: 0010h	Bit	reserved	
					Internal	Mask: 0008h	Bit	reserved	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
					Internal	Mask: 0004h	Bit	reserved	
					Internal	Mask: 0002h	Bit	reserved	
					Internal	Mask: 0001h	Bit	reserved	
Discrete Outputs									
450109	450108	16 bits	bit array	10107	Relay Outputs 1				
					13.01 Relay-Output 1 (Self-test-relay)	Mask: 8000h	Bit	3000XT	
					13.02 Relay-Output 2	Mask: 4000h	Bit	3000XT	
					13.03 Relay-Output 3	Mask: 2000h	Bit	3000XT	
					13.04 Relay-Output 4	Mask: 1000h	Bit	3000XT	
					13.05 Relay-Output 5	Mask: 0800h	Bit	3000XT	
					13.06 Relay-Output 6	Mask: 0400h	Bit	3000XT	
					13.07 Relay-Output 7	Mask: 0200h	Bit	3000XT	
					13.08 Relay-Output 8	Mask: 0100h	Bit	3000XT	
					13.09 Relay-Output 9	Mask: 0080h	Bit	3000XT	
					13.10 Relay-Output 10	Mask: 0040h	Bit	3000XT	
					13.11 Relay-Output 11	Mask: 0020h	Bit	3000XT	
					13.12 Relay-Output 12	Mask: 0010h	Bit	3000XT	
					internal	Mask: 0008h	Bit	3000XT	
					internal	Mask: 0004h	Bit	3000XT	
					internal	Mask: 0002h	Bit	3000XT	
					internal	Mask: 0001h	Bit	3000XT	
450110	450109	16 bits	bit array	10109	Relay Outputs 2				
					13.13 Relay-Output 13	Mask: 8000h	Bit	3500XT-P2	
					13.14 Relay-Output 14	Mask: 4000h	Bit	3500XT-P2	
					13.15 Relay-Output 15	Mask: 2000h	Bit	3500XT-P2	
					13.16 Relay-Output 16	Mask: 1000h	Bit	3500XT-P2	
					13.17 Relay-Output 17	Mask: 0800h	Bit	3500XT-P2	
					13.18 Relay-Output 18	Mask: 0400h	Bit	3500XT-P2	
					13.19 Relay-Output 19	Mask: 0200h	Bit	3500XT-P2	
					13.20 Relay-Output 20	Mask: 0100h	Bit	3500XT-P2	
					13.21 Relay-Output 21	Mask: 0080h	Bit	3500XT-P2	
					13.22 Relay-Output 22	Mask: 0040h	Bit	3500XT-P2	
					internal	Mask: 0020h	Bit	3000XT	
					internal	Mask: 0010h	Bit	3000XT	
					internal	Mask: 0008h	Bit	3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
					internal	Mask: 0004h	Bit	3000XT	
					13.34 Transistor output 2	Mask: 0002h	Bit	3500XT-P2	
					13.33 Transistor output 1	Mask: 0001h	Bit	3500XT-P2	
450111	450110	16 bits	bit array	8005	Relay Outputs 3				
					98.16 LM External DO 16	Mask: 8000h	Bit	3000XT	
					98.15 LM External DO 15	Mask: 4000h	Bit	3000XT	
					98.14 LM External DO 14	Mask: 2000h	Bit	3000XT	
					98.13 LM External DO 13	Mask: 1000h	Bit	3000XT	
					98.12 LM External DO 12	Mask: 0800h	Bit	3000XT	
					98.11 LM External DO 11	Mask: 0400h	Bit	3000XT	
					98.10 LM External DO 10	Mask: 0200h	Bit	3000XT	
					98.09 LM External DO 9	Mask: 0100h	Bit	3000XT	
					98.08 LM External DO 8	Mask: 0080h	Bit	3000XT	
					98.07 LM External DO 7	Mask: 0040h	Bit	3000XT	
					98.06 LM External DO 6	Mask: 0020h	Bit	3000XT	
					98.05 LM External DO 5	Mask: 0010h	Bit	3000XT	
					98.04 LM External DO 4	Mask: 0008h	Bit	3000XT	
					98.03 LM External DO 3	Mask: 0004h	Bit	3000XT	
					98.02 LM External DO 2	Mask: 0002h	Bit	3000XT	
					98.01 LM External DO 1	Mask: 0001h	Bit	3000XT	
450112	450111	16 bits	bit array	8009	Relay Outputs 4				
					98.32 LM External DO 32	Mask: 8000h	Bit	3000XT	
					98.31 LM External DO 31	Mask: 4000h	Bit	3000XT	
					98.30 LM External DO 30	Mask: 2000h	Bit	3000XT	
					98.29 LM External DO 29	Mask: 1000h	Bit	3000XT	
					98.28 LM External DO 28	Mask: 0800h	Bit	3000XT	
					98.27 LM External DO 27	Mask: 0400h	Bit	3000XT	
					98.26 LM External DO 26	Mask: 0200h	Bit	3000XT	
					98.25 LM External DO 25	Mask: 0100h	Bit	3000XT	
					98.24 LM External DO 24	Mask: 0080h	Bit	3000XT	
					98.23 LM External DO 23	Mask: 0040h	Bit	3000XT	
					98.22 LM External DO 22	Mask: 0020h	Bit	3000XT	
					98.21 LM External DO 21	Mask: 0010h	Bit	3000XT	
					98.20 LM External DO 20	Mask: 0008h	Bit	3000XT	
					98.19 LM External DO 19	Mask: 0004h	Bit	3000XT	
					98.18 LM External DO 18	Mask: 0002h	Bit	3000XT	
					98.17 LM External DO 17	Mask: 0001h	Bit	3000XT	
450113	450112	16 bits	bit array	4157	GAPControlBits6				
					28.01 Command 1 to LS5 (OR)	Mask: 8000h	Bit	3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
					28.02 Command 2 to LS5 (OR)	Mask: 4000h	Bit	3000XT	
					28.03 Command 3 to LS5 (OR)	Mask: 2000h	Bit	3000XT	
					28.04 Command 4 to LS5 (OR)	Mask: 1000h	Bit	3000XT	
					28.05 Command 5 to LS5 (OR)	Mask: 0800h	Bit	3000XT	
					28.06 Command 6 to LS5 (OR)	Mask: 0400h	Bit	3000XT	
					Gen excitation limit active	Mask: 0200h	Bit	3000XT	
					03.39 Neutral interlocking - Closed NC	Mask: 0100h	Bit	3000XT	
					05.17 Uprating active	Mask: 0080h	Bit	3000XT	
					Internal	Mask: 0040h	Bit	reserved	
					Internal	Mask: 0020h	Bit	reserved	
					Internal	Mask: 0010h	Bit	reserved	
					Internal	Mask: 0008h	Bit	reserved	
					Internal	Mask: 0004h	Bit	reserved	
					Internal	Mask: 0002h	Bit	reserved	
					Inhibit cranking	Mask: 0001h	Bit	3000XT	New
450114	450113	16 bits			0 (reserve)				
Alarm Management General									
450115	450114	16 bits	bit array	10131	Alarm General				
					01.11 New Alarm triggered	Mask: 8000h	Bit	3000XT	New
					internal	Mask: 4000h	Bit	reserved	
					internal	Mask: 2000h	Bit	reserved	
					internal	Mask: 1000h	Bit	reserved	
					internal	Mask: 0800h	Bit	reserved	
					internal	Mask: 0400h	Bit	reserved	
					internal	Mask: 0200h	Bit	reserved	
					internal	Mask: 0100h	Bit	reserved	
					internal	Mask: 0080h	Bit	reserved	
					internal	Mask: 0040h	Bit	reserved	
					01.06 Alarm class F latched	Mask: 0020h	Bit	3000XT	
					01.05 Alarm class E latched	Mask: 0010h	Bit	3000XT	
					01.04 Alarm class D latched	Mask: 0008h	Bit	3000XT	
					01.03 Alarm class C latched	Mask: 0004h	Bit	3000XT	
					01.02 Alarm class B latched	Mask: 0002h	Bit	3000XT	
					01.01 Alarm class A latched	Mask: 0001h	Bit	3000XT	
450116	450115	16 bits	bit array	10149	Alarms 2 latched (unac-knowledged)				

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
				3064	08.30 Timeout Synchronisation GCB latched	Mask: 8000h	Bit	3000XT	
				3074	08.31 Timeout Synchronisation MCB latched	Mask: 4000h	Bit	3000XT	
				3084	08.32 Timeout Synchronisation GGB latched	Mask: 2000h	Bit	3500XT	
				4056	05.11 Charge fail (D+ functionality) latched	Mask: 1000h	Bit	3000XT	
				2944	Operating range failure 12 latched (phase rotation)	Mask: 0800h	Bit	3000XT	
				10089	Internal	Mask: 0400h	Bit	3000XT	
				10083	Internal	Mask: 0200h	Bit	3000XT	
				10082	internal	Mask: 0100h	Bit	reserved	
				10086	internal	Mask: 0080h	Bit	reserved	
				10085	internal	Mask: 0040h	Bit	reserved	
				10088	08.19 CANopen error at CAN Interface 2	Mask: 0020h	Bit	3000XT	
				4073	08.16 Parameter Alignment LDSS	Mask: 0010h	Bit	3000XT	
				4064	08.17 Missing members	Mask: 0008h	Bit	3000XT	
				1714	Internal	Mask: 0004h	Bit	reserved	
				15125	05.13 ECU red lamp alarm latched	Mask: 0002h	Bit	3000XT	
				15126	05.14 ECU yellow (amber) lamp alarm latched	Mask: 0001h	Bit	3000XT	
450117	450116	16 bits	bit array	4169	Alarms 2 active				
					Timeout Synchronisation GCB	Mask: 8000h	Bit	3000XT	New
					Timeout Synchronisation MCB	Mask: 4000h	Bit	3000XT	New
					Timeout Synchronisation GGB	Mask: 2000h	Bit	3500XT	New
					Charge fail (D+ functionality)	Mask: 1000h	Bit	3000XT	New
					Gen/Busbar/Mains phase rotat.	Mask: 0800h	Bit	3000XT	New
					Internal	Mask: 0400h	Bit	reserved	New
					Internal	Mask: 0200h	Bit	reserved	New
					internal	Mask: 0100h	Bit	reserved	New
					internal	Mask: 0080h	Bit	reserved	New
					internal	Mask: 0040h	Bit	3000XT	New
					CANopen error at CAN Interface 2	Mask: 0020h	Bit	3000XT	New
					Parameter Alignment LDSS	Mask: 0010h	Bit	3000XT	New
					Missing members	Mask: 0008h	Bit	3000XT	New
					internal	Mask: 0004h	Bit	reserved	New
					ECU red lamp alarm	Mask: 0002h	Bit	3000XT	New

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
					ECU yellow (amber) lamp alarm	Mask: 0001h	Bit	3000XT	New
450118	450117	16 bits	bit array	10190	Alarms 3 latched (unac-knowledged)				
				3089	08.34 GGB fail to close latched	Mask: 8000h	Bit	3500XT	
				3090	08.35 GGB fail to open latched	Mask: 4000h	Bit	3500XT	
					Missing 3000XT	Mask: 2000h	Bit	3000XT	New
					Missing LS5	Mask: 1000h	Bit	3500XT	New
				14575	05.18 Cylinder temperature level 1	Mask: 0800h	Bit	3000XT	
				14576	05.19 Cylinder temperature level 2	Mask: 0400h	Bit	3000XT	
				14584	05.20 Cylinder temperature wire break	Mask: 0200h	Bit	3000XT	
					Internal	Mask: 0100h	Bit	reserved	
					Internal	Mask: 0080h	Bit	reserved	
					Internal	Mask: 0040h	Bit	reserved	
					Internal	Mask: 0020h	Bit	reserved	
					Internal	Mask: 0010h	Bit	reserved	
					Internal	Mask: 0008h	Bit	reserved	
					Internal	Mask: 0004h	Bit	reserved	
					Internal	Mask: 0002h	Bit	reserved	
					Internal	Mask: 0001h	Bit	reserved	
450119	450118	16 bits		4193	Alarms 3 active				
					GGB fail to close	Mask: 8000h	Bit	3500XT	New
					GGB fail to open	Mask: 4000h	Bit	3500XT	New
					Missing 3000XT	Mask: 2000h	Bit	3000XT	New
					Missing LS5	Mask: 1000h	Bit	3500XT	New
					Temperature deviation level 1	Mask: 0800h	Bit	3000XT	New
					Temperature deviation level 2	Mask: 0400h	Bit	3000XT	New
					Temperature deviation wire break	Mask: 0200h	Bit	3000XT	New
					internal	Mask: 0100h	Bit	reserved	
					internal	Mask: 0080h	Bit	reserved	
					internal	Mask: 0040h	Bit	reserved	
					internal	Mask: 0020h	Bit	reserved	
					internal	Mask: 0010h	Bit	reserved	
					internal	Mask: 0008h	Bit	reserved	
					internal	Mask: 0004h	Bit	reserved	
					internal	Mask: 0002h	Bit	reserved	
					internal	Mask: 0001h	Bit	reserved	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
450120	450119	16 bits		4086	Operating Range Moni-toring Code Number	Mask: FF00h		3000XT	New Oper-ating range Error-Code
					The current segment number	Mask: 00FFh		3000XT	New One of 64 Seg-ments pos-sible
Alarm Management Engine									
450121	450120	16 bits	bit array	10133	Alarms 1 latched (unac-knowledged)				
				2112	05.01 Engine Over speed 1 latched	Mask: 8000h	Bit	3000XT	Only rename d accordi ng to LM system
				2113	05.02 Engine Over speed 2 latched	Mask: 4000h	Bit	3000XT	Only rename d accordi ng to LM system
				2162	05.03 Engine under speed 1 latched	Mask: 2000h	Bit	3000XT	Only rename d accordi ng to LM system
				2163	05.04 Engine under speed 2 latched	Mask: 1000h	Bit	3000XT	Only rename d accordi ng to LM system
				2652	05.05 Unintended stop detected latched	Mask: 0800h	Bit	3000XT	Only rename d accordi ng to LM system
				2457	05.07 Speed detection alarm latched	Mask: 0400h	Bit	3000XT	Only rename d accordi ng to LM system
				2504	05.06 Shutdown malfunc-tion detected latched	Mask: 0200h	Bit	3000XT	Only rename d accordi ng to LM system

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
				2603	08.05 GCB fail to close latched	Mask: 0100h	Bit	3000XT	Only renamed according to LM system
				2604	08.06 GCB fail to open latched	Mask: 0080h	Bit	3000XT	Only renamed according to LM system
				2623	08.07 MCB fail to close latched	Mask: 0040h	Bit	3000XT	Only renamed according to LM system
				2624	08.08 MCB fail to open latched	Mask: 0020h	Bit	3000XT	Only renamed according to LM system
				10017	08.10 General CAN-J1939 fault latched	Mask: 0010h	Bit	3000XT	Only renamed according to LM system
				3325	05.08 Start fail detected latched	Mask: 0008h	Bit	3000XT	Only renamed according to LM system
				2560	05.09 Maintenance days exceeded latched	Mask: 0004h	Bit	3000XT	Only renamed according to LM system
				2561	05.10 Maintenance hours exceeded latched	Mask: 0002h	Bit	3000XT	Only renamed according to LM system
				10087	08.18 CANopen error at CAN Interface 1	Mask: 0001h	Bit	3000XT	Only renamed according to LM system
450122	450121	16 bits	bit array	4167	Alarms 1 active				
					Engine Over speed 1	Mask: 8000h	Bit	3000XT	New
					Engine Over speed 2	Mask: 4000h	Bit	3000XT	New

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
					Engine under speed 1	Mask: 2000h	Bit	3000XT	New
					Engine under speed 2	Mask: 1000h	Bit	3000XT	New
					Unintended stop detected	Mask: 0800h	Bit	3000XT	New
					Speed detection alarm	Mask: 0400h	Bit	3000XT	New
					Shutdown malfunction detected	Mask: 0200h	Bit	3000XT	New
					GCB fail to close	Mask: 0100h	Bit	3000XT	New
					GCB fail to open	Mask: 0080h	Bit	3000XT	New
					MCB fail to close	Mask: 0040h	Bit	3000XT	New
					MCB fail to open	Mask: 0020h	Bit	3000XT	New
					General CAN-J1939 fault	Mask: 0010h	Bit	3000XT	New
					Start fail detected	Mask: 0008h	Bit	3000XT	New
					Maintenance days exceeded	Mask: 0004h	Bit	3000XT	New
					Maintenance hours exceeded	Mask: 0002h	Bit	3000XT	New
					CANopen error at CAN Interface 1	Mask: 0001h	Bit	3000XT	New
450123	450122	16 bits	bit array	10136	Alarms Analog Inputs 1 latched (unacknowledged)				
					Internal	Mask: 8000h	Bit	3000XT	
					Internal	Mask: 4000h	Bit	3000XT	
					Internal	Mask: 2000h	Bit	3000XT	
					Internal	Mask: 1000h	Bit	3000XT	
					Internal	Mask: 0800h	Bit	3000XT	
					Internal	Mask: 0400h	Bit	3000XT	
					Internal	Mask: 0200h	Bit	3000XT	
					Internal	Mask: 0100h	Bit	3000XT	
					Internal	Mask: 0080h	Bit	3000XT	
					Internal	Mask: 0040h	Bit	3000XT	
					Internal	Mask: 0020h	Bit	reserved	
					05.11 Failure Charging Alternator (D+)	Mask: 0010h	Bit	3000XT	New
				10008	08.02 Battery over voltage 2 latched	Mask: 0008h	Bit	3000XT	
				10006	08.04 Battery under voltage 2 latched	Mask: 0004h	Bit	3000XT	
				10007	08.01 Battery over voltage 1 latched	Mask: 0002h	Bit	3000XT	
				10005	08.03 Battery under voltage 1 latched	Mask: 0001h	Bit	3000XT	
450124	450123	16 bits	bit array	4171	Alarms Analog Inputs 1 active				
					Internal	Mask: 8000h	Bit	reserved	
					Internal	Mask: 4000h	Bit	reserved	
					Internal	Mask: 2000h	Bit	reserved	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
					Internal	Mask: 1000h	Bit	reserved	
					Internal	Mask: 0800h	Bit	reserved	
					Internal	Mask: 0400h	Bit	reserved	
					Internal	Mask: 0200h	Bit	reserved	
					Internal	Mask: 0100h	Bit	reserved	
					Internal	Mask: 0080h	Bit	reserved	
					Internal	Mask: 0040h	Bit	reserved	
					Internal	Mask: 0020h	Bit	reserved	
					Failure Charging Alternator (D+)	Mask: 0010h	Bit	reserved	New
					Battery over voltage 2	Mask: 0008h	Bit	reserved	New
					Battery under voltage 2	Mask: 0004h	Bit	reserved	New
					Battery over voltage 1	Mask: 0002h	Bit	reserved	New
					Battery under voltage 1	Mask: 0001h	Bit	reserved	New
450125	450124	16 bits			0 (reserve)				
450126	450125	16 bits			0 (reserve)				
Alarm Management Generator									
450127	450126	16 bits	bit array	10134	Alarms Generator latched (unacknowledged)				
				1912	06.01 Generator over fre-quency 1 latched	Mask: 8000h	Bit	3000XT	
				1913	06.02 Generator over fre-quency 2 latched	Mask: 4000h	Bit	3000XT	
				1962	06.03 Generator under fre-quency 1 latched	Mask: 2000h	Bit	3000XT	
				1963	06.04 Generator under fre-quency 2 latched	Mask: 1000h	Bit	3000XT	
				2012	06.05 Generator over voltage 1 latched	Mask: 0800h	Bit	3000XT	
				2013	06.06 Generator over voltage 2 latched	Mask: 0400h	Bit	3000XT	
				2062	06.07 Generator under voltage 1 latched	Mask: 0200h	Bit	3000XT	
				2063	06.08 Generator under voltage 2 latched	Mask: 0100h	Bit	3000XT	
				2218	06.09 Generator over cur-rent 1 latched	Mask: 0080h	Bit	3000XT	
				2219	06.10 Generator over cur-rent 2 latched	Mask: 0040h	Bit	3000XT	
				2220	06.11 Generator over cur-rent 3 latched	Mask: 0020h	Bit	3000XT	
				2262	06.12 Reverse / reduced power 1 latched	Mask: 0010h	Bit	3000XT	
				2263	06.13 Reverse / reduced power 2 latched	Mask: 0008h	Bit	3000XT	
				2314	06.14 Generator overload IOP 1 latched	Mask: 0004h	Bit	3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
				2315	06.15 Generator overload IOP 2 latched	Mask: 0002h	Bit	3000XT	
					internal	Mask: 0001h	Bit	reserved	
450128	450127	16 bits	bit array	4161	Alarms Generator active				
					Generator over frequency 1	Mask: 8000h	Bit	3000XT	New
					Generator over frequency 2	Mask: 4000h	Bit	3000XT	New
					Generator under frequency 1	Mask: 2000h	Bit	3000XT	New
					Generator under frequency 2	Mask: 1000h	Bit	3000XT	New
					Generator over voltage 1	Mask: 0800h	Bit	3000XT	New
					Generator over voltage 2	Mask: 0400h	Bit	3000XT	New
					Generator under voltage 1	Mask: 0200h	Bit	3000XT	New
					Generator under voltage 2	Mask: 0100h	Bit	3000XT	New
					Generator over current 1	Mask: 0080h	Bit	3000XT	New
					Generator over current 2	Mask: 0040h	Bit	3000XT	New
					Generator over current 3	Mask: 0020h	Bit	3000XT	New
					Reverse / reduced power 1	Mask: 0010h	Bit	3000XT	New
					Reverse / reduced power 2	Mask: 0008h	Bit	3000XT	New
					Generator overload IOP 1	Mask: 0004h	Bit	3000XT	New
					Generator overload IOP 2	Mask: 0002h	Bit	3000XT	New
					internal	Mask: 0001h	Bit	reserved	New
450129	450128	16 bits	bit array	10138	Alarms Generator 1 latched (unacknowledged)				
				2412	06.16 Generator unbal-anced load 1 latched	Mask: 8000h	Bit	3000XT	
				2413	06.17 Generator unbal-anced load 2 latched	Mask: 4000h	Bit	3000XT	
				3907	06.18 Generator voltage asymmetry latched	Mask: 2000h	Bit	3000XT	
				3263	06.19 Ground fault 1 latched	Mask: 1000h	Bit	3000XT	
				3264	06.20 Ground fault 2 latched	Mask: 0800h	Bit	3000XT	
				3955	06.21 Gen. Phase Rotation mismatch Latched	Mask: 0400h	Bit	3000XT	
				2924	06.29 Gen. active power mismatch Latched	Mask: 0200h	Bit	3000XT	
				3124	06.30 Generator unloading mismatch Latched	Mask: 0100h	Bit	3000XT	
				4038	06.22 Inverse time over current Latched	Mask: 0080h	Bit	3000XT	
				2664	06.31 Operating Range failed latched	Mask: 0040h	Bit	3000XT	
				2362	06.23 Generator overload MOP 1 latched	Mask: 0020h	Bit	3000XT	
				2363	06.24 Generator overload MOP 2 latched	Mask: 0010h	Bit	3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
				2337	06.25 Gen.Power Factor lagging 1 latched	Mask: 0008h	Bit	3000XT	
				2338	06.26 Gen.Power Factor lagging 2 latched	Mask: 0004h	Bit	3000XT	
				2387	06.27 Gen.Power Factor leading 1 latched	Mask: 0002h	Bit	3000XT	
				2388	06.28 Gen.Power Factor leading 2 latched	Mask: 0001h	Bit	3000XT	
450130	450129	16 bits	bit array	4163	Alarms Generator 1 active				
					Generator unbalanced load 1	Mask: 8000h	Bit	3000XT	New
					Generator unbalanced load 2	Mask: 4000h	Bit	3000XT	New
					Generator voltage asym-metry	Mask: 2000h	Bit	3000XT	New
					Ground fault 1	Mask: 1000h	Bit	3000XT	New
					Ground fault 2	Mask: 0800h	Bit	3000XT	New
					Gen. Phase Rotation mis-match	Mask: 0400h	Bit	3000XT	New
					Gen. active power mis-match	Mask: 0200h	Bit	3000XT	New
					Generator unloading mis-match	Mask: 0100h	Bit	3000XT	New
					Inverse time over current	Mask: 0080h	Bit	3000XT	New
					Operating Range failed	Mask: 0040h	Bit	3000XT	New
					Generator overload MOP 1	Mask: 0020h	Bit	3000XT	New
					Generator overload MOP 2	Mask: 0010h	Bit	3000XT	New
					Gen.Power Factor lagging 1	Mask: 0008h	Bit	3000XT	New
					Gen.Power Factor lagging 2	Mask: 0004h	Bit	3000XT	New
					Gen.Power Factor leading 1	Mask: 0002h	Bit	3000XT	New
					Gen.Power Factor leading 2	Mask: 0001h	Bit	3000XT	New
450131	450130	16 bits			0 (reserve)				
450132	450131	16 bits			0 (reserve)				
Alarm Management Mains									
450133	450132	16 bits	bit array	10135	Alarms Mains latched (unacknowledged)				
				2862	07.06 Mains over frequency 1 latched	Mask: 8000h	Bit	3000XT	
				2863	07.07 Mains over frequency 2 latched	Mask: 4000h	Bit	3000XT	
				2912	07.08 Mains under fre-quency 1 latched	Mask: 2000h	Bit	3000XT	
				2913	07.09 Mains under fre-quency 2 latched	Mask: 1000h	Bit	3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
				2962	07.10 Mains over voltage 1 latched	Mask: 0800h	Bit	3000XT	
				2963	07.11 Mains over voltage 2 latched	Mask: 0400h	Bit	3000XT	
				3012	07.12 Mains under voltage 1 latched	Mask: 0200h	Bit	3000XT	
				3013	07.13 Mains under voltage 2 latched	Mask: 0100h	Bit	3000XT	
				3057	07.14 Mains Phase shift latched	Mask: 0080h	Bit	3000XT	
				3114	07.25 Mains decoupling latched	Mask: 0040h	Bit	3000XT	
					internal	Mask: 0020h	Bit	3000XT	
					internal	Mask: 0010h	Bit	3000XT	
					internal	Mask: 0008h	Bit	3000XT	
				3975	07.05 Mains Phase rotation mismatch latched	Mask: 0004h	Bit	3000XT	
					internal	Mask: 0002h	Bit	3000XT	
					internal	Mask: 0001h	Bit	3000XT	
450134	450133	16 bits	bit array	4188	Alarms Mains active				
				2862	Mains over frequency 1	Mask: 8000h	Bit	3000XT	New
				2863	Mains over frequency 2	Mask: 4000h	Bit	3000XT	New
				2912	Mains under frequency 1	Mask: 2000h	Bit	3000XT	New
				2913	Mains under frequency 2	Mask: 1000h	Bit	3000XT	New
				2962	Mains over voltage 1	Mask: 0800h	Bit	3000XT	New
				2963	Mains over voltage 2	Mask: 0400h	Bit	3000XT	New
				3012	Mains under voltage 1	Mask: 0200h	Bit	3000XT	New
				3013	Mains under voltage 2	Mask: 0100h	Bit	3000XT	New
				3057	Mains Phase shift	Mask: 0080h	Bit	3000XT	New
				3114	Mains decoupling	Mask: 0040h	Bit	3000XT	New
					internal	Mask: 0020h	Bit	3000XT	New
					internal	Mask: 0010h	Bit	3000XT	New
					internal	Mask: 0008h	Bit	3000XT	New
				3975	Mains Phase rotation mis-match	Mask: 0004h	Bit	3000XT	New
					internal	Mask: 0002h	Bit	3000XT	New
					internal	Mask: 0001h	Bit	3000XT	New
450135	450134	16 bits	bit array	10278	Alarms Mains 1 latched (unacknowledged)				
				3217	07.21 Mains import power 1 latched	Mask: 8000h	Bit	3000XT	
				3218	07.22 Mains import power 2 latched	Mask: 4000h	Bit	3000XT	
				3241	07.23 Mains export power 1 latched	Mask: 2000h	Bit	3000XT	
				3242	07.24 Mains export power 2 latched	Mask: 1000h	Bit	3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
				2985	07.17 Mains PF lagging 1 latched	Mask: 0800h	Bit	3000XT	
				2986	07.18 Mains PF lagging 2 latched	Mask: 0400h	Bit	3000XT	
				3035	07.19 Mains PF leading 1 latched	Mask: 0200h	Bit	3000XT	
				3036	07.20 Mains PF leading 2 latched	Mask: 0100h	Bit	3000XT	
				3106	07.15 Mains df/dt latched	Mask: 0080h	Bit	3000XT	
				2934	07.16 Mains active power mismatch latched	Mask: 0040h	Bit	3000XT	
				4958	07.28 Mains Time-dep. Voltage (FRT) latched	Mask: 0020h	Bit	3000XT	
					internal	Mask: 0010h	Bit	3000XT	
				8834	07.27 Mains slow voltage increase (10 min)	Mask: 0008h	Bit	3000XT	
					internal	Mask: 0004h	Bit		
				3288	07.29 QV Monitoring step 1 tripped	Mask: 0002h	Bit	3000XT	
				3289	07.30 QV Monitoring step 2 tripped	Mask: 0001h	Bit	3000XT	
450136	450135	16 bits	bit array	4187	Alarms Mains 1 active				
					Mains import power 1	Mask: 8000h	Bit	3000XT	New
					Mains import power 2	Mask: 4000h	Bit	3000XT	New
					Mains export power 1	Mask: 2000h	Bit	3000XT	New
					Mains export power 2	Mask: 1000h	Bit	3000XT	New
					Mains PF lagging 1	Mask: 0800h	Bit	3000XT	New
					Mains PF lagging 2	Mask: 0400h	Bit	3000XT	New
					Mains PF leading 1	Mask: 0200h	Bit	3000XT	New
					Mains PF leading 2	Mask: 0100h	Bit	3000XT	New
					Mains df/dt	Mask: 0080h	Bit	3000XT	New
					Mains active power mis-match	Mask: 0040h	Bit	3000XT	New
					Mains Time-dep. Voltage (FRT)	Mask: 0020h	Bit	3000XT	New
					internal	Mask: 0010h	Bit	3000XT	New
					Mains slow voltage increase (10 min)	Mask: 0008h	Bit	3000XT	New
					internal	Mask: 0004h	Bit	3000XT	New
					QV Monitoring 1 tripped	Mask: 0002h	Bit	3000XT	New
					QV Monitoring 2 tripped	Mask: 0001h	Bit	3000XT	New
450137	450136	16 bits			0 (reserve)				
450138	450137	16 bits			0 (reserve)				
Alarm Management									
Digital Inputs									
450139	450138	16 bits	bit array	10132	Alarms Digital Inputs 1 latched (unacknowledged)				

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
				10600	09.01 Discrete input 1 latched	Mask: 8000h	Bit	3000XT	
				10601	09.02 Discrete input 2 latched	Mask: 4000h	Bit	3000XT	
				10602	09.03 Discrete input 3 latched	Mask: 2000h	Bit	3000XT	
				10603	09.04 Discrete input 4 latched	Mask: 1000h	Bit	3000XT	
				10604	09.05 Discrete input 5 latched	Mask: 0800h	Bit	3000XT	
				10605	09.06 Discrete input 6 latched	Mask: 0400h	Bit	3000XT	
				10607	09.07 Discrete input 7 latched	Mask: 0200h	Bit	3000XT	
				10608	09.08 Discrete input 8 latched	Mask: 0100h	Bit	3000XT	
				10609	09.09 Discrete input 9 latched	Mask: 0080h	Bit	3000XT	
				10610	09.10 Discrete input 10 latched	Mask: 0040h	Bit	3000XT	
				10611	09.11 Discrete input 11 latched	Mask: 0020h	Bit	3000XT	
				10612	09.12 Discrete input 12 latched	Mask: 0010h	Bit	3000XT	
					internal	Mask: 0008h	Bit	3000XT	
					internal	Mask: 0004h	Bit	3000XT	
					internal	Mask: 0002h	Bit	3000XT	
					internal	Mask: 0001h	Bit	3000XT	
450140	450139	16 bits	bit array	4181	Alarms Digital Inputs 1 active				
					Discrete input 1	Mask: 8000h	Bit	3000XT	New
					Discrete input 2	Mask: 4000h	Bit	3000XT	New
					Discrete input 3	Mask: 2000h	Bit	3000XT	New
					Discrete input 4	Mask: 1000h	Bit	3000XT	New
					Discrete input 5	Mask: 0800h	Bit	3000XT	New
					Discrete input 6	Mask: 0400h	Bit	3000XT	New
					Discrete input 7	Mask: 0200h	Bit	3000XT	New
					Discrete input 8	Mask: 0100h	Bit	3000XT	New
					Discrete input 9	Mask: 0080h	Bit	3000XT	New
					Discrete input 10	Mask: 0040h	Bit	3000XT	New
					Discrete input 11	Mask: 0020h	Bit	3000XT	New
					Discrete input 12	Mask: 0010h	Bit	3000XT	New
					internal	Mask: 0008h	Bit	3000XT	New
					internal	Mask: 0004h	Bit	3000XT	New
					internal	Mask: 0002h	Bit	3000XT	New
					internal	Mask: 0001h	Bit	3000XT	New

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
450141	450140	16 bits	bit array	16377	Alarms External Digital Inputs 1 latched (unac-knowledged)				
				16376	12.16 External discrete input 16 latched	Mask: 8000h	Bit	3000XT	
				16375	12.15 External discrete input 15 latched	Mask: 4000h	Bit	3000XT	
				16374	12.14 External discrete input 14 latched	Mask: 2000h	Bit	3000XT	
				16373	12.13 External discrete input 13 latched	Mask: 1000h	Bit	3000XT	
				16372	12.12 External discrete input 12 latched	Mask: 0800h	Bit	3000XT	
				16371	12.11 External discrete input 11 latched	Mask: 0400h	Bit	3000XT	
				16370	12.10 External discrete input 10 latched	Mask: 0200h	Bit	3000XT	
				16369	12.09 External discrete input 9 latched	Mask: 0100h	Bit	3000XT	
				16368	12.08 External discrete input 8 latched	Mask: 0080h	Bit	3000XT	
				16367	12.07 External discrete input 7 latched	Mask: 0040h	Bit	3000XT	
				16366	12.06 External discrete input 6 latched	Mask: 0020h	Bit	3000XT	
				16365	12.05 External discrete input 5 latched	Mask: 0010h	Bit	3000XT	
				16364	12.04 External discrete input 4 latched	Mask: 0008h	Bit	3000XT	
				16362	12.03 External discrete input 3 latched	Mask: 0004h	Bit	3000XT	
				16361	12.02 External discrete input 2 latched	Mask: 0002h	Bit	3000XT	
				16360	12.01 External discrete input 1 latched	Mask: 0001h	Bit	3000XT	
450142	450141	16 bits	bit array	4185	Alarms External Digital Inputs active				
					External discrete input 16	Mask: 8000h	Bit	3000XT	New
					External discrete input 15	Mask: 4000h	Bit	3000XT	New
					External discrete input 14	Mask: 2000h	Bit	3000XT	New
					External discrete input 13	Mask: 1000h	Bit	3000XT	New
					External discrete input 12	Mask: 0800h	Bit	3000XT	New
					External discrete input 11	Mask: 0400h	Bit	3000XT	New
					External discrete input 10	Mask: 0200h	Bit	3000XT	New
					External discrete input 9	Mask: 0100h	Bit	3000XT	New
					External discrete input 8	Mask: 0080h	Bit	3000XT	New
					External discrete input 7	Mask: 0040h	Bit	3000XT	New
					External discrete input 6	Mask: 0020h	Bit	3000XT	New
					External discrete input 5	Mask: 0010h	Bit	3000XT	New
					External discrete input 4	Mask: 0008h	Bit	3000XT	New

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
					External discrete input 3	Mask: 0004h	Bit	3000XT	New
					External discrete input 2	Mask: 0002h	Bit	3000XT	New
					External discrete input 1	Mask: 0001h	Bit	3000XT	New
450143	450142	16 bits	bit array	10284	Alarm External Digital Inputs 2 latched (unac-knowledged)				
				16352	12.32 External discrete input 32 latched	Mask: 8000h	Bit	3000XT	
				16342	12.31 External discrete input 31 latched	Mask: 4000h	Bit	3000XT	
				16332	12.30 External discrete input 30 latched	Mask: 2000h	Bit	3000XT	
				16322	12.29 External discrete input 29 latched	Mask: 1000h	Bit	3000XT	
				16312	12.28 External discrete input 28 latched	Mask: 0800h	Bit	3000XT	
				16302	12.27 External discrete input 27 latched	Mask: 0400h	Bit	3000XT	
				16292	12.26 External discrete input 26 latched	Mask: 0200h	Bit	3000XT	
				16282	12.25 External discrete input 25 latched	Mask: 0100h	Bit	3000XT	
				16272	12.24 External discrete input 24 latched	Mask: 0080h	Bit	3000XT	
				16262	12.23 External discrete input 23 latched	Mask: 0040h	Bit	3000XT	
				16252	12.22 External discrete input 22 latched	Mask: 0020h	Bit	3000XT	
				16242	12.21 External discrete input 21 latched	Mask: 0010h	Bit	3000XT	
				16232	12.20 External discrete input 20 latched	Mask: 0008h	Bit	3000XT	
				16222	12.19 External discrete input 19 latched	Mask: 0004h	Bit	3000XT	
				16212	12.18 External discrete input 18 latched	Mask: 0002h	Bit	3000XT	
				16202	12.17 External discrete input 17 latched	Mask: 0001h	Bit	3000XT	
450144	450143	16 bits	bit array	4195	Alarm External Digital Inputs 2 active				
					External discrete input 32	Mask: 8000h	Bit	3000XT	New
					External discrete input 31	Mask: 4000h	Bit	3000XT	New
					External discrete input 30	Mask: 2000h	Bit	3000XT	New
					External discrete input 29	Mask: 1000h	Bit	3000XT	New
					External discrete input 28	Mask: 0800h	Bit	3000XT	New
					External discrete input 27	Mask: 0400h	Bit	3000XT	New
					External discrete input 26	Mask: 0200h	Bit	3000XT	New
					External discrete input 25	Mask: 0100h	Bit	3000XT	New
					External discrete input 24	Mask: 0080h	Bit	3000XT	New
					External discrete input 23	Mask: 0040h	Bit	3000XT	New

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
					External discrete input 22	Mask: 0020h	Bit	3000XT	New
					External discrete input 21	Mask: 0010h	Bit	3000XT	New
					External discrete input 20	Mask: 0008h	Bit	3000XT	New
					External discrete input 19	Mask: 0004h	Bit	3000XT	New
					External discrete input 18	Mask: 0002h	Bit	3000XT	New
					External discrete input 17	Mask: 0001h	Bit	3000XT	New
450145	450144	16 bits	bit array	10283	Alarms Digital Inputs 2 latched (unacknowledged)				
				10613	09.13 Discrete input 13 latched	Mask: 8000h	Bit	3500XT-P2	
				10614	09.14 Discrete input 14 latched	Mask: 4000h	Bit	3500XT-P2	
				10615	09.15 Discrete input 15 latched	Mask: 2000h	Bit	3500XT-P2	
				10616	09.16 Discrete input 16 latched	Mask: 1000h	Bit	3500XT-P2	
				10617	09.17 Discrete input 17 latched	Mask: 0800h	Bit	3500XT-P2	
				10618	09.18 Discrete input 18 latched	Mask: 0400h	Bit	3500XT-P2	
				10619	09.19 Discrete input 19 latched	Mask: 0200h	Bit	3500XT-P2	
				10620	09.20 Discrete input 20 latched	Mask: 0100h	Bit	3500XT-P2	
				10621	09.21 Discrete input 21 latched	Mask: 0080h	Bit	3500XT-P2	
				10622	09.22 Discrete input 22 latched	Mask: 0040h	Bit	3500XT-P2	
				10623	09.23 Discrete input 23 latched	Mask: 0020h	Bit	3500XT-P2	
					internal	Mask: 0010h	Bit	reserved	
					internal	Mask: 0008h	Bit	reserved	
					internal	Mask: 0004h	Bit	reserved	
					internal	Mask: 0002h	Bit	reserved	
					internal	Mask: 0001h	Bit	reserved	
450146	450145	16 bits	bit array	4183	Alarms Digital Inputs 2 active				
					Discrete input 13	Mask: 8000h	Bit	3500XT-P2	New
					Discrete input 14	Mask: 4000h	Bit	3500XT-P2	New
					Discrete input 15	Mask: 2000h	Bit	3500XT-P2	New
					Discrete input 16	Mask: 1000h	Bit	3500XT-P2	New
					Discrete input 17	Mask: 0800h	Bit	3500XT-P2	New
					Discrete input 18	Mask: 0400h	Bit	3500XT-P2	New

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
					Discrete input 19	Mask: 0200h	Bit	3500XT-P2	New
					Discrete input 20	Mask: 0100h	Bit	3500XT-P2	New
					Discrete input 21	Mask: 0080h	Bit	3500XT-P2	New
					Discrete input 22	Mask: 0040h	Bit	3500XT-P2	New
					Discrete input 23	Mask: 0020h	Bit	3500XT-P2	New
					internal	Mask: 0010h	Bit	reserved	New
					internal	Mask: 0008h	Bit	reserved	New
					internal	Mask: 0004h	Bit	reserved	New
					internal	Mask: 0002h	Bit	reserved	New
					internal	Mask: 0001h	Bit	reserved	New
450147	450146	16 bits			0 (reserve)				
450148	450147	16 bits			0 (reserve)				
450149	450148	16 bits			0 (reserve)				
450150	450149	16 bits			0 (reserve)				
Alarm Management Flexible Thresholds									
450151	450150	16 bits	bit array	10279	Alarms Flexible thresholds 1-16 latched (unacknowl-edged)				
				10033	15.16 Flexible limit 16 latched	Mask: 8000h	Bit	3000XT	
				10032	15.15 Flexible limit 15 latched	Mask: 4000h	Bit	3000XT	
				10031	15.14 Flexible limit 14 latched	Mask: 2000h	Bit	3000XT	
				10030	15.13 Flexible limit 13 latched	Mask: 1000h	Bit	3000XT	
				10029	15.12 Flexible limit 12 latched	Mask: 0800h	Bit	3000XT	
				10028	15.11 Flexible limit 11 latched	Mask: 0400h	Bit	3000XT	
				10027	15.10 Flexible limit 10 latched	Mask: 0200h	Bit	3000XT	
				10026	15.09 Flexible limit 9 latched	Mask: 0100h	Bit	3000XT	
				10025	15.08 Flexible limit 8 latched	Mask: 0080h	Bit	3000XT	
				10024	15.07 Flexible limit 7 latched	Mask: 0040h	Bit	3000XT	
				10023	15.06 Flexible limit 6 latched	Mask: 0020h	Bit	3000XT	
				10022	15.05 Flexible limit 5 latched	Mask: 0010h	Bit	3000XT	
				10021	15.04 Flexible limit 4 latched	Mask: 0008h	Bit	3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
				10020	15.03 Flexible limit 3 latched	Mask: 0004h	Bit	3000XT	
				10019	15.02 Flexible limit 2 latched	Mask: 0002h	Bit	3000XT	
				10018	15.01 Flexible limit 1 latched	Mask: 0001h	Bit	3000XT	
450152	450151	16 bits	bit array	4175	Alarms Flexible thresholds 1-16 active				
					Flexible limit 16	Mask: 8000h	Bit	3000XT	New
					Flexible limit 15	Mask: 4000h	Bit	3000XT	New
					Flexible limit 14	Mask: 2000h	Bit	3000XT	New
					Flexible limit 13	Mask: 1000h	Bit	3000XT	New
					Flexible limit 12	Mask: 0800h	Bit	3000XT	New
					Flexible limit 11	Mask: 0400h	Bit	3000XT	New
					Flexible limit 10	Mask: 0200h	Bit	3000XT	New
					Flexible limit 9	Mask: 0100h	Bit	3000XT	New
					Flexible limit 8	Mask: 0080h	Bit	3000XT	New
					Flexible limit 7	Mask: 0040h	Bit	3000XT	New
					Flexible limit 6	Mask: 0020h	Bit	3000XT	New
					Flexible limit 5	Mask: 0010h	Bit	3000XT	New
					Flexible limit 4	Mask: 0008h	Bit	3000XT	New
					Flexible limit 3	Mask: 0004h	Bit	3000XT	New
					Flexible limit 2	Mask: 0002h	Bit	3000XT	New
					Flexible limit 1	Mask: 0001h	Bit	3000XT	New
450153	450152	16 bits	bit array	10280	Alarms Flexible thresholds 17-32 latched (unacknowl-edged)				
				10049	15.32 Flexible limit 32 latched	Mask: 8000h	Bit	3000XT	
				10048	15.31 Flexible limit 31 latched	Mask: 4000h	Bit	3000XT	
				10047	15.30 Flexible limit 30 latched	Mask: 2000h	Bit	3000XT	
				10046	15.29 Flexible limit 29 latched	Mask: 1000h	Bit	3000XT	
				10045	15.28 Flexible limit 28 latched	Mask: 0800h	Bit	3000XT	
				10044	15.27 Flexible limit 27 latched	Mask: 0400h	Bit	3000XT	
				10043	15.26 Flexible limit 26 latched	Mask: 0200h	Bit	3000XT	
				10042	15.25 Flexible limit 25 latched	Mask: 0100h	Bit	3000XT	
				10041	15.24 Flexible limit 24 latched	Mask: 0080h	Bit	3000XT	
				10040	15.23 Flexible limit 23 latched	Mask: 0040h	Bit	3000XT	
				10039	15.22 Flexible limit 22 latched	Mask: 0020h	Bit	3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
				10038	15.21 Flexible limit 21 latched	Mask: 0010h	Bit	3000XT	
				10037	15.20 Flexible limit 20 latched	Mask: 0008h	Bit	3000XT	
				10036	15.19 Flexible limit 19 latched	Mask: 0004h	Bit	3000XT	
				10035	15.18 Flexible limit 18 latched	Mask: 0002h	Bit	3000XT	
				10034	15.17 Flexible limit 17 latched	Mask: 0001h	Bit	3000XT	
450154	450153	16 bits	bit array	4177	Alarms Flexible thresholds 17-32 active				
					Flexible limit 32	Mask: 8000h	Bit	3000XT	New
					Flexible limit 31	Mask: 4000h	Bit	3000XT	New
					Flexible limit 30	Mask: 2000h	Bit	3000XT	New
					Flexible limit 29	Mask: 1000h	Bit	3000XT	New
					Flexible limit 28	Mask: 0800h	Bit	3000XT	New
					Flexible limit 27	Mask: 0400h	Bit	3000XT	New
					Flexible limit 26	Mask: 0200h	Bit	3000XT	New
					Flexible limit 25	Mask: 0100h	Bit	3000XT	New
					Flexible limit 24	Mask: 0080h	Bit	3000XT	New
					Flexible limit 23	Mask: 0040h	Bit	3000XT	New
					Flexible limit 22	Mask: 0020h	Bit	3000XT	New
					Flexible limit 21	Mask: 0010h	Bit	3000XT	New
					Flexible limit 20	Mask: 0008h	Bit	3000XT	New
					Flexible limit 19	Mask: 0004h	Bit	3000XT	New
					Flexible limit 18	Mask: 0002h	Bit	3000XT	New
					Flexible limit 17	Mask: 0001h	Bit	3000XT	New
450155	450154	16 bits	bit array	10281	Alarms Flexible thresholds 33-40 latched (unacknowl-edged)				
					internal	Mask: 8000h	Bit	3000XT	
					internal	Mask: 4000h	Bit	3000XT	
					internal	Mask: 2000h	Bit	3000XT	
					internal	Mask: 1000h	Bit	3000XT	
					internal	Mask: 0800h	Bit	3000XT	
					internal	Mask: 0400h	Bit	3000XT	
					internal	Mask: 0200h	Bit	3000XT	
					internal	Mask: 0100h	Bit	3000XT	
				10057	15.40 Flexible limit 40 latched	Mask: 0080h	Bit	3000XT	
				10056	15.39 Flexible limit 39 latched	Mask: 0040h	Bit	3000XT	
				10055	15.38 Flexible limit 38 latched	Mask: 0020h	Bit	3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
				10054	15.37 Flexible limit 37 latched	Mask: 0010h	Bit	3000XT	
				10053	15.36 Flexible limit 36 latched	Mask: 0008h	Bit	3000XT	
				10052	15.35 Flexible limit 35 latched	Mask: 0004h	Bit	3000XT	
				10051	15.34 Flexible limit 34 latched	Mask: 0002h	Bit	3000XT	
				10050	15.33 Flexible limit 33 latched	Mask: 0001h	Bit	3000XT	
450156	450155	16 bits	bit array	4179	Alarms Flexible thresholds 33-40 active				
					internal	Mask: 8000h	Bit	3000XT	New
					internal	Mask: 4000h	Bit	3000XT	New
					internal	Mask: 2000h	Bit	3000XT	New
					internal	Mask: 1000h	Bit	3000XT	New
					internal	Mask: 0800h	Bit	3000XT	New
					internal	Mask: 0400h	Bit	3000XT	New
					internal	Mask: 0200h	Bit	3000XT	New
					internal	Mask: 0100h	Bit	3000XT	New
					Flexible limit 40	Mask: 0080h	Bit	3000XT	New
					Flexible limit 39	Mask: 0040h	Bit	3000XT	New
					Flexible limit 38	Mask: 0020h	Bit	3000XT	New
					Flexible limit 37	Mask: 0010h	Bit	3000XT	New
					Flexible limit 36	Mask: 0008h	Bit	3000XT	New
					Flexible limit 35	Mask: 0004h	Bit	3000XT	New
					Flexible limit 34	Mask: 0002h	Bit	3000XT	New
					Flexible limit 33	Mask: 0001h	Bit	3000XT	New
450157	450156	16 bits			0 (reserve)				New
450158	450157	16 bits			0 (reserve)				
450159	450158	16 bits			0 (reserve)				
Alarm Management DC Analogue Values Wirebreak									
450160	450159	16 bits	bit array	10137	Alarms Analog Inputs Wire Break latched (unacknowl-edged)				
					internal	Mask: 0001h	Bit	3000XT	
				10014	10.01 Analog input 1 wire break	Mask: 0002h	Bit	3000XT	
				10015	10.02 Analog input 2 wire break	Mask: 0004h	Bit	3000XT	
				10060	10.03 Analog input 3 wire break	Mask: 0008h	Bit	3000XT	
				10061	10.04 Analog input 4 wire break	Mask: 0010h	Bit	3500XT-P2	
				10062	10.05 Analog input 5 wire break	Mask: 0020h	Bit	3500XT-P2	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
				10063	10.06 Analog input 6 wire break	Mask: 0040h	Bit	3500XT-P2	
				10064	10.07 Analog input 7 wire break	Mask: 0080h	Bit	3500XT-P2	
				10065	10.08 Analog input 8 wire break	Mask: 0100h	Bit	3500XT-P2	
				10066	10.09 Analog input 9 wire break	Mask: 0200h	Bit	3500XT-P2	
				10067	10.10 Analog input 10 wire break	Mask: 0400h	Bit	3500XT-P2	
				10068	internal	Mask: 0800h	Bit	reserved	
				10069	internal	Mask: 1000h	Bit	reserved	
					internal	Mask: 2000h	Bit	reserved	
					internal	Mask: 4000h	Bit	reserved	
					internal	Mask: 8000h	Bit	reserved	
450161	450160	16 bits	bit array	4173	Alarms Analog Inputs Wire Break active				
					internal	Mask: 0001h	Bit	reserved	
					Analog input 1 wire break	Mask: 0002h	Bit	3500XT-P2	New
					Analog input 2 wire break	Mask: 0004h	Bit	3500XT-P2	New
					Analog input 3 wire break	Mask: 0008h	Bit	3500XT-P2	New
					Analog input 4 wire break	Mask: 0010h	Bit	3500XT-P2	New
					Analog input 5 wire break	Mask: 0020h	Bit	3500XT-P2	New
					Analog input 6 wire break	Mask: 0040h	Bit	3500XT-P2	New
					Analog input 7 wire break	Mask: 0080h	Bit	3500XT-P2	New
					Analog input 8 wire break	Mask: 0100h	Bit	3500XT-P2	New
					Analog input 9 wire break	Mask: 0200h	Bit	3500XT-P2	New
					Analog input 10 wire break	Mask: 0400h	Bit	3500XT-P2	New
					internal	Mask: 0800h	Bit	reserved	New
					internal	Mask: 1000h	Bit	reserved	New
					internal	Mask: 2000h	Bit	reserved	New
					internal	Mask: 4000h	Bit	reserved	New
					internal	Mask: 8000h	Bit	reserved	New
450162	450161	16 bits	bit array	10285	Alarms External Analog Inputs Wire Break latched (unacknowledged)				
				10221	25.01 Ext. analog input 1 wire break	Mask: 0001h	Bit	3000XT	
				10222	25.02 Ext. analog input 2 wire break	Mask: 0002h	Bit	3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
				10223	25.03 Ext. analog input 3 wire break	Mask: 0004h	Bit	3000XT	
				10224	25.04 Ext. analog input 4 wire break	Mask: 0008h	Bit	3000XT	
				10225	25.05 Ext. analog input 5 wire break	Mask: 0010h	Bit	3000XT	
				10226	25.06 Ext. analog input 6 wire break	Mask: 0020h	Bit	3000XT	
				10227	25.07 Ext. analog input 7 wire break	Mask: 0040h	Bit	3000XT	
				10228	25.08 Ext. analog input 8 wire break	Mask: 0080h	Bit	3000XT	
				10229	25.09 Ext. analog input 9 wire break	Mask: 0100h	Bit	3000XT	
				10230	25.10 Ext. analog input 10 wire break	Mask: 0200h	Bit	3000XT	
				10231	25.11 Ext. analog input 11 wire break	Mask: 0400h	Bit	3000XT	
				10232	25.12 Ext. analog input 12 wire break	Mask: 0800h	Bit	3000XT	
				10233	25.13 Ext. analog input 13 wire break	Mask: 1000h	Bit	3000XT	
				10234	25.14 Ext. analog input 14 wire break	Mask: 2000h	Bit	3000XT	
				10235	25.15 Ext. analog input 15 wire break	Mask: 4000h	Bit	3000XT	
				10236	25.16 Ext. analog input 16 wire break	Mask: 8000h	Bit	3000XT	
450163	450162	16 bits	bit array	4196	Alarms External Analog Inputs Wire Break active				
					Ext. analog input 1 wire break	Mask: 0001h	Bit	3000XT	New
					Ext. analog input 2 wire break	Mask: 0002h	Bit	3000XT	New
					Ext. analog input 3 wire break	Mask: 0004h	Bit	3000XT	New
					Ext. analog input 4 wire break	Mask: 0008h	Bit	3000XT	New
					Ext. analog input 5 wire break	Mask: 0010h	Bit	3000XT	New
					Ext. analog input 6 wire break	Mask: 0020h	Bit	3000XT	New
					Ext. analog input 7 wire break	Mask: 0040h	Bit	3000XT	New
					Ext. analog input 8 wire break	Mask: 0080h	Bit	3000XT	New
					Ext. analog input 9 wire break	Mask: 0100h	Bit	3000XT	New
					Ext. analog input 10 wire break	Mask: 0200h	Bit	3000XT	New
					Ext. analog input 11 wire break	Mask: 0400h	Bit	3000XT	New

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
					Ext. analog input 12 wire break	Mask: 0800h	Bit	3000XT	New
					Ext. analog input 13 wire break	Mask: 1000h	Bit	3000XT	New
					Ext. analog input 14 wire break	Mask: 2000h	Bit	3000XT	New
					Ext. analog input 15 wire break	Mask: 4000h	Bit	3000XT	New
					Ext. analog input 16 wire break	Mask: 8000h	Bit	3000XT	New
450164	450163	16 bits			0 (reserve)				
450165	450164	16 bits			0 (reserve)				
Alarm Management Other Alarms									
450166	450165	16 bits	bit array	10286	Other Alarms 1 latched (unacknowledged)				
				5195	Internal	Mask: 8000h	Bit	3000XT	rees-tab-lished
				5189	Internal	Mask: 4000h	Bit	3000XT	rees-tab-lished
				5183	Internal	Mask: 2000h	Bit	3000XT	rees-tab-lished
				5177	Internal	Mask: 1000h	Bit	3000XT	rees-tab-lished
				5171	Internal	Mask: 0800h	Bit	3000XT	rees-tab-lished
				5165	Internal	Mask: 0400h	Bit	3000XT	rees-tab-lished
				5159	Internal	Mask: 0200h	Bit	reserved	rees-tab-lished
				5153	17.09 Neutral interl. reply mismatch latched	Mask: 0100h	Bit	3000XT	
				5147	17.08 Decoupling GCB<->MCB latched	Mask: 0080h	Bit	3000XT	
				5141	17.07 Measurement difference 4105 latched	Mask: 0040h	Bit	3000XT	
				5135	17.06 Parameter alignment 4105 latched	Mask: 0020h	Bit	3000XT	
				5129	17.05 Missing member 4105 latched	Mask: 0010h	Bit	3000XT	
				5123	08.22 Busbar v/f not ok latched	Mask: 0008h	Bit	3000XT	
				5117	08.21 Feedback GCB mismatch latched	Mask: 0004h	Bit	reserved	
				5111	17.02 Reactive load share mismatch latched	Mask: 0002h	Bit	3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
				5105	17.01 Active load share mismatch latched	Mask: 0001h	Bit	3000XT	
450167	450166	16 bits	bit array	5197	Other Alarms 1 active (reserved)				
					internal	Mask: 8000h	Bit	3000XT	
					internal	Mask: 4000h	Bit	3000XT	
					internal	Mask: 2000h	Bit	3000XT	
					internal	Mask: 1000h	Bit	3000XT	
					internal	Mask: 0800h	Bit	3000XT	
					internal	Mask: 0400h	Bit	3000XT	
					internal	Mask: 0200h	Bit	3000XT	
					Neutral contactor failure	Mask: 0100h	Bit	3000XT	New
					Decoupling GCB<->MCB	Mask: 0080h	Bit	3000XT	New
					Meas.difference 4105 VDE-AR-N 4105	Mask: 0040h	Bit	3000XT	New
					Parameter alignment VDE-AR-N 4105	Mask: 0020h	Bit	3000XT	New
					Missing member VDE-AR-N 4105	Mask: 0010h	Bit	3000XT	New
					Busbar monitoring latched	Mask: 0008h	Bit	3000XT	New
					Plausibility GCB feedback latched	Mask: 0004h	Bit	3000XT	New
					Reactive load sharing mis-match latched	Mask: 0002h	Bit	3000XT	New
					Active load sharing mis-match latched	Mask: 0001h	Bit	3000XT	New
450168	450167	16 bits	bit array	4085	Internal Flags 1-16				
					96.16 LM Internal Flag 16	Mask: 8000h	Bit	3000XT	New
					96.15 LM Internal Flag 15	Mask: 4000h	Bit	3000XT	New
					96.14 LM Internal Flag 14	Mask: 2000h	Bit	3000XT	New
					96.13 LM Internal Flag 13	Mask: 1000h	Bit	3000XT	New
					96.12 LM Internal Flag 12	Mask: 0800h	Bit	3000XT	New
					96.11 LM Internal Flag 11	Mask: 0400h	Bit	3000XT	New
					96.10 LM Internal Flag 10	Mask: 0200h	Bit	3000XT	New
					96.09 LM Internal Flag 9	Mask: 0100h	Bit	3000XT	New
					96.08 LM Internal Flag 8	Mask: 0080h	Bit	3000XT	New
					96.07 LM Internal Flag 7	Mask: 0040h	Bit	3000XT	New
					96.06 LM Internal Flag 6	Mask: 0020h	Bit	3000XT	New
					96.05 LM Internal Flag 5	Mask: 0010h	Bit	3000XT	New
					96.04 LM Internal Flag 4	Mask: 0008h	Bit	3000XT	New
					96.03 LM Internal Flag 3	Mask: 0004h	Bit	3000XT	New
					96.02 LM Internal Flag 2	Mask: 0002h	Bit	3000XT	New
					96.01 LM Internal Flag 1	Mask: 0001h	Bit	3000XT	New
450169	450168	16 bits	bit array	4095	Internal Flags 17-32				
					96.32 LM Internal Flag 32	Mask: 8000h	Bit	3000XT	New

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
					96.31 LM Internal Flag 31	Mask: 4000h	Bit	3000XT	New
					96.30 LM Internal Flag 30	Mask: 2000h	Bit	3000XT	New
					96.29 LM Internal Flag 29	Mask: 1000h	Bit	3000XT	New
					96.28 LM Internal Flag 28	Mask: 0800h	Bit	3000XT	New
					96.27 LM Internal Flag 27	Mask: 0400h	Bit	3000XT	New
					96.26 LM Internal Flag 26	Mask: 0200h	Bit	3000XT	New
					96.25 LM Internal Flag 25	Mask: 0100h	Bit	3000XT	New
					96.24 LM Internal Flag 24	Mask: 0080h	Bit	3000XT	New
					96.23 LM Internal Flag 23	Mask: 0040h	Bit	3000XT	New
					96.22 LM Internal Flag 22	Mask: 0020h	Bit	3000XT	New
					96.21 LM Internal Flag 21	Mask: 0010h	Bit	3000XT	New
					96.20 LM Internal Flag 20	Mask: 0008h	Bit	3000XT	New
					96.19 LM Internal Flag 19	Mask: 0004h	Bit	3000XT	New
					96.18 LM Internal Flag 18	Mask: 0002h	Bit	3000XT	New
					96.17 LM Internal Flag 17	Mask: 0001h	Bit	3000XT	New
450170	450169	16 bits	bit array	10282	Free Alarms 1 latched (unacknowledged)				
				5195	16.16 Free alarm 16 latched	Mask: 8000h	Bit	3000XT	New
				5189	16.15 Free alarm 15 latched	Mask: 4000h	Bit	3000XT	New
				5183	16.14 Free alarm 14 latched	Mask: 2000h	Bit	3000XT	New
				5177	16.13 Free alarm 13 latched	Mask: 1000h	Bit	3000XT	New
				5171	16.12 Free alarm 12 latched	Mask: 0800h	Bit	3000XT	New
				5165	16.11 Free alarm 11 latched	Mask: 0400h	Bit	3000XT	New
				5159	16.10 Free alarm 10 latched	Mask: 0200h	Bit	3000XT	New
				5153	16.09 Free alarm 9 latched	Mask: 0100h	Bit	3000XT	New
				5147	16.08 Free alarm 8 latched	Mask: 0080h	Bit	3000XT	New
				5141	16.07 Free alarm 7 latched	Mask: 0040h	Bit	3000XT	New
				5135	16.06 Free alarm 6 latched	Mask: 0020h	Bit	3000XT	New
				5129	16.05 Free alarm 5 latched	Mask: 0010h	Bit	3000XT	New
				5123	16.04 Free alarm 4 latched	Mask: 0008h	Bit	3000XT	New
				5117	16.03 Free alarm 3 latched	Mask: 0004h	Bit	3000XT	New
				5111	16.02 Free alarm 2 latched	Mask: 0002h	Bit	3000XT	New
				5105	16.01 Free alarm 1 latched	Mask: 0001h	Bit	3000XT	New
450171	450170	16 bits	bit array	4194	Free Alarms 1 active				
					Free alarm 16 active	Mask: 8000h	Bit	3000XT	New
					Free alarm 15 active	Mask: 4000h	Bit	3000XT	New
					Free alarm 14 active	Mask: 2000h	Bit	3000XT	New
					Free alarm 13 active	Mask: 1000h	Bit	3000XT	New

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
					Free alarm 12 active	Mask: 0800h	Bit	3000XT	New
					Free alarm 11 active	Mask: 0400h	Bit	3000XT	New
					Free alarm 10 active	Mask: 0200h	Bit	3000XT	New
					Free alarm 9 active	Mask: 0100h	Bit	3000XT	New
					Free alarm 8 active	Mask: 0080h	Bit	3000XT	New
					Free alarm 7 active	Mask: 0040h	Bit	3000XT	New
					Free alarm 6 active	Mask: 0020h	Bit	3000XT	New
					Free alarm 5 active	Mask: 0010h	Bit	3000XT	New
					Free alarm 4 active	Mask: 0008h	Bit	3000XT	New
					Free alarm 3 active	Mask: 0004h	Bit	3000XT	New
					Free alarm 2 active	Mask: 0002h	Bit	3000XT	New
					Free alarm 1 active	Mask: 0001h	Bit	3000XT	New
Engine Management Active Diagnostic Trouble Code (DM1) 1-10 (SPN Range 0…65535)full SPN value at 450425-450444									
450172	450171	16 bits	signed	15400	SPN of 1. entry	low 16 bits of 19 bits of SPN		3000XT	
450173	450172	16 bits	byte array	15401 15402	FMI / OC of 1. entry	Hi-Byte: FMI Lo-Byte: OC		3000XT	
450174	450173	16 bits	signed	15403	SPN of 2. entry	low 16 bits of 19 bits of SPN		3000XT	
450175	450174	16 bits	byte array	15404 15405	FMI / OC of 2. entry	Hi-Byte: FMI Lo-Byte: OC		3000XT	
450176	450175	16 bits	signed	15406	SPN of 3. entry	low 16 bits of 19 bits of SPN		3000XT	
450177	450176	16 bits	byte array	15407 15408	FMI / OC of 3. entry	Hi-Byte: FMI Lo-Byte: OC		3000XT	
450178	450177	16 bits	signed	15409	SPN of 4. entry	low 16 bits of 19 bits of SPN		3000XT	
450179	450178	16 bits	byte array	15410 15411	FMI / OC of 4. entry	Hi-Byte: FMI Lo-Byte: OC		3000XT	
450180	450179	16 bits	signed	15412	SPN of 5. entry	low 16 bits of 19 bits of SPN		3000XT	
450181	450180	16 bits	byte array	15413 15414	FMI / OC of 5. entry	Hi-Byte: FMI Lo-Byte: OC		3000XT	
450182	450181	16 bits	signed	15415	SPN of 6. entry	low 16 bits of 19 bits of SPN		3000XT	
450183	450182	16 bits	byte array	15416 15418	FMI / OC of 6. entry	Hi-Byte: FMI Lo-Byte: OC		3000XT	
450184	450183	16 bits	signed	15419	SPN of 7. entry	low 16 bits of 19 bits of SPN		3000XT	
450185	450184	16 bits	byte array	15420 15421	FMI / OC of 7. entry	Hi-Byte: FMI Lo-Byte: OC		3000XT	
450186	450185	16 bits	signed	15422	SPN of 8. entry	low 16 bits of 19 bits of SPN		3000XT	
450187	450186	16 bits	byte array	15423 15424	FMI / OC of 8. entry	Hi-Byte: FMI Lo-Byte: OC		3000XT	
450188	450187	16 bits	signed	15425	SPN of 9. entry	low 16 bits of 19 bits of SPN		3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
450189	450188	16 bits	byte array	15426 15427	FMI / OC of 9. entry	Hi-Byte: FMI Lo-Byte: OC		3000XT	
450190	450189	16 bits	signed	15428	SPN of 10. entry	low 16 bits of 19 bits of SPN		3000XT	
450191	450190	16 bits	byte array	15429 15430	FMI / OC of 10. entry	Hi-Byte: FMI Lo-Byte: OC		3000XT	
Engine Management DM1 Lamp Status									
450192	450191	16 bits	bit array	15395	J1939 Lamp Status DM1				
					internal	Mask 8000h		3000XT	
					internal	Mask 4000h		3000XT	
					On Malfunction Lamp	Mask 2000h		3000XT	
					Off Malfunction Lamp	Mask 1000h		3000XT	
					internal	Mask 0800h		3000XT	
					internal	Mask 0400h		3000XT	
					On Red Stop Lamp	Mask 0200h		3000XT	
					Off Red Stop Lamp	Mask 0100h		3000XT	
					internal	Mask 0080h		3000XT	
					internal	Mask 0040h		3000XT	
					On Amber Warning Lamp	Mask 0020h		3000XT	
					Off Amber Warning Lamp	Mask 0010h		3000XT	
					internal	Mask 0008h		3000XT	
					internal	Mask 0004h		3000XT	
					On Protect Lamp	Mask 0002h		3000XT	
					Off Protect Lamp	Mask 0001h		3000XT	
Engine Management DM2 Lamp Status									
450193	450192	16 bits	bit array	15445	J1939 Lamp Status DM2				
					internal	Mask 8000h		3000XT	
					internal	Mask 4000h		3000XT	
					On Malfunction Lamp	Mask 2000h		3000XT	
					Off Malfunction Lamp	Mask 1000h		3000XT	
					internal	Mask 0800h		3000XT	
					internal	Mask 0400h		3000XT	
					On Red Stop Lamp	Mask 0200h		3000XT	
					Off Red Stop Lamp	Mask 0100h		3000XT	
					internal	Mask 0080h		3000XT	
					internal	Mask 0040h		3000XT	
					On Amber Warning Lamp	Mask 0020h		3000XT	
					Off Amber Warning Lamp	Mask 0010h		3000XT	
					internal	Mask 0008h		3000XT	
					internal	Mask 0004h		3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
					On Protect Lamp	Mask 0002h		3000XT	
					Off Protect Lamp	Mask 0001h		3000XT	
Engine Management Especially Failure Codes									
450194	450193	16 bits	bit array	15109	J1939 MTU ADEC ECU Failure Codes	1		3000XT	
450195	450194	16 bits			0 (reserve)				
450196	450195	16 bits	bit array	15304	J1939 EMR2 Engine Stop Information (extracted from DEUTZ-specific J1939-Message)	"Missing" Value="65535" "Error" Value="65279" "Type 9" Value="9" "Type 8" Value="8" "Type 7" Value="7" "Type 6" Value="6" "Type 5" Value="5" "Type 4" Value="4" "Type 3" Value="3" "Type 2" Value="2" "Type 1" Value="1" "Type 0" Value="0"	enum .	3000XT	
450197	450196	16 bits			0 (reserve)				
450198	450197	16 bits	bit array	15305	J1939 DLN2-Message Scania S6				
					Engine Coolant Temperature				
					J1939-Message not avail-able	Mask 8000h		3000XT	
					Sensor fault	Mask 4000h		3000XT	
					High Temperature.	Mask 2000h		3000XT	
					NOT High Temperature	Mask 1000h		3000XT	
					Engine Oil Pressure				
					J1939-Message not avail-able	Mask 0800h		3000XT	
					Sensor fault	Mask 0400h		3000XT	
					Low Pressure	Mask 0200h		3000XT	
					NOT Low Pressure	Mask 0100h		3000XT	
					High Engine Oil Level				
					J1939-Message not avail-able	Mask 0080h		3000XT	
					Sensor fault	Mask 0040h		3000XT	
					High Level	Mask 0020h		3000XT	
					NOT High Level	Mask 0010h		3000XT	
					Low Engine Oil Level				
					J1939-Message not avail-able	Mask 0008h		3000XT	
					Sensor fault	Mask 0004h		3000XT	
					Low Level	Mask 0002h		3000XT	
					NOT Low Level	Mask 0001h		3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
450199	450198	16 bits			0 (reserve)				
450200	450199	16 bits			0 (reserve)				
450201	450200	16 bits			0 (reserve)				
Engine Management Values									
450202	450201	16 bits	signed	15308	Engine Speed (SPN 190)	1	rpm	3000XT	
450203	450202	16 bits	signed	15202	Engine Coolant Tempera-ture (SPN 110)	1	°C	3000XT	
450204	450203	16 bits	signed	15203	Fuel temperature (SPN 174)	1	°C	3000XT	
450205	450204	16 bits	signed	15309	Engine Oil Temperature 1 (SPN 175)	0.1	°C	3000XT	
450206	450205	16 bits	signed	15205	Engine Oil Pressure (SPN 100)	1	kPa	3000XT	
450207	450206	16 bits	signed	15307	Fuel Rate (SPN 183)	0.1	L/h	3000XT	
450208	450207	16 bits	signed	15206	Coolant Level (SPN 111)	0.1	%	3000XT	
450209	450208	16 bits	signed	15207	Throttle position (SPN 91)	0.1	%	3000XT	
450210	450209	16 bits	signed	15208	Load at current Speed (SPN 92)	1	%	3000XT	
450211	450210	16 bits	signed	15210	Engine oil level (SPN 98)	0.1	%	3000XT	
450212	450211	16 bits	signed	15214	Boost pressure (SPN 102)	1	kPa	3000XT	
450213	450212	16 bits	signed	15215	Intake Manifold 1 Temp (SPN 105)	1	°C	3000XT	
450214	450213	16 bits	signed	15212	Barometric Pressure (SPN 108)	0.1	kPa	3000XT	
450215	450214	16 bits	signed	15213	Air inlet temperature (SPN 172)	1	°C	3000XT	
450216	450215	16 bits	signed	15209	Actual engine torque (SPN 513)	1	%	3000XT	
450217	450216	16 bits	signed	15299	Exhaust Gas Temp.(SPN 173)	0.1	°C	3000XT	
450218	450217	16 bits	signed	15217	Engine Intercooler Temp (SPN52)	1	°C	3000XT	
450219	450218	16 bits	signed	15218	Fuel Delivery Pressure (SPN94)	1	kPa	3000XT	
450220	450219	16 bits	signed	15219	Fuel Filter Differential Pres-sure (SPN95)	1	kPa	3000XT	
450221	450220	16 bits	signed	15220	Crankcase Pressure (SPN101)	1	kPa	3000XT	
450222	450221	16 bits	signed	15221	Turbo Air Inlet Pressure (SPN106)	1	kPa	3000XT	
450223	450222	16 bits	signed	15222	Air Filter 1 Differential Pres-sure (SPN107)	0.01	kPa	3000XT	
450224	450223	16 bits	signed	15223	Coolant Pressure (SPN109)	1	kPa	3000XT	
450225	450224	16 bits	signed	15224	Transmission Oil Pressure (SPN127)	1	kPa	3000XT	
450226	450225	16 bits	signed	15225	Fuel Rail Pressure (SPN157)	0.1	MPa	3000XT	
450227	450226	16 bits	signed	15226	Ambient Air Temperature (SPN171)	0.1	°C	3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
450228	450227	16 bits	signed	15227	Turbo Oil Temperature (SPN176)	0.1	°C	3000XT	
450229	450228	16 bits	signed	15228	Transmission Oil Tempera-ture (SPN177)	0.1	°C	3000XT	
450230	450229	16 bits	signed	15229	Auxiliary Temperature 1 (SPN441)	1	°C	3000XT	
450231	450230	16 bits	signed	15230	Auxiliary Temperature 2 (SPN442)	1	°C	3000XT	
450232	450231	16 bits	signed	15209	Actual engine torque (SPN 513)	1	%	3000XT	
450233	450232	16 bits	signed	15231	Alternator Bear. 1 Temper-ature (SPN1122)	1	°C	3000XT	
450234	450233	16 bits	signed	15232	Alternator Bear. 2 Temper-ature (SPN1123)	1	°C	3000XT	
450235	450234	16 bits	signed	15233	Alternator Wind. 1 Temper-ature (SPN1124)	1	°C	3000XT	
450236	450235	16 bits	signed	15234	Alternator Wind. 2 Temper-ature (SPN1125)	1	°C	3000XT	
450237	450236	16 bits	signed	15235	Alternator Wind. 3 Temper-ature (SPN1126)	1	°C	3000XT	
450238	450237	16 bits	signed	15236	Intake Manifold 2 Tempera-ture (SPN1131)	1	°C	3000XT	
450239	450238	16 bits	signed	15237	Intake Manifold 3 Tempera-ture (SPN1132)	1	°C	3000XT	
450240	450239	16 bits	signed	15238	Intake Manifold 4 Tempera-ture (SPN1133)	1	°C	3000XT	
450241	450240	16 bits	signed	15239	Engine Intercooler Thermo-stat Opening (SPN1134)	0.1	%	3000XT	
450242	450241	16 bits	signed	15240	Engine Oil Temperature 2 (SPN1135)	0.1	°C	3000XT	
450243	450242	16 bits	signed	15241	Engine ECU Temperature (SPN1136)	0.1	°C	3000XT	
450244	450243	16 bits	signed	15242	Exhaust Gas Port 1 Tem-peratures (SPN1137)	0.1	°C	3000XT	
450245	450244	16 bits	signed	15243	Exhaust Gas Port 2 Tem-peratures (SPN1138)	0.1	°C	3000XT	
450246	450245	16 bits	signed	15244	Exhaust Gas Port 3 Tem-peratures (SPN1139)	0.1	°C	3000XT	
450247	450246	16 bits	signed	15245	Exhaust Gas Port 4 Tem-peratures (SPN1140)	0.1	°C	3000XT	
450248	450247	16 bits	signed	15246	Exhaust Gas Port 5 Tem-peratures (SPN1141)	0.1	°C	3000XT	
450249	450248	16 bits	signed	15247	Exhaust Gas Port 6 Tem-peratures (SPN1142)	0.1	°C	3000XT	
450250	450249	16 bits	signed	15248	Exhaust Gas Port 7 Tem-peratures (SPN1143)	0.1	°C	3000XT	
450251	450250	16 bits	signed	15249	Exhaust Gas Port 8 Tem-peratures (SPN1144)	0.1	°C	3000XT	
450252	450251	16 bits	signed	15250	Exhaust Gas Port 9 Tem-peratures (SPN1145)	0.1	°C	3000XT	
450253	450252	16 bits	signed	15251	Exhaust Gas Port 10 Tem-peratures (SPN1146)	0.1	°C	3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
450254	450253	16 bits	signed	15252	Exhaust Gas Port 11 Tem-peratures (SPN1147)	0.1	°C	3000XT	
450255	450254	16 bits	signed	15253	Exhaust Gas Port 12 Tem-peratures (SPN1148)	0.1	°C	3000XT	
450256	450255	16 bits	signed	15254	Exhaust Gas Port 13 Tem-peratures (SPN1149)	0.1	°C	3000XT	
450257	450256	16 bits	signed	15255	Exhaust Gas Port 14 Tem-peratures (SPN1150)	0.1	°C	3000XT	
450258	450257	16 bits	signed	15256	Exhaust Gas Port 15 Tem-peratures (SPN1151)	0.1	°C	3000XT	
450259	450258	16 bits	signed	15257	Exhaust Gas Port 16 Tem-peratures (SPN1152)	0.1	°C	3000XT	
450260	450259	16 bits	signed	15258	Exhaust Gas Port 17 Tem-peratures (SPN1153)	0.1	°C	3000XT	
450261	450260	16 bits	signed	15259	Exhaust Gas Port 18 Tem-peratures (SPN1154)	0.1	°C	3000XT	
450262	450261	16 bits	signed	15260	Exhaust Gas Port 19 Tem-peratures (SPN1155)	0.1	°C	3000XT	
450263	450262	16 bits	signed	15261	Exhaust Gas Port 20 Tem-peratures (SPN1156)	0.1	°C	3000XT	
450264	450263	16 bits	signed	15262	Main Bearing 1 Tempera-tures (SPN1157)	0.1	°C	3000XT	
450265	450264	16 bits	signed	15263	Main Bearing 2 Tempera-tures (SPN1158)	0.1	°C	3000XT	
450266	450265	16 bits	signed	15264	Main Bearing 3 Tempera-tures (SPN1159)	0.1	°C	3000XT	
450267	450266	16 bits	signed	15265	Main Bearing 4 Tempera-tures (SPN1160)	0.1	°C	3000XT	
450268	450267	16 bits	signed	15266	Main Bearing 5 Tempera-tures (SPN1161)	0.1	°C	3000XT	
450269	450268	16 bits	signed	15267	Main Bearing 6 Tempera-tures (SPN1162)	0.1	°C	3000XT	
450270	450269	16 bits	signed	15268	Main Bearing 7 Tempera-tures (SPN1163)	0.1	°C	3000XT	
450271	450270	16 bits	signed	15269	Main Bearing 8 Tempera-tures (SPN1164)	0.1	°C	3000XT	
450272	450271	16 bits	signed	15270	Main Bearing 9 Tempera-tures (SPN1165)	0.1	°C	3000XT	
450273	450272	16 bits	signed	15271	Main Bearing 10 Tempera-tures (SPN1166)	0.1	°C	3000XT	
450274	450273	16 bits	signed	15272	Main Bearing 11 Tempera-tures (SPN1167)	0.1	°C	3000XT	
450275	450274	16 bits	signed	15273	Turbo 1 Compressor Inlet Temperatures (SPN1172)	0.1	°C	3000XT	
450276	450275	16 bits	signed	15274	Turbo 2 Compressor Inlet Temperatures (SPN1173)	0.1	°C	3000XT	
450277	450276	16 bits	signed	15275	Turbo 3 Compressor Inlet Temperatures (SPN1174)	0.1	°C	3000XT	
450278	450277	16 bits	signed	15276	Turbo 4 Compressor Inlet Temperatures (SPN1175)	0.1	°C	3000XT	
450279	450278	16 bits	signed	15277	Turbo 1 Compressor Inlet Pressure (SPN1176)	1	kPa	3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
450280	450279	16 bits	signed	15278	Turbo 2 Compressor Inlet Pressure (SPN1177)	1	kPa	3000XT	
450281	450280	16 bits	signed	15279	Turbo 3 Compressor Inlet Pressure (SPN1178)	1	kPa	3000XT	
450282	450281	16 bits	signed	15280	Turbo 4 Compressor Inlet Pressure (SPN1179)	1	kPa	3000XT	
450283	450282	16 bits	signed	15281	Turbo 1 Turbine Inlet Tem-perature (SPN1180)	0.1	°C	3000XT	
450284	450283	16 bits	signed	15282	Turbo 2 Turbine Inlet Tem-perature (SPN 1181)	0.1	°C	3000XT	
450285	450284	16 bits	signed	15283	Turbo 3 Turbine Inlet Tem-perature (SPN 1182)	0.1	°C	3000XT	
450286	450285	16 bits	signed	15284	Turbo 4 Turbine Inlet Tem-perature (SPN1183)	0.1	°C	3000XT	
450287	450286	16 bits	signed	15285	Turbo 1 Turbine Outlet Temperature (SPN1184)	0.1	°C	3000XT	
450288	450287	16 bits	signed	15286	Turbo 2 Turbine Outlet Temperature (SPN1185)	0.1	°C	3000XT	
450289	450288	16 bits	signed	15287	Turbo 3 Turbine Outlet Temperature (SPN 1186)	0.1	°C	3000XT	
450290	450289	16 bits	signed	15288	Turbo 4 Turbine Outlet Temperature (SPN1187)	0.1	°C	3000XT	
450291	450290	16 bits	signed	15289	Engine Aux. Coolant Pres-sure (SPN1203)	1	kPa	3000XT	
450292	450291	16 bits	signed	15290	Pre-filter Oil Pressure (SPN1208)	1	kPa	3000XT	
450293	450292	16 bits	signed	15291	Engine Aux. Coolant Tem-perature (SPN1212)	1	°C	3000XT	
450294	450293	16 bits	signed	15292	Fuel Filter Differential Pres-sure (SPN1382)	1	kPa	3000XT	
450295	450294	16 bits	signed	15293	Battery 1 Temperature (SPN1800)	1	°C	3000XT	
450296	450295	16 bits	signed	15294	Battery 2 Temperature (SPN1801)	1	°C	3000XT	
450297	450296	16 bits	signed	15295	Intake Manifold 5 Tempera-ture (SPN1802)	1	°C	3000XT	
450298	450297	16 bits	signed	15296	Intake Manifold 6 Tempera-ture (SPN1803)	1	°C	3000XT	
450299	450298	16 bits	signed	15297	Right Exhaust Gas Temper-ature (SPN2433)	0.1	°C	3000XT	
450300	450299	16 bits	signed	15298	Left Exhaust Gas Tempera-ture (SPN2434)	0.1	°C	3000XT	
450301	450300	16 bits	signed	15310	Turbo 1 Compr. Outlet Temperature (SPN2629)	0.1	°C	3000XT	
450302	450301	16 bits	signed	15311	Engine derate request (SPN3644)	0.1	%	3000XT	
450303	450302	16 bits	signed	15312	Batterie Potential (SPN0158)	0.1	V	3000XT	
450304	450303	16 bits	signed	15313	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Level (SPN1761)	0.1	%	3000XT	
450305	450304	16 bits	signed	15314	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Tem-perature (SPN3031)	1	°C	3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
450306	450305	16 bits	signed	15315	Aftertreatment 1 Diesel Exhaust Fluid Tank 2 Level (SPN4367)	0.1	%	3000XT	
450307	450306	16 bits	signed	15316	Aftertreatment 1 Diesel Exhaust Fluid Tank 2 Tem-perature (SPN4368)	1	°C	3000XT	
450308	450307	16 bits	signed	12807	Exhaust Gas Temperature Average(SPN 4151)	0.1	°C	3000XT	
450309	450308	16 bits	signed	12809	Exhaust Gas Temperature Average Bank 1 (SPN 4153)	0.1	°C	3000XT	
450310	450309	16 bits	signed	12812	Exhaust Gas Temperature Average Bank 2 (SPN 4152)	0.1	°C	3000XT	
450311	450310	16 bits	signed	12016	Fuel level 1 (SPN 96)	0.1	%	with release 1.13	rees-tab-lished
450312	450311	16 bits	signed	12017	Fuel level 2 (SPN 38)	0.1	%	with release 1.13	rees-tab-lished
450313	450312	16 bits			0 (reserve)				rees-tab-lished
450314	450313	16 bits			0 (reserve)				rees-tab-lished
450315	450314	16 bits			0 (reserve)				rees-tab-lished
450316	450315	16 bits			0 (reserve)				rees-tab-lished
450317	450316	16 bits			0 (reserve)				rees-tab-lished
450318	450317	16 bits			0 (reserve)				rees-tab-lished
450319	450318	16 bits			0 (reserve)				rees-tab-lished
450320	450319	16 bits			0 (reserve)				rees-tab-lished
450321	450320	16 bits			0 (reserve)				rees-tab-lished
450322	450321	16 bits			0 (reserve)				rees-tab-lished
450323	450322	16 bits			0 (reserve)				rees-tab-lished
450324	450323	16 bits			0 (reserve)				rees-tab-lished
450325	450324	16 bits			0 (reserve)				rees-tab-lished

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
450326	450325	16 bits			0 (reserve)				rees-tab-lished
450327	450326	16 bits			0 (reserve)				rees-tab-lished
450328	450327	16 bits			0 (reserve)				rees-tab-lished
450329	450328	16 bits			0 (reserve)				rees-tab-lished
450330	450329	16 bits			0 (reserve)				rees-tab-lished
450331	450330	16 bits			0 (reserve)				rees-tab-lished
450332	450331	16 bits			0 (reserve)				rees-tab-lished
450333	450332	16 bits			0 (reserve)				rees-tab-lished
450334	450333	16 bits			0 (reserve)				rees-tab-lished
450335	450334	16 bits			0 (reserve)				rees-tab-lished
450336	450335	16 bits			0 (reserve)				rees-tab-lished
450337	450336	16 bits			0 (reserve)				rees-tab-lished
450338	450337	16 bits			0 (reserve)				rees-tab-lished
450339	450338	16 bits			0 (reserve)				rees-tab-lished
450340	450339	16 bits			0 (reserve)				rees-tab-lished
450341	450340	16 bits			0 (reserve)				rees-tab-lished
450342	450341	16 bits			0 (reserve)				rees-tab-lished
450343	450342	16 bits			0 (reserve)				rees-tab-lished
450344	450343	16 bits			0 (reserve)				rees-tab-lished

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
450345	450344	16 bits			0 (reserve)				rees-tab-lished
450346	450345	16 bits			0 (reserve)				rees-tab-lished
450347	450346	16 bits			0 (reserve)				rees-tab-lished
450348	450347	16 bits			0 (reserve)				rees-tab-lished
450349	450348	16 bits			0 (reserve)				rees-tab-lished
450350	450349	16 bits			0 (reserve)				rees-tab-lished
450351	450350	16 bits			0 (reserve)				rees-tab-lished
450352	450351	16 bits			0 (reserve)				rees-tab-lished
450353	450352	16 bits			0 (reserve)				rees-tab-lished
450354	450353	16 bits			0 (reserve)				rees-tab-lished
450355	450354	16 bits			0 (reserve)				rees-tab-lished
450356	450355	16 bits			0 (reserve)				rees-tab-lished
450357	450356	16 bits			0 (reserve)				rees-tab-lished
450358	450357	16 bits			0 (reserve)				rees-tab-lished
450359	450358	16 bits			0 (reserve)				rees-tab-lished
450360	450359	16 bits			0 (reserve)				rees-tab-lished
450361	450360	16 bits			0 (reserve)				rees-tab-lished
450362	450361	16 bits			0 (reserve)				rees-tab-lished
450363	450362	16 bits			0 (reserve)				rees-tab-lished

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
450364	450363	16 bits			0 (reserve)				rees-tab-lished
450365	450364	16 bits			0 (reserve)				rees-tab-lished
450366	450365	16 bits			0 (reserve)				rees-tab-lished
450367	450366	16 bits			0 (reserve)				rees-tab-lished
450368	450367	16 bits			0 (reserve)				rees-tab-lished
450369	450368	16 bits			0 (reserve)				rees-tab-lished
450370	450369	16 bits			0 (reserve)				rees-tab-lished
Miscellaneous									
450371	450370	16 bits		"-"	Free AnalogManager Value 1			3000XT	rees-tab-lished
450372	450371	16 bits		"-"	Free AnalogManager Value 2			3000XT	rees-tab-lished
450373	450372	16 bits		"-"	Free AnalogManager Value 3			3000XT	rees-tab-lished
450374	450373	16 bits		"-"	Free AnalogManager Value 4			3000XT	rees-tab-lished
450375	450374	16 bits		"-"	Free AnalogManager Value 5			3000XT	rees-tab-lished
450376	450375	16 bits		"-"	Free AnalogManager Value 6			3000XT	rees-tab-lished
450377	450376	16 bits		"-"	Free AnalogManager Value 7			3000XT	rees-tab-lished
450378	450377	16 bits		"-"	Free AnalogManager Value 8			3000XT	rees-tab-lished
450379	450378	16 bits		"-"	Free AnalogManager Value 9			3000XT	rees-tab-lished
450380	450379	16 bits		"-"	Free AnalogManager Value 10			3000XT	rees-tab-lished
450381	450380	16 bits		"-"	Free AnalogManager Value 11			3000XT	rees-tab-lished
450382	450381	16 bits		"-"	Free AnalogManager Value 12			3000XT	rees-tab-lished

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
450383	450382	16 bits		"-"	Free AnalogManager Value 13			3000XT	rees-tab-lished
450384	450383	16 bits		"-"	Free AnalogManager Value 14			3000XT	rees-tab-lished (15/16 are avail-able as long)
450385	450384	16 bits			0 (reserve)				rees-tab-lished
450386	450385	16 bits			0 (reserve)				rees-tab-lished
450387	450386	16 bits		4096	Monitored Number of easYgen communicating	Mask FF00h		3000XT	rees-tab-lished Load share Diag-nostic
					Number of easYgens cur-rently communicating	Mask 00FFh		3000XT	rees-tab-lished Load share Diag-nostic
450388	450387	16 bits		4097	Monitored Number of LS5 communicating	Mask FF00h		3500XT	rees-tab-lished LS-5 Diag-nostic
					Number of LS5 currently communicating	Mask 00FFh		3500XT	rees-tab-lished LS-5 Diag-nostic
450389	450388	16 bits		4098	Device number of missing LS-5 (33-48)	Mask FFFFh		3500XT	rees-tab-lished LS-5 Diag-nostic
					LS-5 Device Nr. 48	Mask 8000h			rees-tab-lished
					LS-5 Device Nr. 47	Mask 4000h			rees-tab-lished
					LS-5 Device Nr. 46	Mask 2000h			rees-tab-lished
					LS-5 Device Nr. 45	Mask 1000h			rees-tab-lished

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
					LS-5 Device Nr. 44	Mask 0800h			rees-tab-lished
					LS-5 Device Nr. 43	Mask 0400h			rees-tab-lished
					LS-5 Device Nr. 42	Mask 0200h			rees-tab-lished
					LS-5 Device Nr. 41	Mask 0100h			rees-tab-lished
					LS-5 Device Nr. 40	Mask 0080h			rees-tab-lished
					LS-5 Device Nr. 39	Mask 0040h			rees-tab-lished
					LS-5 Device Nr. 38	Mask 0020h			rees-tab-lished
					LS-5 Device Nr. 37	Mask 0010h			rees-tab-lished
					LS-5 Device Nr. 36	Mask 0008h			rees-tab-lished
					LS-5 Device Nr. 35	Mask 0004h			rees-tab-lished
					LS-5 Device Nr. 34	Mask 0002h			rees-tab-lished
					LS-5 Device Nr. 33	Mask 0001h			rees-tab-lished
450390	450389	16 bits		4099	Device number of missing LS-5 (49-64)	Mask FFFFh		3500XT	rees-tab-lished LS-5 Diag-nostic
					LS-5 Device Nr. 64	Mask 8000h			rees-tab-lished
					LS-5 Device Nr. 63	Mask 4000h			rees-tab-lished
					LS-5 Device Nr. 62	Mask 2000h			rees-tab-lished
					LS-5 Device Nr. 61	Mask 1000h			rees-tab-lished
					LS-5 Device Nr. 60	Mask 0800h			rees-tab-lished
					LS-5 Device Nr. 59	Mask 0400h			rees-tab-lished

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
					LS-5 Device Nr. 58	Mask 0200h			rees-tab-lished
					LS-5 Device Nr. 57	Mask 0100h			rees-tab-lished
					LS-5 Device Nr. 56	Mask 0080h			rees-tab-lished
					LS-5 Device Nr. 55	Mask 0040h			rees-tab-lished
					LS-5 Device Nr. 54	Mask 0020h			rees-tab-lished
					LS-5 Device Nr. 53	Mask 0010h			rees-tab-lished
					LS-5 Device Nr. 52	Mask 0008h			rees-tab-lished
					LS-5 Device Nr. 51	Mask 0004h			rees-tab-lished
					LS-5 Device Nr. 50	Mask 0002h			rees-tab-lished
					LS-5 Device Nr. 49	Mask 0001h			rees-tab-lished
450391	450390	16 bits		181	Phase angle busbar1-gen-erator L1-L2	0.1	°	3000XT	New
450392	450391	16 bits		184	Phase angle mains-busbar1 L1-L2	0.1	°	3000XT	New
450393	450392	16 bits		4641	Delta voltage busbar1-gen-erator	0.1	%	3000XT	New
450394	450393	16 bits		4640	Delta frequency busbar1-generator	0.01	Hz	3000XT	New
450395	450394	16 bits		4607	Phase angle compensated generator-busbar1 L1-L2	0.1	°	3000XT	New
450396	450395	16 bits		139	Generator power factor L1	0.001		3000XT	New
450397	450396	16 bits		203	Generator power factor L2	0.001		3000XT	New
450398	450397	16 bits		204	Generator power factor L3	0.001		3000XT	New
450399	450398	16 bits		8850	Voltage increase monitored value	0.01	%	3000XT	New
450400	450399	16 bits			Phase angle compensated mains-busbar1 L1-L2	0.1	°	3000XT	New
450401	450400	16 bits			0 (reserve)				rees-tab-lished
450402	450401	16 bits			0 (reserve)				rees-tab-lished
450403	450402	16 bits			0 (reserve)				rees-tab-lished

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
450404	450403	16 bits			0 (reserve)				rees-tab-lished
450405	450404	16 bits			0 (reserve)				rees-tab-lished
450406	450405	16 bits			0 (reserve)				rees-tab-lished
450407	450406	16 bits			0 (reserve)				rees-tab-lished
450407	450406	16 bits			0 (reserve)				rees-tab-lished
450408	450407	16 bits			0 (reserve)				rees-tab-lished
450409	450408	16 bits			0 (reserve)				rees-tab-lished
450410	450409	16 bits			0 (reserve)				rees-tab-lished
		Int32 (Long)							
AC Generator and Busbar values									Offset to 5010: 81 addresses
450411	450410	32 bits	signed	135	Total gen. active power	1	W	3000XT	
450413	450412	32 bits	signed	136	Total gen. reactive power	1	var	3000XT	
450415	450414	32 bits	signed	137	Total gen. apparent power	1	VA	3000XT	
450417	450416	32 bits	signed	170	Average Gen. Wye-Voltage	0.1	V	3000XT	
450419	450418	32 bits	signed	171	Average Gen. Delta-Voltage	0.1	V	3000XT	
450421	450420	32 bits	signed	216	Average Busbar Delta-Voltage	0.1	V	3000XT	
450423	450422	32 bits	signed	185	Av. Gen. Current	0.001	A	3000XT	
450425	450424	32 bits	signed	111	Gen. current L1	0.001	A	3000XT	
450427	450426	32 bits	signed	112	Gen. current L2	0.001	A	3000XT	
450429	450428	32 bits	signed	113	Gen. current L3	0.001	A	3000XT	
450431	450430	32 bits	signed	161	Meas. ground current	0.001	A	3000XT	
450433	450432	32 bits	signed	159	Calculated ground current	0.001	A	3000XT	
450435	450434	32 bits	signed	108	Gen. voltage L1-L2	0.1	V	3000XT	
450437	450436	32 bits	signed	109	Gen. voltage L2-L3	0.1	V	3000XT	
450439	450438	32 bits	signed	110	Gen. voltage L3-L1	0.1	V	3000XT	
450441	450440	32 bits	signed	114	Gen. voltage L1-N	0.1	V	3000XT	
450443	450442	32 bits	signed	115	Gen. voltage L2-N	0.1	V	3000XT	
450445	450444	32 bits	signed	116	Gen. voltage L3-N	0.1	V	3000XT	

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
450447	450446	32 bits	signed	125	Gen. active power L1	1	W	3000XT	
450449	450448	32 bits	signed	126	Gen. active power L2	1	W	3000XT	
450451	450450	32 bits	signed	127	Gen. active power L3	1	W	3000XT	
450453	450452	32 bits	signed	182	Busbar 1: voltage L1-L2	0.1	V	3000XT	
450455	450454	32 bits	signed	2520	Gen. real energy	0,01	MWh	3000XT	
450457	450456	32 bits	signed	2522	Gen. positive reactive energy	0,01	Mvar h	3000XT	
450459	450458	32 bits	signed	2568	Gen. hours of operation	0,01	h	3000XT	
450461	450460	32 bits	signed	5542	Setpoint active power	0,1	kW	3000XT	
450463	450462	32 bits	signed	5640	Setpoint voltage	1	V	3000XT	
450465	450464	32 bits	signed	234	Average Busbar Wye-Voltage	0.1	V	3000XT	New
450467	450466	32 bits	signed	189	Busbar 1: voltage L2-L3	0.1	V	3500XT-P2	New
450469	450468	32 bits	signed	193	Busbar 1: voltage L3-L1	0.1	V	3500XT-P2	New
450471	450470	32 bits	signed		0 (prepared Busbar 2 voltage L1-L2)	0.1	V	reserved	
AC Mains values									
450473	450472	32 bits	signed	140	Total mains active power	1	W	3000XT	
450475	450474	32 bits	signed	150	Total mains reactive power	1	var	3000XT	
450477	450476	32 bits	signed	173	Average Mains Wye-Voltage	0.1	V	3000XT	
450479	450478	32 bits	signed	174	Av. Mains Delta-Voltage	0.1	V	3000XT	
450481	450480	32 bits	signed	207	Av. Mains Current	0.001	A	3000XT	
450483	450482	32 bits	signed	134	Mains current L1	0.001	A	3000XT	
450485	450484	32 bits	signed		0 (prepared mains current L2)			reserved	
450487	450486	32 bits	signed		0 (prepared mains current L3)			reserved	
450489	450488	32 bits	signed	118	Mains voltage L1-L2	0.1	V	3000XT	
450491	450490	32 bits	signed	119	Mains voltage L2-L3	0.1	V	3000XT	
450493	450492	32 bits	signed	120	Mains voltage L3-L1	0.1	V	3000XT	
450495	450494	32 bits	signed	121	Mains voltage L1-N	0.1	V	3000XT	
450497	450496	32 bits	signed	122	Mains voltage L2-N	0.1	V	3000XT	
450499	450498	32 bits	signed	123	Mains voltage L3-N	0.1	V	3000XT	
AC System values									
450501	450500	32 bits	signed	217	Reserve real power in system (valid if LDSS is on)	1	kW	3000XT	
450503	450502	32 bits	signed	218	Real power in system (valid if LDSS is on)	1	kW	3000XT	
450505	450504	32 bits	signed	219	Nominal real power in system (valid if LDSS is on)	1	kW	3000XT	
450507	450506	32 bits			0 (reserve)				
450509	450508	32 bits			0 (reserve)				
450511	450510	32 bits			0 (reserve)				

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
Engine Management Active Diagnostic Trouble Code (DM1) 1-10 (All SPNs)									
450513	450512	32 bits	signed	15400	SPN of 1. entry	full 19 bits of SPN		3000XT	
450515	450514	32 bits	signed	15403	SPN of 2. entry	full 19 bits of SPN		3000XT	
450517	450516	32 bits	signed	15406	SPN of 3. entry	full 19 bits of SPN		3000XT	
450519	450518	32 bits	signed	15409	SPN of 4. entry	full 19 bits of SPN		3000XT	
450521	450520	32 bits	signed	15412	SPN of 5. entry	full 19 bits of SPN		3000XT	
450523	450522	32 bits	signed	15415	SPN of 6. entry	full 19 bits of SPN		3000XT	
450525	450524	32 bits	signed	15419	SPN of 7. entry	full 19 bits of SPN		3000XT	
450527	450526	32 bits	signed	15422	SPN of 8. entry	full 19 bits of SPN		3000XT	
450529	450528	32 bits	signed	15425	SPN of 9. entry	full 19 bits of SPN		3000XT	
450531	450530	32 bits	signed	15428	SPN of 10. entry	full 19 bits of SPN		3000XT	
Engine Management Values									
450533	450532	32 bits	signed	15201	Total engine hours (j1939-HOURS, SPN 247)	1	h	3000XT	
450535	450534	32 bits	unsigned	2580	Period of use counter	0.01	h	3000XT	New
450537	450536	32 bits		15319	Engine Total Fuel Used (SPN250)	0.1	L	3000XT	Value for Error indi-cator: 4294967294 Value for Not avail-able: 4294967295
450539	450538	32 bits			(reserve)				
450541	450540	32 bits			(reserve)				
LS5									
450543	450542	32 bits	unsigned	267	Average LS5 Delta Mains voltage L-L	0.1	V	3500XT	
450545	450544	32 bits	unsigned	268	Average LS5 Wye Mains voltage L-N	0.1	V	3500XT	
450547	450546	32 bits	signed	269	Active power LS5	1	W	3500XT	
450549	450548	32 bits	signed	270	Reactive power LS5	1	var	3500XT	
450551	450550	32 bits			(reserve)				
450553	450552	32 bits			(reserve)				
450555	450554	32 bits			(reserve)				
450557	450556	32 bits			(reserve)				
450559	450558	32 bits			(reserve)				
450561	450560	32 bits			(reserve)				
Miscellaneous									
450563	450562	32 bits		231	Busbar Voltage L1-N	0.1	V	3500XT-P2	New

Modicon start addr.	Start addr. (*1)	Size	Format	Param ID	Description	Multiplier (BUS-data * Multiplier = real value)	Unit	Model	Com-ment
450565	450564	32 bits		232	Busbar Voltage L2-N	0.1	V	3500XT-P2	New
450567	450566	32 bits		233	Busbar Voltage L3-N	0.1	V	3500XT-P2	New
450569	450568	32 bits		5646	Setpoint reactive power	0.1	kvar	3000XT	New
450571	450570	32 bits		"-"	Free AnalogManager Value 15 (long)			3000XT	New
450573	450572	32 bits		"-"	Free AnalogManager Value 16 (long)			3000XT	New
450575	450574	32 bits	signed	155	Generator current slave pointer L1	0.001	A	3000XT	New
450577	450576	32 bits	signed	156	Generator current slave pointer L2	0.001	A	3000XT	New
450579	450578	32 bits	signed	157	Generator current slave pointer L3	0.001	A	3000XT	New
450581	450580	32 bits	signed	128	Generator reactive power L1	1	var	3000XT	New
450583	450582	32 bits	signed	129	Generator reactive power L2	1	var	3000XT	New
450585	450584	32 bits	signed	130	Generator reactive power L3	1	var	3000XT	New
450587	450586	32 bits	signed	131	Generator apparent power L1	1	VA	3000XT	New
450589	450588	32 bits	signed	132	Generator apparent power L2	1	VA	3000XT	New
450591	450590	32 bits	signed	133	Generator apparent power L3	1	VA	3000XT	New
450593	450592	32 bits	signed	152	Mains total apparent power	1	VA	3000XT	New
450595	450594	32 bits	signed	158	Mains current slave pointer L1	0.001	A	3000XT	New
450597	450596	32 bits	signed		0 (prepared Mains current slave pointer L2)	0.001	A	3000XT	New
450599	450598	32 bits	signed		0 (prepared Mains current slave pointer L3)	0.001	A	3000XT	New
450601	450600	32 bits	signed						

9.2.14 Protocols 5018 (Basic CAN Protocol)

Data byte 0 (Mux) DEC	HEX	Data byte	Length in Bytes	Param-eter ID	Description	EDS	Multiplier	Unit
0	0	1,2	2		Protocol ID, always 5018			
0	0	3,4,5,6	4	108	Generator voltage 1-2	0x206C	0.1	V
1	1	1,2	2	144	Generator frequency	0x2090	0.01	Hz
1	1	3,4,5,6	4	109	Generator voltage 2-3	0x206D	0.1	V
2	2	1,2	2	160	Generator power factor (cos.phi)	0x20A0	0.001	-
2	2	3,4,5,6	4	110	Generator voltage 3-1	0x206E	0.1	V

Data byte 0 (Mux) DEC	HEX	Data byte	Length in Bytes	Param-eter ID	Description	EDS	Multiplier	Unit
3	3	1,2	2	4607	Phase angle compensated gen-busbar1 L1-L2	0x3202	0.1	°
3	3	3,4,5,6	4	135	Generator total active power	0x2087	0.001	kW
4	4	1,2	2	183	Busbar 1 frequency L1-L2	0x20B7	0.01	Hz
4	4	3,4,5,6	4	182	Busbar 1 voltage	0x20B6	0.1	V

9.2.15 Protocols 5019 (Basic CAN Protocol)

Data byte 0 (Mux) DEC	HEX	Data byte	Length in Bytes	Param-eter ID	Description	EDS	Multiplier	Unit
0	0	1,2	2		Protocol ID, always 5019			
0	0	3,4,5,6	4	114	Generator voltage 1-N	0x2072	0.1	V
1	1	1,2	2	4085	Internal Flags 1-16			
					96.16 LM Internal Flag 16		Mask 8000h	-
					96.15 LM Internal Flag 15		Mask 4000h	-
					96.14 LM Internal Flag 14		Mask 2000h	-
					96.13 LM Internal Flag 13		Mask 1000h	-
					96.12 LM Internal Flag 12		Mask 0800h	-
					96.11 LM Internal Flag 11		Mask 0400h	-
					96.10 LM Internal Flag 10		Mask 0200h	-
					96.09 LM Internal Flag 9		Mask 0100h	-
					96.08 LM Internal Flag 8		Mask 0080h	-
					96.07 LM Internal Flag 7		Mask 0040h	-
					96.06 LM Internal Flag 6		Mask 0020h	-
					96.05 LM Internal Flag 5		Mask 0010h	-
					96.04 LM Internal Flag 4		Mask 0008h	-
					96.03 LM Internal Flag 3		Mask 0004h	-
					96.02 LM Internal Flag 2		Mask 0002h	-
					96.01 LM Internal Flag 1		Mask 0001h	-
1	1	3,4,5,6	4	115	Generator voltage 2-N	0x2073	0.1	V
2	2	1,2	2	9642	Free AnalogManager Value 1			

Data byte 0 (Mux) DEC	HEX	Data byte	Length in Bytes	Param-eter ID	Description	EDS	Multiplier	Unit
2	2	3,4,5,6	4	111	Generator current 1	0x206F	0.001	A
3	3	1,2	2	9646	Free AnalogManager Value 2			
3	3	3,4,5,6	4	112	Generator current 2	0x2070	0.001	A
4	4	1,2	2	9650	Free AnalogManager Value 3			
4	4	3,4,5,6	4	113	Generator current 3	0x2071	0.001	A

9.2.16 Protocols 5020 (Basic CAN Protocol)

Data byte 0 (Mux) DEC	HEX	Data byte	Length in Bytes	Param-eter ID	Description	EDS	Multiplier	Unit
0	0	1,2	2		Protocol ID, always 5020			
0	0	3,4,5,6	4	116	Generator voltage 3-N	0x2074	0.1	V
1	1	1,2	2	147	Mains frequency	0x2093	0.01	Hz
1	1	3,4,5,6	4	174	Mains average delta voltage	0x20AE	0.1	V
2	2	1,2	2	"-"	Phase angle compensated mains-busbar1 L1-L2	0x3202	0.1	°
2	2	3,4,5,6	4	173	Mains average wye voltage	0x20AD	0.1	V
3	3	1,2	2	9654	Free AnalogManager Value 4			
3	3	3,4,5,6	4	118	Mains voltage 1-2	0x2076	0.1	V
4	4	1,2	2	9658	Free AnalogManager Value 5			
4	4	3,4,5,6	4	119	Mains voltage 2-3	0x2077	0.1	V

9.2.17 Protocols 5021 (Basic CAN Protocol)

Data byte 0 (Mux) DEC	HEX	Data byte	Length in Bytes	Param-eter ID	Description	EDS	Multiplier	Unit
0	0	1,2	2		Protocol ID, always 5021			
0	0	3,4,5,6	4	120	Mains voltage L3-L1	0x2078	0.1	V
1	1	1,2	2	9662	Free AnalogManager Value 6			
1	1	3,4,5,6	4	121	Mains voltage L1-N	0x2079	0.1	V
2	2	1,2	2	9666	Free AnalogManager Value 7			
2	2	3,4,5,6	4	122	Mains voltage L2-N	0x207A	0.1	V
3	3	1,2	2	9670	Free AnalogManager Value 8			
3	3	3,4,5,6	4	123	Mains voltage L3-N	0x207B	0.1	V
4	4	1,2	2	4155	Control Bits 1	0x303B		
					03.20 3-Pos. Controller Freq./ Power raise		Mask 8000h	-

Data byte 0 (Mux) DEC	HEX	Data byte	Length in Bytes	Param-eter ID	Description	EDS	Multiplier	Unit
					03.21 3-Pos. Controller Freq./ Power lower		Mask 4000h	-
					03.22 3-Pos. Controller Volt./ ReactPow raise		Mask 2000h	-
					03.23 3-Pos. Controller Volt./ ReactPow lower		Mask 1000h	-
					04.06 GCB is closed		Mask 0800h	-
					04.07 MCB is closed		Mask 0400h	-
					05.16 Derating active (J1939 or freely)		Mask 0200h	-
					04.18 Synchronisation GCB procedure is active		Mask 0100h	-
					04.19 Open command GCB is active		Mask 0080h	-
					04.20 Close command GCB is active		Mask 0040h	-
					04.21 Synchronisation MCB procedure is active		Mask 0020h	-
					04.22 Open command MCB is active		Mask 0010h	-
					04.23 Close command MCB is active		Mask 0008h	-
					04.28 Unloading generator is active		Mask 0004h	-
					04.29 Unloading mains is active		Mask 0002h	-
					04.30 Power limited prerun		Mask 0001h	-
4	4	3,4,5,6	4	9698	Free AnalogManager Value 15			

9.2.18 Additional Data Identifier

9.2.18.1 Transmit Data (sent from remote control to the easYgen)

General notes

The device accepts transmit data from outside. These data are usually remote control data, with which the genset control starts and stops the operation or runs different setpoints.

These data do not require a password level to be accepted. They are overtaken into a non-volatile memory and are lost, if the device is powered down.

Ensure Security!

Transmitting data from outside of the remote control needs secure (network) communication. Do not connect the easYgen with the internet as long the security aspects are not considered! Consider an IP responsible person to discuss proper security procedures like placing routers and fire walls.

Take care for sufficient protection of Ethernet communication.

Remote control word 1

Object 21F7h (Parameter 503)

This object is required for remote control. The data type is UNSIGNED16.

The internal parameter 503 of the easYgen must be set to react on the remote control instructions. This is performed by sending rising signals for the respective bits (refer to Fig. 355 for the priority of start and stop signals).

Parameter no.	Object ID	Name		Unit	Data type	Note
503	21F7h	Control word 1		Bit field	unsigned16	
		Bit 15	Not used			
		Bit 14	Not used			
		Bit 13	Not used			
		Bit 12	Not used			
		Bit 11	Not used			
		Bit 10	Not used			
		Bit 9	Shutdown command			To acknowledge, a "0" must be written and then a "1"
		Bit 8	Not used			
		Bit 7	Not used			
		Bit 6	Not used			
		Bit 5	Not used			
		Bit 4	Ext. Acknowledge (rising edge) Must be set twice to acknowledge			To acknowledge, a 0 must be written and then a 1
		Bit 3	Must always be set to 0			
		Bit 2	Must always be set to 0			

Parameter no.	Object ID	Name		Unit	Data type	Note
		Bit 1	Stop bit (rising edge)			To stop, a 0 must be written and then a 1
		Bit 0	Start bit (rising edge)			To start, a 0 must be written and then a 1

Table 155: Remote control telegram

Bit 0 Start bit	With the rising edge of the bit, the easYgen activates the remote request command (LogicsManager input command variable 04.13). The condition of the start command will be stored and may be used as command variable for the LogicsManager.
Bit 1 Stop bit	With the rising edge of the bit, the easYgen deactivates the remote request command (LogicsManager input command variable 04.13). The condition of the start command will be stored and may be used as command variable for the LogicsManager.
Bit 4 "Reset alarms"	This bit controls the LogicsManager input command variable 04.14. The remote acknowledge bit must be set and reset twice to acknowledge an alarm completely. The first rising edge disables the horn and the second rising edge resets the alarm.
Bit 9 "Shutdown command"	This bit is directly influencing the LogicsManager command variable: “03.40 Remote Shutdown“ and can be taken to create an engine shut down and/or an alarm over an internal flag.
Remote start /stop	The command variable "04.13 Remote request" changes to "1" (high) if the start bit is enabled and changes back to "0" (low) if the stop bit is enabled.
Ext. acknowledge	The command variable "04.14 Remote acknowledge" is the reflection of the control bit. The easYgen deactivates the horn with the first change from "0" to "1" of the logical output "External acknowledge", and acknowledges all alarm messages, which have occurred and are no longer active, with the second change from "0" to "1".

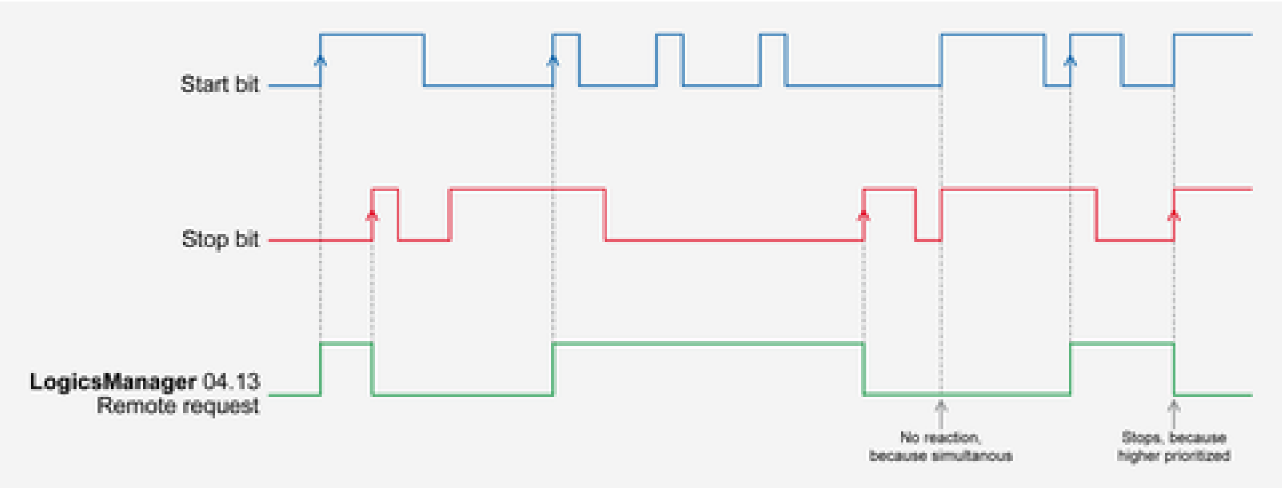


Fig. 355: : Remote control - start/stop priority

Fig. 355 shows the reaction of the command variable on the various status changes of the bits.

*The easYgen does **not** react on the disabling of the start bit, but only on the enabling of the stop bit. This has the advantage that it is not required to maintain the connection established for the whole time in case of a remote start via a modem.*

Remote control word 2

Object 21F8h (Parameter 504)
This object is required for remote control. The data type is UNSIGNED16.

Bit 15 = 1	
Bit 14 = 1	
Bit 13 = 1	
Bit 12 = 1	
Bit 11 = 1	
Bit 10 = 1	
Bit 9 = 1	
Bit 8 = 1	
Bit 7 = 1	Request active power setpoint 2 – this bit activates the LogicsManager command variable [04.40] "Remote power setpoint 2" and is dedicated for switching from active power setpoint 1 to active power setpoint 2
Bit 6 = 1	Request power factor setpoint 2 – this bit activates the LogicsManager command variable [04.39] "Remote PF setpoint 2" and is dedicated for switching from power factor setpoint 1 to power factor setpoint 2
Bit 5 = 1	Request frequency setpoint 2 – this bit activates the LogicsManager command variable [04.38] "Remote frequency setpoint 2" and is dedicated for switching from frequency setpoint 1 to frequency setpoint 2
Bit 4 = 1	Request voltage setpoint 2 – this bit activates the LogicsManager command variable [04.37] "Remote voltage setpoint 2" and is dedicated for switching from voltage setpoint 1 to voltage setpoint 2
Bit 3 = 1	
Bit 2 = 1	
Bit 1 = 1	
Bit 0 = 1	

Remote control word 3

Object 21F9h (Parameter 505)
This object is required for remote control. These remote control bits can be used by a PLC to send control signals via SDO or PDO, which can then be used as command variables in the LogicsManager to control the easYgen. The data type is UNSIGNED16.

Bit 15 = 1 (ID 541)	Remote control bit 16 (command variable 04.59)
Bit 14 = 1 (ID 542)	Remote control bit 15 (command variable 04.58)
Bit 13 = 1 (ID 543)	Remote control bit 14 (command variable 04.57)
Bit 12 = 1 (ID 544)	Remote control bit 13 (command variable 04.56)
Bit 11 = 1 (ID 545)	Remote control bit 12 (command variable 04.55)
Bit 10 = 1 (ID 546)	Remote control bit 11 (command variable 04.54)

Bit 9 = 1 (ID 547)	Remote control bit 10 (command variable 04.53)
Bit 8 = 1 (ID 548)	Remote control bit 9 (command variable 04.52)
Bit 7 = 1 (ID 549)	Remote control bit 8 (command variable 04.51)
Bit 6 = 1 (ID 550)	Remote control bit 7 (command variable 04.50)
Bit 5 = 1 (ID 551)	Remote control bit 6 (command variable 04.49)
Bit 4 = 1 (ID 552)	Remote control bit 5 (command variable 04.48)
Bit 3 = 1 (ID 553)	Remote control bit 4 (command variable 04.47)
Bit 2 = 1 (ID 554)	Remote control bit 3 (command variable 04.46)
Bit 1 = 1 (ID 555)	Remote control bit 2 (command variable 04.45)
Bit 0 = 1 (ID 556)	Remote control bit 1 (command variable 04.44)

Remote active power setpoint

Object 21FBh (Parameter 507)

This value may be used as data source "[05.56] Interface P setp [W]" via the AnalogManager. No password is required to write this value.

This object is required to transmit the active power setpoint for active power control.

The data type is INTEGER32.

*The value is scaled in [kW * 10].*

Example

- *100 kW = 1000 = 03E8h*

Remote power factor setpoint

Object 21FCh (Parameter 508)

This value may be used as data source "[05.12] Interface PF sp [%]" via the AnalogManager. No password is required to write this value.

This object is required to transmit the power factor setpoint for power factor control.

The data type is INTEGER16.

The valid range for this value is [-710 to 1000 to 710].

Example

- *PF (cosphi) = c0.71 (capacitive) = -710 = FD3Ah PF (cosphi) = 1.00 = 1000 = 03E8h PF (cosphi) = i0.71 (inductive) = 710 = 02C6h Remote Frequency Setpoint - Object 21FDh*

Remote frequency setpoint

Object 21FDh (Parameter 509)

This value may be used as data source "[05.53] Interface f setp [Hz]" via the AnalogManager. No password is required to write this value.

This object is required to transmit the frequency setpoint for frequency control.

The data type is INTEGER16.

*The valid range for this value is [Hz * 100].*

Example

– *50.00 Hz = 5000 = 1388h*

Remote voltage setpoint

Object 21FEh (Parameter 510)

This value may be used as data source "[05.59] Interface V setp [V]" via the AnalogManager. No password is required to write this value.

This object is required to transmit the voltage set-point for voltage control.

The data type is UNSIGNED32.

The value is scaled in [V].

Example

– *400 V » 400 = 190h*
– *10000 V » 10000 = 2710h*

External DI request (1 to 16)

Object 3F4Eh (Parameter 8014)

This object is required to receive the state of the external discrete inputs 1 to 16 (e.g. of a Phoenix expansion card). The data type is UNSIGNED16.

Bit 15	External discrete input 16 [DIex16]
Bit 14	External discrete input 15 [DIex15]
Bit 13	External discrete input 14 [DIex14]
Bit 12	External discrete input 13 [DIex13]
Bit 11	External discrete input 12 [DIex12]
Bit 10	External discrete input 11 [DIex11]
Bit 9	External discrete input 10 [DIex10]
Bit 8	External discrete input 9 [DIex09]
Bit 7	External discrete input 8 [DIex08]
Bit 6	External discrete input 7 [DIex07]
Bit 5	External discrete input 6 [DIex06]
Bit 4	External discrete input 5 [DIex05]

Bit 3	External discrete input 4 [DIex04]
Bit 2	External discrete input 3 [DIex03]
Bit 1	External discrete input 2 [DIex02]
Bit 0	External discrete input 1 [DIex01]

External DI request (17 to 32)

Object 3F4Fh (Parameter 8015)
This object is required to receive the state of the external discrete inputs 17 to 32 (e.g. of a Phoenix expansion card). The data type is UNSIGNED16.

Bit 15	External discrete input 32 [DIex32]
Bit 14	External discrete input 31 [DIex31]
Bit 13	External discrete input 30 [DIex30]
Bit 12	External discrete input 29 [DIex29]
Bit 11	External discrete input 28 [DIex28]
Bit 10	External discrete input 27 [DIex27]
Bit 9	External discrete input 26 [DIex26]
Bit 8	External discrete input 25 [DIex25]
Bit 7	External discrete input 24 [DIex24]
Bit 6	External discrete input 23 [DIex23]
Bit 5	External discrete input 22 [DIex22]
Bit 4	External discrete input 21 [DIex21]
Bit 3	External discrete input 20 [DIex20]
Bit 2	External discrete input 19 [DIex19]
Bit 1	External discrete input 18 [DIex18]
Bit 0	External discrete input 17 [DIex17]

External Analog Inputs

Object 4008h ff, Subindex 1 (Parameter 8200 ff)
This unscaled value is transmitted by the external expansion board. The easYgen must be configured to format this value accordingly. The data type is UNSIGNED16.

The external analog inputs 1 to 16 have the following parameter IDs:

AI #	1	2	3	4	5	6	7	8
Object	4008	4009	400A	400B	400C	400D	400E	400F
ID	8200	8201	8202	8203	8204	8205	8206	8207

AI #	9	10	11	12	13	14	15	16
Object	4010	4011	4012	4013	4014	4015	4016	4017
ID	8208	8209	8210	8211	8212	8213	8214	8215

9.2.18.2 Receive Data (sent from easYgen to control external devices)

The device sends data out which are receipt by external devices. These data usually are commands to control expansion boards or annunciators running CANopen.

External DO control (1 to 16)

Object 3F45h (Parameter 8005)
This object is required to control the external outputs (relays) 1 to 16 (e.g. of a Phoenix expansion card). The data type is UNSIGNED16.

Bit 15	External discrete output 16 [Rex16]
Bit 14	External discrete output 15 [Rex15]
Bit 13	External discrete output 14 [Rex14]
Bit 12	External discrete output 13 [Rex13]
Bit 11	External discrete output 12 [Rex12]
Bit 10	External discrete output 11 [Rex11]
Bit 9	External discrete output 10 [Rex10]
Bit 8	External discrete output 9 [Rex09]
Bit 7	External discrete output 8 [Rex08]
Bit 6	External discrete output 7 [Rex07]
Bit 5	External discrete output 6 [Rex06]
Bit 4	External discrete output 5 [Rex05]
Bit 3	External discrete output 4 [Rex04]
Bit 2	External discrete output 3 [Rex03]
Bit 1	External discrete output 2 [Rex02]
Bit 0	External discrete output 1 [Rex01]

External DO control (17 to 32)

> ***Object 3F49h (Parameter 8009)***
> *This object is required to control the external outputs (relays) 17 to 32 (e.g. of a Phoenix expansion card). The data type is UNSIGNED16.*

Bit 15	External discrete output 32 [Rex32]
Bit 14	External discrete output 31 [Rex31]
Bit 13	External discrete output 30 [Rex30]
Bit 12	External discrete output 29 [Rex29]
Bit 11	External discrete output 28 [Rex28]
Bit 10	External discrete output 27 [Rex27]
Bit 9	External discrete output 26 [Rex26]
Bit 8	External discrete output 25 [Rex25]
Bit 7	External discrete output 24 [Rex24]
Bit 6	External discrete output 23 [Rex23]
Bit 5	External discrete output 22 [Rex22]
Bit 4	External discrete output 21 [Rex21]
Bit 3	External discrete output 20 [Rex20]
Bit 2	External discrete output 19 [Rex19]
Bit 1	External discrete output 18 [Rex18]
Bit 0	External discrete output 17 [Rex17]

External Analog Outputs

> ***Object 4806h ff, Subindex 1 (Parameter ID 10246 ff)***
> *This unscaled value is transmitted by the external expansion board. The easYgen must be configured to format this value accordingly. The data type is UNSIGNED16.*

The external analog outputs 1 to 4 have the following parameter IDs:

AI #	1	2	3	4
Object	4806hex	4810hex	481Ahex	4824hex
ID	10245	10255	10265	10275

9.3 LogicsManager Reference

9.3.1 LogicsManager Overview

The LogicsManager is used to customize the sequence of events in the control unit such as the start command of the engine or the operation of control unit relay outputs. For example, the start routine may be programmed so that it requires the closing of a discrete input or a preset time of day.

Depending on the application mode of the unit, the number of available relays that may be programmed with the LogicsManager will vary.

Two independent time delays are provided for the configured action to take place and be reset.

> *Please do not use the output of an equation as input at the same time. Such a configuration could decrease the performance of the interface.*

Structure and description of the LogicsManager

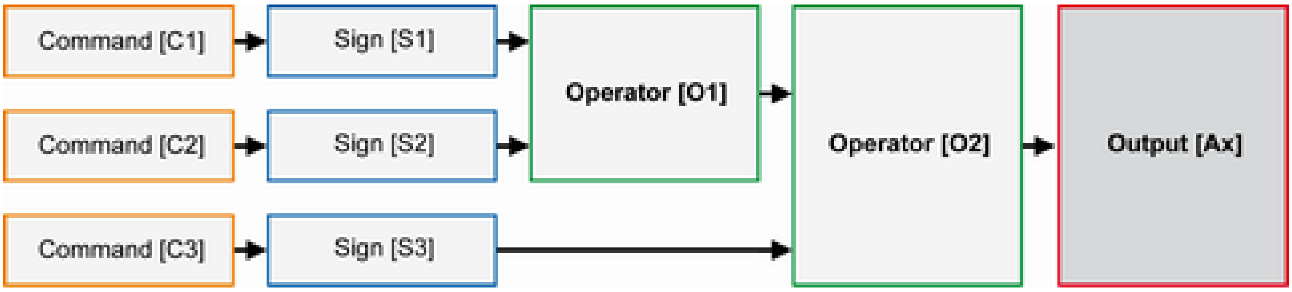
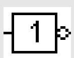


Fig. 356: LogicsManager - function overview

- **Command (variable)**
  A list of over 400 parameters and functions is provided for the command inputs.
  Examples of the parameters that may be configured into these commands are generator undervoltage thresholds 1 and 2, start fail, and cool down.
  These command variables are used to control the output function or relay.
  Refer to *Chapter 9.3.2 "Logical Command Variables" on page 885* for a complete list of all command variables.
- **Sign**
  The sign field can be used to invert the state of the command or to fix its output to a logical true or false if the command is not needed. Setting the sign to the NOT state changes the output of the command variable from true to false or vice versa.
- **Operator**
  A logical device such as AND or OR.
- **(Logical) output**
  The action or control sequence that occurs when all parameters set into the LogicsManager are met.
  For a complete list of all logical outputs refer to *Chapter 9.3.4 "Logical Outputs" on page 919*.

[Sx] - Sign {x}		
	Value {[Cx]}	The value [Cx] is passed 1:1.
	NOT Value {[Cx]}	The opposite of the value [Cx] is passed.

[Sx] - Sign {x}		
"0"	0 [False; always "0"]	The value [Cx] is ignored and this logic path will always be FALSE.
"1"	1 [True; always "1"]	The value [Cx] is ignored and this logic path will always be TRUE.

Table 156: Signs

[Ox] - Operator {x}	
AND	Logical AND
NAND	Logical negated AND
OR	Logical OR
NOR	Logical negated OR
XOR	Exclusive OR
NXOR	Exclusive negated OR

Table 157: Operators

For the various display formats of the corresponding logical symbols refer to *Chapter 9.3.3 "Logical Symbols" on page 918.*

Configuration of the command chain

Using the values specified in the above table, the chain of commands of the LogicsManager (for example: operating the relays, setting the flags, specification of the automatic functions) is configured as follows:

[Ax] = (([C1] & [S1]) & [O1] & ([C2] & [S2])) & [O2] & ([C3] & [S3])

Programming example for the LogicsManager

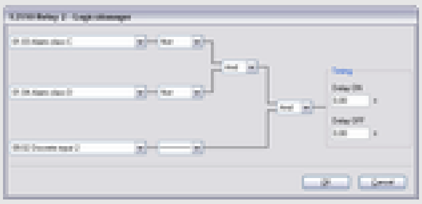


Fig. 357: Programming example (ToolKit)

- Relay [R2] shall energize, whenever "Discrete input [DI 02]" is energized "AND" the control does "NOT" have a fault that is "Alarm class C" "AND" does "NOT" have a fault that is "Alarm class D"

9.3.2 Logical Command Variables

NEW arranged

In comparison to easYgen the easYgen-XT series comes with re-arranged LogicsManagers.

Some samples: ... in general ...

– *easYgen group 00.xx and group 24.xx moved to Part 2: LM results (group 80.xx to group 99.xx)*
– *Parameters that are similarly used for easYgen and easYgen-XT come with the same ID/ number - maybe wording is updated*
– *NEW or remarkable changed parameters come with new (intentionally different) ID/number*

The logical command variables are grouped into different categories.

Part 1: LM variables (1 to 39)

- Group 01: Global alarms
- Group 02: Systems condition
- Group 03: Engine control
- Group 04: Applications condition
- Group 05: Engine related alarms
- Group 06: Generator related alarms
- Group 07: Mains related alarms
- Group 08: System related alarms
- Group 09: Discrete Inputs
- Group 10: Analog Inputs
- Group 11: Clock and timer
- Group 12: External Discrete Inputs
- Group 13: Discrete outputs
- Group 15: Flexible limits
- Group 16: Free alarms latched
- Group 17: System alarms
- Group 25: External Analog Inputs out of range
- Group 26: Flags of LS5 (33 to 48)
- Group 27: Flags of LS5 (49 to 64)
- Group 28: LS5 system conditions

Cascading: Use digital results

*This digital **results** of AnalogManagers and LogicsManagers are available as LogicsManager Variables additionally. Like the other LM Variables they can be used as input signal for (further) AnalogManagers or LogicsManagers.*

Part 2: AM and LM results (80 to 99)

- Group 81: AM Results 1
- Group 82: AM Results 2
- Group 86: LM Results 1

- Group 87: LM Results 2
- Group 88: LM Results 3
- Group 90: AM Internal values 0
- Group 91: AM Internal values 1
- Group 93: AM Analog outputs 1
- Group 96: LM Internal flags 1
- Group 98: LM External DOs 1
- Group 99: LM Internal DOs 1

Devices, packages, and versions
The following tables are describing a full set of parameters. Please ignore data your device does not support.

ID Numbers
The following tables list the "ID" numbers used e.g. for Modbus communication.

9.3.2.1 Group 01: Global Alarms

- Alarm system
- Logic command variables 01.01-01.11

Alarm classes may be configured as command variables for all logical outputs in the LogicsManager. Refer to *Chapter 9.5.1 "Alarm Classes" on page 965* for a description of the alarm classes.

No.	ID	Name / Function	Note
01.01	10720	Alarm class A	TRUE as long as an alarm of this alarm class is active or latched (triggered)
01.02	10721	Alarm class B	TRUE as long as an alarm of this alarm class is active or latched (triggered)
01.03	10722	Alarm class C	TRUE as long as an alarm of this alarm class is active or latched (triggered)
01.04	10723	Alarm class D	TRUE as long as an alarm of this alarm class is active or latched (triggered)
01.05	10724	Alarm class E	TRUE as long as an alarm of this alarm class is active or latched (triggered)
01.06	10725	Alarm class F	TRUE as long as an alarm of this alarm class is active or latched (triggered)
01.07	10726	All alarm classes	TRUE as long as at least one alarm of the alarm classes A/B/C/D/E/F is active or latched (triggered)
01.08	10727	Warning alarm	TRUE as long as at least one alarm of the alarm classes A/B is active or latched (triggered)
01.09	10728	Shutdown alarm	TRUE as long as at least one alarm of the alarm classes C/D/E/F is active or latched (triggered)
01.10	10729	Centralized alarm	TRUE as long as at least one alarm of the alarm classes B/C/D/E/F is active or latched (triggered)
01.11	11620	New alarm triggered	TRUE if any alarm of the Alarm classes B/C/D/E/F has been triggered until it is acknowledged

9.3.2.2 Group 02: Systems Conditions

- Systems condition
- Logic command variables 02.01-02.38

The status of the system may be used as command variable in a logical output to set parameters for customized operations.

No.	ID	Name	Function	Note
02.01	9180	LM FALSE		Fixed value - often used for default setting
02.02	9181	LM TRUE		
02.03	10732	Gen. voltage ok	Generator voltage within operating range	TRUE as long as the generator voltage is within the operating range
02.04	10733	Gen. frequency ok	Generator frequency within operating range	TRUE as long as the generator frequency is within the operating range
02.05	10734	Gen. volt./freq. ok	Generator voltage and frequency within operating ranges	TRUE as long as the generator voltage and frequency are within the operating ranges (02.03. and 02.04 are TRUE)
02.06	10735	Busbar 1 voltage ok	Busbar 1 voltage within generator voltage operating range	TRUE as long as the busbar 1 voltage is within the generator voltage operating range
02.07	10736	Busbar 1 freq. ok	Busbar 1 frequency within frequency voltage operating range	TRUE as long as the busbar 1 frequency is within the generator frequency operating range
02.08	10737	Busb1 volt./freq. ok	Busbar 1 voltage and frequency within generator voltage and frequency operating ranges	TRUE as long as the busbar 1 voltage and frequency are within the generator voltage operating ranges (02.06. and 02.07 are TRUE)
02.09	10738	Mains voltage ok	Mains voltage within operating range	TRUE as long as the mains voltage is within the operating range
02.10	10739	Mains frequency ok	Mains frequency within operating range	TRUE as long as the mains frequency is within the operating range
02.11	10740	Mains volt./freq. ok	Mains voltage and frequency within operating ranges	TRUE as long as the mains voltage and frequency are within the operating ranges (02.09. and 02.10 are TRUE)
02.12	10741	Gen. rotation CCW	Generator voltage: rotating direction CCW	TRUE as long as the respective rotation field is detected in case of a three-phase voltage measurement at the respective measuring location
02.13	10742	Gen. rotation CW	Generator voltage: rotating direction CW	
02.14	10743	Mains rotation CCW	Mains voltage: rotating direction CCW	
02.15	10744	Mains rotation CW	Mains voltage: rotating direction CW	
02.16	10745	Busb.1 rotation CCW	Busbar voltage: rotating direction CCW	
02.17	10746	Busbar 1 rotation CW	Busbar voltage: rotating direction CW	
02.21	11630	Dead busbar1	Busbar 1 is dead	TRUE as long as the busbar voltage is below the value configured in parameter 5820 ➪ p. 433 (Dead bus detection max. volt.)
02.29	11649	Sync.Check gen./busb	Synchronize Check Relay: Generator ↔ Busbar (ANSI 25)	TRUE, if all of the following ranges matches: ■ voltage ■ frequency ■ phase angle ■ acceleration range ■ lead angle

No.	ID	Name	Function	Note
02.32	11641	Sync.Check mns/busb	Synchronize Check Relay: Busbar ↔ Mains (ANSI 25)	TRUE, if all of the following ranges matches: ■ voltage ■ frequency ■ phase angle ■ acceleration range ■ lead angle
02.34	11643	Firing speed electr.	Electrical signal value matches firing speed	
02.35	11644	Firing speed rpm	rpm signal value matches firing speed	
02.36	11645	Speed electr.	Electrical signal value matches speed	
02.37	11646	Speed rpm	rpm signal value matches speed	
02.38	10807	Gen excitation lim.	Value of generator excitation exceeded limit	

9.3.2.3 Group 03: Engine Control

- Engine control
- Logic command variables 03.01-03.45

These variables may be used as command variable in a logical output to set parameters for customized operations.

No.	ID	Name / Function	Note
03.01	10750	Auxiliary services	TRUE if an auxiliary services prerun or postrun is enabled
03.02	10751	Starter	TRUE if the starter relay is energized
03.04	10753	Preglow / Ignition	
03.05	10754	Horn	TRUE if the preglow (Diesel) or ignition (gas) relay is energized
03.06	10755	Engine released	TRUE if alarm class B to F is activated until the time until horn reset is expired or it is acknowledged for the first time.
03.07	10756	Engine delay expired	TRUE if the engine is requested and the start is released
03.08	10757	Break. delay expired	TRUE after expiration of the "delayed engine monitoring" timer until the fuel relay is de-energized
03.09	187	Reserved	
03.10	188	Reserved	
03.11	189	Reserved	
03.12	190	Reserved	
03.13	10762	Blinking lamp ECU	TRUE as soon as the ECU activates the diagnosis light (only for Scania S6 ECU). This command variable is only active if remote control of the ECU via easYgen is activated.
03.14	10763	ECU special ignition	TRUE as long as a reset or read-out of the Scania S6 ECU blink code is requested (only for S6 Scania ECU). This command variable is only active if remote control of the ECU via easYgen is activated.
03.15	10764	ECU seq. B_OUT_1	
03.16	10765	ECU seq. B_OUT_2	

No.	ID	Name / Function	Note
03.17	10766	ECU seq. B_OUT_3	
03.18	10767	ECU seq. B_OUT_4	
03.19		Reserved	
03.20	10769	Governor raise	Three-position controller . TRUE if the respective three-position controller issues the respective control pulse
03.21	11650	Governor lower	
03.22	11651	AVR raise	
03.23	11652	AVR lower	
03.24	11653	Excitation AVR	TRUE if the easYgen excitation is activated
03.25	11654	Engine shall run	
03.27	11656	Stop solenoid	TRUE if a stop signal is issued until the stop time of engine expires
03.28	11657	Start/Gas	TRUE if the fuel solenoid (Diesel) or gas valve (gas) relay is energized
03.29		Reserved	
03.30	11659	Aux. serv. prerun	TRUE, if "Auxiliary services prerun" is active
03.31	11660	Aux. serv. postrun	TRUE, if "Auxiliary services postrun" is active
03.32	11661	+ PID1 controller	TRUE if the respective three-position controller issues the respective control pulse
03.33	11662	- PID1 controller	
03.34	11663	+ PID2 controller	
03.35	11664	- PID2 controller	
03.36	11665	+ PID3 controller	
03.37	11666	- PID3 controller	
03.38	11667	Inhibit cranking	TRUE if the easYgen inhibit cranking is activated
03.39	11668	Close neutral cont.	
03.40	11669	Remote Shutdown	
03.41	11186	Aux. excit. 12V act.	
03.42	11187	Aux. excit. 24V act.	
03.44	10808	Protection lamp DM1	
03.45	10809	Emission lamp DM1	

9.3.2.4 Group 04: Applications Condition

- Applications condition
- Logic command variables 04.01-04.67

These operating statuses may be used as command variable in a logical output to set parameters for customized operations.

No.	ID	Name	Function	Note
04.01	10770	Operat. mode AUTO	AUTOMATIC operating mode active	TRUE in AUTOMATIC operating mode
04.02	10771	Operat. mode STOP	STOP operating mode active	TRUE in STOP operating mode

No.	ID	Name	Function	Note
04.03	10772	Operat. mode MAN	MANUAL operating mode active	TRUE in MANUAL operating mode
04.04	12273	Operat. mode TEST	A lamp test is being performed	TRUE if the lamp test is active
04.05	10774	Acknowledge	"Acknowledge" push button has been pressed or an external acknowledgment via LogicsManager	This condition is TRUE for approx. 40 ms and must be extended utilizing a delay time
04.06	10775	GCB closed	GCB is closed A03 and A04	TRUE if DI 8 (Reply GCB) is de-energized
04.07	10776	MCB closed	MCB is closed A04 only	TRUE if DI 7 (Reply MCB) is de-energized
04.08		Reserved		
04.09	10778	Emergency mode	Emergency power operation active	TRUE with the expiration of the emergency power delay; FALSE with the expiration of the mains setting time and the reply from the MCB is closed
04.10	10779	Cool down	Engine cool-down cycle active	TRUE as long as the cool down time is running
04.11	10780	Mains settling	Mains settling time active	Becomes TRUE with a mains failure and FALSE after the mains settling timer has expired
04.12	10781	Start w/o load	Start without closing GCB is active	TRUE if Start w/o load is enabled
04.13	10782	Remote request	Request over remote control to activate a function	TRUE if the start bit is set via serial connection (Modbus) or CAN bus (CANopen), (control word 503)
04.14	10783	Remote acknowledge	Request over remote control to acknowledge	TRUE if this bit is set via interface (control word 503)
04.15	10784	Idle run active	Idle mode is active	TRUE if the idle mode is active. This may be used to issue an "Idle" command to a speed controller.
04.16	10785	GGB closed	GGB is closed	TRUE if DI 9 (Reply GGB) is de-energized
04.17	10786	GGB released	GGB is released	GGB is released
04.18	10787	Synchron. GCB active	Synchronization GCB is active	TRUE if the GCB shall be synchronized until the GCB is closed
04.19	10788	Opening GCB active	Opening GCB is active	TRUE if a GCB open command is issued until DI 8 (Reply GCB) is energized
04.20	10789	Closing GCB active	Closing GCB is active	TRUE if a GCB close command is issued; same function as relay 6 in A03 or A04
04.21	11670	Syn. MCB is active	Synchronization MCB is active	TRUE if the MCB shall be synchronized until the MCB is closed
04.22	11671	Opening MCB active	Opening MCB is active	TRUE if an MCB open command is issued until DI 7 (Reply GCB) is energized
04.23	11672	Closing MCB active	Closing MCB is active	TRUE if an MCB close command is issued; same function as relay 8 in A04
04.24	11673	Syn. GGB active	Synchronization GGB is active	TRUE if the GGB shall be synchronized until the GGB is closed
04.25	11674	Opening GGB active	Opening GGB is active	TRUE if a GGB open command is issued until DI 9 (Reply GGB) is energized
04.26	11675	Closing GGB active	Closing GGB is active	TRUE if a GGB close command is issued; same function as relay 10 in
04.27	11676	Critical mode	Critical mode operation is enabled	TRUE if critical mode is enabled
04.28	11677	Generator unloading	Generator unloading sequence is active	TRUE if a stop command has been issued until the GCB is opened
04.29	11678	Mains unloading	Mains unloading sequence is active	TRUE if a synchronization has been started until the MCB is opened
04.30	11679	Limited prerun	Prerun operation with power limitation is active	TRUE as long as the warm up load limitation is enabled
04.31	11680	Segment no.2 act.	Load share group 2 is activated	Internal calculation Refer to parameter 12929 ➡ p. 256/➡ p. 929.

No.	ID	Name	Function	Note
04.32	11681	Segment no.3 act.	Load share group 3 is activated	Internal calculation Refer to parameter 12928 ␣ p. 256/ p. 929.
04.33	11682	Segment no.4 act.	Load share group 4 is activated	Internal calculation Refer to parameter 12927 p. 256/ p. 929.
04.34	11683	LDSS Priority 2	Load-dependent start/stop priority 2 is activated	Internal calculation Refer to parameter 12926 p. 303/ p. 929.
04.35	11684	LDSS Priority 3	Load-dependent start/stop priority 3 is activated	Internal calculation Refer to parameter 12925 p. 303/ p. 929.
04.36	11685	LDSS Priority 4	Load-dependent start/stop priority 4 is activated	Internal calculation Refer to parameter 12924 p. 303/ p. 929.
04.37	11686	Remote volt. setp. 2	Voltage setpoint 2 is enabled	TRUE if this bit is set via interface (control word 504)
04.38	11687	Remote freq. setp. 2	Frequency setpoint 2 is enabled	
04.39	11688	Remote PF setp. 2	Power factor setpoint 2 is enabled	
04.40	11689	Remote pwr. setp. 2	Load setpoint 2 is enabled	
04.41	11690	Transition mode 1	Breaker transition mode alternative 1	Internal calculation Refer to parameter 12931 p. 221/ p. 929.
04.42	11691	Transition mode 2	Breaker transition mode alternative 2	Internal calculation Refer to parameter 12932 p. 222/ p. 929.
04.43	11692	LD start stop	Load-dependent start/stop is activated	Internal calculation Refer to parameter 12930 p. 303/ p. 536/ p. 929.
04.44	11693	RemoteControl Bit 1	Free control bit 1 is activated	
04.45	11694	RemoteControl Bit 2	Free control bit 2 is activated	
04.46	11695	RemoteControl Bit 3	Free control bit 3 is activated	
04.47	11696	RemoteControl Bit 4	Free control bit 4 is activated	
04.48	11697	RemoteControl Bit 5	Free control bit 5 is activated	
04.49	11698	RemoteControl Bit 6	Free control bit 6 is activated	
04.50	11699	RemoteControl Bit 7	Free control bit 7 is activated	
04.51	11700	RemoteControl Bit 8	Free control bit 8 is activated	
04.52	11701	RemoteControl Bit 9	Free control bit 9 is activated	
04.53	11702	RemoteControl Bit 10	Free control bit 10 is activated	
04.54	11703	RemoteControl Bit 11	Free control bit 11 is activated	
04.55	11704	RemoteControl Bit 12	Free control bit 12 is activated	
04.56	11705	RemoteControl Bit 13	Free control bit 13 is activated	

No.	ID	Name	Function	Note
04.57	11706	RemoteControl Bit 14	Free control bit 14 is activated	
04.58	11707	RemoteControl Bit 15	Free control bit 15 is activated	
04.59	11708	RemoteControl Bit 16	Free control bit 16 is activated	
04.60	11709	Crit. mode postrun	Critical mode postrun is active	TRUE as long as the critical mode postrun time is running
04.61	10773	Lamp test	Releases the lamp test	All illuminated buttons and signs at the front panel are a short time illuminated for test
04.62	11981	Act.pow.LS active	Active power load share is active	
04.63	11982	React.pow.LS active	Reactive power load share is active	
04.64	11970	Key activation	ON if any key is activated	Relevant for versions with front panel (HMI) only
04.65	11973	System update active	System update is active	
04.66	11977	Mains failure ended	Mains failure ended	
04.67	11980	Reserve power avail.	Reserve power is available	

9.3.2.5 Group 05: Engine Related Alarms

- Engine related alarms
- Logic command variables 05.01-05.20

These engine alarms may be used as command variable in a logical output to set parameters for customized operations.

No.	ID	Name / Function	Note
05.01	10790	Overspeed 1	TRUE = alarm latched (triggered)
05.02	10791	Overspeed 2	FALSE = alarm acknowledged
05.03	10792	Underspeed 1	
05.04	10793	Underspeed 2	
05.05	10794	Unintended stop	
05.06	10795	Eng. stop malfunct.	
05.07	10796	Speed/freq. mismatch	
05.08	10797	Start fail	
05.09	10798	Maint. days exceeded	
05.10	10799	Maint. hrs exceeded	
05.11	10800	Charge alt. low volt	
05.12		Reserved	
05.13	10802	Red stop lamp	
05.14	10803	Amber warning lamp	
05.16	10805	Derating active	TRUE if derating is activated ➪ *Chapter 4.4.4.5.4.3 "Derating Parameters" on page 283*

No.	ID	Name / Function	Note
05.17	10806	Uprating active	TRUE if uprating is activated *Chapter 4.4.4.5.4.3 "Derating Parameters" on page 283*
05.18	13306	Cyl.tmp.lev.1	
05.19	13307	Cyl.tmp.lev.2	
05.20	13308	Cyl.tmp.wire brk.	

9.3.2.6 Group 06: Generator Related Alarms

- Generator related alarms
- Logic command variables 06.01-06.33

These generator alarms may be used as command variable in a logical output to set parameters for customized operations.

No.	ID	Name / Function	Note
06.01	10810	06.01 Gen. overfrequency 1	TRUE = alarm latched (triggered) FALSE = alarm acknowledged
06.02	10811	06.02 Gen. overfrequency 2	
06.03	10812	06.03 Gen.underfrequency 1	
06.04	10813	06.04 Gen.underfrequency 2	
06.05	10814	06.05 Gen. overvoltage 1	
06.06	10815	06.06 Gen. overvoltage 2	
06.07	10816	06.07 Gen. undervoltage 1	
06.08	10817	06.08 Gen. undervoltage 2	
06.09	10818	06.09 Gen. overcurrent 1	
06.10	10819	06.10 Gen. overcurrent 2	
06.11	10820	06.11 Gen. overcurrent 3	
06.12	10821	06.12 Gen. rev./red. pwr.1	
06.13	10822	06.13 Gen. rev./red. pwr.2	
06.14	10823	06.14 Gen. overload IOP 1	
06.15	10824	06.15 Gen. overload IOP 2	
06.16	10825	06.16 Unbalanced load 1	
06.17	10826	06.17 Unbalanced load 2	
06.18	10827	06.18 Gen. volt. asymmetry	
06.19	10828	06.19 Ground fault 1	
06.20	10829	06.20 Ground fault 2	
06.21	10830	06.21 Gen.ph.rot. mismatch	
06.22	10831	06.22 Inv. time overcurr.	
06.23	10832	06.23 Gen. overload MOP 1	
06.24	10833	06.24 Gen. overload MOP 2	
06.25	10834	06.25 Gen. PF lagging 1	
06.26	10835	06.26 Gen. PF lagging 2	
06.27	10836	06.27 Gen. PF leading 1	

No.	ID	Name / Function	Note
06.28	10837	06.28 Gen. PF leading 2	
06.29	10838	06.29 Gen.act.pwr.mismatch	
06.30	10839	06.30 Gen. unload.mismatch	
06.31	10840	06.31 Operat. range failed	
06.32	10843	06.32 Generator AC wiring plausibility	
06.33	10844	06.33 Busbar 1 AC wiring plausibility	

9.3.2.7 Group 07: Mains Related Alarms

- Mains related alarms
- Logic command variables 07.01-07.32

These mains alarms may be used as command variable in a logical output to set parameters for customized operations.

No.	ID	Function	Note
07.01 .. 07.04		Reserved	
07.05	10854	Mains mismatched phase rotation (rotation field alarm)	TRUE = alarm latched (triggered) FALSE = alarm acknowledged
07.06	10855	Mains overfrequency (limit) 1	
07.07	10856	Mains overfrequency (limit) 2	
07.08	10857	Mains underfrequency (limit) 1	
07.09	10858	Mains underfrequency (limit) 2	
07.10	10859	Mains overvoltage (limit) 1	
07.11	10860	Mains overvoltage (limit) 2	
07.12	10861	Mains undervoltage (limit) 1	
07.13	10862	Mains undervoltage (limit) 2	
07.14	10863	Mains phase shift	
07.15	10864	Mains df/dt	
07.16	10865	Mains active power mismatch	
07.17	10866	Mains power factor inductive (limit) 1	
07.18	10867	Mains power factor inductive (limit) 2	
07.19	10868	Mains power factor capacitive (limit) 1	
07.20	10869	Mains power factor capacitive (limit) 2	
07.21	10870	Mains import power (limit) 1	
07.22	10871	Mains import power (limit) 2	
07.23	10872	Mains export power (limit) 1	
07.24	10873	Mains export power (limit) 2	
07.25	10874	Mains decoupling	
07.26		Reserved	
07.27	10876	Mains voltage increase	TRUE = alarm latched (triggered) FALSE = alarm acknowledged
07.28	10877	Time-dependent voltage	
07.29	10878	QV monitoring 1	

No.	ID	Function	Note
07.30	10879	QV monitoring 2	
07.31	11750	Time-dep. voltage 2	
07.32	10930	Mains AC wiring plausibility	

9.3.2.8 Group 08: System Related Alarms

- System related alarms
- Logic command variables 08.01-08.45

These system alarms may be used as command variable in a logical output n to set parameters for customized operations.

No.	ID	Function	Note
08.01	10880	Battery overvoltage (limit) 1	TRUE = alarm latched (triggered) FALSE = alarm acknowledged
08.02	10881	Battery overvoltage (limit) 2	
08.03	10882	Battery undervoltage (limit) 1	
08.04	10883	Battery undervoltage (limit) 2	
08.05	10884	GCB fail to close	
08.06	10885	GCB fail to open	
08.07	10886	MCB fail to close	
08.08	10887	MCB fail to open	
08.09		Reserved	
08.10	10889	CAN J1939 communication alarm	
08.11		Reserved	
08.12		Reserved	
08.13		Reserved	
08.14		Reserved	
08.15		Reserved	
08.16	10895	Parameter alignment	
08.17	10896	Missing members	
08.18	10897	CANopen Interface 1	
08.19	10898	CANopen Interface 2	
08.20		Reserved	
08.21		Reserved	
08.22	11781	Busbar v/f not ok	
08.23		Reserved	
08.24		Reserved	
08.25		Reserved	
08.26		Reserved	
08.27	11786	Missing easYgen	
08.28	11787	Missing LS5	

No.	ID	Function	Note
08.29	11788	CANopen Interface 3	
08.30	11789	Timeout synchronization GCB	
08.31	11790	Timeout synchronization MCB	
08.32	11791	Timeout synchronization GGB	
08.33		Reserved	
08.34	11793	GGB fail to close	
08.35	11794	GGB fail to open	
08.36		Reserved	
08.37	11796	J1939 ECU timeout	
08.38	11797	J1939 device 1 timeout	
08.39	11798	J1939 device 2 timeout	
08.40	11799	J1939 device 3 timeout	
08.41	11800	Ethernet B fault	
08.42	11801	Ethernet C fault	
08.43	11802	System update easYgen	
08.44	11803	System update LS5	
08.45	11804	CPU overload R1 trip	

9.3.2.9 Group 09: Discrete Inputs

- Discrete inputs
- Logic command variables 09.01-09.12

The discrete inputs may be used as command variable in a logical output to set parameters for customized operations.

No.	ID	Function	Note
09.01	10900	DI 1 (Discrete input [DI 01])	TRUE = logical "1" (delay times and N.O./N.C. parameters are ignored) FALSE = logical "0" (alarm has been acknowledged or immediately after TRUE condition is not present anymore, if Control is configured as alarm class)
09.02	10901	DI 2 (Discrete input [DI 02])	
09.03	10902	DI 3 (Discrete input [DI 03])	
09.04	10903	DI 4 (Discrete input [DI 04])	
09.05	10904	DI 5 (Discrete input [DI 05])	
09.06	10905	DI 6 (Discrete input [DI 06])	
09.07	10906	DI 7 (Discrete input [DI 07])	
09.08	10907	DI 8 (Discrete input [DI 08])	
09.09	10908	DI 9 (Discrete input [DI 09])	
09.10	10909	DI 10 (Discrete input [DI 10])	
09.11	10910	DI 11 (Discrete input [DI 11])	
09.12	10911	DI 12 (Discrete input [DI 12])	

9.3.2.10 Group 10: Analog Inputs

- Analog inputs
- Logic command variables 10.01-10.03

The analog inputs may be used as command variable in a logical output.

No.	ID	Name / Function	Note
10.01	11072	Analog input AI 01 wire break	TRUE = measured value out of range FALSE = logical "0" (alarm has been acknowledged, or immediately after TRUE condition is not present anymore, if Control is configured as alarm class)
10.02	11073	Analog input AI 02 wire break	
10.03	11074	Analog input AI 03 wire break	

9.3.2.11 Group 11: Clock And Timer

- Clock and timer
- Logic command variables 11.01-11.10

Time functions may be used as command variable in a logical output.

No.	ID	Name / Function	Note
11.01	10940	Timer setpoint 1 (exceeded)	Refer to parameter 1652 ➪ p. 483, 1651 ➪ p. 483 and 1650 ➪ p. 483.
11.02	10941	Timer setpoint 2 (exceeded)	Refer to parameters 1657 ➪ p. 483, 1656 ➪ p. 483 and 1655 ➪ p. 483.
11.03	10942	Active weekday (equal to setting)	Refer to parameter 1670 ➪ p. 484, 1671 ➪ p. 484, 1672 ➪ p. 484, 1673 ➪ p. 484, 1674 ➪ p. 484, 1675 ➪ p. 484, and 1676 ➪ p. 484.
11.04	10943	Active day (equal to setting)	Refer to parameter 1663 ➪ p. 483.
11.05	10944	Active hour (equal to setting)	Refer to parameter 1662 ➪ p. 483.
11.06	10945	Active minute (equal to setting)	Refer to parameter 1661 ➪ p. 484.
11.07	10946	Active second (equal to setting)	Refer to parameter 1660 ➪ p. 484.
11.08	10947	Engine (running hours exceeded by) 1 hour	Status changes every operating hour
11.09	10948	Engine (running hours exceeded by) 10 hour	Status changes every 10 operating hours
11.10	10949	Engine (running hours exceeded by) 100 hour	Status changes every 100 operating hours

9.3.2.12 Group 12: External Discrete Inputs

- External discrete inputs
- Logic command variables 12.01-12.32

Additional discrete inputs from an expansion board (i.e. IKD 1 extension board) may be used as command variable in a logical output.

No.	ID	Name / Function	Note
12.01	609	External DI 1	TRUE = logical "1" (delay times and N.O./N.C. parameters are ignored) FALSE = logical "0" (alarm has been acknowledged, or immediately after TRUE condition is not present anymore, if Control is configured as alarm class)
12.02	610	External DI 2	
12.03	611	External DI 3	
12.04	612	External DI 4	
12.05	613	External DI 5	
12.06	614	External DI 6	
12.07	615	External DI 7	
12.08	616	External DI 8	
12.09	617	External DI 9	
12.10	618	External DI 10	
12.11	619	External DI 11	
12.12	620	External DI 12	
12.13	621	External DI 13	
12.14	622	External DI 14	
12.15	623	External DI 15	
12.16	624	External DI 16	
12.17	11350	External DI 17	
12.18	11351	External DI 18	
12.19	11352	External DI 19	
12.20	11353	External DI 20	
12.21	11354	External DI 21	
12.22	11355	External DI 22	
12.23	11356	External DI 23	
12.24	11357	External DI 24	
12.25	11358	External DI 25	
12.26	11359	External DI 26	
12.27	11360	External DI 27	
12.28	11361	External DI 28	
12.29	11362	External DI 29	
12.30	11363	External DI 30	
12.31	11364	External DI 31	
12.32	11365	External DI 32	

9.3.2.13 Group 13: Discrete Outputs

- Discrete outputs
- Logic command variables 13.01-13.12

The discrete outputs may be used as command variable in a logical output.

No.	ID	Name / Function	Note
13.01	10980	Discrete output DO1 [R01]	TRUE = logical "1" (this condition indicates the logical status of the internal relays) FALSE = logical "0" (this condition indicates the logical status of the internal relays)
13.02	10981	Discrete output DO2 [R02]	
13.03	10982	Discrete output DO3 [R03]	
13.04	10983	Discrete output DO4 [R04]	
13.05	10984	Discrete output DO5 [R05]	
13.06	10985	Discrete output DO6 [R06]	
13.07	10986	Discrete output DO7 [R07]	
13.08	10987	Discrete output DO8 [R08]	
13.09	10988	Discrete output DO9 [R09]	
13.10	10989	Discrete output DO10 [R10]	
13.11	10990	Discrete output DO11 [R11]	
13.12	10991	Discrete output DO12 [R12]	

9.3.2.14 Group 15: Flexible Limits

- Flexible limits
- Logic command variables 15.01-15.40

The flexible analog input thresholds may be used as command variable in a logical output.

No.	ID	Name / Function	Note
15.01	11093	Flexible analog limit 1 (triggered)	TRUE = limit value reached FALSE = alarm acknowledged
15.02	11094	Flexible analog limit 2 (triggered)	
15.03	11095	Flexible analog limit 3 (triggered)	
15.04	11096	Flexible analog limit 4 (triggered)	
15.05	11097	Flexible analog limit 5 (triggered)	
15.06	11098	Flexible analog limit 6 (triggered)	
15.07	11099	Flexible analog limit 7 (triggered)	
15.08	11100	Flexible analog limit 8 (triggered)	
15.09	11101	Flexible analog limit 9 (triggered)	
15.10	11102	Flexible analog limit 10 (triggered)	
15.11	11103	Flexible analog limit 11 (triggered)	
15.12	11104	Flexible analog limit 12 (triggered)	
15.13	11105	Flexible analog limit 13 (triggered)	
15.14	11106	Flexible analog limit 14 (triggered)	
15.15	11107	Flexible analog limit 15 (triggered)	

No.	ID	Name / Function	Note
15.16	11108	Flexible analog limit 16 (triggered)	
15.17	11109	Flexible analog limit 17 (triggered)	
15.18	11110	Flexible analog limit 18 (triggered)	
15.19	11111	Flexible analog limit 19 (triggered)	
15.20	11112	Flexible analog limit 20 (triggered)	
15.21	11113	Flexible analog limit 21 (triggered)	
15.22	11114	Flexible analog limit 22 (triggered)	
15.23	11115	Flexible analog limit 23 (triggered)	
15.24	11116	Flexible analog limit 24 (triggered)	
15.25	11117	Flexible analog limit 25 (triggered)	
15.26	11118	Flexible analog limit 26 (triggered)	
15.27	11119	Flexible analog limit 27 (triggered)	
15.28	11120	Flexible analog limit 28 (triggered)	
15.29	11121	Flexible analog limit 29 (triggered)	
15.30	11122	Flexible analog limit 30 (triggered)	
15.31	11123	Flexible analog limit 31 (triggered)	
15.32	11124	Flexible analog limit 32 (triggered)	
15.33	11125	Flexible analog limit 33 (triggered)	
15.34	11126	Flexible analog limit 34 (triggered)	
15.35	11127	Flexible analog limit 35 (triggered)	
15.36	11128	Flexible analog limit 36 (triggered)	
15.37	11129	Flexible analog limit 37 (triggered)	
15.38	11130	Flexible analog limit 38 (triggered)	
15.39	11131	Flexible analog limit 39 (triggered)	
15.40	11132	Flexible analog limit 40 (triggered)	

9.3.2.15 Group 16: Free Alarms latched

- Free alarms latched
- Logic command variables 16.01-16.16

No.	ID	Name / Function	Note
16.01	11040	Free alarm 1 latched	
16.02	11041	Free alarm 2 latched	
16.03	11042	Free alarm 3 latched	
16.04	11043	Free alarm 4 latched	
16.05	11044	Free alarm 5 latched	
16.06	11045	Free alarm 6 latched	
16.07	11046	Free alarm 7 latched	
16.08	11047	Free alarm 8 latched	

No.	ID	Name / Function	Note
16.09	11048	Free alarm 9 latched	
16.10	11049	Free alarm 10 latched	
16.11	11050	Free alarm 11 latched	
16.12	11051	Free alarm 12 latched	
16.13	11052	Free alarm 13 latched	
16.14	11053	Free alarm 14 latched	
16.15	11054	Free alarm 15 latched	
16.16	11055	Free alarm 16 latched	

9.3.2.16 Group 17: System Alarms

- System alarms
- Logic command variables 17.01-17.09

No.	ID	Name / Function	Note
17.01	10841	Act. load shar.mism.	
17.02	10842	React.load shar.mism	
17.05	11156	Missing member 4105	Parameters are aligned to VDE-AR-N 4105 conditions
17.06	11157	Para.alignment 4105	
17.07	11158	Meas.difference 4105	Measuring difference detected according to VDE-AR-N 4105
17.08	11159	Decoupling GCB<->MCB	
17.09	11160	N-cont. reply mism.	

9.3.2.17 Group 25: Ext. Analog inputs "out of range"

- Ext. analog inputs "out of range"/"wire break" information
- Logic command variables 25.01-25.16

No.	ID	Name	Function	Note
25.01	11489	Ext. AI 1 wire break-status		TRUE, if "out of range"/"wire break" of dedicated ext. analog input is recognized
25.02	11490	Ext. AI 2 wire break-status		
25.03	11491	Ext. AI 3 wire break-status		
25.04	11492	Ext. AI 4 wire break-status		
25.05	11493	Ext. AI 5 wire break-status		
25.06	11494	Ext. AI 6 wire break-status		
25.07	11495	Ext. AI 7 wire break-status		
25.08	11496	Ext. AI 8 wire break-status		

No.	ID	Name	Function	Note
25.09	11497	Ext. AI 9 wire break-status		
25.10	11498	Ext. AI 10 wire break-status		
25.11	11499	Ext. AI 11 wire break-status		
25.12	11500	Ext. AI 12 wire break-status		
25.13	11501	Ext. AI 13 wire break-status		
25.14	11502	Ext. AI 14 wire break-status		
25.15	11503	Ext. AI 15 wire break-status		
25.16	11504	Ext. AI 16 wire break-status		

9.3.2.18 Group 26: Flags Of LS5 (33 to 48)

- Flags of LS5 (33 to 48)
- Logic command variables 26.01-26.80

Information exchanges between easYgen and LS-5 via command variables.

No.	ID	Name / Function	Note
26.01	8300	Flag 1 LS5 device 33	TRUE if LogicsManager 12952 in LS-5 device no. {x} is activated [x = 33 to 48]
26.02	8301	Flag 2 LS5 device 33	TRUE if LogicsManager 12953 in LS-5 device no. {x} is activated [x = 33 to 48]
26.03	8302	Flag 3 LS5 device 33	TRUE if LogicsManager 12954 in LS-5 device no. {x} is activated [x = 33 to 48]
26.04	8303	Flag 4 LS5 device 33	TRUE if LogicsManager 12955 in LS-5 device no. {x} is activated [x = 33 to 48]
26.05	8304	Flag 5 LS5 device 33	TRUE if LogicsManager 12956 in LS-5 device no. {x} is activated [x = 33 to 48]
26.06	8305	Flag 1 LS5 device 34	
26.07	8306	Flag 2 LS5 device 34	
26.08	8307	Flag 3 LS5 device 34	
26.09	8308	Flag 4 LS5 device 34	
26.10	8309	Flag 5 LS5 device 34	
26.11	8310	Flag 1 LS5 device 35	
26.12	8311	Flag 2 LS5 device 35	
26.13	8312	Flag 3 LS5 device 35	
26.14	8313	Flag 4 LS5 device 35	
26.15	8314	Flag 5 LS5 device 35	
26.16	8315	Flag 1 LS5 device 36	
26.17	8316	Flag 2 LS5 device 36	

No.	ID	Name / Function	Note
26.18	8317	Flag 3 LS5 device 36	
26.19	8318	Flag 4 LS5 device 36	
26.20	8319	Flag 5 LS5 device 36	
26.21	8320	Flag 1 LS5 device 37	
26.22	8321	Flag 2 LS5 device 37	
26.23	8322	Flag 3 LS5 device 37	
26.24	8323	Flag 4 LS5 device 37	
26.25	8324	Flag 5 LS5 device 37	
26.26	8325	Flag 1 LS5 device 38	
26.27	8326	Flag 2 LS5 device 38	
26.28	8327	Flag 3 LS5 device 38	
26.29	8328	Flag 4 LS5 device 38	
26.30	8329	Flag 5 LS5 device 38	
26.31	8330	Flag 1 LS5 device 39	
26.32	8331	Flag 2 LS5 device 39	
26.33	8332	Flag 3 LS5 device 39	
26.34	8333	Flag 4 LS5 device 39	
26.35	8334	Flag 5 LS5 device 39	
26.36	8335	Flag 1 LS5 device 40	
26.37	8336	Flag 2 LS5 device 40	
26.38	8337	Flag 3 LS5 device 40	
26.39	8338	Flag 4 LS5 device 40	
26.40	8339	Flag 5 LS5 device 40	
26.41	8340	Flag 1 LS5 device 41	
26.42	8341	Flag 2 LS5 device 41	
26.43	8342	Flag 3 LS5 device 41	
26.44	8343	Flag 4 LS5 device 41	
26.45	8344	Flag 5 LS5 device 41	
26.46	8345	Flag 1 LS5 device 42	
26.47	8346	Flag 2 LS5 device 42	
26.48	8347	Flag 3 LS5 device 42	
26.49	8348	Flag 4 LS5 device 42	
26.50	8349	Flag 5 LS5 device 42	
26.51	8350	Flag 1 LS5 device 43	
26.52	8351	Flag 2 LS5 device 43	
26.53	8352	Flag 3 LS5 device 43	
26.54	8353	Flag 4 LS5 device 43	

No.	ID	Name / Function	Note
26.55	8354	Flag 5 LS5 device 43	
26.56	8355	Flag 1 LS5 device 44	
26.57	8356	Flag 2 LS5 device 44	
26.58	8357	Flag 3 LS5 device 44	
26.59	8358	Flag 4 LS5 device 44	
26.60	8359	Flag 5 LS5 device 44	
26.61	8360	Flag 1 LS5 device 45	
26.62	8361	Flag 2 LS5 device 45	
26.63	8362	Flag 3 LS5 device 45	
26.64	8363	Flag 4 LS5 device 45	
26.65	8364	Flag 5 LS5 device 45	
26.66	8365	Flag 1 LS5 device 46	
26.67	8366	Flag 2 LS5 device 46	
26.68	8367	Flag 3 LS5 device 46	
26.69	8368	Flag 4 LS5 device 46	
26.70	8369	Flag 5 LS5 device 46	
26.71	8370	Flag 1 LS5 device 47	
26.72	8371	Flag 2 LS5 device 47	
26.73	8372	Flag 3 LS5 device 47	
26.74	8373	Flag 4 LS5 device 47	
26.75	8374	Flag 5 LS5 device 47	
26.76	8375	Flag 1 LS5 device 48	
26.77	8376	Flag 2 LS5 device 48	
26.78	8377	Flag 3 LS5 device 48	
26.79	8378	Flag 4 LS5 device 48	
26.80	8379	Flag 5 LS5 device 48	

9.3.2.19 Group 27: Flags Of LS5 (49 to 64)

- Flags of LS5 (49 to 64)
- Logic command variables 27.01-27.80

Information exchanges between easYgen and LS-5 via command variables.

No.	ID	Name / Function	Note
27.01	8399	Flag 1 LS5 device 49	TRUE if LogicsManager 12952 in LS-5 device no. {x} is activated [x = 49 to 64]
27.02	8400	Flag 2 LS5 device 49	TRUE if LogicsManager 12953 in LS-5 device no. {x} is activated [x = 49 to 64]
27.03	8401	Flag 3 LS5 device 49	TRUE if LogicsManager 12954 in LS-5 device no. {x} is activated [x = 49 to 64]
27.04	8402	Flag 4 LS5 device 49	TRUE if LogicsManager 12955 in LS-5 device no. {x} is activated [x = 49 to 64]
27.05	8403	Flag 5 LS5 device 49	TRUE if LogicsManager 12956 in LS-5 device no. {x} is activated [x = 49 to 64]
27.06	8404	Flag 1 LS5 device 50	
27.07	8405	Flag 2 LS5 device 50	
27.08	8406	Flag 3 LS5 device 50	
27.09	8407	Flag 4 LS5 device 50	
27.10	8408	Flag 5 LS5 device 50	
27.11	8409	Flag 1 LS5 device 51	
27.12	8410	Flag 2 LS5 device 51	
27.13	8411	Flag 3 LS5 device 51	
27.14	8412	Flag 4 LS5 device 51	
27.15	8413	Flag 5 LS5 device 51	
27.16	8414	Flag 1 LS5 device 52	
27.17	8415	Flag 2 LS5 device 52	
27.18	8416	Flag 3 LS5 device 52	
27.19	8417	Flag 4 LS5 device 52	
27.20	8418	Flag 5 LS5 device 52	
27.21	8419	Flag 1 LS5 device 53	
27.22	8420	Flag 2 LS5 device 53	
27.23	8421	Flag 3 LS5 device 53	
27.24	8422	Flag 4 LS5 device 53	
27.25	8423	Flag 5 LS5 device 53	
27.26	8424	Flag 1 LS5 device 54	
27.27	8425	Flag 2 LS5 device 54	
27.28	8426	Flag 3 LS5 device 54	
27.29	8427	Flag 4 LS5 device 54	
27.30	8428	Flag 5 LS5 device 54	

No.	ID	Name / Function	Note
27.31	8429	Flag 1 LS5 device 55	
27.32	8430	Flag 2 LS5 device 55	
27.33	8431	Flag 3 LS5 device 55	
27.34	8432	Flag 4 LS5 device 55	
27.35	8433	Flag 5 LS5 device 55	
27.36	8434	Flag 1 LS5 device 56	
27.37	8435	Flag 2 LS5 device 56	
27.38	8436	Flag 3 LS5 device 56	
27.39	8437	Flag 4 LS5 device 56	
27.40	8438	Flag 5 LS5 device 56	
27.41	8439	Flag 1 LS5 device 57	
27.42	8440	Flag 2 LS5 device 57	
27.43	8441	Flag 3 LS5 device 57	
27.44	8442	Flag 4 LS5 device 57	
27.45	8443	Flag 5 LS5 device 57	
27.46	8444	Flag 1 LS5 device 58	
27.47	8445	Flag 2 LS5 device 58	
27.48	8446	Flag 3 LS5 device 58	
27.49	8447	Flag 4 LS5 device 58	
27.50	8448	Flag 5 LS5 device 58	
27.51	8449	Flag 1 LS5 device 59	
27.52	8450	Flag 2 LS5 device 59	
27.53	8451	Flag 3 LS5 device 59	
27.54	8452	Flag 4 LS5 device 59	
27.55	8453	Flag 5 LS5 device 59	
27.56	8454	Flag 1 LS5 device 60	
27.57	8455	Flag 2 LS5 device 60	
27.58	8456	Flag 3 LS5 device 60	
27.59	8457	Flag 4 LS5 device 60	
27.60	8458	Flag 5 LS5 device 60	
27.61	8459	Flag 1 LS5 device 61	
27.62	8460	Flag 2 LS5 device 61	
27.63	8461	Flag 3 LS5 device 61	
27.64	8462	Flag 4 LS5 device 61	
27.65	8463	Flag 5 LS5 device 61	
27.66	8464	Flag 1 LS5 device 62	
27.67	8465	Flag 2 LS5 device 62	

No.	ID	Name / Function	Note
27.68	8466	Flag 3 LS5 device 62	
27.69	8467	Flag 4 LS5 device 62	
27.70	8468	Flag 5 LS5 device 62	
27.71	8469	Flag 1 LS5 device 63	
27.72	8470	Flag 2 LS5 device 63	
27.73	8471	Flag 3 LS5 device 63	
27.74	8472	Flag 4 LS5 device 63	
27.75	8473	Flag 5 LS5 device 63	
27.76	8474	Flag 1 LS5 device 64	
27.77	8475	Flag 2 LS5 device 64	
27.78	8476	Flag 3 LS5 device 64	
27.79	8477	Flag 4 LS5 device 64	
27.80	8478	Flag 5 LS5 device 64	

9.3.2.20 Group 28: LS5 System Conditions

- LS5 system conditions
- Logic command variables 28.01-28.06

No.	ID	Name / Function	Note
28.01	8498	Command 1 to LS5 easYgen (OR)	TRUE if at least one easYgen sets the command variable to TRUE (OR operation)
28.02	8499	Command 2 to LS5 easYgen (OR)	
28.03	8500	Command 3 to LS5 easYgen (OR)	
28.04	8501	Command 4 to LS5 easYgen (OR)	
28.05	8502	Command 5 to LS5 easYgen (OR)	
28.06	8503	Command 6 to LS5 easYgen (OR)	

These command variables can be taken also to exchange binary information between the easY-gens. A typical example here by is to command 'droop mode' to all neighbor easYgen.

9.3.2.21 Group 81: AM Results 1

- Binary outputs of function-related AnalogManagers.
- Logic command variables 81.01-81.29

No.	ID	Name	Function	Note
81.01	9308	AM Preglow criterion		The boolean result BR of the AnalogManager
81.02	9311	AM Warm-up criterion		
81.03	9313	AM Freq.source SP1		
81.04	9315	AM Freq.source SP2		
81.05	9317	AM ActPwr.source SP1		
81.06	9319	AM ActPwr.source SP2		
81.07	9322	AM ActPwr.source SP3		
81.08	9324	AM ActPwr.source SP4		
81.09	9326	AM Volt.source SP1		
81.10	9328	AM Volt.source SP2		
81.11	9387	AM PF/var src. SP1		
81.12	9389	AM PF/var src. SP2		
81.13	5691	AM PID1 setpoint		
81.14	5695	AM PID1 actual value		
81.15	5696	AM PID2 setpoint		
81.16	5697	AM PID2 actual value		
81.17	5698	AM PID3 setpoint		
81.18	5699	AM PID3 actual value		
81.19	9391	AM Ext.mains act.pwr.		
81.20	9393	AM Ext.mains RPower		
81.21	9395	AM Derating source		
81.22	9397	AM ECU seq.A_IN_1		
81.23	9398	AM ECU seq.A_IN_2		
81.24	9593	AM Engine speed		
81.25	9595	AM Engine oil press.		
81.26	9597	AM Engine hours		
81.27	9599	AM Engine fuel level		
81.28	9603	AM Engine batt.volt.		
81.29	9613	AM Engine coolant T		

9.3.2.22 Group 82: AM Results 2

- Binary outputs of function-related AnalogManagers (flexible limits)
- Logic command variables 82.01-82.40

No.	ID	Name	Function	Note
82.01	9330	AM Flexible limit 1		The boolean result BR of the AnalogManager
82.02	9331	AM Flexible limit 2		
82.03	9332	AM Flexible limit 3		
82.04	9333	AM Flexible limit 4		
82.05	9334	AM Flexible limit 5		
82.06	9335	AM Flexible limit 6		
82.07	9336	AM Flexible limit 7		
82.08	9337	AM Flexible limit 8		
82.09	9338	AM Flexible limit 9		
82.10	9339	AM Flexible limit 10		
82.11	9340	AM Flexible limit 11		
82.12	9341	AM Flexible limit 12		
82.13	9342	AM Flexible limit 13		
82.14	9343	AM Flexible limit 14		
82.15	9344	AM Flexible limit 15		
82.16	9345	AM Flexible limit 16		
82.17	9346	AM Flexible limit 17		
82.18	9347	AM Flexible limit 18		
82.19	9348	AM Flexible limit 19		
82.20	9349	AM Flexible limit 20		
82.21	9350	AM Flexible limit 21		
82.22	9351	AM Flexible limit 22		
82.23	9352	AM Flexible limit 23		
82.24	9353	AM Flexible limit 24		
82.25	9354	AM Flexible limit 25		
82.26	9355	AM Flexible limit 26		
82.27	9356	AM Flexible limit 27		
82.28	9357	AM Flexible limit 28		
82.29	9358	AM Flexible limit 29		
82.30	9359	AM Flexible limit 30		
82.31	9360	AM Flexible limit 31		
82.32	9361	AM Flexible limit 32		

No.	ID	Name	Function	Note
82.33	9362	AM Flexible limit 33		
82.34	9363	AM Flexible limit 34		
82.35	9364	AM Flexible limit 35		
82.36	9365	AM Flexible limit 36		
82.37	9366	AM Flexible limit 37		
82.38	9367	AM Flexible limit 38		
82.39	9368	AM Flexible limit 39		
82.40	9369	AM Flexible limit 40		

9.3.2.23 Group 86: LM Results 1

- Binary outputs of function-related LogicsManager
- Logic command variables 86.01-86.99

No.	ID	Name	Function	Note
86.09	10708	LM: Start req in AUTO		The (boolean) result of the LogicsManager
86.10	10709	LM: Stop req. in AUTO		
86.11	10710	LM: Inhibit emerg.run		
86.12	10711	LM: Undelay close GCB		
86.13	11987	LM: LS interf. EthA		
86.14	10713	LM: Constant idle run		
86.15	10714	LM: Ext. acknowledge		
86.16	10715	LM: Operat. mode AUTO		
86.17	10716	LM: Operat. mode MAN		
86.18	10717	LM: Operat. mode STOP		
86.19	10718	LM: Start w/o load		
86.20	10719	LM: Auto idle mode		
86.21	11600	LM: Discrete f/P +		
86.22	11601	LM: Discrete f/P -		
86.23	11602	LM: Discrete V/PF +		
86.24	11603	LM: Discrete V/PF -		
86.25	11604	LM: Freq. droop act.		
86.26	11605	LM: Volt. droop act.		
86.27	11606	LM: Ext. mns.decoupl.		
86.28	11607	LM: Critical mode		
86.29	12272	LM: Operat. mode TEST		
86.30	11924	LM: Lock keypad 1		

No.	ID	Name	Function	Note
86.31	11647	LM: ECU seq. B_IN_1		
86.32	11648	LM: ECU seq. B_IN_2		
86.33	11971	LM: 2nd disp.bright.		
86.34	11972	LM: Enable heater		
86.35	11974	LM: Syst. update		
86.38	11617	LM: Syn. mode CHECK		
86.39	11618	LM: Syn. mode PERMIS.		
86.40	11619	LM: Syn. mode RUN		
86.41	11975	LM: IOP Res.power 2		
86.42	11976	LM: MOP Res.power 2		
86.43	11994	LM: RP3000XT Full mode		
86.44	11995	LM: RP3000XT Annunciator		
86.45	11996	LM: RP3000XT Off mode		
86.81	11910	LM: Setpoint 2 freq.		
86.82	11911	LM: Setp. 2 load		
86.83	11912	LM: Setp. 2 voltage		
86.84	11913	LM: Setp.2 pwr.factor		
86.85	11914	LM: Enable MCB		
86.86	11915	LM: LDSS enabled		
86.87	11916	LM: Segment no.2 act.		
86.88	11917	LM: Segment no.3 act.		
86.89	11918	LM: Segment no.4 act.		
86.90	11919	LM: LDSS Priority 2		
86.91	11920	LM: LDSS Priority 3		
86.92	11921	LM: LDSS Priority 4		
86.93	11922	LM: Transition mode 1		
86.94	11923	LM: Transition mode 2		
86.96	11925	LM: Release f-control		
86.97	11926	LM: Release V-control		
86.98	11927	LM: P-control active		
86.99	11928	LM: Q control active		

9.3.2.24 Group 87: LM Results 2

- Binary outputs of function-related LogicsManager
- Logic command variables 87.17 - 87.77

No.	ID	Name	Function	Note
87.17	11406	LM: PID1 ctrl.release		The (boolean) result of the LogicsManager
87.18	11407	LM: PID2 ctrl.release		
87.19	11408	LM: PID3 ctrl.release		
87.23	11412	LM: LS5 command 1		
87.24	11413	LM: LS5 command 2		
87.25	11414	LM: LS5 command 3		
87.26	11415	LM: LS5 command 4		
87.27	11416	LM: LS5 command 5		
87.28	11417	LM: LS5 command 6		
87.29	11418	LM: Bypass min. Pgen.		
87.30	11419	LM: Run-up sync.		
87.31	11420	LM: Enable Mns dec.		
87.46	11435	LM: GCB open in MAN		
87.47	11436	LM: GCB close in MAN		
87.48	11437	LM: MCB open in MAN		
87.49	11438	LM: MCB close in MAN		
87.50	11439	LM: MAN engine start		
87.59	11448	LM: MAN engine stop		
87.60	11449	LM: Free derating		
87.61	11450	LM: GGB open in MAN		
87.62	11451	LM: GGB close in MAN		
87.66	11455	LM: Inhibit cranking		
87.67	11456	LM: Setp. 3 load		
87.68	11457	LM: Firing speed		
87.69	11458	LM: Speed detected		
87.70	11459	LM: Release eng.mon.		
87.71	11460	LM: Release cyl.temp.		
87.72	11461	LM: Disable mns.mon.		
87.73	11462	LM: Mains decoupl.MCB		
87.74	11463	LM: Inh.dead bus GCB		
87.75	11464	LM: Setp. 4 load		
87.76	11465	LM: Disable load ramp		
87.77	11979	LM: 2nd load SP ramp		

9.3.2.25 Group 88: LM Results 3

- Binary outputs of function-related LogicsManager (free alarms)
- Logic command variables 88.01 - 88.16

No.	ID	Name	Function	Note
88.01	11550	LM: Free alarm 1		The (boolean) result of the LogicsManager
88.02	11551	LM: Free alarm 2		
88.03	11552	LM: Free alarm 3		
88.04	11553	LM: Free alarm 4		
88.05	11554	LM: Free alarm 5		
88.06	11555	LM: Free alarm 6		
88.07	11556	LM: Free alarm 7		
88.08	11557	LM: Free alarm 8		
88.09	11558	LM: Free alarm 9		
88.10	11559	LM: Free alarm 10		
88.11	11560	LM: Free alarm 11		
88.12	11561	LM: Free alarm 12		
88.13	11562	LM: Free alarm 13		
88.14	11563	LM: Free alarm 14		
88.15	11564	LM: Free alarm 15		
88.16	11565	LM: Free alarm 16		

9.3.2.26 Group 90: AM Internal Values 0

- Binary outputs of function-related AnalogManagers (customer screen)
- Logic command variables 90.01 - 90.59

No.	ID	Name	Function	Note
90.01	7694	AM Cust.screen 1.1		The boolean result BR of the AnalogManager
90.02	7699	AM Cust.screen 1.2		
90.03	7704	AM Cust.screen 1.3		
90.04	7709	AM Cust.screen 1.4		
90.05	7714	AM Cust.screen 1.5		
90.06	7719	AM Cust.screen 1.6		
90.07	7724	AM Cust.screen 1.7		
90.08	7729	AM Cust.screen 1.8		
90.09	7734	AM Cust.screen 1.9		

No.	ID	Name	Function	Note
90.51	7739	AM Cust.screen 2.1		
90.52	7744	AM Cust.screen 2.2		
90.53	7749	AM Cust.screen 2.3		
90.54	7754	AM Cust.screen 2.4		
90.55	7759	AM Cust.screen 2.5		
90.56	7764	AM Cust.screen 2.6		
90.57	7769	AM Cust.screen 2.7		
90.58	7774	AM Cust.screen 2.8		
90.59	7779	AM Cust.screen 2.9		

9.3.2.27 Group 91: AM Internal Values 1

- Binary outputs of function-related AnalogManagers (internal values)
- Logic command variables 91.01 - 91.16

No.	ID	Name	Function	Note
91.01	9643	AM Internal value 1		The boolean result BR of the AnalogManager
91.02	9647	AM Internal value 2		
91.03	9651	AM Internal value 3		
91.04	9655	AM Internal value 4		
91.05	9659	AM Internal value 5		
91.06	9663	AM Internal value 6		
91.07	9667	AM Internal value 7		
91.08	9671	AM Internal value 8		
91.09	9675	AM Internal value 9		
91.10	9679	AM Internal value 10		
91.11	9683	AM Internal value 11		
91.12	9687	AM Internal value 12		
91.13	9691	AM Internal value 13		
91.14	9695	AM Internal value 14		
91.15	9699	AM Internal value 15		
91.16	9703	AM Internal value 16		
91.17 - 91.99		free		

9.3.2.28 Group 93: AM Analog outputs 1

- Binary outputs of function-related AnalogManagers (data sources)
- Logic command variables 93.01 - 93.24

No.	ID	Name	Function	Note
93.01	9704	AM Data source AO1	Data source analog output 1 is valid	The boolean result BR of the AnalogManager
93.02	9706	AM Data source AO2	Data source analog output 2 is valid	
93.03 - 93.20		free		
93.21	9717	AM Data s. ext. AO1	Data source of external analog output 1 is valid	
93.22	9719	AM Data s. ext. AO2	Data source of external analog output 2 is valid	
93.23	9721	AM Data s. ext. AO3	Data source of external analog output 3 is valid	
93.24	9723	AM Data s. ext. AO4	Data source of external analog output4 is valid	
93.25 - 93.99		free		

9.3.2.29 Group 96: LM Internal flags 1

- Binary outputs of function-related LogicsManagers (internal flags)
- Logic command variables 96.01 - 96.32

No.	ID	Name	Function	Note
96.01	10700	LM: Flag 1		The (boolean) result of the LogicsManager
96.02	10701	LM: Flag 2		
96.03	10702	LM: Flag 3		
96.04	10703	LM: Flag 4		
96.05	10704	LM: Flag 5		
96.06	10705	LM: Flag 6		
96.07	10706	LM: Flag 7		
96.08	10707	LM: Flag 8		
96.09	11609	LM: Flag 9		
96.10	11610	LM: Flag 10		
96.11	11611	LM: Flag 11		
96.12	11612	LM: Flag 12		
96.13	11613	LM: Flag 13		
96.14	11614	LM: Flag 14		
96.15	11615	LM: Flag 15		
96.16	11616	LM: Flag 16		
96.17	12232	LM: Flag 17		
96.18	12234	LM: Flag 18		

No.	ID	Name	Function	Note
96.19	12236	LM: Flag 19		
96.20	12238	LM: Flag 20		
96.21	12242	LM: Flag 21		
96.22	12244	LM: Flag 22		
96.23	12246	LM: Flag 23		
96.24	12248	LM: Flag 24		
96.25	12252	LM: Flag 25		
96.26	12254	LM: Flag 26		
96.27	12256	LM: Flag 27		
96.28	12258	LM: Flag 28		
96.29	12262	LM: Flag 29		
96.30	12264	LM: Flag 30		
96.31	12266	LM: Flag 31		
96.32	12268	LM: Flag 32		

9.3.2.30 Group 98: LM External DOs 1

- Binary outputs of function-related LogicsManagers (external DOs)
- Logic command variables 98.01 - 98.32

No.	ID	Name	Function	Note
98.01	11892	LM: External DO 1		The (boolean) result of the Log-icsManager
98.02	11893	LM: External DO 2		
98.03	11894	LM: External DO 3		
98.04	11895	LM: External DO 4		
98.05	11896	LM: External DO 5		
98.06	11897	LM: External DO 6		
98.07	11898	LM: External DO 7		
98.08	11899	LM: External DO 8		
98.09	11900	LM: External DO 9		
98.10	11901	LM: External DO 10		
98.11	11902	LM: External DO 11		
98.12	11903	LM: External DO 12		
98.13	11904	LM: External DO 13		
98.14	11905	LM: External DO 14		
98.15	11906	LM: External DO 15		
98.16	11907	LM: External DO 16		

No.	ID	Name	Function	Note
98.17	11390	LM: External DO 17		
98.18	11391	LM: External DO 18		
98.19	11392	LM: External DO 19		
98.20	11393	LM: External DO 20		
98.21	11394	LM: External DO 21		
98.22	11395	LM: External DO 22		
98.23	11396	LM: External DO 23		
98.24	11397	LM: External DO 24		
98.25	11398	LM: External DO 25		
98.26	11399	LM: External DO 26		
98.27	11400	LM: External DO 27		
98.28	11401	LM: External DO 28		
98.29	11402	LM: External DO 29		
98.30	11403	LM: External DO 30		
98.31	11404	LM: External DO 31		
98.32	11405	LM: External DO 32		

9.3.2.31 Group 99: LM Internal DOs 1

- Binary outputs of function-related LogicsManagers (internal discrete outputs e.g. relays)
- Logic command variables 99.01 - 99.12

No.	ID	Name	Function	Note
99.01	11870	LM: Ready for op. OFF	The flag *"Ready for operation"* (negative logic) is OFF	ON would mean the device is NOT READY for operation
99.02	11871	LM: Relay 2		The (boolean) result of the LogicsManager
99.03	11872	LM: Relay 3		
99.04	11873	LM: Relay 4		
99.05	11874	LM: Relay 5		
99.06	11875	LM: Relay 6		
99.07	11876	LM: Relay 7		
99.08	11877	LM: Relay 8		
99.09	11878	LM: Relay 9		
99.10	11879	LM: Relay 10		
99.11	11880	LM: Relay 11		
99.12	11881	LM: Relay 12		

9.3.3 Logical Symbols

The following symbols are used for the graphical programming of the LogicsManager. The easYgen displays symbols according to the IEC standard by default.

- Use parameter 4117 ↳ p. 479 to change display mode to ASA standard.

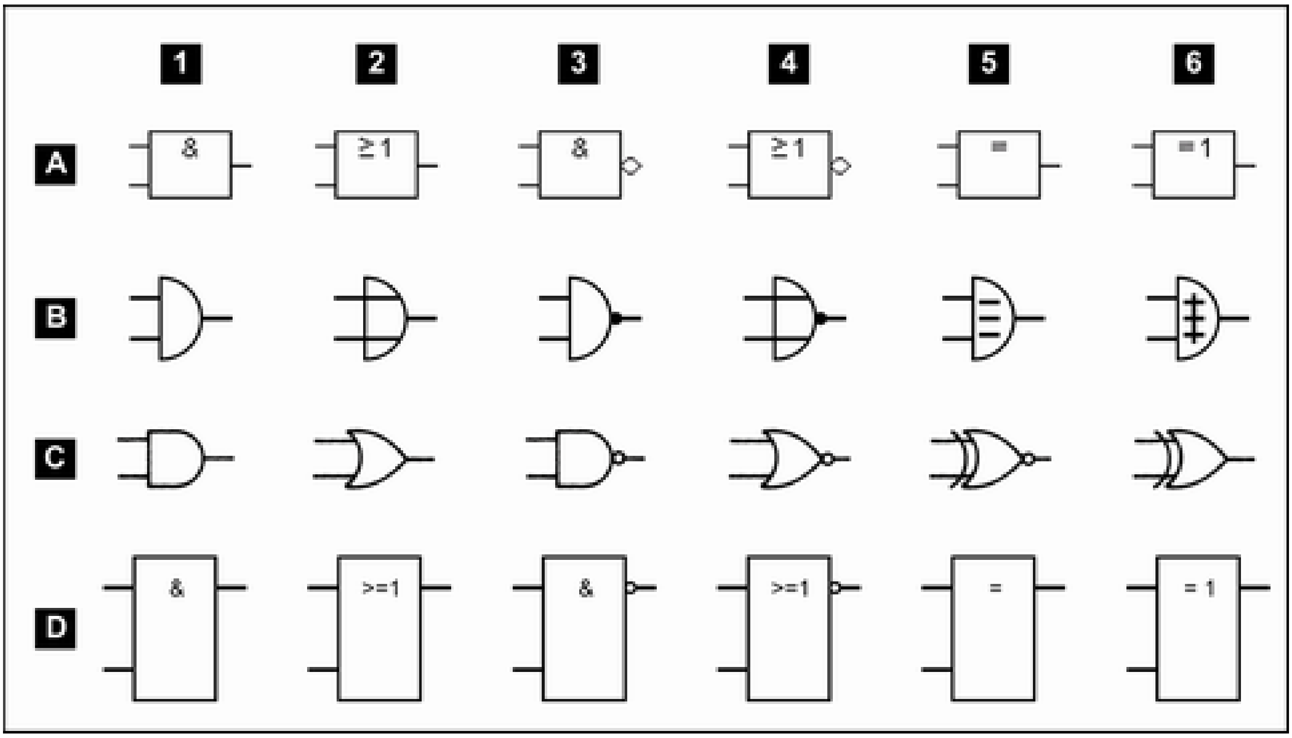


Fig. 358: Logical symbols

Row	... according to standard:
A	easYgen (default: IEC)
B	DIN 40 700
C	ASA US MIL (configurable)
D	IEC617-12

Meaning of the columns					
1	2	3	4	5	6
AND	OR	NAND	NOR	NXOR	XOR

AND				OR				NAND				NOR				NXOR				XOR		
x1	x2	y		x1	x2	y		x1	x2	y		x1	x2	y		x1	x2	y		x1	x2	y
0	0	0		0	0	0		0	0	1		0	0	1		0	0	1		0	0	0
0	1	0		0	1	1		0	1	1		0	1	0		0	1	0		0	1	1

AND				OR				NAND				NOR				NXOR				XOR		
x1	x2	y		x1	x2	y		x1	x2	y		x1	x2	y		x1	x2	y		x1	x2	y
1	0	0		1	0	1		1	0	1		1	0	0		1	0	0		1	0	1
1	1	1		1	1	1		1	1	0		1	1	0		1	1	1		1	1	0

Table 158: Truth table

9.3.4 Logical Outputs

The logical outputs or combinations may be grouped into three categories:

- Internal logical flags
- Internal functions
- Relay outputs

The numbers of the logical outputs in the third column may again be used as input variable for other outputs in the LogicsManager.

Internal flags

32 internal logical flags may be programmed to activate/deactivate functions. This permits more than 3 commands to be included in a logical function. They may be used like "auxiliary flags".

Name	Function	Number	ID
LM: Flag 1	Internal flag 1	96.01	10700
LM: Flag 2	Internal flag 2	96.02	10701
LM: Flag 3	Internal flag 3	96.03	10702
LM: Flag 4	Internal flag 4	96.04	10703
LM: Flag 5	Internal flag 5	96.05	10704
LM: Flag 6	Internal flag 6	96.06	10705
LM: Flag 7	Internal flag 7	96.07	10706
LM: Flag 8	Internal flag 8	96.08	10707
LM: Flag 9	Internal flag 9	96.09	11609
LM: Flag 10	Internal flag 10	96.10	11610
LM: Flag 11	Internal flag 11	96.11	11611
LM: Flag 12	Internal flag 12	96.12	11612
LM: Flag 13	Internal flag 13	96.13	11613
LM: Flag 14	Internal flag 14	96.14	11614
LM: Flag 15	Internal flag 15	96.15	11615
LM: Flag 16	Internal flag 16	96.16	11616
LM: Flag 17	Internal flag 17	96.17	12232
LM: Flag 18	Internal flag 18	96.18	12234
LM: Flag 19	Internal flag 19	96.19	12236
LM: Flag 20	Internal flag 20	96.20	12238

Name	Function	Number	ID
LM: Flag 21	Internal flag 21	96.21	12242
LM: Flag 22	Internal flag 22	96.22	12244
LM: Flag 23	Internal flag 23	96.23	12246
LM: Flag 24	Internal flag 24	96.24	12248
LM: Flag 25	Internal flag 25	96.25	12252
LM: Flag 26	Internal flag 26	96.26	12254
LM: Flag 27	Internal flag 27	96.27	12256
LM: Flag 28	Internal flag 28	96.28	12258
LM: Flag 29	Internal flag 29	96.29	12262
LM: Flag 30	Internal flag 30	96.30	12264
LM: Flag 31	Internal flag 31	96.31	12266
LM: Flag 32	Internal flag 32	96.32	12268

Internal functions

The following logical functions may be used to activate/deactivate functions.

Name	Function	Number	ID
LM: Start req in AUTO	Start in AUTOMATIC operating mode (parameter 12120 ➡ p. 290/➡ p. 927)	86.09	10708
LM: Stop req. in AUTO	Stop in AUTOMATIC operating mode (parameter 12190 ➡ p. 290/➡ p. 927)	86.10	10709
LM: Inhibit emerg.run	Blocking or interruption of an emergency power operating in AUTOMATIC operating mode (parameter 12200 ➡ p. 314/➡ p. 927)	86.11	10710
LM: Undelay close GCB	Immediately closing of the GCB after engine start without waiting for the engine delayed monitoring and generator stable timer to expire (parameter 12210 ➡ p. 226/➡ p. 927)	86.12	10711
LM: LS interf. EthA	Enables to switch load share interface between CAN and Ethernet A (parameter 11986 ➡ p. 659)	86.13	11987
LM: Constant idle run	Enables idle/rated speed modes (parameter 12550 ➡ p. 176/➡ p. 928).	86.14	10713
LM: Ext. acknowledge	The alarm acknowledgement is performed from an external source (parameter 12490 ➡ p. 407/➡ p. 928)	86.15	10714
LM: Operat. mode AUTO	Activation of the AUTOMATIC operating mode (parameter 12510 ➡ p. 288/➡ p. 928)	86.16	10715
LM: Operat. mode MAN	Activation of the MANUAL operating mode (parameter 12520 ➡ p. 288/➡ p. 928)	86.17	10716
LM: Operat. mode STOP	Activation of the STOP operating mode (parameter 12530 ➡ p. 289/➡ p. 928)	86.18	10717
LM: Start w/o load	Starting the engine without closing the GCB (parameter 12540 ➡ p. 290/➡ p. 928/➡ p. 928)	86.19	10718
LM: Auto idle mode	Automatic idle mode (blocks the undervoltage, underfrequency, and underspeed monitoring for a configured time automatically, parameter 12570 ➡ p. 176/➡ p. 928)	86.20	10719
LM: Discrete f/P +	Raise frequency / real power setpoint (parameter 12900 ➡ p. 287/➡ p. 929)	86.21	11600
LM: Discrete f/P -	Lower frequency / real power setpoint (parameter 12901 ➡ p. 287/➡ p. 929)	86.22	11601
LM: Discrete V/PF +	Raise voltage / power factor setpoint (parameter 12902 ➡ p. 287/➡ p. 929)	86.23	11602
LM: Discrete V/PF -	Lower voltage / power factor setpoint (parameter 12903 ➡ p. 287/➡ p. 929)	86.24	11603
LM: Freq. droop act.	Activation of the frequency droop (parameter 12904 ➡ p. 265/➡ p. 929)	86.25	11604
LM: Volt. droop act.	Activation of the voltage droop (parameter 12905 ➡ p. 241/➡ p. 929)	86.26	11605

Name	Function	Number	ID
LM: Ext. mns.decoupl.	Activation of the mains decoupling function (parameter 12922 ➨ p. 363/➨ p. 929)	86.27	11606
LM: Critical mode	Activation of critical mode operation (parameter 12220 ➨ p. 298/➨ p. 927)	86.28	11607
LM: Operat. mode TEST		86.29	12272
LM: Lock keypad 1		86.30	11924
LM: ECU seq. B_IN_1		86.31	11647
LM: ECU seq. B_IN_2		86.32	11648
LM: 2nd disp.bright.		86.33	11971
LM: Enable heater		86.34	11972
LM: Syst. update		86.35	11974
LM: Syn. mode CHECK	Activation of CHECK synchronization mode (parameter 12906 ➨ p. 233/➨ p. 929)	86.38	11617
LM: Syn. mode PERMIS.	Activation of PERMISSIVE synchronization mode (parameter 12907 ➨ p. 233/➨ p. 929)	86.39	11618
LM: Syn. mode RUN	Activation of RUN synchronization mode (parameter 12908 ➨ p. 233/➨ p. 929)	86.40	11619
LM: IOP Res.power 2		86.41	11975
LM: MOP Res.power 2		86.42	11976
LM: Setpoint 2 freq.	Activates the frequency setpoint 2 (parameter 12918 ➨ p. 264/➨ p. 929)	86.81	11910
LM: Setp. 2 load	Activates the load setpoint 2 (parameter 12919 ➨ p. 273/➨ p. 542/➨ p. 929)	86.82	11911
LM: Setp. 2 voltage	Activates the voltage setpoint 2 (parameter 12920 ➨ p. 241/➨ p. 929)	86.83	11912
LM: Setp.2 pwr.factor	Activates the power factor setpoint 2 (parameter 12921 ➨ p. 245/➨ p. 929)	86.84	11913
LM: Enable MCB	Enables the MCB (parameter 12923 ➨ p. 232/➨ p. 929)	86.85	11914
LM: LDSS enabled	Activation of load-dependent start/stop (parameter 12930 ➨ p. 303/➨ p. 536/➨ p. 929)	86.86	11915
LM: Segment no.2 act.	Assigns the genset to load share segm. #2 (parameter 12929 ➨ p. 256/➨ p. 929)	86.87	11916
LM: Segment no.3 act.	Assigns the genset to load share segm. #3 (parameter 12928 ➨ p. 256/➨ p. 929)	86.88	11917
LM: Segment no.4 act.	Assigns the genset to load share segm. #4 (parameter 12927 ➨ p. 256/➨ p. 929)	86.89	11918
LM: LDSS Priority 2	Sets the LDSS priority to 2 (parameter 12926 ➨ p. 303/➨ p. 929)	86.90	11919
LM: LDSS Priority 3	Sets the LDSS priority to 3 (parameter 12925 ➨ p. 303/➨ p. 929)	86.91	11920
LM: LDSS Priority 4	Sets the LDSS priority to 4 (parameter 12924 ➨ p. 303/➨ p. 929)	86.92	11921
LM: Transition mode 1	Activates breaker transition mode 1 (parameter 12931 ➨ p. 221/➨ p. 929)	86.93	11922
LM: Transition mode 2	Activates breaker transition mode 2 (parameter 12932 ➨ p. 222/➨ p. 929)	86.94	11923
LM: Release f-control		86.96	11925
LM: Release V-control		86.97	11926
LM: P-control active		86.98	11927
LM: Q control active		86.99	11928
LM: PID1 ctrl.release		87.17	11406
LM: PID2 ctrl.release		87.18	11407
LM: PID3 ctrl.release		87.19	11408

Name	Function	Number	ID
LM: LS5 command 1		87.23	11412
LM: LS5 command 2		87.24	11413
LM: LS5 command 3		87.25	11414
LM: LS5 command 4		87.26	11415
LM: LS5 command 5		87.27	11416
LM: LS5 command 6		87.28	11417
LM: Bypass min. Pgen.		87.29	11418
LM: Run-up sync.		87.30	11419
LM: Enable Mns dec.		87.31	11420
LM: GCB open in MAN		87.46	11435
LM: GCB close in MAN		87.47	11436
LM: MCB open in MAN		87.48	11437
LM: MCB close in MAN		87.49	11438
LM: MAN engine start		87.50	11439
LM: MAN engine stop		87.59	11448
LM: Free derating		87.60	11449
LM: GGB open in MAN		87.61	11450
LM: GGB close in MAN		87.62	11451
LM: Inhibit cranking		87.66	11455
LM: Setp. 3 load		87.67	11456
LM: Firing speed		87.68	11457
LM: Speed detected		87.69	11458
LM: Release eng.mon.		87.70	11459
LM: Release cyl.temp.		87.71	11460
LM: Disable mns.mon.		87.72	11461
LM: Mains decoupl.MCB		87.73	11462
LM: Inh.dead bus GCB		87.74	11463
LM: Setp. 4 load		87.75	11464
LM: Disable load ramp		87.76	11465
LM: 2nd load SP ramp		87.77	11979
LM: Free alarm 1		88.01	11550
LM: Free alarm 2		88.02	11551
LM: Free alarm 3		88.03	11552
LM: Free alarm 4		88.04	11553
LM: Free alarm 5		88.05	11554
LM: Free alarm 6		88.06	11555
LM: Free alarm 7		88.07	11556

Name	Function	Number	ID
LM: Free alarm 8		88.08	11557
LM: Free alarm 9		88.09	11558
LM: Free alarm 10		88.10	11559
LM: Free alarm 11		88.11	11560
LM: Free alarm 12		88.12	11561
LM: Free alarm 13		88.13	11562
LM: Free alarm 14		88.14	11563
LM: Free alarm 15		88.15	11564
LM: Free alarm 16		88.16	11565

Priority hierarchy of the logical outputs

The following table contains the priority relationships between the start conditions of the logical outputs in the LogicsManager:

Prioritized function	Overrides	Reaction
Critical mode	Stop req. in Auto	A start will still be performed.
	Start req. in Auto	The behavior of the system depends on the configuration of the related parameters.
Stop req. in Auto	Start req. in Auto	No start will be performed.
	Emergency power	No start will be performed.
	Idle mode	No start will be performed.
Start w/o load	Start req. in Auto	The GCB remains open / will be opened.
Emergency power	Start w/o load	The GCB will be closed nevertheless.
	Critical mode	The GCB will be closed nevertheless. The alarm class management is still performed like for the critical mode. If emergency power is already enabled and the critical mode will be enabled then, a pause time may be configured for the emergency power operation.
Inhibit emergency run	Emergency power	No start will be performed.
	Emergency power during Start w/o load	The generator keeps on running without taking over load.

Relay outputs

All relays may be controlled directly by the LogicsManager depending on the respective application mode.

Name LM:	Function	Number	ID
Relay 1 (Ready for operation OFF)	If this logical output becomes true, the relay output 1 will be activated	99.01	11870
Relay 2	If this logical output becomes true, the relay output 2 will be activated	99.02	11871
Relay 3	If this logical output becomes true, the relay output 3 will be activated	99.03	11872
Relay 4	If this logical output becomes true, the relay output 4 will be activated	99.04	11873

Name LM:	Function	Number	ID
Relay 5	If this logical output becomes true, the relay output 5 will be activated	99.05	11874
Relay 6	If this logical output becomes true, the relay output 6 will be activated	99.06	11875
Relay 7	If this logical output becomes true, the relay output 7 will be activated	99.07	11876
Relay 8	If this logical output becomes true, the relay output 8 will be activated	99.08	11877
Relay 9	If this logical output becomes true, the relay output 9 will be activated	99.09	11878
Relay 10	If this logical output becomes true, the relay output 10 will be activated	99.10	11879
Relay 11	If this logical output becomes true, the relay output 11 will be activated	99.11	11880
Relay 12	If this logical output becomes true, the relay output 12 will be activated	99.12	11881

Name	Function	Number	ID
External DO 1	If this logical output becomes true, the external relay output 1 will be activated	98.01	11892
External DO 2	If this logical output becomes true, the external relay output 2 will be activated	98.02	11893
External DO 3	If this logical output becomes true, the external relay output 3 will be activated	98.03	11894
External DO 4	If this logical output becomes true, the external relay output 4 will be activated	98.04	11895
External DO 5	If this logical output becomes true, the external relay output 5 will be activated	98.05	11896
External DO 6	If this logical output becomes true, the external relay output 6 will be activated	98.06	11897
External DO 7	If this logical output becomes true, the external relay output 7 will be activated	98.07	11898
External DO 8	If this logical output becomes true, the external relay output 8 will be activated	98.08	11899
External DO 9	If this logical output becomes true, the external relay output 9 will be activated	98.09	11900
External DO 10	If this logical output becomes true, the external relay output 10 will be activated	98.10	11901
External DO 11	If this logical output becomes true, the external relay output 11 will be activated	98.11	11902
External DO 12	If this logical output becomes true, the external relay output 12 will be activated	98.12	11903
External DO 13	If this logical output becomes true, the external relay output 13 will be activated	98.13	11904
External DO 14	If this logical output becomes true, the external relay output 14 will be activated	98.14	11905
External DO 15	If this logical output becomes true, the external relay output 15 will be activated	98.15	11906
External DO 16	If this logical output becomes true, the external relay output 16 will be activated	98.16	11907
External DO 17	If this logical output becomes true, the external relay output 17 will be activated	98.17	11390

Name	Function	Number	ID
External DO 18	If this logical output becomes true, the external relay output 18 will be activated	98.18	11391
External DO 19	If this logical output becomes true, the external relay output 19 will be activated	98.19	11392
External DO 20	If this logical output becomes true, the external relay output 20 will be activated	98.20	11393
External DO 21	If this logical output becomes true, the external relay output 21 will be activated	98.21	11394
External DO 22	If this logical output becomes true, the external relay output 22 will be activated	98.22	11395
External DO 23	If this logical output becomes true, the external relay output 23 will be activated	98.23	11396
External DO 24	If this logical output becomes true, the external relay output 24 will be activated	98.24	11397
External DO 25	If this logical output becomes true, the external relay output 25 will be activated	98.25	11398
External DO 26	If this logical output becomes true, the external relay output 26 will be activated	98.26	11399
External DO 27	If this logical output becomes true, the external relay output 27 will be activated	98.27	11400
External DO 28	If this logical output becomes true, the external relay output 28 will be activated	98.28	11401
External DO 29	If this logical output becomes true, the external relay output 29 will be activated	98.29	11402
External DO 30	If this logical output becomes true, the external relay output 30 will be activated	98.30	11403
External DO 31	If this logical output becomes true, the external relay output 31 will be activated	98.31	11404
External DO 32	If this logical output becomes true, the external relay output 32 will be activated	98.32	11405

<table>
<tr><th colspan="2">Relay</th><th colspan="11">Application mode (parameter 3444 ↬ p. 220)</th></tr>
<tr><th>No.</th><th>Term.</th><th>None A01</th><th>GCB open A02</th><th>GCB A03</th><th>GCB/ MCB A04</th><th>GCB/G GB A05</th><th>GCB/G GB/MC B A06</th><th>GCB/LS 5 A07</th><th>GCB/L-MCB A08</th><th>GCB/G GB/L-MCB A09</th><th>GCB/L-GGB A10</th><th>GCB/L-GGB/L-MCB A11</th></tr>
<tr><td colspan="13">Internal relay outputs, board #1</td></tr>
<tr><td>[R 01]</td><td>41/42</td><td colspan="11">'Ready for operation'; additionally programmable with LogicsManager
CAUTION! Only relay [R 01] has an inverse logic. The relay opens (all other relays close), if the logical output of the LogicsManager becomes TRUE.</td></tr>
<tr><td>[R 02]</td><td>43/46</td><td colspan="11">LogicsManager; pre-assigned with 'Centralized alarm (horn)'</td></tr>
<tr><td>[R 03]</td><td>44/46</td><td colspan="11">LogicsManager; pre-assigned with 'Starter'</td></tr>
<tr><td>[R 04]</td><td>45/46</td><td colspan="11">LogicsManager; pre-assigned with 'Diesel: Fuel solenoid, Gas: Gas valve'</td></tr>
<tr><td>[R 05]</td><td>47/48</td><td colspan="11">LogicsManager; pre-assigned with 'Diesel: Preglow, Gas: Ignition'</td></tr>
<tr><td>[R 06]</td><td>49/50</td><td colspan="2">LogicsManager</td><td colspan="9">Command: close GCB</td></tr>
<tr><td>[R 07]</td><td>51/52</td><td>Logi-csMan-ager</td><td colspan="10">Command: open GCB</td></tr>
<tr><td>[R 08]</td><td>53/54</td><td colspan="3">LogicsManager</td><td>Com-mand: close MCB</td><td>Logi-csMan-ager</td><td>Com-mand: close MCB</td><td colspan="5">LogicsManager</td></tr>
</table>

<table>
<tr><th colspan="2">Relay</th><th colspan="11">Application mode (parameter 3444 p. 220)</th></tr>
<tr><th>No.</th><th>Term.</th><th>None A01</th><th>GCB open A02</th><th>GCB A03</th><th>GCB/ MCB A04</th><th>GCB/GGB A05</th><th>GCB/GGB/MCB A06</th><th>GCB/LS5 A07</th><th>GCB/L-MCB A08</th><th>GCB/GGB/L-MCB A09</th><th>GCB/L-GGB A10</th><th>GCB/L-GGB/L-MCB A11</th></tr>
<tr><td>[R 09]</td><td>55/56</td><td colspan="3">LogicsManager; pre-assigned with 'Mains decoupling'</td><td>Command: open MCB</td><td>LogicsManager; pre-assigned with 'Mains decoupling'</td><td>Command: open MCB</td><td colspan="5">LogicsManager; pre-assigned with 'Mains decoupling'</td></tr>
<tr><td>[R 10]</td><td>57/60</td><td colspan="4">LogicsManager; pre-assigned with 'Auxiliary services'</td><td colspan="2">Command: close GGB</td><td colspan="2">LogicsManager; pre-assigned with 'Auxiliary services'</td><td>Command: close GGB</td><td colspan="2">LogicsManager; pre-assigned with 'Auxiliary services'</td></tr>
<tr><td>[R 11]</td><td>58/60</td><td colspan="4">LogicsManager; pre-assigned with 'Alarm class A, B active'</td><td colspan="2">Command: open GGB</td><td colspan="2">LogicsManager; pre-assigned with 'Alarm class A, B active'</td><td>Command: open GGB</td><td colspan="2">LogicsManager; pre-assigned with 'Alarm class A, B active'</td></tr>
<tr><td>[R 12]</td><td>59/60</td><td colspan="11">LogicsManager; pre-assigned with 'Alarm class C, D, E, F active'</td></tr>
</table>

9.3.5 Factory Settings

LogicsManager's default definition

ID	Name	Function
4871	Inhibit cranking	(02.01 LM FALSE And True) And True
5580	PID1 ctrl.release	(False And True) And True
5593	PID2 ctrl.release	(False And True) And True
5679	PID3 ctrl.release	(False And True) And True
7794	Enable 2nd display brightness	(Not 04.64 Key activation And True) And True
7799	Enable front foil heater	(True And True) And True
7801	System update	(False And True) And True
8120	Free alarm 1	(02.01 LM FALSE And True) And True
8124	Free alarm 2	(02.01 LM FALSE And True) And True
8128	Free alarm 3	(02.01 LM FALSE And True) And True
8132	Free alarm 4	(02.01 LM FALSE And True) And True
8136	Free alarm 5	(02.01 LM FALSE And True) And True
8140	Free alarm 6	(02.01 LM FALSE And True) And True
8144	Free alarm 7	(02.01 LM FALSE And True) And True
8148	Free alarm 8	(02.01 LM FALSE And True) And True
8154	Free alarm 9	(02.01 LM FALSE And True) And True
8158	Free alarm 10	(02.01 LM FALSE And True) And True
8165	Free alarm 11	(02.01 LM FALSE And True) And True
8170	Free alarm 12	(02.01 LM FALSE And True) And True
8174	Free alarm 13	(02.01 LM FALSE And True) And True
8178	Free alarm 14	(02.01 LM FALSE And True) And True
8182	Free alarm 15	(02.01 LM FALSE And True) And True

ID	Name	Function
8186	Free alarm 16	(02.01 LM FALSE And True) And True
11978	2nd load control setpoint ramp	(False And 02.02 LM TRUE) And 02.02 LM TRUE
12110	Relay 2	(03.05 Horn And True) And True
12120	Start req in AUTO	(09.02 Discrete input 2 Or False) Or 04.13 Remote request
12130	Relay 5	(03.04 Preglow / Ignition And True) And True
12140	Relay 6	(False And True) And True
12150	Relay 7	(False And True) And True
12160	Relay 8	(False And True) And True
12170	Relay 9	(False And True) And True
12180	Relay 10	(03.01 Auxiliary services And True) And True
12190	Stop req. in AUTO	(False And True) And True
12200	Inhibit emerg.run	(False And True) And True
12210	Undelay close GCB	(04.09 Emergency mode And True) And True
12220	Critical mode	(False And Not 05.08 Start fail) And Not 09.01 Discrete input 1
12230	Flag 1	(02.01 LM FALSE And True) And True
12231	Flag 17	(02.01 LM FALSE And True) And True
12233	Flag 18	(02.01 LM FALSE And True) And True
12235	Flag 19	(02.01 LM FALSE And True) And True
12237	Flag 20	(02.01 LM FALSE And True) And True
12240	Flag 2	(02.01 LM FALSE And True) And True
12241	Flag 21	(02.01 LM FALSE And True) And True
12243	Flag 22	(02.01 LM FALSE And True) And True
12245	Flag 23	(02.01 LM FALSE And True) And True
12247	Flag 24	(02.01 LM FALSE And True) And True
12250	Flag 3	(02.01 LM FALSE And True) And True
12251	Flag 25	(02.01 LM FALSE And True) And True
12253	Flag 26	(02.01 LM FALSE And True) And True
12255	Flag 27	(02.01 LM FALSE And True) And True
12257	Flag 28	(02.01 LM FALSE And True) And True
12260	Flag 4	(02.01 LM FALSE And True) And True
12261	Flag 29	(02.01 LM FALSE And True) And True
12263	Flag 30	(02.01 LM FALSE And True) And True
12265	Flag 31	(02.01 LM FALSE And True) And True
12267	Flag 32	(02.01 LM FALSE And True) And True
12269	Setp. 4 load	(False And True) And True
12270	Flag 5	(02.01 LM FALSE And True) And True
12271	Operat. mode TEST	(False And True) And True
12280	Flag 6	(02.01 LM FALSE And True) And True
12290	Flag 7	(02.01 LM FALSE And True) And True
12300	Flag 8	(02.01 LM FALSE And True) And True
12310	Relay 3	(03.02 Starter And True) And True
12320	Relay 4	(03.28 Start/Gas And True) And True

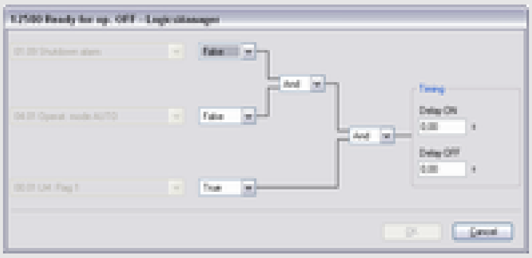
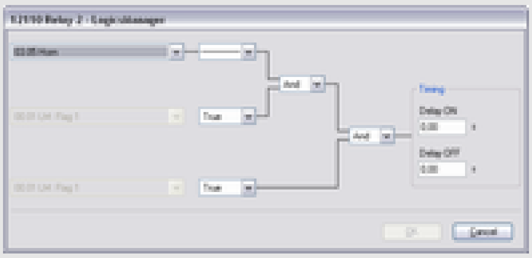
ID	Name	Function
12330	External DO 1	(False And True) And True
12331	External DO 17	(False And True) And True
12332	External DO 18	(False And True) And True
12333	External DO 19	(False And True) And True
12334	External DO 20	(False And True) And True
12335	External DO 21	(False And True) And True
12336	External DO 22	(False And True) And True
12337	External DO 23	(False And True) And True
12338	External DO 24	(False And True) And True
12339	External DO 25	(False And True) And True
12340	External DO 2	(False And True) And True
12341	External DO 26	(False And True) And True
12342	External DO 27	(False And True) And True
12343	External DO 28	(False And True) And True
12344	External DO 29	(False And True) And True
12345	External DO 30	(False And True) And True
12346	External DO 31	(False And True) And True
12347	External DO 32	(False And True) And True
12350	External DO 3	(False And True) And True
12360	External DO 4	(False And True) And True
12370	External DO 5	(False And True) And True
12380	External DO 6	(False And True) And True
12390	External DO 7	(False And True) And True
12400	External DO 8	(False And True) And True
12410	External DO 9	(False And True) And True
12420	External DO 10	(False And True) And True
12430	External DO 11	(False And True) And True
12440	External DO 12	(False And True) And True
12450	External DO 13	(False And True) And True
12460	External DO 14	(False And True) And True
12470	External DO 15	(False And True) And True
12480	External DO 16	(False And True) And True
12490	Ext. acknowledge	(09.05 Discrete input 5 And True) Or 04.14 Remote acknowledge
12510	Operat. mode AUTO	(False And True) And True
12520	Operat. mode MAN	(False And True) And True
12530	Operat. mode STOP	(False And True) And True
12540	Start w/o load	(False And True) And True
12540	Start w/o load	(False And True) And True
12550	Constant idle run	(False And True) And True
12560	Relay 11	(01.08 Warning alarm And True) And True
12570	Auto idle mode	(False And True) And True
12580	Ready for op. OFF	(False And False) And True

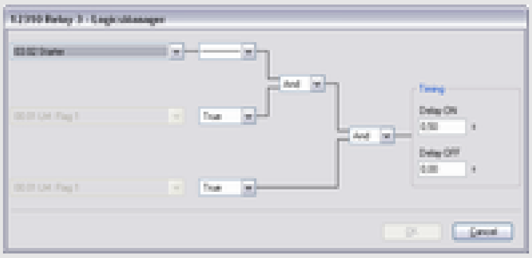
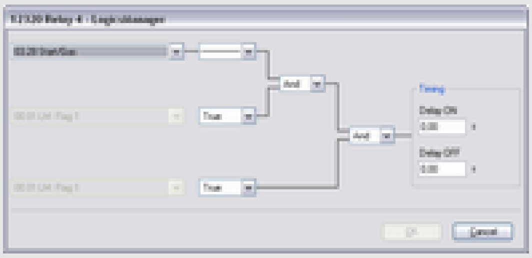
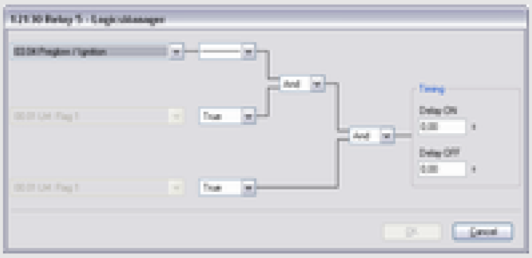
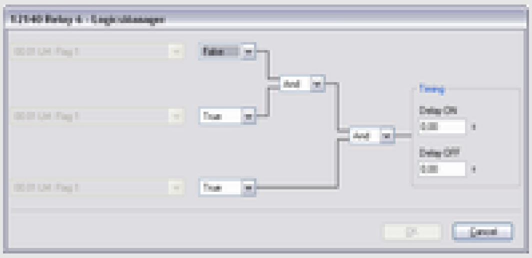
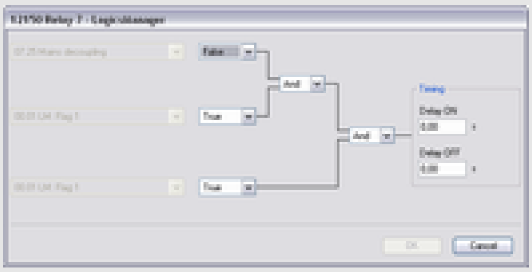
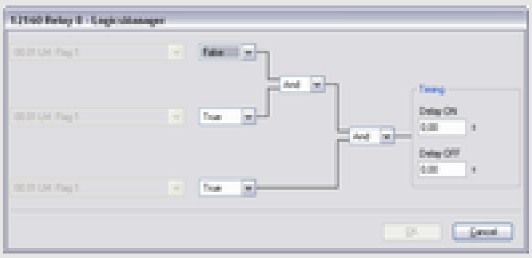
ID	Name	Function
12590	Relay 12	(01.09 Shutdown alarm And True) And True
12604	IOP Reserve power 2	(False And True) And True
12605	MOP Reserve power 2	(False And True) And True
12853	Disable load setpoint ramp	(02.01 LM FALSE And True) And True
12900	Discrete f/P +	(False And True) And True
12901	Discrete f/P -	(False And True) And True
12902	Discrete V/PF +	(False And True) And True
12903	Discrete V/PF -	(False And True) And True
12904	Freq. droop act.	(08.17 Missing members Or 08.06 GCB fail to open) And True
12905	Volt. droop act.	(08.17 Missing members Or 08.06 GCB fail to open) And True
12906	Syn. mode CHECK	(False And True) And True
12907	Syn. mode PERMIS.	(False And True) And True
12908	Syn. mode RUN	(False And True) And True
12909	Release f-control	(True And True) And True
12910	Flag 9	(02.01 LM FALSE And True) And True
12911	Flag 10	(02.01 LM FALSE And True) And True
12912	Flag 11	(02.01 LM FALSE And True) And True
12913	Flag 12	(02.01 LM FALSE And True) And True
12914	Flag 13	(02.01 LM FALSE And True) And True
12915	Flag 14	(02.01 LM FALSE And True) And True
12916	Flag 15	(02.01 LM FALSE And True) And True
12917	Flag 16	(02.01 LM FALSE And True) And True
12918	Setpoint 2 freq.	(False And True) And True
12919	Setp. 2 load	(False And True) And True
12920	Setp. 2 voltage	(False And True) And True
12921	Setp.2 pwr.factor	(False And True) And True
12922	Ext. mns.decoupl.	(False And True) And True
12923	Enable MCB	(09.06 Discrete input 6 And Not 08.07 MCB fail to close) And Not 07.05 Mns.ph.rot. mismatch
12924	LDSS Priority 4	(02.01 LM FALSE And True) And True
12925	LDSS Priority 3	(02.01 LM FALSE And True) And True
12926	LDSS Priority 2	(02.01 LM FALSE And True) And True
12927	Segment no.4 act.	(02.01 LM FALSE And True) And True
12928	Segment no.3 act.	(02.01 LM FALSE And True) And True
12929	Segment no.2 act.	(02.01 LM FALSE And True) And True
12930	LD start stop	(False And True) And True
12931	Transition mode 1	(False And True) And True
12932	Transition mode 2	(False And True) And True
12938	Release V-control	(True And True) And True
12940	P control	(04.07 MCB closed And 04.06 GCB closed) And True
12941	Q control	(04.07 MCB closed And 04.06 GCB closed) And True
12942	Enable mains decoupl.	(02.02 LM TRUE And True) And True

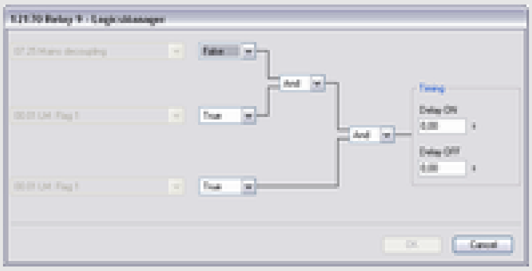
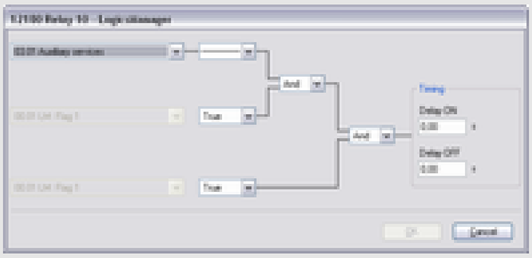
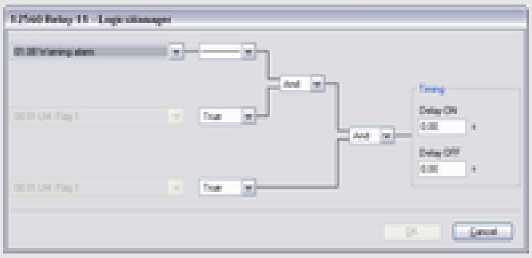
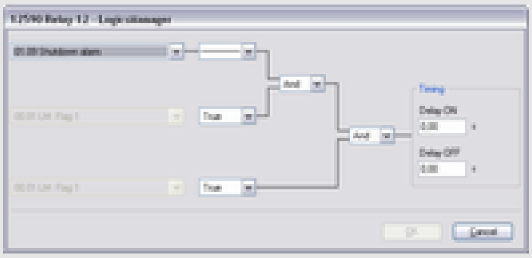
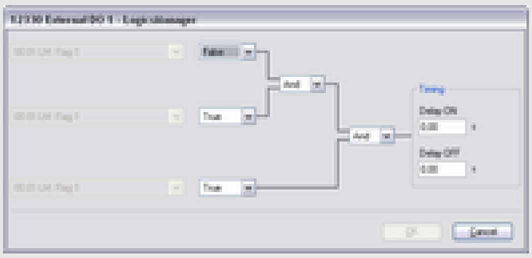
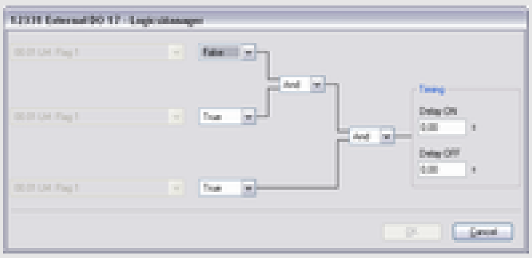
ID	Name	Function
12951	Firing speed detection	(02.34 Firing speed electr. Or 02.35 Firing speed rpm) And True
12970	MAN engine start	(False And True) And True
12971	MAN engine stop	(False And True) And True
12974	MCB open in MAN	(False And True) And True
12975	MCB close in MAN	(False And True) And True
12976	GCB open in MAN	(False And True) And True
12977	GCB close in MAN	(False And True) And True
12978	Lock keypad 1	(False And True) And True
12989	Speed detection	(02.36 Speed electr. Or 02.37 Speed rpm) And True
12998	Setp. 3 load	(False And True) And True
12999	Release eng.mon.	(02.34 Firing speed electr. Or 02.35 Firing speed rpm) And 03.28 Start/Gas
15146	Free derating	(02.01 LM FALSE And True) And True
15158	Release cyl.temp.	(02.01 LM FALSE And True) And True
15159	Disable mns.mon.	(False And True) And True
15160	Mains decoupl.MCB	(False And True) And True
15161	Inh.dead bus GCB	(False And True) And True
15164	ECU seq. B_IN_1	(False And True) And True
15165	ECU seq. B_IN_2	(False And True) And True

Table 159: Factory settings by ID: LogicsManager

Relay outputs

Simple (function)	Extended (configuration)	Result
[99.01] Relay 1 [R01] - Ready for operation OFF Relay will be de-energized if unit is not ready for operation or the logics manager output is TRUE. Deactivated by default Note: This function is pre-configured and may be activated by passing through the command variables [01.09] Shutdown alarm or [04.01] Operating mode AUTO or [00.01] LM: Flag 1 ('–' instead of '0'). The unit is only ready for operation after an start-up delay following the power supply connection.		FALSE
[99.02] Relay 2 [R02] - Centralized alarm (horn) / freely configurable Relay energizes if the internal condition "Horn" is TRUE		dependent on Logics Command Variable [03.05]

Simple (function)	Extended (configuration)	Result
[99.03] Relay 3 [R03] - Starter / freely configurable Relay energizes if the internal condition "Starter" is TRUE		dependent on Logics Command Variable [03.02]
[99.04] Relay 4 [R04] - Start/Gas / freely configurable Relay energizes if the internal condition "Start/Gas" is TRUE to energize the start (Diesel) or gas (Gas) solenoid		dependent on Logics Command Variable [03.28]
[99.05] Relay 5 [R05] - Preglow/Ignition / freely configurable Relay energizes if the internal condition "Preglow/Ignition" is TRUE to preglow the Diesel engine or enabling the ignition of the gas engine		dependent on Logics Command Variable [03.04]
[99.06] Relay 6 [R06] - Free / Command: close GCB In application mode A01 and A02 = freely configurable relay (unassigned) In application mode A03 to A11 "Command: close GCB" Deactivated by default		FALSE
[99.07] Relay 7 [R07] - Mains decoupling / freely configurable / Command: open GCB In application mode A01 pre-configured to mains decoupling. Relay energizes if the internal condition "Mains decoupling" is TRUE to decouple the genset from the mains. In application mode A03 to A11 "Command: open GCB" Deactivated by default		dependent on application mode and Logics Command Variable [07.25]
[99.08] Relay 8 [R08] - Free / Command: close MCB In application mode A01, A02, A03, A05, A07, A08, A09, A10 and A11 = freely configurable relay (unassigned) In application mode A04 and A06 "Command: close MCB" Deactivated by default		FALSE

Simple (function)	Extended (configuration)	Result
[99.09] Relay 9 [R09] - Mains decoupling / freely configurable / Command: open MCB In application mode A01, A02, A03, A05, A07, A08, A09, A10 and A11 pre-configured to mains decoupling. Relay energizes if the internal condition "Mains decoupling" is TRUE to decouple the genset from the mains. In application mode A04 and A06 "Command: open MCB" Deactivated by default		dependent on application mode and Logics Command Variable [07.25]
[99.10] Relay 10 [R10] - Auxiliary services / freely configurable In application mode A01, A02, A03, A04, A07, A08, A10 and A11 pre-configured to auxiliary services. Relay energizes if the internal condition "Aux. services" is TRUE to activate the auxiliary services (it energizes prior to an engine start and de-energizes with the engine stop) In application mode A05, A06 and A09 "Command: close GGB"		dependent on Logics Command Variable [03.01]
[99.11] Relay 11 [R11] - Warning alarm class active / freely configurable In application mode A01, A02, A03, A04, A07, A08, A10 and A11 pre-configured to alarm class A or B. Relay energizes if one of the alarm classes A or B is active In application mode A05, A06 and A09 "Command: open GGB"		dependent on Logics Command Variable [01.08]
[99.12] Relay 12 [R12] - Shutdown alarm class active / freely configurable Relay energizes if one of the alarm classes C, D, E or F is active		dependent on Logics Command Variable [01.09]
[98.xx] External discrete output {y} - {xx} = 01 to 32 ; {y} = 1 to 32) Control of the external relay {y}, if this is connected Prepared for: Deactivated by default		FALSE
[98.xx] External discrete output {y} - Free (external expansion card, if connected; {xx} = 01 to 16 ; {y} = 17 to 32). Control of the external relay {y}, if this is connected Prepared for: Deactivated by default		FALSE

Discrete inputs

Number	LM	ID	Alarm class		Pre-assigned to
DI 01	09.01	10900	F	freely configurable	EMERGENCY STOP
DI 02	09.02	10901	CONTROL	freely configurable	LogicsManager Start in AUTO
DI 03	09.03	10902	B	freely configurable	Low oil pressure
DI 04	09.04	10903	B	freely configurable	Coolant temperature
DI 05	09.05	10904	CONTROL	freely configurable	LogicsManager External acknowledgment
DI 06	09.06	10905	CONTROL	freely configurable	LogicsManager Enable MCB
DI 07	09.07	10906		fixed	Reply MCB
DI 08	09.08	10907		fixed	Reply GCB
DI 09	09.09	10908	B	freely configurable	unassigned
DI 10	09.10	10909	B	freely configurable	unassigned
DI 11	09.11	10910	B	freely configurable	unassigned
DI 12	09.12	10911	B	freely configurable	unassigned

9.4 AnalogManager Reference

9.4.1 Data Sources AM

To enhance flexibility of programming the functions of the easYgen-3000XT series, an AnalogManager is used.

All analog values may be used as data sources for the analog outputs (refer to ⇘ *Chapter 4.4.2.5 "Analog Outputs" on page 198*), the flexible limit monitoring (refer to ⇘ *Chapter 4.5.5 "Flexible Limits" on page 402*), and the controller setpoints (refer to ⇘ *Chapter 4.4.4 "Configure Controller" on page 236*).

- *Every data source is indicated by a group number and a sub-number.*
- *Some values are percentage values and relate to reference values.*

Groups 1 to 79 make available even more than the already arranged analog variables out of the easYgen system.

Groups 80 to 99 are result variables of AnalogManager calculations.

AnalogManager Variables

AnalogManager Results

Cascading: Use analog results

*This analog **results** of an AnalogManager is available as AnalogManager input additionally. Like the other AnalogManager inputs they can be used as input signal for (further) AnalogManagers.*

The groups 80.xx to 89.xx contain analog outputs (results) of function-related AnalogManagers.

The description/name of these analog variables starts always with 'AM ...'.

'Internal'/Fixed AnalogManager Values

The groups 90.xx to 99.xx contain analog outputs of fixed Analog-Managers.

The description/name of these analog variables starts always with 'AM ...'.

9.4.1.1 Group 01: Generator Values

Analog Input #	ID	Data Source	Reference Value	Remarks
01.01	15730	Generator: Voltage wye average	Gen.volt L-N [%]	Percentage value related on Generator Rated Voltage.
01.02	15731	Generator voltage L1-N	Gen.volt L1-N [%]	Percentage value related on Generator Rated Voltage.
01.03	15732	Generator voltage L2-N	Gen.volt L2-N [%]	Percentage value related on Generator Rated Voltage.
01.04	15733	Generator voltage L3-N	Gen.volt L3-N [%]	Percentage value related on Generator Rated Voltage.
01.05	15734	Generator: Voltage delta average	Gen.volt L-L [%]	Percentage value related on Generator Rated Voltage.
01.06	15735	Generator voltage L1-L2	Gen.volt L1-L2 [%]	Percentage value related on Generator Rated Voltage.
01.07	15736	Generator voltage L2-L3	Gen.volt L2-L3 [%]	Percentage value related on Generator Rated Voltage.
01.08	15737	Generator voltage L3-L1	Gen.volt L3-L1 [%]	Percentage value related on Generator Rated Voltage.
01.09	15738	Generator frequency	Gen.frequency [%]	Percentage value related on Generator Nominal Frequency.
01.10	15739	Generator frequency L1-L2	Gen.freq.L1-L2 [%]	Percentage value related on Generator Nominal Frequency.
01.11	15740	Generator frequency L2-L3	Gen.freq.L2-L3 [%]	Percentage value related on Generator Nominal Frequency.
01.12	15741	Generator frequency L3-L1	Gen.freq.L3-L1 [%]	Percentage value related on Generator Nominal Frequency.
01.13	15742	Generator average current	Gen.current [%]	Percentage value related on Generator Rated Current.
01.14	15743	Generator current L1	Gen.current L1 [%]	Percentage value related on Generator Rated Current.
01.15	15744	Generator current L2	Gen.current L2 [%]	Percentage value related on Generator Rated Current.
01.16	15745	Generator current L3	Gen.current L3 [%]	Percentage value related on Generator Rated Current.
01.17	15746	Dragged generator current L1	Gen.curr.max. L1 [%]	Percentage value related on Generator Rated Current.
01.18	15747	Dragged generator current L2	Gen.curr.max. L2 [%]	Percentage value related on Generator Rated Current.
01.19	15748	Dragged generator current L3	Gen.curr.max. L3 [%]	Percentage value related on Generator Rated Current.
01.20	15749	Generator power factor	Gen. PF [%]	Percentage value related on Power Factor 1.
01.21	15750	Generator power factor L1	Gen. PF L1 [%]	Percentage value related on Power Factor 1.

Analog Input #	ID	Data Source	Reference Value	Remarks
01.22	15751	Generator power factor L2	Gen. PF L2 [%]	Percentage value related on Power Factor 1.
01.23	15752	Generator power factor L3	Gen. PF L3 [%]	Percentage value related on Power Factor 1.
01.24	15753	Total Generator real power	Gen. act. power [%]	Percentage value related on Generator rated active power.
01.25	15754	Generator real power L1-N	Gen.act.pwr. L1 [%]	Percentage value related on Generator rated active power.
01.26	15755	Generator real power L2-N	Gen.act.pwr. L2 [%]	Percentage value related on Generator rated active power.
01.27	15756	Generator real power L3-N	Gen.act.pwr. L3 [%]	Percentage value related on Generator rated active power.
01.28	15757	Total gen. reactive power	Gen.react.pwr. [%]	Percentage value related on Generator rated reactive power.
01.29	15758	Generator reactive power L1-N	Gen.react.pwr.L1 [%]	Percentage value related on Generator rated reactive power.
01.30	15759	Generator reactive power L2-N	Gen.react.pwr.L2 [%]	Percentage value related on Generator rated reactive power.
01.31	15760	Generator reactive power L3-N	Gen.react.pwr.L3 [%]	Percentage value related on Generator rated reactive power.
01.32	15761	Total gen. apparent power	Gen.app.power [%]	Percentage value related on Generator rated active- and reactive power.
01.33	15762	Generator apparent power L1-N	Gen.app.pwr. L1 [%]	Percentage value related on Generator rated active- and reactive power.
01.34	15763	Generator apparent power L2-N	Gen.app.pwr. L2 [%]	Percentage value related on Generator rated active- and reactive power.
01.35	15764	Generator apparent power L3-N	Gen.app.pwr. L3 [%]	Percentage value related on Generator rated active- and reactive power.
01.51	9730	Generator voltage wye average	Gen volt L-N [V]	Voltage Format
01.52	9731	Generator voltage 1-N	Gen volt L1-N [V]	Voltage Format
01.53	9732	Generator voltage L2-N	Gen.volt L2-N [V]	Voltage Format
01.54	9733	Generator voltage L3-N	Gen.volt L3-N [V]	Voltage Format
01.55	9734	Generator voltage delta average	Gen.volt L-L [V]	Voltage Format
01.56	9735	Generator voltage L1-L2	Gen.volt L1-L2 [V]	Voltage Format
01.57	9736	Generator voltage L2-L3	Gen.volt L2-L3 [V]	Voltage Format
01.58	9737	Generator voltage L3-L1	Gen.volt L3-L1 [V]	Voltage Format
01.59	9738	Generator frequency	Gen.frequency [Hz]	Frequency Format
01.60	9739	Generator frequency L1-L2	Gen.freq.L1-L2 [Hz]	Frequency Format
01.61	9740	Generator frequency L2-L3	Gen.freq.L2-L3 [Hz]	Frequency Format
01.62	9741	Generator frequency L3-L1	Gen.freq.L3-L1 [Hz]	Frequency Format
01.63	9742	Generator average current	Gen.current [A]	Current Format
01.64	9743	Generator current L1	Gen.current L1 [A]	Current Format.
01.65	9744	Generator current L2	Gen.current L2 [A]	Current Format
01.66	9745	Generator current L3	Gen.current L3 [A]	Current Format
01.67	9746	Dragged generator current L1	Gen.curr.max. L1 [A]	Current Format
01.68	9747	Dragged generator current L2	Gen.curr.max. L2 [A]	Current Format
01.69	9748	Dragged generator current L3	Gen.curr.max. L3 [A]	Current Format

Analog Input #	ID	Data Source	Reference Value	Remarks
01.70	9749	Generator power factor	Gen. PF	Power Factor Format
01.71	9750	Generator power factor L1	Gen. PF L1	Power Factor Format
01.72	9751	Generator power factor L2	Gen. PF L2	Power Factor Format
01.73	9752	Generator power factor L3	Gen. PF L3	Power Factor Format
01.74	9753	Total Generator real power	Gen. act. power [W]	Power Format
01.75	9754	Generator real power L1-N	Gen.act.pwr. L1 [W]	Power Format
01.76	9755	Generator real power L2-N	Gen.act.pwr. L2 [W]	Power Format
01.77	9756	Generator real power L3-N	Gen.act.pwr. L3 [W]	Power Format
01.78	9757	Total generator reactive power	Gen. react.pwr. [var]	Reactive Power Format
01.79	9758	Generator reactive power L1-N	Gen.react.pwr.L1[var]	Reactive Power Format
01.80	9759	Generator reactive power L2-N	Gen.react.pwr.L2[var]	Reactive Power Format
01.81	9760	Generator reactive power L3-N	Gen.react.pwr.L3[var]	Reactive Power Format
01.82	9761	Total generator apparent power	Gen.app.power [VA]	Apparent Power Format
01.83	9762	Generator apparent power L1-N	Gen.app.pwr. L1 [VA]	Apparent Power Format
01.84	9763	Generator apparent power L2-N	Gen.app.pwr. L2 [VA]	Apparent Power Format
01.85	9764	Generator apparent power L3-N	Gen.app.pwr. L3 [VA]	Apparent Power Format

9.4.1.2 Group 02: Mains Values

Analog Input #	ID	Data Source	Reference Value	Remarks
02.01	15780	Mains: Voltage wye average	Mains volt L-N [%]	Percentage value related on Mains Rated Voltage.
02.02	15781	Mains voltage 1-N	Mains volt L1-N [%]	Percentage value related on Mains Rated Voltage.
02.03	15782	Mains voltage 2-N	Mains volt L2-N [%]	Percentage value related on Mains Rated Voltage.
02.04	15783	Mains voltage 3-N	Mains volt L3-N [%]	Percentage value related on Mains Rated Voltage.
02.05	15784	Mains: Voltage delta average	Mains volt L-L [%]	Percentage value related on Mains Rated Voltage.
02.06	15785	Mains voltage 1-2	Mains volt L1-L2 [%]	Percentage value related on Mains Rated Voltage.
02.07	15786	Mains voltage 2-3	Mains volt L2-L3 [%]	Percentage value related on Mains Rated Voltage.
02.08	15787	Mains voltage 3-1	Mains volt L3-L1 [%]	Percentage value related on Mains Rated Voltage.
02.09	15788	Mains frequency	Mains frequency [%]	Percentage value related on Nominal Frequency.
02.10	15789	Mains frequency 1-2	Mains freq.L1-L2 [%]	Percentage value related on Nominal Frequency.
02.11	15790	Mains frequency 2-3	Mains freq.L2-L3 [%]	Percentage value related on Nominal Frequency.
02.12	15791	Mains frequency 3-1	Mains freq.L3-L1 [%]	Percentage value related on Nominal Frequency.
02.13	15792	Mains average current	Mains current [%]	Percentage value related on Mains Rated Current.

Analog Input #	ID	Data Source	Reference Value	Remarks
02.14	15793	Mains current 1	Mains current L1 [%]	Percentage value related on Mains Rated Current.
02.15	15794	Mains current 2	Mains current L2 [%]	Percentage value related on Mains Rated Current.
02.16	15795	Mains current 3	Mains current L3 [%]	Percentage value related on Mains Rated Current.
02.17	15796	Dragged mains current 1	Mns.curr.max.L1 [%]	Percentage value related on Mains Rated Current.
02.18	15797	Dragged mains current 2	Mns.curr.max.L2 [%]	Percentage value related on Mains Rated Current.
02.19	15798	Dragged mains current 3	Mns.curr.max.L3 [%]	Percentage value related on Mains Rated Current.
02.20	15799	Mains powerfactor	Mains PF [%]	Percentage value related on Power Factor 1.
02.21	15800	Mains powerfactor 1	Mains PF L1 [%]	Percentage value related on Power Factor 1.
02.22	15801	Mains powerfactor 2	Mains PF L2 [%]	Percentage value related on Power Factor 1.
02.23	15802	Mains powerfactor 3	Mains PF L3 [%]	Percentage value related on Power Factor 1.
02.24	15803	Total mains. real power	Mains act. power [%]	Percentage value related on Mains rated active power.
02.25	15804	Mains power 1-N	Mns.act.pwr.L1 [%]	Percentage value related on Mains rated active power.
02.26	15805	Mains power 2-N	Mns.act.pwr.L2 [%]	Percentage value related on Mains rated active power.
02.27	15806	Mains power 3-N	Mns.act.pwr.L3 [%]	Percentage value related on Mains rated active power.
02.28	15807	Total mains reactive power	Mns.react. pwr. [%]	Percentage value related on Mains rated reactive power.
02.29	15808	Mains reactive power 1-N	Mns.react.pwr.L1 [%]	Percentage value related on Mains rated reactive power.
02.30	15809	Mains reactive power 2-N	Mns.react.pwr.L2 [%]	Percentage value related on Mains rated reactive power.
02.31	15810	Mains reactive power 3-N	Mns.react.pwr.L3 [%]	Percentage value related on Mains rated reactive power.
02.32	15811	Total mains apparent power	Mns.app.power [%]	Percentage value related on Mains rated active- and reactive power.
02.33	15812	Mains apparent power 1-N	Mns.app.pwr.L1 [%]	Percentage value related on Mains rated active- and reactive power.
02.34	15813	Mains apparent power 2-N	Mns.app.pwr.L2 [%]	Percentage value related on Mains rated active- and reactive power.
02.35	15814	Mains apparent power 3-N	Mns.app.pwr.L3 [%]	Percentage value related on Mains rated active- and reactive power.
02.36	15815	Mains external measured active power by AI	Mns.ext.act.pwr. [%]	Percentage value related on Mains rated active power.
02.37	15816	Mains external measured reactive power by AI	Mns.ext.react.pwr[%]	Percentage value related on Mains rated reactive power.
02.38	15817	Mains calculated Power Factor by AI	Mains ext. PF [%]	Percentage value related on Power Factor 1.
02.51	9780	Mains : Voltage wye average	Mains volt L-N [V]	Voltage Format
02.52	9781	Mains voltage 1-N	Mains volt L1-N [V]	Voltage Format

Analog Input #	ID	Data Source	Reference Value	Remarks
02.53	9782	Mains voltage 2-N	Mains volt L2-N [V]	Voltage Format
02.54	9783	Mains voltage 3-N	Mains volt L3-N [V]	Voltage Format
02.55	9784	Mains: Voltage delta average	Mains volt L-L [V]	Voltage Format
02.56	9785	Mains voltage 1-2	Mains volt L1-L2 [V]	Voltage Format
02.57	9786	Mains voltage 2-3	Mains volt L2-L3 [V]	Voltage Format
02.58	9787	Mains voltage 3-1	Mains volt L3-L1 [V]	Voltage Format
02.59	9788	Mains frequency	Mains frequency [Hz]	Frequency Format
02.60	9789	Mains frequency 1-2	Mains freq.L1-L2 [Hz]	Frequency Format
02.61	9790	Mains frequency 2-3	Mains freq.L2-L3 [Hz]	Frequency Format
02.62	9791	Mains frequency 3-1	Mains freq.L3-L1 [Hz]	Frequency Format
02.63	9792	Mains average current	Mains current [A]	Current Format
02.64	9793	Mains current 1	Mains current L1 [A]	Current Format
02.65	9794	Mains current 2	Mains current L2 [A]	Current Format
02.66	9795	Mains current 3	Mains current L3 [A]	Current Format
02.67	9796	Dragged mains current 1	Mns.curr.max.L1 [A]	Current Format
02.68	9797	Dragged mains current 2	Mns.curr.max.L2 [A]	Current Format
02.69	9798	Dragged mains current 3	Mns.curr.max.L3 [A]	Current Format
02.70	9799	Mains powerfactor	Mains PF	Power Factor Format
02.71	9810	Mains powerfactor 1	Mains PF L1	Power Factor Format
02.72	9811	Mains powerfactor 2	Mains PF L2	Power Factor Format
02.73	9812	Mains powerfactor 3	Mains PF L3	Power Factor Format
02.74	9813	Total mains. real power	Mains act. power [W]	Power Format
02.75	9814	Mains power 1-N	Mns.act.pwr. L1 [W]	Power Format
02.76	9815	Mains power 2-N	Mns.act.pwr. L2 [W]	Power Format
02.77	9816	Mains power 3-N	Mns.act.pwr. L3 [W]	Power Format
02.78	9817	Total mains reactive power	Mns.react.pwr. [var]	Reactive Power Format
02.79	9818	Mains reactive power 1-N	Mns.react.pwr.L1[var]	Reactive Power Format
02.80	9819	Mains reactive power 2-N	Mns.react.pwr.L2[var]	Reactive Power Format
02.81	9820	Mains reactive power 3-N	Mns.react.pwr.L3[var]	Reactive Power Format
02.82	9821	Total mains apparent power	Mns.app.power [VA]	Apparent Power Format
02.83	9822	Mains apparent power 1-N	Mns.app.pwr. L1 [VA]	Apparent Power Format
02.84	9823	Mains apparent power 2-N	Mns.app.pwr. L2 [VA]	Apparent Power Format
02.85	9824	Mains apparent power 3-N	Mns.app.pwr. L3 [VA]	Apparent Power Format
02.86	9825	Mains external measured active power by AI	Mns.ext.act.pwr. [W]	Power Format
02.87	9826	Mains external measured reactive power by AI	Mns.ext.reac.pwr [var]	Reactive Power Format
02.88	9827	Mains calculated Power Factor by AI	Mains ext. PF	Power Factor Format
02.89	11571	Mains settling time	Mains settl.time [s]	Seconds format

9.4.1.3 Group 03: Busbar 1 Values

Analog Input #	ID	Data Source	Reference Value	Remarks
03.01	15830	Busbar 1: voltage delta average [%]	Busb1 volt. L-L [%]	Percentage value related on Busbar 1 rated voltage.
03.02	15831	Busbar 1: voltage L1-L2 [%]	Busb1 volt.L1-L2 [%]	Percentage value related on Busbar 1 rated voltage.
03.03	15832	Busbar 1: voltage L2-L3 [%]	Busb1 volt.L2-L3 [%]	Percentage value related on Busbar 1 rated voltage.
03.04	15833	Busbar 1: voltage L3-L1 [%]	Busb1 volt.L3-L1 [%]	Percentage value related on Busbar 1 rated voltage.
03.05	15834	Busbar 1: Frequency [%]	Busb1 frequency [%]	Percentage value related on Nominal Frequency.
03.06	15835	Busbar 1: Frequency L1-L2 [%]	Busb1 freq.L1-L2 [%]	Percentage value related on Nominal Frequency.
03.51	9840	Busbar 1: Voltage delta average [V]	Busb1 volt.L-L [V]	Voltage Format
03.52	9841	Busbar 1: voltage L1-L2 [V]	Busb1 volt.L1-L2 [V]	Voltage Format
03.55	9844	Busbar 1: Frequency [Hz]	Busb1 frequency [Hz]	Frequency Format
03.56	9845	Busbar 1: Frequency L1-L2 [Hz]	Busb1 freq.L1-L2 [Hz]	Frequency Format

9.4.1.4 Group 05: Controller Setpoints

Analog Input #	ID	Data Source	Reference Value	Remarks
05.01	15860	Internal freq.setp.1	Internal f setp1 [%]	Percentage value related on Nominal Frequency.
05.02	15861	Internal freq.setp.2	Internal f setp2 [%]	Percentage value related on Nominal Frequency.
05.03	15862	Interface freq.setp.	Interface f setp [%]	Percentage value related on Nominal Frequency.
05.04	15863	Internal pow.setp.1	Internal P setp1 [%]	Percentage value related on Gener-ator rated active power.
05.05	15864	Internal pow.setp.2	Internal P setp2 [%]	Percentage value related on Gener-ator rated active power.
05.06	15865	Interface pow.setp.	Interface P setp [%]	Percentage value related on Gener-ator rated active power.
05.07	15866	Internal volt.setp.1	Internal V setp1 [%]	Percentage value related on Gener-ator rated voltage.
05.08	15867	Internal volt.setp.2	Internal V setp2 [%]	Percentage value related on Gener-ator rated voltage.
05.09	15868	Interface volt.setp.	Interface V setp [%]	Percentage value related on Gener-ator rated voltage.
05.10	15869	Int.pow.factor setp1	Intern. PF setp1 [%]	Percentage value related on Power Factor 1.
05.11	15870	Int.pow.factor setp2	Intern. PF setp2 [%]	Percentage value related on Power Factor 1.
05.12	15871	Interface pow.factor	Interface PF sp [%]	Percentage value related on Power Factor 1.
05.13	15872	Digital poti freq.	Discrete f +/- [%]	Percentage value related on Nominal Frequency.

Analog Input #	ID	Data Source	Reference Value	Remarks
05.14	15873	Digital poti power	Discrete P +/- [%]	Percentage value related on Generator rated active power
05.15	15874	Digital poti voltage	Discrete V +/- [%]	Percentage value related on Generator rated voltage
05.16	15875	Dig. poti pow.factor	Discrete PF +/- [%]	Percentage value related on Power Factor 1.
05.17	15876	Used freq.setp.	Used f setp. [%]	Percentage value related on Nominal Frequency.
05.18	15877	Used freq.setp.ramp	Used f setp.ramp [%]	Percentage value related on Nominal Frequency.
05.19	15878	Used pwr. setp.	Used P setp. [%]	Percentage value related on Generator rated active power
05.20	15879	Used pwr. setp.ramp	Used P setp.ramp [%]	Percentage value related on Generator rated active power
05.21	15880	Used volt.setp.	Used V setp. [%]	Percentage value related on Generator rated voltage
05.22	15881	Used volt.setp.ramp	Used V setp.ramp [%]	Percentage value related on Generator rated voltage
05.23	15882	Used PF setp.	Used PF setp [%]	Percentage value related on Power Factor 1.
05.24	15883	Used PF setp.ramp	Used PF sp ramp [%]	Percentage value related on Power Factor 1.
05.28	15887	Pred(F)	P derating (f) [%]	Percentage value related on Generator rated active power
05.29	15888	cosphi(P)	PF characteristic %	Percentage value related on Power Factor 1.
05.30	15889	Internal pow.setp.3	Internal P setp3 [%]	Percentage value related on Generator rated active power.
05.31	15501	Internal kvar setpoint 1	Int. kvar setp1 [%]	Percentage value related on Generator rated reactive power.
05.32	15502	Internal kvar setpoint 2	Int. kvar setp2 [%]	Percentage value related on Generator rated reactive power.
05.33	15503	Interface kvar setpoint	Interf. kvar sp [%]	Percentage value related on Generator rated reactive power.
05.34	9188	Internal pow.setp.4	Internal P setp4 [%]	Percentage value related on Generator rated active power.
05.35	9196	F/P controller setpoint	F/P control setp [%]	
05.36	9197	V/Q controller setpoint	V/Q control setp [%]	
05.51	9863	Internal freq.setp.1	Internal f setp1 [Hz]	Frequency Format
05.52	9864	Internal freq.setp.2	Internal f setp2 [Hz]	Frequency Format
05.53	9865	Interface freq.setp.	Interface f setp [Hz]	Frequency Format
05.57	9869	Internal volt.setp.1	Internal V setp1 [V]	Voltage Format
05.58	9870	Internal volt.setp.2	Internal V setp2 [V]	Voltage Format
05.59	9871	Interface volt.setp.	Interface V setp [V]	Voltage Format
05.63	9883	Digital poti freq.	Discrete f +/- [Hz]	Frequency Format
05.65	9885	Digital poti voltage	Discrete V +/- [V]	Voltage Format
05.67	9872	Used freq.setp.	Used f setp. [Hz]	Frequency Format
05.68	9873	Used freq.setp.ramp	Used f setp.ramp [Hz]	Frequency Format
05.71	9876	Used volt.setp.	Used V setp. [V]	Voltage Format

Analog Input #	ID	Data Source	Reference Value	Remarks
05.72	9877	Used volt.setp.ramp	Used V setp.ramp [V]	Voltage Format
05.75	15884	Int. PID 1 Setp.	Int. PID 1 setpoint	
05.76	15885	Int. PID 2 Setp.	Int. PID 2 setpoint	
05.77	15886	Int. PID 3 Setp.	Int. PID 3 setpoint	

9.4.1.5 Group 06: DC Analog Inputs

Analog Input #	ID	Data Source	Reference Value	Remarks
06.01	15890	Analog input 1	Analog input 1	
06.02	15891	Analog input 2	Analog input 2	
06.03	15892	Analog input 3	Analog input 3	

9.4.1.6 Group 07: J1939 Values 1

Analog Input #	ID	Data Source	Reference Value	Remarks
07.01	15920	SPN 52: Engine Intercooler	52:Eng. Interc.Temp.	
07.02	15921	SPN 91: Throttle Position	91:Accel.Pedal Pos.1	
07.03	15922	SPN 92: Load At Current Speed	92:Load at Speed	
07.04	15923	SPN 94: Fuel Delivery Pressure	94:Fuel Deliv.Press.	
07.05	15924	SPN 95: Fuel Filter Difference Pressure	95:Fuel Filt.Diff. Pr.	
07.06	15925	SPN 98: Engine Oil Level	98:Engine Oil Level	
07.07	15926	SPN 100: Engine Oil Pressure	100:Engine Oil Press.	
07.08	15927	SPN 101: Crankcase Pressure	101:Crankcase Press.	
07.09	15928	SPN 102: Boost Pressure	102:Int.Manif.1 Pr.	
07.10	15929	SPN 105: Intake Manifold 1 Temperature	105:Int.Manif.1 Temp.	
07.11	15930	SPN 106: Turbo Air Inlet Pressure	106:Air Intake Press.	
07.12	15931	SPN 107: Air Filter 1 Difference Pressure	107:Air Filt1 Diff.Pr	
07.13	15932	SPN 108: Barometric Pressure	108:Barometric Press.	
07.14	15933	SPN 109: Coolant Pressure	109:Coolant Pressure	
07.15	15934	SPN 110: Engine Coolant Temperature	110:Eng.Coolant Temp.	
07.16	15935	SPN 111: Coolant Level	111:Coolant Level	
07.17	15936	SPN 127: Transmission Oil Pressure	127:Transm.Oil Press.	
07.18	15937	SPN 157: Fuel Rail Pressure	157:Inj.Met.Rail1 Pr.	
07.19	15938	SPN 171: Ambient Air Temperature	171:Ambient Air Temp.	
07.20	15939	SPN 172: Air Intake Temperature	172:Air Intake Temp.	
07.21	15940	SPN 173: Exhaust Gas Temperature	173:Exhaust Gas Temp.	

Analog Input #	ID	Data Source	Reference Value	Remarks
07.22	15941	SPN 174: Fuel Temperature	174:Fuel Temp. 1	
07.23	15942	SPN 175: Engine Oil Temperature 1	175:Oil Temperature 1	
07.24	15943	SPN 176: Turbo Oil Temperature	176:Turbo Oil Temp.	
07.25	15944	SPN 177: Transmission Oil Temperature	177:Transm.Oil Temp.1	
07.26	15945	SPN 183: Fuel Rate	183:Fuel Rate	
07.27	15946	SPN 190: Engine Speed	190:Engine Speed	
07.28	15947	SPN 441: Auxiliary Temperature 1	441:Auxiliary Temp.1	
07.29	15948	SPN 442: Auxiliary Temperature 2	442:Auxiliary Temp.2	
07.30	15949	SPN 513: Actual Engine Torque	513:Actual Eng.Torque	
07.31	15321	SPN 1122: Alternator Bearing 1 Temperature	1122:Altern.Bear.1 T	
07.32	15322	SPN 1123: Alternator Bearing 2 Temperature	1123:Altern.Bear.2 T	
07.33	15323	SPN 1124: Alternator Winding 1 Temperature	1124:Altern.Wind.1 T	
07.34	15324	SPN 1125: Alternator Winding 2 Temperature	1125:Altern.Wind.2 T	
07.35	15325	SPN 1126: Alternator Winding 3 Temperature	1126:Altern.Wind.3 T	
07.36	15326	SPN 1131: Intake Manifold 2 Temperature	1131:Int.Manif.2 Temp	
07.37	15327	SPN 1132: Intake Manifold 3 Temperature	1132:Int.Manif.3 Temp	
07.38	15328	SPN 1133: Intake Manifold 4 Temperature	1133:Int.Manif.4 Temp	
07.39	15329	SPN 1134: Engine Thermostat	1134:Cooler Therm.Op.	
07.40	15330	SPN 1135: Engine Oil Temperature 2	1135:Oil Temp. 2	
07.41	15331	SPN 1136: Engine ECU Temperature	1136:ECU Temperature	
07.42	15332	SPN 1137: Exhaust Gas Port 1 Temperature	1137:Exh.Gas P.1 Temp	
07.43	15333	SPN 1138: Exhaust Gas Port 2 Temperature	1138:Exh.Gas P.2 Temp	
07.44	15334	SPN 1139: Exhaust Gas Port 3 Temperature	1139:Exh.Gas P.3 Temp	
07.45	15335	SPN 1140: Exhaust Gas Port 4 Temperature	1140:Exh.Gas P.4 Temp	
07.46	15336	SPN 1141: Exhaust Gas Port 5 Temperature	1141:Exh.Gas P.5 Temp	
07.47	15337	SPN 1142: Exhaust Gas Port 6 Temperature	1142:Exh.Gas P.6 Temp	
07.48	15338	SPN 1143: Exhaust Gas Port 7 Temperature	1143:Exh.Gas P.7 Temp	
07.49	15339	SPN 1144: Exhaust Gas Port 8 Temperature	1144:Exh.Gas P.8 Temp	
07.50	15340	SPN 1145: Exhaust Gas Port 9 Temperature	1145:Exh.Gas P.9 Temp	
07.51	15341	SPN 1146: Exhaust Gas Port 10 Temperature	1146:Exh.Gas P.10 T	
07.52	15342	SPN 1147: Exhaust Gas Port 11 Temperature	1147:Exh.Gas P.11 T	

Analog Input #	ID	Data Source	Reference Value	Remarks
07.53	15343	SPN 1148: Exhaust Gas Port 12 Temperature	1148:Exh.Gas P.12 T	
07.54	15344	SPN 1149: Exhaust Gas Port 13 Temperature	1149:Exh.Gas P.13 T	
07.55	15345	SPN 1150: Exhaust Gas Port 14 Temperature	1150:Exh.Gas P.14 T	
07.56	15346	SPN 1151: Exhaust Gas Port 15 Temperature	1151:Exh.Gas P.15 T	
07.57	15347	SPN 1152: Exhaust Gas Port 16 Temperature	1152:Exh.Gas P.16 T	
07.58	15348	SPN 1153: Exhaust Gas Port 17 Temperature	1153:Exh.Gas P.17 T	
07.59	15349	SPN 1154: Exhaust Gas Port 18 Temperature	1154:Exh.Gas P.18 T	
07.60	15350	SPN 1155: Exhaust Gas Port 19 Temperature	1155:Exh.Gas P.19 T	
07.61	15351	SPN 1156: Exhaust Gas Port 20 Temperature	1156:Exh.Gas P.20 T	
07.62	15352	SPN 1157: Main Bearing 1 Temperature	1157:Main Bear.1 Temp	
07.63	15353	SPN 1158: Main Bearing 2 Temperature	1158:Main Bear.2 Temp	
07.64	15354	SPN 1159: Main Bearing 3 Temperature	1159:Main Bear.3 Temp	
07.65	15355	SPN 1160: Main Bearing 4 Temperature	1160:Main Bear.4 Temp	
07.66	15356	SPN 1161: Main Bearing 5 Temperature	1161:Main Bear.5 Temp	
07.67	15357	SPN 1162: Main Bearing 6 Temperature	1162:Main Bear.6 Temp	
07.68	15358	SPN 1163: Main Bearing 7 Temperature	1163:Main Bear.7 Temp	
07.69	15359	SPN 1164: Main Bearing 8 Temperature	1164:Main Bear.8 Temp	
07.70	15360	SPN 1165: Main Bearing 9 Temperature	1165:Main Bear.9 Temp	
07.71	15361	SPN 1166: Main Bearing 10 Temperature	1166:Main Bear.10 T	
07.72	15362	SPN 1167: Main Bearing 11 Temperature	1167:Main Bear.11 T	
07.73	15363	SPN 1172: Turbo 1 Compressor Inlet Temperature	1172:Tb1 Compr.Int.T	
07.74	15364	SPN 1173: Turbo 2 Compressor Inlet Temperature	1173:Tb2 Compr.Int.T	
07.75	15365	SPN 1174: Turbo 3 Compressor Inlet Temperature	1174:Tb3 Compr.Int.T	
07.76	15366	SPN 1175: Turbo 4 Compressor Inlet Temperature	1175:Tb4 Compr.Int.T	
07.77	15367	SPN 1176: Turbo 1 Compressor Inlet pressure	1176:Tb1 Compr.Int.Pr	
07.78	15368	SPN 1177: Turbo 2 Compressor Inlet pressure	1177:Tb2 Compr.Int.Pr	
07.79	15369	SPN 1178: Turbo 3 Compressor Inlet pressure	1178:Tb3 Compr.Int.Pr	
07.80	15370	SPN 1179: Turbo 4 Compressor Inlet pressure	1179:Tb4 Compr.Int.Pr	
07.81	15371	SPN 1180: Turbo 1 Inlet Temperature	1180:Turbo1 Int.Temp	
07.82	15372	SPN 1181: Turbo 2 Inlet Temperature	1181:Turbo2 Int.Temp	

Analog Input #	ID	Data Source	Reference Value	Remarks
07.83	15373	SPN 1182: Turbo 3 Inlet Temperature	1182:Turbo3 Int.Temp	
07.84	15374	SPN 1183: Turbo 4 Inlet Temperature	1183:Turbo4 Int.Temp	
07.85	15375	SPN 1184: Turbo 1 Outlet Temperature	1184:Turbo1 Outl.Temp	
07.86	15376	SPN 1185: Turbo 2 Outlet Temperature	1185:Turbo2 Outl.Temp	
07.87	15377	SPN 1186: Turbo 3 Outlet Temperature	1186:Turbo3 Outl.Temp	
07.88	15378	SPN 1187: Turbo 4 Outlet Temperature	1187:Turbo4 Outl.Temp	
07.89	15379	SPN 1203: Engine Auxiliary Coolant Pressure	1203:Aux.Coolant Pr.	
07.90	15380	SPN 1208: Pre-Filter Oil Pressure	1208:Pre-filt.Oil Pr.	
07.91	15381	SPN 1212: Engine Auxiliary Coolant Temperature	1212:Aux.Coolant Temp	
07.92	15382	SPN 1382: Fuel Filter Difference Pressure	1382:Fuel Filt.DiffPr	
07.93	15383	SPN 1800: Battery 1 Temperature	1800:Battery 1 Temp.	
07.94	15384	SPN 1801: Battery 2 Temperature	1801:Battery 2 Temp.	
07.95	15385	SPN 1802: Intake Manifold 5 Temperature	1802:Int.Manif.5 Temp	
07.96	15386	SPN 1803: Intake Manifold 6 Temperature	1803:Int.Manif.6 Temp	
07.97	15387	SPN 2433: Right Exhaust Gas Temperature	2433:Right Exh.Gas T	
07.98	15388	SPN 2434: Left Exhaust Gas Temperature	2434:Left Exh.Gas T	
07.99	15389	SPN 2629: Turbo 1 Compressor Outlet Temperature	2629:Tb1 Compr.Outl.T	

9.4.1.7 Group 08: External Analog Inputs

Analog Input #	ID	Data Source	Reference Value	Remarks
08.01	15950	External Analog input 1	Ext. analog input 1	
08.02	15951	External Analog input 2	Ext. analog input 2	
08.03	15952	External Analog input 3	Ext. analog input 3	
08.04	15953	External Analog input 4	Ext. analog input 4	
08.05	15954	External Analog input 5	Ext. analog input 5	
08.06	15955	External Analog input 6	Ext. analog input 6	
08.07	15956	External Analog input 7	Ext. analog input 7	
08.08	15957	External Analog input 8	Ext. analog input 8	
08.09	15958	External Analog input 9	Ext. analog input 9	
08.10	15959	External Analog input 10	Ext. analog input 10	
08.11	15960	External Analog input 11	Ext. analog input 11	
08.12	15961	External Analog input 12	Ext. analog input 12	
08.13	15962	External Analog input 13	Ext. analog input 13	

Analog Input #	ID	Data Source	Reference Value	Remarks
08.14	15963	External Analog input 14	Ext. analog input 14	
08.15	15964	External Analog input 15	Ext. analog input 15	
08.16	15965	External Analog input 16	Ext. analog input 16	

9.4.1.8 Group 09: J1939 Values 2

Analog Input #	ID	Data Source	Reference Value	Remarks
09.01	12001	3644: Engine Derate Request	3644:Derate Request	
09.02	12002	158: Keyswitch Battery Potential	158:Keysw.Batt.Pot.	
09.03	12003	4151:Exhaust Gas Temp. average	4151:Exh.Gas T Avr.	
09.04	12004	4153:Exhaust Gas Temp.average Bank 1	4153:Exh.Gas T Avr.B1	
09.05	12005	4152:Exhaust Gas Temp.average Bank 2	4152:Exh.Gas T Avr.B2	
09.06	12006	ECU sequencer analog output 1	ECU seq. A_OUT_1	
09.07	12007	ECU sequencer analog output 2	ECU seq. A_OUT_2	
09.08	12008	SPN 1761 Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Level	1761:Aft1Exh.Tank1Lev	
09.09	12009	SPN 3031 Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Temperature	3031:Aft1 Exh.Tank1 T	
09.10	12010	SPN 4367 Aftertreatment 1 Diesel Exhaust Fluid Tank 2 Level	4367:Aft1Exh.Tank2Lev	
09.11	12011	SPN 4368 Aftertreatment 1 Diesel Exhaust Fluid Tank 2 Temp	4368:Aft1Exh.Tank2 T	
09.12	12012	SPN 250 Engine Total Fuel Used	250: Total fuel used	
09.13	12013	SPN 247 Total Engine hours	247: Total Eng. hours	
09.14	12014	SPN 96 Fuel level 1	96: Fuel Level 1	
09.15	12015	SPN 96 Fuel level 2	96: Fuel Level 1	
09.16	12020	SPN 3719: DPF 1 Soot load	3719: DPF 1 Soot load	
09.17	12021	SPN 3720: DPF 1 Ash load	3720: DPF 1 Ash load	

9.4.1.9 Group 10: Internal Values

Analog Input #	ID	Data Source	Reference Value	Remarks
10.01	9178	Zero	ZERO	always 0
10.02	9179	One	ONE	always 1
10.04	15703	Battery voltage	Battery voltage [%]	Percentage value related on Battery Voltage 24V.

Analog Input #	ID	Data Source	Reference Value	Remarks
10.06	15705	Calculated ground current	Calc.ground curr.[%]	Calculated Percentage value related on Rated Ground Current
10.07	15706	Direct measured ground current	Meas.ground curr.[%]	Measured percentage value related on Rated Ground Current
10.08	5570	Free PID 1 analog output (PID1 bias)	AM PID1 bias	
10.09	5597	Free PID 2 analog output (PID2 bias)	AM PID2 bias	
10.10	5682	Free PID 3 analog output (PID3 bias)	AM PID3 bias	
10.11	15710	Active nominal power in system	System nominal P [%]	Percentage value related on System rated active power
10.12	15711	Total real power in system	System real P [%]	Percentage value related on System rated active power
10.13	15712	Reserve real power in system	Syst.res.real P [%]	Percentage value related on System rated active power
10.14		Act. power LS-5	Act. power LS-5 [%]	*Valid for SI values only (not for % values)* Find corresponding SI value at: "Analog Input #" + xx.50
10.15		React. power LS-5	React. power LS-5 [%]	*Valid for SI values only (not for % values)* Find corresponding SI value at: "Analog Input #" + xx.50
10.16		Total reactive power in system	Syst.react.pwr. [%]	*Valid for SI values only (not for % values)* Find corresponding SI value at: "Analog Input #" + xx.50
10.20		LS-5 frequency L-L	LS-5 freq. L-L [%]	*Valid for SI values only (not for % values)* Find corresponding SI value at: "Analog Input #" + xx.50
10.21		Average LS-5 voltage L-L	Aver.LS-5 volt.L-L[%]	*Valid for SI values only (not for % values)* Find corresponding SI value at: "Analog Input #" + xx.50
10.22		Average LS-5 voltage L-N	Aver.LS-5 volt.L-N[%]	*Valid for SI values only (not for % values)* Find corresponding SI value at: "Analog Input #" + xx.50
10.54	9855	Battery voltage	Battery voltage [V]	Voltage format
10.56	9856	Calculated ground current	Calc.ground curr.[A]	Current format
10.57	9857	Direct measured ground current	Meas.ground curr.[A]	Current format
10.61	9858	Active nominal power in system	System nominal P [W]	Power format
10.62	9859	Total real power in system	System real P [W]	Power format
10.63	9860	Reserve real power in system	Syst.res.real P [W]	Power format
10.64	15713	Active power LS-5	Act. power LS5 [W]	Power format
10.65	15714	Reactive power LS-5	React. power LS5 [var]	Reactive Power Format

Analog Input #	ID	Data Source	Reference Value	Remarks
10.66	15722	Total reactive power in system	Syst.react.pwr.[var]	Reactive Power Format
10.70	15719	LS-5 frequency L-L	LS-5 freq. L-L [Hz]	Frequency format
10.71	15720	LS-5 voltage L-L	LS-5 volt.L-L [V]	Voltage format
10.72	15721	LS-5 voltage L-N	LS-5 volt.L-N [V]	Voltage format
10.79	11988	10.79 RTC Year	RTC Year	
10.80	11989	10.80 RTC Month	RTC Month	
10.81	11990	10.81 RTC Day	RTC Day	
10.82	11991	10.82 RTC Hour	RTC Hour	
10.83	11992	10.83 RTC Minute	RTC Minute	
10.84	11993	10.84 RTC Second	RTC Second	
10.85	11985	10.85 RTC Weekday	RTC Weekday	(Definition: 1 = Sunday)

9.4.1.10 Group 11: Engine Values

Analog Input #	ID	Data Source	Reference Value	Remarks
11.01	15700	Engine speed	Engine speed [%]	Percentage value related on Engine rated Speed.
11.02	15701	Biasing Volt/Preact	Voltage bias [%]	
11.03	15702	Biasing Freq/Pact	Speed bias [%]	
11.04	15704	Analog input D+	Analog input D+ [%]	Percentage value related on Battery Voltage 24V.
11.51	9861	Engine speed	Engine speed [rpm]	Speed Format
11.54	9862	Analog input D+	Analog input D+ [V]	Voltage Format
11.55	15715	Engine operating hours	Eng.oper.hours [h]	Hour Format
11.56	15716	Average Cylinder temp. bank 1	Cyl.temp.bank 1 [°C]	Temperature Format
11.57	15717	Average Cylinder temp. bank 2	Cyl.temp.bank 2 [°C]	Temperature Format
11.58	15723	Period of use	Period of use hours	Hour Format
11.59	11566	Cooldown time	Cooldown time [s]	Seconds format. Remaining time only!
11.60	11567	Preglow time	Preglow time [s]	Seconds format. Remaining time only!
11.61	11568	Eng. monit. delay	Eng. monit. delay [s]	Seconds format. Remaining time only!
11.62	11569	Auxil.serv.prerun	Auxil.serv.prerun [s]	Seconds format. Remaining time only!
11.63	11570	Auxil.serv.postr.	Auxil.serv.postr.[s]	Seconds format. Remaining time only!
11.64	11572	Stop engine	Stop engine [s]	Seconds format. Remaining time only!

9.4.1.11 Groups 12 Free

Ideas to enhance the functionality and/or usability of our devices are welcome!

Please see contact info at the rear page.

9.4.1.12 Group 13: Free Constants

Analog Input #	ID	Data Source	Reference Value	Remarks
13.01	15551	13.01 Free constant 1	Free constant 1	
13.02	15552	13.02 Free constant 2	Free constant 2	
13.03	15553	13.03 Free constant 3	Free constant 3	
13.04	15554	13.04 Free constant 4	Free constant 4	
13.05	15555	13.05 Free constant 5	Free constant 5	
13.06	15556	13.06 Free constant 6	Free constant 6	
13.07	15557	13.07 Free constant 7	Free constant 7	
13.08	15558	13.08 Free constant 8	Free constant 8	
13.09	15559	13.09 Free constant 9	Free constant 9	
13.10	15560	13.10 Free constant 10	Free constant 10	
13.11	15561	13.11 Free constant 11	Free constant 11	
13.12	15562	13.12 Free constant 12	Free constant 12	
13.13	15563	13.13 Free constant 13	Free constant 13	
13.14	15564	13.14 Free constant 14	Free constant 14	
13.15	15565	13.15 Free constant 15	Free constant 15	
13.16	15566	13.16 Free constant 16	Free constant 16	

9.4.1.13 Groups 14 .. 79: Free

Ideas to enhance the functionality and/or usability of our devices are welcome!

Please see contact info at the rear page.

9.4.1.14 Group 80: Reserved - don't use

9.4.1.15 Group 81: Results 1

Analog Input #	ID	Data Source	Reference Value	Remarks
81.01	9308	Preglow criterion	AM Preglow criterion	
81.02	9309	Engine Warm-up criterion	AM Warm-up criterion	
81.03	9312	Frequency setpoint 1 source [Hz]	AM Frequency SP1[Hz]	
81.04	9314	Frequency setpoint 2 source [Hz]	AM Frequency SP2[Hz]	
81.05	9316	Active power setpoint 1 source [W]	AM ActPower SP1 [W]	
81.06	9318	Active power setpoint 2 source [W]	AM ActPower SP2 [W]	
81.07	9321	Active power setpoint 3 source [W]	AM ActPower SP3 [W]	
81.08	9323	Active power setpoint 4 source [W]	AM ActPower SP4 [W]	
81.09	9325	Voltage setpoint 1 source [V]	AM Voltage SP1 [V]	
81.10	9327	Voltage setpoint 2 source [V]	AM Voltage SP2 [V]	
81.11	9386	PF/var setpoint 1 source [-/var]	AM PF/var SP1[-/var]	
81.12	9388	PF/var setpoint 2 source [-/var]	AM PF/var SP2[-/var]	
81.13	5583	PID 1 control setpoint	AM PID1 setpoint	
81.14	5596	PID 1 control actual value	AM PID1 actual value	
81.15	5598	PID 2 control setpoint	AM PID2 setpoint	
81.16	5599	PID 2 control actual value	AM PID2 actual value	
81.17	5683	PID 3 control setpoint	AM PID3 setpoint	
81.18	5684	PID 3 control actual value	AM PID3 actual value	
81.19	9390	External measured mains active power	AM Ext.mains act.pwr.	
81.20	9392	External measured mains reactive power	AM Ext.mains RPower	
81.21	9394	Free derating source	AM Derating source	
81.22	9396	ECU sequencer analog input 1	AM ECU seq.A_IN_1	
81.23	9398	ECU sequencer analog input 2	AM ECU seq.A_IN_2	
81.24	9592	AM Engine speed	AM Engine speed	
81.25	9594	AM Engine oil pressure	AM Engine oil press.	
81.26	9596	AM Engine hours	AM Engine hours	
81.27	9598	AM Engine tank level	AM Engine fuel level	
81.28	9601	AM Engine battery voltage	AM Engine batt.volt.	
81.29	9611	AM Engine coolant water temperature	AM Engine coolant T	

9.4.1.16 Group 82: Results 2

Analog Input #	ID	Data Source	Reference Value	Remarks
82.01	9250	Flexible Limit 1 data source	AM FlexLim 1 source	
82.02	9251	Flexible Limit 2 data source	AM FlexLim 2 source	
82.03	9252	Flexible Limit 3 data source	AM FlexLim 3 source	
82.04	9253	Flexible Limit 4 data source	AM FlexLim 4 source	
82.05	9254	Flexible Limit 5 data source	AM FlexLim 5 source	
82.06	9255	Flexible Limit 6 data source	AM FlexLim 6 source	
82.07	9256	Flexible Limit 7 data source	AM FlexLim 7 source	
82.08	9257	Flexible Limit 8 data source	AM FlexLim 8 source	
82.09	9258	Flexible Limit 9 data source	AM FlexLim 9 source	
82.10	9259	Flexible Limit 10 data source	AM FlexLim 10 source	
82.11	9260	Flexible Limit 11 data source	AM FlexLim 11 source	
82.12	9261	Flexible Limit 12 data source	AM FlexLim 12 source	
82.13	9262	Flexible Limit 13 data source	AM FlexLim 13 source	
82.14	9263	Flexible Limit 14 data source	AM FlexLim 14 source	
82.15	9264	Flexible Limit 15 data source	AM FlexLim 15 source	
82.16	9265	Flexible Limit 16 data source	AM FlexLim 16 source	
82.17	9266	Flexible Limit 17 data source	AM FlexLim 17 source	
82.18	9267	Flexible Limit 18 data source	AM FlexLim 18 source	
82.19	9268	Flexible Limit 19 data source	AM FlexLim 19 source	
82.20	9269	Flexible Limit 20 data source	AM FlexLim 20 source	
82.21	9270	Flexible Limit 21 data source	AM FlexLim 21 source	
82.22	9271	Flexible Limit 22 data source	AM FlexLim 22 source	
82.23	9272	Flexible Limit 23 data source	AM FlexLim 23 source	
82.24	9273	Flexible Limit 24 data source	AM FlexLim 24 source	
82.25	9274	Flexible Limit 25 data source	AM FlexLim 25 source	
82.26	9275	Flexible Limit 26 data source	AM FlexLim 26 source	
82.27	9276	Flexible Limit 27 data source	AM FlexLim 27source	
82.28	9277	Flexible Limit 28 data source	AM FlexLim 28 source	
82.29	9278	Flexible Limit 29 data source	AM FlexLim 29 source	
82.30	9279	Flexible Limit 30 data source	AM FlexLim 30 source	
82.31	9280	Flexible Limit 31 data source	AM FlexLim 31 source	
82.32	9281	Flexible Limit 32 data source	AM FlexLim 32 source	
82.33	9282	Flexible Limit 33 data source	AM FlexLim 33 source	
82.34	9283	Flexible Limit 34 data source	AM FlexLim 34 source	
82.35	9284	Flexible Limit 35 data source	AM FlexLim 35 source	

Analog Input #	ID	Data Source	Reference Value	Remarks
82.36	9285	Flexible Limit 36 data source	AM FlexLim 36 source	
82.37	9286	Flexible Limit 37 data source	AM FlexLim 37 source	
82.38	9287	Flexible Limit 38 data source	AM FlexLim 38 source	
82.39	9288	Flexible Limit 39 data source	AM FlexLim 39 source	
82.40	9289	Flexible Limit 40 data source	AM FlexLim 40 source	

9.4.1.17 Groups 83..89: Reserved - don't use

9.4.1.18 Group 90: 'Internal'/Fixed Values 0

Analog Input #	ID	Data Source	Reference Value	Remarks
90.01	7693	Screen 1 row 1	AM Cust. screen 1.1	Customer defined screen
90.02	7698	Screen 1 row 2	AM Cust.screen 1.2	Customer defined screen
90.03	7703	Screen 1 row 3	AM Cust.screen 1.3	Customer defined screen
90.04	7708	Screen 1 row 4	AM Cust.screen 1.4	Customer defined screen
90.05	7713	Screen 1 row 5	AM Cust.screen 1.5	Customer defined screen
90.06	7718	Screen 1 row 6	AM Cust.screen 1.6	Customer defined screen
90.07	7723	Screen 1 row 7	AM Cust.screen 1.7	Customer defined screen
90.08	7728	Screen 1 row 8	AM Cust.screen 1.8	Customer defined screen
90.09	7733	Screen 1 row 9	AM Cust.screen 1.9	Customer defined screen
90.51	7738	Screen 2 row 1	AM Cust.screen 2.1	Customer defined screen
90.52	7743	Screen 2 row 2	AM Cust.screen 2.2	Customer defined screen
90.53	7748	Screen 2 row 3	AM Cust.screen 2.3	Customer defined screen
90.54	7753	Screen 2 row 4	AM Cust.screen 2.4	Customer defined screen
90.55	7758	Screen 2 row 5	AM Cust.screen 2.5	Customer defined screen
90.56	7763	Screen 2 row 6	AM Cust.screen 2.6	Customer defined screen
90.57	7768	Screen 2 row 7	AM Cust.screen 2.7	Customer defined screen
90.58	7773	Screen 2 row 8	AM Cust.screen 2.8	Customer defined screen
90.59	7778	Screen 2 row 9	AM Cust.screen 2.9	Customer defined screen

9.4.1.19 Group 91: 'Internal'/Fixed Values 1

Analog Input #	ID	Data Source	Reference Value	Remarks
91.01	9642	Internal Value 1	AM Internal value 1	
91.02	9646	Internal Value 2	AM Internal value 2	
91.03	9650	Internal Value 3	AM Internal value 3	

Analog Input #	ID	Data Source	Reference Value	Remarks
91.04	9654	Internal Value 4	AM Internal value 4	
91.05	9658	Internal Value 5	AM Internal value 5	
91.06	9662	Internal Value 6	AM Internal value 6	
91.07	9666	Internal Value 7	AM Internal value 7	
91.08	9670	Internal Value 8	AM Internal value 8	
91.09	9674	Internal Value 9	AM Internal value 9	
91.10	9678	Internal Value 10	AM Internal value 10	
91.11	9682	Internal Value 11	AM Internal value 11	
91.12	9686	Internal Value 12	AM Internal value 12	
91.13	9690	Internal Value 13	AM Internal value 13	
91.14	9694	Internal Value 14	AM Internal value 14	
91.15	9698	Internal Value 15	AM Internal value 15	
91.16	9702	Internal Value 16	AM Internal value 16	

9.4.1.20 Group 92: Reserved - don't use

9.4.1.21 Group 93: Analog Outputs 1

Analog Output #	ID	Data Source	Reference Value	Remarks
93.01	9705	Analog output 1 data source	AM Data source AO1	
93.02	9707	Analog output 2 data source	AM Data source AO2	
93.21	9717	AM Data source external AO1	AM Data s. ext. AO1	
93.22	9719	AM Data source external AO2	AM Data s. ext. AO2	
93.23	9721	AM Data source external AO3	AM Data s. ext. AO3	
93.24	9723	AM Data source external AO4	AM Data s. ext. AO4	

9.4.1.22 Groups 94..99: Reserved - don't use

9.4.2 Reference Values

9.4.2.1 Generator Rated Voltage

Generator voltage values

(Wye and Delta and average values)

User defined max. output value = 100% means, that the 100% refer to the generator rated voltage. If parameter “Source value at maximal output” is set to “+100.00%” this will result in that the Analog output delivers its maximum output value if for example 400V Phase-phase are the nominal value and 400V are measured. If only 200 V are measured this will result in an analog output value of 50% end scale.

9.4.2.2 Mains Rated Voltage

Mains voltage values

(Wye, Delta, Average, and dragged values)

User defined max. output value = 100% means, that the 100% refer to the mains rated voltage. If parameter “Source value at maximal output” is set to “+100.00%” this will result in that the Analog output delivers its maximum output value if for example 400V are the nominal value and 400V are measured. If only 200 V are measured this will result in an analog output value of 50% end scale.

9.4.2.3 Nominal Frequency

Generator, Mains,Busbar1,Busbar2 frequency values

User defined max. output value = 100% means, that the 100% refer to the nominal frequency. If parameter “Source value at maximal output” is set to “+100.00%” this will result in that the Analog output delivers its maximum output value if a for example 50Hz are the nominal value and 50V are measured.

9.4.2.4 Generator/Mains rated active/reactive Power

Generator and Mains active/ reactive/ apparent power values

User defined max. output value = 100% means, that the 100% refer to the rated active power value. If parameter “Source value at maximal output” is set to “+100.00%” this will result in that the Analog output delivers its maximum output value if a for example 1000kW are the nominal value and 1000kW are measured. If only 200kW are measured this will result in an Analog output value of 20% end scale.

9.4.2.5 Generator/Mains Power Factor

Mains and Generator Power factors

User defined max. output value = 100% means, that 50% refers to power factor 1.00.

If the power factor moves to lagging (inductive) the output goes to 100%. If the power factor goes to leading (capacitive), the output goes to 0%.

Examples:

0,05% = -0,001(capacitive)

99,95% = 0,001(inductive)

100% = 0% = cosphi 0

9.4.2.6 Generator Rated Current

Generator current values

(Wye,Delta,Average and dragged values)

User defined max. output value = 100% means, that the 100% refer to the rated generator current. If parameter “Source value at maximal output” is set to “+100.00%” this will result in that the Analog output delivers its maximum output value if a for example 1000A are the nominal value and 1000A are measured. If only 200A are measured this will result in an Analog output value of 20% end scale.

9.4.2.7 Mains rated Current

Mains current values

(Wye,Delta,Average and dragged values)

User defined max. output value = 100% means, that the 100% refer to the rated mains current. If parameter “Source value at maximal output” is set to “+100.00%” this will result in that the Analog output delivers its maximum output value if a for example 1000A are the nominal value and 1000A are measured. If only 200A are measured this will result in an Analog output value of 20% end scale.

9.4.2.8 Nominal Speed

Pickup speed

User defined max. output value = 100% means, that the 100% refer to the parametrized nominal speed. If parameter “Source value at maximal output” is set to “+100.00%” this will result in that the Analog output delivers its maximum output value if a for example 1500 RPM are the nominal value and 1500 RPM are measured. If only 750 RPM are measured this will result in an Analog output value of 50% end scale.

9.4.2.9 Battery Voltage

Battery voltage and Auxiliary excitation

User defined max. output value = 100% means, that the 100% refer to a voltage of 24.0 Volts . If parameter “Source value at maximal output” is set to “+100.00%” this will result in that the Analog output delivers its maximum output value if a for example 24.0 Volts are the nominal value and 24.0 Volts are measured. If only 12.0 Volts are measured this will result in an Analog output value of 50% end scale.

9.4.2.10 Fixed Value 10000

Analog inputs, GAP values

User defined max. output value = 100% means, that the 100% refer to a fixed value of 10000. If parameter “Source value at maximal output” is set to “+100.00%” this will result in that the Analog output delivers its maximum output value if a for example “10000” is delivered by GAP.

9.4.2.11 Busbar 1 Rated Voltage

Busbar 1 voltages (delta values)

User defined max. output value = 100% means, that the 100% refer to the nominal busbar 1 voltage. If parameter “Source value at maximal output” is set to “+100.00%” this will result in that the Analog output delivers its maximum output value if a for example 400V are the nominal value and 400V are measured.

9.4.2.12 Display Value Format

The analog input values refer to the display value format (refer to parameter 1035 ␡ p. 196/␡ p. 575).

Delimiters like decimal points or commas are ignored. If the display value format is 0.01 bar for example, a value of 5 bar corresponds with 00500.

Analog output example

- An analog input is configured to VDO 120 °C characteristic.
- The source value at maximum output is configured to 00100 (i.e. 100 °C).
- The source value at minimum output is configured to 00020 (i.e. 20 °C).
- The analog output range is configured to 0 to 20 mA.

- If a value of 20 °C (or below) is measured, the analog output issues its lower limit (i.e. 0 mA).
- If a value of 100 °C (or above) is measured, the analog output issues its upper limit (i.e. 20 mA).
- If a value of 60 °C is measured, the analog output issues 50% of its upper limit (i.e. 10 mA).
- If a value of 84 °C is measured, the analog output issues 80% of its upper limit (i.e. 16 mA).

Flexible limit example

- An analog input is configured to VDO 10 bar characteristic.
- If the flexible limit is to be configured to 5.23 bar, it must be entered as 00523.

See the fixed display value formats below:

Analog input type	Display value format	Example value	Example format
VDO 5 bar	0.01 bar	5.0 bar	500
VDO 10 bar	0.01 bar	6.6 bar	660
VDO 120 °C	1 °C	69 °C	69
VDO 150 °C	1 °C	73 °C	73
Pt100	1 °C	103 °C	103

Table 160: Display value format

9.4.3 Factory Settings

AnalogManager's default settings

ID	Name	Operator	Default setting/value
5518	AM Frequency SP1[Hz]	Analog1 ("A1 =")	05.51 Internal f setp1 [Hz]
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————
		Operators-Unary2	————
5519	AM Frequency SP2[Hz]	Analog1 ("A1 =")	05.52 Internal f setp2 [Hz]
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————
		Operators-Unary2	————
15147	AM Derating source	Analog1 ("A1 =")	06.01 Analog input 1
		Analog2 ("A2 =")	06.01 Analog input 1
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————
		Operators-Unary2	————
5539	AM ActPower SP1 [W]	Analog1 ("A1 =")	05.54 Internal P setp1 [W]
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————
		Operators-Unary2	————
5540	AM ActPower SP2 [W]	Analog1 ("A1 =")	05.55 Internal P setp2 [W]
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0

ID	Name	Operator	Default setting/value
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————
		Operators-Unary2	————
5606	AM ActPower SP3 [W]	Analog1 ("A1 =")	05.80 Internal P setp3 [W]
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————
		Operators-Unary2	————
5609	AM ActPower SP4 [W]	Analog1 ("A1 =")	05.84 Internal P setp4 [W]
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————
		Operators-Unary2	————
5538	AM Warm-up criterion	Analog1 ("A1 =")	10.01 ZERO
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————
		Operators-Unary2	————
5638	AM PF/var SP1[-/var]	Analog1 ("A1 =")	05.10 Intern. PF setp1 [%]
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————

ID	Name	Operator	Default setting/value
		Operators-Unary2	————
5639	AM PF/var SP2[-/var]	Analog1 ("A1 =")	05.11 Intern. PF setp2 [%]
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————
		Operators-Unary2	————
3346	AM Preglow criterion	Analog1 ("A1 =")	10.01 ZERO
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————
		Operators-Unary2	————
5618	AM Voltage SP1 [V]	Analog1 ("A1 =")	05.57 Internal V setp1 [V]
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————
		Operators-Unary2	————
5619	AM Voltage SP2 [V]	Analog1 ("A1 =")	05.58 Internal V setp2 [V]
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————
		Operators-Unary2	————
5577	AM PID1 setpoint	Analog1 ("A1 =")	05.75 Int. PID1 setpoint
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through

ID	Name	Operator	Default setting/value
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————
		Operators-Unary2	————
5578	AM PID1 actual value	Analog1 ("A1 =")	10.01 ZERO
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————
		Operators-Unary2	————
5590	AM PID2 setpoint	Analog1 ("A1 =")	05.76 Int. PID2 setpoint
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————
		Operators-Unary2	————
5591	AM PID2 actual value	Analog1 ("A1 =")	10.01 ZERO
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————
		Operators-Unary2	————
5676	AM PID3 setpoint	Analog1 ("A1 =")	05.77 Int. PID3 setpoint
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————
		Operators-Unary2	————

ID	Name	Operator	Default setting/value
5677	AM PID3 actual value	Analog1 ("A1 =")	10.01 ZERO
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————
		Operators-Unary2	————
3346	AM Preglow criterion	Analog1 ("A1 =")	10.01 ZERO
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————
		Operators-Unary2	————
5200	AM Data source AO1	Analog1 ("A1 =")	11.03 Speed bias [%]
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————
		Operators-Unary2	————
5214	AM Data source AO2	Analog1 ("A1 =")	11.02 Voltage bias [%]
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————
		Operators-Unary2	————
10237	AM Data source ext.AO1	Analog1 ("A1 =")	11.03 Speed bias [%]
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE

ID	Name	Operator	Default setting/value
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————
		Operators-Unary2	————
10247	AM Data source ext.AO2	Analog1 ("A1 =")	11.03 Speed bias [%]
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	
		Operators-Unary1	————
		Operators-Unary2	————
10257	AM Data source ext.AO3	Analog1 ("A1 =")	11.03 Speed bias [%]
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	5
		Operators-Unary1	————
		Operators-Unary2	————
10267	AM Data source ext.AO4	Analog1 ("A1 =")	11.03 Speed bias [%]
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	5
		Operators-Unary1	————
		Operators-Unary2	————
15162	AM ECU seq.A_IN_1	Analog1 ("A1 =")	10.01 ZERO
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	5
		Operators-Unary1	————
		Operators-Unary2	————
15163	AM ECU seq.A_IN_2	Analog1 ("A1 =")	10.01 ZERO
		Analog2 ("A2 =")	10.01 ZERO

ID	Name	Operator	Default setting/value
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	5
		Operators-Unary1	————
		Operators-Unary2	————
9640	AM Internal value 1	Analog1 ("A1 =")	10.01 ZERO
9644	AM Internal value 2	Analog2 ("A2 =")	10.01 ZERO
9648	AM Internal value 3	Constant1 ("C1 =")	0
9652	AM Internal value 4	Function Type ("Type =")	Pass through
9656	AM Internal value 5	Logic1 "L1"	02.01 LM FALSE
9660	AM Internal value 6	Logic2 "L2"	02.01 LM FALSE
9664	AM Internal value 7	Operators	5
9668	AM Internal value 8	Operators-Unary1	————
9672	AM Internal value 9	Operators-Unary2	————
9676	AM Internal value 10		
9680	AM Internal value 11		
9684	AM Internal value 12		
9688	AM Internal value 13		
9692	AM Internal value 14		
9696	AM Internal value 15		
9700	AM Internal value 16		
5780	AM Ext.mains act.pwr	Analog1 ("A1 =")	06.01 Analog input 1
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	5
		Operators-Unary1	————
		Operators-Unary2	————
5794	AM Ext.mains RPower	Analog1 ("A1 =")	06.02 Analog input 2
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	5
		Operators-Unary1	————
		Operators-Unary2	————
4206	AM FlexLim 1 source	Analog1 ("A1 =")	10.01 ZERO
4223	AM FlexLim 2 source	Analog2 ("A2 =")	10.01 ZERO
4240	AM FlexLim 3 source		

ID	Name	Operator	Default setting/value
4257 4276 4286 4296	AM FlexLim 4 source AM FlexLim 5 source AM FlexLim 6 source AM FlexLim 7 source	Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	5
		Operators-Unary1	————
		Operators-Unary2	————
6006 6016 6026 6026 + (N x (+10)) ... 6326	AM FlexLim 8 source AM FlexLim 9 source AM FlexLim 10 source AM FlexLim 10 + N source ((N = 1, 2, ...)) ... AM FlexLim 40 source	Analog1 ("A1 =")	10.01 ZERO
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	5
		Operators-Unary1	————
		Operators-Unary2	————
7690 7695 7700 7705 7710 7715 7720 7725 7730 7735 7740 7745 7750 7755 7760 7765 7770 7775	AM Customer screen 1.1 AM Customer screen 1.2 AM Customer screen 1.3 AM Customer screen 1.4 AM Customer screen 1.5 AM Customer screen 1.6 AM Customer screen 1.7 AM Customer screen 1.8 AM Customer screen 2.9 AM Customer screen 2.1 AM Customer screen 2.2 AM Customer screen 2.3 AM Customer screen 2.4 AM Customer screen 2.5 AM Customer screen 2.6 AM Customer screen 2.7 AM Customer screen 2.8 AM Customer screen 2.9	Analog1 ("A1 =")	10.01 ZERO
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	————
		Operators-Unary1	————
		Operators-Unary2	
8891	AM Engine speed	Analog1 ("A1 =")	11.51 Engine speed [rpm]
		Analog2 ("A2 =")	10.02 ONE
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	5
		Operators-Unary1	————
		Operators-Unary2	————
8893	AM Engine oil pressure	Analog1 ("A1 =")	07.07 100:Engine Oil Press.

ID	Name	Operator	Default setting/value
		Analog2 ("A2 =")	10.02 ONE
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	5
		Operators-Unary1	————
		Operators-Unary2	————
8895	AM Engine hours	Analog1 ("A1 =")	11.55 Eng.oper.hours [h]
		Analog2 ("A2 =")	10.02 ONE
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	5
		Operators-Unary1	————
		Operators-Unary2	————
8897	AM Engine fuel level	Analog1 ("A1 =")	06.03 Analog input 3
		Analog2 ("A2 =")	10.02 ONE
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	5
		Operators-Unary1	————
		Operators-Unary2	————
8899	AM Engine batt.voltage	Analog1 ("A1 =")	10.54 Battery voltage [V]
		Analog2 ("A2 =")	10.02 ONE
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	5
		Operators-Unary1	————
		Operators-Unary2	————
8901	AM Engine coolant temp.	Analog1 ("A1 =")	07.15 110:Eng.Coolant Temp.
		Analog2 ("A2 =")	10.02 ONE
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	5

ID	Name	Operator	Default setting/value
		Operators-Unary1	————
		Operators-Unary2	————

Table 161: Factory settings: AnalogManager

9.5 Event And Alarm Reference

9.5.1 Alarm Classes

The control functions are structured in the following alarm classes:

Alarm class	Visible in the display	LED "Alarm" & horn	Relay "Command: open GCB"	Shut-down engine	Engine blocked until ack. sequence has been performed
A	Yes	No	No	No	No
Warning Alarm	This alarm does not interrupt the unit operation. A message output without a centralized alarm occurs: ■ Alarm text.				
B	Yes	Yes	No	No	No
Warning Alarm	This alarm does not interrupt the unit operation. An output of the centralized alarm occurs and the command variable 3.05 (horn) is issued. ■ Alarm text + flashing LED "Alarm" + Relay centralized alarm (horn).				
C	Yes	Yes	Soft unloading	Cool down time	Yes
Shutdown Alarm	With this alarm the GCB is opened and the engine is stopped. Coasting occurs. ■ Alarm text + flashing LED "Alarm" + Relay centralized alarm (horn) + GCB open + Coasting + Engine stop.				
D	Yes	Yes	Immediately	Cool down time	Yes
Shutdown Alarm	With this alarm the GCB is opened and the engine is stopped. Coasting occurs. ■ Alarm text + flashing LED "Alarm" + Relay centralized alarm (horn) + GCB open + Coasting + Engine stop.				
E	Yes	Yes	Soft unloading	Immediately	Yes
Shutdown Alarm	With this alarm the GCB is opened immediately and the engine is stopped. ■ Alarm text + flashing LED "Alarm" + Relay centralized alarm (horn) + GCB open + Engine stop.				
F	Yes	Yes	Immediately	Immediately	Yes
Shutdown Alarm	With this alarm the GCB is opened immediately and the engine is stopped. ■ Alarm text + flashing LED "Alarm" + Relay centralized alarm (horn) + GCB open + Engine stop.				
Control	No	No	No	No	No
Control Signal	This signal issues a control command only. It may be assigned to a discrete input for example to get a control signal, which may be used in the LogicsManager. No alarm message and no entry in the alarm list or the event history will be issued. This signal is always self-acknowledging, but considers a delay time and may also be configured with an engine delay.				

> **CAUTION!**
> If an alarm of class C, D, or E is present and the GCB cannot be opened, the engine will not be stopped. This can only be achieved by enabling GCB monitoring (parameter 2600 ↳ p. 395) with the alarm class configured to "F" (parameter 2601 ↳ p. 396).

If an alarm has been configured with a shutdown alarm that has been enabled to self-acknowledge, and has been configured as engine delayed the following scenario may happen:

- The alarm shuts down the engine because of its alarm class.
- Due to the engine stopping, all engine delayed alarms are ignored.
- The alarm class is acknowledged automatically.
- The alarm will self-acknowledge and clear the fault message that shut the engine down.
  This prevents the fault from being analyzed. After a short delay, the engine will restart.
- After the engine monitoring delay expires, the fault that originally shut down the engine will do so again.
  This cycle will continue to repeat until corrected.

9.5.2 Conversion Factors

Temperature

°C → °F	T [°F] = (T [°C] x 1.8) + 32
°F → °C	T [°C] = (T [°F] – 32) / 1.8

Pressure

bar → psi	P [psi] = P [bar] x 14.503
psi → bar	P [bar] = P [psi] / 14.503

9.5.3 Status Messages

Status messages on main screen

In alphabetical order:

Message text ID	Meaning
AUTO mode ready 13253	**Automatic mode ready for start** The unit is waiting for a start signal in Automatic operating mode and no alarm of class C, D, E, or F is present.
Aux. serv. postrun 13200	**Postrun of the auxiliary operation is active** After the engine has stopped, auxiliary operations are enabled. These operations ensure that required equipment which is necessary for the operation of the engine continues to run (i.e. electric cooling fan).
Aux. services prerun 13201	**Prerun of the auxiliary operation is active** Before the engine is started the signal "aux. services prerun" is enabled, so that all required equipment which is necessary for the operation of the engine can be initialized, started or switched.
Busbar 1 AC wiring 10094	**AC wiring issue of Busbar voltages** One or more of the busbar voltages are wrong wired (detected by plausibility checking of frequencies).

Message text ID	Meaning
Cool down 13204	**Coasting of the engine is active** The no load operation is performed prior to the stopping of the engine. The no load operation is utilized to cool the engine.
Crank protect 13214	**Starter protection** To prevent the starter from being damaged by an engine that is rotating, a crank protection delay is active to ensure that the engine has time to stop rotating.
Critical mode 13202	**Critical mode (Sprinkler operation) is active** The sprinkler operation is activated.
Derating active 13281	**Derating active** As long as the derating function is activated, this text message is shown (parameter 15143 p. 283).
Emergency/Critical 13215	**Emergency operation during active critical operation** A04 A06 A07 A08 A09 A11 Both Critical mode and Emergency run are activated.
Emergency run 13211	**Emergency power operation** A04 A06 A07 A08 A09 A11 After the control unit detects that a mains fault has occurred, the engine is started after the emergency delay timer expires. The MCB is opened, the GCB is closed, and the generator set assumes the load. If the generator set is already running, operations continue until the emergency power operation conditions no longer exist. If the mains return, the mains settling timer becomes active first (see below).
GCB dead bus close 13209	**Dead bus closing of the GCB** A03 to A11 The GCB is closed onto the de-energized busbar. The measured busbar voltage is below the configured dead bus detection limit.
GCB → MCB Delay 13261	**GCB – MCB delay time is active** A04 If the breaker logic is configured to Open Transition and a transfer from generator to mains supply is initiated, the transfer time delay will start after the replay "GCB is open" is received. The MCB close command will be issued after the transfer time has expired.
GCB open 13255	**The GCB is being opened** A02 to A11 A GCB open command has been issued.
Gen. AC wiring 10093	**AC wiring issue of Generator voltages** One or more of the generator voltages are wrong wired (detected by plausibility checking of frequencies).
Gen. stable time 13250	**Generator stable time is active** If the engine monitoring delay timer has expired, the generator settling time starts. This permits for an additional delay time before the breaker is closed in order to ensure that none of the engine delayed watchdogs trips.
GGB dead bus close 13270	**Dead bus closing of the GGB** A05 A06 A09 A10 A11 The GGB is closed when the busbar is inside the operating range and the load busbar is dead.
GGB → MCB Delay 13272	**GGB – MCB delay time is active** A06 A09 A11 If the breaker logic is configured to Open Transition and a transfer from busbar to mains supply is initiated, the transfer time delay will start after the replay "GGB is open" is received. The MCB close command will be issued after the transfer time has expired.
GGB open 13268	**The GGB is being opened** A05 A06 A09 A10 A11 A GGB open command has been issued.
Idle run active 13216	**The control is in idle mode** No undervoltage, underfrequency, and underspeed monitoring is performed in idle mode. The flexible limits 33 through 40 are not monitored.
Ignition 13213	**Enable the ignition (Gas engine)** After the purging operation and before the fuel solenoids opened.
In operation 13251	**The genset is in regular operation** The genset is in regular operation and is ready for supplying load.

Message text ID	Meaning
Loading Generator 13258	**The generator power will be increased to the setpoint** The generator power will be increased to the configured setpoint with a rate defined by the power control setpoint ramp.
Mains AC wiring 10095	**AC wiring issue of Mains voltages** One or more of the mains voltages are wrong wired (detected by plausibility checking of frequencies).
Mains settling 13205	**Mains settling time is active** A04 A06 A07 A08 A09 A11 When the control unit detects that the mains fault is no longer present and power has been restored, the mains settling timer begins counting down. If the mains are stable after the expiration of the timer (the mains voltage has not fallen below or risen over the configured monitoring limits), the load is transferred from the generator supply to the mains supply.
MCB dead bus close 13210	**Dead bus closing of the MCB** A04 A06 A08 A09 A11 The MCB is closed onto the de-energized busbar. The measured busbar voltage is below the configured dead bus detection limit.
MCB → GCB Delay 13262	**MCB – GCB delay time is active** A04 If the breaker logic is configured to Open Transition and a transfer from mains to generator supply is initiated, the transfer time delay will start after the reply "MCB is open" is received. The GCB close command will be issued after the transfer time has expired.
MCB → GGB Delay 13273	**MCB – GGB delay time is active** A06 A09 A11 If the breaker logic is configured to Open Transition and a transfer from mains to generator supply is initiated, the transfer time delay will start after the reply "MCB is open" is received. The GGB close command will be issued after the transfer time has expired.
MCB open 13257	**The MCB is being opened** A04 A06 A08 A09 A11 An MCB open command has been issued.
P(V) derating 13309	**P(V) derating is active**
Power limited prerun 13252	**Active power limited prerun is active** The real power setpoint is limited to the warm up power limit for the configured warm up time.
Preglow 13208	**Preglow of the engine is active (Diesel engine)** The diesel engine is preheated prior to starting.
Ramp to rated 13254	**Engine is accelerating to rated speed** After firing speed has been exceeded, the engine monitoring delay timer starts. This message is displayed during this period.
Ready for Operation 12580	**Ready for Operation OFF** The discrete output R01 is energized by default to monitor controlled/uncontrolled operation of the device itself.
Run-up Synchron. 13271	**Run-up Synchronization** A03 to A11 The run-up synchronization mode is active (parameter 3435 ↻ p. 177).
Start 13206	**Start engine is active** After the "Prerun auxiliary operation" expires, the engine is started according to the configured start logic (Diesel or gas engine). When the start sequence is active, various relays are enabled and representative signals are passed via the CAN bus to a secondary engine control.
Start – Pause 13207	**Start pause while starting the engine is active** If the engine could not be started, the controller will pause for the configured time prior to attempting to issuing a start command again.
Start w/o Load 13263	**Start without load is active** A regular engine start is performed. The GCB operation is blocked to prevent a change from mains to generator supply.
Stop engine 13203	**Engine will be stopped** The engine will be stopped. The engine stop delay will be started when ignition speed has been fallen below. A restart is only possible if the engine stop delay has been expired.

Message text ID	Meaning
Synch. CHECK 13266	**Synchronization mode CHECK** If the synchronization mode is set to “CHECK” (parameter 5728 ↳ p. 233) the screen message “Synch. CHECK” is blinking on the main screen.
Synch. OFF 13267	**Synchronization mode OFF** If the synchronization mode is set to “OFF” (parameter 5728 ↳ p. 233) the screen message “Synch. OFF” is blinking on the main screen.
Synch. PERMISSIVE 13265	**Synchronization mode PERMISSIVE** If the synchronization mode is set to “PERMISSIVE” (parameter 5728 ↳ p. 233) the screen message “Synch. PERMISSIVE” is blinking on the main screen.
Synchronization GCB 13259	**The GCB will be synchronized** The control tries to synchronize the GCB.
Synchronization GGB 13269	**The GGB will be synchronized** The control tries to synchronize the GGB.
Synchronization LS5 13283	**The LS-5 will be synchronized** The control tries to synchronize the LS-5
Synchronization MCB 13260	**The MCB will be synchronized** The control tries to synchronize the MCB.
Turning 13212	**Purging operation is active (Gas engine)** Before the fuel solenoid opens and the ignition of the gas engine is energized the remaining fuel, that may be present in the combustion chamber, will be removed by a purging operation. The starter turns the engine without enabling the ignition for a specified time to complete the purging operation. After the purging process, the ignition is energized.
Unloading Generator 13256	**The generator power will be decreased** The generator power will be decreased after a stop command has been issued with a rate defined by the power control setpoint ramp before the GCB will be opened.
Unloading LS5 13282	**Unloading the LS-5** The LS-5 performs a power reduction to make sure that there is little power in the system before opening the breaker .
Unloading mains 13264	**The mains power will be decreased** The real power setpoint is increased with the configured rate after synchronizing the generator in interchange transition mode. After the mains have been unloaded, the MCB will be opened.
Uprating active 13287	**Uprating active** As long as the uprating function is activated, this text message is shown (Please refer to ↳ *Chapter 4.4.4.5.4 “Derating And Uprating Of Power ” on page 275* for details).

Status messages to be displayed on special screens only

In alphabetical order:

Message text ID	Meaning
Add-off delay 13275	**Load dependent start/stop (LDSS) add-off delay time** Shows the current state of LDSS in the sequencing screen. A countdown of the configured add-off delay time will be displayed.
Add-on delay 13274	**Load dependent start/stop (LDSS) add-on delay time** Shows the current state of LDSS in the sequencing screen. A countdown of the configured add-on delay time will be displayed.
Minimum run time 13276	**Load dependent start/stop (LDSS) minimum run time** Shows the current state of LDSS in the sequencing screen. A countdown of the configured minimum run time will be displayed.

9.5.4 Event History

General notes

The event history is a 1000 entry FIFO (First In/First Out) memory for logging alarm events and operation states of the unit. As new event messages are entered into the history, the oldest messages are deleted once 1000 events have occurred.

For additional information refer to *Chapter 5 "Operation" on page 499*.

Resetting event history

Make sure to have set the appropriate code level to reset the event history.

If you have not entered the correct password for the required code level, the parameters for resetting the event history are not available (for additional information refer to *Chapter 4.3.4.1 "Password System - Parameter Overview" on page 156**).*

Three ways to reset Event History

- **ToolKit**: Click the *"Clear all "* button at *"STATUS MENU ➔ Diagnostic: Event History"*.
  (Read Event History at the same page)
- **HMI/display**: Go to *"Parameter ➔ Configure system management ➔ Factory default settings"* and select *[Yes]*, then *[Clear eventlog]* appears. Select *[Yes]* for *[Clear event log]*
  (To read Event History go to: *"Next Page ➔ Diagnostic ➔ Event History"*)
- **Parameter/remote**:Set parameter 1706 p. 634 *[Clear eventlog]*) to "TRUE" (1)
- The complete event history is now being cleared

9.5.4.1 Event Messages

Message text	Meaning	ID
AUTO mode	The unit is switched to AUTO mode	14353
Close command GCB	Control commands GCB close	14719
Close command GGB	Control commands GGB close	14723
Close command MCB	Control commands MCB close	14721
Critical mode	The critical mode is initiated	14707
Emergency run	The emergency run is initiated	14705
Engine idle run	The engine is running in idle mode	14762
Engine is running	The engine is started	14706
GCB close	The GCB reply signals GCB is closed	14703
GCB open	The GCB reply signals GCB is open	14702
Gen excitation lim.	The limit of the generator's excitation is exceeded	13288
GGB close	The GGB reply signals GGB is closed	14717
GGB open	The GGB reply signals GGB is open	14712
Load test	Testmode started with load	4684
Mains failure	Mains frequency or voltage is not ok	14704
MAN mode	The unit is switched to MANUAL mode	14355
MCB close	The MCB reply signals MCB is closed	14701
MCB open	The MCB reply signals MCB is open	14700
Neutral cont. closed	Neutral control is closed	1843
Neutral cont. opened	Neutral control is opened	1842
No load test	Testmode started without load	4683
Open command GCB	Control commands GCB open	14718
Open command MCB	Control commands MCB open	14720
Open command GGB	Control commands GGB open	14722
Operation mode TEST	The unit is switched to TEST mode	4685
Power derating act.	Power derating is activated	16192
Power uprating act.	Power uprating is activated	16193
Start up power	Start up power supply	14778
STOP mode	The unit is switched to STOP mode	14354
System update	System update is ongoing	14763

9.5.4.2 Alarm Messages

For a detailed description of the monitoring functions, which trigger the alarm messages, refer to *➪ Chapter 4.5.1 “Configure Generator Monitoring” on page 315.*

In alphabetical order:

Message text ID	Meaning
Active LS mismatch 5105	**Active power loadsharing mismatch.** Percentage load value of this device is different to the others.
Amber warning lamp 15126	**Amber warning lamp, J1939 interface** This watchdogs monitors, whether a specific alarm bit is received from the CAN J1939 interface. This enables to configure the control in a way that a reaction is caused by this bit (e.g. warning, shutdown). No alarm can be indicated if the CAN communication fails.
Bat. overvoltage 1 10007	**Battery overvoltage, limit value 1** The battery voltage has exceeded the limit value 1 for battery overvoltage for at least the configured time and does not fall below the value of the hysteresis.
Bat. overvoltage 2 10008	**Battery overvoltage, limit value 2** The battery voltage has exceeded the limit value 2 for battery overvoltage for at least the configured time and does not fall below the value of the hysteresis.
Bat. undervoltage 1 10005	**Battery undervoltage, limit value 1** The battery voltage has fallen below the limit value 1 for battery undervoltage for at least the configured time and has not exceeded the value of the hysteresis.
Bat. undervoltage 2 10006	**Battery undervoltage, limit value 2** The battery voltage has fallen below the limit value 2 for battery undervoltage for at least the configured time and has not exceeded the value of the hysteresis.
Busbar v/f not ok 5123	**Busbar voltage or frequency is not ok** Busbar values are not in the range defined by the operating ranges gen./busbar settings
CANopen Interface 1 10087	**Interface alarm CANopen on CAN bus 1** No Receive Process Data Object (RPDO) is received within the configured time.
CANopen Interface 2 10088	**Interface alarm CANopen on CAN bus 2** No message is received from the external expansion board (Node-ID) within the configured time.
CANopen Interface 3 10090	**Interface alarm CANopen on CAN bus 3** No Receive Process Data Object (RPDO) is received within the configured time.
Charge alt. low volt 4056	**Charging alternator voltage low** The charging alternator voltage has fallen below the critical limit for at least the configured time and has not exceeded the value of the hysteresis (the critical limit is 9 V for 12 V systems and 20 V for 24 V systems).
Cylinder temp.lev.1 14575	**Cylinder temperature Level 1**
Cylinder temp.lev.2 14576	**Cylinder temperature Level 2**
Cyl.tmp.wire brk. 14584	**Cylinder temperature monitoring wire is detected as broken**
Decoupling GCB <-> MCB 5147	**Decoupling GCB <->MCB** During decoupling there was a change over from the preferred breaker to the other.
Eng. stop malfunct. 2504	**Stop alarm of the engine** The engine failed to stop when given the stop command. When a stop command is issued a timer starts a countdown. If speed is still detected when this timer expires the controller recognizes an unsuccessful stop of the engine. An unsuccessful stop of the engine is determined if speed (measured by the generator frequency, the MPU, or the LogicsManager "ignition speed") is detected within the configured time after the stop signal has been issued.

Message text ID	Meaning
Free alarm 1 5165	**Free alarm 1 is detected**
Free alarm 2 5171	**Free alarm 2 is detected**
Free alarm 3 5177	**Free alarm 3 is detected**
Free alarm 4 5183	**Free alarm 4 is detected**
GCB fail to close 2603	**GCB failed to close** The easYgen has attempted to close the GCB the configured maximum number of attempts and failed. Depending on the configuration, the easYgen will continue to attempt to close the GCB as long as the conditions for closing the GCB are fulfilled.
GCB fail to open 2604	**GCB failed to open** The easYgen is still receiving the reply "GCB closed" after the GCB open monitoring timer has expired.
GCB syn. timeout 3064	**GCB synchronization time exceeded** The easYgen has failed to synchronize the GCB within the configured synchronization time.
Gen act. pwr mismatch 2924	**Generator active power mismatch** The deviation between the generator power and the active power setpoint has exceeded the limit for at least the configured time.
Gen. overcurrent 1 2218	**Generator overcurrent, limit value 1** The generator current has exceeded the limit value 1 for the generator overcurrent for at least the configured time and does not fall below the value of the hysteresis.
Gen. overcurrent 2 2219	**Generator overcurrent, limit value 2** The generator current has exceeded the limit value 2 for the generator overcurrent for at least the configured time and does not fall below the value of the hysteresis.
Gen. overcurrent 3 2220	**Generator overcurrent, limit value 3** The generator current has exceeded the limit value 3 for the generator overcurrent for at least the configured time and does not fall below the value of the hysteresis.
Gen. overfrequency 1 1912	**Generator overfrequency, limit value 1** The generator frequency has exceeded the limit value 1 for generator overfrequency for at least the configured time and does not fall below the value of the hysteresis.
Gen. overfrequency 2 1913	**Generator overfrequency, limit value 2** The generator frequency has exceeded the limit value 2 for generator overfrequency for at least the configured time and does not fall below the value of the hysteresis.
Gen. overload IOP 1 2314	**Generator overload IOP, limit value 1** The generator power has exceeded the limit value 1 for generator overload in islanded operation (MCB is open) for at least the configured time and does not fall below the value of the hysteresis.
Gen. overload IOP 2 2315	**Generator overload IOP, limit value 2** The generator power has exceeded the limit value 2 for generator overload in islanded operation (MCB is open) for at least the configured time and does not fall below the value of the hysteresis.
Gen. overload MOP 1 2362	**Generator overload MOP, limit value 1** The generator power has exceeded the limit value 1 for generator overload in mains parallel operation (GCB and MCB are closed) for at least the configured time and does not fall below the value of the hysteresis.
Gen. overload MOP 2 2363	**Generator overload MOP, limit value 2** The generator power has exceeded the limit value 2 for generator overload in mains parallel operation (GCB and MCB are closed) for at least the configured time and does not fall below the value of the hysteresis.

Message text ID	Meaning
Gen. overvoltage 1 2012	**Generator overvoltage, limit value 1** The generator voltage has exceeded the limit value 1 for generator overvoltage for at least the configured time and does not fall below the value of the hysteresis.
Gen. overvoltage 2 2013	**Generator overvoltage, limit value 2** The generator voltage has exceeded the limit value 2 for generator overvoltage for at least the configured time and does not fall below the value of the hysteresis.
Gen. PF lagging 1 2337	**Generator overexcited, limit value 1** The power factor limit 1 has been exceeded at the generator towards inductive (i.e. the current is lagging) for at least the configured time and does not fall below the value of the hysteresis.
Gen. PF lagging 2 2338	**Generator overexcited, limit value 2** The power factor limit 2 has been exceeded at the generator towards inductive (i.e. the current is lagging) for at least the configured time and does not fall below the value of the hysteresis.
Gen. PF leading 1 2387	**Generator underexcited, limit value 1** The power factor limit 1 has fallen below at the generator towards capacitive (i.e. the current is leading) for at least the configured time and does not exceed the value of the hysteresis.
Gen. PF leading 2 2388	**Generator underexcited, limit value 2** The power factor limit 2 has fallen below at the generator towards capacitive (i.e. the current is leading) for at least the configured time and does not exceed the value of the hysteresis.
Gen. ph. rot. mismatch 3955	**Generator rotating field mismatch** The generator rotating field does not correspond with the configured direction.
Gen. rev/red. pwr.1 2262	**Generator reverse power, limit value 1 / Generator reduced power, limit value 1** The generator power has exceeded the limit value 1 for generator reverse power / generator reduced power for at least the configured time and does not fall below the value of the hysteresis.
Gen. rev/red. pwr.2 2263	**Generator reverse power, limit value 2 / Generator reduced power, limit value 2** The generator power has exceeded the limit value 2 for generator reverse power / generator reduced power for at least the configured time and does not fall below the value of the hysteresis.
Gen. underfrequency 1 1962	**Generator underfrequency, limit value 1** The generator frequency has fallen below the limit value 1 for generator underfrequency for at least the configured time and has not exceeded the value of the hysteresis. Additionally, the alarm has not been acknowledged (unless the "Self acknowledgment" is configured YES).
Gen. underfrequency 2 1963	**Generator underfrequency, limit value 2** The generator frequency has fallen below the limit value 2 for generator underfrequency for at least the configured time and has not exceeded the value of the hysteresis.
Gen. undervoltage 1 2062	**Generator undervoltage, limit value 1** The generator voltage has fallen below the limit value 1 for generator undervoltage for at least the configured time and has not exceeded the value of the hysteresis.
Gen. undervoltage 2 2063	**Generator undervoltage, limit value 2** The generator voltage has fallen below the limit value 2 for generator undervoltage for at least the configured time and has not exceeded the value of the hysteresis.
Gen unloading fault 3124	**Generator unloading mismatch** The easYgen failed to reduce the generator power below the configured unload limit within the configured time.
Gen. volt. asymmetry 3907	**Voltage asymmetry** The generator phase-to-phase voltages have higher differences between each other than the configured limit value.
GGB fail to close 3089	**GGB failed to close** The easYgen has attempted to close the GGB the configured maximum number of attempts and failed. Depending on the configuration, the easYgen will continue to attempt to close the GGB as long as the conditions for closing the GGB are fulfilled.
GGB fail to open 3090	**Failed GGB open** The easYgen is still receiving the reply "GGB closed" after the GGB open monitoring timer has expired.

Message text ID	Meaning
Ground fault 1 3263	**Generator ground current, limit value 1** The measured or calculated ground current has exceeded the limit value 1 for the generator ground current for at least the configured time and does not fall below the value of the hysteresis.
Ground fault 2 3264	**Generator ground current, limit value 2** The measured or calculated ground current has exceeded the limit value 2 for the generator ground current for at least the configured time and does not fall below the value of the hysteresis.
Inv. time overcurr. 4038	**Generator inverse time-overcurrent** Current monitoring with tripping time depending on the measured current. The higher the current is the faster the tripping time according to a defined curve. According to IEC 255 three different characteristics are available: normal, highly, and extremely inverse.
J1939 dev. 1 timeout 10059	**J1939 device 1 timeout** Messages from the J1939 device 1 are missing. (CAN2)
J1939 dev. 2 timeout 10059	**J1939 device 2 timeout** Messages from the J1939 device 2 are missing. (CAN2)
J1939 dev. 3 timeout 10059	**J1939 device 3 timeout** Messages from the J1939 device 3 are missing. (CAN2)
J1939 ECU timeout 10058	**J1939 ECU timeout** Messages from the J1939 ECU are missing. (CAN2)
Mains decoupling 3114	**Mains decoupling is initiated** One or more monitoring function(s) considered for the mains decoupling functionality has triggered.
Mains df/dt 3106	**Mains df/dt (ROCOF)** A mains df/dt, which has exceeded the configured limit, has occurred. Triggering this monitoring function causes the mains decoupling function to trigger.
Mains export power 1 3241	**Mains export power, limit value 1** The mains export power has exceeded or fallen below the limit value 1 for mains export power for at least the configured time and does not fall below or exceed the value of the hysteresis.
Mains export power 2 3242	**Mains export power, limit value 2** The mains export power has exceeded or fallen below the limit value 2 for mains export power for at least the configured time and does not fall below or exceed the value of the hysteresis.
Mains import power 1 3217	**Mains import power, limit value 1** The mains import power has exceeded or fallen below the limit value 1 for mains import power for at least the configured time and does not fall below or exceed the value of the hysteresis.
Mains import power 2 3218	**Mains import power, limit value 2** The mains import power has exceeded or fallen below the limit value 2 for mains import power for at least the configured time and does not fall below or exceed the value of the hysteresis.
Mains overfreq. 1 2862	**Mains overfrequency, limit value 1** The mains frequency has exceeded the limit value 1 for mains overfrequency for at least the configured time and does not fall below the value of the hysteresis.
Mains overfreq. 2 2863	**Mains overfrequency, limit value 2** The mains frequency has exceeded the limit value 2 for mains overfrequency for at least the configured time and does not fall below the value of the hysteresis. Triggering this monitoring function causes the mains decoupling function to trigger.
Mains overvoltage 1 2962	**Mains overvoltage, limit value 1** The mains voltage has exceeded the limit value 1 for mains overvoltage for at least the configured time and does not fall below the value of the hysteresis.
Mains overvoltage 2 2963	**Mains overvoltage, limit value 2** The mains voltage has exceeded the limit value 2 for mains overvoltage for at least the configured time and does not fall below the value of the hysteresis. Triggering this monitoring function causes the mains decoupling function to trigger.

Message text ID	Meaning
Mains PF lagging 1 2985	**Mains overexcited, limit value 1** The power factor limit 1 has been exceeded at the mains interchange point towards inductive (i.e. the current is lagging) for at least the configured time and does not fall below the value of the hysteresis.
Mains PF lagging 2 2986	**Mains overexcited, limit value 2** The power factor limit 2 has been exceeded at the mains interchange point towards inductive (i.e. the current is lagging) for at least the configured time and does not fall below the value of the hysteresis.
Mains PF leading 1 3035	**Mains underexcited, limit value 1** The power factor limit 1 has fallen below at the mains interchange point towards capacitive (i.e. the current is leading) for at least the configured time and does not exceed the value of the hysteresis.
Mains PF leading 2 3036	**Mains underexcited, limit value 2** The power factor limit 1 has fallen below at the mains interchange point towards capacitive (i.e. the current is leading) for at least the configured time and does not exceed the value of the hysteresis.
Mains phase shift 3057	**Mains phase shift** A mains phase shift, which has exceeded the configured limit, has occurred. Triggering this monitoring function causes the mains decoupling function to trigger.
Mains underfreq. 1 2912	**Mains underfrequency, limit value 1** The mains frequency has fallen below the limit value 1 for mains underfrequency for at least the configured time and has not exceeded the value of the hysteresis.
Mains underfreq. 2 2913	**Mains underfrequency, limit value 2** The mains frequency has fallen below the limit value 2 for mains underfrequency for at least the configured time and has not exceeded the value of the hysteresis. Triggering this monitoring function causes the mains decoupling function to trigger.
Mains undervoltage 1 3012	**Mains undervoltage, limit value 1** The mains voltage has fallen below the limit value 1 for mains undervoltage for at least the configured time and has not exceeded the value of the hysteresis.
Mains undervoltage 2 3013	**Mains undervoltage, limit value 2** The mains voltage has fallen below the limit value 2 for mains undervoltage for at least the configured time and has not exceeded the value of the hysteresis. Triggering this monitoring function causes the mains decoupling function to trigger.
Mains volt. incr. 8834	**Mains voltage increase** The mains voltage has exceeded for a longer time period the voltage increase criteria.
Maint. days exceeded 2560	**Maintenance days exceeded** The generator run time has exceeded the configured number of days since the last maintenance period. Additionally, the alarm has not been acknowledged.
Maint. hrs exceeded 2561	**Maintenance hours exceeded** The generator run time has exceeded the configured number of operating hours since the last maintenance period. Additionally, the alarm has not been acknowledged.
MCB fail to close 2623	**MCB failed to close** The easYgen has attempted to close the MCB the configured maximum number of attempts and failed. Depending on the configuration, the easYgen will continue to attempt to close the GCB as long as the conditions for closing the MCB are fulfilled.
MCB fail to open 2624	**Failed MCB open** The easYgen is still receiving the reply MCB closed" after the MCB open monitoring timer has expired.
MCB syn. timeout 3074	**MCB synchronization time exceeded** The easYgen has failed to synchronize the MCB within the configured synchronization time.
Meas.difference 4105 5141	**Measurement difference 4105** There is a difference in the measured mains values between the 4105 devices.
Missing easYgen 4059	**Missing easYgen** At least one easYgen is missing.

Message text ID	Meaning
Missing LS5 4069	**Missing LS5** At least one LS5 is missing.
Missing members 4105 4064	**Missing load share members detected** The easYgen has detected that the number of available units for load sharing does not correspond with the configured number of members.
Mns act. pwr mismatch 2934	**Mains active power mismatch** The deviation between the import/export power and the active import/export power setpoint has exceeded the limit for at least the configured time.
Mns. ph. rot. mismatch 3975	**Mains rotating field mismatch** The mains rotating field does not correspond with the configured direction.
N-cont. reply mism. 5153	**Neutral contactor reply mismatch** Neutral contactor reply mismatch alarm is active
Oper.range failed 1 Oper.range failed 2 Oper.range failed 3 Oper.range failed 4 Oper.range failed 5 Oper.range failed 6 Oper.range failed 7 Oper.range failed 8 Oper.range failed 9 Oper.range failed 10 Oper.range failed 11 Oper.range failed 12 2665 to 2676	**Measured values checked but not within operating range** An alarm will be issued if check x result is negative because measured values are not within the configured operating range. No alarm will be issued in idle mode. For details refer to ↬ *Chapter 4.5.6.16 "Operating Range Failure" on page 427*.
Operat. range failed 2664	**Measured values not within operating range** An alarm will be issued if ignition speed is exceeded and the measured values for generator and/or mains are not within the configured operating range. No alarm will be issued in idle mode.
Overspeed 1 2112	**Engine overspeed, limit value 1** The engine speed has exceeded the limit value 1 for engine overspeed for at least the configured time and does not fall below the value of the hysteresis.
Overspeed 2 2113	**Engine overspeed, limit value 2** The engine speed has exceeded the limit value 2 for engine overspeed for at least the configured time and does not fall below the value of the hysteresis.
Parameter alignment 4073	**LDSS parameter mismatch detected** The easYgen has detected that not all LDSS parameters are configured identically at all participating units. Refer to ↬ *Chapter 4.5.6.12 "Multi-Unit Parameter Alignment" on page 419* for a list of all monitored parameters.
Ph. rotation mismatch 2944	**Generator/busbar/mains phase rotation different** Generator, busbar (easYgen-3400/3500 only), and mains have different rotating fields. A CB closure is blocked. The phase rotation monitoring is always enabled and cannot be disabled.
QV monitoring 1 3288	**QV monitoring, delay time 1** The generator reactive power has exceeded the limit for at least the configured delay time 1.
QV monitoring 2 3289	**QV monitoring, delay time 2** The generator reactive power has exceeded the limit for at least the configured delay time 2.

Message text ID	Meaning
Reactive LS mismatch 5111	**Reactive power loadsharing mismatch** Percentage load value of this device is different to the others.
Red stop lamp 15125	**Red stop lamp, J1939 interface** This watchdog monitors, whether a specific alarm bit is received from the CAN J1939 interface. This enables to configure the control in a way that a reaction is caused by this bit (e.g. warning, shutdown). No alarm can be indicated if the CAN communication fails.
Speed/freq. mismatch 2457	**Difference in frequency/speed measurement alarm** The speed differential between the generator frequency (ascertained by the generator voltage measurement) and the engine speed (measured by the MPU) has exceeded the configured limit value / differential frequency for at least the configured time and has not fallen below the value of the hysteresis. The alarm may also be triggered if the LogicsManager "ignition speed" is enabled and no electrical frequency is detected as well as the other way round.
Start fail 3325	**Failure of engine to start alarm** The generator set has failed to start after the configured number of attempts. Depending on the configuration, no more start attempt will be carried out until the alarm is acknowledged.
Syst. update easYgen 4074	**System update easYgen** An additional easYgen is detected and so a new system update is required.
Syst. update LS5 4075	**System update LS5** An additional LS5 is detected and so a new system update is required.
Time-dep. voltage 1 4958	**Time-dependent voltage, limit value 1** The measured voltage falls below/exceeds the configured criteria.
Time-dep. voltage 2 5022	**Time-dependent voltage, limit value 2** The measured voltage falls below/exceeds the configured criteria.
Timeout syn. GGB 3084	**GGB synchronization time exceeded** The easYgen has failed to synchronize the GGB within the configured synchronization time.
Unbalanced load 1 2412	**Generator unbalanced load, limit value 1** The generator current has exceeded the limit value 1 for generator unbalanced load for at least the configured time and does not fall below the value of the hysteresis.
Unbalanced load 2 2413	**Generator unbalanced load, limit value 2** The generator current has exceeded the limit value 2 for generator unbalanced load for at least the configured time and does not fall below the value of the hysteresis.
Underspeed 1 2162	**Engine underspeed, limit value 1** The engine speed has fallen below the limit value 1 for engine underspeed and has not exceeded the value of the hysteresis.
Underspeed 2 2163	**Engine underspeed, limit value 2** The engine speed has fallen below the limit value 2 for engine underspeed and has not exceeded the value of the hysteresis.
Unintended stop 2652	**Unintended Stop** The easYgen expects the generator to be running but a sudden underrun of the ignition speed has been detected.
{Analog input x}	**Analog input {x}, wire break** During measurement of the analog input a wire break was detected. This text may be assigned customer defined. The text in angular brackets is the default text. Refer to ➭ *"Message IDs for analog inputs" on page 979* and ➭ *"Message IDs for external analog inputs" on page 979.*
{Discrete input x}	**Discrete input {x}, energized / de-energized** The actual state of the monitored discrete input is energized / de-energized (depending on the configuration) for at least the configured time. This text may be assigned customer defined. The text in angular brackets is the default text. Refer to ➭ *"Message IDs for discrete inputs" on page 979.*

Message text ID	Meaning
{Ext. Discrete input x}	**External discrete input {x}, energized / de-energized** The actual state of the monitored external discrete input is energized / de-energized (depending on the configuration) for at least the configured time. This text may be assigned customer defined. The text in angular brackets is the default text. Refer to *"Message IDs for external discrete inputs" on page 980.*
{Flexible limit x}	**Flexible threshold {x}, overrun / underrun** The actual value of the monitored analog value has exceeded / fallen below the threshold (depending on the configuration) for at least the configured time and does not fall below / exceed the value of the hysteresis. This text may be assigned customer defined. The text in angular brackets is the default text. Refer to *"Message IDs for flexible limits" on page 980.*

Message IDs for analog inputs

Analog input #	1	2	3
Message ID	10014	10015	10060

Message IDs for external analog inputs

External analog input #	1	2	3	4	5	6	7	8
Message ID	10221	10222	10223	10224	10225	10226	10227	10228

External analog input #	9	10	11	12	13	14	15	16
Message ID	10229	10230	10231	10232	10233	10234	10235	10236

Message IDs for discrete inputs

Discrete input #	1	2	3	4	5	6	7	8	9	10	11	12
Message ID	10600	10601	10602	10603	10604	10605	10607	10608	10609	10610	10611	10612

Message IDs for external discrete inputs

External discrete input #	1	2	3	4	5	6	7	8
Message ID	16360	16361	16362	16364	16365	16366	16367	16368

External discrete input #	9	10	11	12	13	14	15	16
Message ID	16369	16370	16371	16372	16373	16374	16375	16376

External discrete input #	17	18	19	20	21	22	23	24
Message ID	16202	16212	16222	16232	16242	16252	16262	16272

External discrete input #	25	26	27	28	29	30	31	32
Message ID	16282	16292	16302	16312	16322	16332	16342	16352

Message IDs for flexible limits

Flexible limit #	1	2	3	4	5	6	7	8	9	10
Message ID	10018	10019	10020	10021	10022	10023	10024	10025	10026	10027

Flexible limit #	11	12	13	14	15	16	17	18	19	20
Message ID	10028	10029	10030	10031	10032	10033	10034	10035	10036	10037

Flexible limit #	21	22	23	24	25	26	27	28	29	30
Message ID	10038	10039	10040	10041	10042	10043	10044	10045	10046	10047

Flexible limit #	31	32	33	34	35	36	37	38	39	40
Message ID	10048	10049	10050	10051	10052	10053	10054	10055	10056	10057

9.6 Formulas

9.6.1 Load Dependent Start Stop (LDSS) Formulas

The following formulas are used by the load-dependent start/stop function to determine whether a genset is to be started or stopped.

Abbreviations

Abbreviation	Parameter	
$PGN_{\text{real active}}$		Momentary active generator real power on the busbar
$P_{\text{rated active}}$		Momentary active generator rated power on the busbar

Abbreviation	Parameter	
Preserve		$P_{rated\ active} – PGN_{real\ active}$
$P_{reserve\ islanded}$	5760	Minimum permissible reserve power on busbar in islanded operation
$P_{hysteresis}$ IOP	5761	hysteresis in islanded operation
$PMN_{setpoint}$		Export / import power control setpoint
PMN_{real}		Momentary active power at the interchange point
$PMOP_{minimum}$	5767	Minimum requested generator load
$P_{reserve\ parallel}$	5768	Minimum permissible reserve power on busbar in mains parallel operation
$P_{hysteresis}$ MOP	5769	$P_{hysteresis}$ in mains parallel operation
$P_{max.\ load\ islanded}$	5762	Maximum permissible generator load in islanded operation
$P_{min.\ load\ islanded}$	5763	Minimum permissible generator load in islanded operation
$P_{max.\ load\ parallel}$	5770	Maximum permissible generator load in mains parallel operation
$P_{min.\ load\ parallel}$	5771	Minimum permissible generator load in mains parallel operation

LDSS mode "Reserve Power"

Task	Formula
Islanded Operation	
Changing the Engine Combination to Increase Rated Power	$PGN_{real\ active} + P_{reserve\ islanded} > P_{rated\ active}$
Changing the Engine Combination to Reduce Rated Power	$PGN_{real\ active} + P_{reserve\ islanded} + P_{hysteresis}\ IOP < P_{rated\ active}$
Mains Parallel Operation (Import/Export Control)	
Starting the First Engine Combination (no engine supplies the busbar)	$PMN_{setpoint} – PMN_{real} + PGN_{real\ active} > PMOP_{minimum}$
Changing the Engine Combination to Increase Rated Power	$PMN_{setpoint} – PMN_{real} + PGN_{real\ active} + P_{reserve\ parallel} > P_{rated\ active}$
Changing the Engine Combination to Reduce Rated Power	$PMN_{setpoint} – PMN_{real} + PGN_{real\ active} + P_{reserve\ parallel} + P_{hysteresis}\ MOP < P_{rated\ active}$
Stopping the Last Engine Combination (load close to minimum load)	$PMN\ setpoint – PMN_{real} + PGN_{real\ active} < PMOP_{minimum} – P_{hysteresis}\ MOP$

LDSS mode "Generator Load"

Task	Formula
Islanded Operation	
Changing the Engine Combination to Increase Rated Power	$PGN_{real\ active} > P_{max.\ load\ islanded}$
Changing the Engine Combination to Reduce Rated Power (except dynamic setpoint is not matched)	$PGN_{real\ active} < P_{min.\ load\ islanded}$
Mains Parallel Operation (Import/Export Control)	
Starting the First Engine Combination (no engine supplies the busbar)	$PMN_{setpoint} – PMN_{real} + PGN_{real\ active} > PMOP_{minimum}$
Changing the Engine Combination to Increase Rated Power	$PGN_{real\ active} > P_{max.\ load\ parallel}$
Changing the Engine Combination to Reduce Rated Power (except dynamic setpoint is not matched)	$PGN_{real\ active} < P_{min.\ load\ parallel}$
Stopping the Last Engine Combination (load close to minimum load)	$PMN\ setpoint – PMN_{real} + PGN_{real\ active} < PMOP_{minimum} – P_{hysteresis}\ MOP$

LDSS dynamic

Dynamic characteristic		= [(max. generator load – min. generator load) * dynamic] + (min. generator load)
Dynamic power level		= (dynamic characteristic) * (generator rated power)
Constants	Low dynamic	= 25 %
	Moderate dynamic	= 50 %
	High dynamic	= 75 %

Example for moderate dynamic

- Dynamic characteristic = [(80 % – 40 %) * 50 %] + (40 %) = 60 %
- Dynamic power level = (60 %) * (200 kW) = 120 kW

9.7 Additional Information

9.7.1 CAN Bus Pin Assignments Of Third-Party Units

"For your information only ..."

The following pin assignments are typically by third-party units.

For the CAN Bus pin assignments of your Woodward device please go to *Table 162 "Pin assignment CANbus" on page 982.*

6-pole screw terminal connector

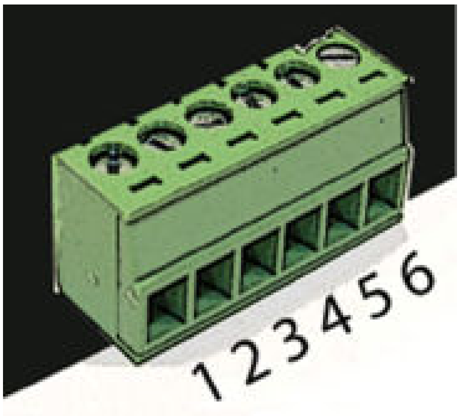
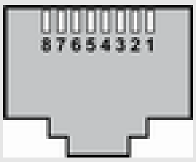
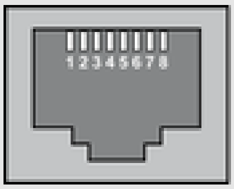


Fig. 359: CANbus terminal

Terminal	Description	A_{max}
1	GND - local galvanically islanded	N/A
2	CAN-L	N/A
3	Shield	N/A
4	CAN-H	N/A
5	Not connected	N/A
6	Not connected	N/A

Table 162: Pin assignment CANbus

RJ45/8P8C connector

Male / plug	Female / socket
	

Terminal	Signal	Description
1	TX_D+	Transmit Data Positive
2	TX_D-	Transmit Data Negative
3	RX_D+	Receive Data Positive
4	-	Reserved
5	-	Reserved
6	RX_D-	Receive Data Negative
7	-	Reserved

Table 163: Pin assignment RJ-45

10 Glossary And List Of Abbreviations

AM	AnalogManager
BDEW	German community of 1,800 companies represented by the German Association of Energy and Water Industries (Bundesverband der Energie- und Wasserwirtschaft)
CB	Circuit Breaker
CL	Code Level
CT	Current Transformer
DI	Discrete Input
DO	Discrete (Relay) Output
ECU	Engine Control Unit
FMI	Failure Mode Indicator
GAP	Graphical Application Programming (GAP™)
GCB	Generator Circuit Breaker
GCP	Woodward device series (Genset Control) - not preferred for new design!
GGB	Generator Group Breaker
HMI	Human Machine Interface e.g., a front panel with display and buttons for interaction
I	Current
IOP	Islanded Operation in Parallel ("Islanded Parallel Operation")
LDSS	Load-Dependent Start/Stop operation
LM	LogicsManager©
LSG	Woodward device: Load Share Gateway (communication converter)
MCB	Mains Circuit Breaker
MFR	Woodward device series (multifunctional relays) - not preferred for new design!
MOP	Mains Operation in Parallel
MPU	Magnetic Pickup Unit
N.C.	Normally Closed (break) contact
N.O.	Normally Open (make) contact
NC	Neutral Contactor
OC	Occurrence Count
Operation	In (general) operation. State when the genset is running according to the selected mode, all parameters are in allowed values and ranges, and without OPEN requests or alarms. Somehow "waiting for next occurrence".
P	Real power
P/N	Part Number
PF	Power Factor
PID	Proportional Integral Derivative controller
PLC	Programmable Logic Control

PT	Potential (Voltage) Transformer
Q	Reactive power
S	Apparent power
S/N	Serial Number
Sequencer	A sequencer file is carrying specific settings e.g. to enable communication with and/or control of an expansion module. Such files can be prepared by Woodward.
SPN	Suspect Parameter Number
V	Voltage

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Released

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