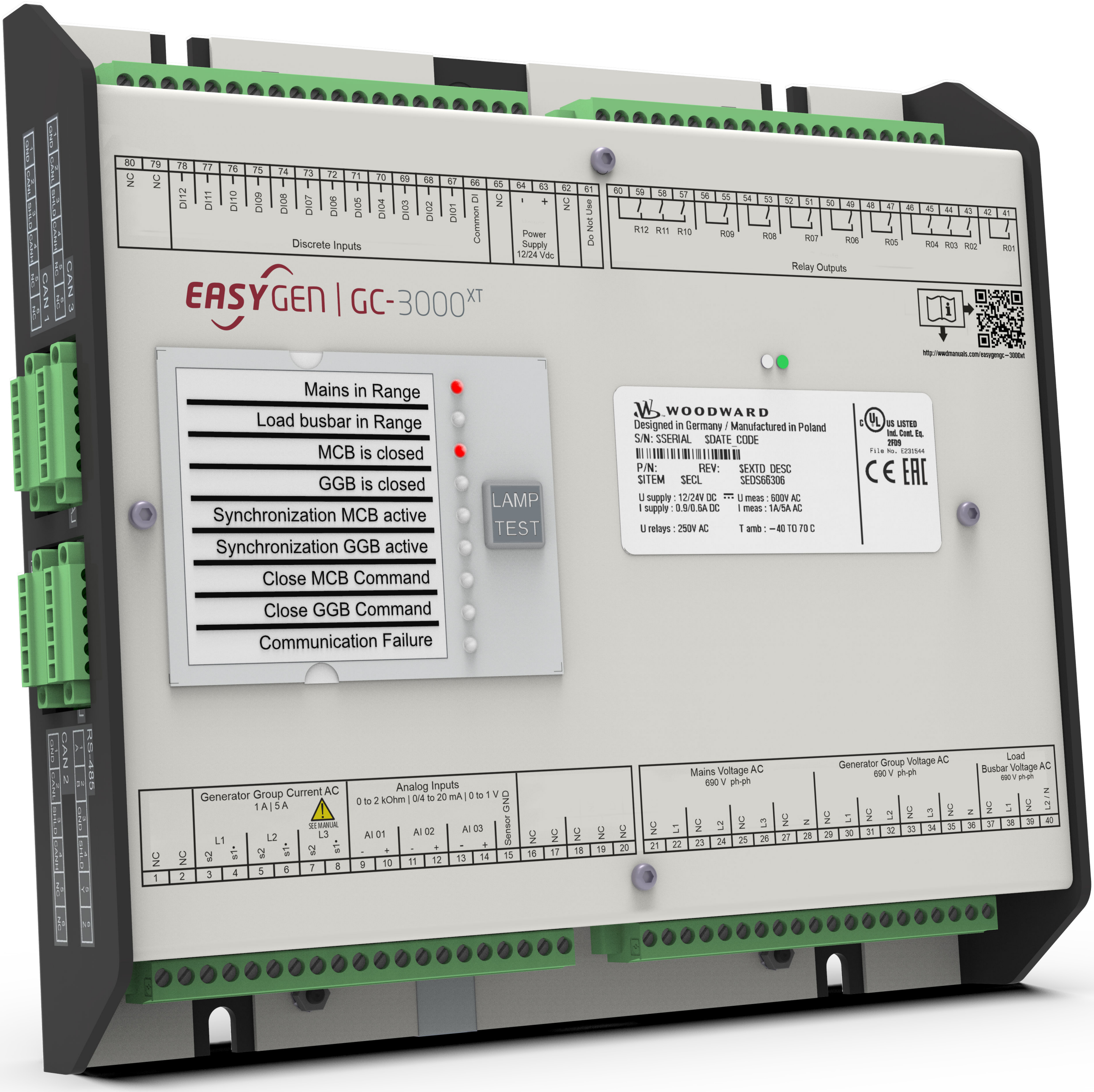
WOODWARD

Group Controller GC-3400XT-P1

Technical Manual | easYgen | GC-3000XT



Group Controller – GC-3400XT-P1

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Manual (original)

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

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Brief Overview

The GC-3400XT-P1 is a control unit for engine-generator system management applications. It is only usable in conjunction with **easYgen-3500XT-P1/P2** devices.

All function described in this manual are only performable, if parameter ”3444 Application mode“ of the easYgen-3500XT are configured to ”GCB/GC“.

The Group Controller (GC) concept is mainly intended for applications with more than 32 easYgens. Whereby one Group Controller bundles up to 31 easYgens. The GC handles this group as a big generator to the load bus bar and shares load across all groups. Maximum 16 GC can be supported. So that up to 496 generators can be installed.

Further features of the GC concept is the handling of a generator group breaker GGB. So the GC can synchronize or serve the breaker in dead busbar situations accordingly.

Through a provided mains AC measurement of the group controller the device can support a synchronization of a MCB at the interchange point to utility.

The GC is providing two application modes: (refer to chapter application ⮩ “6 Application Field”)

- GGB/MCB: the GC is handling the GGB and the MCB (see figure below)
- GGB/LSx: the GC controls only the GGB and is operating with LS-6XT

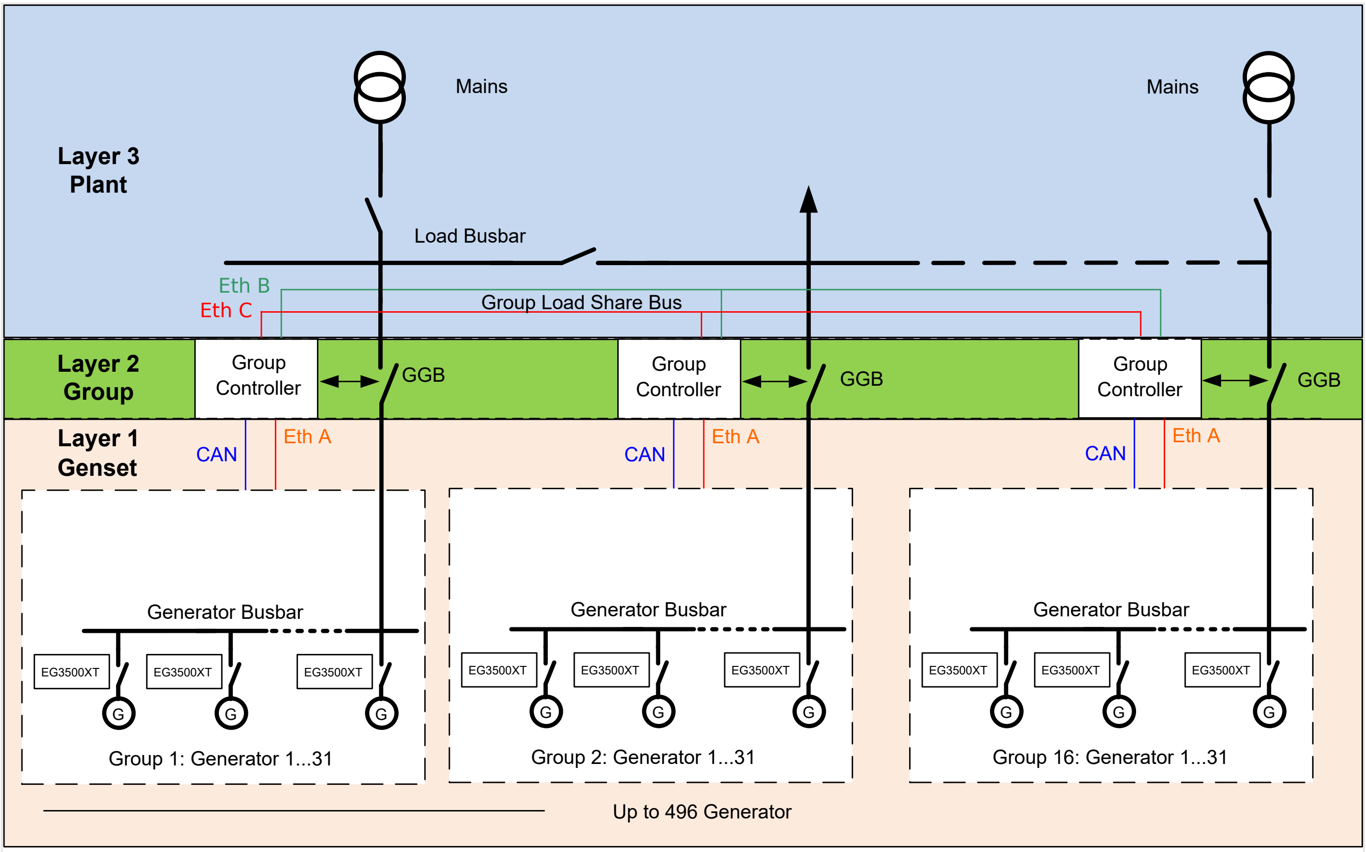


Fig. 1: Example with application mode GGB/MCB

The data flow within a group **”Layer 1“** is handled either by CAN, Ethernet A or redundant CAN/Ethernet A. The GC collects and sorts the data of its group and acts itself as a “Big Genset” control to other group controller(s).

The group controller shares therefore the needed data over a second communication bus at **”Layer 3“**, here named as “Group Load Share Bus” (via Ethernet B, Ethernet C or redundant Ethernet B/C). Through the separation of the overall data, the bus band width can be kept low and the single genset operation can be kept alive, even if a group controller fails.
(”Layer 2“ with the GCs is introduced only for better overview.)

The Generator Group is defined as follows:

- 1 Group Controller GC-3400XT-P1 (GC) per group.
- A group contains up to 31 easYgens.
- Theoretically up to 16 groups are possible.
- The GC manages a Generator Group Breaker (GGB) with synchronization and dead busbar closure.
- The GC participates on the Internal Group Load Share communication (Layer 1) by CAN, Ethernet A or redundant CAN/Ethernet A.
- The GC participates on the Group Load Share communication (Layer 3) to other GC by Ethernet B, Ethernet C or redundant Ethernet B/C.
- The GC provides Toolkit as HMI for service purposes
- The GC provides relevant data for PLC and SCADA systems (Modbus TCP)
- Load share communications are performed with redundant communication channels.
- The GC contains the LDSS algorithm and starts/stops up to 496 easYgens.
- The LDSS algorithm can be emulated with a PC program
- The outcome of the emulation can be a parameter transfer to the GC devices
- The GC leads its own easYgens in voltage and frequency to support a tie- or MCB synchronization.
- The GC leads its own easYgens in active and reactive power to unloading the MCB at the interchange point.

Schematic GC-3400XT-P1

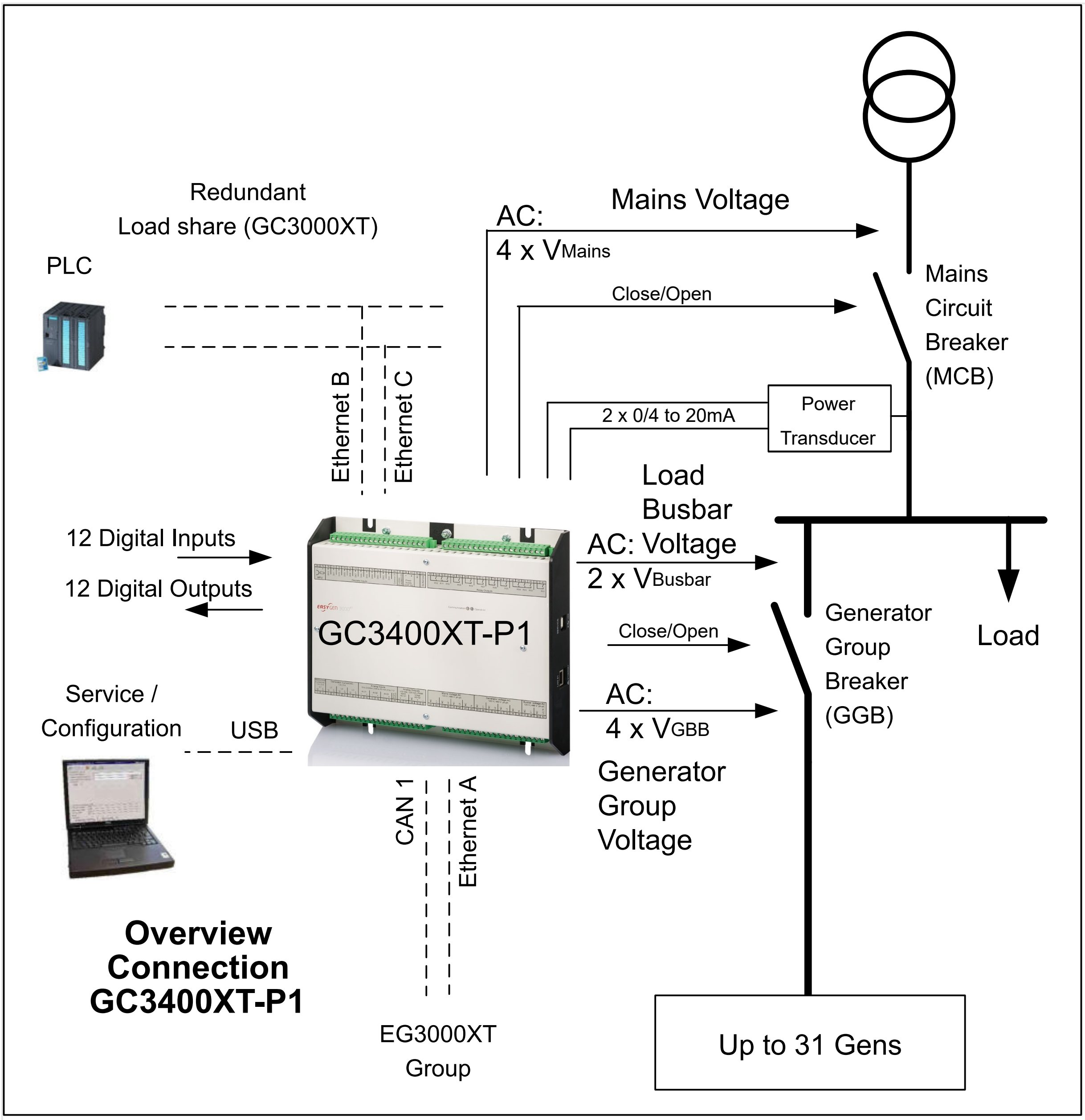


Fig. 2: GC-3400XT-P1 – connectivity overview

Scope of delivery

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

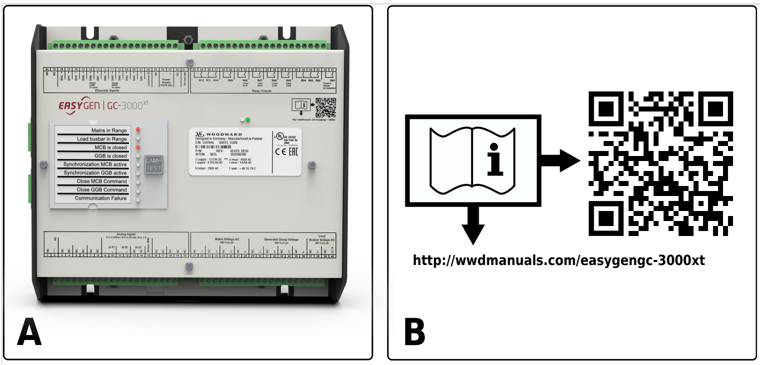


Fig. 3: Scope of delivery - schematic

A Device GC-3400XT-P1 (sheet metal housing). All screwable terminal connectors are delivered with plug and jack.

B Printed QR Code sticker

Configuration data and Technical Manual are available on device internal memory. Opening USB connection to the device via ToolKit offers read access to the files listed below but with status "delivery". Please be aware that these files are not updated, not even with a firmware update. The latest versions are available at the Woodward web site.

Files stored at device:

- Technical Manual (PDF)
- Toolkit msi file
- For CAN an eds.zip file
- Multilingual zip file

QR Code

To get access to the complete actual product documentation, scan this QR code or use the following link: ⟹ http://wwdmanuals.com/easygengc-3000xt.

Table of Contents

1 General Information

1.1 Revision History

Rev.	Date	Editor	Changes
E	1. Mai. 2024	BS	Software Revision Release 2.14 or higher **NEW features & functions** • Introduction of the Ethernet Interconnectivity Function (refer to ⮡ "4.6.2.6 Ethernet Interconnectivity". • More flexibility in the Ethernet UDP message handling: ◦ Introduction of a new parameter "Timeout cycles data" for declaring data invalid ⮡ 7497. ◦ The parameters "Transmission rate" and "Timeout cycles" are now configurable in codelevel 2. ◦ Refer to ⮡ "6.5.4 Tips for commissioning load share communication via Ethernet". ◦ Refer to ⮡ "6.7 Ethernet Communication - General Measures to optimize bus load on GC devices". • The GC provides a "Reboot" function in ToolKit. (refer to ⮡ "4.2.4 System Management" and ⮡ "4.6.3 Modbus Protocol" . • The CAN Timeout handling is improved. Now it can be clear determined when the CAN Loadhare data shall be declared invalid ⮡ 9990. • Some ToolKit improvements: ◦ Each internal LogicsManager flag provides a configurable description. ◦ Each AnalogManager result variable and result flag is indicated near to the AM in ToolKit. ◦ Providing of an overview page with all free LM internal flags and their descriptions, free AM internal analog values with their free AM internal flags with their descriptions. (Path: "PARAMETER"/"Configure L/A Manager"/"Overview L/A Manager") ◦ Slightly design changes in button colours and icons. • DI commands included into LogicsManager equations (refer to ⮡ "4.3.2.2 Discrete Inputs") • Ethernet address filter to avoid not allowed address ranges (refer to ⮡ "4.6.2 Ethernet Interfaces") • The following new analog values are available in AnalogMangager pool ◦ P Load in % in own segment (16.01) ◦ Q Load in % in own segment (16.02) ◦ Number of closed GGBs in own segment (16.03) ◦ Number of closed GCB in own Layer 3 segment (16.04) • Two annunciator easYlite-200 Modules (2 x 16 LEDs) are supported (refer to ⮡ "6.4.6 Connecting easYlite-200 on CAN Bus"). • New CPU load diagnostic values (refer to ⮡ "6.7 Ethernet Communication - General Measures to optimize bus load on GC devices"). • The settings conversion function is now available
D	30. Oct. 2022	BS	**NEW Software Revision Release 2.13-0 or higher** Due to a hardware adjustment, the software had to be changed. Note: This means that the hardware is not compatible with previous software versions. For more details on which hardware is affected, see QR Server ⟹ http://wwdmanuals.com/easygengc-3000xt.
C			**N/A**
B	22. Oct. 2021	BS	Software Revision Release 2.11 or higher

Rev.	Date	Editor	Changes
			NEW features & functions • Run-up synchronization: The GC provides now Run-up synchronization functionality in own generator group or over all generator groups together. “6.4.8 Run-Up Synchronization” • The GC provides now 3 Phase Generator Group Current and Power measurement. “4.5.2 Generator Group” • The GC provides Generator group overcurrent monitoring including: “4.4.1.3 Generator Group Current Monitoring” Overcurrent 1-3, Voltage restraint overcurrent, Inverse time overcurrent • The GC can now open the GGB with unload functionality. “4.4.3.4 GGB Unload Mismatch” and “4.3.3.2.2 Serving the Group Breaker” • The GC is now able to send 6 command flags to all members in the own Generator Group (Layer 1). “easYgen flags” • The parameter "1896 Parameter update rate " is now accessible in ToolKit. “4.2.4 System Management” • The GC is now able to communicate with a LSG device over CAN. “4.3.1.2.1 Load Share Interface Layer 1” • All not restricted DIs are now free configurable in regards of the following items: Description, Delay, Operation, Alarms Class, Self Acknowledge, Enable “4.3.2.2 Discrete Inputs” • The restricted breaker feedback DIs 5 and 8 are still configurable for Operation (NC / NO). • The dedicated relay outputs which are configured as not used (through settings or application mode) are now free configurable. “4.3.2.3 Discrete Outputs (LogicsManager)” • The GC provides now a Modbus Master functionality. “6.9.5 Modbus master” • New load share message timeout flags available for the event logger and as LogicsManager command variables (08.78 - 08.80 and 08.82 - 08.84). “4.3.1.2.1 Load Share Interface Layer 1” and “4.3.1.2.2 Load Share Interface Layer 3”

A	01. Sep. 2020	SM	Introduction of the "easYgen | GC3400XT-P1" device as a genset expansion optional together with LS-6 XT devices.
			
			Software Revision Release 2.10 or higher
			
			Note: With the software version 2.10 the GC device starts with a new part number. The software of the device is not backward compatible to already running applications with older software versions. Please contact Woodward when you plan to upgrade existing installations.
			
			NEW features & functions
			
			• The GC is equipped now with 9 additional LEDs on the housing.
			• The GC provides now two configurable application modes. This is the mode GGB/MCB as before and the mode GGB/LSx for running with LSx breaker controls. “2.2.2 Application modes”
			• The GC system can be expanded to 16 groups running up to 248 easYgens. “6.1 Application Layers”
			• The GC supports the three analog inputs AI1 - AI3 as free configurable analog outputs similar to the EG3000XT platform.
			• The GC allows to connect up to 2 IKDs on CAN2 interface. “2.8 External I/O module IKD1”
			• Implementation of a PLC capability similar to the EG3000XT platform, like
			  ◦ LogicsManager
			  ◦ AnalogManager
			  ◦ flexible thresholds
			  ◦ Alarm system (including event logger)

Rev.	Date	Editor	Changes
			• The CAN1 of the GC supports 5 Transmit and 5 Receive PDOs to maintain a configurable CAN interconnectivity inside the generator group. • The GC Modbus slave interface can be configured with an own value list using the Woodward own PC program TelegramMapper. • The Home Page is redesigned. • External utility kW and kvar are embedded into the free configurable analog inputs AI1-AI3. • The synchronization of the GGB and MCB can be executed with a separated slip frequency. • The segment number allocation with discrete inputs in the application mode GGB/MCB is expanded on 16 segments. ⮱▷ "4.3.1.1 Configuration Segmenting" • The Modbus slave protocol 5023 is replacing the former protocol 5022. ⮱▷ "7.1.4 The Modbus Visualization Protocol 5023" • The capability to send remote control flags to the GC is improved. • The Synchronization can be monitored with a timeout check.
1.1-0 39641	2018-10-01	SM	• Removing of experimental status. • Added Parameter for Missing easYgen Self Acknowledge. • ToolKit: Providing different texts and logic for the LED on homepage "GGB open".

1.2 Safety

NOTICE!

Damage due to improper use!

Improper use of the device may cause damage to the device as well as connected components.

Improper use includes, but is not limited to:

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

1.2.1 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:

Personnel:

- **Qualified electrician**

The qualified electrician is able to execute tasks on electrical equipment and independently detect and avoid any possible dangers due to his training, expertise and experience, as well as knowledge of all applicable regulations.

The qualified electrician has been specially trained for the work environment in where he is active and familiar with all relevant standards and regulations.

- **User**

  The user operates the device within the limits of its intended use, without additional previous knowledge but according to the instructions and safety notes in this manual.

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.

1.2.2 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. Per default (factory settings) discrete output R01 is energized/ closed if device itself is OK.

LogicsManager (LM) equation parameter 12580 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!

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

Before working with terminals please read the following instructions.

⚙ **Preventing electrostatic discharge damage (ESD)**

>

- 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".

1.2.3 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:

Protective equipment: 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:

Special tool: 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 Intended Use

The GC is designed for use with a dedicated easYgen-3500XT device. All functions described in this manual are only performable, if the correct easYgen-3500XT are incorporated. Please refer to Woodward for the correct easYgen device.

2.2 Function overview

2.2.1 Group Controller Concept

High-level Architecture attributes

- A generator group is always realized as one segment (electrically connected area).
- Group Controllers can be switched into different segments.
- The genset controls in the groups are EG-3400XT/3500XT (release 2.10-1 or higher).
- The Group Controller is based on the hardware of EG3400XT-P1.
- The Group Controller accepts the group breaker commands and operates the group breaker (close, synchronization, open).
- Up to 31 gensets are supported per Group Controller.
- Up to 16 Group Controller are supported.
- Configuration of the group controller is provided by the Woodward Toolkit PC software.
- Testing the LDSS settings and load scenarios are possible via an emulation program running on a computer. Obtain the LDSS Emulation Tool using the GC QR code. ⮡ "QR Code"
- The Group Controller supports the synchronization of its group or the whole segment together with another Group Controller while doing the load sharing.
- The group controller supports an unloading mains function with opening MCB, if power flow comes into a configurable window.
- The group controller supports an unloading generator group function with opening GGB, if power flow comes into a configurable window.
- The group controller supports a run-up synchronization function over multiple groups.

2.2.2 Application modes

The GC is providing two application modes: (refer to chapter application ⮡ "6 Application Field")

- GGB/MCB: the GC is handling the GGB and the MCB

- GGB/LSx: the GC controls only the GGB and is operating with LS-6XT

2.2.3 Load Share

Communication Interface

- Standard Load share procedure by load percentage active and reactive power
- The load share- and control communication within a genset group (Layer 1) is maintained either by CAN, Ethernet A or redundant CAN/Ethernet A..
- The load share- and control communication between group controls (Layer 3) is maintained by Ethernet B, Ethernet C or redundant Ethernet B/C . See Figure ⮱ Fig. 60.
- When any single device or group controller is missing, each genset control goes into droop.
- The GC provides a Communication Diagnostic function to locate the issue, see ⮱ “6.5.2 Diagnostic Screens”.
- The GC provides a system update function to teach-in the new communication situation after isolating the broken device, see ⮱ “6.5 Communication Management”.

2.2.4 Dead busbar Closure

The Group Controllers guide the dead busbar sequence. As long the communication interfaces are working correctly, the device coordinates the dead bus closure of the single sources.

2.2.5 Run-up synchronization

Feature Overview

- The generators are paralleled together by closing their circuit breakers during the engine start sequence.
- With a open GGB, all easYgens inside the own group are able to activate the excitation simultaneously or individually.
- With a closed GGB all easYgens of multiple groups are able to activate the excitation simultaneously or individually.
- Up to 496 generators (16 x 31) can participate on the run-up synchronization together.
- The Group Controller has no Run-up synchronization settings. All parameter according Run-up Synchronization are to configure in the easYgens.
- The GC is not closing/opening the GGB or MCB during run-up synchronization by it self. This has to be done by configuration and/or PLC commands.

2.2.6 Load Dependent Start Stop (LDSS)

Feature Overview

- The LDSS algorithm runs inside the Group Controller and supports up to 496 gensets (16 x 31).
- If the load busbar drops into separated segments, each segment gets its own LDSS master.
- Each genset will be directed with start and stop commands by the LDSS master.
- The Group Controller with the smallest Device ID and closed GGB within the segment makes the LDSS master.
- The series LDSS function in the easYgens is bypassed.
- A LDSS emulation tool will be provided for playing through the different scenarios and settings.
- The LDSS provides two modes:
  - Start/Stop related to Generator Load
  - Start/Stop related to Reserve Power
- Additional in comparison to the LDSS easYgen series the LDSS in the GC provides:
  - a configurable “Minimum Power” consideration
  - a configurable “Group Distribution” consideration

2.2.7 Breaker Logic

Feature Overview

- Breaker logic is handled by the upper level PLC.
- Open/close commands for the GGB are given via LogicsManagers preconfigured with digital inputs
  - ”12948 Enable close GGB“
  - ”12947 Open GGB immediatley“
  - ”12946 Open GGB unload“
- Open/close commands for the MCB (in application mode GGB/MCB) are given via LogicsManagers preconfigured with digital inputs
  - ”12923 Enable close MCB“
  - ”12893 Unload Mains / MCB open“
- In the application mode GGB/MCB the PLC is responsible for the segmenting logic, following is to adhere:

  - Generally the PLC assigns segment numbers to the group controllers according to the segmenting rules provided by Woodward.

2.2.8 Supporting Synchronization of the MCB

Supporting Synchronization of the MCB

- The Group Controller supports the synchronization of the MCB through its Mains AC voltage measurement.
- The Group Controller gets the condition of the load busbar to mains connection by a DI (MCB open)
- The Group Controller gets the command "Enable MCB" to determine the frequency and voltage control according to the AC mains measurement in order to get the MCB synchronized. The MCB synch command MCB is executed by the device.

2.2.9 Assign Segment Number to Devices

Assign Segment Number "Group Controller" in application mode "GGB/MCB"

Group Load Share Bus (dependent on parameter "1724 Source segment number"):

- "Internal": The basic segment number in the GC will be overridden by communication interface.
- "External": The basic segment number is overridden. 4 LogicsManager, binary encoded, determining 16 configurable segment numbers. (⮱▷ 1270, ⮱▷ 1271, ⮱▷ 1272, ⮱▷ 1273)

Assign Segment Number "Group Controller" in application mode "GGB/LSx"

- The basic segment number in the GC will be overridden by communication interface by the information from LS-6XT.

Assign Segment Number "easYgen-3500XT" in application mode "GCB/GC"

NOTICE!

Inside the group the GC has the Device Number 32. Do not use the Device Number 32 in the easYgen.

If there is a tie-breaker in the group which separates easYgens under each other they have to consider:

The easYgen(s) which is directly connected at the segment of the Group Breaker is always number 1. The other easYgens getting segment numbers beginning with 4 because the numbers 2 and 3 are already occupied internally by the GC.

- Connected to the internal Load Share Bus
- The group segment number is usually configured to 1 by default setting.

- **Note:** Do not change the segment number in the easYgen as long the device is used in GC mode.

2.2.10 SCADA Data Acquisition

SCADA Data Acquisition

An independent SCADA system reads required data directly from the single easYgen genset controllers via Modbus TCP. Group Controller data for the SCADA system is provided by the PLC which pulls out the relevant data from the Group Controller(s).

Under special circumstances, if the Group Load Share communication is not redundant performed the SCADA system can also pull data from the GC directly.

It is also possible to transmit data to the GC (refer to ⮡ "9.3.2 Additional Data Identifier").

2.2.11 The LDSS Emulation Tool

For the GC device a LDSS emulation tool can be ordered. The LDSS emulation tool is running on a PC and can be taken to playing through the different scenarios in regards to load, configuration, engine hours, genset size and priorities. This is a powerful test program which helps to find the correct set up for the LDSS algorithm. Tested LDSS settings can be transferred afterwards with the PC program directly into the devices, if a Ethernet connection is set up.

2.3 Status Indicators (on housing)

LEDs Indicate State of Metal Housing Variant

The GC-3000XT variant is coming with two DUO LEDs red/green/orange (orange = red/ green simultaneously) and nine LEDs red.

LEDs on top view

- "Operation" (green/red):
  - Prio1: Off, if device is not ready for operation.
  - Prio2: Is green blinking, if the unit is included in the "System Update Procedure" process.
  - Prio3: Is red continuously, if the unit detects an critical alarm.
  - Prio4: Lights green and red alternate, if an warning alarm is active.
  - Prio5: Is green continuously, if the unit is ready for operation.
- "Sync Enable" (green/red):
  - Prio1: Off, if device is not ready for operation.
  - Prio2: Is green, indicates the GGB or the MCB synchronization close pulse.

LEDs closed to the Paper strip

- "Mains in Range" (pre-configured 02.11 Mains volt./freq. ok)
- "Load busbar in Range" (pre-configured 02.08 Load bus volt/freq ok)
- "MCB is closed" (pre-configured 04.07 MCB closed)
- "GGB is closed" (pre-configured 04.16 GGB closed)
- "Synchronization MCB active" (pre-configured 04.21 Syn. MCB is active)
- "Synchronization GGB active" (pre-configured 04.24 Syn. GGB active)
- "Close MCB Command" (pre-configured 04.23 Closing MCB active)
- "Close GGB Command" (pre-configured 04.26 Closing GGB active)
- "Communication Failure" (fixed 08.17 Missing members)

Defaults

The LEDs 1 to 8 representing LogicsManager states are triggered based on the settings of parameters 12962 to 12969.

The conditions printed next to the LEDs on the sheet metal housing represent the corresponding LogicsManager's parameter defaults. This is done by an inserted paper strip that can be exchanged by customer.

For additional information refer to “9.1 Paper strip”

Note:

During boot-up and firmware update procedures the LEDs are acting different.

2.4 HOME PAGE (ToolKit)

Home Page and starting point for all HMI relevant purposes.

It gives a short overview about the connected GC. From here the operator can navigate to the different visualisation and configuration screens. Refer to the ToolKit manual for more information. “4.1 Access Via PC (ToolKit)”

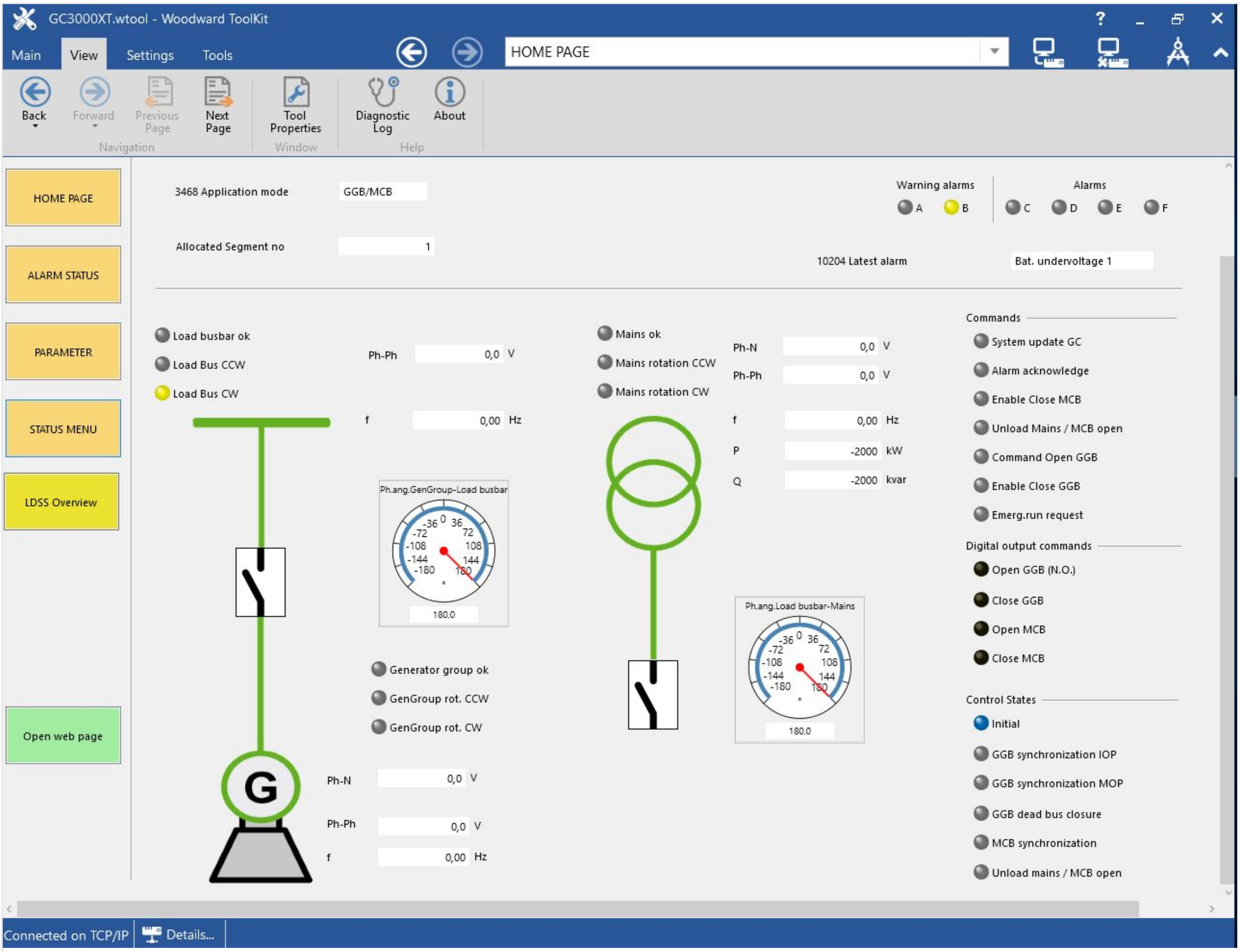


Fig. 4: Example Home Page screen

2.5 States easYgens (ToolKit)

Navigation by Status Menu/Multi-unit/States easYgen

This screen gives information about the current situation within the own generator group. The group breaker is the device 32. The power flow of the group breaker can be observed.

Groups which are not recognized are faded out.

Each device (1-32) is visualized by:

- Operation Mode
- Breaker feedback
- Active power in kW
- Reactive power in kvar
- LDSS command On/-/Off
- Device number

- Current active segment (usually always 1)

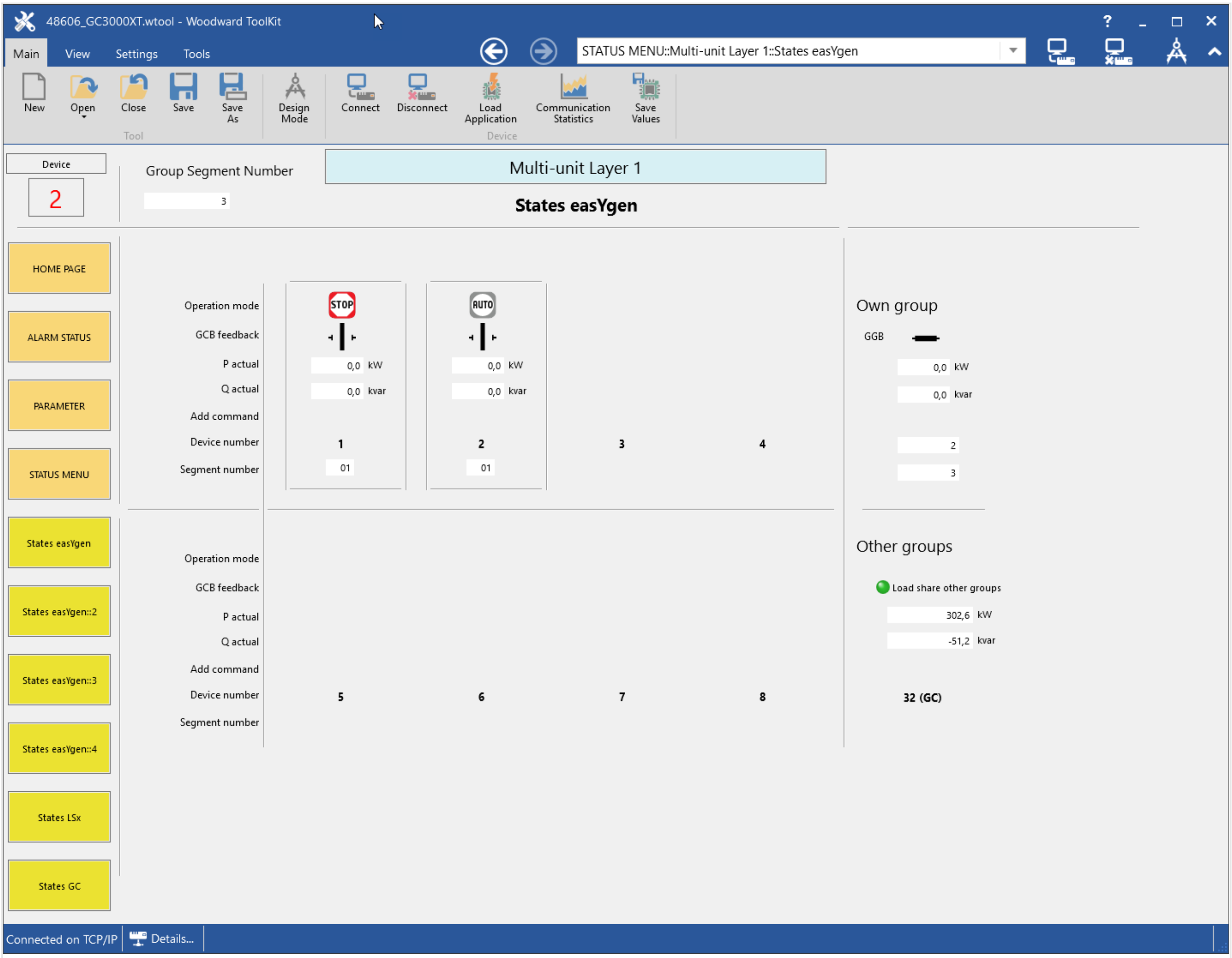


Fig. 5: Example of a State easYgen Screen

States easYgens in own group

These fields indicate the operation mode, the breaker condition, the load situation, the LDSS add command and the segment number of each easYgen.

Note: The easYgen segment number must be always 1 otherwise this easYgen is not accepted as a group member.

Own group

Indicates the GGB condition, the active and reactive power flow over the GGB (calculated out of the easYgen values).

The device number of the GC (group number). The current allocated segment number.

Other groups

Indicates with a LED symbol the linkage to at least one easYgen out of the group. The active and reactive power of these easYgen(s) are indicated.

2.6 States groups (ToolKit)

Navigation by Status Menu/Multi-unit/States GC

This screen gives information about the group controller system. Currently up to 16 groups are visualized.

Group controllers which are not recognized are faded out.

Each device (1-16) is visualized by:

- Breaker feedback
- Nominal Power active in kW
- Active power in kW
- Load in %
- Reactive power in kvar
- Reactive power in %
- Group number
- Current active segment

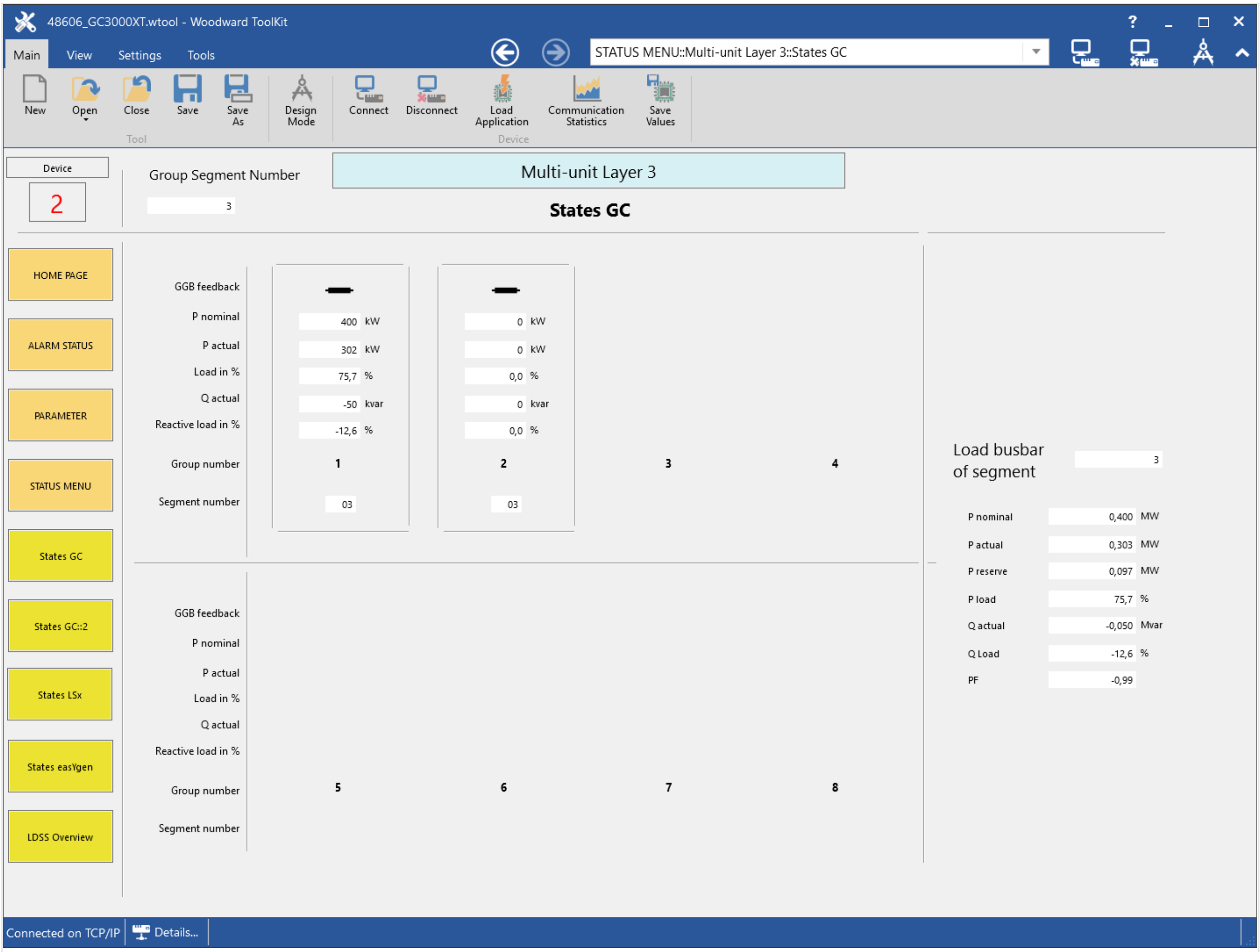


Fig. 6: Example of a State GC Screen

States groups

These fields indicate the breaker condition, the load situation and the segment number of each Group Controller.

Own Segment

Own segment shows the summarized load of all groups which are in the same segment as the GC to which ToolKit is connected.

2.7 LDSS Overview Screen (ToolKit)

Navigation by Status Menu/Multi-unit/LDSS overview or directly from the HOME PAGE

This page informs about the important conditions and settings related to the load dependent start stop feature. For all GCs (1-16) in the same segment there is a LED that visualizes if the LDSS is turned on/off. For the GC which is the LDSS Master this LED is green. Additional the following conditions of the related easYgens are shown.

- easYgen operating modes
- LDSS start/stop information

The load values of the own segment and the LDSS settings are also shown.

> The LDSS settings are the settings from the GC which is connected to ToolKit. They may differ from the LDSS settings of the LDSS Master.

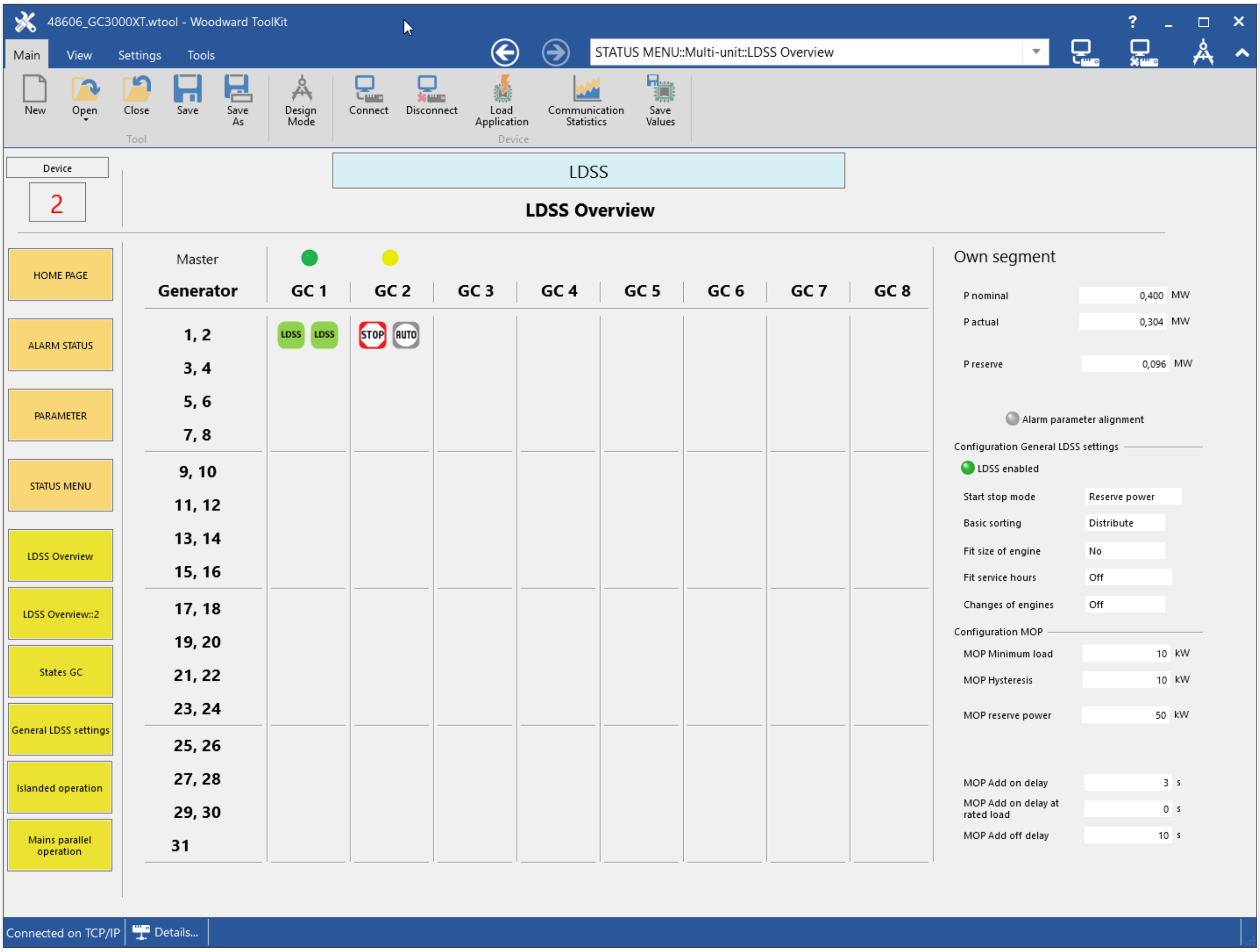


Fig. 7: Example of an LDSS Overview Screen

2.8 External I/O module IKD1

With Woodward's IKD1 an external digital I/O module expansion is available, which can provide eight digital inputs and eight digital outputs. Up to two of these modules can be connected via the CAN bus.

The IKD1 can read the status of eight discrete inputs and transmit these via the CAN bus to the higher level control unit. In the opposite direction the higher level control unit can control the eight relay outputs situated on the IKD1 via the CAN bus.

For configuration of digital Inputs see ⮱ "4.3.2.1.3 External Discrete Inputs (IKD)". For connection of the interfaces see ⮱ "6.4.5 IKD Configuration Tool" and ⮱ "6.4.4 Setup Expansion Modules at CAN 2".

3 Installation

NOTICE!

Avoid electrostatic discharge!

Before working with terminals please read and follow the instructions of chapter ⮱ "Electrostatic discharge".

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

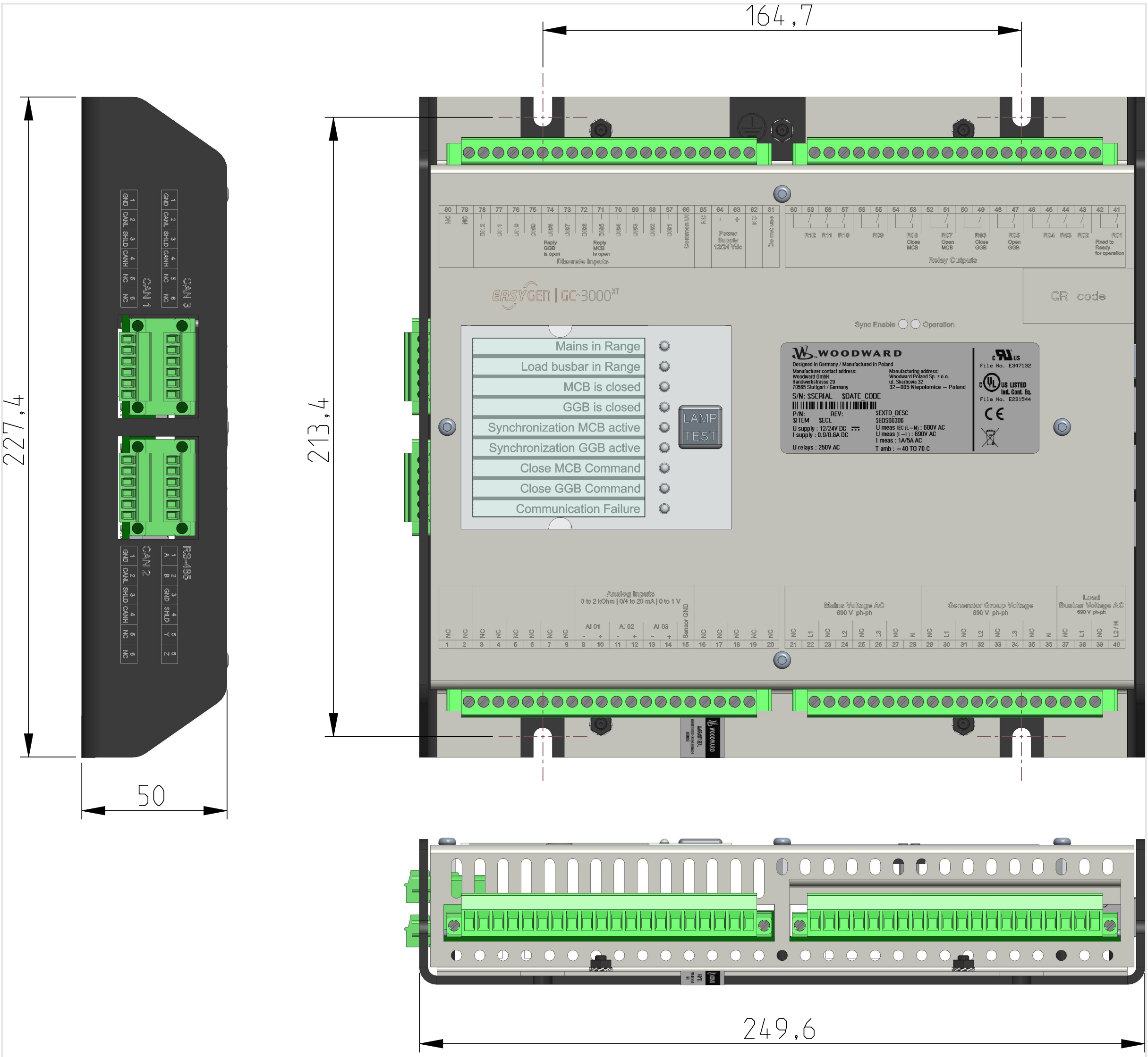


Fig. 8: Sheet metal housing - dimensions

⚙ **Mounting into a cabinet**

> • Special tool: Torque screwdriver

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

1. ▷

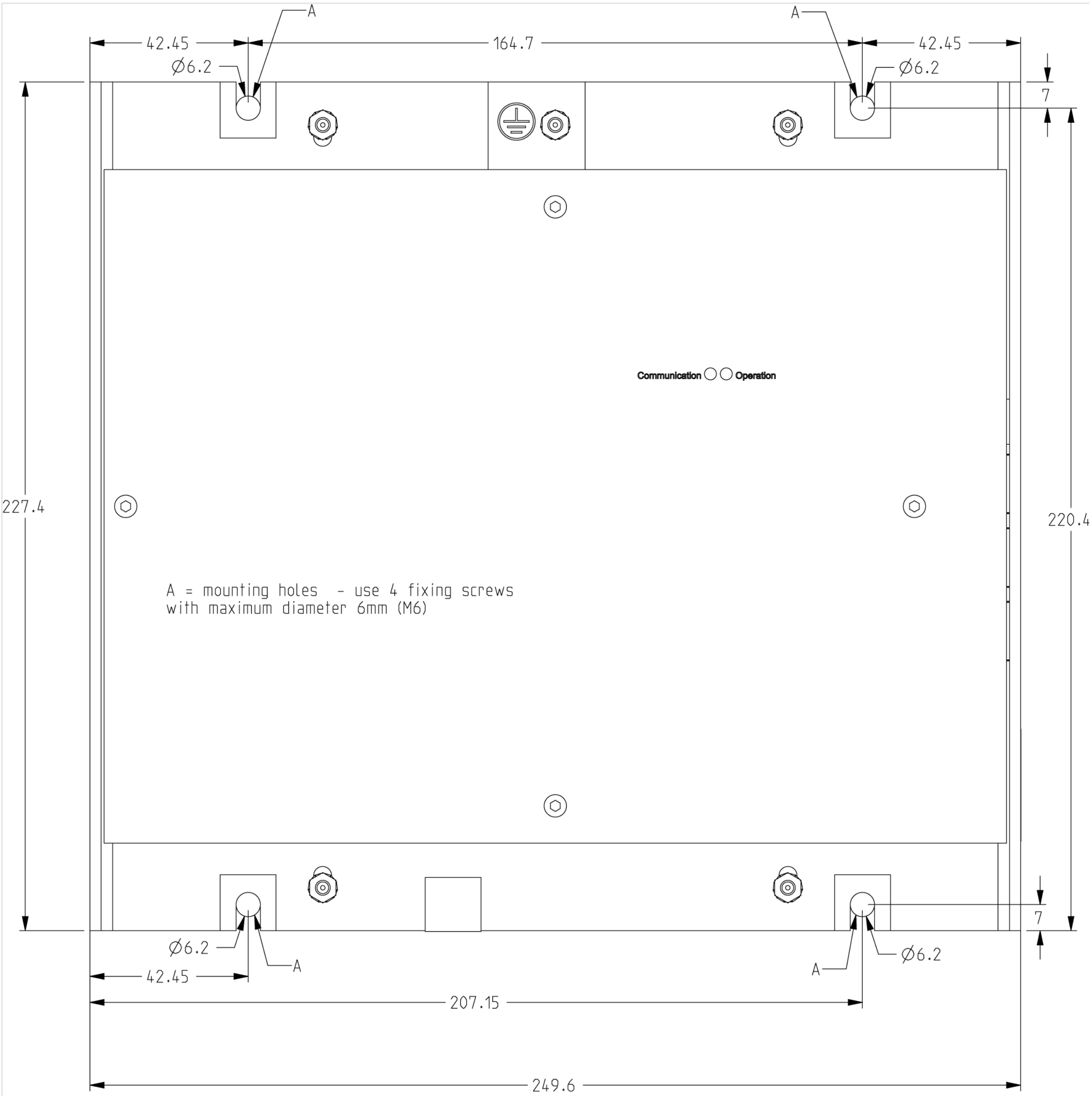


Fig. 9: Sheet metal housing - drill plan

Drill the holes according to the dimensions in the figure above (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 Setup Connections

NOTICE!

Avoid electrostatic discharge!

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

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 "8.1 Technical Data".

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

3.2.1 Terminal Allocation

NOTICE!

Avoid electrostatic discharge!

Before working with terminals please read and follow the instructions of chapter ⮡ "Electrostatic discharge".

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

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

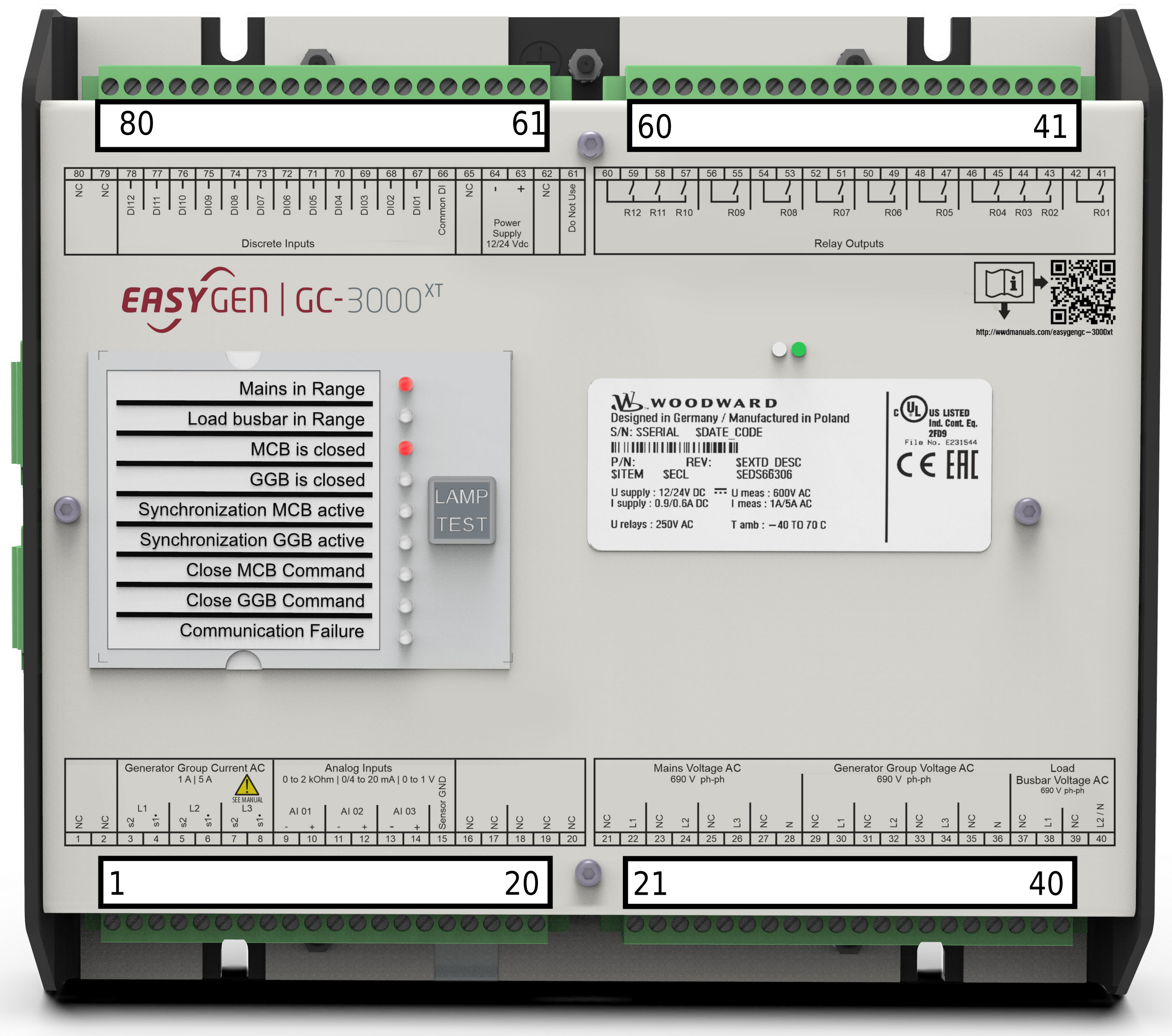


Fig. 10: Terminals Group Controller sheet metal housing

3.2.2 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.

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 or AI:

- 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.

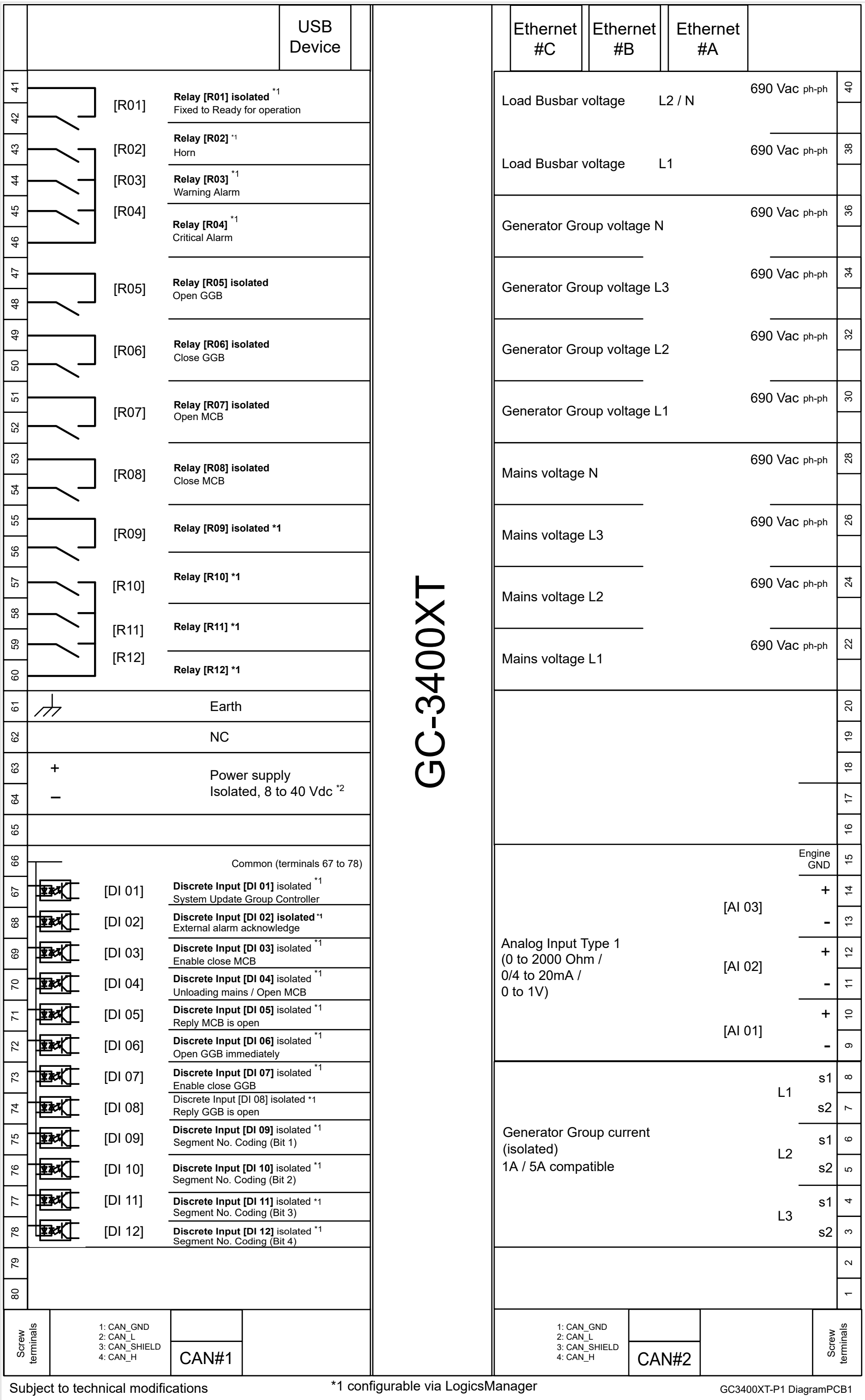


Fig. 11: Wiring diagram GC-3400XT-P1

Pin 61: don't use

3.2.3 Power Supply

General notes

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 mm^2 (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 GC-3000XT device is monitoring self preparation by some LED.

Schematic and terminals

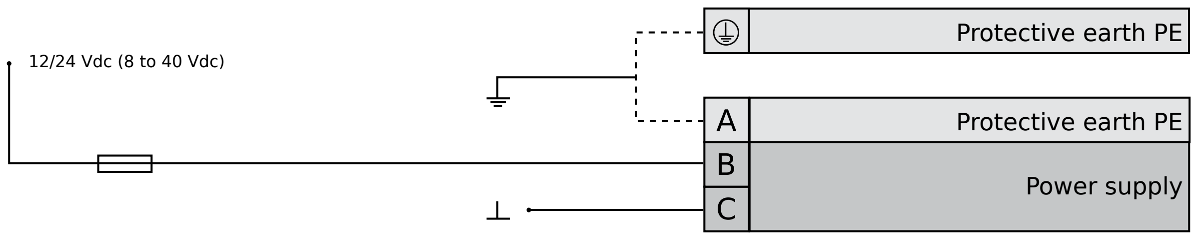


Fig. 12: Power supply - wiring

Terminal		Description
A	61	Don't use
B	63	12/24Vdc (8 to 40.0 Vdc)
C	64	0 Vdc

Table 2: Power supply - terminal assignment

Characteristics

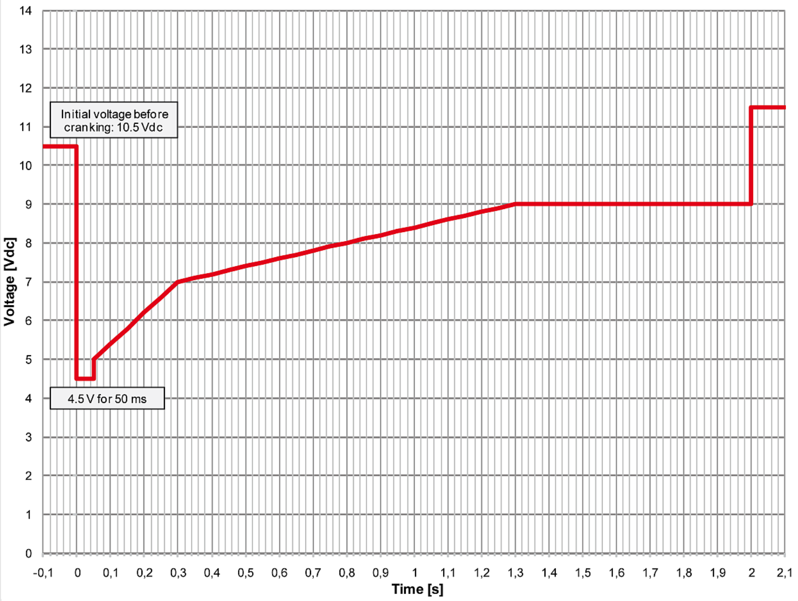


Fig. 13: Power supply - crank waveform

3.2.4 Voltage Measuring

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 controller device. Settings are described in chapter "4.5 Configure Measurement".

NOTICE!

The maximum permissible voltage against ground connected on the GC is 600 Volt. This is to consider if phase voltages are grounded.

3.2.4.1 Generator Group 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 ToolKit.

Parameter ⮱▷ 1800 (Gen.group PT sec. rated volt.) must be configured to the correct value to ensure proper measurement.

Schematic and terminals

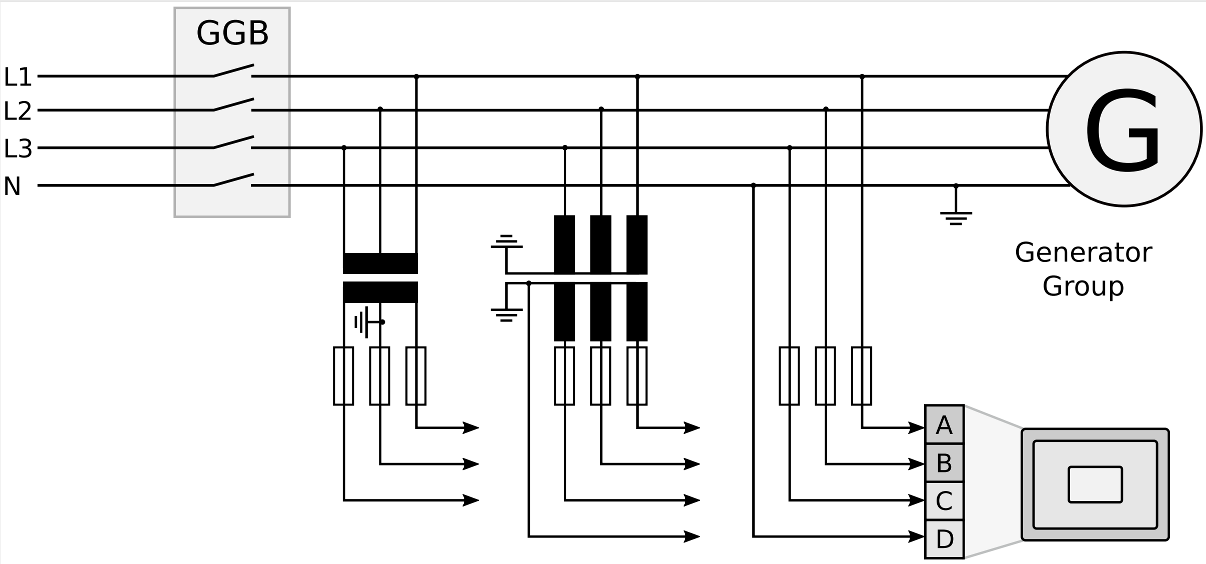


Fig. 14: Voltage measuring - generator group - wiring

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

Table 3: Voltage measuring - generator group- terminal assignment

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

Generator group windings

A generator group 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.

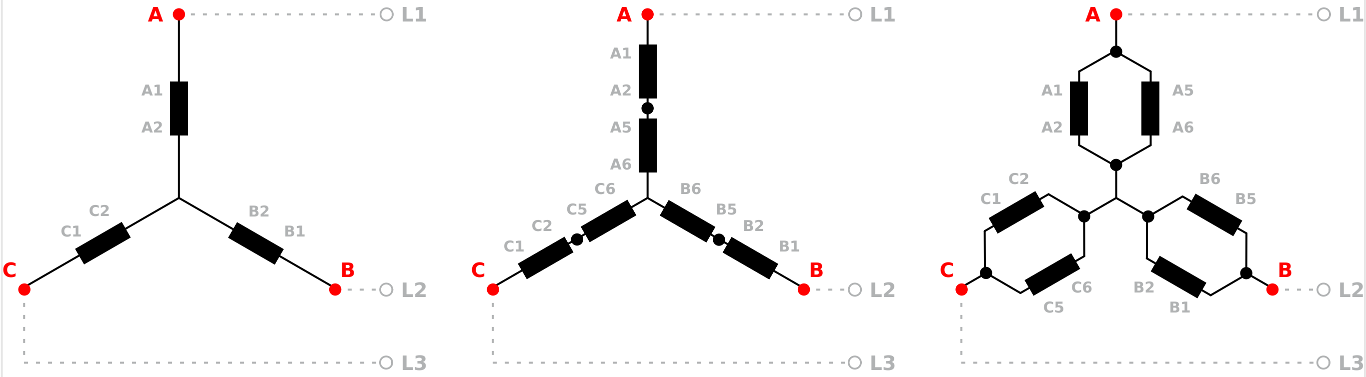


Fig. 15: Generator group windings - 3Ph 4W OD

Measuring inputs

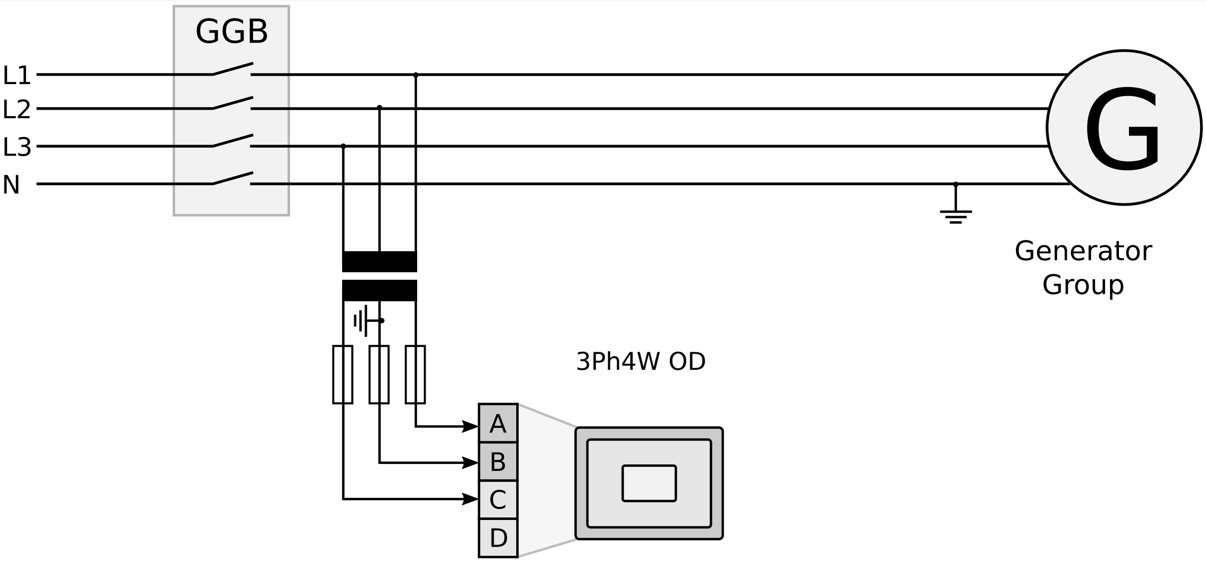


Fig. 16: Measuring inputs - 3Ph 4W OD

Terminal assignment

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

Measuring input / Phase	**Terminal**
Generator group voltage - N	-/-

Table 4: Generator group terminal assignment 3Ph 4W OD

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

Generator group windings

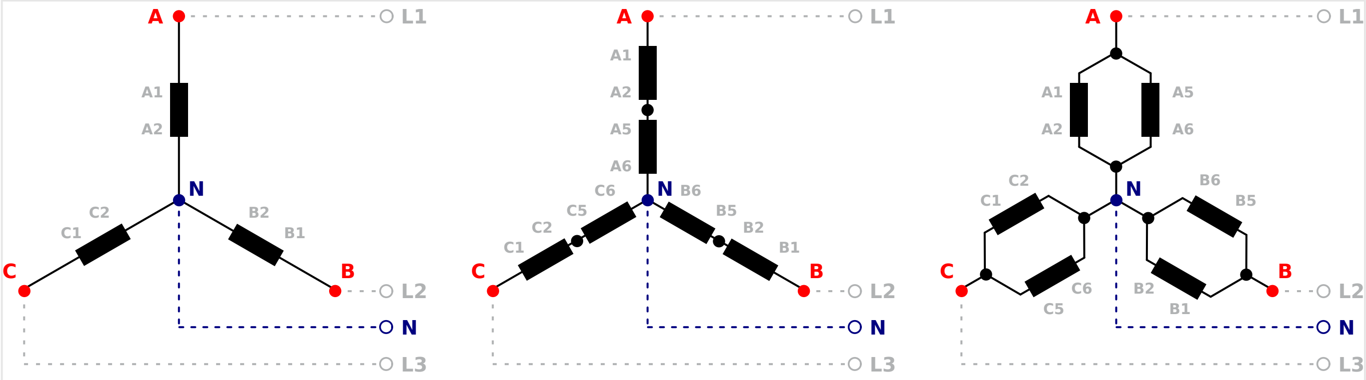


Fig. 17: Generator group windings - 3Ph 4W

Measuring inputs

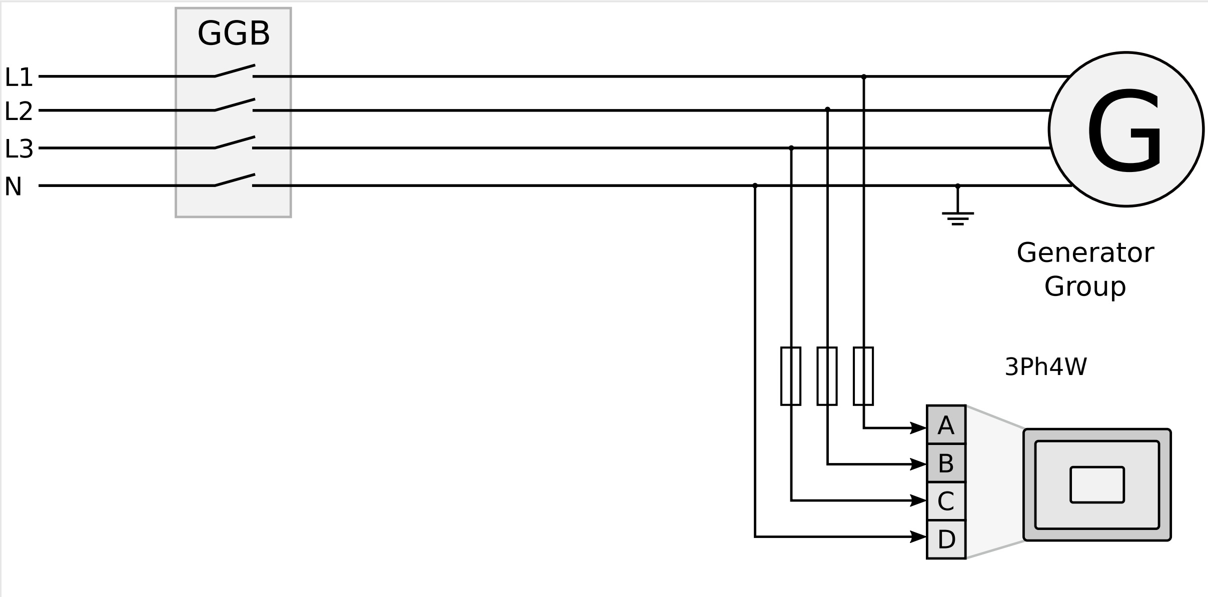


Fig. 18: Measuring inputs - 3Ph 4W

Terminal assignment

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

Measuring input / Phase	Terminal	
Generator group voltage - N	D	36

Table 5: Generator group terminal assignment 3Ph 4W

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

Generator group windings

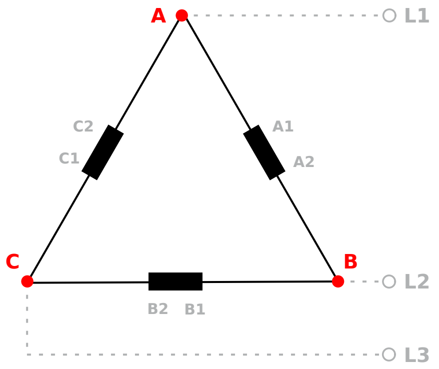


Fig. 19: Generator group windings - 3Ph 3W

Measuring inputs

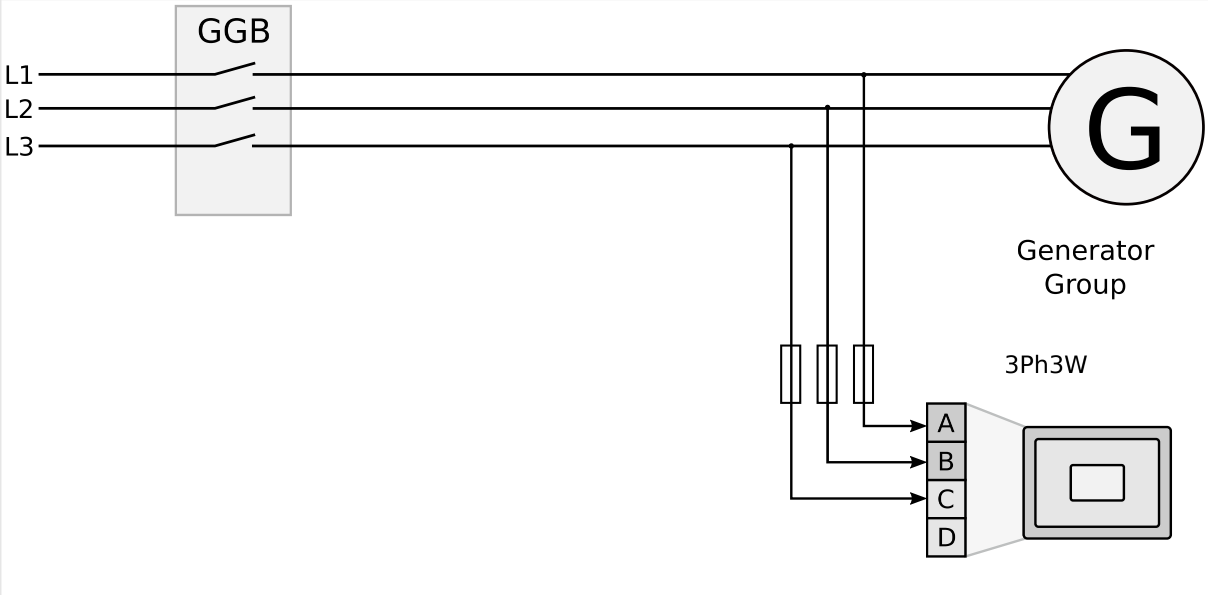


Fig. 20: Measuring inputs - 3Ph 3W

Terminal assignment

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

Measuring input / Phase	Terminal	
-/-	-/-	36

Table 6: Generator group terminal assignment 3Ph 3W

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

Generator group windings

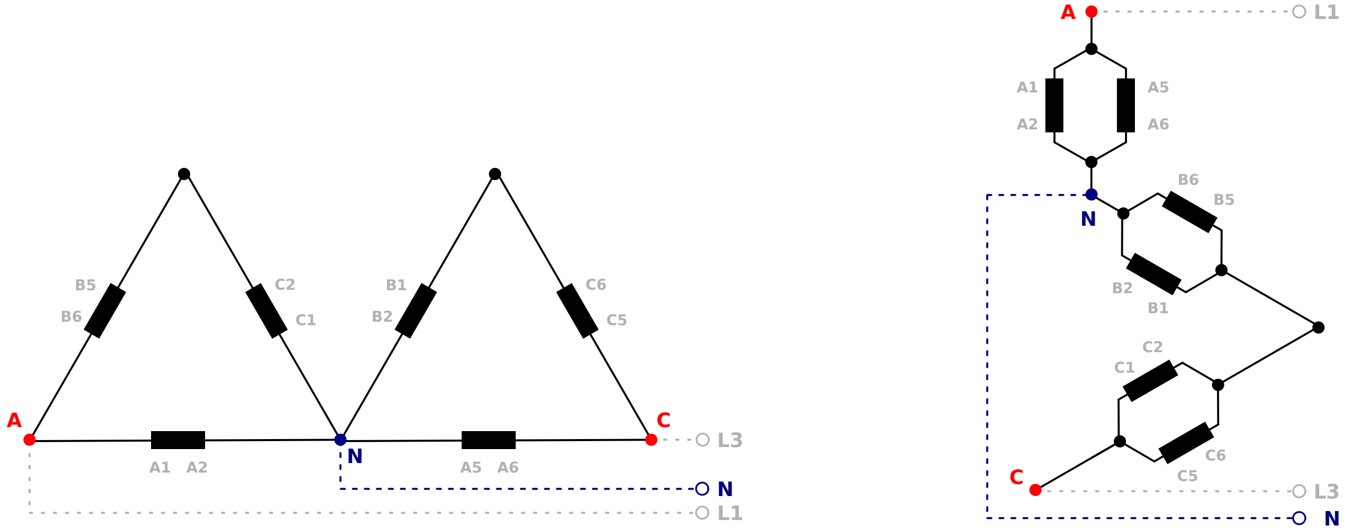


Fig. 21: Generator group windings - 1Ph 3W

Measuring inputs

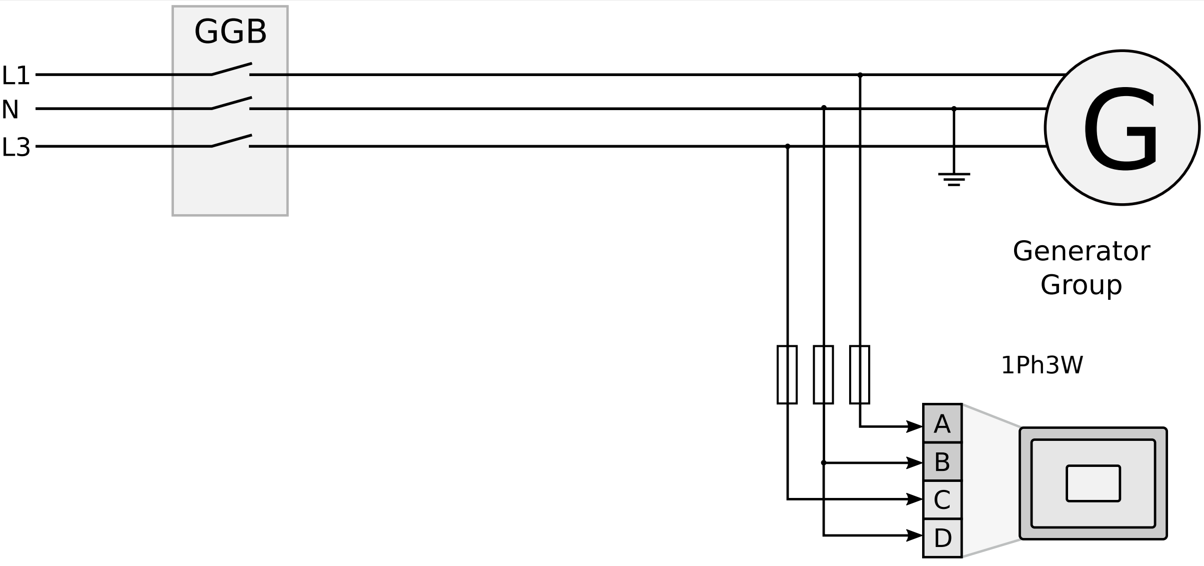


Fig. 22: Measuring inputs - 1Ph 3W

Terminal assignment

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

Table 7: Generator group terminal assignment 1Ph 3W

3.2.4.1.5 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 Group Controller consistently.

3.2.4.1.5.1 '1Ph 2W' Phase-Neutral Measuring

Generator group windings

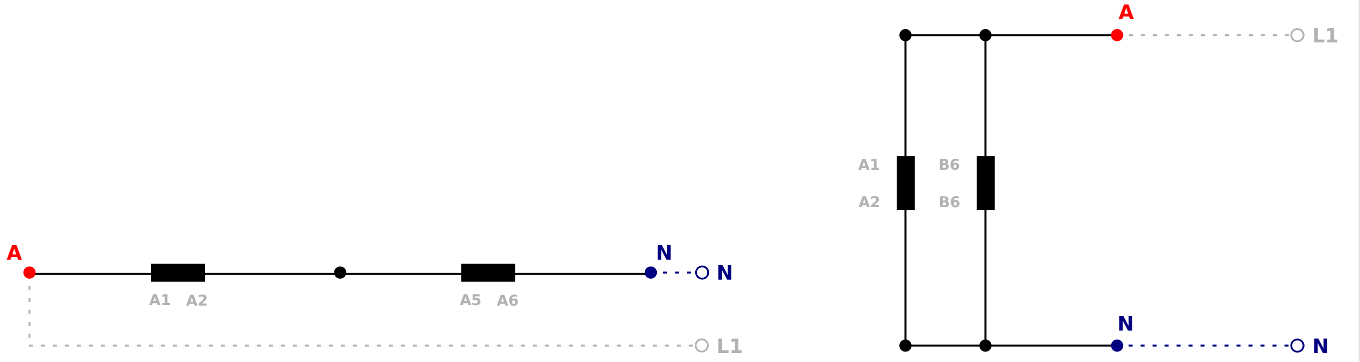


Fig. 23: Generator group windings - 1Ph 2W (phase-neutral)

Measuring inputs

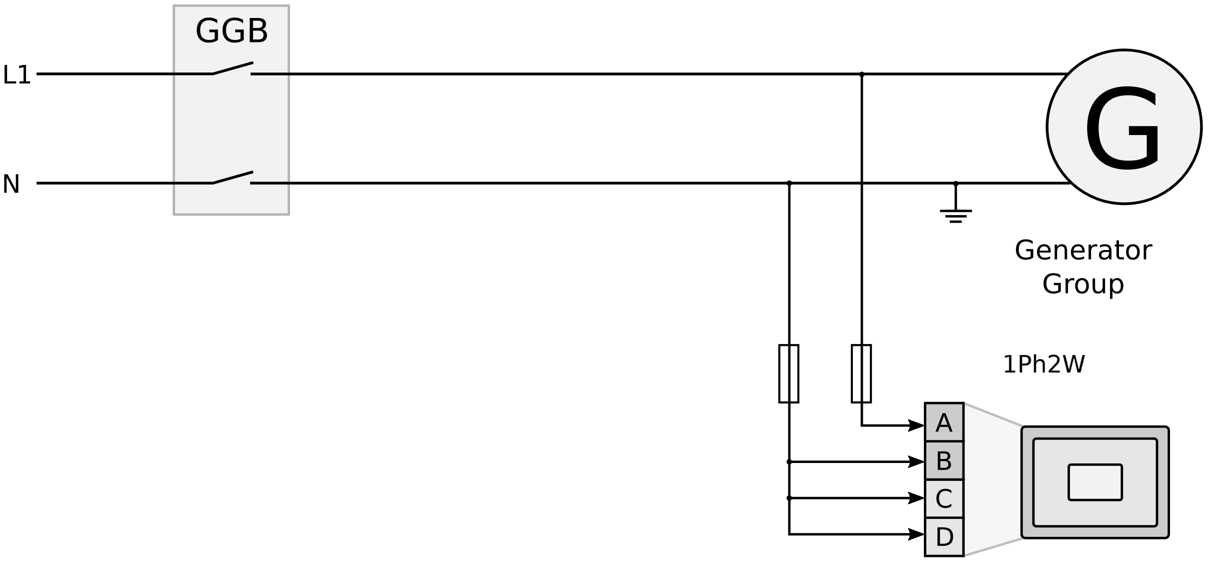


Fig. 24: Measuring inputs - 1Ph 2W (phase neutral)

Terminal assignment

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

Table 8: Generator group terminal assignment 1Ph 2W (phase neutral)

Never configure the busbar measurement for phase-neutral, if the other systems like mains and generator group 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.

3.2.4.1.5.2 '1Ph 2W' Phase-Phase Measuring

Generator group windings

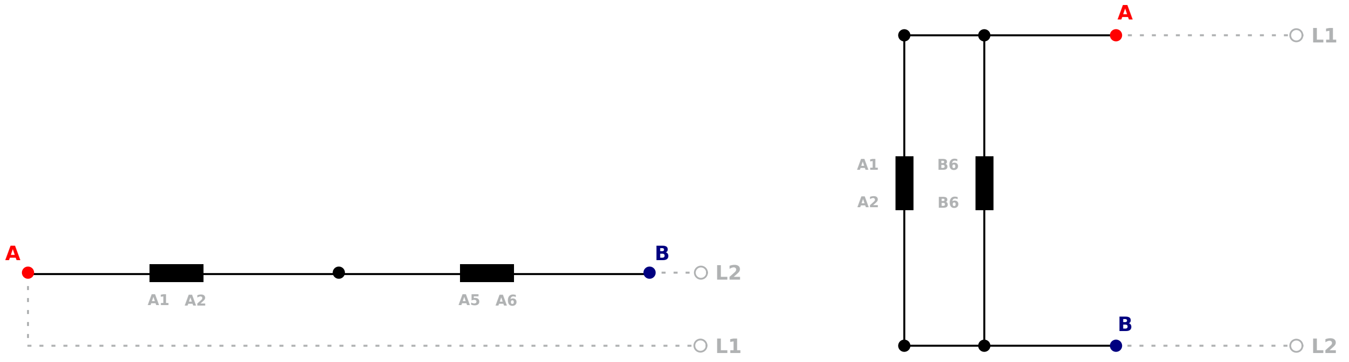


Fig. 25: Generator group windings - 1Ph 2W (phase-phase)

Measuring inputs

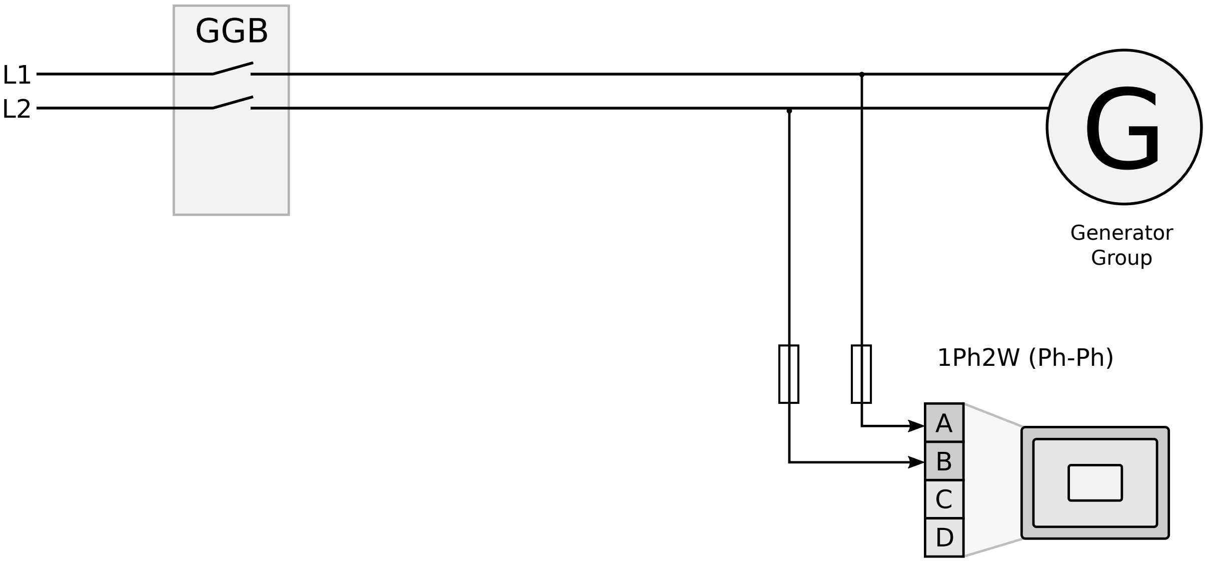


Fig. 26: Measuring inputs - 1Ph 2W (phase-phase)

Terminal assignment

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

Table 9: Generator group terminal assignment 1Ph 2W (phase-phase)

3.2.4.2 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 ToolKit.

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

If the GC 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

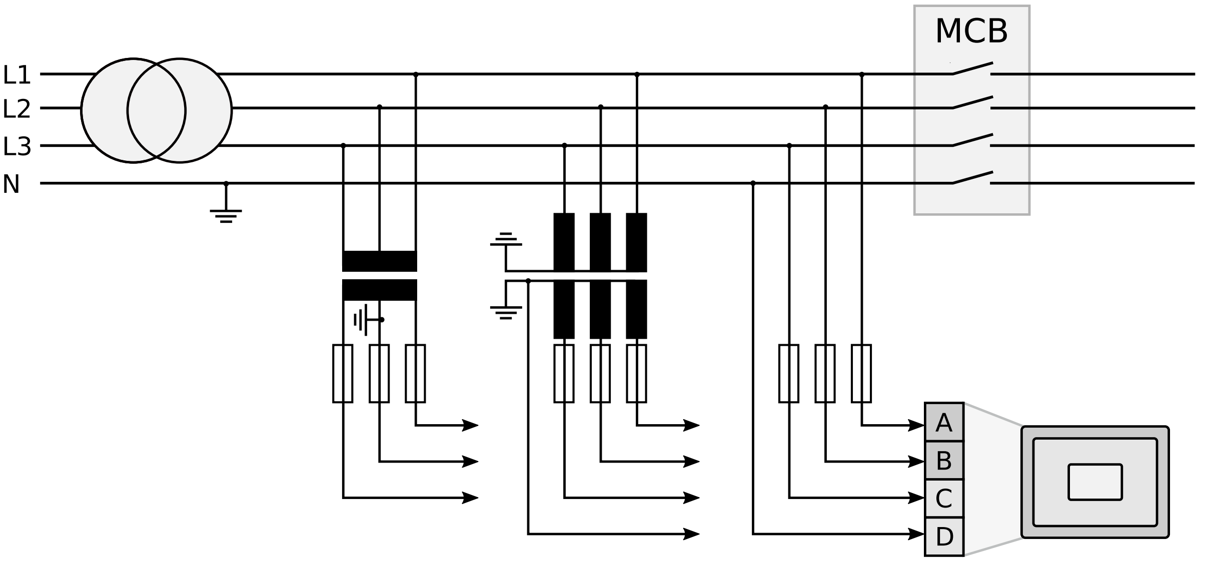


Fig. 27: Voltage measuring - mains - wiring

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 10: Voltage measuring - mains - terminal assignment

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

Mains windings

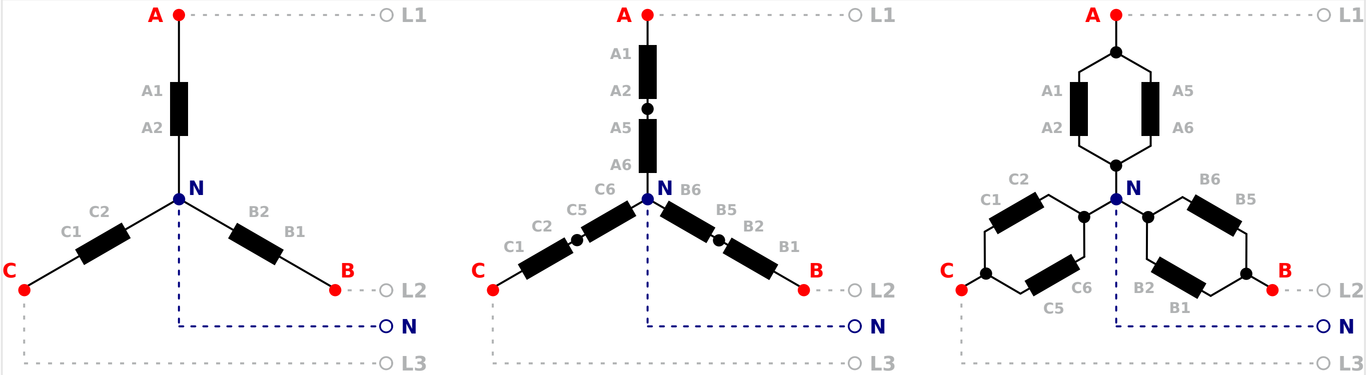


Fig. 28: Mains windings - 3Ph 4W

Measuring inputs

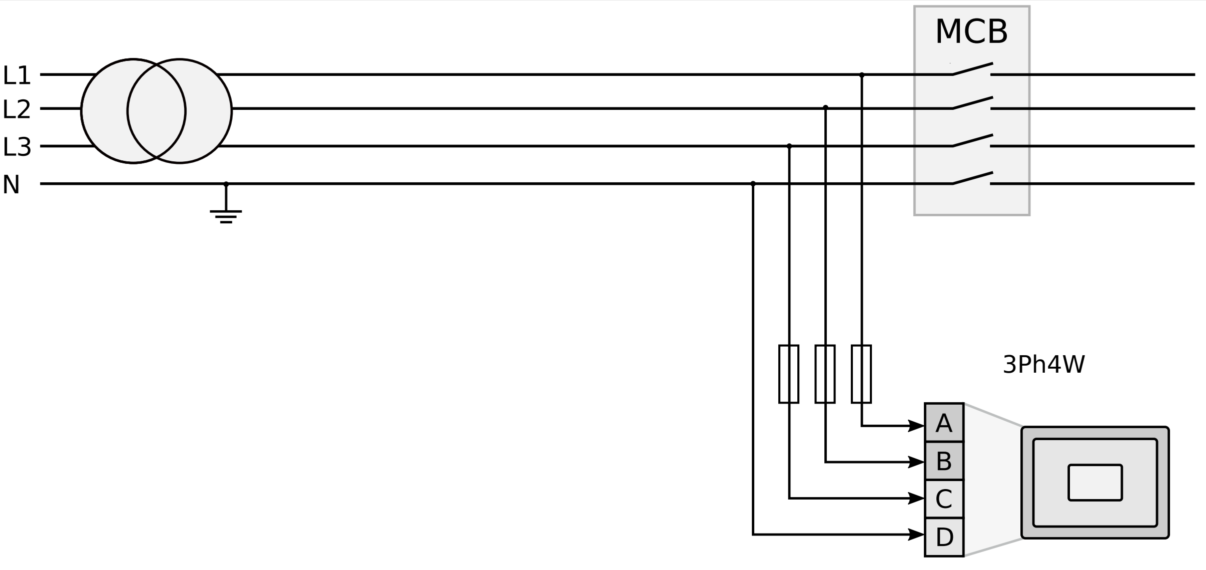


Fig. 29: Measuring inputs - 3Ph 4W

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 11: Mains terminal assignment 3Ph 4W

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

Mains windings

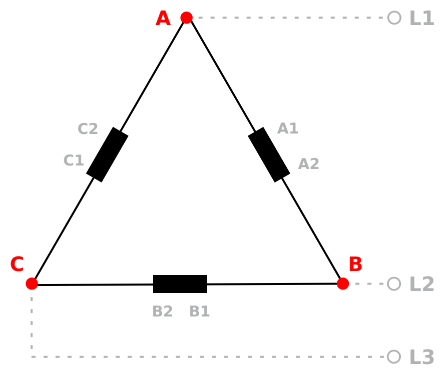


Fig. 30: Mains windings - 3Ph 3W

Measuring inputs

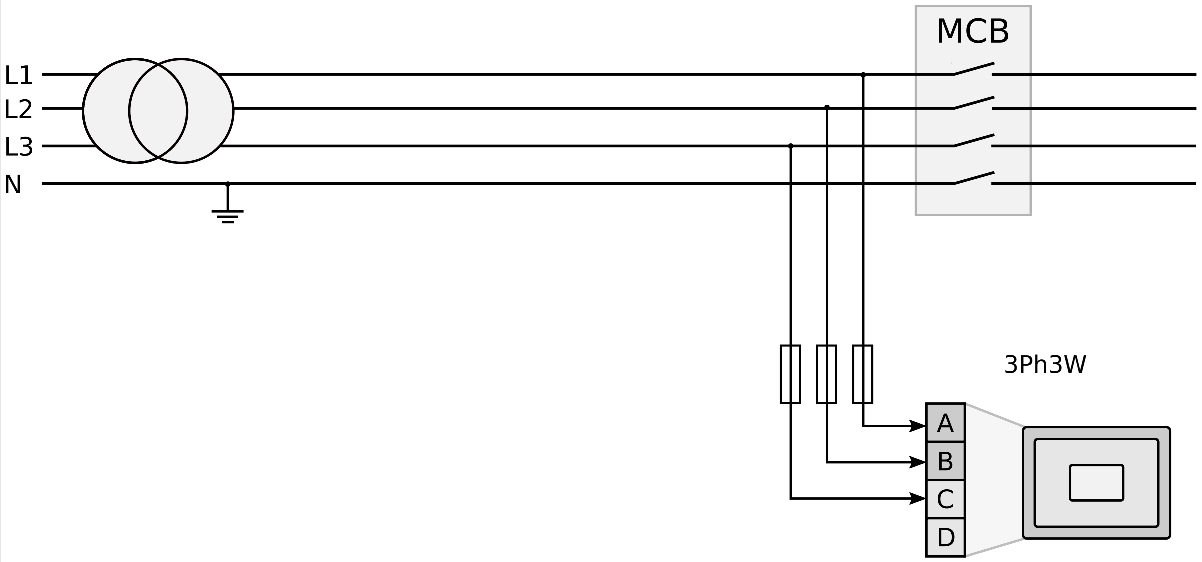


Fig. 31: Measuring inputs - 3Ph 3W

Terminal assignment

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

Table 12: Mains terminal assignment 3Ph 3W

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

Mains windings

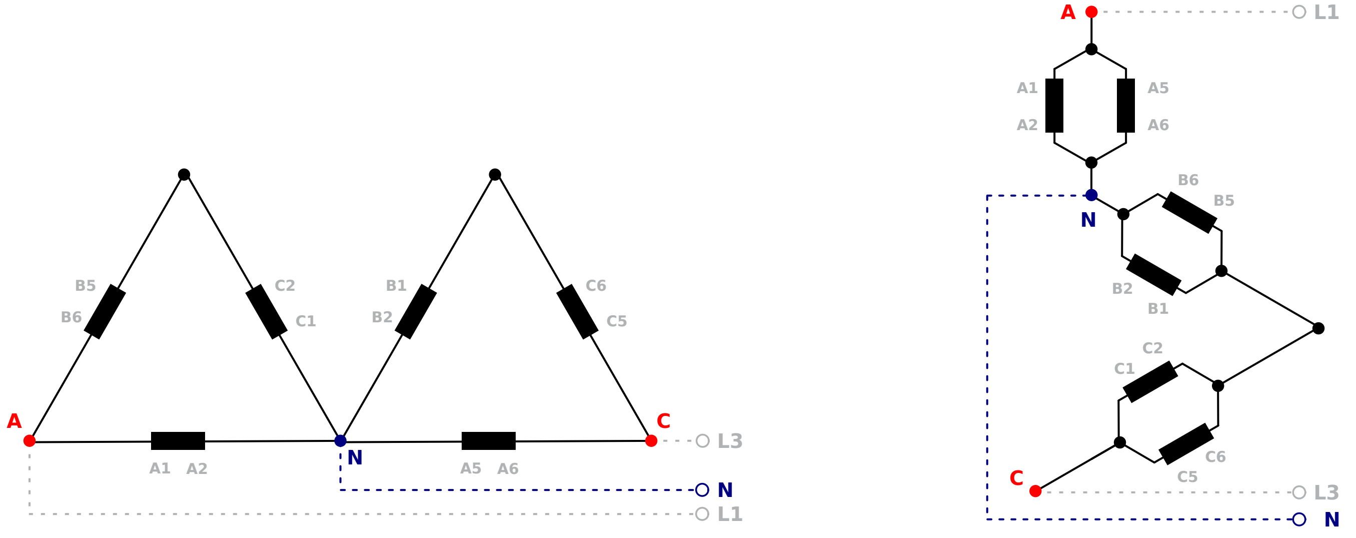


Fig. 32: Mains windings - 1Ph 3W

Measuring inputs

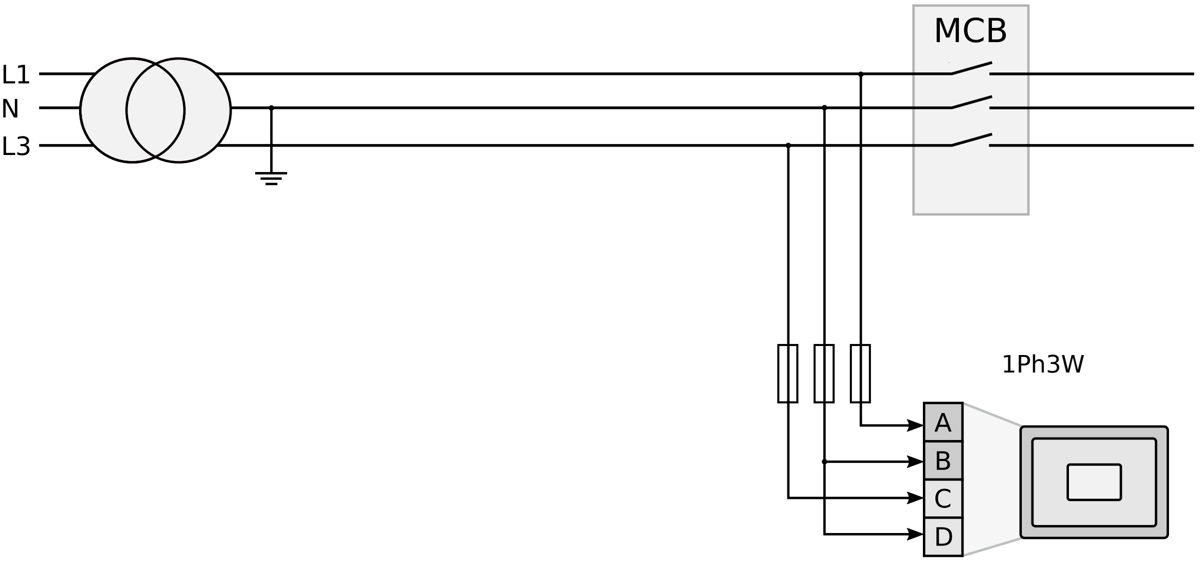


Fig. 33: Measuring inputs - 1Ph 3W

Terminal assignment

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

Measuring input / Phase	Terminal	
	D	28

Table 13: Mains terminal assignment 1Ph 3W

3.2.4.2.4 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 Group Controller consistently.

3.2.4.2.4.1 '1Ph 2W' Phase-Neutral Measuring

Mains windings

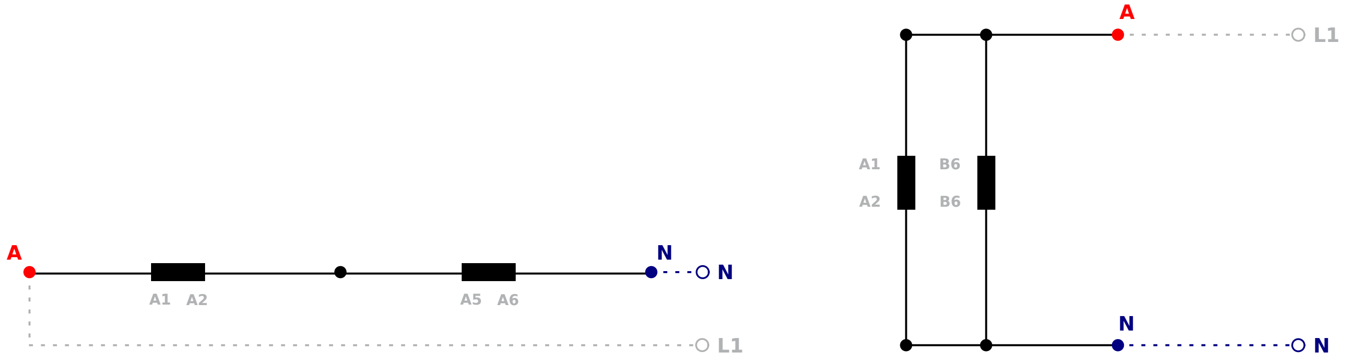


Fig. 34: Mains windings - 1Ph 2W (phase neutral)

Measuring inputs

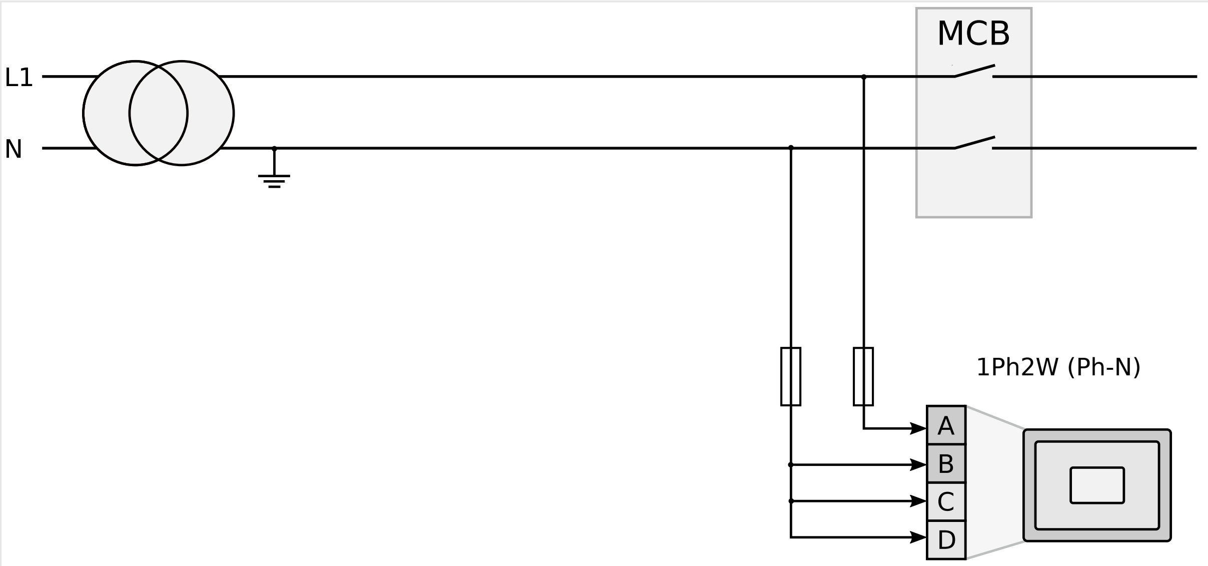


Fig. 35: Measuring inputs - 1Ph 2W (phase neutral)

Terminal assignment

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

Table 14: Mains terminal assignment 1Ph 2W phase neutral

3.2.4.2.4.2 '1Ph 2W' Phase-Phase Measuring

Mains windings

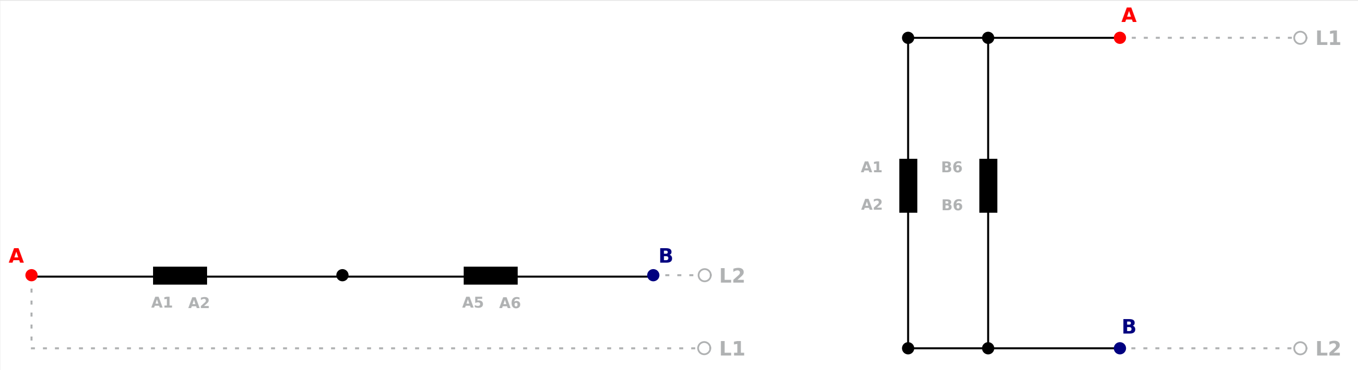


Fig. 36: Mains windings - 1Ph 2W (phase-phase)

Measuring inputs

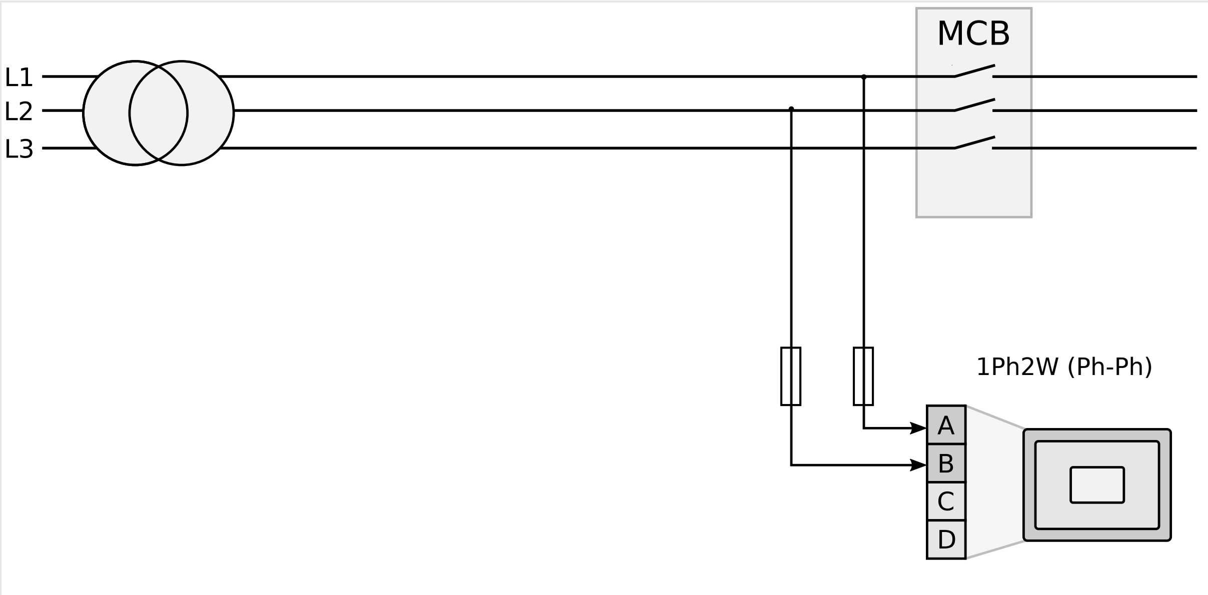


Fig. 37: Measuring inputs - 1Ph 2W (phase-phase)

Terminal assignment

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

Table 15: Mains terminal assignment 1Ph 2W phase-phase

3.2.4.3 Load 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 ToolKit.

Parameter ⮡▷ 1812 (Load Bus PT sec. rated volt.) must be configured to the correct value to ensure proper measurement.

Schematic and terminals

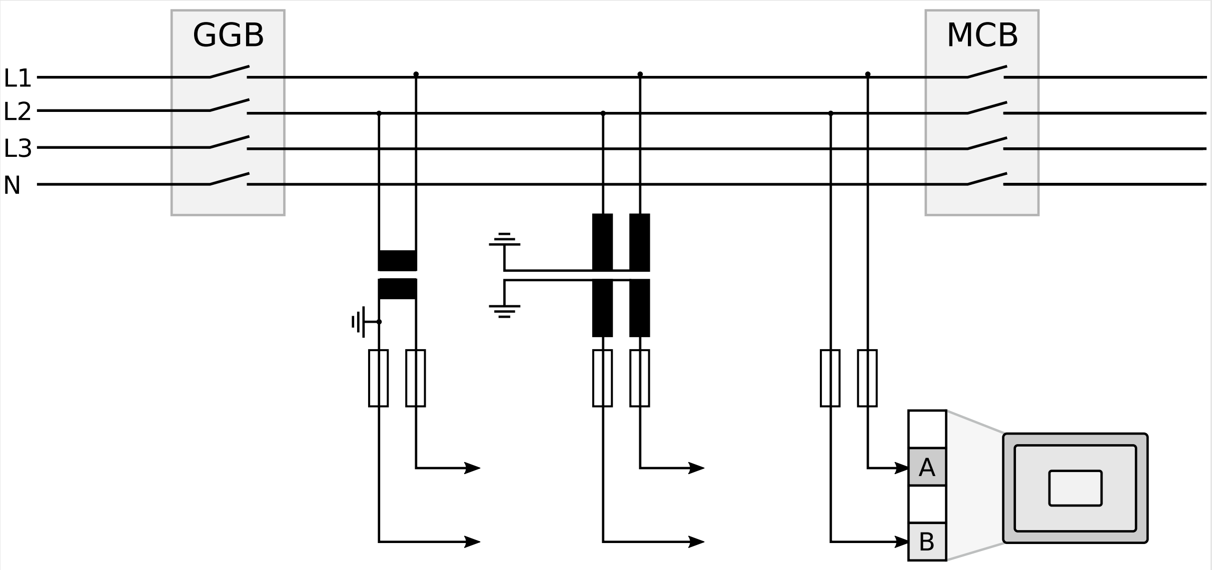


Fig. 38: Voltage measuring - load busbar wiring

Measuring input / Phase	Terminal		A_{max}
Load Busbar voltage - L1	A	38	2.5 mm²

Measuring input / Phase	Terminal		A_{max}
Load Busbar voltage - L2/N	B	40	2.5 mm²

Table 16: Voltage measuring - load busbar - terminal assignment

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 GC consistently.

3.2.4.3.1 '1Ph 2W' Phase-Neutral Measuring

Load busbar windings

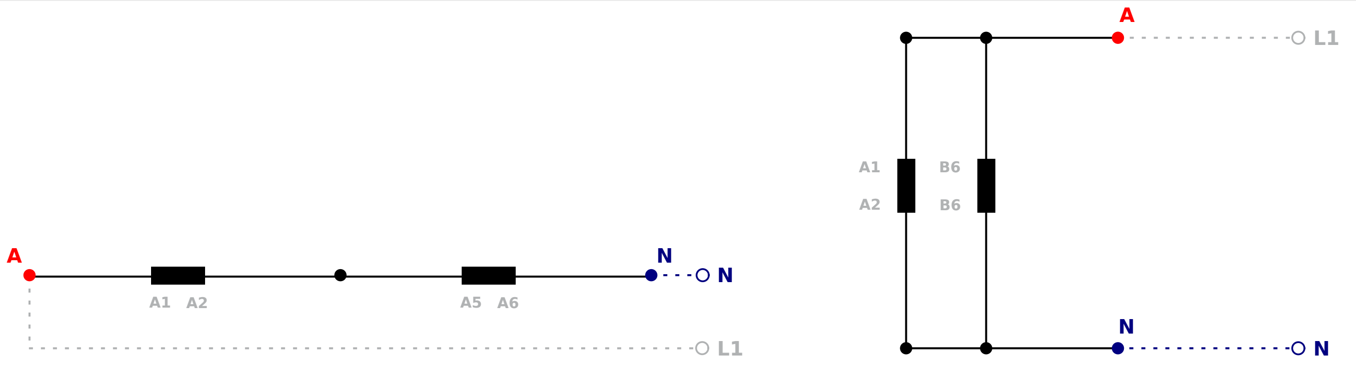


Fig. 39: Load busbar windings - 1Ph 2W (phase-neutral)

Measuring inputs

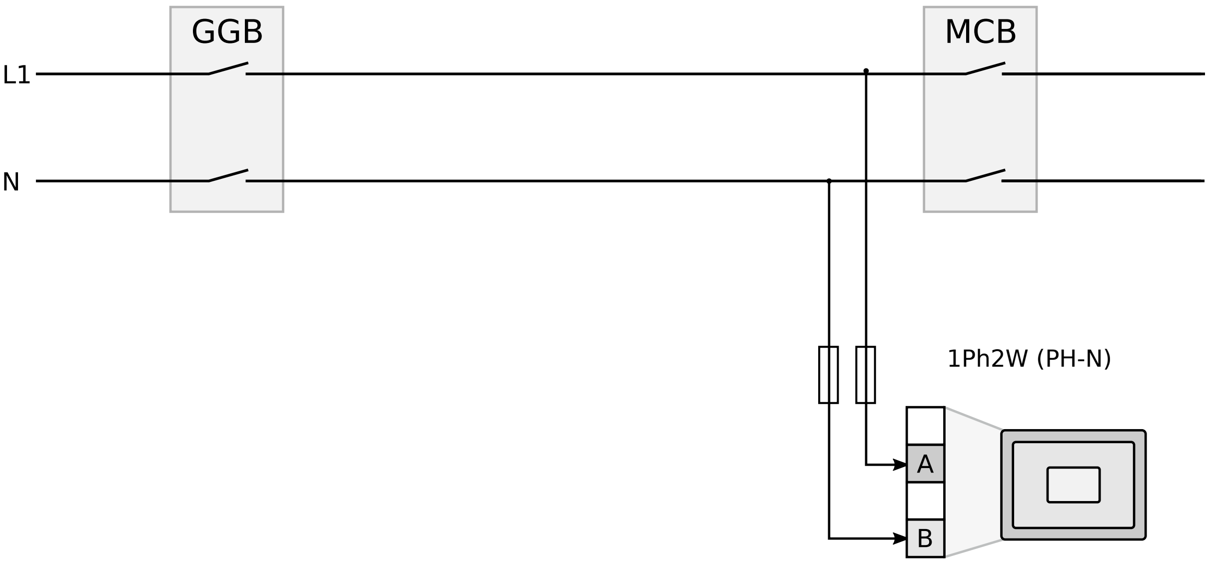


Fig. 40: Measuring inputs - 1Ph 2W (phase neutral)

Terminal assignment

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

Table 17: Load busbar terminal assignment 1Ph 2W phase neutral

3.2.4.3.2 '1Ph 2W' Phase-Phase Measuring

Busbar windings

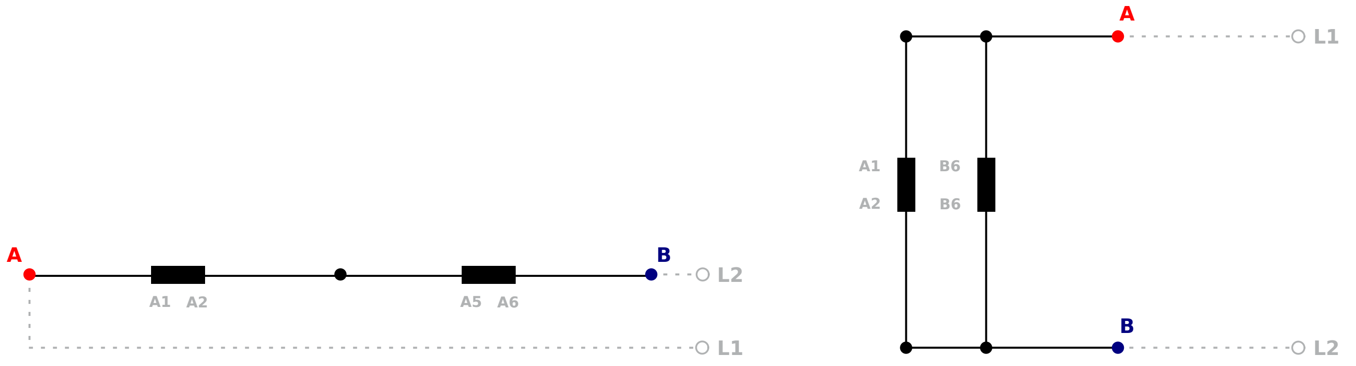


Fig. 41: Load busbar windings - 1Ph 2W (phase-phase)

Measuring inputs

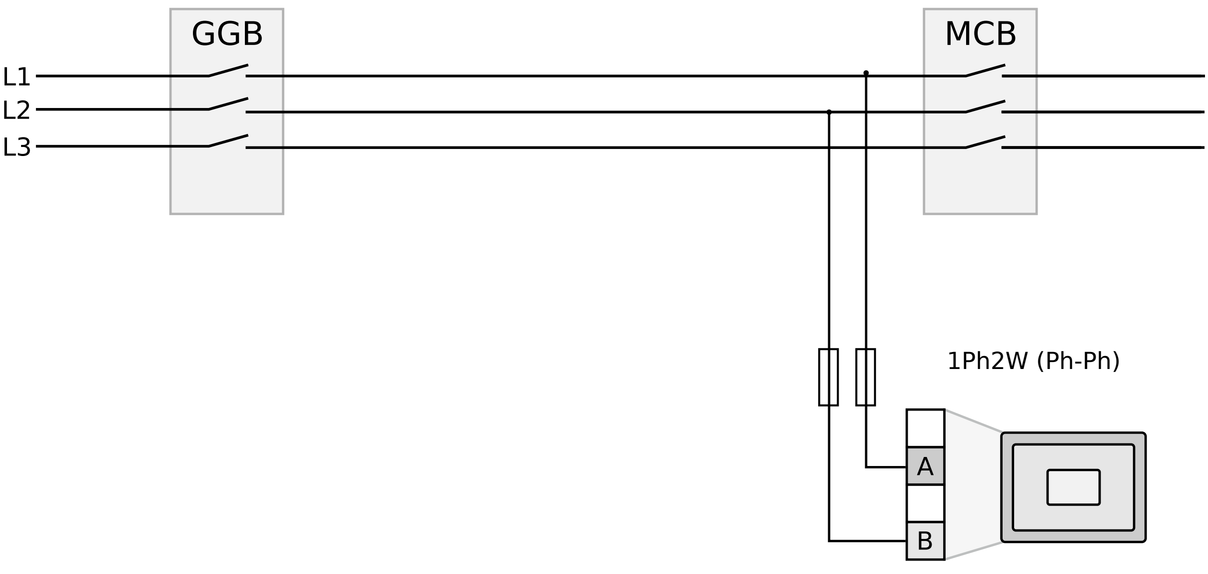


Fig. 42: Measuring inputs - 1Ph 2W (phase-phase)

Terminal assignment

Measuring input / Phase	Terminal	
Load Busbar voltage - phase L1	A	38

Measuring input / Phase	Terminal	
Load Busbar voltage - phase L2	B	40
Load Busbar voltage - phase L3	-/-	

Table 18: Load busbar terminal assignment 1Ph 2W phase-phase

3.2.5 Current Measuring

3.2.5.1 Generator Group 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 ToolKit.

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

CAUTION!

External current transformers shall provide insulation adequate to system voltage to which unit is connected.

Schematic and terminals

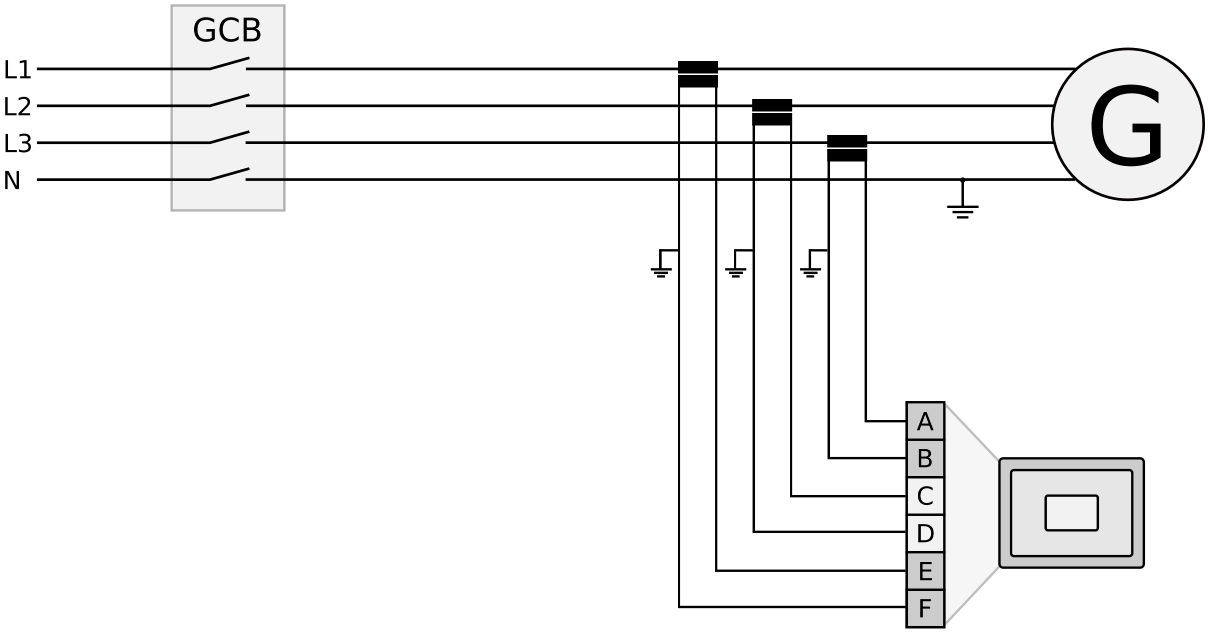


Fig. 43: Current measuring - generator group - wiring

Terminal		**Description**
A	8	Generator group current - L3 - transformer terminal s1 (k)
B	7	Generator group current - L3 - transformer terminal s2 (l)
C	6	Generator group current - L2 - transformer terminal s1 (k)
D	5	Generator group current - L2 - transformer terminal s2 (l)
E	4	Generator group current - L1 - transformer terminal s1 (k)
F	3	Generator group current - L1 - transformer terminal s2 (l)

Table 19: Current measuring - generator group - terminal assignment

3.2.5.1.1 Parameter Setting 'L1 L2 L3'

Schematic and terminals

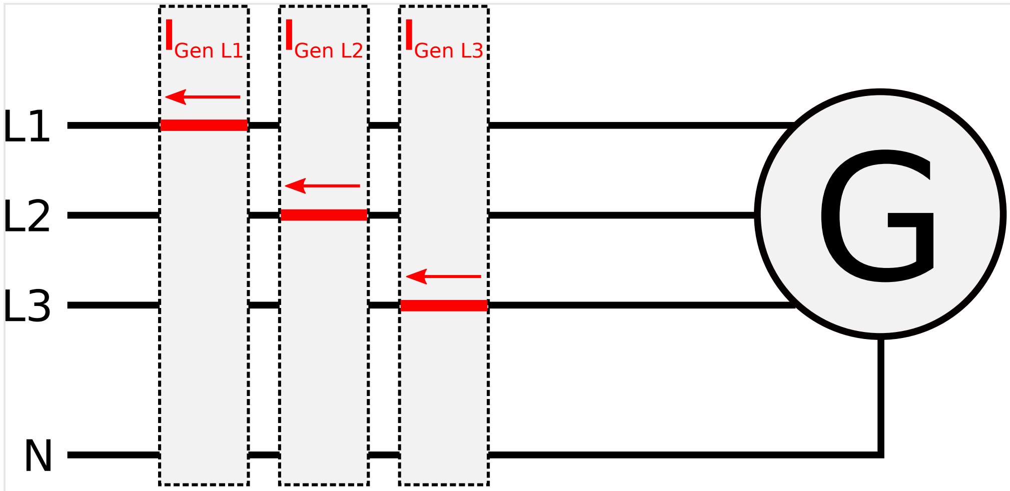


Fig. 44: Current measuring - generator group, L1 L2 L3

	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 group voltage measurement is configured to 1Ph 3W (⮡ "3.2.4.1 Generator Group Voltage").

3.2.5.1.2 Parameter Setting 'Phase L1' 'Phase L2' 'Phase L3'

Schematic and terminals

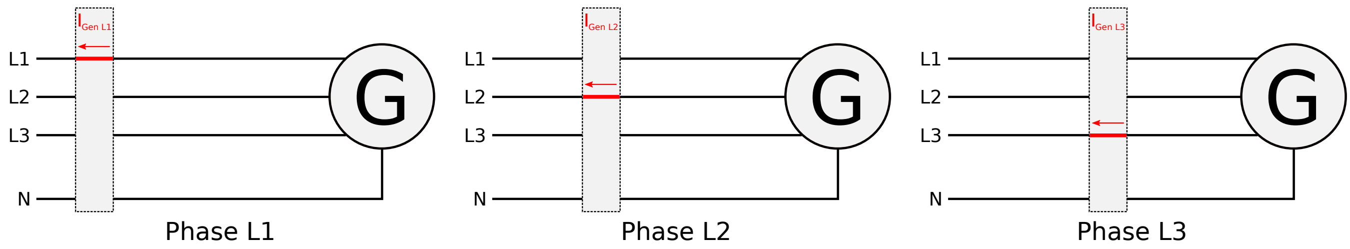


Fig. 45: Current measuring - generator group, 'Phase L1' 'Phase L2' 'Phase L3'

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

3.2.6 Discrete Inputs

General notes

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

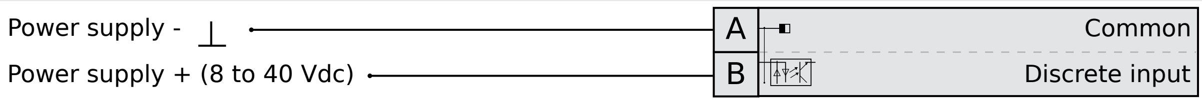


Fig. 46: Discrete input - positive polarity signal

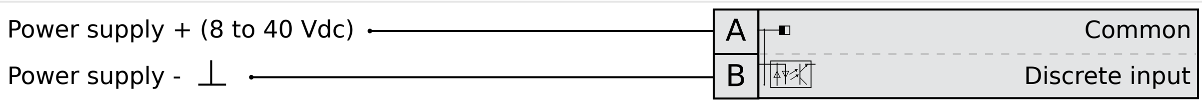


Fig. 47: Discrete input - negative polarity signal

Terminal		Description	
A	**B**		
66	67	Discrete Input [DI 01]	Preconfigured to "System update GC"
GND Common ground	68	Discrete Input [DI 02]	Preconfigured to "External alarm acknowledge"
	69	Discrete Input [DI 03]	Preconfigured to "Enable close MCB"

Terminal		Description	
A	B		
	70	Discrete Input [DI 04]	Preconfigured to "Unloading mains/ Open MCB" (if GGB/MCB mode)
	71	Discrete Input [DI 05]	Fixed to "Reply: MCB is open" (if GGB/MCB mode)
	72	Discrete Input [DI 06]	Preconfigured to "Open GGB immediately"
	73	Discrete Input [DI 07]	Preconfigured to "Enable close GGB"
	74	Discrete Input [DI 08]	Fixed to "Reply: GGB is open"
	75	Discrete Input [DI 09]	Preconfigured to "Segment code bit 1" (if GGB/MCB and external segmenting)
	76	Discrete Input [DI 10]	Preconfigured to "Segment code bit 2" (if GGB/MCB and external segmenting)
	77	Discrete Input [DI 11]	Preconfigured to "Segment code bit 3" (if GGB/MCB and external segmenting)
	78	Discrete Input [DI 12]	Preconfigured to "Segment code bit 4" (if GGB/MCB and external segmenting)

Table 20: DI 01-12

3.2.7 Relay Outputs

Schematic and terminals

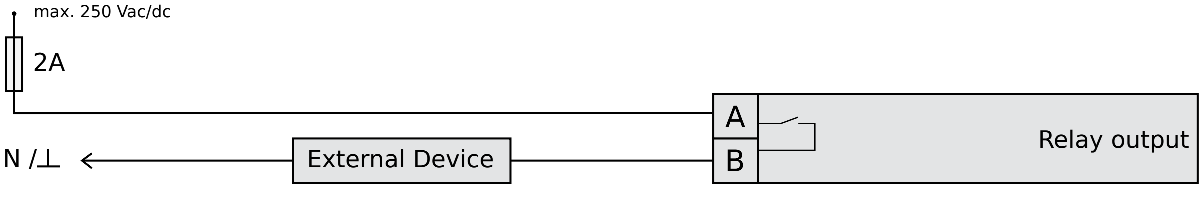


Fig. 48: Relay outputs - schematic

Terminal		Description		
N.O.	Common			
A	B	Form A		
42	41	Relay output [R 01]	Fixed to "Ready for operation" (It is possible to configure additional events.)[1]	
43	46	Relay output [R 02]	Preconfigured to "Horn"[1]	
44		Relay output [R 03]	Preconfigured to "Warning Alarm"[1]	
45		Relay output [R 04]	Preconfigured to "Critical Alarm"[1]	
48	47	Relay output [R 05]	Fixed to "Open GGB" if GGB relay is not set to "Not Used", otherwise configurable[1]	
50	49	Relay output [R 06]	Fixed to "Close GGB"	

Terminal		Description		
N.O.	Common			
A	B	Form A		
52	51	Relay output [R 07]	Fixed to "Open MCB" if application mode is GGB/ MCB, otherwise configurable[1]	
54	53	Relay output [R 08]	Fixed to "Close MCB" if application mode is GGB/ MCB, otherwise configurable[1]	
56	55	Relay output [R 09]	Configurable (not preconfigured)[1]	
57	60	Relay output [R 10]	Preconfigured to (NOT) Dead Busbar[1]	
58		Relay output [R 11]	Configurable (not preconfigured)[1]	
59		Relay output [R 12]	Configurable (not preconfigured)[1]	

[1] configurable via LogicsManager

3.2.7.1 Connecting 24 V Relays

NOTICE!

Damage to adjacent electronic components due to induced voltages

- Implement protection circuits as detailed below.

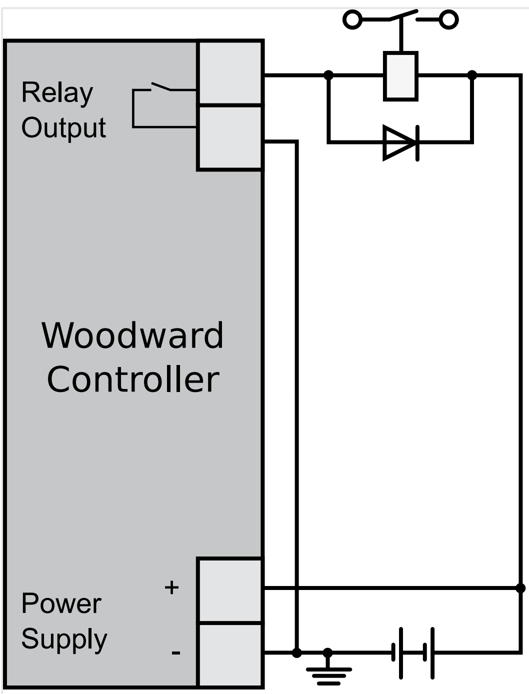


Fig. 49: Protection circuit (example)

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.

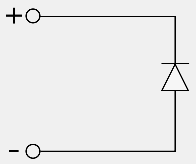
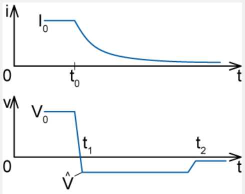
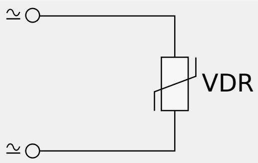
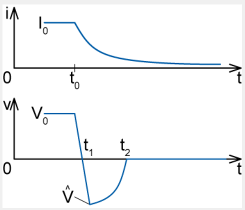
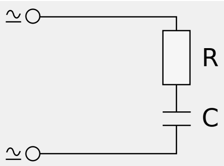
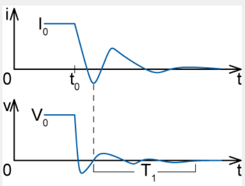
When disabling such a device, high switch-off induced voltages may occur, which might destroy adjacent electronic devices or result interference voltage pulses, which lead to functional faults, by capacitive coupling mechanisms.

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

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

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

3.2.8 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 Ground and as close to the GC-3000XT terminals as possible.

For two pole senders of **0/4 to 20 mA** or **0 to 1 V** sensors 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 (⟹ https://www.vdo.com)

Wiring senders (example)

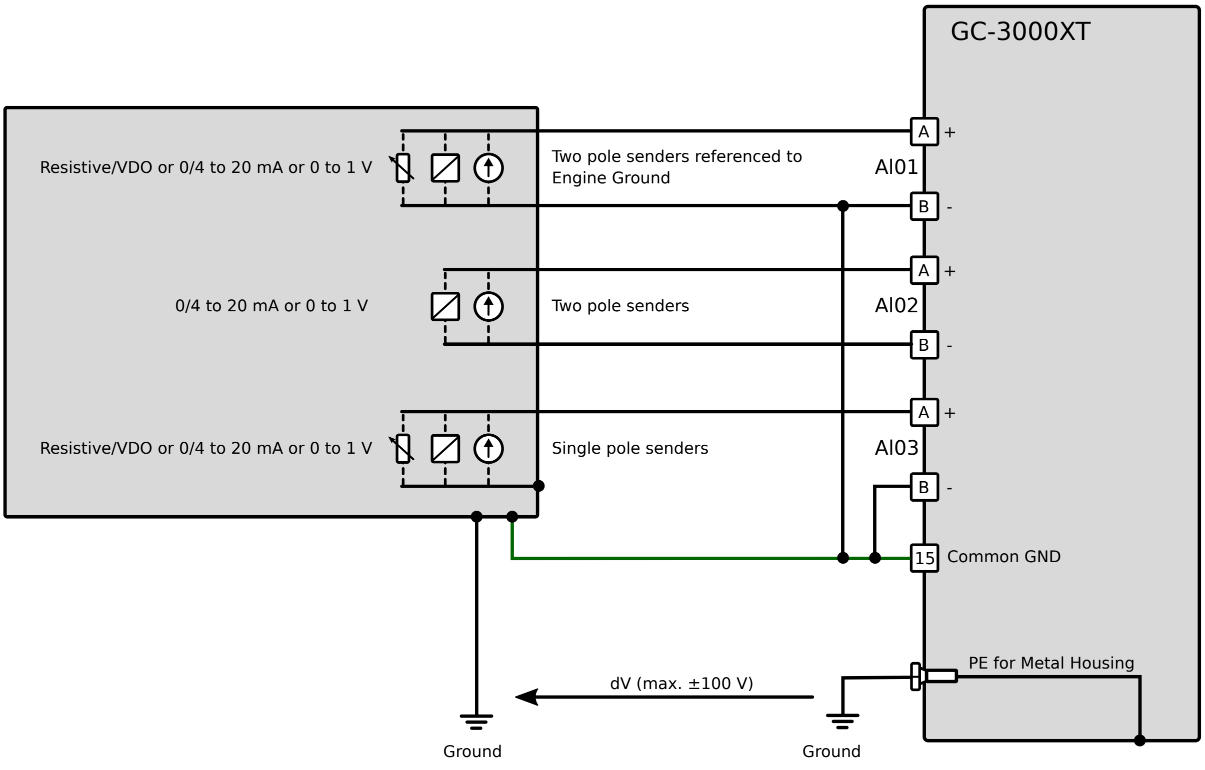


Fig. 50: Analog inputs - wiring senders (example)

Terminal			Description
AI01	A	10	Analog input [AI 01 +]
	B	9	Analog input [AI 01 -] ground, connect with Common GND terminal 15
AI02	A	12	Analog input [AI 02 +]
	B	11	Analog input [AI 02 -]
AI03	A	14	Analog input [AI 03 +]
	B	13	Analog input [AI 03 -] ground, connect with Common GND 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 Common GND (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 Setup Interfaces

NOTICE!

Avoid electrostatic discharge!

Before working with terminals please read and follow the instructions of chapter ⮑ "Electrostatic discharge".

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

3.3.1 Interfaces overview

Unshielded cable length

For CAN:

- Cabling without shield coverage should be less than 25 mm.

The following drawing shows all available interfaces of the device:

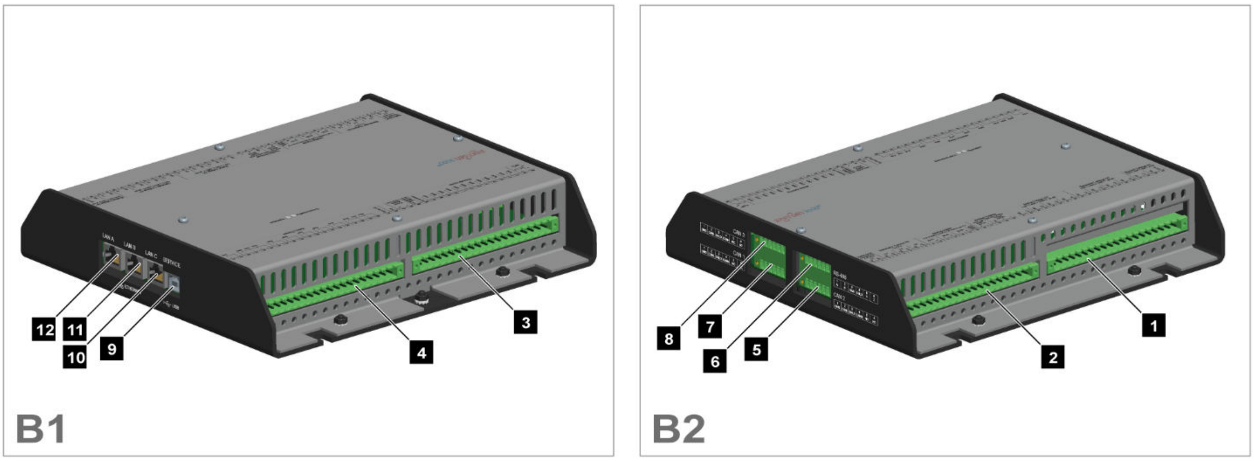


Fig. 51: GC-3400XT-P1 (sheet metal housing)

1	Mains/generator group/load busbar PT terminal
2	Analog inputs/outputs, generator CT, and mains/GND current terminal
3	Discrete inputs and power supply
4	Relay outputs terminal
5	CAN bus interface connector CAN #2 (for IKD1)
6	RS-485 interface connector RS-485 #1 (not supported)
7	CAN bus interface connector CAN #1
8	CAN bus interface connector CAN #3 (not supported)
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

3.3.2 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 ⮑ Fig. 51.

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.

3.3.3 CAN Bus Interfaces

Avoid electrostatic discharge!

Avoid electrostatic discharge during cable connection to the unit.

Pin assignment

For location of CAN interface 1 and 2 see ⮑ Fig. 51.

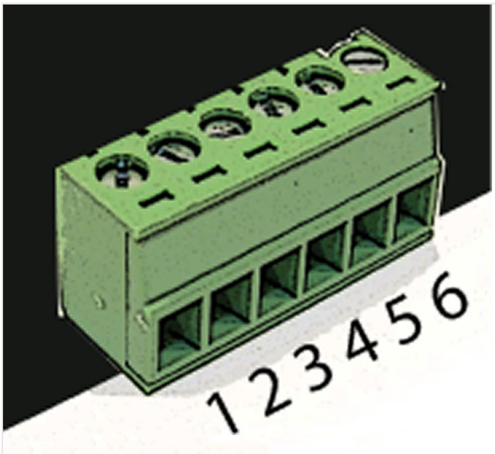


Fig. 52: screwable 6-terminal connector - CAN bus

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

Terminal	Description	A_{max}
6	Not connected	1.5 mm^2

Table 21: 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.

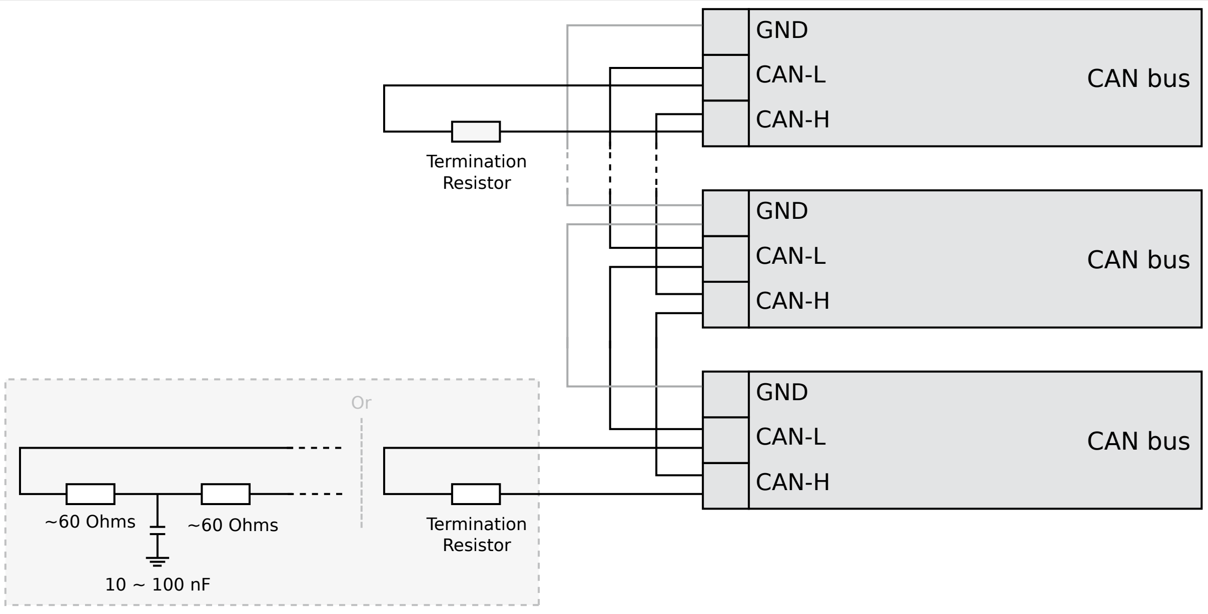


Fig. 53: CAN bus - termination

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

Baud rate	Max. length
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.

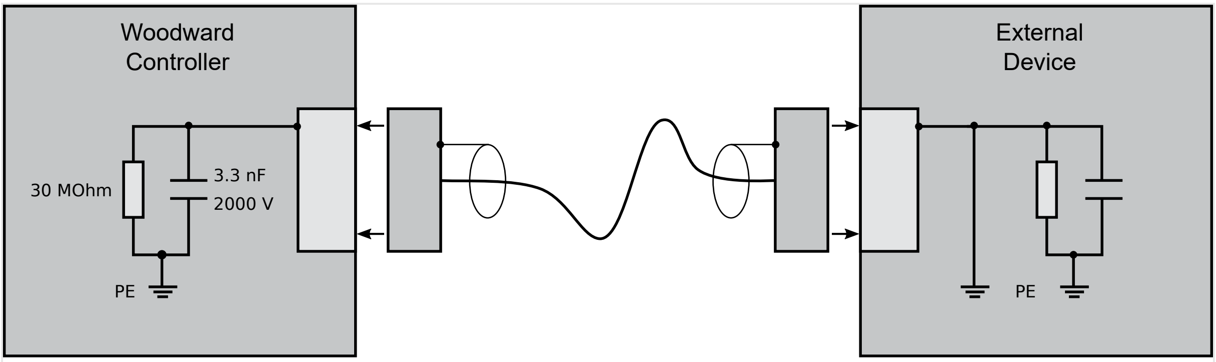


Fig. 54: Bus shielding (internal RC element)

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

3.3.4 Ethernet Interface

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 these interfaces, see Fig. 51.

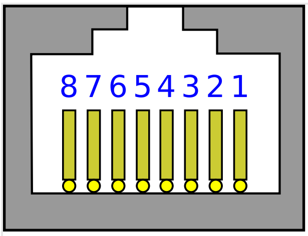


Fig. 55: RJ-45 connector - Ethernet

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 22: 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, which 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.

Troubleshooting

Check first the power supply of the switches.

Check the IP addresses of the single devices.

4 Configuration

All function described in this manual are only performable, if parameter ”3444 Application mode“ of the easYgen-3500XT are configured to ”GCB/GC“.

4.1 Access Via PC (ToolKit)

Version

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

- Required version: 7.0 or higher
- Please use the latest available version!
- To obtain the latest version scan this QR code or use the following link: ⟹ https://wss.woodward.com/manuals/PGC/SW_Tools/ToolKit.

4.2 Basic Setup

4.2.1 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.

Select language

In ToolKit the language can be selected in the following menu

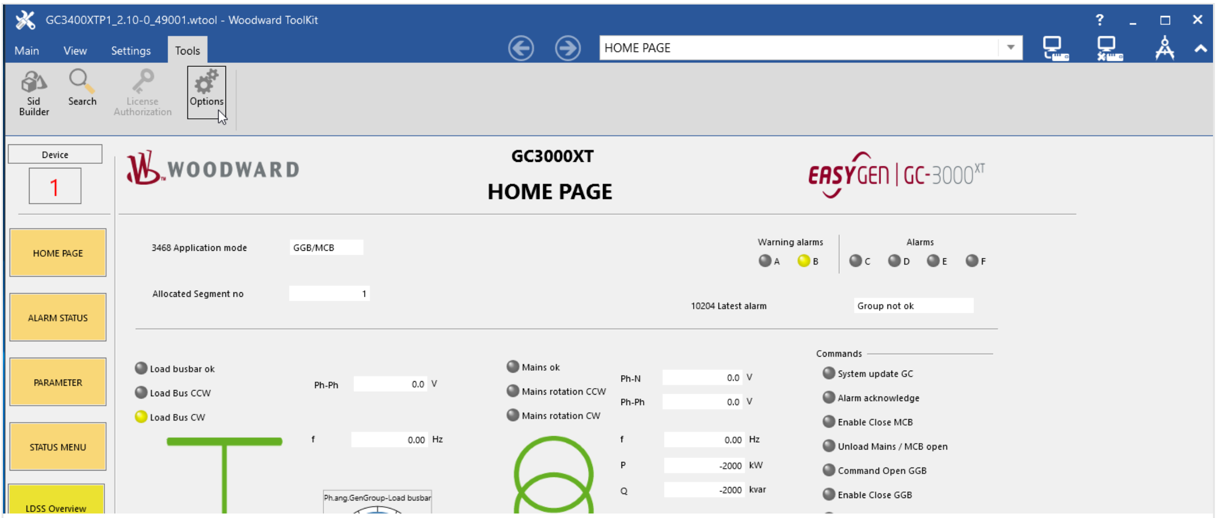


Fig. 56: Menu Tools - Options

At the bottom of the options window the language can be selected.

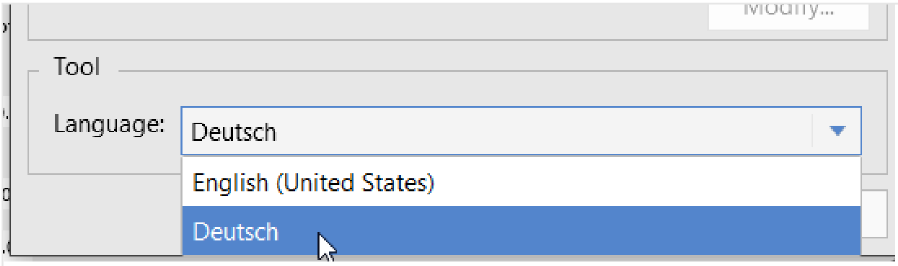


Fig. 57: Select language

Configure clock

> Update clock settings
>
> - ToolKit displays the »Actual values« (Time IDs 1690 to 1692; Date IDs 1693 to 1695) besides the parameters. So the time values and date values can be prepared each as a set before transferring.

ID	Parameter	CL	Setting range [Default]	Description
»Values to be set«				
1710	**Hour**	0	hour 0 to 23 h **[real-time clock]**	The hour of the clock time is set here. **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**

ID	Parameter	CL	Setting range [Default]	Description
				• 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**	0	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 date to clock**	0	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.

ID	Parameter	CL	Setting range **[Default]**	Description
				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.
				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) 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) 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) is set to "On".

ID	Parameter	CL	Setting range [Default]	Description
4593	**DST begin month**	2	1 to 12 **[3]**	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) is set to "On".
4597	**DST end time**	2	0 to 23 **[3]**	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) is set to "On".
4599	**DST end weekday**	2	Sunday to Saturday **[Sunday]**	The weekday for the DST end date is configured here
				Notes This parameter is only displayed, if Daylight saving time (parameter 4591) 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) is set to "On".
4596	**DST end month**	2	1 to 12	The month for the DST begin date is configured here.

ID	Parameter	CL	Setting range [Default]	Description
			[10]	**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) is set to "On".

Table 23: Parameters 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 24 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 24: 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 25: Daylight saving time - exemplary dates

4.2.2 Lamp Test

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

Lamp Test can be executed through the Button "LAMPTEST" on the housing or over ToolKit under

[Parameter / Lamp test]

For the time the Lamp test is active the logical command variable "04.61. Lamp test" is TRUE and the LEDs on the housing shine as follows:

- "Sync Enable" shine orange (Green and red LED simultaneously)
- "Operation" shine orange (Green and red LED simultaneously)
- All 9 LEDs close to the paper strip shine red

4.2.3 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.

Password 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 GC-3400XT-P1.

Access to the GC-3000XT by a/an ...	# used in ⮡ Fig. 58below
PC running ToolKit servlink, connected over USB	②
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

Access to the GC-3000XT by a/an ...	# used in Fig. 58below
Netbiter® Easy Connect gateway running Servlink TCP (ToolKit via internet)	⑤

Each channel has its own independent access level.

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

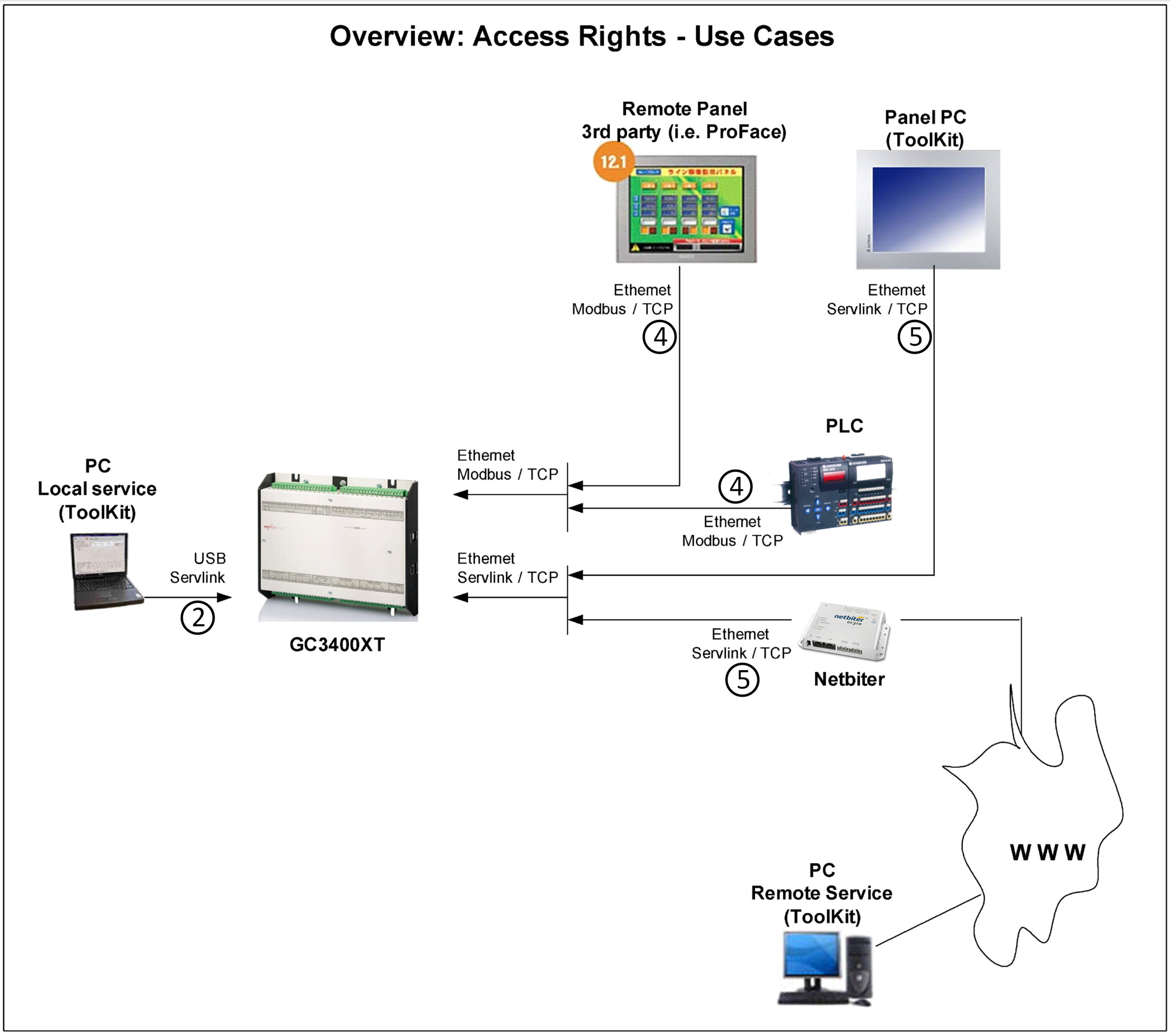


Fig. 58: Access to the GC-3400XT-P1 device - Overview

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 "User Account Entry"

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

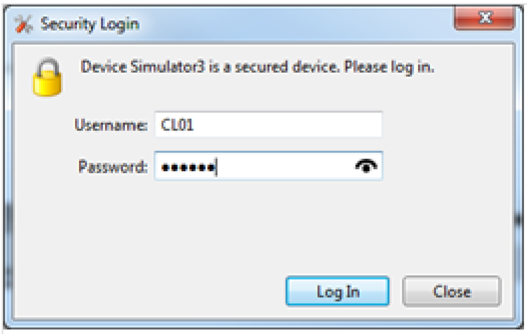


Fig. 59: Password entry: ToolKit

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

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.

Code Level	User Account Entry		Basic Code Entry	Comment
	User Name (fix)	Password (default)	Password (default)	
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.

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.

The device provides different access channels via ...	Remarks
USB	ToolKit Servlink
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!

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

- **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.

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

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)").

- **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.

Code Level	User Account Entry	
	User Name (fix)	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 »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.

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

- **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

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

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

- **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

Level	User Account Entry	
	User Name	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 »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.

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

- **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

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

Level	User Account Entry	
	User Name **(fix)**	**Password** **(default)**
5	CL05	CL0500

Automatic Logout from Password level (Fall into level 0)

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)

The ToolKit Servlink access with logout function

The Modbus TCP (in all channels) with wrong password

Definition of the password

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; ⮱▷ 10438) 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 in ToolKit

The ToolKit supports the User Account entry and in case of CANopen 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 GC-3400XT-P1 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-
for "User name" to parameter ⮡ 7490 (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-
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.

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
7486	**Code level**	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.
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**	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**	0	**[0]**	This value displays the code level, which is currently enabled for access via the Modbus TCP/IP interface.

ID	Parameter	CL	Setting range [Default]	Description
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.
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.

4.2.3.1 Password System - Parameter Overview

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 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.

ID	Parameter	CL	Setting range [Default]	Description
				Refer to ⮑ "4.2.3 Enter Password" for default values.
10413	**Password commissioning**	3	1 to 9999 **[-]**	The password for the code level "Commissioning" is defined in this parameter. Refer to ⮑ "4.2.3 Enter Password" 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 ⮑ "4.2.3 Enter Password" 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.

4.2.3.1.1 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 GC device. Needed to get an alphanumeric password by Woodward support.

4.2.3.1.2 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)

ID	Parameter	CL	Setting range [Default]	Description
10441	Confirm password basic level	1	((empty))	Repeat here your new alphanumeric password string for the basic code level (CL01)
10442	Change password 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		Change passw.error basic level
			[green]	Password was not changed or successfully changed
			red	Error: password could not be changed
10434	**Reset password 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 password commiss.level	3	((empty))	Repeat here your new alphanumeric password string for the commiss. code level (CL03)
10447	Change password 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 comm.level	0		Flag: illuminated LED
			[green]	Password was not changed or successfully changed
			red	Error: password could not be changed
10435	**Reset password commiss. level**	4	Yes	The control resets the password of the commissioning level to "CL0003".
			[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)

ID	Parameter	CL	Setting range [Default]	Description
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. error super 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]	

4.2.4 System Management

CAUTION!

Don't initiate »Set factory default settings« during active breaker control! This causes Group Controller rebooting.

Parameter ⮡ 1701 »Set factory default values« causes a reboot of the control. During this time the breaker and the system is not controlled by the Group Controller! 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 16 **[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.

ID	Parameter	CL	Setting range [Default]	Description
				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.
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.
10455	**Reboot the device**	2	**[No]** Yes	Yes: Shows Parameter ⮑ 10417 which finally can initiates a reboot.
				Notes Some parameters require a reboot to take effect.
10419	**REBOOT**	2	**[No]** Yes	This Parameter is only shown if Parameter ⮑ 10455 is set to Yes first. Yes: Reboot will be initiated.
				Notes Some parameters require a reboot to take effect.
10417	**Factory default settings**	0	Yes	The following parameter is visible and restoring the configured parameters to factory default values is enabled.
			[No]	The following parameter is 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

ID	Parameter	CL	Setting range [Default]	Description
				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) is set to "Yes".
1896	**Parameter update rate**	4	3 to 7200 s [3 s]	Parameters are usually copied from RAM to flash memory. This is done by cyclically comparing the RAM with flash content. This parameter defines the rate of cyclical parameter update. For application where parameters get changed very often the update rate may be increased. This will decrease the write operations to flash memory.

4.3 Configuration Application

4.3.1 Configure Load Share

4.3.1.1 Configuration Segmenting

General notes

A segment number is defined as a section of the bus, feeder, or interconnection, which cannot electrically be isolated to a smaller section and is connected to a circuit breaker or an isolation switch which is operated or supervised by a GC-3000XT. A transformer is not to be considered as a segment or a point of isolation. Each segment, feeder, or interconnection must be assigned with a number that is unique to that segment.

ID	Parameter	CL	Setting range [Default]	Description
7665	**GC basic segment number**	2	1 to 128 **[1]**	This is the dedicated segment number for the GC-3000XT to define the load busbar segment on which the generator group is working if the GGB is closed.

ID	Parameter	CL	Setting range [Default]	Description
				It is also the initial segment number after reboot the device.
1724	**Source segment number**	2		The parameter determines from which source the segment number information comes from.
			Internal	The segment number is defined by parameter ⮑ 7665.
			[External]	Application mode **GGB/MCB** ⮑ 3468 The segment number is defined by LogicsManager (refer to parameter 1270, 1271, 1272, 1273 and logic table segment number ⮑ "6.2.2 Segment Control").
				Application mode **GGB/LSx** ⮑ 3468 The segment number is defined by LSx devices which are connected over the load share interface.
1270	Segm. code bit 1	2	Determined by LogicsManager 87.01 **[(09.09 & 1) & 1]**	Defines bit 1 of the segment number if external segmenting is configured.
1271	Segm. code bit 2	2	Determined by LogicsManager 87.02 **[(09.10 & 1) & 1]**	Defines bit 2 of the segment number if external segmenting is configured.
1272	Segm. code bit 3	2	Determined by LogicsManager 87.03 **[(09.11 & 1) & 1]**	Defines bit 3 of the segment number if external segmenting is configured.
1273	Segm. code bit 4	2	Determined by LogicsManager 87.04 **[(09.12 & 1) & 1]**	Defines bit 4 of the segment number if external segmenting is configured.

4.3.1.2 Configure Load Share Interface

Introduction

The GC allows to enable/disable single interface channels. Refer to Parameter ⮡ "4.3.1.2.1 Load Share Interface Layer 1" and ⮡ "4.3.1.2.2 Load Share Interface Layer 3" for more information. According to the configured interface channel there are different interface monitoring functions available.

Disabling a single interface channel will not reset related latched alarm flags. This has to be done manually.

Overview

The GC-3400XT-P1 is equipped with 5 interfaces:

- Interface USB slave (Service port)
- Interface CAN #1 (CANopen EG3000XT load share bus)
- Interface Ethernet A (UDP EG3000XT load share bus, Servlink TCP ToolKit)
- Interface Ethernet B (UDP GC-3400XT-P1 load share bus, Modbus TCP, Servlink TCP ToolKit)
- Interface Ethernet C (UDP GC-3000XT load share bus, Modbus TCP, Servlink TCP ToolKit)

All load share lines are redundant

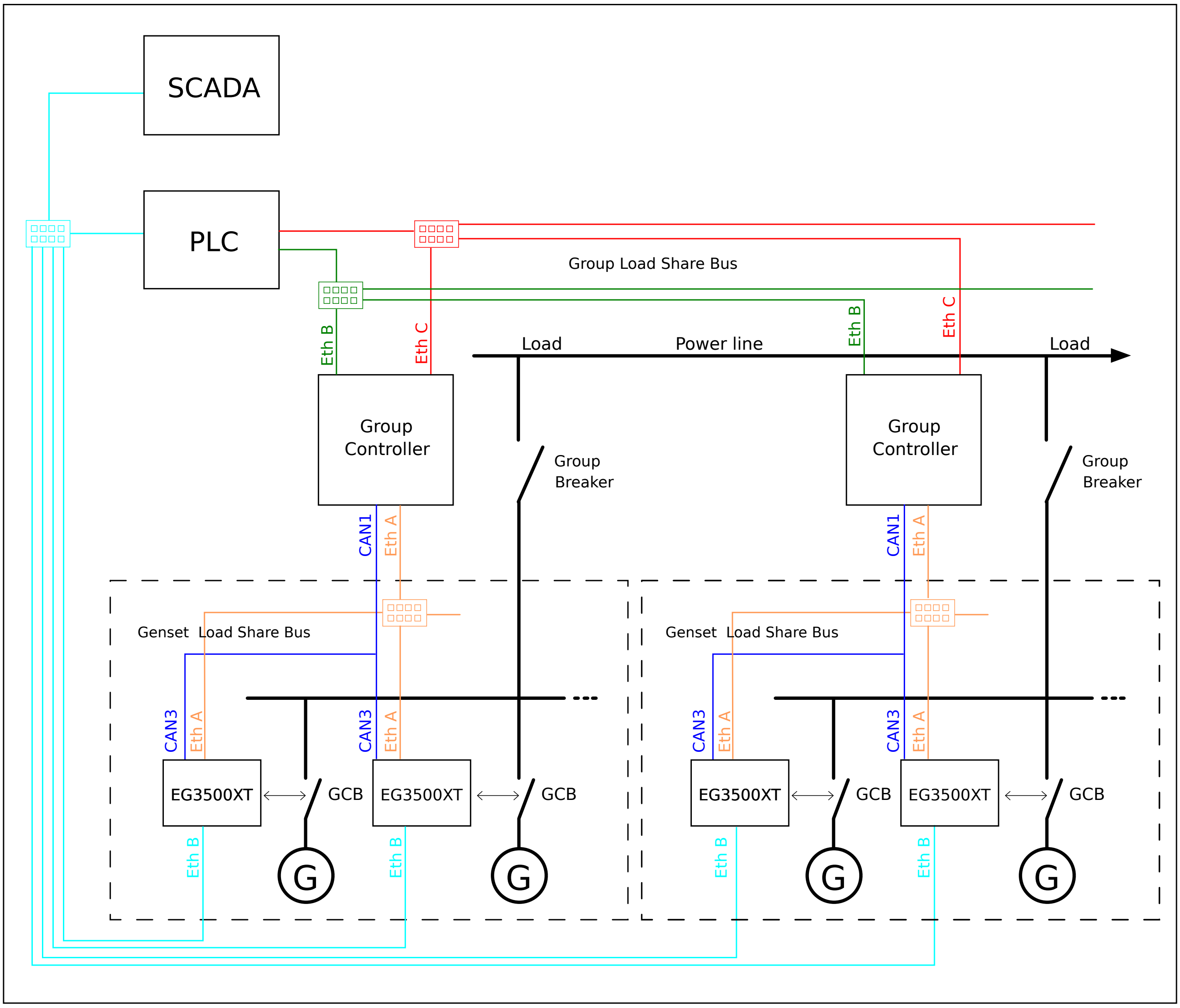


Fig. 60: Example: GC-3000XT system with full load share line redundancy on all load share busses.

The example shows a system in which all load share lines (genset load share bus and group load share bus) shall be redundant designed. In this case the GC is configured to CAN1/Ethernet A respectively Ethernet B/C. The easYgen is configured to CAN 3 / Ethernet A.

If a SCADA system with Modbus master functionality shall be installed over the whole system following items shall be adhered:

- The easYgens must get an own Ethernet network on Ethernet B in conjunction with the SCADA
- A PLC pulls data from its GC either redundant or single Ethernet connected
- The PLC provides an additional individual Ethernet port on the SCADA network

Device	Network	Configuration
GC-3000XT	Ethernet A (Ethernet Network 1)	Load share data
	CAN1	Load share data
	Ethernet B (Ethernet Network 2)	Load share data
	Ethernet C (Ethernet Network 3)	Load share data
easYgenXT	Ethernet A (Ethernet Network 1)	Load share data
	CAN3	Load share data
	Ethernet B (Ethernet Network 4)	Modbus TCP / Toolkit Servlink
	Ethernet C (Ethernet Network 5)	Modbus TCP / Toolkit Servlink

Only Group Controller with redundant load share line

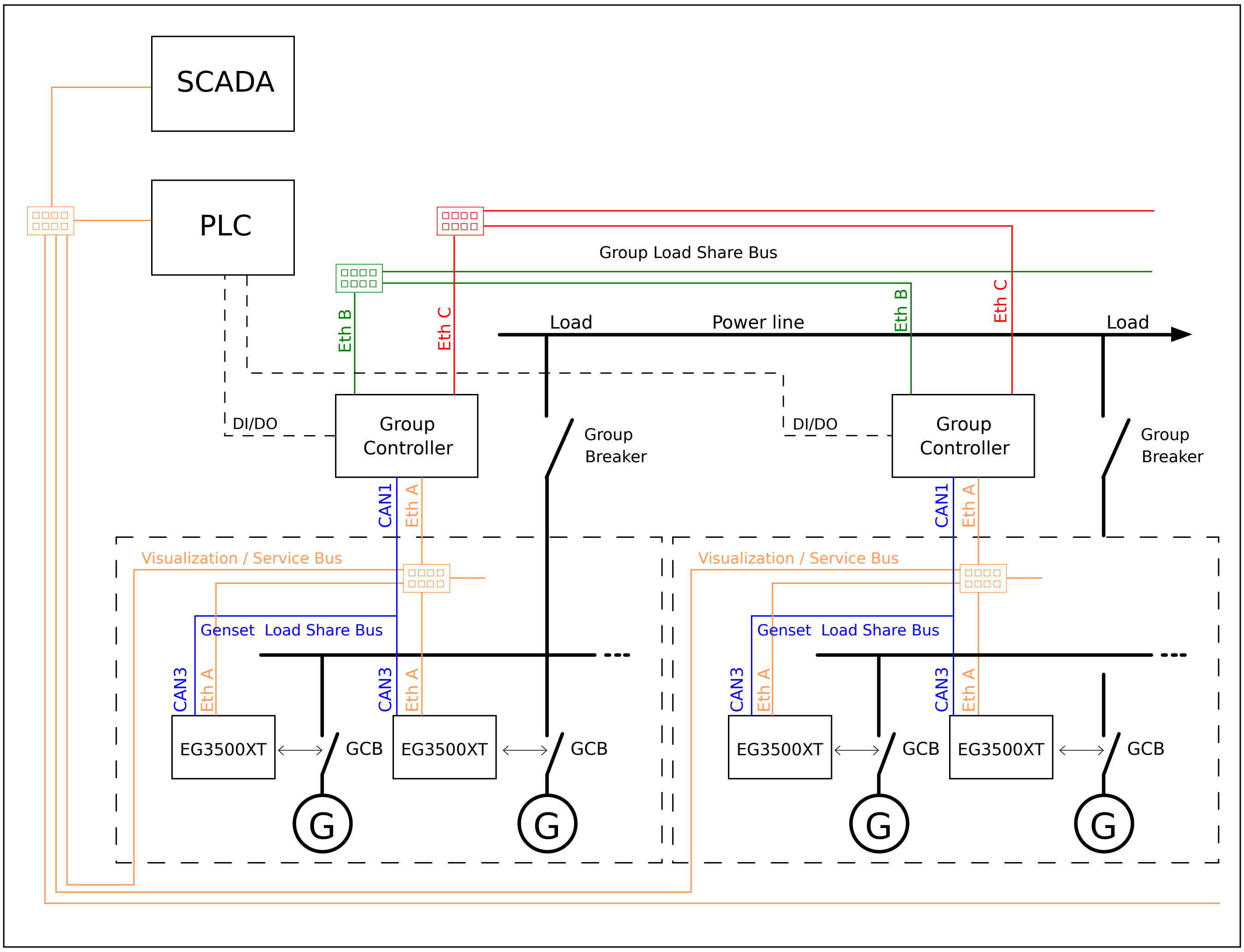


Fig. 61: Example: GC-3000XT system with single line CAN on easYgen level and load share line redundancy on GC level

The example shows a system in which only the group load share bus shall be redundant designed. In this case the GC is configured to CAN1 only for the genset load share bus and Ethernet B/C for the group load share bus. The easYgen is configured to CAN only for load share.

This application allows to use a common Ethernet A bus for visualization data or connecting ToolKit to a common point in the system.

If a SCADA system with Modbus master functionality shall be installed over the whole system following items shall be adhered:

- The easYgens must get an own Ethernet network on Ethernet B in conjunction with the SCADA
- A PLC pulls data from its GC either redundant or single Ethernet connected

The PLC provides an additional individual Ethernet port on the SCADA network

Device	Network	Configuration
GC-3000XT	Ethernet A (Ethernet Network 1)	Load share data disabled
	CAN1	Load share data
	Ethernet B (Ethernet Network 2)	Load share data
	Ethernet C (Ethernet Network 3)	Load share data
easYgenXT	Ethernet A (Ethernet Network 1)	Load share data disabled Used for: SCADA data Modbus TCP / Toolkit Servlink
	CAN3	Load share data

4.3.1.2.1 Load Share Interface Layer 1

ID	Parameter	CL	Setting range [Default]	Description
9924	**Interface Layer 1**	2		This configuration determines the communication interface between Generator Group Controller and its easYgens.
			Off	There is no Interface enabled to transport load share and control data between GC and easYgen. The interface monitoring is accordingly disabled.
			CAN1	Only Interface CAN1 transports load share and control data between GC and easYgen. The interface monitoring is accordingly adapted.
			Ethernet A	Only Interface Ethernet A transports load share and control data between GC and easYgen. The interface monitoring is accordingly adapted.
			[CAN1/Ethernet A]	CAN1 and Ethernet A interface is used to transport load share and control data between GC and easYgen. The redundancy with both busses is maintained. The interface monitoring is accordingly adapted.
				Note: Each change of this parameter requires a new system update procedure for the interfaces.
2442	**Load share timeout event**	2	**[Off]**	Loadshare timeout events for Layer 1 are disabled.
			On	Loadshare timeout events for Layer 1 are enabled. If a loadshare message was not received within a defined time, a loadshare timeout event will be shown in the Event History. Possible events are "easYgen LS timeout", "LSx LS timeout L1" and "Red. LS timeout L1"
5568	**Mode ext. load share gateway**	2		The operation mode for the external Woodward Load Share Gateway (LSG) is configured here.

ID	Parameter	CL	Setting range [Default]	Description
			[0]	Off
			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 − GC and GCP/MFR share the same CAN bus
			10 to 16	Not defined
				Notes Refer to the Load Share Gateway (LSG) Manual for security guidelines and detailed information about the configuration. **R**: Internal resistance **P**: Range for active power **Q**: range for reactive power

4.3.1.2.2 Load Share Interface Layer 3

ID	Parameter	CL	Setting range [Default]	Description
9929	**Interface Layer 3**	2		This configuration determines the communication interface between Generator Group Controller.
			Off	There is no Interface enabled to transport load share and control data between GCs. The interface monitoring is accordingly disabled.
			Ethernet B	Only Interface Ethernet B transports load share and control data between GCs. The interface monitoring is accordingly adapted.
			Ethernet C	Only Interface Ethernet C transports load share and control data between GCs. The interface monitoring is accordingly adapted.
			[Ethernet B/C]	Ethernet B and Ethernet C are used to transport load share and control data between GCs. The redundancy with both busses is maintained. The interface monitoring is accordingly adapted.
				Note: Each change of this parameter requires a new system update procedure for the interfaces.
2446	**Load share timeout event**	2	**[Off]**	Loadshare timeout events for Layer 3 are disabled.
			On	Loadshare timeout events for Layer 3 are enabled. If a loadshare message was not received within a defined time, a loadshare timeout event Layer 3 will be shown in the Event History. Possible events are "GC LS timeout", "LSx LS timeout L3" and "Red. LS timeout L3"

4.3.2 Inputs And Outputs

4.3.2.1 Function Of Inputs And Outputs

4.3.2.1.1 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 "external acknowledge".
  - 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 "System update Layer 3"	This discrete input is used to trigger a system update of Layer 3. It is assigned to "12892 System update Layer 3".
Discrete input [DI 02]	Programmable Preconfigured to "External Acknowledge"	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. It is assigned to "12490 EXt. acknowledge".
Discrete input [DI 03]	Programmable Preconfigured to "Enable close MCB"	This discrete input is used as Control input for the LM "12923 Enable close MCB".
Discrete input [DI 04]	Programmable Preconfigured to "Unloading mains/ Open MCB"	This discrete input is used as Control input for the LM "12893 Unloading mains/ Open MCB".
Discrete input [DI 05]	Fixed to "Reply: MCB is open"	This discrete input must be energized to indicate that the MCB breaker is open and de-energized to indicate that the MCB is closed. It is assigned to Only applicable for application mode "GGB/MCB". In application mode "GGB/LSx" this input is free programmable.
Discrete input [DI 06]	Programmable Preconfigured to "Open GGB immediately"	This discrete input is used as Control input for the LM "Open GGB immediately".
Discrete input [DI 07]	Programmable Preconfigured to "Enable close GGB"	This discrete input is used as Control input for the LM "Enable close GGB".
Discrete input [DI 08]	Fixed to "Reply: GGB open"	This discrete input must be energized to indicate that the GGB breaker is open and de-energized to indicate that the GGB is closed.
Discrete input [DI 09]	Programmable Preconfigured to "Segment code bit 1"	⮡ "4.3.1.1 Configuration Segmenting". Only applicable for application mode GGB/MCB and external segmenting.
Discrete input [DI 10]	Programmable Preconfigured to "Segment code bit 2"	⮡ "4.3.1.1 Configuration Segmenting". Only applicable for application mode GGB/MCB and external segmenting.
Discrete input [DI 11]	Programmable Preconfigured to "Segment code bit 3"	⮡ "4.3.1.1 Configuration Segmenting". Only applicable for application mode GGB/MCB and external segmenting.
Discrete input [DI 12]	Programmable Preconfigured to "Segment code bit 4"	⮡ "4.3.1.1 Configuration Segmenting". Only applicable for application mode GGB/MCB and external segmenting.

4.3.2.1.2 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.

CAUTION!

Uncontrolled operation due to faulty configuration

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

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	When a centralized alarm is issued, this discrete output is enabled.

Output	Type/Preset	Description
	Preconfigured to "Centralized alarm (horn)"	A horn or a buzzer maybe activated via this discrete output. An external acknowledge comand will acknowledge the centralized alarm and disable this discrete output. The discrete output is re-enabled 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 "Warning alarm"	This discrete output is enabled if an alarm class A or B is active or latched.
Relay output [R 04]	Programmable Preconfigured to "Critical alarm"	This discrete output is enabled if an alarm class C, D, E or F is active or latched.
Relay output [R 05]	Fixed to "Command: open GGB"	The controller enables this discrete output when the GGB is to be opened for switching operations. The parameter ⮡ 5669 defines how this relay functions: • If configured as "N.O.", the relay contacts close resulting in the GGB opening circuit energizing. • If configured as "N.C.", the relay contacts open resulting in the GGB opening circuit de-energizing. • If configured as "Not Used", the relay output is free programmable via LogicsManger.
Relay output [R 06]	Fixed to "Command: close GGB"	The discrete output "Command: close GGB" is an impulse output signal. The discrete output is enabled for the time configured in parameter ⮡ 5726. An external holding coil and sealing contacts must be installed into the GGB closing circuit.
Relay output [R 07]	Fixed to "Command: open MCB"	Only applicable for application mode "GGB/MCB" The controller enables this discrete output when the MCB is to be opened for switching operations. In application mode "GGB/LSx" this relay output is free programmable via LogicsManger.
Relay output [R 08]	Fixed to "Command: close MCB"	Only applicable for application mode "GGB/MCB" The discrete output "Command: close MCB" is an impulse output signal. The discrete output is enabled for the time configured in parameter ⮡ 3417. An external holding coil and sealing contacts must be installed into the MCB closing circuit. In application mode "GGB/LSx" this relay output is free programmable via LogicsManger.
Relay output [R 09]	Programmable	No preconfiguration
Relay output [R 10]	Programmable Preconfigured to "(NOT) Dead busbar"	This discrete output is enabled if the Load busbar is energized.
Relay output [R 11]	Programmable	No preconfiguration
Relay output [R 12]	Programmable	No preconfiguration

4.3.2.1.3 External Discrete Inputs (IKD)

If Woodward IKDs are connected to the Group Controller via the CAN bus, it is possible to use 16 additional external discrete inputs.

There is no configuration for the single external discrete inputs required. The physical states of the these inputs are available in the LogicsManager system ”Group 12: Ext.discrete inputs“.

Only the used interface CAN 1 or CAN 2 must be configured:

- CAN 1 (“6.4.3 Connecting IKD 1 on CAN Bus 1”)
- CAN 2 (“6.4.4 Setup Expansion Modules at CAN 2”)

4.3.2.1.4 External Discrete Outputs (IKD)

If Woodward IKDs are connected to the Group Controller via the CAN bus, it is possible to use 16 additional discrete outputs.

The configuration of the external DOs is performed in the same way as for the internal DOs.

Refer to the tables below for the parameter IDs of the corresponding LogicsManager equations.

For interface configuration CAN 1 or CAN 2 refer to :

- CAN 1 (“6.4.3 Connecting IKD 1 on CAN Bus 1”)
- CAN 2 (“6.4.4 Setup Expansion Modules at CAN 2”)

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 26: External discrete outputs ”1st IKD“: - 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 27: External discrete outputs ”2nd IKD“: - parameter IDs (9 to 16)

4.3.2.2 Discrete Inputs

General notes

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

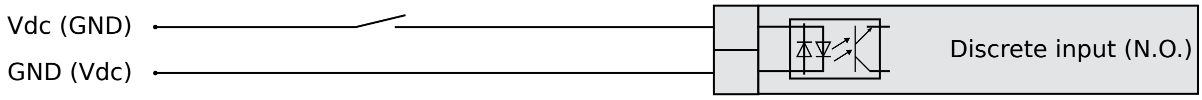


Fig. 62: Discrete inputs - alarm/control inputs - operation logic (state N.O.)

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.

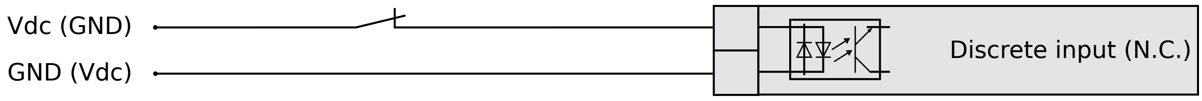


Fig. 63: Discrete inputs - alarm/control inputs - operation logic (state N.C.)

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 4, 6 and 7 are pre-configured to various functions and differ in their default values. However, they may still be configured freely.

The discrete inputs 5 is used for the mains circuit breaker (MCB) reply and can only be configured if not in GGB/MCB mode.

The discrete inputs 8 is used for the group circuit breaker (GGB) reply and cannot only be configured.

The discrete inputs 9 to 12 are preconfigured for the external segment coding (LogicsManagers 1270, 1271, 1272, 1273). Care must be taken not to use these DIs twice!

NOTICE!

If a DI is not used for the preconfigured function, the preconfigured LogicsManager must be adapted accordingly so that the DI is not mistakenly used more than one function.

Internal discrete inputs - terminal assignment

Number	Terminal	Assignment (all application modes)
[DI 01]	67	Pre-configured for Control input 'System Update Layer 3' (⮩ 12892)
[DI 02]	68	Pre-configured for Control input 'External acknowledgment' (⮩ 12490)
[DI 03]	69	Pre-configured for Control input 'Enable close MCB' (⮩ 12923)
[DI 04]	70	Pre-configured for Control input 'Unloading mains/open MCB' (⮩ 12893)
[DI 05]	71	Reply MCB (if GGB/MCB mode)
[DI 06]	72	Pre-configured for Control input 'GGB open immediately'
[DI 07]	73	Pre-configured for Control input 'Enable close GGB' (⮩ 12948)
[DI 08]	74	Pre-configured for Reply GGB
[DI 09]	75	Pre-configured for external segmenting bit 1 (⮩ 1270)
[DI 10]	76	Pre-configured for external segmenting bit 2 (⮩ 1271)
[DI 11]	77	Pre-configured for external segmenting bit 3 (⮩ 1272)
[DI 12]	78	Pre-configured for external segmenting bit 4 (⮩ 1273)

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 28 for the parameter IDs of the parameters DI 2 through DI 12.

	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 reply			GGB open reply only	Seg. code bit 1	Seg. code bit 2	Seg. code bit 3	Seg. code bit 4
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	1341	1361	1381	1206	1226
Alarm class	1202	1222	1242	1262	1282	1302	1322		1362	1382	1207	1227
Self acknowledg-ed	1204	1224	1244	1264	1284	1304	1324		1364	1384	1209	1229
Enabled	1203	1223	1243	1263	1283	1303	1323		1363	1383	1208	1228

Table 28: Discrete inputs - parameter IDs

ID	Parameter	CL	Setting range [Default]	Description
1400	**Description**	2	user defined (up to 39 characters) for default see ⮩ Table	This parameter is for describing the function of the discrete input. The description will also be shown in the status overview of the discrete inputs.

ID	Parameter	CL	Setting range **[Default]**	Description
1200	**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	**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	**Alarm class**	2		An alarm class may be assigned to the discrete input. The alarm class is executed when the discrete input is enabled.
			Class A, **[Class B]**	Warning alarm classes
			Class C, Class D, Class E, Class 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 (⮡ "9.4.1 LogicsManager Overview") can be assigned to the discrete input.
1204	**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).

ID	Parameter	CL	Setting range [Default]	Description
				Notes If the DI is configured with the alarm class "Control", self acknowledgment is always active.
1203	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			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: Flag 1, 96.02 LM: Flag 2, ..., 96.32 LM: Flag 32

4.3.2.3 Discrete Outputs (LogicsManager)

Configurable discrete outputs are controlled via the LogicsManager.

For information on the LogicsManager and its default settings see “9.4.1 LogicsManager Overview”.

CAUTION!

Uncontrolled operation due to faulty configuration

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

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	2	Determined by Logics-Manager 99.01 **[(02.01 FALSE & 1) & 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 “9.4.1 LogicsManager Overview”.

ID	Parameter	CL	Setting range [Default]	Description
12110 (See ID table below)	Relay 2	2	Determined by Logics-Manager 99.02 **[(01.12 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 ⮱▷ "9.4.1 LogicsManager Overview".

Parameter IDs

- The parameter IDs above refers to relay 1 and 2.
- For the LogicsManager IDs of relay 1 - 5 and 7 - 12 refer to table below.
- LogicsManager for relay 5 is only used if Parameter ⮱▷ 5669 is set to "Not Used".
- LogicsManagers for relay 7 and 8 are only used if application mode is set to "GGB/ LSx".

	R 1	R 2	R 3	R 4	R 5	R 7	R 8	R 9	R 10	R 11	R 12
Parameter ID	12580	12110	12310	12320	12130	12150	12160	12170	12180	12560	12590

4.3.2.4 Analog Inputs

4.3.2.4.1 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 2000 Ohms, 0 to 1 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.

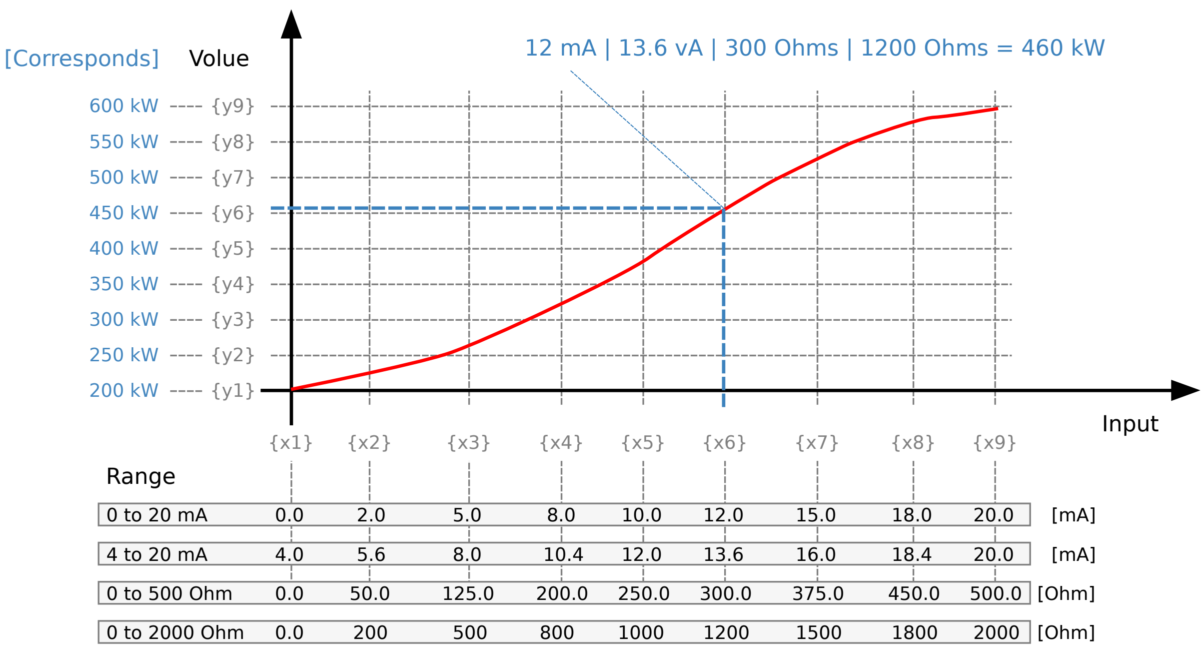


Fig. 64: Characteristic curves (example table)

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	200	500	800	1000	1200	1500	1800	2000
Y-coordinate	-100	-95	-50	-10	+3	+17	+18	+100	+2000
wrong:									
X-coordinate	0	200	500	800	**400**	900	1500	**1000**	2000
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 X value is smaller than the maximum of the hardware range, all higher X 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" 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, ... , 20]**	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, ... , 100]**	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.

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]**

4.3.2.4.2 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 ("4.4.4 Flexible Limits").

ID	Parameter	CL	Setting range [Default]	Description
1025 1075 1125	**Description**	2	user-defined (up to 39 characters) 1025: **[P Mains]** 1075: **[Q Mains]** 1125: **[Analog inp.3]**	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 The max. number of characters depends on the numbers of Bytes for each character.
1000 1050 1100	**Type**	2		According to the following parameters different measuring ranges are possible at the analog inputs.
			1000: Off 1050: Off 1100: **[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.
			1000: **[Linear]** 1050: **[Linear]** 1100: 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, ⮑ 1089 or ⮑ 1139). The maximum value refers to the value configured as "Sender value at display max." (parameter ⮑ 1040, ⮑ 1090 or ⮑ 1140).
			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 ⮑ "4.3.2.4.1 User Defined Tables A/B (Characteristic Curves Setup)".

ID	Parameter	CL	Setting range [Default]	Description
1001 1051 1101	**User defined min display value**	2	-21000000.00 to 21000000.00 **[0.00]**	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/ ⮱ 1050/ ⮱ 1100) is configured to "Linear".
1002 1052 1102	**User defined max display value** (User defined maximum display value)	2	-21000000.00 to 21000000.00 **[2000.00]**	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/ ⮱ 1050/ ⮱ 1100) 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/ ⮱ 1050/ ⮱ 1100) is configured to "Linear".
1040 1090 1140	**Sender value at display max.** (Sender value at display maximum)	2	0.000 to 2000.000 **[2000.00]**	The value (x-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/ ⮱ 1050/ ⮱ 1100) is configured to "Linear".

Example: Hardware range 4 to 20 mA mapped to 0 to 1000 display value

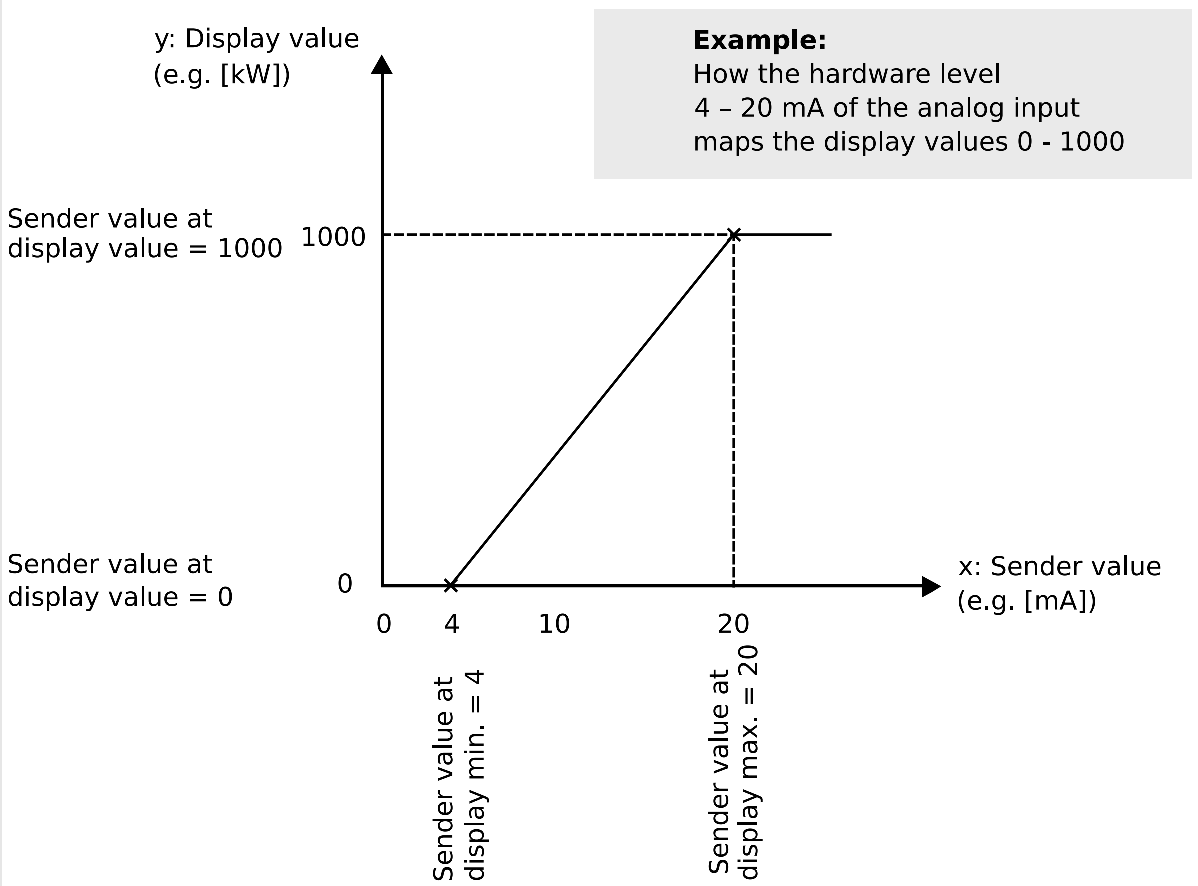


Fig. 65: Analog Input Mapping

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.
			1020: 0 to 2000 Ohms 1070: 0 to 2000 Ohms 1120: **[0 to 2000 Ohms]**	The measuring range of the analog input is 0 to 2000 Ohms.
			1020: **[0 to 20 mA]** 1070: **[0 to 20 mA]** 1120: 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/ 1050/ 1100) is set to "VDO xx", "Pt100" or "Pt1000", this parameter must be configured to "0 to 2000 Ohm"!

ID	Parameter	CL	Setting range **[Default]**	Description
1046 1096 1146	**Offset**	2	-20.0 to 20.0 Ohm **[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.
				Notes This parameter is only visible if the parameter "Sender type" (⮡ 1020, ⮡ 1070, ⮡ 1120) 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.
				Examples: Value of analog input is 2000: • Exponent is 0: Value at protocol = 2000 * $1/10^0$ = 2000 • Exponent is 3: Value at protocol = 2000 * $1/10^3$ = 2 • Exponent is -2: Value at protocol = 2000 * $1/10^{-2}$ = 200000
1033 1083 1133	**Analog input 1**	(displayed only)		Current scaled value of the AI {X}

Monitoring of the analog inputs (overrun/underrun) must be configured manually to the flexible limits (⮱ "4.4.4 Flexible Limits").

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/ ⮱ 1096/ ⮱ 1146) 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.)

ID	Parameter	CL	Setting range [Default]	Description
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/ ⮱ 1075/ ⮱ 1125). 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.
				Notes A wire break is indicated in ToolKit by displaying an analog input value "Error".

ID	Parameter	CL	Setting range [Default]	Description
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/ ⮱ 1053/ ⮱ 1103) is not set to "Off" For additional information refer to ⮱ "9.6.3 Alarm Classes".

ID	Parameter	CL	Setting range [Default]	Description
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 if wire break monitoring (parameter ⮱ 1003/ ⮱ 1053/ ⮱ 1103) is not set to "Off"
10113 10114 10116	**Filter time constant** "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)
			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)

ID	Parameter	CL	Setting range [Default]	Description
1034 1084 1134	**Unit**	2	up to 6 characters text 1034: **[kW]** 1084: **[kvar]** 1134: **[Unit]**	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.

4.3.3 Configure Breakers

4.3.3.1 General Breaker Settings

General notes

This parameter determine in which application mode the GC-3000XT operates and have to be adjusted as early as possible.

Please refer to application chapter for additional information. ⮡▷ "6 Application Field"

ID	Parameter	CL	Setting range [Default]	Description
3468	**Application mode**	2	**[GGB/MCB]**	In this application mode the GC-3000XT controls the GGB and MCB with the connected generator group. The segmenting is realized with an external assgined number (via LogicsManagers ⮡▷ 1270, ⮡▷ 1271, ⮡▷ 1272, ⮡▷ 1273 preconfigured to DIs 9 to 12) from a PLC or tie-breaker feedback.
			GGB/LSx	The GC-3000XT operates in a multiple application system with LS-6XT and controls only the GGB with the connected generator group. The segmenting is handled by the LSx devices in the system over the load share interface.

4.3.3.2 Configure GGB

4.3.3.2.1 Operating the GGB (Generator Group Breaker)

Introduction

The GC is able to operate the GGB. With this functionality following items are included:

- Measurement AC Voltage Generator Group and Load Busbar

- Relay output commands
- Synchronization function with all its configurations
- Synchroscope by Toolkit
- Phase Angle compensation function
- Dead busbar closure modes
- Breaker Diagnostics
- Plausibility Checks

4.3.3.2.2 Serving the Group Breaker

Serving the Group Breaker

The initial order to close or to open the GGB is maintained by LogicsManager commands:

- LM 12948 "87.37 Enable close GGB"
- LM 12947 "87.36 Open GGB immed."
- LM 12946 "87.35 Open GGB unload"

The command open GGB has higher priority than the enable to close GGB signal. The open GGB command always gets through.

The GC controls its Group Breaker (GGB) with following functions:

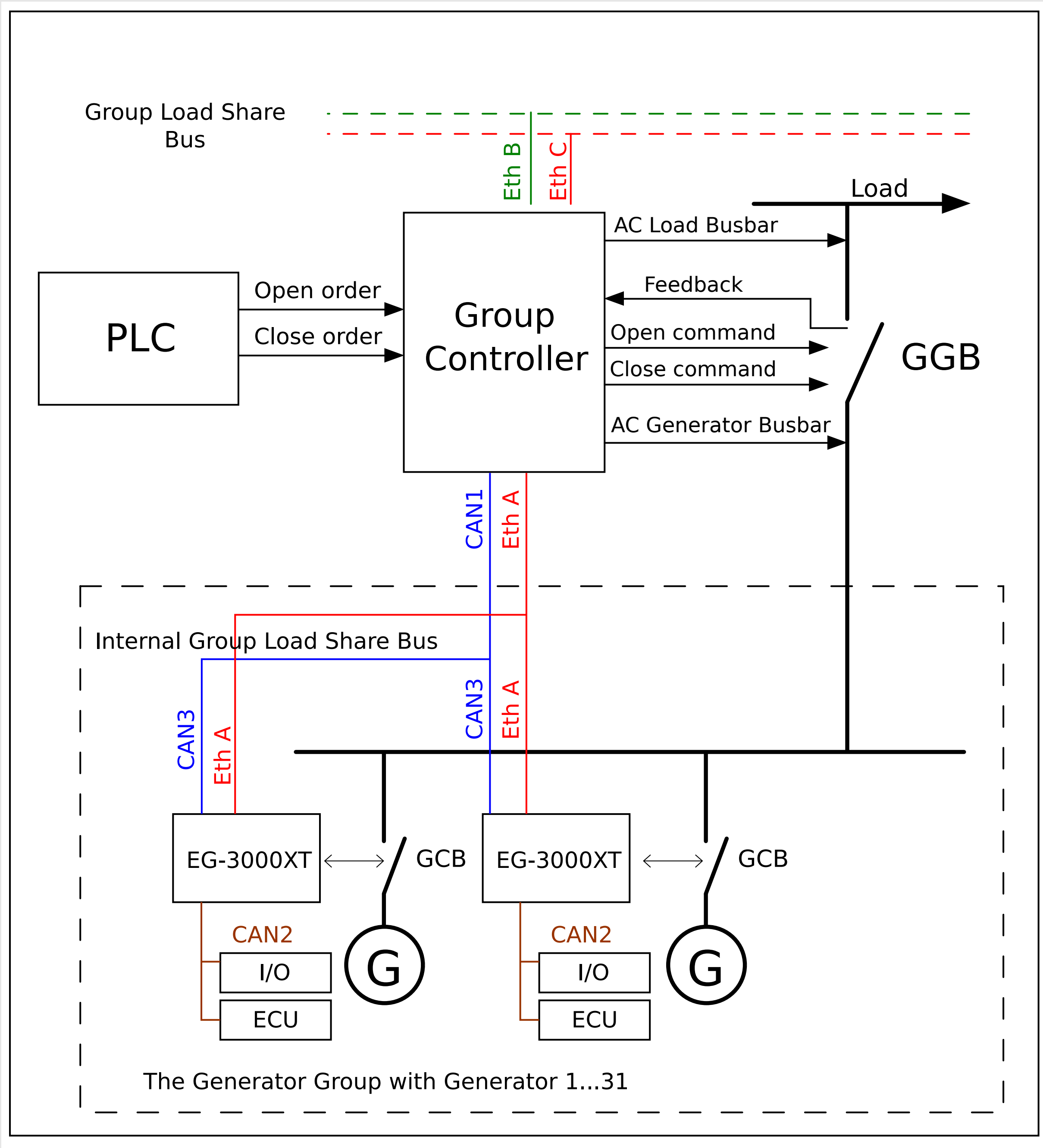
- Synchronization of Generator Group onto Load Busbar
- Dead busbar closure Group Breaker including dead busbar negotiation
- Unloading the Group Breaker before opening

The relay 6 is the dedicated output for the GGB close pulse.

The relay 5 is the dedicated output for the GGB open pulse.

The command open GGB is configurable as normally opened (N.O.), normally closed (N.C.) or as not used. The not used setting is prepared for future purposes.

The GC expects a GGB feedback signal acting on DI 08 "Reply GGB is open".



ID	Parameter	CL	Setting range [Default]	Description
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.
5669	GGB open relay	2	Not used **[N.O.]**	Not used: In preparation for future purposes. The relay GGB open will be never energized.
			N.C.	N.O.: Normally open The relay "command: GGB open" will be energized to open the GGB and will be de-energized again after the discrete

ID	Parameter	CL	Setting range [Default]	Description
				input "Reply GGB is open" is energized to signal the control that the GGB is open.
				N.C.: Normally closed The relay "command: GGB open" will be de-energized to open the GGB and will be energized again after the discrete input "Reply GGB is open" is energized to signal the control that the GGB is open.
5731	Synchronization GGB	2	**[Slip frequency]**	Type of Synchronization. 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 easYgen setting of " 5502 Slip frequency setpoint offset".
			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 GGB" (parameter ⮑ 8825) influences the GGB synchronization as well. In both synchronisations the phase angle between generator busbar and mains is used.
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 load busbar voltage does not exceed the value configured here and the mains voltage is within the operating voltage window (parameters ⮑ 5810 and ⮑ 5811), the "Command: GGB close" may be issued.

ID	Parameter	CL	Setting range [Default]	Description
				Notes Please consider that the "Phase angle compensation GGB" (parameter ⮡ 8825) influences the GGB synchronization as well. In both synchronisations the phase angle between generator busbar and mains is used.
5721	Pos. freq. 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).
5722	Neg. freq. 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).
5723	Max. 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.
5724	Max. 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 above the configured maximum permissible angle.
5727	Dwell time GGB	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.
8825	Phase angle compensation GGB	2		The phase angle between generator group voltage and busbar voltage can be compensated according to an installed power transformer between generator group and busbar.

ID	Parameter	CL	Setting range [Default]	Description
			On	The compensation is active. The phase will be compensated according the value configured in parameter ⮱▷ 8824.
				Notes Measured values 181 ”Loadbus-gen. group“ and 184 ”Mains-loadbus“ are not changed but the compensated (⮱▷ 8824) 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 GC-3000XT with a label showing the configured phase angle compensation. Refer to ⮱▷ “6.4.2 Phase Angle Compensation (Vector Group Adjustment)” for details.
8824	**Phase angle GGB**	2	-180 to 180° **[0°]**	The phase angle compensation corrects the degree between generator group 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!

ID	Parameter	CL	Setting range [Default]	Description
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.
4558	GC missing member delay	2	0.00 to 9.99 s **[0.5 s]**	If a GC missing member alarm occurs, the dead busbar closure will be delayed under the multiple GCs. This shall reduce the probability that multiple GCs closing their GGB onto a dead busbar to the exact same time. The time entered here is differently permuted in the single GC devices. So the GC device no.1 has no delay as the GC device no.2 is delayed with 0.5 seconds, the GC no.3 is delayed with 1 second and so on. Refer also to the dead busbar closure rules. Each device calculates its delay according the formula: (Device number -1) x Configurable Delay Time.
12947	Open GGB immediately	2	Determined by LogicsManager 87.36 **[(09.06 DI06 & 1) & 1]** = 11425	Once the conditions of the LogicsManager have been fulfilled, the GGB will be opened immediately.
12948	Enable close GGB	2	Determined by LogicsManager 87.37 **[(09.07 DI07 & 1) & 1]** = 11426	Once the conditions of the LogicsManager have been fulfilled, the GGB is enabled to close.

ID	Parameter	CL	Setting range **[Default]**	Description
12946	Open GGB unload	2	Determined by LogicsManager 87.35 **[(02.01 LM FALSE & 02.01 LM FALSE) & 02.01 LM FALSE]** = 11424	Once the conditions of the LogicsManager have been fulfilled, the GGB will be opened with unloading.

4.3.3.2.3 GGB Dead Bus Closure Negotiation

Introduction

It must be insured in a Group Controller system that all dead busbar closure actions are coordinated. Otherwise it can lead to a simultaneous closure of different sources. If generators are involved it can lead to damages. Therefore it is required to include a dead busbar closure negotiation or ranking into the system in addition to the already existing dead busbar negotiation of the easYgens.

General

If the GC receives a GGB close command under dead busbar conditions, it runs a dead busbar negotiation with all the other GC.

The GC performs the GGB dead busbar closure only, if the switching source matches the operating ranges.

The GC performs the GGB dead busbar closure only, if the target dead busbar is dead according to the configurable dead busbar limit.

If the GC receives a GGB close command which causes a GGB dead busbar closure from an alive load busbar to a dead generator group, the GC will have higher priority than its easYgens.

The GGB dead bus closure in the GC is blocked, if the GCB fail to close alarm is tripped.

Be aware that when you handle the dead bus closure configuration "Dead bus closure GCB" ID3432 or the LogicsManager "Inhibit dead bus GCB" ID15161 at all easYgen devices to the same time in dead bus situation, it could come to a simultaneous closure at the running devices.

Function

The Group Controllers and easYgens follow rules to prevent uncoordinated closure:

Rule 1: The GC which has on both sides of the GGB a dead busbar and at least one connection to any source (mains, genset), inhibits its GGB dead busbar closure.

Rule 2: The GC which gets a "Missing GC alarm" caused by other GC(s) missing, delays its operation mode dead bus closure depending on its GC device number. This is cascaded through: (Device number -1) x Configurable Delay Time. The default setting of the configurable delay time is 0.5s. (Parameter ⮡ 4558 'GC missing member delay'). *This procedure cannot prevent a wrong dead busbar closure but it minimizes the probability that this happens.*

Rule 3: The easYgen3000XT (GC mode enabled) which has triggered a "Missing easYgen alarm", delays its operation mode dead bus closure depending on its device number. This is cascaded through: (Device number easYgen) x 0.5s The GC is not delayed, if the "Missing easYgen alarm" is triggered. This procedure cannot prevent a wrong dead busbar closure but it minimizes the probability that this happens.

Rule 4: The GC which sees a dead generator busbar (GenGroup is dead) but recognizes at least one easYgen in its group with a closed GCB, inhibits its GGB dead busbar closure.

Rule 5: The GC which executes its GGB dead busbar closure, inhibits the dead busbar closure of all its easYgens first before it performs the GGB dead busbar closure. (800ms)

This is done by the "Inhibit Dead busbar closure" bit sent to the easYgens (see LogicsManager flag 02.41).

Rule 6: The GC which recognizes a dead load busbar but still sees a linkage to any generator of other groups, inhibits its GGB dead busbar closure. This rule requires a correct segmenting.

(Situation: GenGroup voltage is alive, load busbar is dead).

Rule 7: The GC which recognizes a dead load busbar but still sees any MCB closed, inhibits its GGB dead busbar closure. This rule requires a correct segmenting.

(Situation: GenGroup voltage is alive, load busbar is dead).

Rule 8: The GC which recognizes a dead load busbar and sees no linkage to any generator of other groups, negotiates the dead busbar closure with the neighbor GCs in the same segment. The GC with smallest device no. will be usually the first. This rule requires a correct segmenting.

(Situation: GenGroup is alive, load busbar is dead).

Rule9: If the GC has a closed GGB, and it recognizes a GGB dead busbar closure of a GC in the same segment, it blocks generally the GCB dead busbar closure of its easYgens.

This is done by the "Inhibit Dead busbar closure" bit sent to the easYgens (see LogicsManager flag 02.41).

Rule 10: If the own GGB is closed and it is recognized that an own easYgen is willing to do a dead busbar closure, the GC publishes this dead busbar closure request and negotiates the desire with other GCs in the same segment.

Negotiation: Lower GC device no. wins.

If the own group has lower priority, the GC inhibits the dead busbar closure of its easYgens

If the own group has higher priority, the GC does not inhibit the dead busbar closure of its easYgens.

4.3.3.3 Configure MCB

4.3.3.3.1 Operating the MCB

Introduction

The Group Controller provides an additional AC measurement (Mains) to support the synchronization of an MCB at the interchange point to mains or to any other voltage source.

As example for "any other voltage source" could be the voltage of the other side of a tie-breaker over the load busbar.

Supporting the synchronization means that the group controller passes the frequency and voltage of the mains down to its gensets with the command to synchronize its generators on that frequency and voltage.

The GC checks via AC measurement (mains and load busbar) the delta frequency, delta voltage and phase angle. If the values are matching according to the configuration the GC executes the closure of the CB, if all relevant criteria are matched.

This functionality has the following items included:

- AC Measurement of Generator Group, Load Busbar and Mains
- Relay output commands
- Synchronization function with all its configurations
- Unloading Mains including command MCB open
- Synchroscope by Toolkit
- Phase Angle compensation function
- Breaker Diagnostics

4.3.3.3.2 Serving the Mains Breaker

The initial order to close or to open the MCB is maintained by LogicsManager commands:

- LM 12923 "86.85 Enable close MCB"
- LM 12893 "86.47 Unloading Mains/Open MCB"

The commands "Enable close MCB" and "Unloading Mains/Open MCB" cannot be active at the same time. No related function will be performed, if both signals are active.

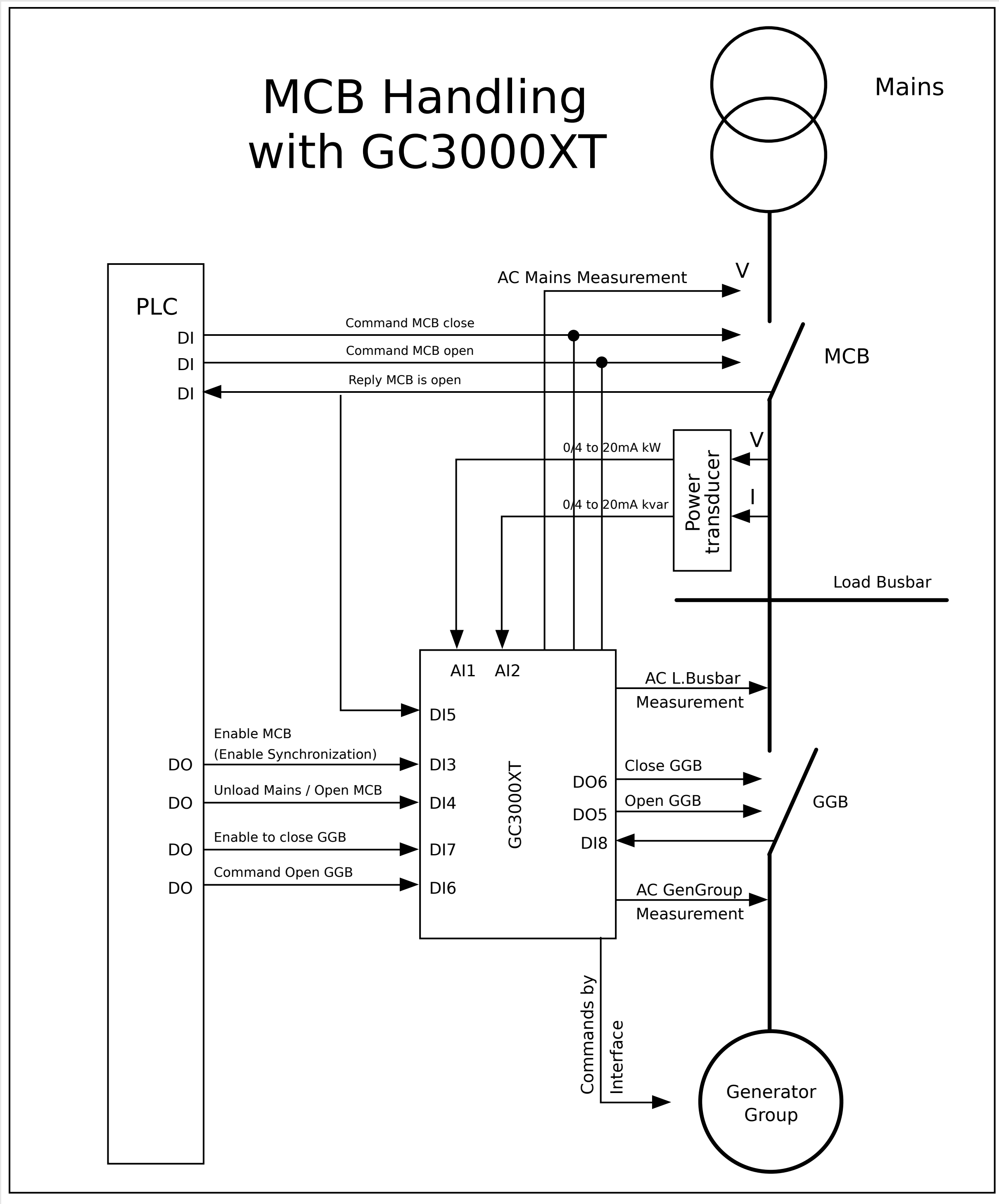
The GC controls a Mains Circuit Breaker (MCB) with following functions:

- Synchronization of Load Busbar onto Mains (Own GGB is closed).
- Open MCB, if the unload function is enabled (Own GGB is closed).

The relay 8 is the dedicated output for the MCB close pulse.

The relay 7 is the dedicated output for the MCB open pulse.

The GC expects a MCB feedback signal acting on DI 05 "Reply MCB is open.



Example of a single group interacting with mains

Configuration

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.

ID	Parameter	CL	Setting range [Default]	Description
5730	**Synchronization MCB**	2	**[Slip frequency]**	Type of Synchronization. Slip frequency: The frequency controller adjusts the frequency in a way, that the frequency of the source (busbar) is marginal greater or smaller than the target (mains). When the synchronizing conditions are reached, a close command will be issued.
			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.
5711	**Pos. freq. differential MCB**	2	0.0 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).
5712	**Neg. freq. 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).
5710	**Voltage differential MCB**	2	0.50 to 20.00%	The maximum permissible voltage differential for closing the mains circuit breaker is configured here.
			[5.00%]	**Notes** This value refers to parameter ⮱▷ 1781 'Load Busbar rated voltage' and parameter ⮱▷ 1768 'Mains rated voltage'. If the difference between mains and load busbar voltage does not exceed the value configured here and the mains voltage is within the operating voltage window (parameters ⮱▷ 5810 'Upper voltage limit' and ⮱▷ 5811 'Lower voltage limit'), the "Command: MCB close" may be issued.

ID	Parameter	CL	Setting range **[Default]**	Description
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 load busbar and mains is below the configured maximum positive permissible angle.
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 leading phase angle between load busbar and mains is above the configured maximum negative permissible angle.
5709	**MCB sync. with separate slip**	2	On	The MCB is synchronized with an individual slip frequency (also negative). This frequency is configured in the easYgen with parameter ”6676 LSx slip freq. seperate offset”.
			[Off]	The MCB is synchronized with the slip frequency configured in the easYgen with parameter ”5502 Slip frequency setpoint offset“.
				Note This parameter is only visible if parameter 'Synchronization MCB' of the GC is set to 'Slip frequency'. ⇒ 5730 'Synchronization MCB'
8841	**Phase angle compensation MCB**	2		The phase angle between load busbar voltage and mains voltage can be compensated according to an installed power transformer between load busbar and mains.
			On	The compensation is active. The phase will be compensated according the value configured in parameter ⇒ 8842.
				Notes Measured values 181 'Ph.ang.busb1-gen.L12' and 184 'Ph.ang.mns.busb1 L12' are not changed but the compensated (⇒ 8842) values are taken for synchronization control and synchroscope display.

ID	Parameter	CL	Setting range [Default]	Description
			[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 ⮡ "6.4.2 Phase Angle Compensation (Vector Group Adjustment)" for details.
8842	**Phase angle MCB**	2	-180 to 180° **[0°]**	The phase angle compensation corrects the degree between load busbar voltage and mains voltage. The configured degree is added to the real measured phase angle.
				Note Ensure correct configuration to prevent erroneous synchronization settings to avoid generator **destructive power**. Incorrect wiring cannot be compensated 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.
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.

ID	Parameter	CL	Setting range [Default]	Description
8819	**Unload level MCB**	2	0 to 999999.9 kW **[5 kW]**	The Unload level MCB defines at what kW at the interchange point the MCB can be opened.
12923	**Enable close MCB**	2	Determined by LogicsManager 86.85 **[(09.03 DI03 & 1) & 1]** = 11914	Once the conditions of the LogicsManager have been fulfilled, the MCB will be enabled.
12893	**Unloading mains/Open MCB**	2	Determined by LogicsManager 86.47 **[(09.04 DI04 & 1) & 1]** = 11969	Once the conditions of the LogicsManager have been fulfilled, the GC opens the MCB with unloading.

4.3.3.4 Configure Synchronization

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.
			PERMISSIVE	The unit acts as a synch check device. The unit will not issue speed or voltage bias commands to achieve synchronization, but if synchronization conditions are matched (frequency, phase, voltage and phase angle), the control will issue a breaker close command.
			CHECK	Used for checking a synchronizer prior to commissioning. The control actively synchronizes generator group(s) by issuing speed and voltage bias commands, but does not issue a breaker closure command.
			[RUN]	Normal operating mode. The control actively synchronizes and issues breaker closure commands.
				Notes

ID	Parameter	CL	Setting range [Default]	Description
				The device will still perform a dead busbar closure if the conditions are valid.

4.3.4 Configure Controller

4.3.4.1 Setpoint for Export/Import Control at the Interchange Point

Introduction

The GC is receiving the real power at the interchange point (AI1 0/4 to 20mA). It can provide the export/import power setpoint for the own easYgen group. The setpoint is configured over ToolKit. This value can be changed by a PLC over Modbus TCP also. The input is in kW. This setpoint configuration in the GC is mandatory for the LDSS function running parallel to mains applications (MOP).

The export/import setpoint is related to the GC segment. In cases the GC system falls into two or more groups the different segments must be treated accordingly. So the mains power at the interchange point will be different and/or the export/import power will be different.

Function

The setpoint is transferred from the GC to its easYgens.

- The input is in kW
- Negative input means: Regulate Import Power at the interchange point to mains
- Positive input means: Regulate Export Power at the interchange point to mains.

This setpoint in transferred as absolute value to all easYgens in the same group. So there is no signing incorporated in the setpoint variable. The easYgen itself takes this "GC Power setpoint" as a sign less value. Only through the import or export setting in the easYgen the value is a setpoint at the interchange point to mains.

Note: A negative setpoint in the GC requires an import setup in the easYgen. A positive setpoint in the GC requires an export setup in the easYgen.

The easYgenXT accepts this setpoint, if:

1	The easYgen is configured in GC-Mode
2	The setpoint from the GC is selected over the AnalogManager (05.90 GC P setp [kW])
3	The setpoint is configured as export or import character
4	The easYgen runs in AUTO with start request in AUTO (with or without LDSS)
5	The easYgen recognizes parallel to mains operation
6	The load control is activated

ID	Parameter	CL	Setting range [Default]	Description
5089	**Export/Import load setpoint**	2	-999999 to 999999 kW **[0 kW]**	This is the export / import power setpoint for the generator group. The value is sent to the single easYgens in the own group. In the easYgenXT the setpoint is provided as AnalogManager (05.90 GC P setp [kW]). **Note:** The setpoint is to allocate in the easYgen through the according load control setpoint AnalogManager.

4.3.5 Load Dependent Start/Stop

Introduction

Due to the fact that the GC coordinates its group anyway the LDSS function is provided in the GC. The LDSS algorithm runs inside the Group Controller and supports up to 496 gensets. If the main bus drops into separated segments, each segment gets its own LDSS master. The Group Controller with the smallest Device ID within the segment becomes the LDSS master. Each genset will be directed with start and stop commands by the LDSS master. The LDSS algorithm in the single genset controls are disabled.

The LDSS in the GC provides two modes:

- Start/Stop related to Generator Load
- Start/Stop related to Reserve Power

In comparison to the LDSS in the easYgen the GC provides additionally:

- a configurable “Minimum Power” consideration
- a configurable “Base Sorting” consideration

Woodward offers an LDSS emulation tool running on PC for testing different scenarios. A settings manager inside the tool helps to transfer the tested settings into real GCs on site afterwards.

Abbreviations

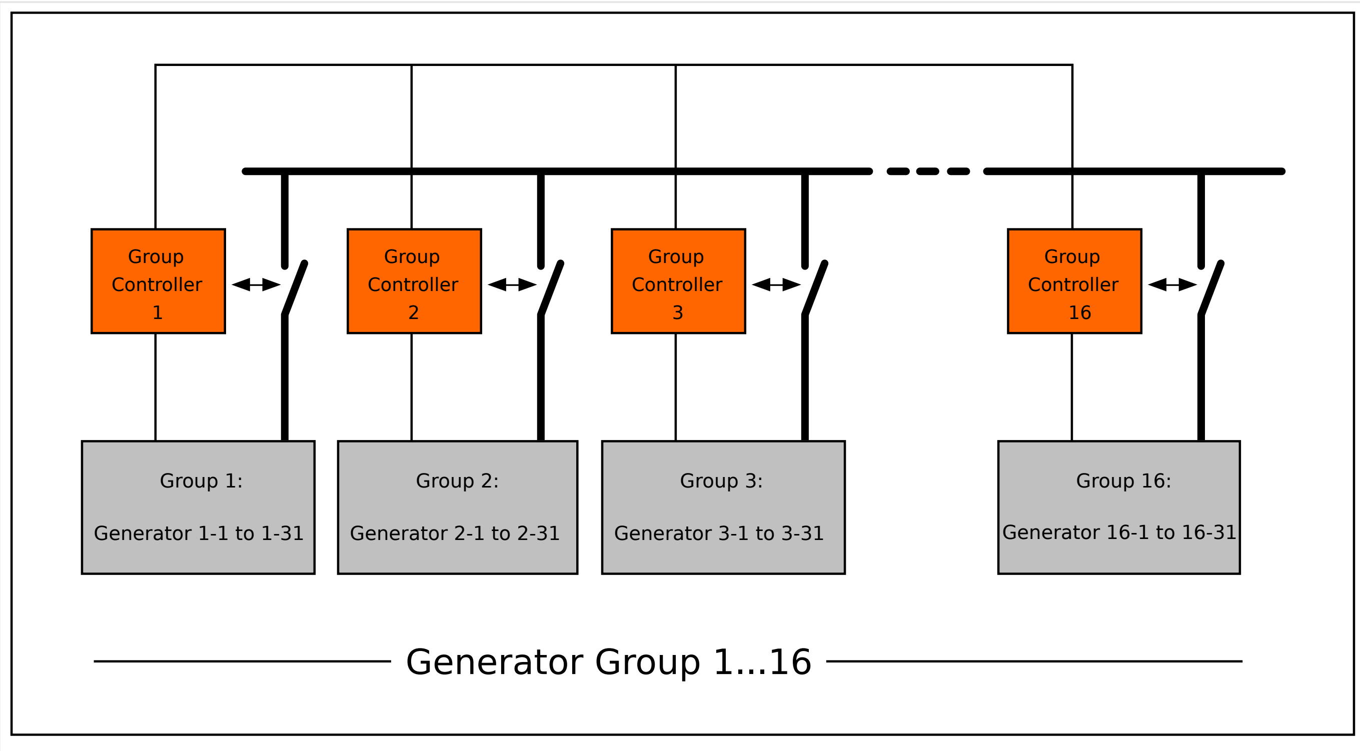
Abbreviation	Parameter	
$P_{Gen\ real}$		Momentary active generator real power on the busbar
$P_{Gen\ rated}$		Momentary active generator rated power on the busbar
$P_{Reserve}$		$P_{Gen\ rated} - P_{Gen\ real}$
$P_{Reserve\ IOP}$	5760	Minimum permissible reserve power on busbar in islanded operation
$P_{Hysteresis\ IOP}$	5761	Hysteresis in islanded operation
$P_{Mains\ setpoint}$		Export / import power control setpoint for parallel operation
$P_{Mains\ real}$		Momentary active power at the interchange point
$P_{Minimum\ MOP}$	5767	Minimum requested generator load in parallel operation
$P_{Reserve\ MOP}$	5768	Minimum permissible reserve power on busbar in mains parallel operation

Abbreviation	Parameter	
$P_{Hysteresis\ MOP}$	5769	Hysteresis in mains parallel operation
$P_{Max.\ load\ IOP}$	5762	Maximum permissible generator load in islanded operation
$P_{Min.\ load\ IOP}$	5763	Minimum permissible generator load in islanded operation
$P_{Max.\ load\ MOP}$	5770	Maximum permissible generator load in mains parallel operation
$P_{Min.\ load\ MOP}$	5771	Minimum permissible generator load in mains parallel operation

4.3.5.1 The LDSS System

In an easYgen system with group controller the LDSS algorithm is transferred to the group controller device. The principle of the LDSS function remains essentially the same like in the easYgen but the algorithm is designed so that much more gensets can be handled. The current LDSS release controls up to 496 generators.

The algorithm is located in each group controller. But only one algorithm per load segment is enabled. The current release supports 16 groups. The output of the LDSS algorithm starts / stops the gensets 1 to 496. The naming of the generators are 1-1 to 16-31. The generator number is absolute.

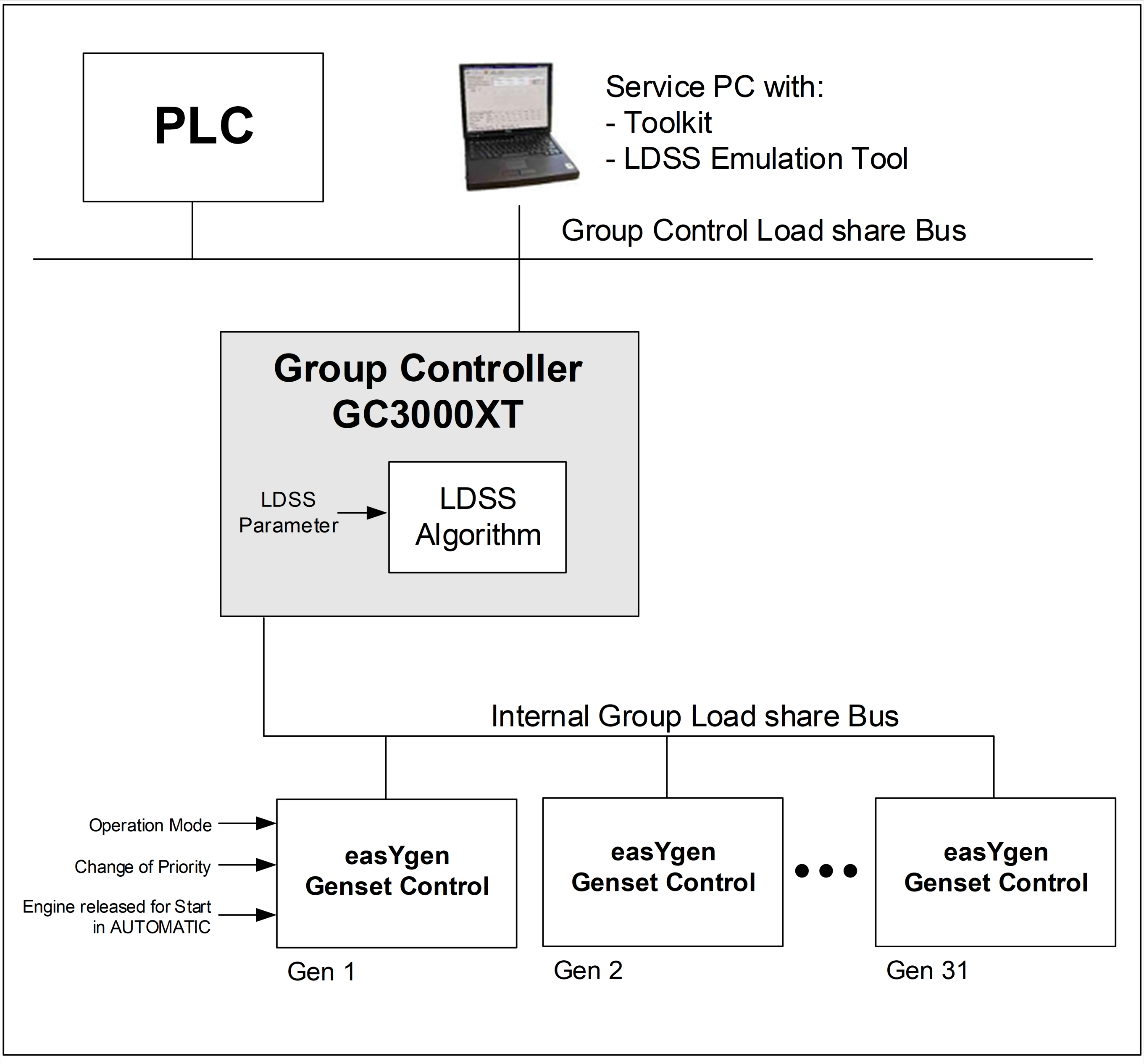


Schematic: The Group Controllers and its generators

As long as Group Controllers are working on the same segment (same segment number), the Group Controller with the smallest device number becomes the LDSS Master. The LDSS algorithm of this Group Controller controls all groups in this segment. But if the system falls into different segments, multiple Group Controllers become the LDSS Master (for each segment one LDSS Master).

Example

All 16 Group Controllers are connected on the same segment. The LDSS of Group Controller No.1 determines the whole fleet of gensets 1-1 to 16-31. The LDSS of the other Group Controllers are in standby. Assumption: A tie-breaker between Group Controller 1 and 2 is opened and the load segment falls into two segments. The LDSS outputs of the Group Controller No.1 will determine now only the generators 1-1 to 1-31. The LDSS of the Group Controller 2 becomes now the master for the gensets 2-1 to 16-31.



Schematic: The Group Controller with its group and its setting

Each GC in the same Communication Network must have a unique ID number. Having the same ID number multiple times in the same segment or in different segments leads to unexpected behavior.

To use the LDSS in a GC system, the participating easYgens must be configured properly as well. See “6.4.1 Enable/Disable LDSS function in the GC-easYgen System”

4.3.5.2 Fit size of engines

The LDSS offers like in the easYgen the function "Fit size of engine". Due to this setting different sized engines can be treated as efficiency as possible. Two main rules are:

- Figure out the closest genset combination to match the requested power. (Increase the reserve power as less as possible)
- Select possible combinations, which have preferably a minimized number of gensets

To run a proper LDSS functionality with the enabled "Fit Size of Engine" function, only LDSS controlled generators are allowed to run on busbar. Generators with steady power operation are allowed to add.

4.3.5.3 Engine Hours

Like in the LDSS of the easYgen engine hours of the single engines can be considered. This can be the absolute engine hours (Period of use hours) or remaining engine hours until service. The mentioned hours are usually considered, if the load situation has changed. In cases the load is relatively stable a forced change of engine can be configured.

4.3.5.4 Basic Sorting

In cases there is no differentiation between gensets evaluable (engine hours, size of engine,...) the configurable basic sorting takes place. The LDSS algorithm provides a parameter to it. Two base sorts are configurable.

The basic sorting configuration allows the customer to start the available gensets either in regards to fill-up one group after each other or to distribute them evenly over all groups.

4.3.5.5 Principle Order Priority

The principle order priority is a list of rules which is used by the LDSS to decide which next generator shall be started or stopped. The first rule in the list has the highest priority.

The order priority is defined as follows:

1	Genset Priority
2	Size of Engines (only if “Fit size of Engine” is active)
3	Service Hours (only if “Fit service Hours” is active)

4	Basic Sorting

4.3.5.6 LDSS in Islanded Operation (IOP) General

Islanded operation (MCB is open)

In case of an islanded operation (MCB open), the first genset will be connected to the deenergized busbar.

The isolated operation uses dedicated parameters, like:

- Individual Reserve Power or Min/Max. Load level
- Individual Hysteresis (only Reserve Power Mode)
- Individual Add On/Off delays

Note: At least one genset must be in operation in islanded operation.

4.3.5.7 LDSS in Mains Operation (MOP) General

Parallel to Mains operation (MCB is closed)

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). The load dependent Start/Stop function is active in mains to parallel operation during Export/Import control. The first engine is started dependent on a minimum load demand. This prevents an unloaded run, which can damage the engine.

During base load the Start/Stop function is switched off for this particular easYgen. Allowed is to run Gensets with export/import control and base load control simultaneously. The base loading gens will not be started or stopped by the load dependent start/stop function.

The parallel to mains operation uses dedicated parameters, like:

- Minimum power
- Individual Reserve Power or Min/Max. Load level
- Individual Hysteresis (only Reserve Power Mode)
- Individual Add On/Off delays

Note:

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.

4.3.5.8 LDSS Mode "Generator Power"

If the "Start stop mode" 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 "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 "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.

If the minimum level is surpassed the LDSS function checks additionally whether there is no generator cycling*1). In these cases the minimum level may become lower.

The procedure considers also a configurable **Minimum Power** to maintain in all situations a minimum of rated power even though the upper mentioned minimum level is surpassed.

**1): In some situations a generator cycling can occur, if with removing of a generator the resulting maximum level is exceeded even though the load didn't change.*

Island Operation (IOP)

If the configured maximum generator capacity utilization is exceeded, another genset will be added.

$P_{\text{Gen real}}\ [\%] > P_{\text{Max. load IOP}}\ [\%]$

If the configured minimum generator capacity utilization has fallen below, a genset stop will be considered.

$P_{\text{Gen real}}\ [\%] < P_{\text{Min. load IOP}}\ [\%]$

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 "MOP Minimum load"), the first genset will be added.

$P_{\text{Mains setpoint}}\ [kW] - P_{\text{Mains real}}\ [kW] > P_{\text{Minimum MOP}}\ [kW]$

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 "MOP Max. generator load", another genset will be added.

$P_{\text{Gen real}}\ [\%] > P_{\text{Max. load MOP}}\ [\%]$

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.

$P_{\text{Gen real}}\ [\%] < P_{\text{Min. load MOP}}\ [\%]$

If one genset is supplying the load in parallel with the mains and the generator load exceeds the MOP minimum load threshold (parameter "MOP Minimum load") minus the hysteresis (parameter "MOP Hysteresis"), the genset will be stopped.

The hysteresis is intended to prevent frequent starting and stopping of gensets in case of small load variations.

$P_{\text{Mains setpoint}}\ [kW] - P_{\text{Mains real}}[kW] + P_{\text{Gen real}}\ [kW] < P_{\text{Minimum MOP}}[kW] - P_{\text{Hysteresis MOP}}\ [kW]$

4.3.5.9 The LDSS Mode "Reserve Power"

If the "Start stop mode" 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.

Island Operation (IOP)

$P_{Reserve} = P_{Gen\ rated} - P_{Gen\ real}.$

$P_{Gen\ rated} = P_{Gen\ 1\ rated} + P_{Gen\ 2\ rated} + \dots + P_{Gen\ n\ rated}$

(Total rated power of all gensets on the busbar in the system)

$P_{Gen\ real} = P_{Gen\ 1\ real} + P_{Gen\ 2\ real} + \dots + P_{Gen\ n\ real}$

(Total actual load of all gensets on the busbar in the system)

If the reserve power falls below the IOP reserve power threshold (parameter "IOP Reserve power"), another genset will be added.

$P_{Reserve} < P_{Reserve\ IOP}$

If the reserve power exceeds the IOP reserve power threshold (parameter "IOP Reserve power") plus the hysteresis (parameter "IOP Hysteresis") 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.

$P_{Reserve} > P_{Reserve\ IOP} + P_{Hysteresis\ IOP} + P_{Gen\ rated}$

Mains Operation (MOP)

$P_{Reserve} = P_{Gen\ rated} - P_{Gen\ real}.$

$P_{Gen\ rated} = P_{Gen\ 1\ rated} + P_{Gen\ 2\ rated} + \dots + P_{Gen\ n\ rated}$

(Total rated power of all gensets on the busbar in the system)

$P_{Gen\ real} = P_{Gen\ 1\ real} + P_{Gen\ 2\ real} + \dots + P_{Gen\ n\ real}$

(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 "MOP Minimum load"), the first genset will be added.

$P_{Mains\ setpoint} - P_{Mains\ real} > P_{Minimum\ MOP}$

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 "MOP Reserve power"), another genset will be added.

$P_{Reserve} < P_{Reserve\ MOP}$

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 "MOP Reserve power") plus the hysteresis (parameter "MOP Hysteresis") 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.

$P_{Reserve} > P_{Reserve\ MOP} + P_{Hysteresis\ MOP} + P_{Gen\ rated}$

If one genset is supplying the load in parallel with the mains and the generator load exceeds the MOP minimum load threshold (parameter "MOP Minimum load") minus the hysteresis (parameter "MOP Hysteresis"), the genset will be stopped.

The hysteresis is intended to prevent frequent starting and stopping of gensets in case of small load variations.

$P_{Mains\ setpoint} - P_{Mains\ real} + P_{Gen\ real} < P_{Minimum\ MOP} - P_{Hysteresis\ MOP}$

4.3.5.10 The Minimum Power Feature

The LDSS offers a configuration to have a minimum power always supported. The idea of this feature is to be prepared for a big load, which is much higher than the usual desired Reserve Power, which is needed once the big load is switched on. When the mentioned load is on load busbar the classical reserve power or generator load approach will take place. This increases the availability and saves fuel. The Minimum Power feature is only available for islanded operations.

To be prepared for a big load which will come in, a Minimal Power can be configured.

Requested Power for Mode “Generator Load”

Requested Power = max [[(Actual load * 200) / ($P_{Max.\ load\ IOP}$ [%] + $P_{Min.\ load\ IOP}$ [%])], [Minimal Power]]

Requested Power for Mode “Reserve Power”

Requested Power = max [[Actual load + $P_{Reserve\ IOP}$], [Minimal Power]]

4.3.5.11 Configuration LDSS General

ID	Parameter	CL	Setting range [Default]	Description
12930	LD start stop	2	Determined by LogicsManager 86.86 **[(02.01 FALSE & 1) & 1]**	This is the general LogicsManager to enable the LDSS function in the GC. Once the conditions of the LogicsManager have been fulfilled, the LDSS algorithm in the GC is enabled. The GC sends start orders to the own easYgens and to easYgens whose GC is in the same segment. Otherwise the LDSS algorithm is disabled. All start orders are removed.

ID	Parameter	CL	Setting range **[Default]**	Description
				To empower the easYgens to be guided by the GC in regards of LDSS, the GC-Mode in the easYgen must be enabled and the according LogicsManager start stop needs to be TRUE. Refer to the easYgen operation manual for more information.
5752	Start stop mode	2		This parameter determines the load criteria for start and stopping a next generator.
			[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.
			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, a genset will be stopped.
5804	IOP Minimum Power	2	0 to 999999 kW **[180 kW]**	The minimum power setting is only active in island operation. The minimum power setting shall ensure to keep always a minimum of rated power on the load busbar even the usual required rated power (Reserve Power or current generator load) is in tune. According to the application this minimum expected power is to configure. Required Rated Power = max[Minimum Power, (Actual Load + Reserve Power)] *With switching the “big” load onto the busbar, the Required Rated Power changes from Minimum Power to (Actual Load + Reserve Power). This allows to keep the Reserve Power smaller as the Minimum Load and finally saves fuel consumption.*
5806	Basic sorting	2		In cases a next starting or stopping genset is to choose and there is no clear definition currently valid to differentiate the gensets (Engine hours, Size of engine,...), the LDSS follows the basic sorting.
			Fill-up	According to the load the smallest available generator number of the smallest Group (GC) number will be started first until all available gens of this group are running. Then the next higher Group number takes place and so on. Run order: GC1 EG1; GC1 EG2; GC1 EG3;...;GC2 EG1; GC2 EG2;....;
			[Distribute]	According to the load the smallest available generator number of the smallest Group (GC) number will be started first. Then the next genset will be the smallest available generator number of the next higher Group number. If the load still increases the next genset will be the smallest available generator number of the next higher Group number and so on.
5754	Fit size of engine	2		This parameter defines whether the start/stop priority order 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.

ID	Parameter	CL	Setting range [Default]	Description
				The fuel efficiency may be optimized when this parameter is enabled. This parameter may be disabled if all generators have the same size.
			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.
				Note: The algorithm tries preferably using large engines, even if it is not matched the best possible efficiency. If an engine selection yields a condition, in which multiple small engines with their rated power cover exactly the rated power of an possible bigger engine, the bigger engine is preferred.
5755	Fit service hours	2		With this parameter the LDSS function can be configured so that redundant engines can be started and stopped 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 'Changes of engines' has no influence and can be ignored.
			Staggered	The remaining hours until the next service 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. **Note:** 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. **Note:** To run this functionality properly the maintenance call must be acknowledged accordingly.
			Period of use hours:	The period of use hours 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 engines	2	Off	Note: If the LDSS function "Fit service hours" is enabled with "Equal" or "Period of use" hours, this

ID	Parameter	CL	Setting range [Default]	Description
				configuration gets valid. Otherwise this parameter can be ignored. 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 creates therefor for each engine an individual unit’s time group. Refer to manual chapter Engine time groups for better understanding. With setting "Off" no time slot is considered and the change of engine is relating directly on the passed engine hours. With a configured time slot (2/4/8/16/32h/64h/128h) a minimum of passed engine running hours is taken into account before changing the gensets.
			[Off]	No special grouping. The engines are selected according to its priority with 1 hour spacing in case of new sorting.
			All 2h	All relevant engines are changed with a 2 hour spacing.
			All 4h	All relevant engines are changed with a 4 hour spacing.
			All 8h	All relevant engines are changed with a 8 hour spacing.
			All 16h	All relevant engines are changed with a 16hour spacing.
			All 32h	All relevant engines are changed with a 32 hour spacing.
			All 64h	All relevant engines are changed with a 64hour spacing.
			All 128h	All relevant engines are changed with a 128 hour spacing.

4.3.5.12 Configuration LDSS “Island Operation”

ID	Parameter	CL	Setting range [Default]	Description
5760	IOP Reserve power	2	1 to 999999 kW **[100 kW]**	This parameter is only effective if start stop mode is configured to "Reserve power". 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

ID	Parameter	CL	Setting range **[Default]**	Description
				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.
5761	IOP Hysteresis	2	1 to 65000 kW **[20 kW]**	The hysteresis here determines how much the real reserve power must be increased in comparison to the configured reserve power to stop again a genset. Usually the hysteresis is adjusted so that small load changes not causing continuous engine start stop cycles.
				Notes This parameter is only effective if start stop mode is configured to "Reserve power".
5762	IOP Max. generator load	2	0 to 100% **[70%]**	This parameter is only effective if start stop mode is configured to "Generator load". The maximum generator load must be configured higher than the minimum generator load for proper operation. If the generator load exceeds the threshold configured here, the load dependent start/stop function will start another genset.
				Note The IOP Max. generator load can be overwritten through the communication interface with ID562. During the device startup procedure of the device this value is entered as a basic setting.
5763	IOP Min. generator load	2	0 to 100% **[30%]**	If the generator load falls below the threshold configured here and a generator cycling is not possible, the LDSS function will stop a genset. If with surpassing this limit a generator cycle takes place, the LDSS function keeps the genset constellation until an according minimum power is reached, which prevents a generator cycling. *A generator cycling occurs, if with removing of a generator the resulting maximum level is reached to start a generator even though the load didn’t change.*
				Note: The IOP Min. generator load can be overwritten through the communication interface with ID565. During the device startup procedure of the device this value is entered as a basic setting.
5764	IOP Add on delay	2	0 to 32000s **[10s]**	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.

ID	Parameter	CL	Setting range **[Default]**	Description
5765	IOP Add on delay at rated load	2	0 to 32000s **[3s]**	In case the already running genset(s) have reached rated load a special IOP Add-on delay time can be configured here. Usually the time configured here is shorter as the “IOP Add on delay time” to achieve a faster start in this critical situation
5766	IOP Add off delay	2	0 to 32000s **[60s]**	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.

4.3.5.13 Configuration LDSS “Mains Parallel Operation”

ID	Parameter	CL	Setting range **[Default]**	Description
5767	MOP Minimum load	2	1 to 650000 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.
5768	MOP Reserve power	2	0 to 999999 kW **[50 kW]**	This parameter is only effective if start stop mode is configured to "Reserve power". The minimum reserve power in mains parallel operation is configured here. This is the maximum expected load swing on the interchange point, 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. **Note:** The MOP Reserve power can be overwritten through the communication interface with ID563. During the device startup procedure this value is entered as a basic setting.
5769	MOP Hysteresis	2	1 to 65000kW **[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.
5770	MOP Max. generator load	2	0 to 100% **[70%]**	This parameter is only effective if start stop mode is configured to "Generator load". The maximum generator load must be configured higher than the minimum generator load for proper operation. If the generator load exceeds the threshold configured here, the load dependent start/stop function will start another genset. **Note:** The MOP Max. generator load can be overwritten through the communication interface

ID	Parameter	CL	Setting range **[Default]**	Description
				with ID566. During the device startup procedure this value is entered as a basic setting.
5771	MOP Min. generator load	2	0 to 100% **[30%]**	This parameter is only effective if start stop mode is configured to "Generator load". The maximum generator load must be configured higher than the minimum generator load for proper operation. If the generator load falls below the threshold configured here and a generator cycling is not possible, the LDSS function will stop a genset. If with surpassing this limit a generator cycle takes place, the LDSS function keeps the genset constellation until an according minimum power is reached, which prevents a generator cycling. *A generator cycling occurs, if with removing of a generator the resulting maximum level is reached to start a generator even though the load didn't change.* **Note:** The MOP Min. generator load can be overwritten through the communication interface with ID567. During the device startup procedure this value is entered as a basic setting.
5772	MOP Add on delay	2	0 to 32000s **[20s]**	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 32000s **[5s]**	In case the already running genset(s) have reached rated load a special MOP Add-on delay time can be configured here. Usually the time configured here is shorter as the “MOP Add on delay time” to achieve a faster start in this critical situation.
5774	MOP Add off delayy	2	0 to 32000s **[60s]**	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 conmand is not issued.

4.3.5.14 LDSS Parameter Alignment Check

The LDSS in the GC provides a LDSS parameter alignment check like the easYgen. Even there is only one LDSS master engaged, it is important to ensure that the other potential GCs are well prepared.

The aligned parameters are:

ID	Parameter	Comment
12930	LDSS enabled	Always considered
5752	Load dependent start stop mode	Always considered
5806	Load dependent start stop basic sorting	Always considered
5754	Load dependent start stop Fit size of engine	Always considered
5755	Load dependent start stop Fit service hours	Always considered
5756	Engine change 2h - 128h	Always considered
5760	Load dependent start stop IOP Reserve power	Only Startup configuration considered
5804	Load dependent start stop IOP Minimum Power	Only Startup configuration considered
5761	Load dependent start stop IOP Hysteresis	Always considered
5762	Load dependent start stop IOP Max. Generator Load	Only Startup configuration considered
5763	Load dependent start stop IOP Min. Generator Load	Only Startup configuration considered
5764	Load dependent start stop IOP Add on Delay	Always considered
5765	Load dependent start stop IOP – Add-on delay rated	Always considered
5766	Load dependent start stop IOP - Add-off Delay	Always considered
5767	Load dependent start stop MOP minimum load	Always considered
5768	Load dependent start stop MOP Reserve Power	Only Startup configuration considered
5769	Load dependent start stop MOP Hysteresis	Always considered
5770	Load dependent start stop MOP Max. Generator Load	Only Startup configuration considered
5771	Load dependent start stop MOP Min. Generator Load	Only Startup configuration considered
5772	Load dependent start stop MOP - Add on Delay"	Always considered
5773	Load dependent start stop MOP – Add on delay rated	Always considered
5774	Load dependent start stop MOP - Add off Delay	Always considered
9921	Transfer rate LS fast message	Always considered

4.3.5.15 LDSS Overview Screen

Through the capability to run up to 496 gensets with LDSS the GC provides on a ToolKit page a LDSS Overview Screen. The idea is to get all relevant data into one screen.

Different colors of bitmaps help to recognize what is going on with the particular genset.

The according information are also provided for PLCs and SCADA systems.

Enum-eration	Condition	ToolKit Field Indication:
0	Generator does not exist or is not in the same Segment like our GC	Solid Grey Field (Nothing visible)
1	Generator is in operation mode STOP	

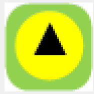
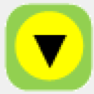
Enum-eration	Condition	ToolKit Field Indication:
2	Generator is in operation mode MANUAL	
3	Generator is in operation mode TEST	
4	Generator is in operation mode AUTO and for LDSS not available	
5	Generator is for LDSS available and waits for LDSS commands	
6	Generator has a LDSS Start Wish	
7	Generator is running over LDSS and breaker is closed	
8	Generator has a LDSS Stop Wish	
10-15	reserve	

Table 29: Genset states information in Toolkit

LDSS Overview in Toolkit

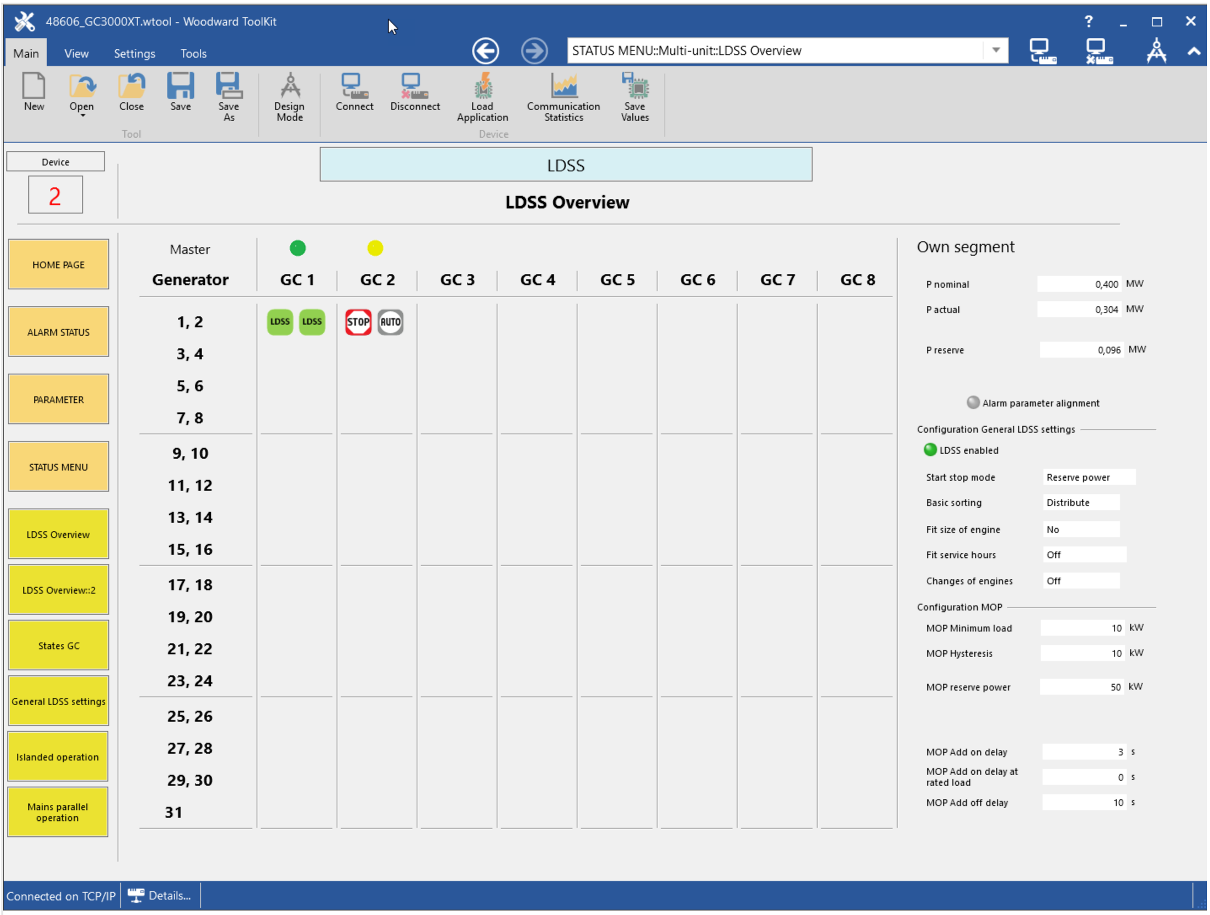


Fig. 66: Example overview GC and genset states in Toolkit

4.3.5.16 The LDSS Remote Settings (Remotely adjustable)

The LDSS remote settings are values which can be written frequently by communication interface to the device. The differentiation to already existing parameter is that the sent value replaces the startup configuration and is kept on a nonvolatile memory until power down the device. Additionally the remotely written values are not included in the LDSS parameter alignment check. The values can be written in all Code levels.

Remote Settings			
ID	**Name**	**According LDSS Parameter**	**Format**
560	Remote Exp./Imp. Power Setpoint [kW]	5089 Exp./Imp. setpoint	SINT32
561	Remote IOP Minimum Power [kW]	5804 IOP Minimum Power	UINT32
562	Remote IOP Reserve power [kW]	5760 IOP Reserve power	UINT32
563	Remote MOP Reserve power [kW]	5768 MOP Reserve power	UINT32
564	Remote IOP Max. generator load [%]	5762 IOP Max. generator load	UINT16
565	Remote IOP Min. generator load [%]	5763 IOP Min. generator load	UINT16
566	Remote MOP Max. generator load [%]	5770 MOP Max. generator load	UINT16

Remote Settings			
ID	**Name**	**According LDSS Parameter**	**Format**
567	Remote MOP Min. generator load [%]	5771 MOP Min. generator load	UINT16

4.3.6 Emergency start segments

General notes

The parameter only applies to application mode **GGB/LSx** ⮡ 3468

The emergency start (AMF mode) of the easYgen(s) in the group depend on the segments which are configured in the GC device. The GCs receive the measured voltages of the segments from LS-6XT. The GC monitors the configured segment(s). If at least one segment is recognized as out of the operating ranges, the generators in the own group get an emergency run start signal. With successful start the generator(s) close its breaker. The GGB breaker closure is to coordinate with a logic inside the GC (LogicsManager equations) or by a PLC which gives the close command.

The AMF mode will only be stopped, if all monitored segments are OK for the mains settling time and have connection to mains again.

ID	Parameter	CL	Setting range [Default]	Description
2805	**Emergency start Seg No 1-16**	2	—	The GC-3000XT provides an emergency run according to the configured segments 1-16. If the operating range of the particular segment is lost, the generators in the own group get an emergency run start signal.
2806	**Emergency start Seg No 17-32**	2	—	The GC-3000XT provides an emergency run according to the configured segments 17-32. If the operating range of the particular segment is lost, the generators in the own group get an emergency run start signal.
2807	**Emergency start Seg No 33-48**	2	—	The GC-3000XT provides an emergency run according to the configured segments 33-48. If the operating range of the particular segment is lost, the generators in the own group get an emergency run start signal.
2808	**Emergency start Seg No 49-64**	2	—	The GC-3000XT provides an emergency run according to the configured segments 49-64. If the operating range of the particular segment is lost, the generators in the own group get an emergency run start signal.
2811	**Emergency start Seg No 65-80**	2	—	The GC-3000XT provides an emergency run according to the configured segments 65-80. If the operating range of the particular segment is lost, the generators in the own group get an emergency run start signal.
2812	**Emergency start Seg No 81-96**	2	—	The GC-3000XT provides an emergency run according to the configured segments 81-96. If the operating range of the particular segment is lost, the generators in the own group get an emergency run start signal.
2813	**Emergency start Seg No 97-112**	2	—	The GC-3000XT provides an emergency run according to the configured segments 97-112. If the operating range of the particular segment is

ID	Parameter	CL	Setting range **[Default]**	Description
				lost, the generators in the own group get an emergency run start signal.
2814	**Emergency start Seg No 113-128**	2	—	The GC-3000XT provides an emergency run according to the configured segments 113-128. If the operating range of the particular segment is lost, the generators in the own group get an emergency run start signal.

4.4 Configure Monitoring

4.4.1 Generator Group

4.4.1.1 Generator Group Operating Ranges / Load Busbar Monitoring

Operating Voltage and Frequency

Different operations like synchronize GGB or dead bus closure GGB require the condition of the Generator Group and the Load Busbar. Whether a generator group and load busbar are in the correct range is configurable. The outcomes are used for logical purposes internally and available as command variables (refer to ⮑ "9.4.2.2 Group 02: System conditions".

Usually the monitored sources are the phase-phase voltages.

An exception is, if phase-neutral voltage are only available (1Ph2W = Phase-neutral). Then the Phase-Neutral voltage is taken.

ID	Parameter	CL	Setting range **[Default]**	Description
5800	**Upper voltage limit** Maximum operating voltage limit	2	100 to 150% **[110%]** (Hysteresis: 1%)	The maximum permissible positive deviation of the generator group voltage from the generator group rated voltage (parameter 1766) is configured here.
5801	**Lower voltage limit** (Minimum operating voltage limit)	2	50 to 100% **[90%]** (Hysteresis: 1%)	The maximum permissible negative deviation of the generator group voltage from the generator group rated voltage (parameter 1766) is configured here.
5802	**Upper frequency limit** (Maximum operating frequency limit)	2	100.0 to 150.0% **[105.0%]** (Hysteresis: 0.05%)	The maximum permissible positive deviation of the generator group frequency from the rated system frequency (parameter 1750) is configured here.
5803	**Lower frequency limit** (Minimum operating frequency limit)	2	50.0 to 100.0% **[95.0%]** (Hysteresis: 0.05%)	The maximum permissible negative deviation of the generator group frequency from the rated system frequency (parameter 1750) is configured here.

4.4.1.2 Generator Group Voltage Rotation Mismatch Monitoring

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 group is connected with the terminal of the control unit which is intended for the generator group L1 phase)

The unit observes the phase rotation of generator group and issue an alarm, if the phase rotation do not match the desired rotation type (CW or CCW).

Correct phase rotation of the phase voltages ensures that damage will not occur during a breaker closure to either the load busbar or the generator group. 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 Toolkit Homepage.

This monitoring function is only enabled if the generator group voltage measuring (parameter **1851**) is configured to "3Ph 4W", "3Ph 3W" or "3Ph 4W OD".

The Phase Rotation Monitor is internally configured with a 0.5 seconds delay. .

Configuration

ID	Parameter	CL	Setting range [Default]	Description
3954	**Generator phase rotation**	2	**[CW]**	Expected generator group phase rotation. CW: The three-phase measured generator group voltage is rotating CW (clockwise; that means the voltage rotates in L1-L2-L3 direction; standard setting).
			CCW	CCW: The three-phase measured generator group voltage is rotating CCW (counter clockwise; that means the voltage rotates in L1-L3-L2 direction).

- This monitor is always enabled.
- The delay time is 0.5 seconds.
- It is self-acknowledging
- If this monitor function is triggered, "Gen.Gr.ph.rot. mism." with alarm class C is indicated and the logical command variable "06.21" will be enabled.

4.4.1.3 Generator Group Current Monitoring

4.4.1.3.1 Generator Group Time-Overcurrent (Level 1, 2 & 3) ANSI# 50/51

General notes

Current is monitored according to how the parameter "Gen. group current measuring" (parameter ⮱▷ 1850) 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 GenGr. overcurrent 1, "06.10 GenGr. overcurrent 2", or "06.11 GenGr. overcurrent 3" will be enabled.

Refer to ⮱▷ "9.2.1 Triggering Characteristics" 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 Gen. group rated current (parameter ⮱▷ 1754).

ID	Parameter	CL	Setting range [Default]	Description
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**	4	Yes	The control provides Voltage restraint overcurrent according to ANSI 51 V individually for each generator group current monitoring function. For details refer to ⮡ "4.4.1.3.3 Generator Group Voltage Restrained Overcurrent Monitoring - ANSI #51V".
			[No]	Voltage restraint monitoring is disabled.
2201 2207 2213	**Alarm class**	2	Class A, Class B, Class C, Class D, Class E, Class F , Control 2201: **[Class E]** 2207: **[Class F]** 2213: **[Class 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 ⮡ "9.6.3 Alarm Classes"
2202 2208 2214	**Self acknowledge**	2 4 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 LM ⮡ 12490 Ext. acknowledge (via a discrete input or via an interface).
2203 2209 2215	**Enabled**	4	**[Always]**	Monitoring for this fault condition is continuously enabled.
			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: Flag 1, 96.02 LM: Flag 2, ..., 96.32 LM: Flag 32

4.4.1.3.2 Generator Group Inverse Time-Overcurrent ANSI# IEC 255

General notes

The current produced by the generator is monitored depending on how parameter "Gen. group current measuring" (1850) 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, ToolKit indicates "Inverse time overcurrent and the logical command variable "06.22 Inv. time overcurr." 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

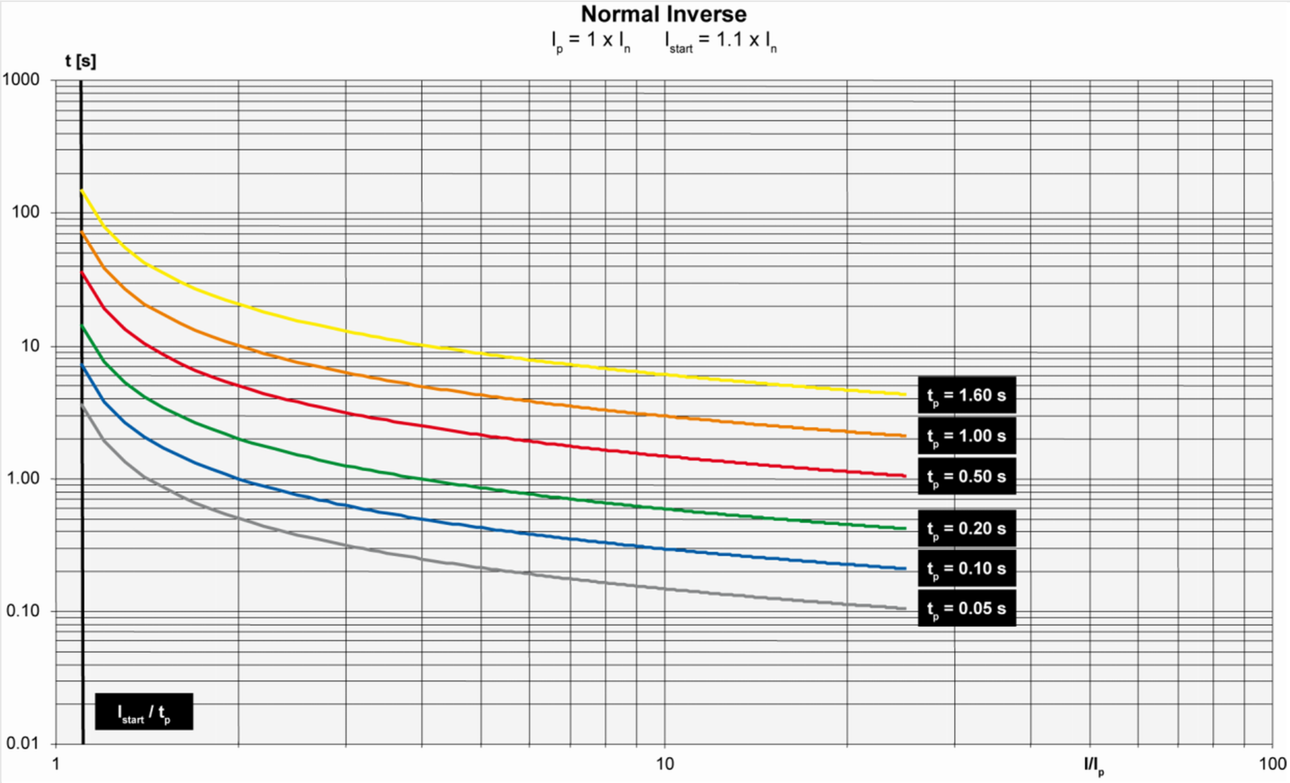


Fig. 67: Normal Inverse time characteristic

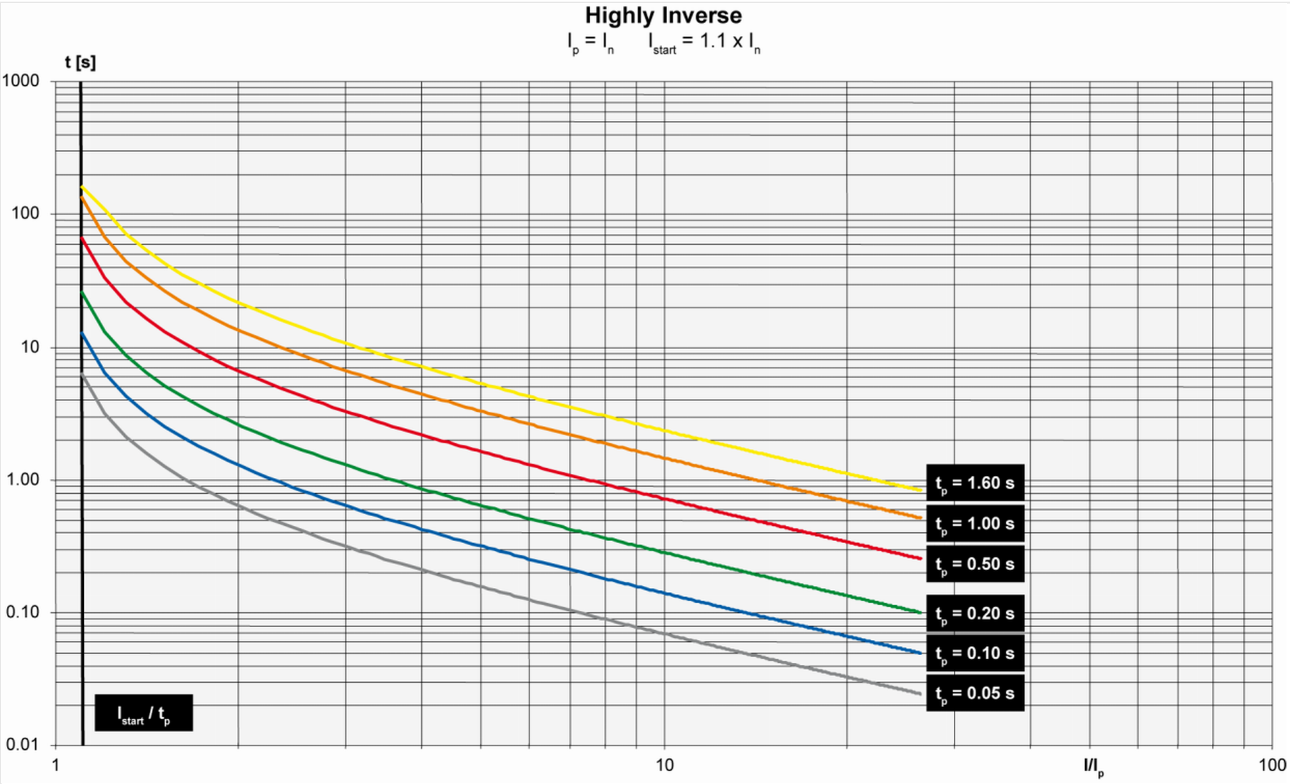


Fig. 68: Strong Inverse time characteristic

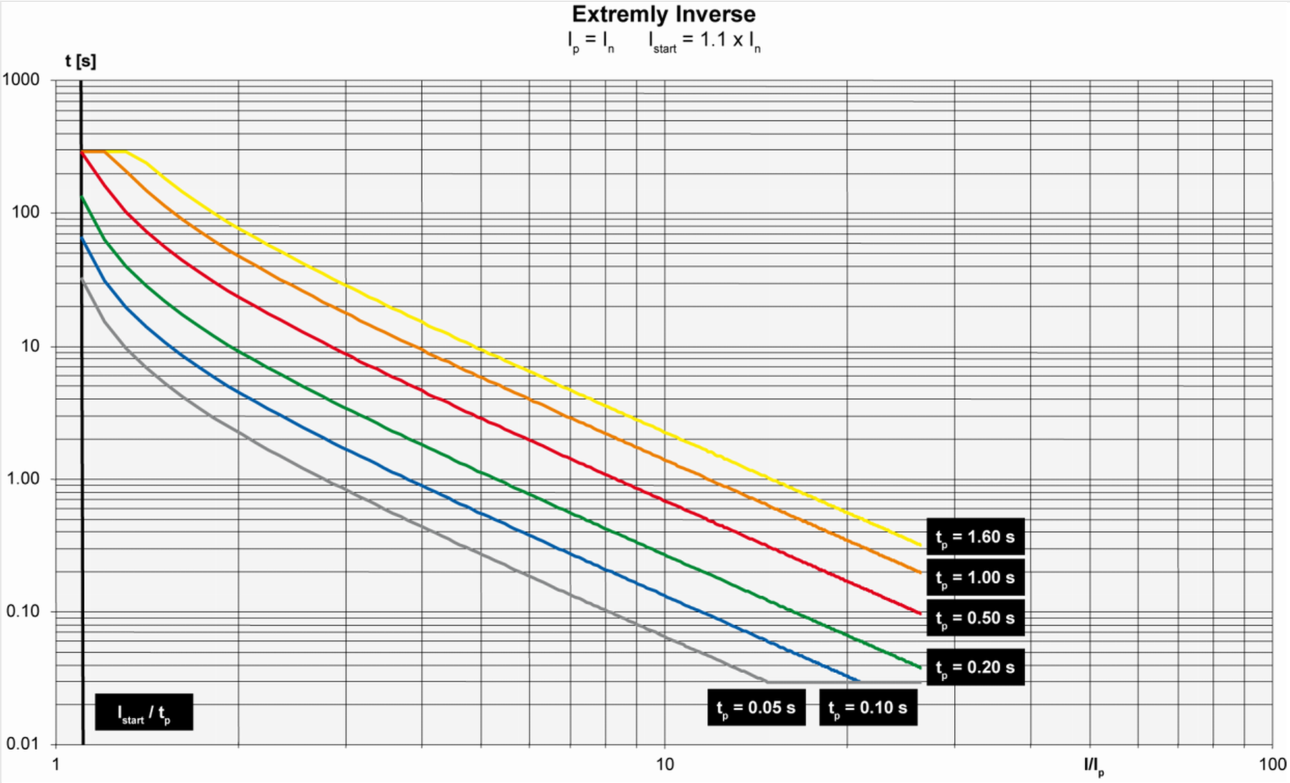


Fig. 69: Extreme Inverse time characteristic

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
			Strong	The "Strong" inverse tripping curve will be used
			Extreme	The "Extreme" inverse tripping curve will be used.
4035	**Inverse time overcurrent Tp=**	2	0.01 to 5.00 s **[0.06 s]**	Time constant T_p used to calculate the characteristics.
4036	**Inverse time overcurr. Ip=**	2	10.0 to 300.0% **[100.0%]**	Current constant I_P used to calculate the characteristics.
4037	**Inv. time overcurr. 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.

ID	Parameter	CL	Setting range [Default]	Description
2227	**Voltage restraint monitoring**	4	Yes	The control provides »Voltage restraint overcurrent« monitoring. For general information about voltage restrained monitoring refer to ⮡ "4.4.1.3.3 Generator Group Voltage Restrained Overcurrent Monitoring - ANSI #51V".
			[No]	Voltage restraint monitoring is disabled.
4031	**Alarm class**	2	Class A, Class B, Class C, Class D, Class E, Class F , Control **[Class 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 ⮡ "9.6.3 Alarm Classes"
4032	**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 LM ⮡ 12490 Ext. acknowledge (via a discrete input or via an interface).
4033	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			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: Flag 1, 96.02 LM: Flag 2, ..., 96.32 LM: Flag 32

4.4.1.3.3 Generator Group Voltage Restrained Overcurrent Monitoring - ANSI #51V

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 Parameter ⮱▷ 1770 "Gen. group voltage monitoring"). The monitor takes always the lowest considered voltage into account for calculating the modification factor.

Voltage restraint overcurrent monitoring can be activated individually for Gen. overcurrent 1, Gen. overcurrent 2, Gen. overcurrent 3 and Inverse time overcurrent, if the according Voltage restraint monitoring parameters (⮱▷ 2224, ⮱▷ 2225, ⮱▷ 2226, ⮱▷ 2227) are switched to "Yes".

The modification factor depends on the measured voltage in percent of rated voltage. It is defined by a Voltage restraint overcurrent characteristic which is defined by parameters ⮱▷ 2230, ⮱▷ 2231 and ⮱▷ 2232 cf. figure). This characteristic is taken into account for all over current monitoring functions, if enabled.

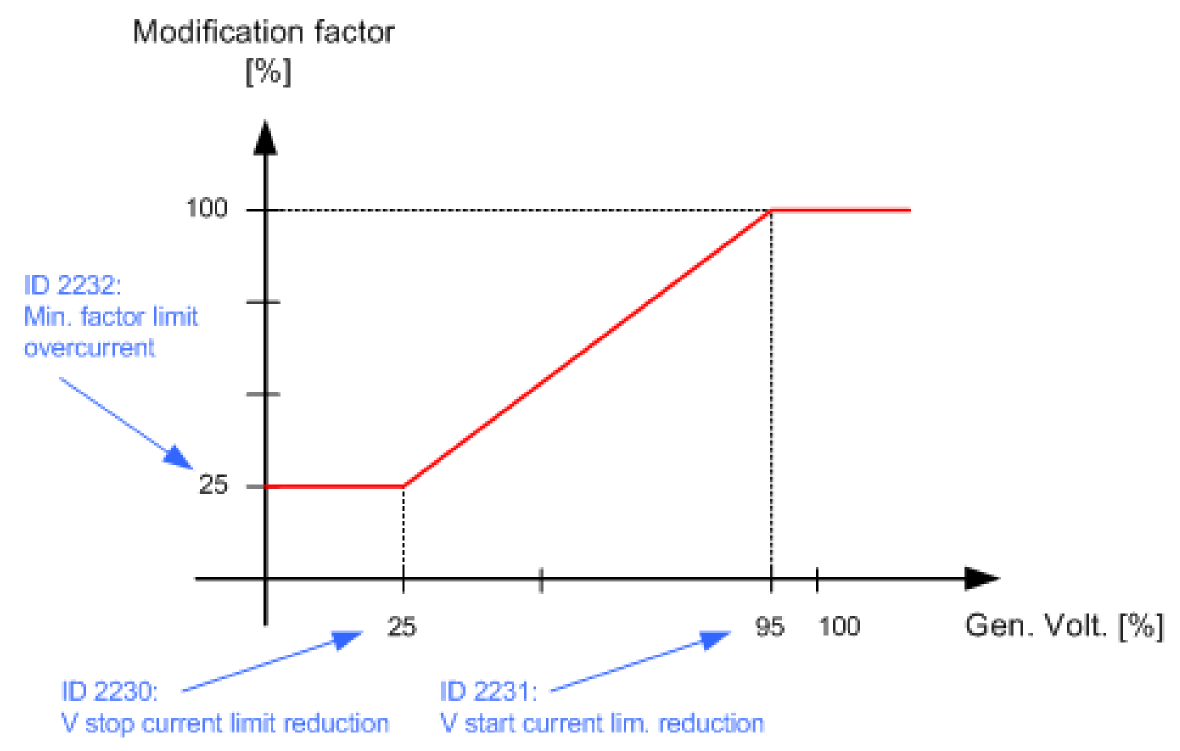


Fig. 70: Example for generator group voltage restraint overcurrent characteristic

Beginning at a voltage dip of 95% rated voltage (configured by ⮱▷ 2231), the modification factor will be linearly reduced (cf. figure). 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 limit 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

4.4.1.4 Generator Group Voltage Monitoring

ID	Parameter	CL	Setting range [Default]	Description
1770	**Gen. group voltage monitoring**	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 (V_{L-L}) will be monitored.
			Phase - neutral	The phase-neutral voltage (V_{L-N}) will be monitored.
				Notes WARNING: This parameter defines how the protective function “4.4.1.3.3 Generator Group Voltage Restrained Overcurrent Monitoring - ANSI #51V” operates.

Table 30: Settings: Generator Group Voltage Monitoring

4.4.2 Mains

4.4.2.1 Mains operating ranges

Operating Voltage and Frequency

Different operations like synchronize MCB or considering mains settling time require the condition of the mains. Whether the mains is in the correct range is configurable. The outcomes are used for logical purposes internally and available as command variables (refer to ⮱▷ "9.4.2.2 Group 02: System conditions".

Usually the monitored sources are the phase-phase voltages.

An exception is, if phase-neutral voltage are only available (1Ph2W = Phase-neutral). Then the Phase-Neutral voltage is taken.

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) is configured here.
5814	**Hysteresis upper voltage limit**	2	0 to 50% **[2%]**	If the mains voltage has exceeded the limit configured in parameter 5810, 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) is configured here.
5815	**Hysteresis lower voltage limit**	2	0 to 50% **[2%]**	If the mains voltage has fallen below the limit configured in parameter 5811, 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) is configured here. **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	**Hyst. upper frequency limit**	2	0 to 50.0% **[0.5%]**	If the mains frequency has exceeded the limit configured in parameter 5812, 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) is configured here. **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 %.

ID	Parameter	CL	Setting range [Default]	Description
5817	**Hyst. lower frequency limit**	2	0 to 50.0% **[0.5%]**	If the mains frequency has exceeded the limit configured in parameter 5813, the frequency must raise above the limit and the value configured here, to be considered as being within the operating limits again.

4.4.2.2 Mains Phase Rotation Mismatch Monitoring

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 mains is connected with the terminal of the control unit which is intended for the L1 of the mains)
- The LogicsManager function "Enable MCB" (refer to parameter ⮡ 12923) is false in case of a incorrect rotation field

Configure Monitoring: Mains, Voltage Phase Rotation:

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 in the Toolkit Homepage.

This monitoring function is only enabled if Mains voltage measuring (parameter **1853**) is configured to "3Ph 4W" or "3Ph 3W".

The Phase Rotation Monitor is internally configured with a 0.5 seconds delay.

Configuration

ID	Parameter	CL	Setting range [Default]	Description
3974	**Mains phase rotation**	2	**[CW]**	Expected mains phase rotation. CW: The three-phase measured mains voltage is rotating CW (clockwise; that means the voltage rotates in L1-L2-L3 direction; standard setting).
			CCW	CCW: The three-phase measured mains voltage is rotating CCW (counter clockwise; that means the voltage rotates in L1-L3-L2 direction).

- This monitor is always enabled.
- The delay time is 0.5 seconds.
- It is self-acknowledging
- If this monitor function is triggered, "Mns.ph.rot. mismatch" with alarm class C is indicated and the logical command variable "07.05" will be enabled.

4.4.3 Breakers

4.4.3.1 GGB feedback check

Function

The function checks, if the feedback of the GGB is plausible to the measured AC voltages connected on the breaker.

So if the GGB is closed and Generator Group and Load Busbar are in range, the phase angle will be checked. If the phase angle is outside +/-12° an alarm will be tripped.

The intention of this monitor is to detect wiring failures or blown fuses.

- This monitor is always enabled.
- The delay time is 2 seconds.
- It is **not** self-acknowledging
- If this monitor function is triggered, "GGB plausibility" with alarm class C is indicated and the logical command variable "08.68" will be enabled.

4.4.3.2 GGB "fail to close" / "fail to open" Monitoring

General notes

Circuit breaker monitoring contains two alarms: A breaker "fail to close" alarm and a breaker "fail to open" alarm.

Breaker "fail to close" 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 "GGB max. closing attempts", parameter 3087).

The close attempt counter is reset, if:

- The close command by the internal logic is removed for more than 5 seconds
- A successful feedback is active for more than 5 seconds

If this protective function is triggered, "GGB fail to close" is indicated with alarm class B and the logical command variable "08.34" will be enabled.

Breaker Open Alarm

If the control initiates an open of the breaker and the breaker fails to open in limited time defined with parameter 3088 the monitoring CB alarm will be initiated. (Refer to parameter "GGB open monitoring", parameter 3088 ⮡ 3088).

If this protective function is triggered, "GGB fail to open" is indicated with alarm class C and the logical command variable "08.35" will be enabled.

Configuration

ID	Parameter	CL	Setting range [Default]	Description
3085	**GGB monitoring**	2		Enabling GGB monitoring. Circuit breaker monitoring contains two alarms: A GGB "fail to close" alarm and a GGB "fail to open" alarm.
			[On]	On: Monitoring is enabled
			Off	Off: Monitoring is disabled
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, a "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, a "GGB fail to open" alarm is issued. This timer initiates as soon as the "open breaker" sequence begins. The alarm configured is issued.

4.4.3.3 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. This alarm is self-acknowledging with alarm class B.

4.4.3.4 GGB Unload Mismatch

ID	Parameter	CL	Setting range [Default]	Description
3120	**Monitoring**	2	On	Monitoring of the GGB unloading is carried out according to the following parameters.
			[Off]	Monitoring is disabled.
3125	**Unload trip level GGB**	2	0.5 to 99.9 % **[3.0 %]**	If the monitored power flow of the Generator group falls below this value, a "GGB open" command will be issued.
				Notes This value refers to the "Gen. group rated active power" (parameter ⮱▷ 1752).
3123	**Delay**	2	1 to 999 s **[30 s]**	If the monitored Generator group power does not fall below the limit configured in (parameter ⮱▷ 3125) before the time configured here expires, a GGB open command will be issued (even if Parameter ⮱▷ 3120 is configured to "Off"). If Parameter ⮱▷ 3120 is configured to "On", also the alarm "GGB unload mismatch" is triggered and the logical command variable "08.81 GGB unload mismatch" will be enabled.
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 ⮡ "9.6.3 Alarm Classes"
3122	**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 "Ext. acknowledge" output (via a discrete input or via an interface).
3126	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			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

4.4.3.5 MCB "fail to close" / "fail to open" Monitoring

General notes

Circuit breaker monitoring contains two alarms: A breaker "fail to close" alarm and a breaker "fail to open" alarm.

Breaker "fail to close" 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 "MCB max. closing attempts", parameter 3419).

The close attempt counter is reset, if:

- The close command by the internal logic is removed for more than 5 seconds
- A successful feedback is active for more than 5 seconds

> If this protective function is triggered, "MCB fail to close" is indicated with alarm class B and the logical command variable "08.07" will be enabled.

Breaker "fail to open" alarm

If the control initiates an open of the breaker and the breaker fails to open in limited time defined with parameter 3421 the monitoring CB alarm will be initiated. (Refer to parameter "MCB open monitoring", parameter 3421).

If this protective function is triggered, "MCB fail to open" is indicated with alarm class B and the logical command variable "08.08" will be enabled.

Configuration

ID	Parameter	CL	Setting range [Default]	Description
2620	**MCB monitoring**	2		Enabling MCB monitoring. Circuit breaker monitoring contains two alarms: A breaker "fail to close" alarm and a breaker "fails to open" alarm.
			[On]	On: Monitoring is enabled
			Off	Off: Monitoring is disabled
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, a "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, a "MCB fail to open" alarm is issued. This timer initiates as soon as the "open breaker" sequence begins. The alarm configured is issued.

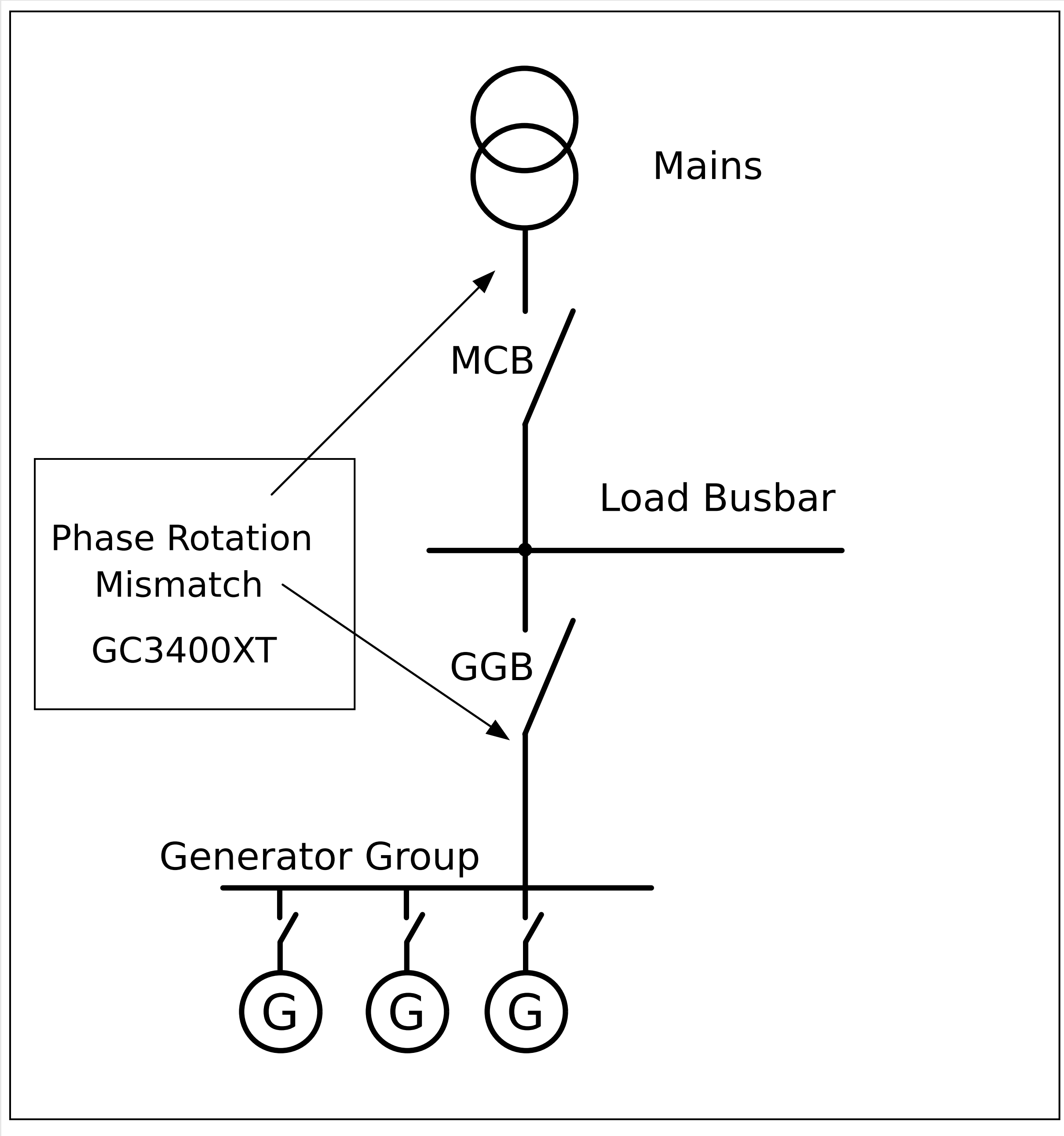
4.4.3.6 Synchronization MCB

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	**Delay**	2	3 to 999 s **[30 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. This alarm is self-acknowledging with alarm class B.

4.4.3.7 Phase Rotation Mismatch diagnostic

Function

The unit observes, if the phase rotation are equal between the measured voltage systems. This means: If the unit detects for mains a CCW rotation and for the Generator group a CW rotation, an alarm shall be issued and the breaker synchronization shall be inhibited.



Example

The delay time is 1 second.

This monitor is always enabled.

Alarm Indication

- Alarm class C
- Entry in Alarm list "Ph.rotation mismatch"
- Logic command variable "08.33 Ph.rotation mismatch" will be enabled.
- This alarm is self-acknowledging
- Entry protocol 5023

- The GGB synchronization is inhibited, if the MCB is closed

4.4.4 Flexible Limits

General notes

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 critical) 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.

> The flexible limits 25 through 32 are configurable additionally with a 'Fallback time' e.g., for load shedding.

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}]**	**Notes** The max. number of characters depends on the numbers of Bytes for each character.
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) for at least the delay time configured in parameter ⮡ 4207 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. **Note**

ID	Parameter	CL	Setting range [Default]	Description
				Because all "AnalogManager Variables" are in float format, the limits can be entered without any formatting factor.
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 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.
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) 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 99999.99 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 ⮑ "9.6.3 Alarm Classes"
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

ID	Parameter	CL	Setting range [Default]	Description
				output "External acknowledgment" (via a discrete input or via an interface).
4203	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			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 "9.5.2 Data Sources AM" for a list of all data sources.

Parameter IDs

Flexible limit #	Descrip-tion	Monitor-ing	Monitor-ed analog value	Monitor-ing at	Limit	Hyster-esis	Delay Fallback	Alarm class	Self acknow-ledge	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

Flexible limit #	Descrip-tion	Monitor-ing	Monitor-ed analog value	Monitor-ing at	Limit	Hyster-esis	Delay Fallback	Alarm class	Self acknow-ledge	Enabled
20	7228	6120	6126	6124	6125	6128	6127	6121	6122	6123
21	7236	6130	6136	6134	6135	6138	6137	6131	6132	6133
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 31: Flexible limits - parameter IDs

4.4.5 Miscellaneous

4.4.5.1 General monitoring settings

ID	Parameter	CL	Setting range [Default]	Description
1756	**Time until horn reset**	0	0 to 1000 s **[1 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.
12490	**Ext. acknowledge** (External acknowledgment of alarms)	2	Determined by LogicsManager 86.15 **[(09.02 Discrete input 2 & 1) & 1]**	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 messages. 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 variable 03.05 (horn). The second high signal acknowledges all inactive alarm messages.

4.4.5.2 Alarm acknowledge

The ToolKit page ”Alarm Status“ informs about the condition of the single alarms. Usually an alarm is only acknowledgeable, if the alarm is not active anymore.

Alarms are always common acknowledged. This can be executed in different ways:

- By LogicsManager ”12490 Ext. acknowledge“ (refer to ⮡ 12490)
- By ToolKit button ”Clear all“ at page ”Alarm Status“
- By the easYgens of the own group

4.4.5.3 Multi unit Layer 1

4.4.5.3.1 Monitoring System update Layer 1

General notes

The multi-unit system update monitoring function checks whether only the participating units are available (sending data on the load share line).

If the number of available units (easYgen or LSx) is more than the number of displayed units (easYgen or LSx), "Syst. Update Layer 1" with alarm class B is indicated and the logical command variables "08.65" will be enabled. (The alarm is self-acknowledging.)

For more information see ⮡ “6.5 Communication Management”

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. To detect **less** LSx devices against latest updated system configuration use missing member monitor ⮡ 4066.
			Off	Monitoring is disabled.
7801	**System update Layer 1**	2	Determined by LogicsManager 86.35 **[(02.01 LM FALSE & 1) & 1]** = 11974	To select logical input(s) to cause a system update at Layer 1.

4.4.5.3.2 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 "Monitored easYgen" ⮡ 9925 (initiated by System update) for at least the delay time, "Missing easYgen" with alarm class B is indicated and the logical command variable "08.27" will be enabled.

After energizing the device, a delay is started, which allows a possible "Missing easYgen" alarm to become active.

For using only a CAN bus connection, this delay depends on the Node-ID of the device (parameter ⮡ 8950) and the transfer rate of a load share fast message (parameter ⮡ 9921) and may last for approx. 140 seconds for a high Node-ID (e.g. 127). This delay serves for detecting the Master of the 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 (Transfer rate LS fast message).

For Ethernet connections, this delay time is 12 seconds. Approximately 12 seconds after energizing the device, the alarm delay will be set to 1 second.

During »System update« the alarm is disabled.

For more information see ⮡ "6.5 Communication Management"

ID	Parameter	CL	Setting range [Default]	Description
4060	**Monitoring**	2	**[On]**	Multi-unit missing monitoring is carried out.
			Off	Monitoring is disabled.
4062	**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.

4.4.5.3.3 Multi-unit missing LSx

General notes

The multi-unit missing LSx 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 "Monitored LSx" ⮡ 9926 (initiated by System update) for at least the delay time, "Missing LSx Layer 1" with alarm class B is indicated and the logical command variable "08.28" will be enabled.

After energizing the device, a delay is started, which allows a possible "Missing LSx Layer 1" alarm to become active.

For using only a CAN bus connection, this delay depends on the Node-ID of the device (parameter ⮡ 8950) and the transfer rate of a load share fast message (parameter ⮡ 9921) and may last for approx. 140 seconds for a high Node-ID (e.g. 127). This delay serves for detecting the Master of the 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 (Transfer rate LS fast message).

For Ethernet connections, this delay time is 12 seconds. Approximately 12 seconds after energizing the device, the alarm delay will be set to 1 second.

During »System update« the alarm is disabled.

For more information see ⮡ “6.5 Communication Management”

ID	Parameter	CL	Setting range [Default]	Description
4066	**Monitoring**	2	**[On]**	Multi-unit missing LSx monitoring is carried out.
			Off	Monitoring is disabled.
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.

4.4.5.3.4 Load share interface monitoring

CAN Load share

If "Interface Layer 1" (parameter ⮡ 9924) is configured to any CAN mode and the device doesn't receive any load share message for at least 2 s, "CAN LS fault" with alarm class B is indicated and the logical command variable "08.51" will be enabled. (The alarm is self-acknowledging.)

ID	Parameter	CL	Setting range [Default]	Description
3956	**Monitoring**	2		Enabling CAN1 monitoring.
			[On]	On: Monitoring is enabled
			Off	Off: Monitoring is disabled

Ethernet A Load share

If "Interface Layer 1" (parameter ⮡ 9924) is configured to any Ethernet A mode and the device doesn't receive any load share message for at least 2 s, "Ethernet A LS fault" with alarm class B is indicated and the logical command variable "08.52" will be enabled. (The alarm is self-acknowledging.)

ID	Parameter	CL	Setting range [Default]	Description
3962	**Monitoring**	2		Enabling Ethernet A monitoring.

ID	Parameter	CL	Setting range [Default]	Description
			[On]	On: Monitoring is enabled
			Off	Off: Monitoring is disabled

CAN Ethernet A Load share redundancy

If "Interface Layer 1" (parameter ⮱▷ 9924) is configured to "CAN1/ Ethernet A" and the device does receive load share message for at least 2 s either only on CAN1 or only on Ethernet A, "CAN EthA redundancy" with alarm class B is indicated and the logical command variable "08.70" will be enabled. (The alarm is self-acknowledging.)

ID	Parameter	CL	Setting range [Default]	Description
3988	**Monitoring**	2		Enabling CAN1 / Ethernet A redundancy monitoring.
			[On]	On: Monitoring is enabled
			Off	Off: Monitoring is disabled

4.4.5.3.5 Group ok monitoring

Function

The device observes the communication within every group. If the own group is recognized with a communication diagnostic failure at Layer 1 the alarm is issued.

The single failures are (if corresponding monitoring is enabled):

- System update Layer 1 (parameter ⮱▷ 7832)
- Missing easYgen (parameter ⮱▷ 4060)
- Missing LSx (parameter ⮱▷ 4066)
- CAN1/EthA redundancy (parameter ⮱▷ 3988)

If one of these failure is active at the own group, "Group not ok" with alarm class B is indicated and the logical command variable "08.67" will be enabled. (The alarm is self-acknowledging.)

Additionally "Group not ok" is reported to all other GCs. This makes it possible to give an overview of all groups what is indicated in ToolKit at page "Diagnostic GC". Refer to ⮱▷ "6.5.2 Diagnostic Screens"

Note: Before the system update on the group controller level is executed, all single GC groups must be okay. If not, check first the root cause of this single group not okay issue and solve it first.

4.4.5.4 Multi unit Layer 3

4.4.5.4.1 Monitoring system update Layer 3

General notes

The multi-unit system update monitoring function checks whether only the participating units are available (sending data on the load share line).

If the number of available units (GCs or LSx) is more than the number of displayed units (GCs or LSx), "Syst. Update Layer 3" with alarm class B is indicated and the logical command variables "08.66" will be enabled. (The alarm is self-acknowledging.)

For more information see ⮡ "6.5 Communication Management"

ID	Parameter	CL	Setting range [Default]	Description
7866	**Monitoring**	2	**[On]**	Enabling to monitor the system if there are **more** devices against latest updated system configuration. **Notes** To detect **less** GC devices against latest updated system configuration use missing member monitor ⮡ 4136. To detect **less** LSx devices against latest updated system configuration use missing member monitor ⮡ 4040.
			Off	Monitoring is disabled.
12892	**System update Layer 3**	2	Determined by LogicsManager 86.37 **[(09.01 Discrete Input 1 & 1) & 1]** = 11968	To select logical input(s) to cause a system update at Layer 3.

4.4.5.4.2 Multi-unit GC

General notes

The multi-unit missing GC 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 "Monitored GC" ⮡ 9928 (initiated by System update) for at least the delay time, "Missing GC" with alarm class B is indicated and the logical command variable "08.63" will be enabled.

After energizing the device, a delay is started, which allows a possible "Missing GC" alarm to become active.

For Ethernet connections, this delay time is 12 seconds. Approximately 12 seconds after energizing the device, the alarm delay will be set to 1 second.

During »System update« the alarm is disabled.

For more information see “6.5 Communication Management”

ID	Parameter	CL	Setting range [Default]	Description
4136	**Monitoring**	2	**[On]**	Multi-unit missing GC monitoring is carried out.
			Off	Monitoring is disabled.
4042	**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.

4.4.5.4.3 Multi-unit missing LSx

General notes

The multi-unit missing LSx 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 "Monitored LSx" 7877 (initiated by System update) for at least the delay time, "Missing LSx Layer 3" with alarm class B is indicated and the logical command variable "08.64" will be enabled.

After energizing the device, a delay is started, which allows a possible "Missing LSx Layer 3" alarm to become active.

For Ethernet connections, this delay time is 12 seconds. Approximately 12 seconds after energizing the device, the alarm delay will be set to 1 second.

During »System update« the alarm is disabled.

For more information see “6.5 Communication Management”

ID	Parameter	CL	Setting range [Default]	Description
4040	**Monitoring**	2	**[On]**	Multi-unit missing LSx monitoring is carried out.
			Off	Monitoring is disabled.
4045	**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.

4.4.5.4.4 Multi-unit parameter alignment (LDSS Parameter Alignment Monitoring)

Introduction

The LDSS algorithm must be enabled in all GCs, if the LDSS function is desired. This implies that the LDSS parameter must be all the same. To help the commissioner to have equal LDSS parameter in all GCs he can use the parameter alignment monitoring. The monitoring triggers an alarm, if the own LDSS parameter set does not match the set of any other GC device.

A visualization screen in ToolKit informs which devices are different in relation to the own GC device.

Refer to the LDSS chapter to get more information regarding LDSS master handling.

Function

The GC device calculates a LDSS parameter checksum of the own LDSS parameter and sends this value to the neighbor GCs. The parameter alignment monitor of each device compares its checksum with the others. A different checksum occurs an alarm.

A LDSS parameter alignment overview screen shows that GC, which differs to the own GC device.

Configuration

ID	Parameter	CL	Setting range [Default]	Description
4070	**Monitoring**	2		Enabling multi-unit parameter alignment monitoring. All LDSS parameter of the GCs are checked here. Therefore a CRC checksum is exchanged between the GC devices.
			[Off]	Monitoring is disabled
			On	Monitoring is enabled
4076	**Delay**	2	0.02 to 999.99s **[3 s]**	If the parameter alignment error occurs, the alarm output can be delayed here.
4077	**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.

4.4.5.4.5 Load share interface monitoring

Ethernet B Load share

If "Interface Layer 3" (parameter ⮱▷ 9929) is configured to "Ethernet B" and the device doesn't receive any load share message for at least 2 s, "Ethernet B LS fault" with alarm class B is indicated and the logical command variable "08.41" will be enabled. (The alarm is self-acknowledging.)

ID	Parameter	CL	Setting range [Default]	Description
3976	**Monitoring**	2		Enabling Ethernet B monitoring.
			[On]	On: Monitoring is enabled
			Off	Off: Monitoring is disabled

Ethernet C Load share

If "Interface Layer 3" (parameter ⮱▷ 9929) is configured to "Ethernet C" mode and the device doesn't receive any load share message for at least 2 s, "Ethernet C LS fault" with alarm class B is indicated and the logical command variable "08.42" will be enabled. (The alarm is self-acknowledging.)

ID	Parameter	CL	Setting range [Default]	Description
3982	**Monitoring**	2		Enabling Ethernet C monitoring.
			[On]	On: Monitoring is enabled
			Off	Off: Monitoring is disabled

Ethernet B/C Load share redundancy

If "Interface Layer 3" (parameter ⮱▷ 9929) is configured to "Ethernet B/C" and the device does receive load share message for at least 2 s either only on Ethernet B or only on Ethernet C, "EthB EthA redundancy" with alarm class B is indicated and the logical command variable "08.53" will be enabled. (The alarm is self-acknowledging.)

ID	Parameter	CL	Setting range [Default]	Description
3994	**Monitoring**	2		Enabling Ethernet B/C redundancy monitoring.
			[On]	On: Monitoring is enabled
			Off	Off: Monitoring is disabled

4.4.5.5 Interfaces

4.4.5.5.1 CAN Interfaces

- CAN Interface 1 (CANopen): See ⮱▷ "4.4.5.5.1.1 CAN Interface 1".
- CAN Interface 1 (Loadshare): See ⮱▷ "4.4.5.3.4 Load share interface monitoring".
- CAN Interface 2: See ⮱▷ "4.4.5.5.1.2 CAN Interface 2".

4.4.5.5.1.1 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. (For additional indication refer to ⮡ "Additional error indication ")

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 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 ⮡ "9.6.3 Alarm Classes"
3152	**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.

Additional error indication

Detailed error indication is shown at ToolKit status page "CAN 1 state"

- 8954 Configuration errors
- 8942 Missing Receive-PDO number: active

4.4.5.5.1.2 CAN Interface 2

General notes

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 (IKD) 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 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 ⮡ "9.6.3 Alarm Classes"
16190	**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.

4.4.5.5.2 Ethernet interfaces

General notes

The devices reacts on an abnormal rate of Ethernet UDP-messages per time scale e.g. "broadcast storm". If a maximal allowed number of messages is received, the device closes all Ethernet ports to give the own device more calculation time. After about 100ms the Ethernet ports are opened again to recheck the UDP message traffic. As long the traffic is still high the device remains in this protection state.

If this protective function is triggered, after the configured delay time the display indicates the alarm "Ethernet issue" and the logical command variable "08.62 Ethernet issue" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
3174	**Monitoring**	2	**[On]**	Ethernet UDP message monitoring is enabled.

ID	Parameter	CL	Setting range [Default]	Description
			Off	Monitoring is disabled.
3175	**Delay**	2	0.02 to 99.00 s **[2.0 s]**	If the issue contiunoes for the time configured here, an alarm will be issued.
3176	**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 “9.6.3 Alarm Classes”
3177	**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.
3178	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			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

4.4.5.6 Other Monitoring

4.4.5.6.1 Battery Overvoltage (Level 1 & 2)

General notes

There are two battery overvoltage alarm levels available in the control. Both alarms are definite time alarms and the monitoring of the voltage is done in two steps.

If this protective function is triggered, the display indicates "Bat. overvoltage 1" or "Bat. overvoltage 2" and the logical command variable "08.01" or "08.02" will be enabled.

Refer to Fig. 140 for the triggering characteristic of this monitoring function.

ID	Parameter	CL	Setting range [Default]	Description
3450	**Monitoring**	2	3450: **[On]**	Overvoltage monitoring of the battery voltage is carried out according to the following parameters.

ID	Parameter	CL	Setting range [Default]	Description
3456			3456: **[On]**	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.
3454 3460	**Limit**	2	8.0 to 42.0 V 3454: **[32.0 V]** 3460: **[35.0 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 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 ⮡ "9.6.3 Alarm Classes"
3452 3458	**Self acknowledge**	2 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).
3453 3459	**Enabled**	2 4	**[Always]**	Monitoring for this fault condition is continuously enabled.
			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

4.4.5.6.2 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 ⮡ Fig. 141 for the triggering characteristic of this monitoring function.

ID	Parameter	CL	Setting range [Default]	Description
3500 3506	**Monitoring**	2	3500: **[On]** 3506: **[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 ⮡ "9.6.3 Alarm Classes"
3502 3508	**Self acknowledge**	2 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.

ID	Parameter	CL	Setting range [Default]	Description
				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**	2 4	**[Always]**	Monitoring for this fault condition is continuously enabled.
			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

4.4.5.6.3 Voltage / Frequency Plausibility Check (Plausibility AC Wiring)

These parameters are effective for generator group and mains frequency

Function

It might occur that for example generator frequency is measured even if the generator is not running.

This could happen e.g. if PE (terminal 61) is not connected, the generator neutral connection is broken and the mains is energized with 1 phase 2 wire connection. In this case a potential shift occurs which could lead to "ghostly" voltages at the generator phase-neutral system. This voltages lead to a frequency measurement even if no voltage is detected in the generator phase-phase system. (Similar situation is possible mains.)

For this reason the "Plausbility AC wiring" monitoring is introduced to indicate such situations at generator or mains measurement. These alarms are tripping if only "Phase-Phase" or only "Phase-Neutral" frequency is detected.

If such an alarm has tripped please check all "Phase-Phase" and "Phase-Neutral" voltages via Toolkit to get more information and check the AC wiring.

- The delay time is 2 seconds.
- It is self-acknowledging
- If one of these monitor function is triggered, "Gen. AC wiring" or "Mains. AC wiring" with alarm class B is indicated and the logical command variable "06.32 Gen.Group AC wiring" or "07.32 Mains. AC wiring" will be enabled.

Plausibility AC Wiring

ID	Parameter	CL	Setting range[Default]	Description
1964	**Monitoring**	2		Enabling Plausibility AC Wiring.
			[On]	On: Monitoring is enabled
			Off	Off: Monitoring is disabled

4.5 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

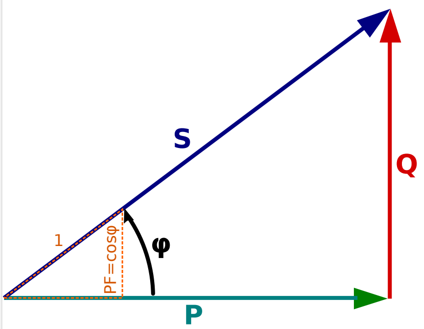


Fig. 71: AC power triangle

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 = $\sqrt{(S^2 - P^2)}$
- S = $\sqrt{(P^2 + Q^2)}$
- P = S * PF

4.5.1 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.
1858	**1Ph2W voltage measuring**	3	**[Phase - phase]**	The unit is configured for measuring phase-phase voltages if 1Ph 2W measuring is selected.
			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 ⮡ "3.2.4.1 Generator Group Voltage". Never configure the busbar measurement for phase-neutral, if the other systems like mains and generator group are configured as 3Ph 3W or 3Ph 4W. The phase angle for synchronization would not be 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 ⮡ "3.2.4.1 Generator Group Voltage".
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), a dead bus condition is detected and the logical command variable 02.21 (Busbar 1 is dead) becomes TRUE.

4.5.2 Generator Group

ID	Parameter	CL	Setting range [Default]	Description
1766	**Gen. group rated voltage**	2	50 to 650000 V **[400 V]**	This value refers to the rated voltage of the generator (generator voltage on the 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. group rated active power**	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).

ID	Parameter	CL	Setting range [Default]	Description
				These values are indicated in the generator data plate (⮑ Fig. 71).
1758	**Gen. group rated react. power**	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 (⮑ Fig. 71).
1754	**Gen. group 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	**Gen.group 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). Measurement, display, and protection are adjusted according to the rules for single-phase systems. Monitoring refers to the VL13 voltage.
			1Ph 2W	Measurement is performed Line-Neutral (WYE connected system) if parameter ⮑ 1858 is configured to "Phase - neutral" and Line-Line (Delta connected system) if parameter ⮑ 1858 is configured to "Phase - phase". Measurement, display and protection are adjusted according to the rules for phase-phase or phase-neutral systems. Monitoring refers to VL1N or VL12 voltages
			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 . Phase voltages and the neutral must be connected for proper calculation. Measurement, display and

ID	Parameter	CL	Setting range [Default]	Description
				protection are adjusted according to the rules for WYE connected systems. Monitoring refers to the following voltages: • VL12, VL23 and VL31
				Notes If this parameter is configured to 1Ph 3W, the generator and mains rated voltages (parameters ⮡ 1766 and ⮡ 1768) must be entered as Line-Line (Delta) and the busbar 1 rated voltage (parameter ⮡ 1781) must be entered as Line-Neutral (WYE). For information on measuring principles refer to ⮡ "3.2.4.1 Generator Group Voltage".
1850	**Gen. group 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 L1 Phase L2 Phase L3	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) is configured to "3Ph 4W" or "3Ph 3W". For information on measuring principles refer to ⮡ "3.2.5.1 Generator Group Current".

4.5.2.1 Configure transformer

General notes

The setpoints for specific parameters will differ depending upon the setting of parameter »Generator current range« ⮡ 1830.

- 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.group PT prim. rated volt.** (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

ID	Parameter	CL	Setting range [Default]	Description
				less), then the measured voltage will be entered into this parameter.
1800	**Gen.group PT sec. 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.group CT prim. rated curr.** (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	**Gen. group current range**	2	1A **[5A]**	The input range of the current transformer must be selected/defined.

4.5.3 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	**Load Busbar 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

ID	Parameter	CL	Setting range [Default]	Description
				voltage related functions, which use a percentage value, like synchronization.

4.5.3.1 Configure transformer

ID	Parameter	CL	Setting range [Default]	Description
1813	**Load Bus PT primary rated volt** (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	**Load Bus PT sec. 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.

4.5.4 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.
1853	**Mains voltage measuring**	2	**[3Ph 4W]**	Measurement is performed Line-Neutral (WYE connected system) and Line-Line (Delta connected system). 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:

ID	Parameter	CL	Setting range [Default]	Description
				• VL12, VL23 and VL31
			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 is configured to "Phase - neutral" and Line-Line (Delta connected system) if parameter ⮡ 1858 is configured to "Phase - phase". Measurement, display and protection are adjusted according to the rules for phase-phase or phase-neutral systems. Monitoring refers to the following voltages: • VL1N or VL12
			1Ph 3W	Measurement is performed Line-Neutral (WYE connected system) and Line-Line (Delta connected system). Measurement, display, and protection are adjusted according to the rules for single-phase systems. Monitoring refers to the voltages VL13.
				Notes If this parameter is configured to 1Ph 3W, the generator and mains rated voltages (parameters ⮡ 1766 and ⮡ 1768) must be entered as Line-Line (Delta) and the busbar 1 rated voltage (parameter ⮡ 1781) must be entered as Line-Neutral (WYE).

4.5.4.1 Configure transformer

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.

ID	Parameter	CL	Setting range [Default]	Description
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.

4.6 Configure Interfaces

4.6.1 CAN Interfaces

4.6.1.1 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 and ⮑▷ 9101 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

CANopen master	COB-ID TIME	Time applied	Time transmitted
	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.
8950	**Node-ID CAN bus 1**	2	1 to 127 (dec) **[32]**	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. For multiple device applications please make sure to change parameter ⮩ 1702 as well
8993	**CANopen Master**	2		One bus participant must take over the network management and put the other participants into "operational" mode. The GC 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) 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 or the GC 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

ID	Parameter	CL	Setting range **[Default]**	Description
				CAN bus (except the easYgens and GC) 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"
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) it will send the SYNC message with this interval. The time configured here will be rounded up to the next 10 ms step.
9101	**COB-ID TIME Messagee**	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"
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) it will send the TIME message with this interval.
				Notes The structure of this object is shown in ⮱ "TIME synchronization message"

ID	Parameter	CL	Setting range [Default]	Description
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.

4.6.1.1.1 Receive PDO {x} (Process Data Object)

General notes

RPDO mapping is carried out as shown in (⮩ Fig. 72).

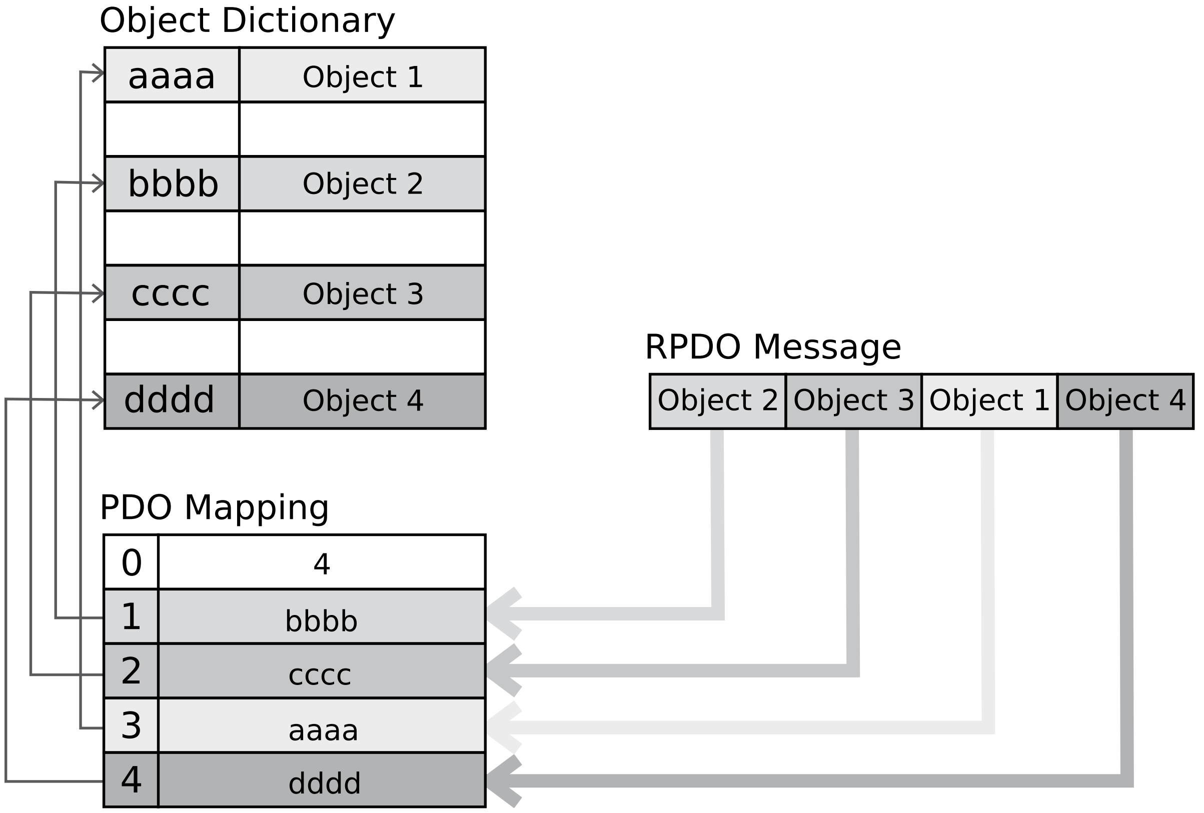


Fig. 72: RPDO mapping principle

> Parameters ⮩ 9300/ ⮩ 9310/ ⮩ 9320/ ⮩ 12805/ ⮩ 12806 use communication parameters that adhere to the following structure.
>
> RPDO Objects can be remote signals (parameter 505; please refer to ⮩ "Remote control word" for details), DI states and AI measured values.

Bit number (of COB-ID)	Value	Meaning
31 (MSB)	0	PDO exists / is valid
	1	PDO does not exist / is not valid

Bit number (of COB-ID)	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
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 ⮡ Chapter 4.6.1.1.1. 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 8970: **[65000]** 8971: **[65001]** 8972: **[0]** 8973: **[0]** 8974: **[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

ID	Parameter	CL	Setting range [Default]	Description
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.
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.

4.6.1.1.2 Transmit PDO {x} (Process Data Object)

General notes

TPDO mapping is carried out as shown in (Fig. 73).

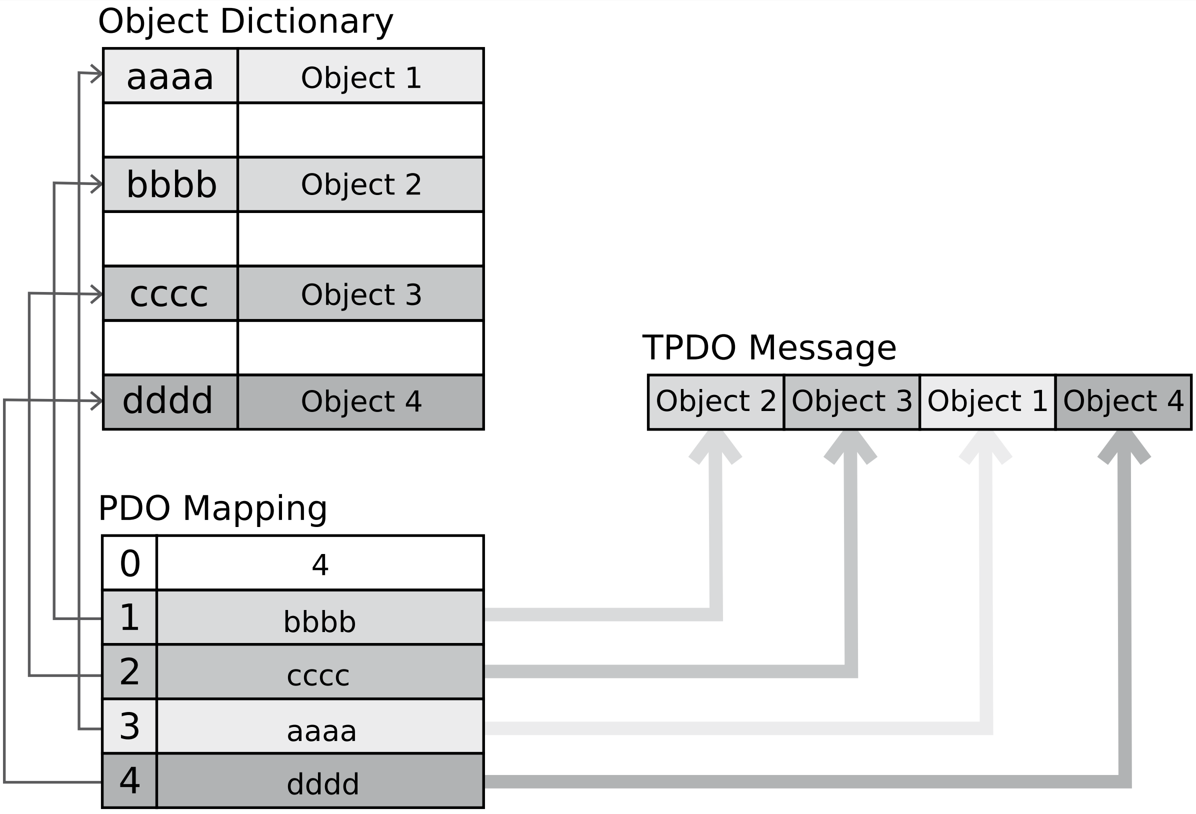


Fig. 73: TPDO mapping

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"):

- 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/ ⮱▷ 9610/ ⮱▷ 9620/ ⮱▷ 9630/ ⮱▷ 12792 use communication parameters that adhere to the following structure.

Bit number (of COB-ID)	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/ ⮱▷ 9612/ ⮱▷ 9622/ ⮱▷ 9632/ ⮱▷ 12793 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 ⮱ Chapter 4.6.1.1.2 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.
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).
				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”.
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: **[65000]** 8963: **[65001]** 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

ID	Parameter	CL	Setting range [Default]	Description
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
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

4.6.1.2 CAN Interface 2

General notes

This CAN Interface is dedicated to

- IKD-1 (Woodward external digital terminals).

  Refer to “6.4.4 Setup Expansion Modules at CAN 2”)

- easYlite-200 (Remote Annunciator)

  Refer to “6.4.6 Connecting easYlite-200 on CAN Bus”)

General Settings

ID	Parameter	CL	Setting range [Default]	Description
3157	**Baudrate**	2	20 kBd / 50 kBd / 100 kBd / 125 kBd / 250 kBd **[250 kBd]**	This parameter defines the used baud rate. **Notes** All participants on the CAN bus must use the same baud rate.

4.6.1.3 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. **Note:** This setting must be the same for all members.
9999	**Load share timeout factor**	2	2 to 30 **[2]**	"Transfer rate LS fast message" (ID 9921) multiplied by "Load share timeout factor" (ID 9999) defines the loadshare timeout. With the expired loadshare timeout the taught-in participant is marked as not recognized and the loadshare timeout flag is set. **Note:** This setting must be the same for all members.

ID	Parameter	CL	Setting range [Default]	Description
				Refer to “7.4 Load Sharing” for more information.
9990	**Load share timeout factor data**	2	0 to 30 **[12]**	If a taught-in participant is marked as not recognized, the user can set here how many more CAN fast messages may be lost consecutively from this partner before his data is declared invalid. **Note:** This setting must be the same for all members. Refer to “7.4 Load Sharing” for more information.
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).

4.6.2 Ethernet Interfaces

General notes

The Ethernet network provides a fast communication capability to different devices, like 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 SCADA visualization tool). At least the GC-3000XT provides a UDP protocol for system relevant and time discrete information exchange.

> Do not connect the GC-3000XT with the internet as long the security aspects are not considered. Consider an IT responsible person to discuss proper security procedures like placing routers and fire walls.
>
> If the GC-3000XT (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	**Transmission rate**	2	**[80 ms]** 80 to 400 ms	The transmission rate defines the refresh rate (time) of the UDP load share and control messages. The entry is done in 80ms steps (80, 160, 240, 320, 400). **Note:** This setting must be the same for all members.

ID	Parameter	CL	Setting range [Default]	Description
				Refer to ⮑ "7.4 Load Sharing" for more information.
7489	**Timeout cycles**	2	**[5]** 2 to 10	The device monitors the UDP messages it receives. Here you can set how many UDP messages may be lost one after the other from a taught-in partner before this participant is marked with "Unit not recognized". The timeout time is calculated as follows: "Timeout cycles" (ID7489) multiplied with "Transmission rate" (ID 7488). **Note:** This setting must be the same in all members. Refer to ⮑ "7.4 Load Sharing" for more information.
7497	**Timeout cycles data**	2	**[12]** 0 to 30	The device monitors the received UDP messages and invalidates the data from lost members. If a taught-in participant is marked as not recognized, you can set here how many more UDP messages may be lost consecutively from this partner before his data is declared invalid. With declaring the data of any taught-in member invalid, the alarm "Missing member" will be issued. The resulting timeout time for declaring data as invalid is calculated as follows: "[Timeout cycles" (ID 7489) + "Timeout cycles data"(ID7497)] multiplied with "Transmission rate"(ID 7488). **Note:** This setting must be the same in all members. Refer to ⮑ "7.4 Load Sharing" for more information.
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.

4.6.2.1 General notes “Network address”

A network address is basically calcutated of an IP address and a subnet mask. The network address is the result of a binary AND connection of the IP address and the subnet mask:

Example network address calculation		
	decimal	**binary**
IP address	192.168.002.001	11000000 10101000 00000010 00000001
Subnet mask	255.255.255.224	11111111 11111111 11111111 11100000
Network address = IP address AND Subnet mask	192.168.002.000	11000000 10101000 00000010 00000000

The device (host) part is the individual part of the network address for a dedicated device. The device part is the result of the binary AND connection of the IP address and the inverted subnet mask:

Example device part (host) calculation		
	decimal	**binary**
IP address	192.168.002.001	11000000 10101000 00000010 00000001
Subnet mask	255.255.255.224	11111111 11111111 11111111 11100000
Subnet mask inverted		00000000 00000000 00000000 00011111
Device part = IP address AND Subnet mask inverted	000.000.000.001	00000000 00000000 00000000 00000001

Note: Because the device has 3 Ethernet ports (A , B and C) it is important to make sure that the network addresses of all ports are different!

Note: Network address check

There is a plausibility check between Ethernet A, B and C to ensure that all three networks uses different network addresses. The plausibility check uses the actual network address (IP address with the related subnet mask) for the compare.

In case that not all ethernet ports uses different networks the alarm "Eth. configuration" with alarm class B and the LM flag "08.54 Eth. configuration" are active. (This alarm is self-acknowledging.)

Note: IP address range *224.0.0.0 to 239.255.255.255*

This address range is restricted for specific use (multicast class D addresses) and not usable for the Ethernet IP configuration from network A, B and C.

IP addresses starting from 224.0.0.0 are blocked by the system and can´t be entered.

Bad example (there is a conflict between Ethernet A and Ethernet B because of the same resulting network address)

- Ethernet A:

IP address: 192.168.074.070

Subnet mask: 255.255.255.000

Resulting network address: 192.168.074.000

- Ethernet B:

IP address: 192.168.074.071

Subnet mask: 255.255.255.000

Resulting network address: 192.168.074.000

- Ethernet C:

IP address: 192.168.073.071

Subnet mask: 255.255.255.000

Resulting network address: 192.168.073.000

Good example (there is no conflict between Ethernet A, B and C because all have different network address)

- Ethernet A:

IP address: 192.168.075.070

Subnet mask: 255.255.255.000

Resulting network address: 192.168.075.000

- Ethernet B:

IP address: 192.168.074.071

Subnet mask: 255.255.255.000

Resulting network address: 192.168.074.000

- Ethernet C:

IP address: 192.168.073.071

Subnet mask: 255.255.255.000

Resulting network address: 192.168.073.000

4.6.2.2 Ethernet Network A

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 GC-3000XT 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

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 a GC-3000XT 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 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.
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

4.6.2.3 Ethernet Network B

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 GC-3000XT 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 ToolKit as decimal values.

ID	Parameter	CL	Setting range [Default]	Description
5430 5431 5432 5433	**IP address**	2	[192, 168, 0, 1]	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, 255, 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.

4.6.2.4 Ethernet Network C

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 GC-3000XT 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 ToolKit as decimal values.

ID	Parameter	CL	Setting range [Default]	Description
7418 7419 7420 7421	**IP address**	2	[192, 168, 1, 1]	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, 255, 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.

4.6.2.5 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 GC-3000XT can be configured as a SNTP client. The GC-3000XT 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 GC-3000XT requests time and date information from an external SNTP server, marked with an own IP address.

- **Load sharing mode**

  The GC-3000XT 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 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 6000s	Set the time rate of the SNTP-Server request.
7785	**Timeout**	2	**[60s]** 30 to 600s	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 sharing	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 sharing:** 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.

4.6.2.6 Ethernet Interconnectivity

General notes

The GC offers the possibility to send and receive data via the Ethernet communication bus independent on load share and control messages. Therefore the customer can configure with the PC Tool InterConnectMapper textual control files to be place in the according GC. In the simplest application there is placed a sent control file into the sending GC and a receive control file into the receiving GC. The protocol for sending/ receiving this data contains individually created UDP messages and is independent of the load share protocol.

The GC must be configured separately for Layer 1 and Layer 3. Therefore two control files must be created with the InterConnectMapper and the Ethernet interface for Layer 1 and Layer 3 has to be configured accordingly.

If the GC shall only send/receive data in Layer 3, the control file for Layer 1 is not needed.

If the GC shall only send/receive data in Layer 1, the control file for Layer 3 is not needed.

The data pool for this feature are LogicsManager Command variables, AnalogManager variables, data addressed by indices and constants. The refresh rate of these UDP messages is configurable.

The interconnectivity function can be provided with redundancy as long the Ethernet B/C bus is taken as communication medium.

Up to 127 devices can be in one system. Each device can be configured to send an own send telegram. Each device can be configured to listen to up to 126 other devices.

The full send telegram of each device can have up to 246 bytes data.

For typical use cases for this type of communication refer to ⮱ "6.6 Ethernet Interconnectivity".

Configuration

Woodward offers a PC software named InterconnectMapper Tool to configure the Interconnectivity Function.

The InterconnectMapper is a PC Tool to configure a device to send freely definable UDP telegrams with freely mapped data on it and also to configure devices to listen to these telegrams and extract data from it. The InterConnectMapper software can be installed separately from other Woodward software. Please check proper licensing procedures with your Woodward service.

For more information, please refer to application chapter ⮱ "6.6 Ethernet Interconnectivity".

The InterconnectMapper PC software includes a Help file for more details.

ID	Parameter	CL	Setting range [Default]	Description
7487	**Interconnectivity**	2	**[Off]**	The Interconnectivity function is disabled and no according data is sent or receipt.
			Ethernet A	The Interconnectivity function send and receives data according to the control files via Ethernet A.

ID	Parameter	CL	Setting range [Default]	Description
7498	**Interconnectivity Layer3**	2	**[Off]**	The Interconnectivity function is disabled and no according data is sent or receipt.
			LS interface	The Interconnectivity function send and receives data according to the control

ID	Parameter	CL	Setting range [Default]	Description
				files via the configured load share interface. (Refer to ⮱▷ 9924.) **Note:** Load share interface CAN is not working with Interconnectivity!
			Ethernet B	The Interconnectivity function send and receives data according to the control files via Ethernet B.
			Ethernet C	The Interconnectivity function send and receives data according to the control files via Ethernet C. **Note:**If Ethernet C only is selected the device is not compatible with the Ethernet C messages from another device which is set to Ethernet B/C.

4.6.3 Modbus Protocol

Modbus Protocol

Data Format(s)

Modbus registers are read and written according to the Modbus standard as Big-endian.

ID	Parameter	CL	Setting range [Default]	Description
3184	**Modbus protocol number**	2	**[5023]**	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" PC software to create your own Data Telegrams (refer to ⮱▷ "6.9.4.1 Introduction" Modbus Telegram Mapper(Customer Written Data Protocols)). Notes Another protocol can be used after a reboot of the control: Change Modbus protocol number first, then reboot!
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.

ID	Parameter	CL	Setting range [Default]	Description
			Off	The Modbus message is not checked.
3181	**Power [kW] exponent 10^x**	2	2 to 5 **[3]**	This setting adjusts the format of the 16 bit power values in the data telegram. Refer to "Power measurement example" 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. Refer to "Voltage measurement example" 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 (Prepared for future.)
3219	**Modbus master**	2	**[Off]**	The Modbus master function is disabled and no Modbus master requests are sent.
			On	The Modbus master function is requesting data according to the control file. **Note** Take care that a modbus master control file is already load into the device. For details refer to chapter "6.9.5 Modbus master").
10455	**Reboot the device**	2	**[No]** Yes	Yes: Shows Parameter 10417 which finally can initiates a reboot.
				Notes Some parameters require a reboot to take effect.
10419	**REBOOT**	2	**[No]** Yes	This Parameter is only shown if Parameter 10455 is set to Yes first. Yes: Reboot will be initiated.
				Notes Some parameters require a reboot to take effect.

Power measurement example

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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 32: 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 value 3182	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 33: Voltage measurement example

4.6.4 Remote Control

To remotely control individually functions in the GC-3000XT the device offers 16 LogicsManager command variables, which can be influenced by communication interface.

Please find remote control parameter 505 described at: ⮑ "Remote control word".

This can be done in different ways:

Remote control 505

- Writing an 16 bit integer onto the database index 505.
- Writing single binary orders onto 16 particular indices ID556 up to ID541.
- Receiving an 16 Bit integer as RPDO.

Remote control 505 and 506

- Writing an 8 bit integer onto the database index 505 and another 8 bit integer onto database index 506.
- Writing single binary orders onto 16 particular indices ID556 up to ID541.
- Receiving an 8 Bit integer as RPDOx (Flag 1 up to 8) and receiving another 8 Bit integer as RPDOy (Flag 9 up to 16).

ID	Parameter	CL	Setting range [Default]	Description
3160	**Remote control ID 505**	2	**[16 Bit]**	The remote control format is 16 bit and all bits from the **ID 505** are used for the remote control (LogicsManager command variables 1-16).
			8 Bit	The remote control format is 8 bit and the **ID 505** uses only the lower byte (bit 1-8) for the remote control (LogicsManager command variables 1-8) and the **ID 506** with lower byte (bit 1-8) is used for the remote control (LogicsManager command variables 9-16).

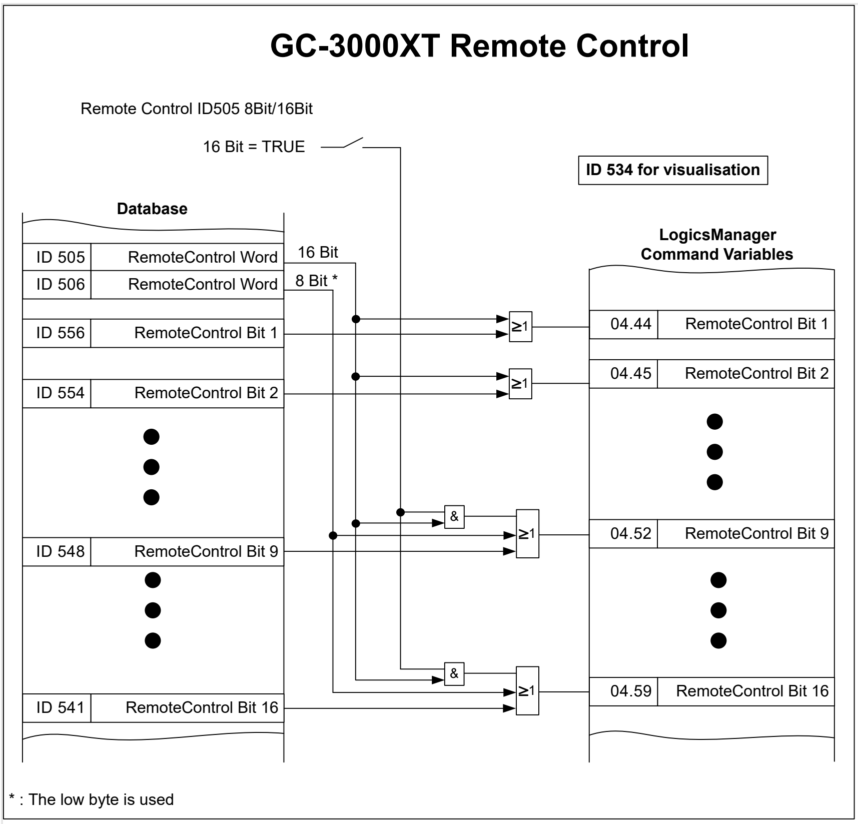


Fig. 74: Remote Control

4.7 Configure LogicsManager

Logical symbols

> Refer to "9.4.1 LogicsManager Overview"for an introduction how a LogicsManager works.

Internal flags

Internal flags within the LogicsManager logical outputs may be programmed and used for multiple functions.

ID	Parameter	CL	Setting range [Default]	Description
{yyyyy}	**Flag {x}**	2	Determined by LogicsManager {XX.XX} **[(02.01 & 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. For the corresponding IDs refer to Table 34, Table 35, Table 36 and Table 37. **Notes**

ID	Parameter	CL	Setting range [Default]	Description
				{XX.XX} is a placeholder for the LogicsManager group number {yyyyy} is a placeholder for the LogicsManager Parameter ID {nnnnn} is a placeholder for the parameter ID of the logical output of the LogicsManager equation

Flag {x}	Flag 1	Flag 2	Flag 3	Flag 4	Flag 5	Flag 6	Flag 7	Flag 8
Group number {XX.XX}	96.01	96.02	96.03	96.04	96.05	96.06	96.07	96.08
Parameter ID {yyyyy}	12230	12240	12250	12260	12270	12280	12290	12300
Result ID {nnnnn}	10700	10701	10702	10702	10704	10705	10706	10707

Table 34: Flag parameter IDs (1 to 8)

Flag {x}	Flag 9	Flag 10	Flag 11	Flag 12	Flag 13	Flag 14	Flag 15	Flag 16
Group number {XX.XX}	96.09	96.10	96.11	96.12	96.13	96.14	96.15	96.16
Parameter ID {yyyyy}	12910	12911	12912	12913	12914	12915	12916	12917
Result ID {nnnnn}	11609	11610	11611	11612	11613	11614	11615	11616

Table 35: Flag parameter IDs (9 to 16)

Flag {x}	Flag 17	Flag 18	Flag 19	Flag 20	Flag 21	Flag 22	Flag 23	Flag 24
Group number {XX.XX}	96.17	96.18	96.19	96.20	96.21	96.22	96.23	96.24
Parameter ID {yyyyy}	12231	12233	12235	12237	12241	12243	12245	12247
Result ID {nnnnn}	12232	12234	12236	12238	12242	12244	12246	12248

Table 36: Flag parameter IDs (17 to 24)

Flag {x}	Flag 25	Flag 26	Flag 27	Flag 28	Flag 29	Flag 30	Flag 31	Flag 32
Group number {XX.XX}	96.25	96.26	96.27	96.28	96.29	96.30	96.31	96.32
Parameter ID {yyyyy}	12251	12253	12255	12257	12261	12263	12265	12267

Flag {x}	Flag 25	Flag 26	Flag 27	Flag 28	Flag 29	Flag 30	Flag 31	Flag 32
Result ID {nnnnn}	12252	12254	12256	12258	12262	12264	12266	12268

Table 37: Flag parameter IDs (25 to 32)

For conditions and explanation of programming please refer to ⮱ "9.4.1 LogicsManager Overview".

GC flags

Each GC has six special Layer 3 flags ("GC command 1" to "GC command 6") which can be defined via LogicsManager. They are transmitted via the load share interface. These flags are received by other Layer 3 devices (GC-3000XT and LS-6XT) as command variables 51.01 to 51.06 (ored) and 52.01 to 52.96 (single). All these flags can be used as inputs for the LogicsManager.

The command parameters are listed as one entry in the parameter table below. For the parameter IDs of each individual command parameter refer to ⮱ "9.4.2 Logical Command Variables"

ID	Parameter	CL	Setting range **[Default]**	Description
{yyyyy}	**GC command {x}**	2	Determined by LogicsManager **[(02.01 & 1) & 1]**	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. For the corresponding IDs refer to ⮱ Table 38.
				Notes {XX.XX} is a placeholder for the LogicsManager group number {yyyyy} is a placeholder for the LogicsManager Parameter ID {nnnnn} is a placeholder for the parameter ID of the logical output of the LogicsManager equation

GC command {x}	GC command 1	GC command 2	GC command 3	GC command 4	GC command 5	GC command 6
Group number {XX.XX}	87.90	87.91	87.92	87.93	87.94	87.95
Parameter ID {yyyyy}	12992	12993	12994	12995	12996	12997
Result ID {nnnnn}	11344	11345	11346	11347	11348	11349

Table 38: GC-3400XT-P1 flag parameter IDs

For conditions and explanation of programming please refer to ⮱▷ "9.4.1 LogicsManager Overview".

easYgen flags

Each GC has six special Layer 1 flags ("easYgen command 1" to "easYgen command 6") which can be defined via LogicsManager. They are transmitted via the load share interface. These flags are received by other Layer 1 devices in own group (easYgen-3000XT and LS-6XT) as command variables 28.01 to 28.06 (ored with all send easYgens flags in own group). In LS-6XT devices they are also available as command variables 30.91 to 30.96 (dedicated for easYgen 32 (GC)). All these flags can be used as inputs for the LogicsManager.

The command parameters are listed as one entry in the parameter table below. For the parameter IDs of each individual command parameter refer to ⮱▷ "9.4.2 Logical Command Variables"

ID	Parameter	CL	Setting range [Default]	Description
{yyyyy}	**easYgen command {x}**	2	Determined by LogicsManager **[(02.01 & 1) & 1]**	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. For the corresponding IDs refer to ⮱▷ Table 39.
				Notes {XX.XX} is a placeholder for the LogicsManager group number {yyyyy} is a placeholder for the LogicsManager Parameter ID {nnnnn} is a placeholder for the parameter ID of the logical output of the LogicsManager equation

easYgen command {x}	easYgen command 1	easYgen command 2	easYgen command 3	easYgen command 4	easYgen command 5	easYgen command 6
Group number {XX.XX}	87.23	87.24	87.25	87.26	87.27	87.28
Parameter ID {yyyyy}	12979	12980	12981	12982	12983	12984
Result ID {nnnnn}	11412	11413	11414	11415	11416	11417

Table 39: GC-3400XT-P1 flag parameter IDs

For conditions and explanation of programming please refer to ⮱▷ "9.4.1 LogicsManager Overview".

LEDs

Each GC has eight LED flags ("LED 1" to "LED 8") which can be defined via LogicsManager.

LED (internal) flags (87.51 to 87.58) within the LogicsManager logical outputs may be programmed and used for multiple functions.

> The LED configuration is used in the GC-3000XT to control the LEDs.

> The flag parameters are listed as one entry in the parameter table below. For the parameter IDs of each individual flag parameter refer to ⮑ "9.4.2 Logical Command Variables".

> For conditions and explanation of programming please refer to ⮑ "9.4.1 LogicsManager Overview".

ID	Parameter	CL	Setting range [Default]	Description
{yyyyy}	**LED {x}**	2	Determined by LogicsManager	The flags are used to control the LED states. The default values are defined on the provided paper strip. For the corresponding IDs refer to ⮑ Table 40.

LED {x}	LED 1	LED 2	LED 3	LED 4	LED 5	LED 6	LED 7	LED 8
Parameter ID {yyyyy}	12962	12963	12964	12965	12966	12967	12968	12969

Table 40: LED flag parameter IDs

4.8 Configure AnalogManager

> The examples and pictures in this chapter are only intended to show how the AnalogManager can be used.

4.8.1 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 ⮡ "4.8.2 AnalogManager Constants" for 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.

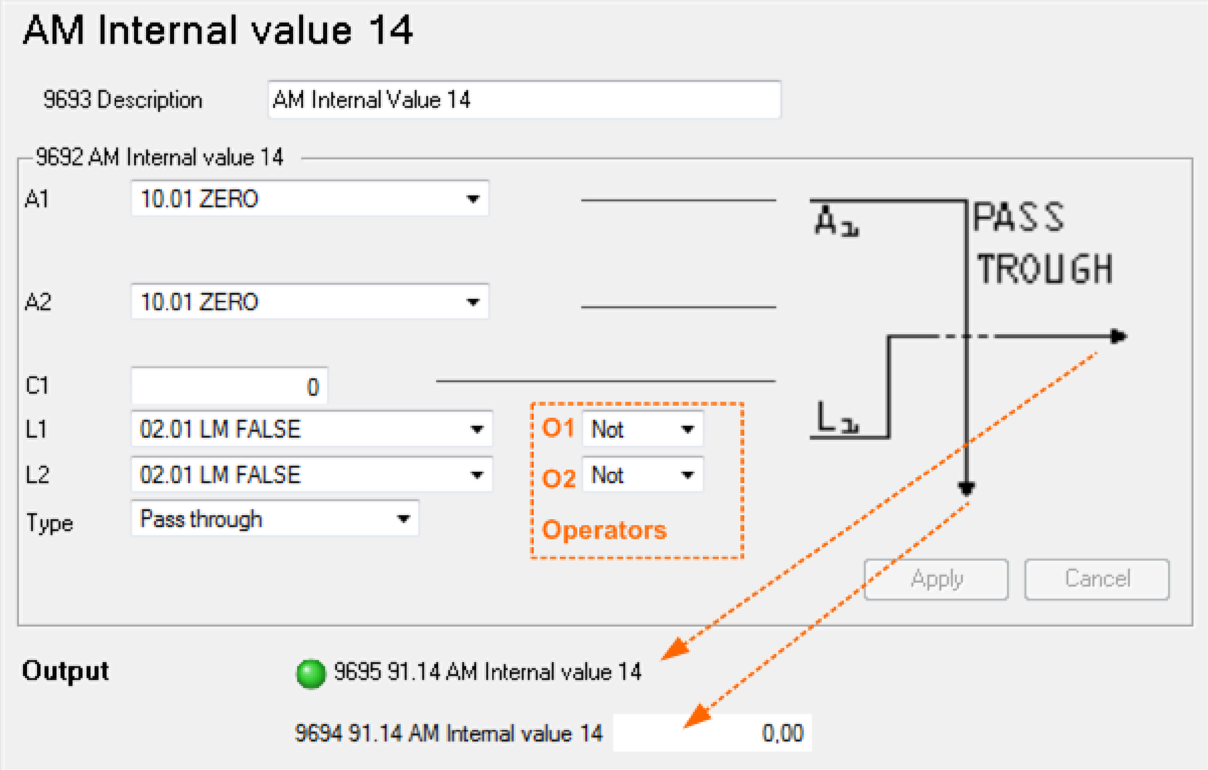


Fig. 75: ToolKit AM14

*) Please be aware that the boolean information passes an operator. So the input for the AnalogManager 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 ToolKit or other (remote) interface **Notes** 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 ToolKit or other (remote) interface
O2	Operator 2 (Operators-Unary 2)	selected via ToolKit or other (remote) interface
Type	AnalogManager type (operation)	selected via ToolKit or other (remote) interface
BR	Boolean result	result/output of the boolean operation **Notes**

Acronym	Name	Value
		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 41: 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 42: 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 “9.5.2 Data Sources AM” for a list of all data sources.
{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.

ID	Parameter	CL	Setting range [Default]	Description
				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}.

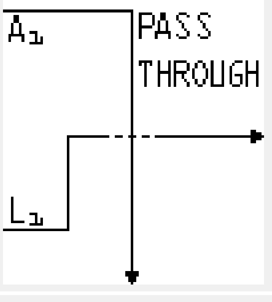
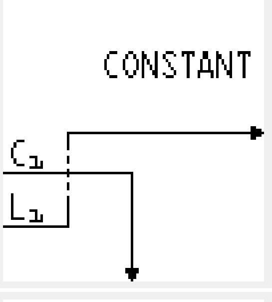
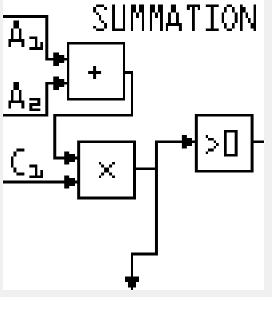
The following AnalogManager operations are available:

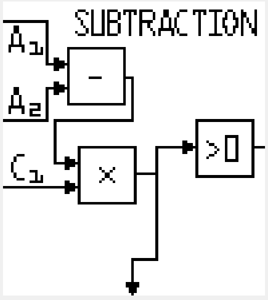
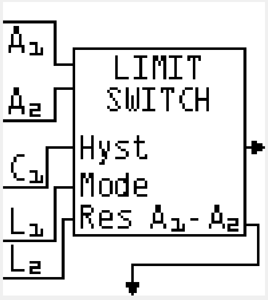
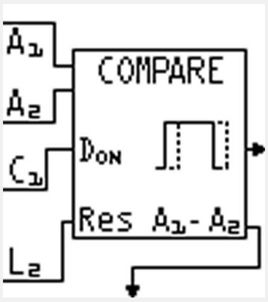
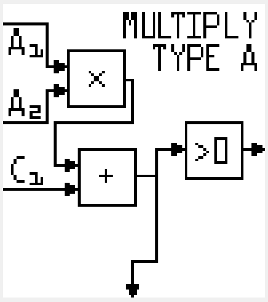
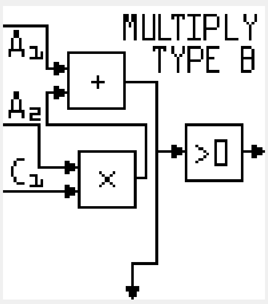
New AnalogManager "Type" selected? Then: ...

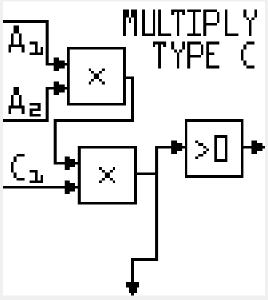
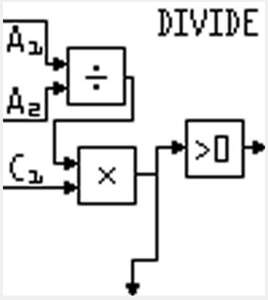
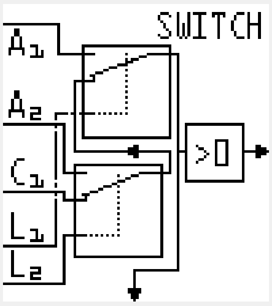
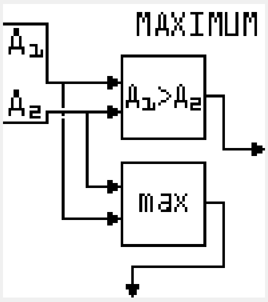
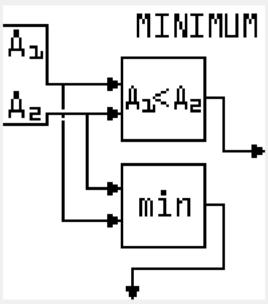
Please be aware that the input values stay "as is" (are NOT changed) if a new Type is selected. Check all input settings A1, A2, C1, L1, L2, O1, O2 before applying!

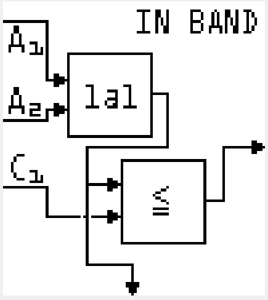
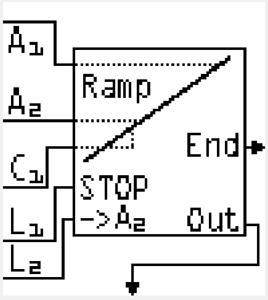
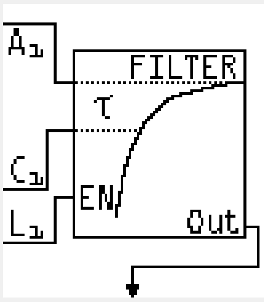
Example:

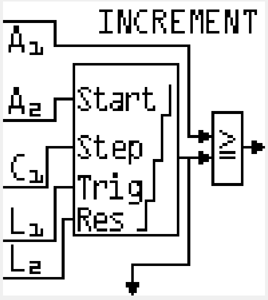
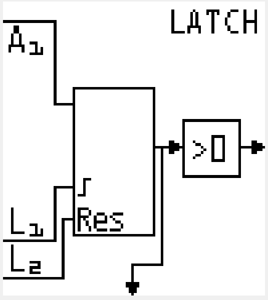
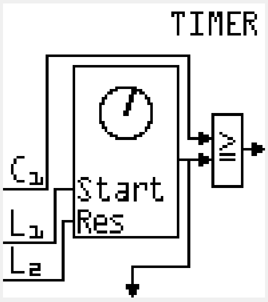
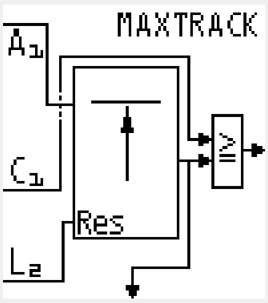
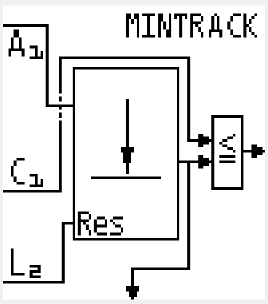
If A2 = 0 and you select Type »Divide«, you would ask the AnalogManager to divide by zero ...

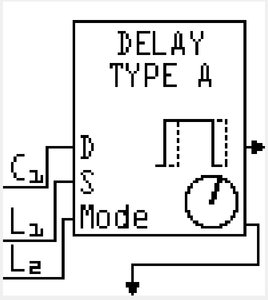
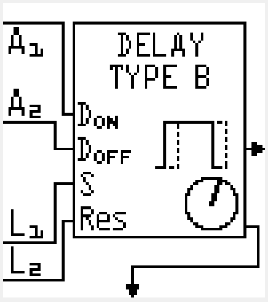
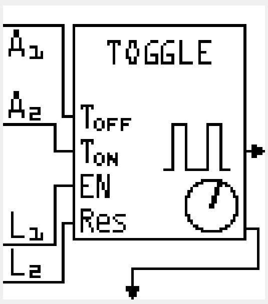
AnalogManager Operation (Type)	Bitmap	Function (Output)
Pass through		Analog Result = A1 Boolean Result = L1
Constant		Analog Result = C1 Boolean Result = L1
Summation		Analog Result = (A1 + A2) * C1 Boolean Result goes TRUE, if Analog Result > 0

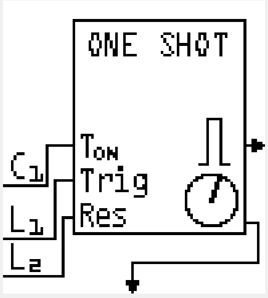
AnalogManager Operation (Type)	Bitmap	Function (Output)
Subtraction		Analog Result = (A1 - A2) * C1 Boolean Result goes TRUE, if Analog Result > 0
Limit Switch		Analog Result = (A1 - A2) **L1 = FALSE -> Overrun mode**: Boolean Result goes TRUE, if A1 > A2 Boolean Result goes FALSE, if A1 <= (A2 - C1) **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 [s], otherwise FALSE C1 = Time Delay to switch on [s] L2 = Reset Time Delay. Absolute value of C1 is taken as time [s] (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

AnalogManager Operation (Type)	Bitmap	Function (Output)
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
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

AnalogManager Operation (Type)	Bitmap	Function (Output)
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 [s] 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 **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)

AnalogManager Operation (Type)	Bitmap	Function (Output)
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 [s] Boolean Result goes TRUE, if Analog Result > = C1 C1 = Timer Compare [s] 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 [s] for Boolean Result to go to TRUE Boolean Result goes TRUE, if L1 = TRUE for at least C1[s] time. **Mode "Delay Off:** Analog Result = Remaining time [s] 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 [s] (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 [s] to switch Boolean Result Boolean Result = TRUE, if L1 was TRUE for at least A1 time [s] Boolean Result = FALSE, if L1 was FALSE for at least A2 time [s] A1 = Delay-On time [s], no negative time allowed A2 = Delay-Off time [s], 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[s] 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.

AnalogManager Operation (Type)	Bitmap	Function (Output)
One Shot		Analog Result = Remaining time to fall back to FALSE [s] Boolean Result = L1 rising edge forces TRUE state for C1 time [s] C1 = Absolute value of C1 is taken as time in [s] (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.

4.8.2 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	15573	15574
Value	15551	15552	15553	15554	15555	15556	15557	15558
AM	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 43: AM Constant IDs (1 to 8)

AM Constant #	9	10	11	12	13	14	15	16
Description	15575	15576	15577	15578	15003	15004	15005	15006
Value	15559	15560	15561	15562	15563	15564	15565	15566
AM	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 44: 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
15567 - 15578, 15003 - 15006	**Description constant {1 -16}**	2	user-defined (up 22 to characters) **[13.yy Free constant {1 - 16}]**	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.
15551 - 15566	**13.yy Free constant {1 - 16}**	2	-21000.00 e3 to 21000.00 e3 **[1]**	Preset value to be used as AM 13.yy.

5 Operation

5.1 Power ON

Behavior during starting GC

The start-up procedure of the GC device can be caused by the following reasons:

- Power ON
- Power cycling e.g. by ⮱▷ 1701» Set factory default values«
- Power is back after voltage drop

This process is visualized by the LEDs »Sync. Enable« and »Operation« ⮱▷ “2.3 Status Indicators (on housing)” .

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 GC 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 GC finished starting.

With power cycle or reboot of the GC the USB connection is lost: Please unplug/plug and/or start USB connection again after the GC finished starting.

... starting

Power ON from zero power

- LEDs are twinkling
- LEDs are illuminated according to the state of the device

Power cycling

- LEDs are twinkling
- LEDs are illuminated according to the state of the device

6 Application Field

6.1 Application Layers

Introduction

For applications with more then 32 easYgens, one or more Group Controllers are needed to bundle up to 31 easYgens in one group. The GC-3000XT handles this group as a big generator group to the load bus bar and shares load across all other groups. Maximum 16 Group Controllers can be supported (16 groups). So that up to 496 generators can be installed.

According to the separating of the easYgens through the Group Controllers, such a system consist of different Layers (Layer 1, 2 and 3), see ⇨ Fig. 76.

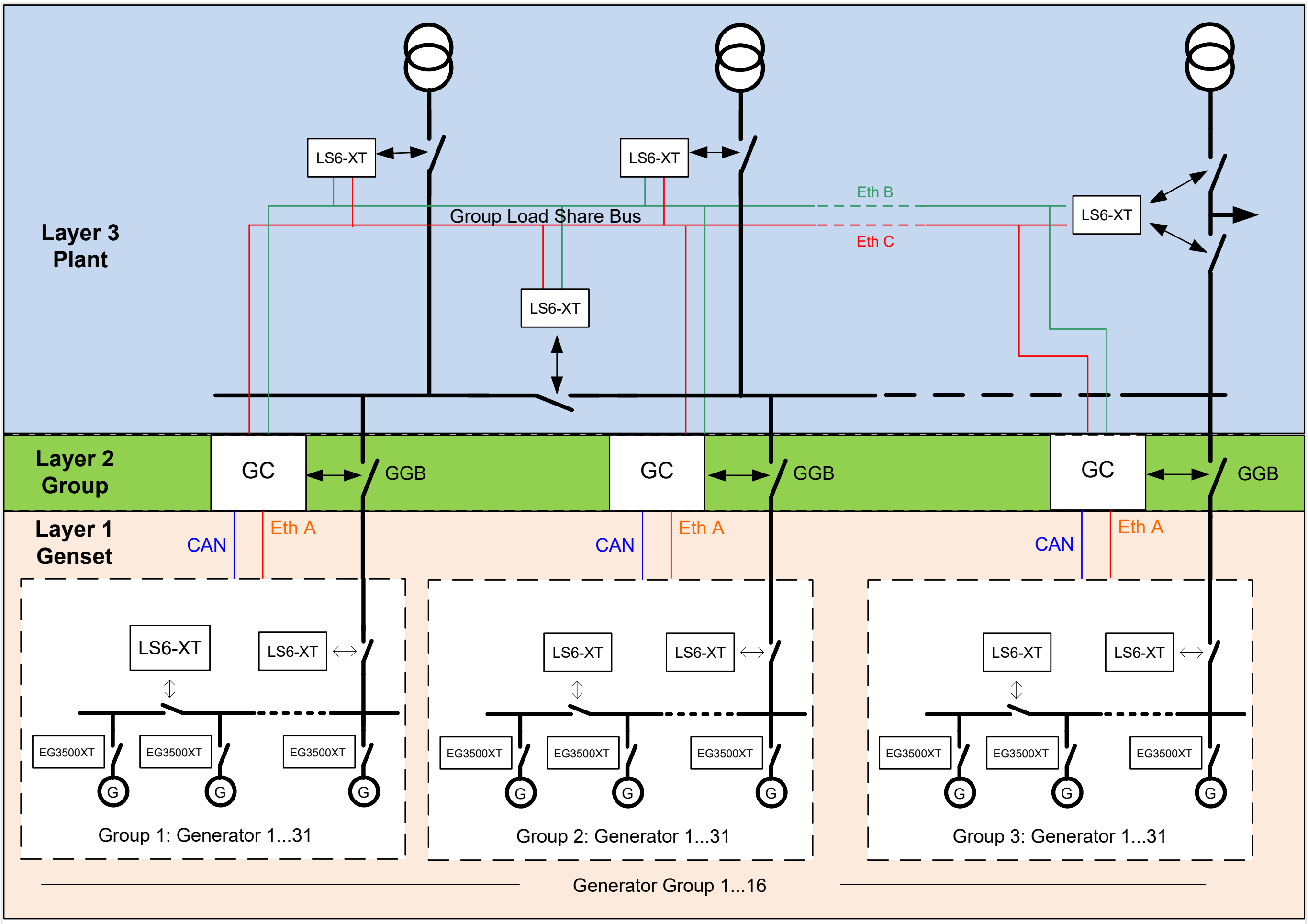


Fig. 76: Example overview layers

Figure ⇨ Fig. 76 shows an example of the three different Layers:

- Layer 1 with the generator groups, easYgens, GCBs and LS-6XT (Genset)
- Layer 2 with the Group Controllers (Group)
- Layer 3 with the load bus bar, mains breaker, tie-breaker and LS-6XT (Plant)

Communication in Layer 1

The GC-3000XT communicates with all easYgens and LS-6XT devices in the same group. The communication (Load share interface, Layer 1) between the Group Controller, LS-6XT and its easYgens can be configured as CAN, Ethernet A or redundant CAN/Ethernet A, according to the Load Share Interface parameter ⮱ 9924. The Group Controller appears in the diagnostic screen as "easYgen (32)' and "LSx (33)".

Communication Layer 2

A Group Controller is displayed in Layer 2 but belongs also to Layer 1 and 3. The Layer 2 shall give a better understanding that between Layer 1 and Layer 3 there is no direct communication. A Group Controller acts as interface device between these layers.

Communication in Layer 3

The GC-3000XT communicates with all Group Controller and LS-6XT devices. The communication (Load share interface, Layer 3) between the Group Controllers and LS-6XT can be configured as Ethernet B, Ethernet C or redundant Ethernet B/C according to the Load Share Interface parameter ⮱ 9929.

6.2 Application Mode GGB/MCB

6.2.1 Breaker Application Examples

6.2.1.1 Initial Setup

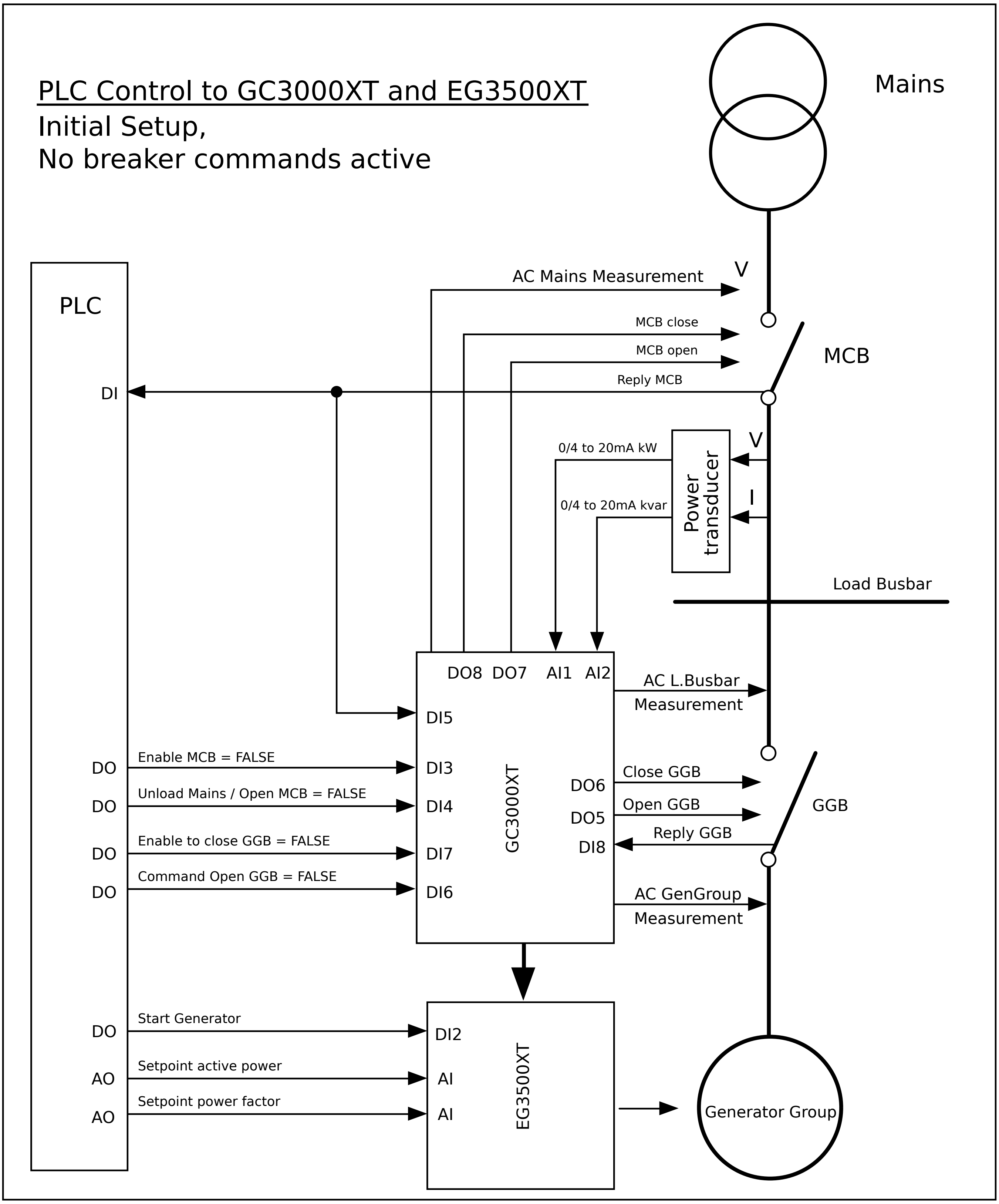


Fig. 77: Initial Setup controlling breaker via the GC-3400XT-P1 in conjunction with a PLC

As long no breaker commands from the PLC are active the GC behaves passive. The breaker feedbacks are accepted and will be passed to the easYgen group in following manner:

With closed GGB and MCB the GC passes the information "Mains linked" to the easYgens. As long nothing special is configured, the easYgen executing an active and reactive power control after closing their MCB.

(The easYgen shows on display, if the mains linkage is detected.

The command "Open GGB" usually coming from the PLC is always directly accepted and will be transformed into a GGB open command.

6.2.1.2 Mains Operation - GGB shall be synchronized

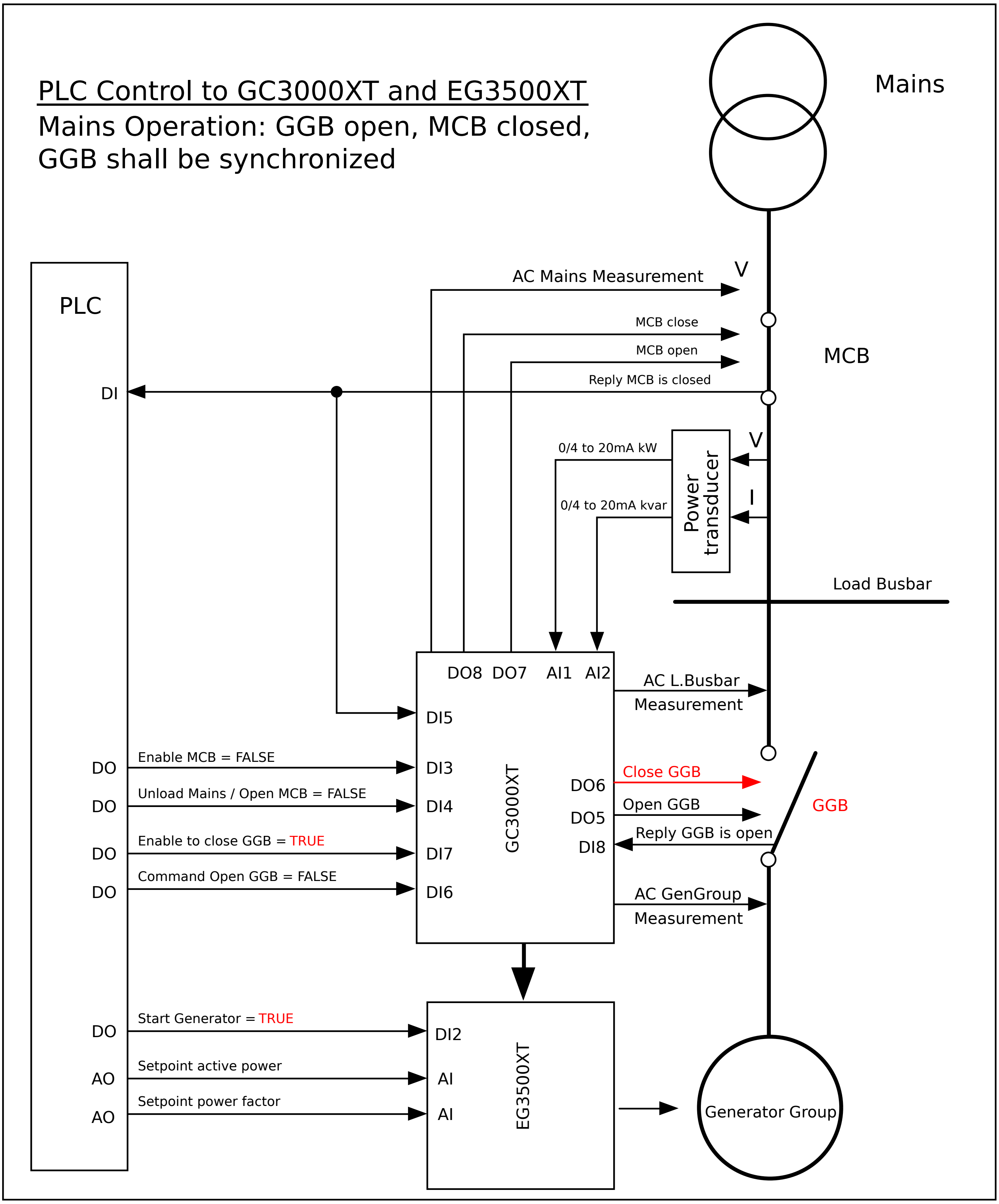


Fig. 78: Synchronization of the GGB initiated by PLC.

In Mains Operation (MCB is closed), when the GGB shall be synchronized, the GC leads its generator group to match the synchronization of the GGB. If all configured conditions are matched, the GC issues a GGB close pulse.

A synchronization can only be maintained, if at least one GCB of the own group is closed. With closed GGB the easYgen(s) switches to active and reactive power control.

6.2.1.3 Island Operation - GGB shall be synchronized

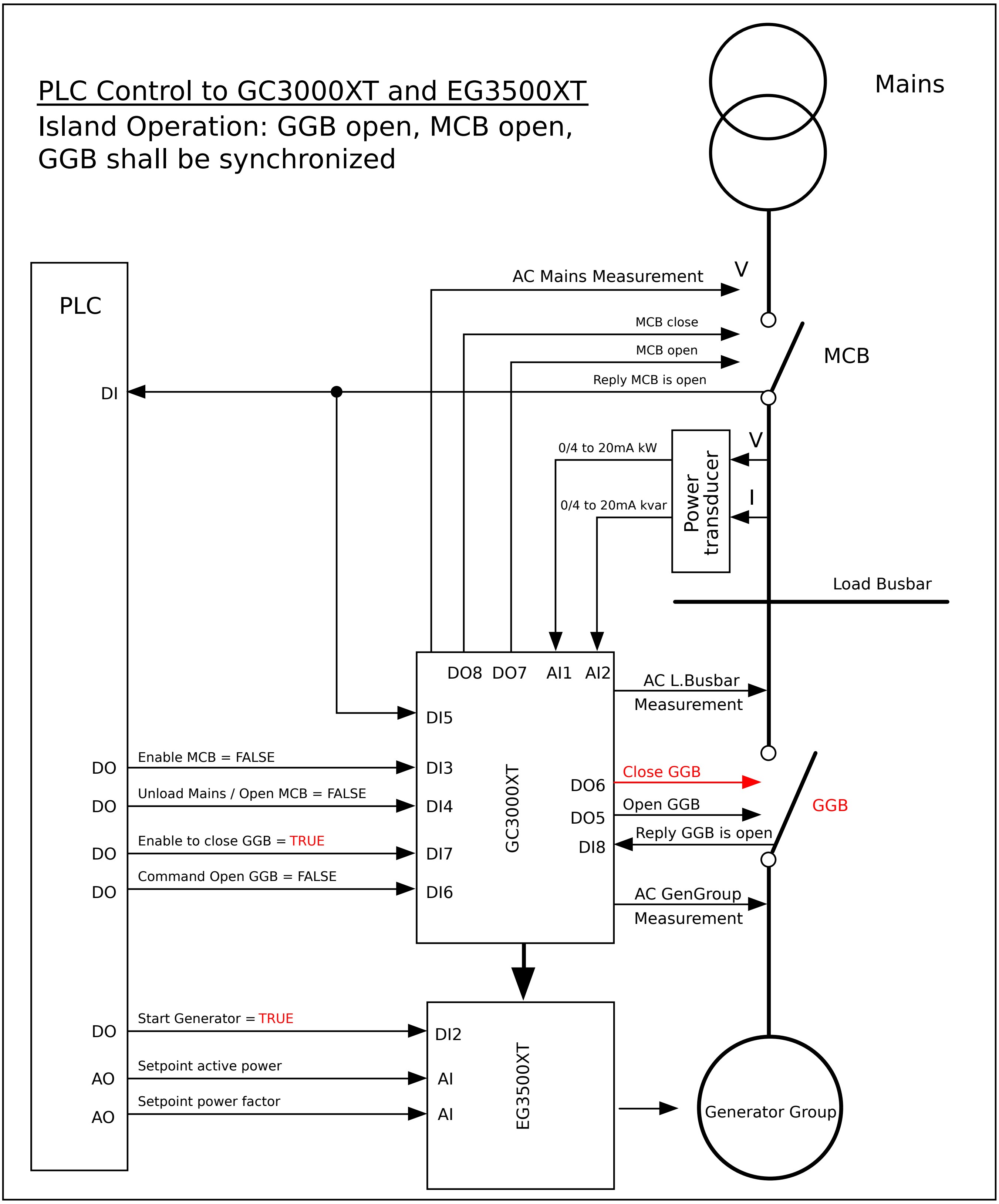


Fig. 79: Synchronization of the GGB initiated by PLC.

In island operation (MCB is open), when the GGB shall be synchronized, the GC leads its generator group to match the synchronization of the GGB. If all configured conditions are matched, the GC issues a GGB close pulse.

A synchronization can only be maintained, if at least one GCB of the own group is closed. With closed GGB the easYgen(s) remain on frequency and voltage control.

6.2.1.4 Island Operation - MCB shall be synchronized

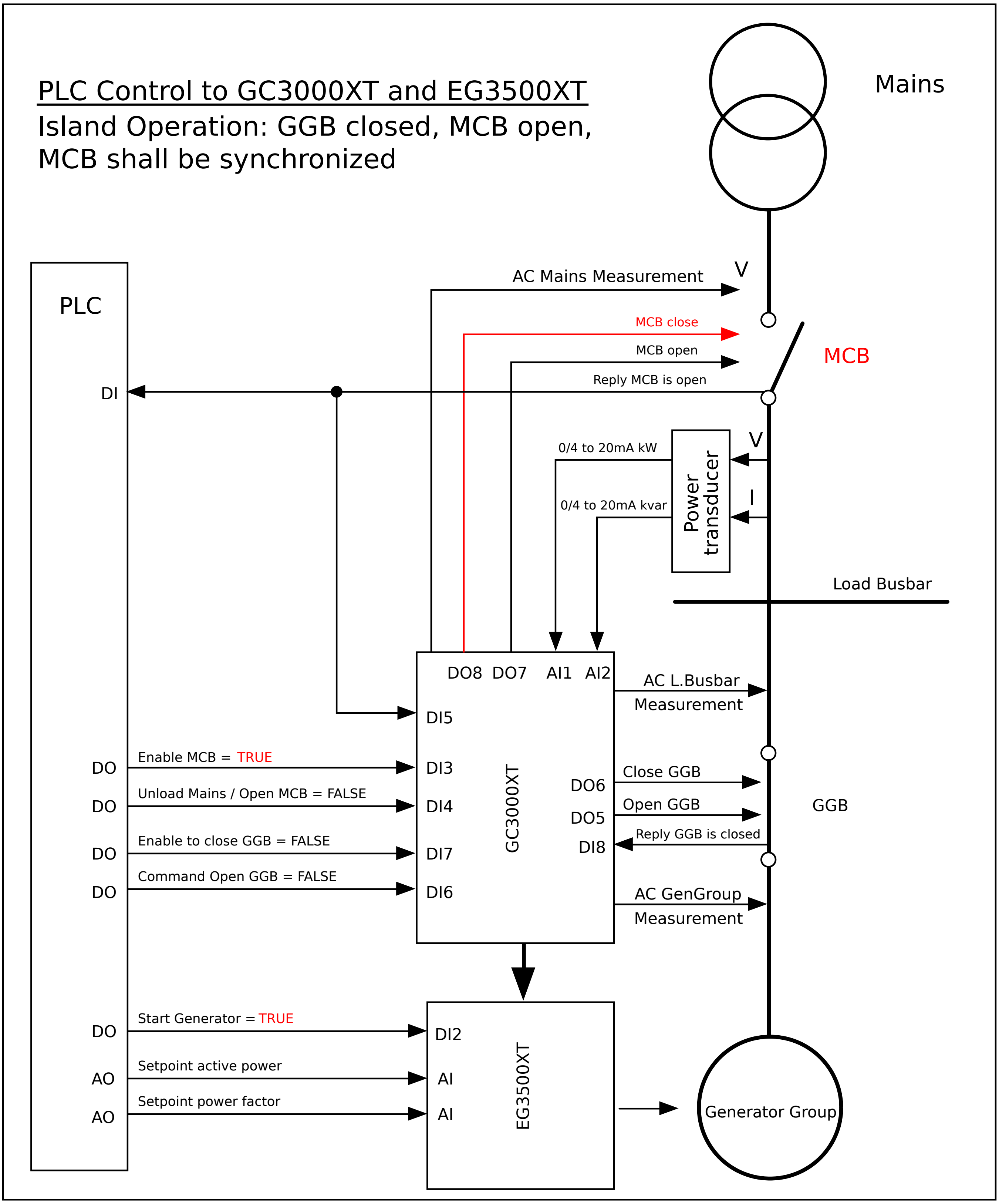


Fig. 80: Synchronization of the MCB initiated by PLC.

In island operation (MCB is open), the own GGB is closed, the GC(s) lead their generator groups to match the synchronization of the GGB. If all configured conditions are matched, the GC issues a MCB close pulse.

A synchronization can only be maintained, if at least one GCB of the own group is closed. With closed MCB the easYgen(s) switches from frequency and voltage control to active and reactive power control.

Note: If segments between GCs are placed refer additionally to chapter "Multiple GC handling with PLC".

6.2.1.5 Mains Operation - Unload Mains / MCB shall be opened

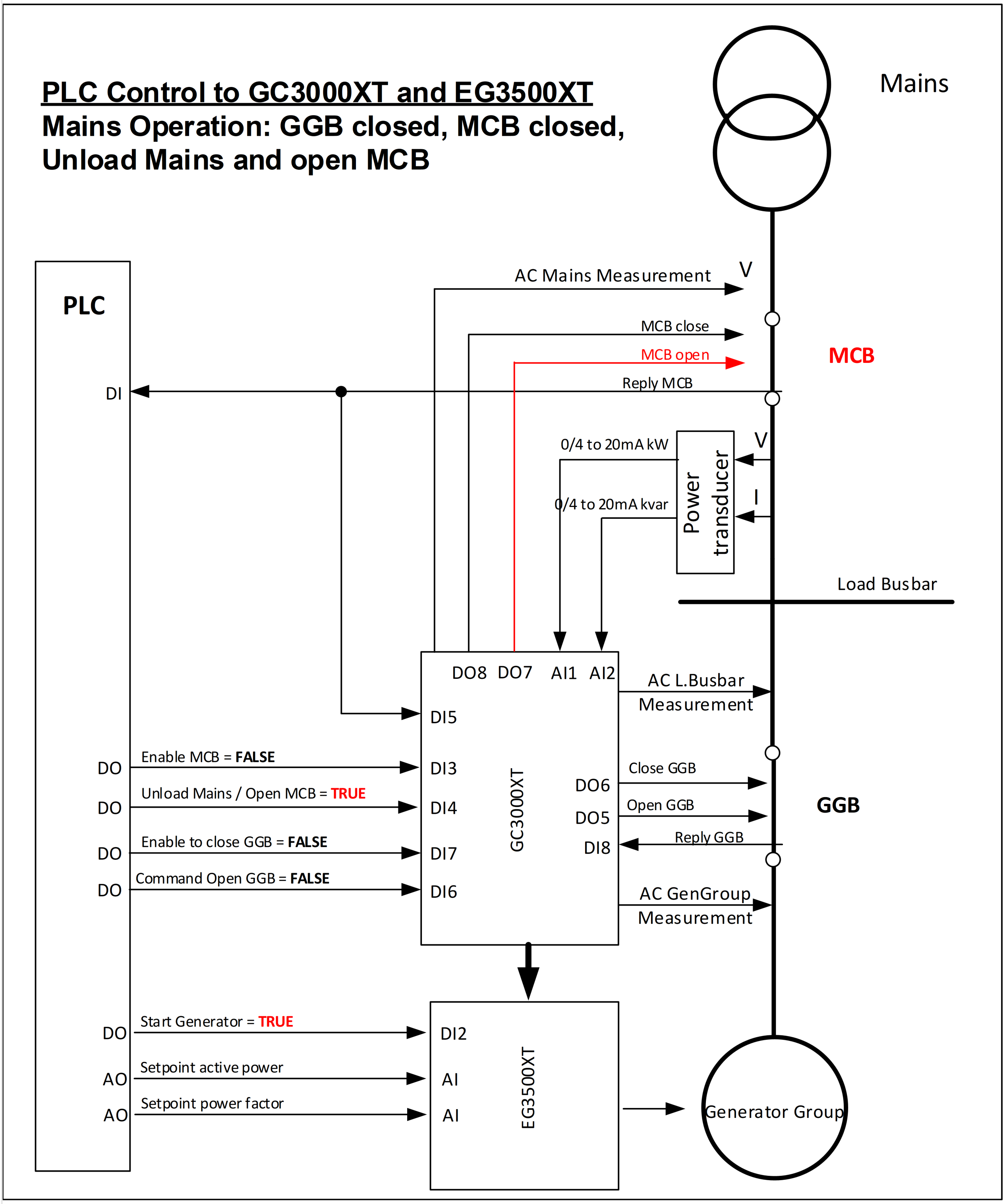


Fig. 81: Synchronization of the MCB initiated by PLC.

There is a situation in which a generator group shall overtake the load from the mains. This can be done by:

1. Starting the needed amount of generator groups to support the island load

2. With the correct amount of generator groups on load busbar the PLC enables the function "Unload Mains / Open MCB" through the DI 4 on the GC.

Then the easYgens with closed GCB executing an Import/Export power control with setpoint 0kW and 0kvar at the interchange point. If the power reaches the power window, the GC(s) issue an open MCB pulse. With open MCB the easYgen(s) continue with frequency and voltage control doing island operation.

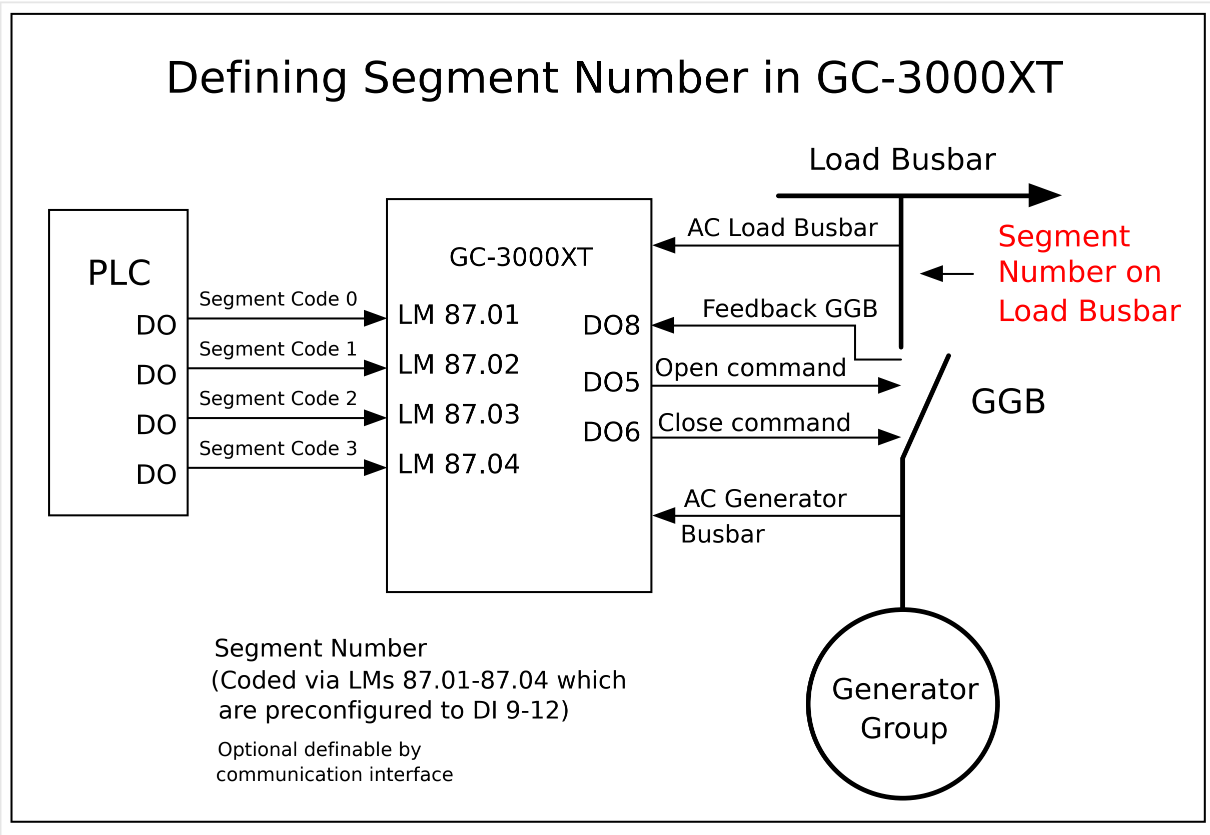
6.2.2 Segment Control

Introduction

segment is defined as a section of the bus, feeder, or interconnection, which cannot electrically be isolated to a smaller section and is connected to a circuit breaker or an isolation switch which is operated or supervised by a GC. A transformer is not to be considered as a segment or a point of isolation. Each segment, feeder, or interconnection must be assigned with a number that is unique to that segment.

Segment Number

Each Group Controller needs the information with which other Group Controllers he is connected if he closes its Group Breaker. This is defined with a segment number information coming from outside. In simple cases it can be created with a tie-breaker feedback or in more complex application it is determined by a PLC.



The Segment number handling defines the Load Busbar Segment.

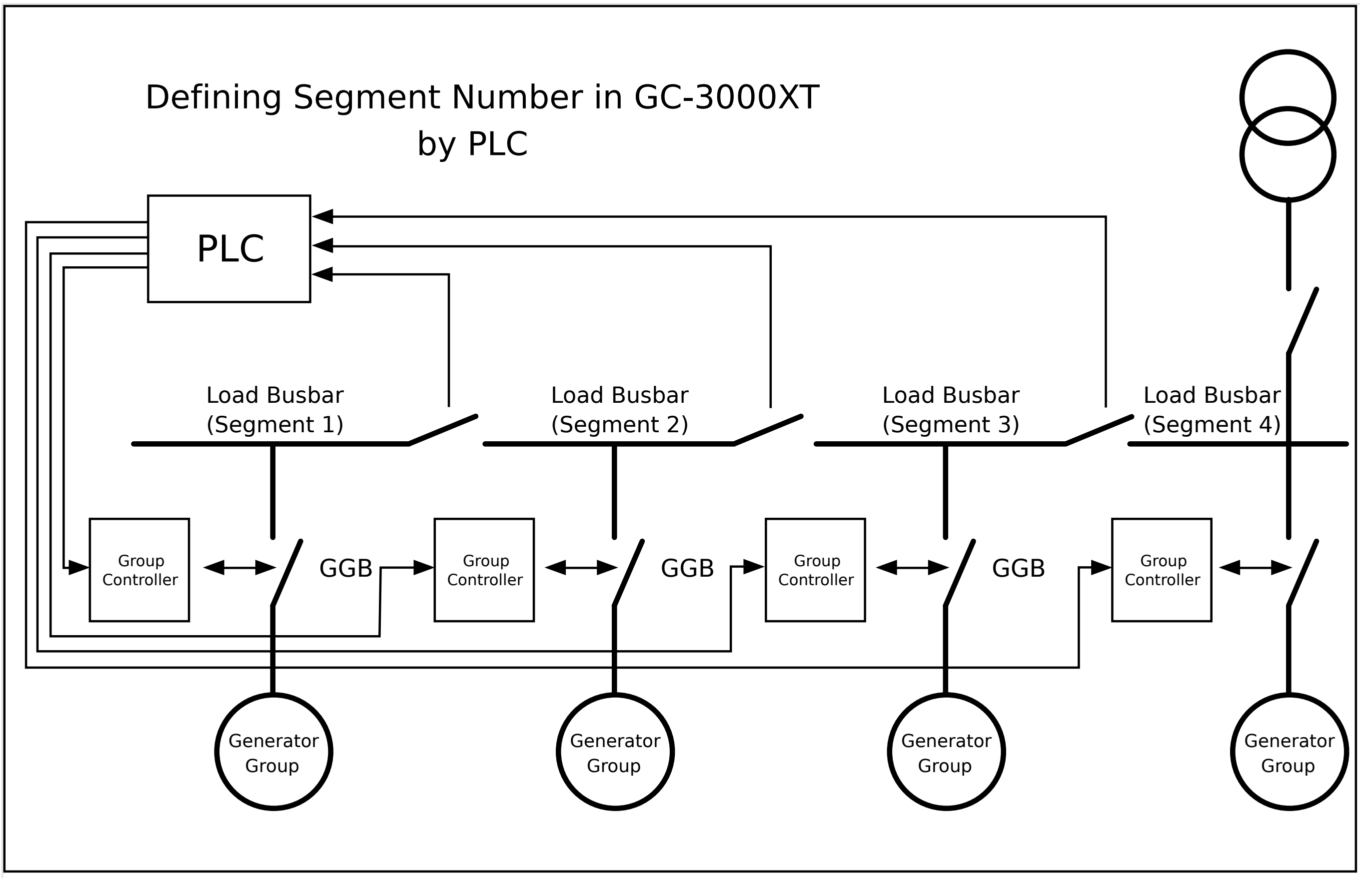
The generator group segment is not splitable into different segments and is therefore always indicated as segment no. 1.

The devices provides a configuration to determine the source of the segment number definition:

- DI
- Parameter
- Communication Interface (Fallback is parameter)

Logic table for segment number:

Segm. code bit 4 preconfigured to DI 12	Segm. code bit 3 preconfigured to DI 11	Segm. code bit 2 preconfigured to DI 10	Segm. code bit 1 preconfigured to DI 9	Segment Number
0	0	0	0	1
0	0	0	1	2
0	0	1	0	3
0	0	1	1	4
0	1	0	0	5
0	1	0	1	6
0	1	1	0	7
0	1	1	1	8
1	0	0	0	9
1	0	0	1	10
1	0	1	0	11
1	0	1	1	12
1	1	0	0	13
1	1	0	1	14
1	1	1	0	15
1	1	1	1	16



Example: The segment number for each Group Controller (Generator Group) is defined by PLC.

6.3 Application Mode GGB/LSx

6.3.1 Breaker Application Example

6.3.1.1 General

In the application mode GGB/LSx the GC device expects at least 1 LSx device in layer 3. So there are one or more LS-6XT devices are installed over tie- and utility breakers. The segmenting is determined by the LSx devices.

In dependence of the complexity of the system a PLC is sending close and open orders to GC and LSx devices. The commands can be executed with hard wired signals or by communication interface.

The LSx devices are able to measure power and serve the GC among other things with mains linkage information and potentially export/import power at the interchange point for the particular segment. The GC gets informed about the condition of each segment through the LSx device. So the GC can initiate an AMF start down to its group.

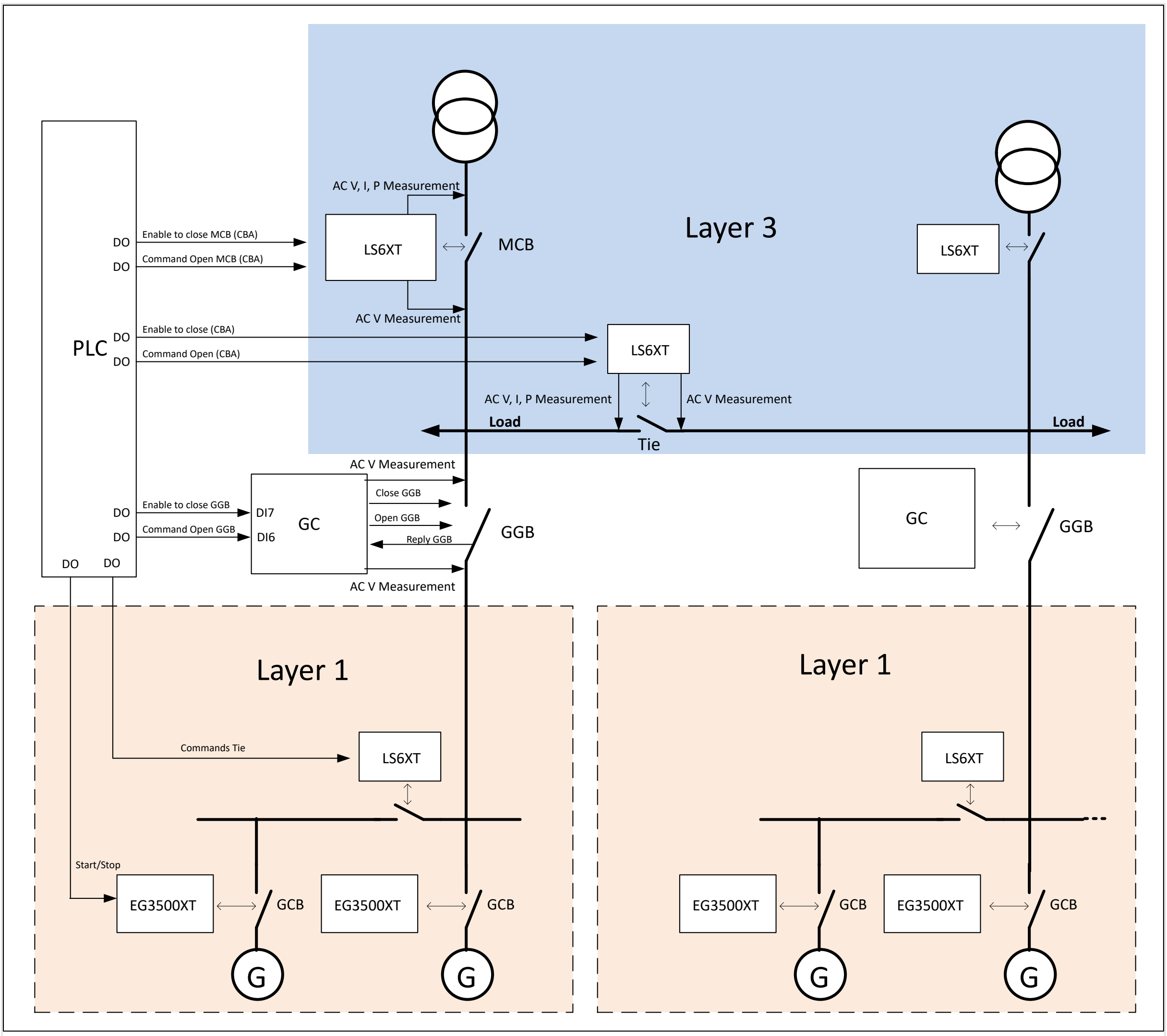


Fig. 82: Initial Setup controlling breaker with the GC-3000XT and LS-6XT in conjunction with a PLC

6.3.1.2 Synchronization GGB

In Mains Operation (MCB is closed) when the GGB shall be synchronized, the PLC starts at first the necessary generator groups and closes the tie-breaker (LS-6XT in Layer 1).

With the "Enable to close GGB" command the GC leads its generator group to match the synchronization of the GGB. If all configured conditions are matched, the GC issues a GGB close pulse.

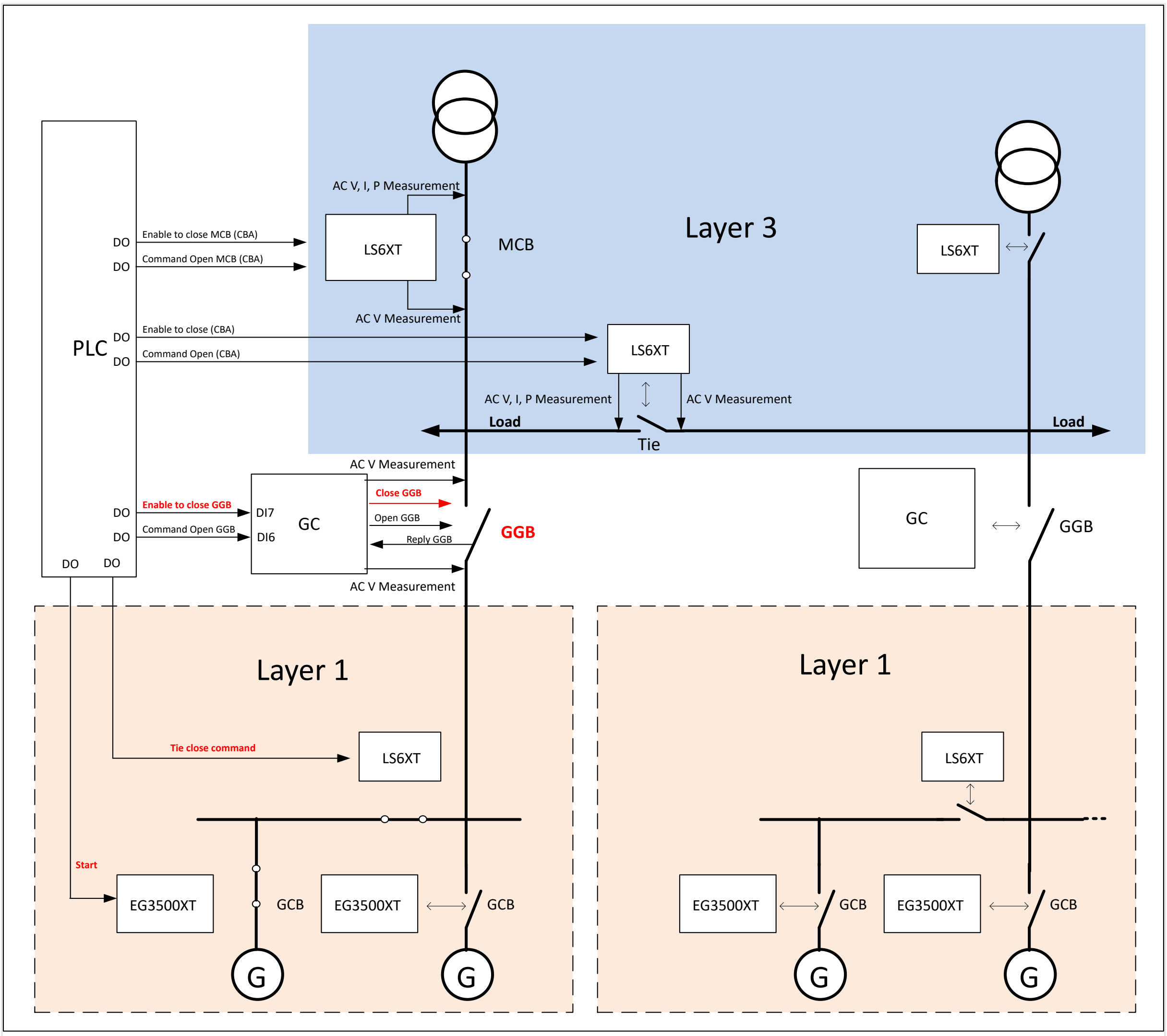


Fig. 83: Synchronization of the "GGB" initiated by PLC.

6.3.1.3 Synchronization LS-6XT (MCB)

In Isolated Operation (MCB is open) when the MCB shall be synchronized, the PLC gives the "Enable to close MCB (CBA)" command to the LS-6XT (Layer 3).

The LS-6XT transfer the closing request together with the reference values (frequency, voltage and phase angle) to the GC-3000XT and the GC leads its generator group to match the synchronization of the MCB.

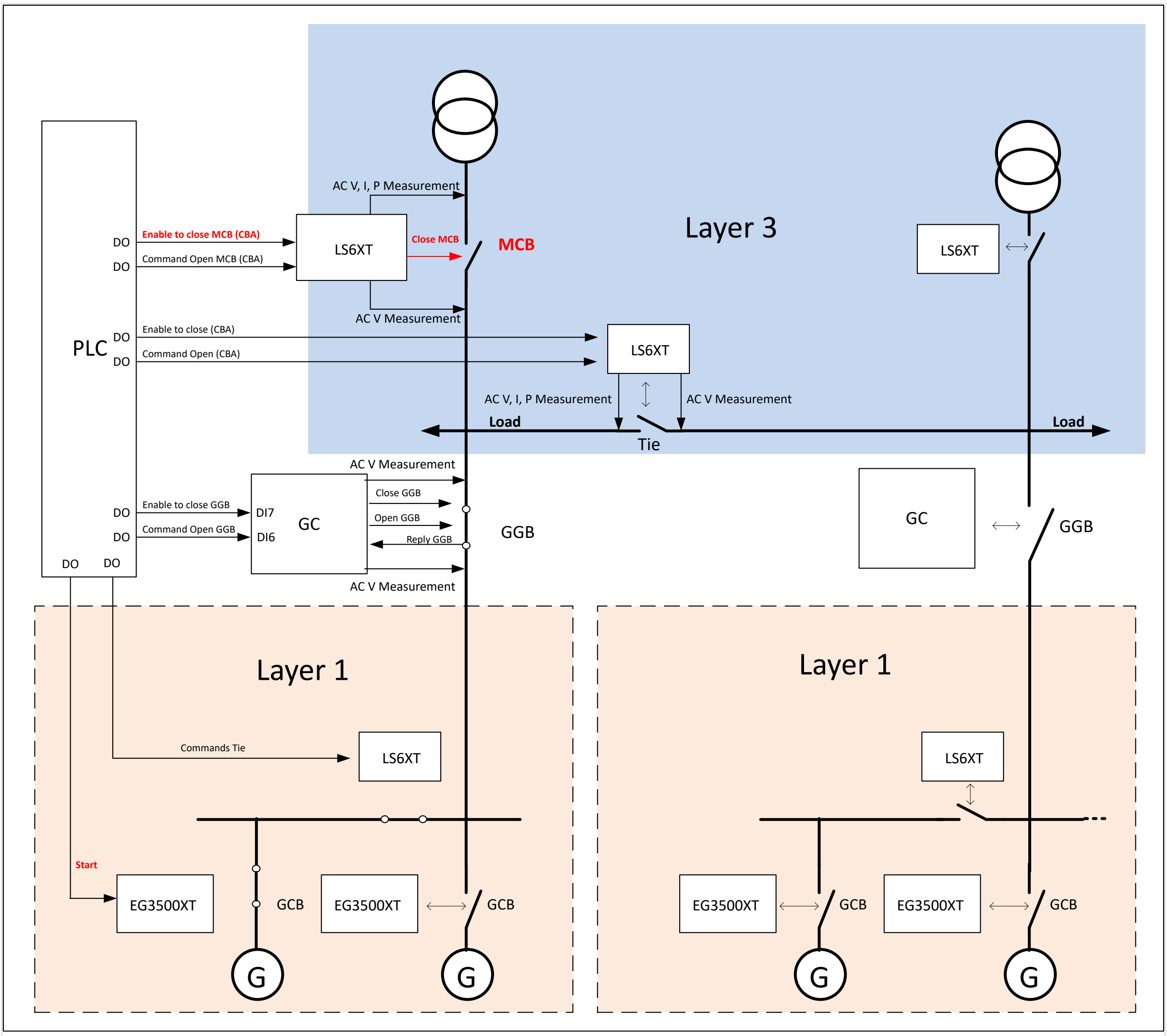


Fig. 84: Synchronization of the "MCB" initiated by PLC.

6.3.1.4 Unloading LS-6XT (Tie Breaker)

When the Tie breaker shall be open with unloading, the PLC gives the "Command open CBA" to the LS-6XT (Layer 3) located at the Tie breaker.

Depending on the variable system configuration the LS-6XT transfer the unloading request together with the measured values (active-/ reactive power) to one of the GC-3000XT and this GC leads its generator group to reduce the power flow across the Tie breaker.

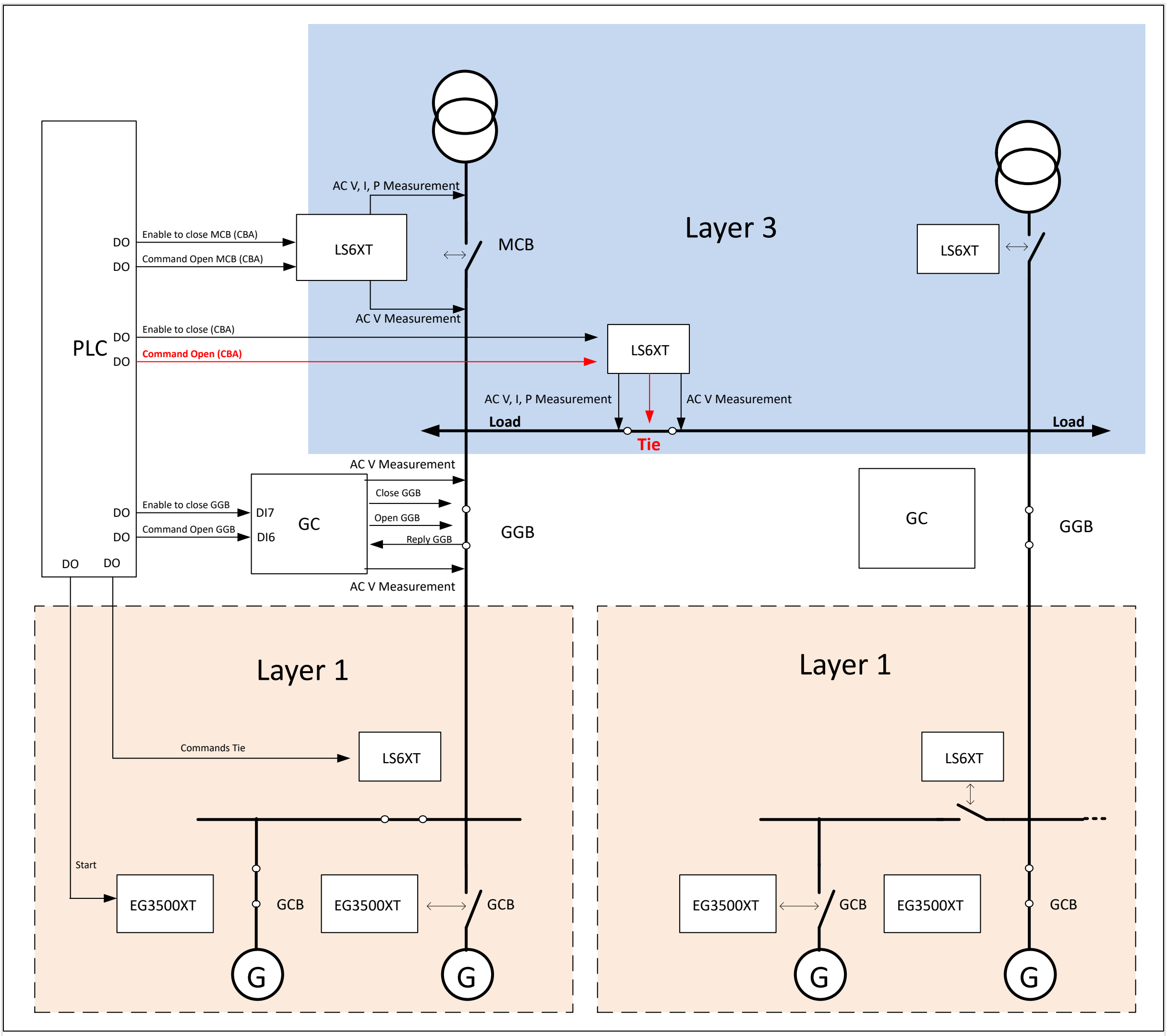


Fig. 85: Unloading of the "Tie Breaker" initiated by PLC.

6.3.2 System Application Example

6.3.2.1 General

The GC device interacts with easYgens and further GCs. It often interacts additionally with LS-6XT devices which are installed over utility and tie-breakers. In rare cases it can be possible that also LS-6XT devices are installed over tie-breaker which are located inside the GC group. The different locations are defined as layers. Refer to chapter “Application Layers” ⮱ “6.1 Application Layers” for better understanding. So in the end a big system must be set up and commissioned.

This chapter shall give more insight in setting up of these systems. It focus on the GCB/LSx mode.

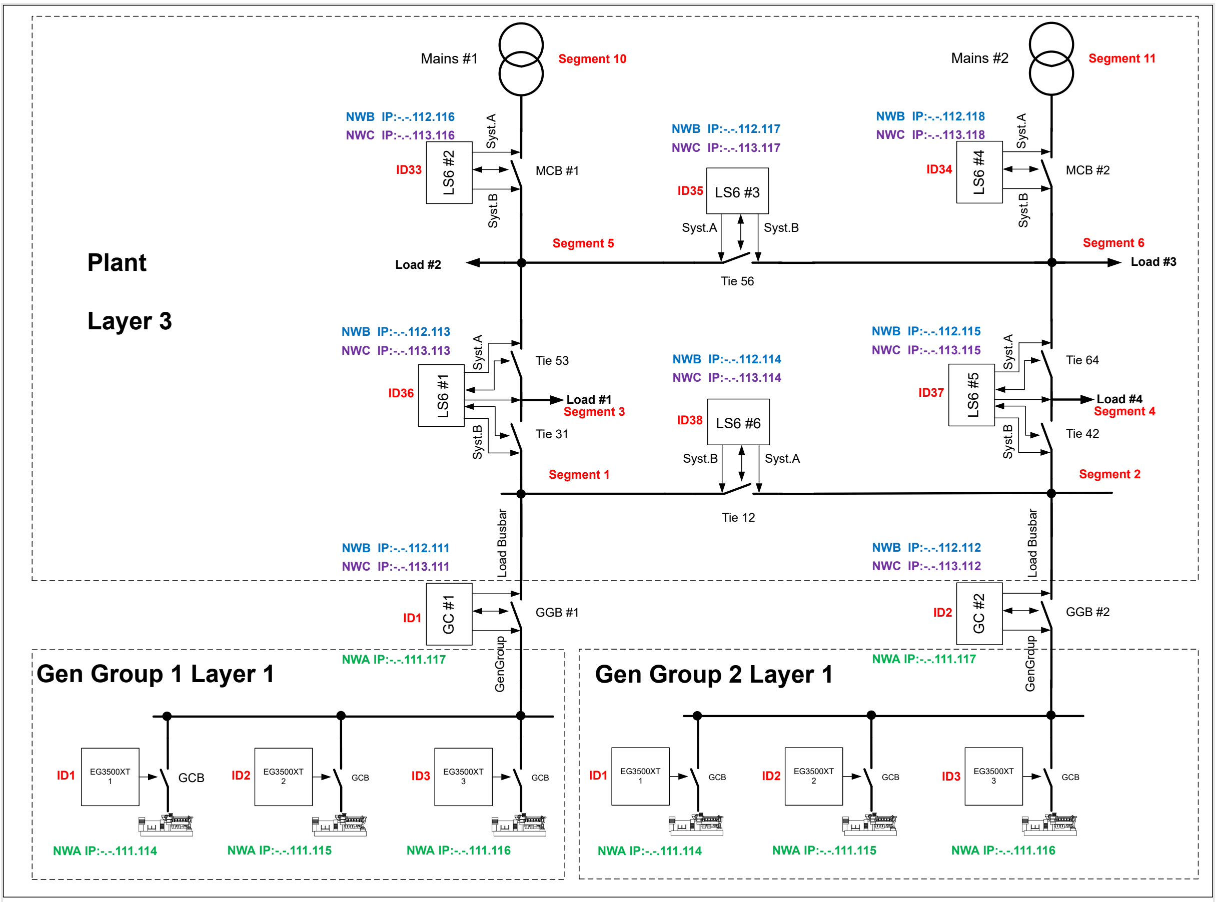


Fig. 86: Drawing of an application with 2 Groups containing 3 Gensets in H-Configuration with 2 utility

6.3.2.2 Network bus and Addresses

Please have in mind some rules when you are select your device communication addresses:

- The load share and communication bus inside the group remains inside the group and cannot be connected with layer 3 devices outside the group or with devices from another group
- The Ethernet load share and communication bus must go onto the same physical port under each other. The CAN bus can be differently so is the easYgen-3400XT/easYgen-3500XT connected with CAN3 and the GC respectively LS-6XT is connected with CAN1
- The CAN bus and the Ethernet A bus are not usable as load share and communication bus on layer 3.

The GC-3000XT has 3 Ethernet ports. These ports are not physically separated. So it is very important that to all times three separate network address are configured. Also in cases when you are only using one port. Refer to chapter ⮡ "4.6.2.1 General notes "Network address"" for more information.

Please refer to chapter ⮡ "4.3.1.2 Configure Load Share Interface" to learn more about the different possibilities to perform the communication interfaces.

6.3.2.3 Maximal number of Devices

- Maximal 31 easYgens and one Group Controller (GC) is allowed per group
- Maximal 16 GCs are allowed
- Maximal 64 LS-6XTs (Layer 3) are allowed

6.3.2.4 Drawing

Make a drawing of your application with all power lines and switchable breakers independent on if they are operated automatically or manually

1. ▷ Draw in the Segment Numbers. Each Segment is defined as smallest undividable power line in the application. The particular numbers on layer 3 must be unique and are free distributable up to the highest number (max.128)

2. ▷ Think about your communication interface strategy. Following concepts are possible:

   Inside the group (Layer 1)

   - The load share and control bus is performed with CAN bus
   - The load share and control bus is performed with Ethernet A bus
   - The load share and control bus is performed redundant with CAN/Ethernet A bus

   Outside the group (Layer 3)

   - The load share and control bus is performed with Ethernet B bus
   - The load share and control bus is performed with Ethernet C bus
   - The load share and control bus is performed redundant with Ethernet B/Ethernet C bus

3. ▷ Enter the IP addresses into your drawing and/or alternatively create an IP address table with device, location (Network address) and IP address.

4. ▷ Enter the Device IDs into the drawing

   - The easYgens inside its group must have unique device numbers (⮡ 1702 'Device number'). The possible IDs are 1 to 31. The device with the smaller ID is usually preferred when a multiple device dead bus closure shall be performed.

   - The GC device number goes from 1 to 16. The device with the smaller ID is usually preferred when a multiple device dead bus closure shall be performed.

   - The LS-6XT device number goes from 33 to 96. The device with the smaller ID is usually preferred when a simultaneously closure with multiple breaker devices shall be performed.

NOTICE!

From there on you will build up your application and wire all communication interfaces according to your interface strategy. Be aware that you will need switches. Latest then you will configure the communication interfaces and the segmenting as a basic set up of your system.

6.3.2.5 Configure Devices

This chapter describes now what is especially to do in the application ⮡ Fig. 86. Generally the most settings should cover similarly applications.

Device Application Modes (and HMI)

All devices supporting different application modes. So they must be adapted under each other. Please check:

easYgen

- Select in all devices the application mode “GCB/GC” via the parameter ”3444 Application mode“
- Select in all devices the HMI to “Generator/LSx/GC” via the parameter ”4103 Home screen data“
- Set the HMI parameter ”4129 Oneline diagram with mains“ to “On” when you want see mains values on the easYgen Home Page.
- Set the HMI parameter 4147 GC Oneline diagram with GGB to “On” when you want see the GGB condition in the Home Page Oneline diagram.

GC-3000XT

- Select in all devices the application mode “GGB/LSx” via the parameter ⮡ 3468 'Application mode'

LS-6XT

- Configure in each device individually the breaker mode “CBA” OR “CBA/CBB” via the parameter ”9018 Breaker mode LS6“ according to the application.
- Configure in each device the breaker mode “LSx” via the parameter ”8840 Application mode CBA“ or ”8992 Application mode CBA/CBB“ according to the application.
- Configure in each device the application layer “Layer 3” via the parameter ”8990 Application layer“.

Device IDs

easYgen

- Enter the device numbers 1, 2, 3 in the easYgen 1, 2, 3 per group via parameter “1702 Device number”.

GC-3000XT

- Enter the device numbers 1, 2 in GC 1, 2 via the parameter ⮡ 1702 'Device number'.

LS-6XT

- Enter the device numbers 33 to 38 in the LS-6XT 1 to 6 via the parameter ⮡ 1702 'Device number'.

Communication Interface

> The following sections are related to the application example ⮡ Fig. 86.
>
> - Communication inside the Group: CAN/Ethernet A
> - Communication outside the Group: Ethernet B/C

easYgen

- Select in all devices “CAN/Ethernet A” via the parameter ⮡ 9924 'Interface Layer 1'.
- Set in all devices the parameter ”1895 Align device no. with Node-ID“ on “Yes”, as long the CAN Node ID can be similar to the device number. Check all devices on same CAN baud rate.
- Enter in all devices the Ethernet A Network Address and the individual IP network address. The Ethernet A Network address can be equal in all easYgens of both groups because they will be not connected to each other.

GC-3000XT

- Load share interface Layer 1:
  - Select in all devices “CAN1/Ethernet A” via the parameter "9924 Interface Layer 1".
  - Configure the parameter ⮡ 8950 'Node-ID CAN bus 1' on 32 for both devices. Check the CAN baud rate.
  - Enter in all devices for Ethernet A the Network Address and the individual IP network address. The Ethernet A Network address can be equal in both GCs because they will be not connected to each other.
- Load share interface Layer 3:
  - Select in all devices “Ethernet B/C” via the parameter ⮡ 9929 'Interface Layer 3'.
  - Enter in all devices for the Ethernet B the Network Address (different to A and C) and the individual IP network address.
  - Enter in all devices for the Ethernet C the Network Address (different to A and B) and the individual IP network address.

LS-6XT

- Select in all devices “Layer 3” via the parameter ”8990 Application layer“
- Select in all devices “Ethernet B/C” via the parameter ⮡ 9924 'Interface Layer 1'.

- Enter in all devices for the Ethernet B the Network Address (different to A and C) but the same like the GCs and the individual IP network address.
- Enter in all devices for the Ethernet C the Network Address (different to A and C) but the same like the GCs and the individual IP network address.

IP address example according to the application ***Fig. 86***

Device	ID	NW	IP	Subnet mask	Comment
easYgen-1	1	A	192.168.111.114	255.255.255.0	Group 1 (Layer 1)
easYgen-2	2	A	192.168.111.115	255.255.255.0	Group 1 (Layer 1)
easYgen-3	3	A	192.168.111.116	255.255.255.0	Group 1 (Layer 1)
GC-1	32	A	192.168.111.117	255.255.255.0	Group 1 (Layer 1)
easYgen-4	1	A	192.168.111.114	255.255.255.0	Group 2 (Layer 1)
easYgen-5	2	A	192.168.111.115	255.255.255.0	Group 2 (Layer 1)
easYgen-6	3	A	192.168.111.116	255.255.255.0	Group 2 (Layer 1)
GC-2	32	A	192.168.111.117	255.255.255.0	Group 2 (Layer 1)
GC-1	1	B	192.168.112.111	255.255.255.0	Plant (Layer 3)
GC-1	1	C	192.168.113.111	255.255.255.0	Plant (Layer 3)
GC-2	2	B	192.168.112.112	255.255.255.0	Plant (Layer 3)
GC-2	2	C	192.168.113.112	255.255.255.0	Plant (Layer 3)
LS6-1	36	B	192.168.112.113	255.255.255.0	Plant (Layer 3)
LS6-1	36	C	192.168.113.113	255.255.255.0	Plant (Layer 3)
LS6-2	33	B	192.168.112.116	255.255.255.0	Plant (Layer 3)
LS6-2	33	C	192.168.113.116	255.255.255.0	Plant (Layer 3)
LS6-3	35	B	192.168.112.117	255.255.255.0	Plant (Layer 3)
LS6-3	35	C	192.168.113.117	255.255.255.0	Plant (Layer 3)
LS6-4	34	B	192.168.112.118	255.255.255.0	Plant (Layer 3)
LS6-4	34	C	192.168.113.118	255.255.255.0	Plant (Layer 3)
LS6-5	37	B	192.168.112.115	255.255.255.0	Plant (Layer 3)
LS6-5	37	C	192.168.113.115	255.255.255.0	Plant (Layer 3)
LS6-6	38	B	192.168.112.114	255.255.255.0	Plant (Layer 3)
LS6-6	38	C	192.168.113.114	255.255.255.0	Plant (Layer 3)

NOTICE!

From now on all devices should be individually addressed and differentiated. So the next step is to commission the communication interface. This will be done through the system update function. Please refer to “6.5.3 Practicing the System Update Functionality” and execute the complete teach-in process for your system.

Segmenting

The segmenting is a very important part and must be performed very carefully. If the segmenting does not match the controls interpreting their bus connection wrong. This can lead to situations like:

- The easYgen does not recognize being parallel to utility OR
- The easYgen does not recognize being parallel to another generator group OR
- The easYgen does not react on synchronization demands
- GC and LS6XT - a dead bus closure damage could occur

Configuration of the application example:

- easYgen

  Navigate over Parameter/Configure Application/Configure controller/Configure load share to the parameter ”1723 Segment number“. All easYgens are connected to their internal group segment. This group segment is always configured on “1”.

The Group segment, which is directly connected to the GC, is always number 1. only if there is a tie-breaker in the group, there can be a deviation, because the tie-breaker separates easYgens from the GC.

The segment numbers 2 and 3 in layer 1 are not allowed because they are reserved for the GC.

- GC-3000XT

  Navigate over Parameter/Configure Application/Configure load share/Segmenting to the parameter 7665 'GC basic segment number'. For the GC #1 is to configure the number “1”. For the GC #2 is to configure the number “2”.

The parameter 1724 'Source segment number' does not play any role in this application mode.

- LS-6XT

  To match the application example navigate via Parameter/Configure Application/ Configure segment to the segmenting parameters, which have to be configured as follows:

Device	Device ID	Parameter	Setting
1	36	8810 Segment number System A	5
		8811 Segment number System B	1

Device	Device ID	Parameter	Setting
		8812 Segment number isol. switch	(not applicable, faded out)
		8813 Mains power measurement	Valid
		8814 Mains connection	None
		8815 Isol. switch	(not applicable, faded out)
		8816 Variable system	System B
		8799 Segment number load	3
2	33	8810 Segment number System A	10
		8811 Segment number System B	5
		8812 Segment number isol. switch	1 (not applicable)
		8813 Mains power measurement	Valid
		8814 Mains connection	System A
		8815 Isol. switch	None
		8816 Variable system	System B
		8799 Segment number load	(not applicable, faded out)
3	35	8810 Segment number System A	5
		8811 Segment number System B	6
		8812 Segment number isol. switch	1 (not applicable)
		8813 Mains power measurement	Valid
		8814 Mains connection	None
		8815 Isol. switch	None
		8816 Variable system	System B
		8799 Segment number load	(not applicable, faded out)
4	34	8810 Segment number System A	11
		8811 Segment number System B	6
		8812 Segment number isol. switch	1 (not applicable)
		8813 Mains power measurement	Valid
		8814 Mains connection	System A
		8815 Isol. switch	None
		8816 Variable system	System B
		8799 Segment number load	not applicable, faded out)
5	37	8810 Segment number System A	6
		8811 Segment number System B	2
		8812 Segment number isol. switch	(not applicable, faded out)
		8813 Mains power measurement	Valid
		8814 Mains connection	None
		8815 Isol. switch	(not applicable, faded out)
		8816 Variable system	System B
		8799 Segment number load	4

Device	Device ID	Parameter	Setting
6	38	8810 Segment number System A	2
		8811 Segment number System B	1
		8812 Segment number isol. switch	1 (not applicable)
		8813 Mains power measurement	Valid
		8814 Mains connection	None
		8815 Isol. switch	None
		8816 Variable system	System B
		8799 Segment number load	(not applicable, faded out)

6.3.2.6 Monitoring the Segmenting

The easYgen / GC / LSx system devices offering visualization screens to monitor the correct segmenting. Take these screens for double check the segmenting configuration in conjunction with your drawing.

easYgen

- Navigate to STATUS MENU / Multi-unit / Multi-unit Layer 1 / States easYgen (Devices 1-8)

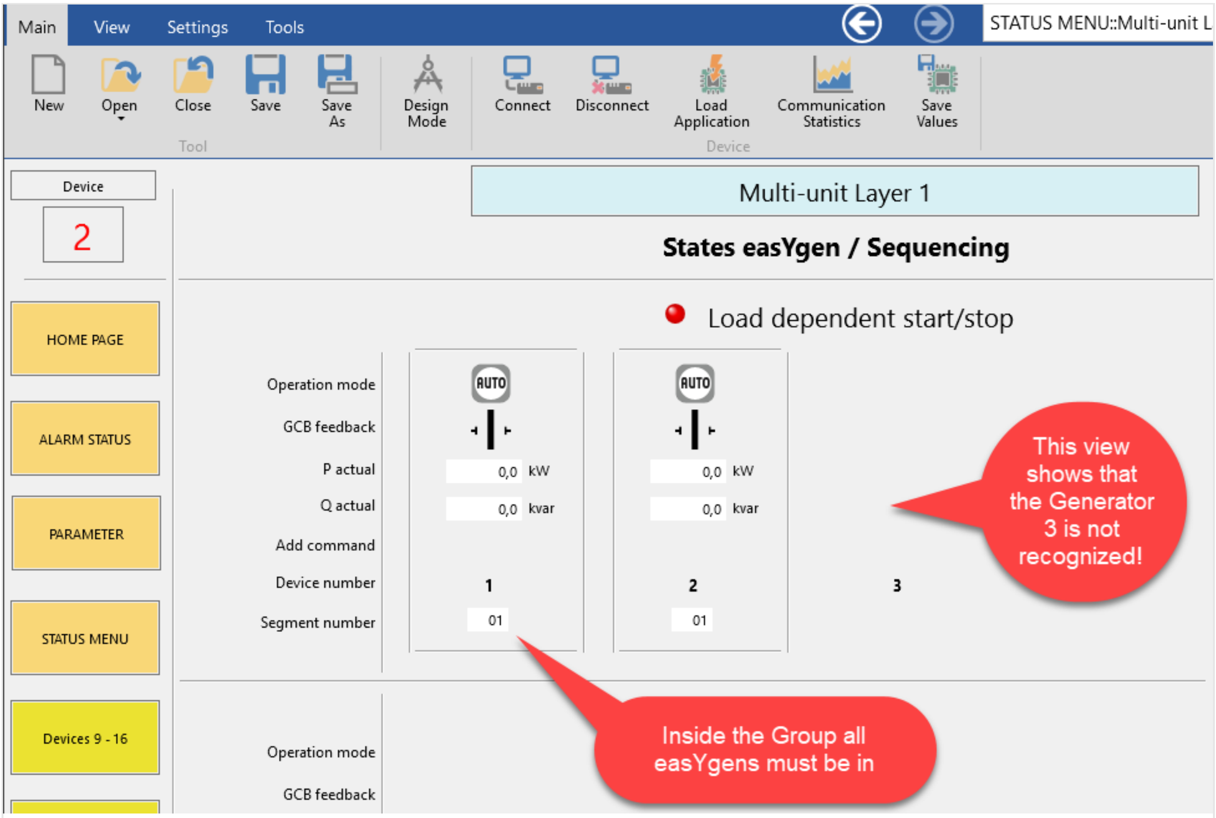


Fig. 87: ToolKit screen: Example with a faulty generator group 3

- Navigate to STATUS MENU / Multi-unit / Multi-unit Layer 1 / States easYgen (Devices 25-32)

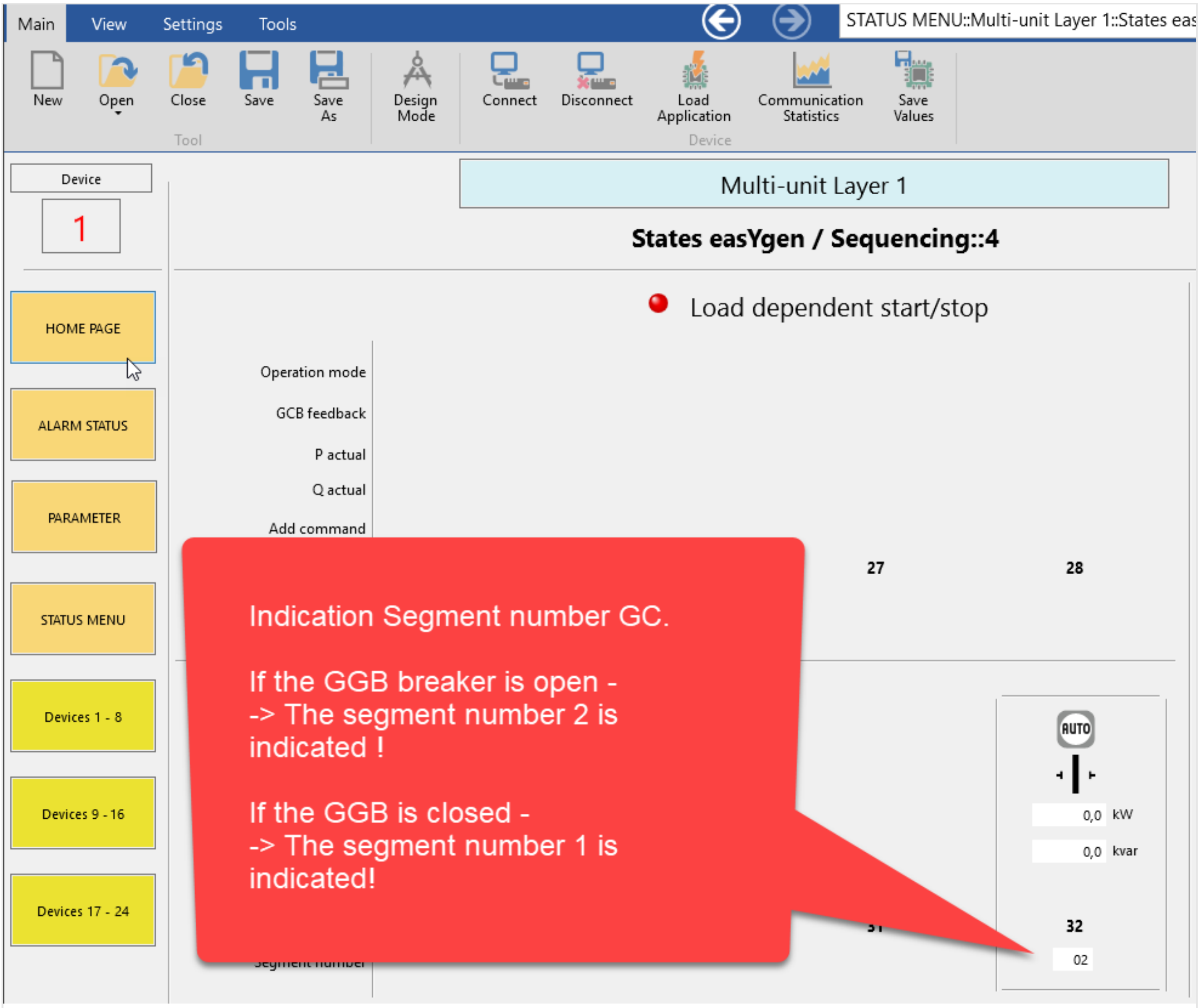


Fig. 88: *ToolKit screen: The GC is indicated as device 32 inside the group.*

GC-3000XT

- Navigate to STATUS MENU / Multi-unit / Multi-unit Layer 3 / States GC

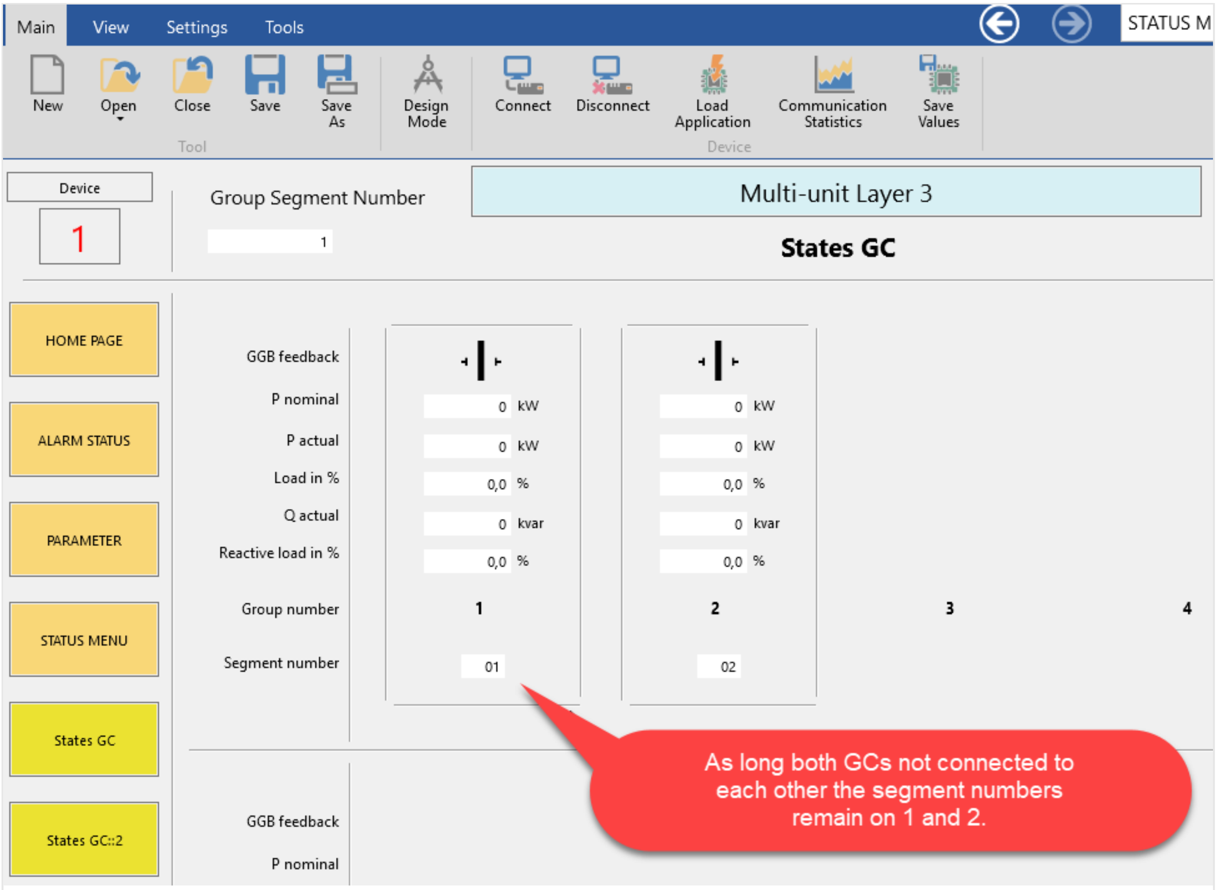


Fig. 89: ToolKit screen: Multi-unit Layer 3 – "States GC" screen of GC 1

- Navigate to STATUS MENU / Multi-unit / Multi-unit Layer 3 / States LSx

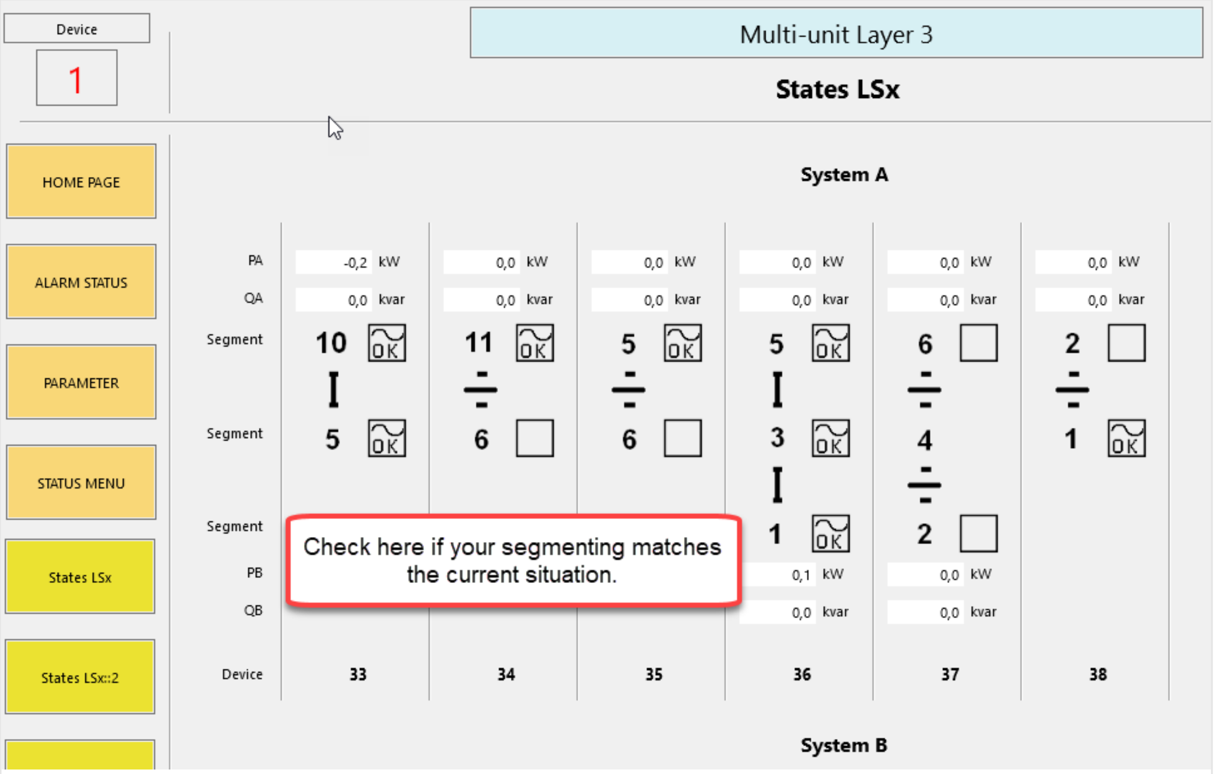


Fig. 90: ToolKit screen: Multi-unit Layer 3 – "States LSx" screen of GC 1

LS-6XT

- Navigate to STATUS MENU / Multi-unit Layer 3 / States GC

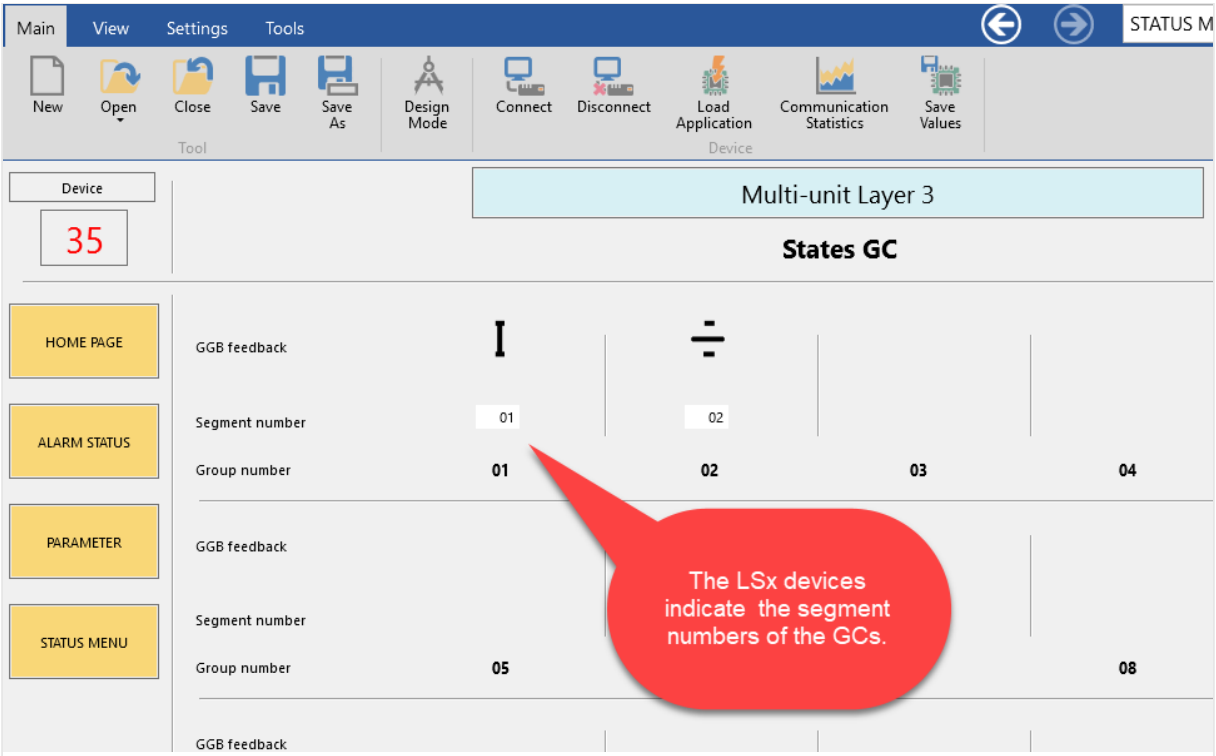


Fig. 91: ToolKit screen: Multi-unit Layer 3 – “States GC” screen of the LSx

6.3.2.7 Control the devices

This chapter contains no direct recommendation how to send control commands to the single devices. But it shall rough show what is possible. All devices are well usable as measurement transducers so that the CANopen or the Modbus communication can be taken to read measurement values for PLCs and SCADA systems. Principally following main methods are doable:

- Sending control commands by hard-wired contacts: Depending on the complexity a PLC will give engine start, engine stop, breaker open and close commands. Therefor the devices offer discrete inputs. Following inputs are preconfigured:

Device	Meaning	Input
easYgen	Remote Start	DI 2
GC	Enable to close GGB	DI 7
GC	Open GGB	DI 6
LS-6XT	Enable to close CBA	DI 7
LS-6XT	Open CBA (with unloading)	DI 6
LS-6XT	Enable to close CBB	DI 4
LS-6XT	Open CBB (with unloading)	DI 3

- A PLC transfers the commands over the communication interface to the devices: All devices are offering the ID505 for receiving binary commands which are present as Remote Control flags in the LogicsManager. Refer to the different chapters with the topic “Remote Control” in the easYgen, the GC and the LSx devices.

- Breaker commands are sent via the easYgen load share and control bus: Depending on the complexity there is a possibility to transfer commands over the load share control bus from the easYgens to the GCs and from there further to LSx devices located on layer 3.

  Each easYgen provides up to 6 “LSx command flags”. Refer to the sub chapter named “LSx related command flags” in the easYgen manual. These flags are transported to neighbor easYgens and LSx devices in layer 1 and to the own GC. The GC can take this information for itself or passes these commands to LSx devices on layer 3.

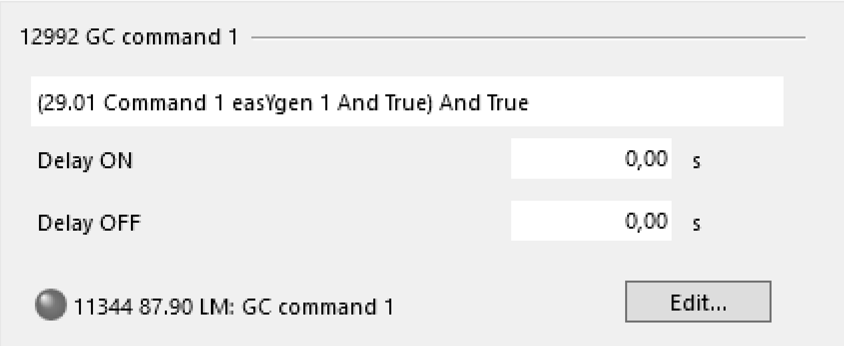


Fig. 92: Example: Command 1 from easYgen 1 is taken and bypassed to Layer3 devices as GC Command 1

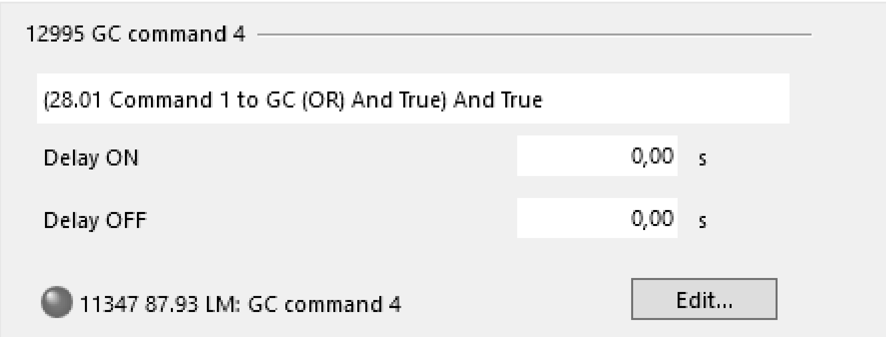


Fig. 93: Example: Ored Command 1 from all easYgens inside group is taken and bypassed to Layer3 devices as GC Command 1

6.4 Special Applications

6.4.1 Enable/Disable LDSS function in the GC-easYgen System

No LDSS required or LDSS realized by PLC

Configuration in the GC:

1. ▷ Set "ID12930 LD start stop" to FALSE (LogicsManager)

⚙	**Configuration in the easYgen:**
1. ▷	Set "ID12930 LD start stop" to FALSE (LogicsManager)

LDSS function is required

⚙	**Configuration in the GC:**
1. ▷	Set "ID12930 LD start stop" to TRUE (LogicsManager)
2. ▷	Set all LDSS parameter appropriately. Refer to ⮡ "4.3.5 Load Dependent Start/Stop" for more information

⚙	**Configuration in the easYgenXT:**
1. ▷	Set "ID7950 GC mode" to "On"
2. ▷	Set "ID12930 LD start stop" to TRUE (LogicsManager)
3. ▷	Set "ID5751 Base Priority" (12926, 12925, 12924)
4. ▷	Set "ID5759 Minimum Running Time"
5. ▷	Set "ID5805 LDSS transition time"

EasYgen Engine Start Condition in AUTOMATIC

The single start stop commands are sent by interface or by DIs directly on the easYgenXT. For a better understanding of the different dependencies in the easYgen enigne start logic, see ⮡ Fig. 94

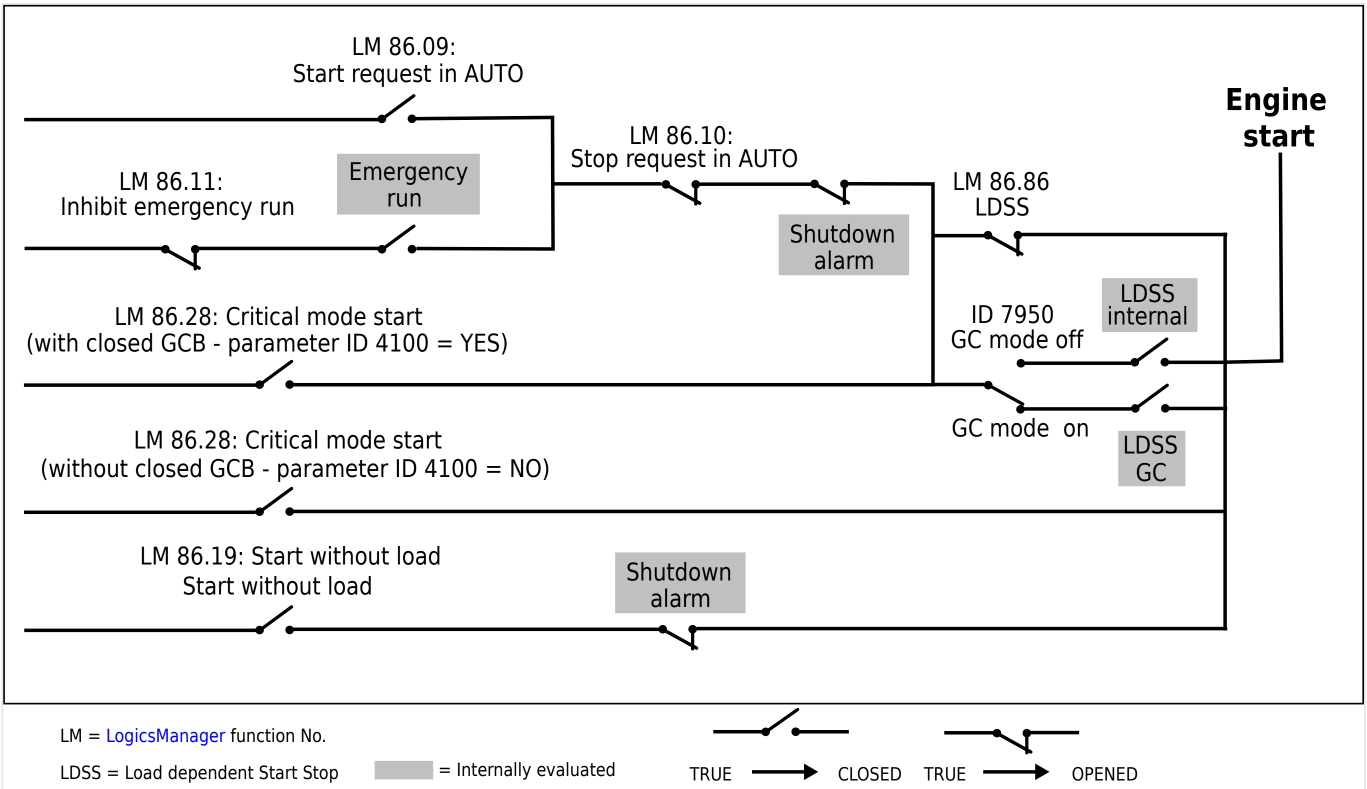


Fig. 94: EasYgen Engine Start Condition in AUTOMATIC

6.4.2 Phase Angle Compensation (Vector Group Adjustment)

WARNING!

Check parameters!

Erroneous synchronization settings can destroy the generator with destructive power!

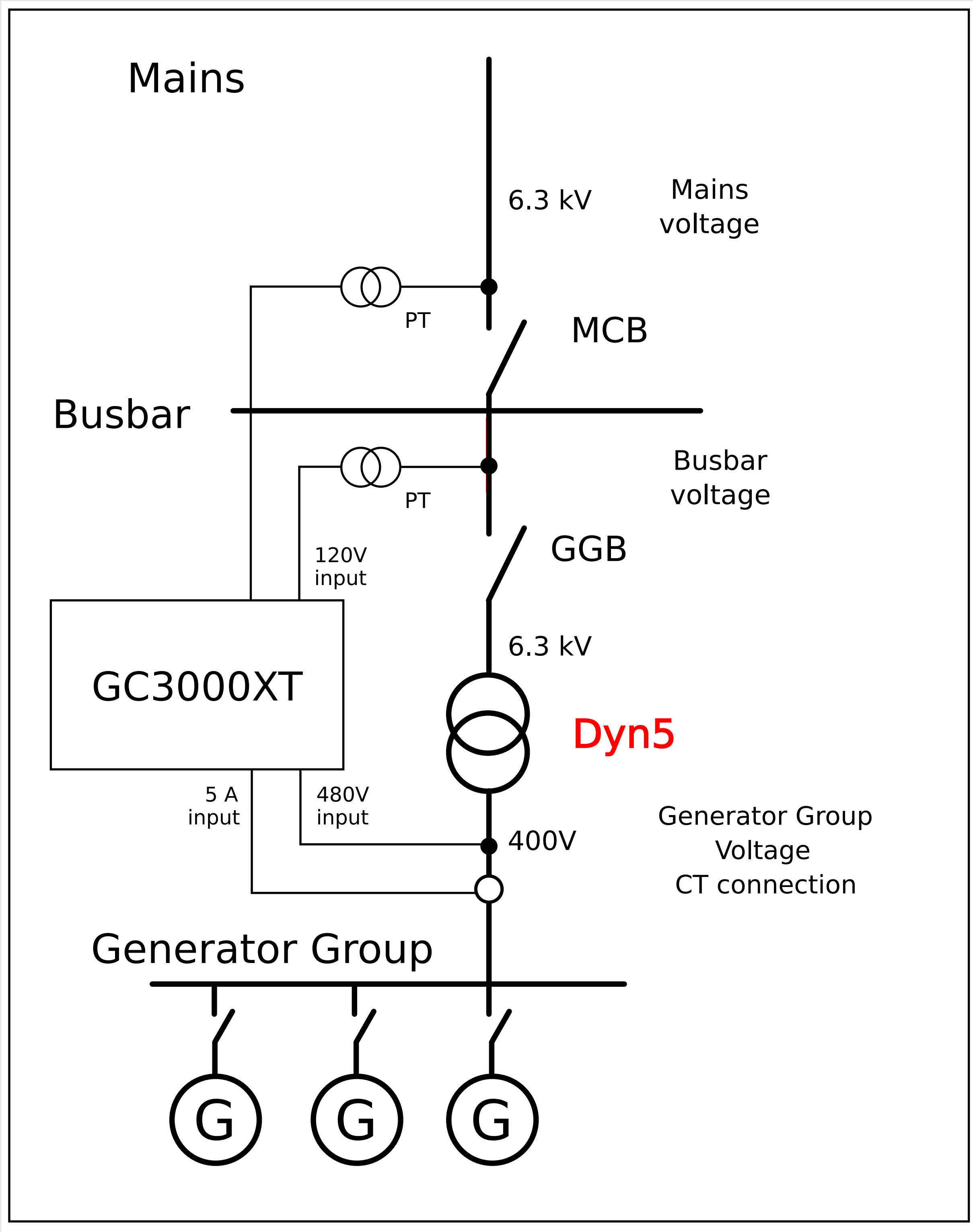
Ensure the parameters are configured correctly! Incorrect wiring of the system cannot be compensated with this parameter!

General notes

This feature allows the GC to adapt the phase angle measurement system according to the transformer type. The phase angle of the "generator group to load busbar" and the "load busbar to mains" measurement can be compensated . The phase angle compensation is activated with the parameters "Phase angle compensation GGB" (parameter ⮑▷ 8825) and "Phase angle compensation MCB" (parameter ⮑▷ 8841) .

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 GGB" (parameter ⮑▷ 8824) and "Phase angle MCB" (parameter ⮑▷ 8842). 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.

6.4.2.1 Generator Group Voltage to Load Busbar voltage



Example 1

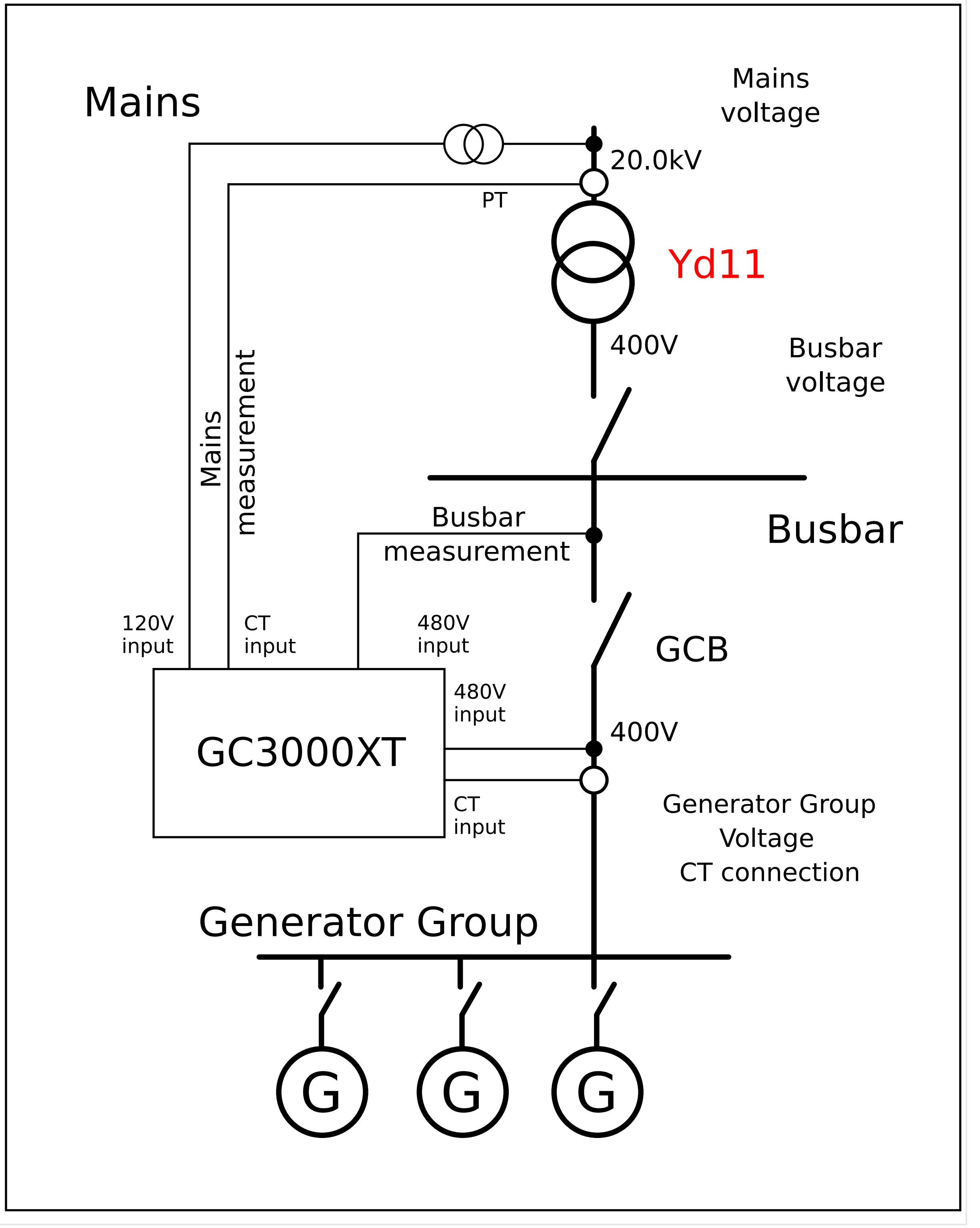
The generator group voltage is connected to the low voltage side of a transformer with the vector group ***Dyn5***. The GC3000XT load busbar voltage is connected to the high voltage side.

Because of the transformer the phase angles between Generator group voltage and busbar differs due closed GGB. The synchronization function of the GC can compensate this by a configurable phase angle deviation.

Using the vector group 5 (Dyn**5**) it counts α = 5 ´30 ° = 150 °.

Because 150° < 180 ° and GC load busbar measurement is connected to the high voltage side this results into α to be used as phase difference. Enter **150 °** into as parameter for the phase difference Gen/Busbar.

6.4.2.2 Load Busbar voltage to Mains voltage



Example 2

Using the vector group 11 (Yd**11**) it counts α = 11 ´30 ° = 330 °. Because 330 ° > 180 ° and Group Controller Mains measurement is connected to the high voltage side this results into (-360 ° + α) to be used as phase difference. Enter **-30** ° into as parameter for the phase difference Mains/Busbar.

6.4.3 Connecting IKD 1 on CAN Bus 1

We recommend to connect the external expansion boards Woodward IKD 1 to CAN bus 2. CAN bus 2 offers preconfigured settings for operating with IKDs.

However, it is also possible to connect up to two IKD 1 to CAN bus 1.

Refer to the ⮡ "4.6.1.1.2 Transmit PDO {x} (Process Data Object)" and ⮡ "4.6.1.1.1 Receive PDO {x} (Process Data Object)" for the configuration of the parameters concerned.

Refer also to ⮡ "7.2 CANopen Protocol" for a description of the data objects.

The GC may be configured by using the ToolKit software.

Transmit PDO

The GC must be configured for sending to data protocol 65000 (external DOs 1 to 8) and CAN ID 181 (hex) every 20 ms on TPDO1.

TPDO is used to send messages to an external device.

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 45: TPDO1 configuration

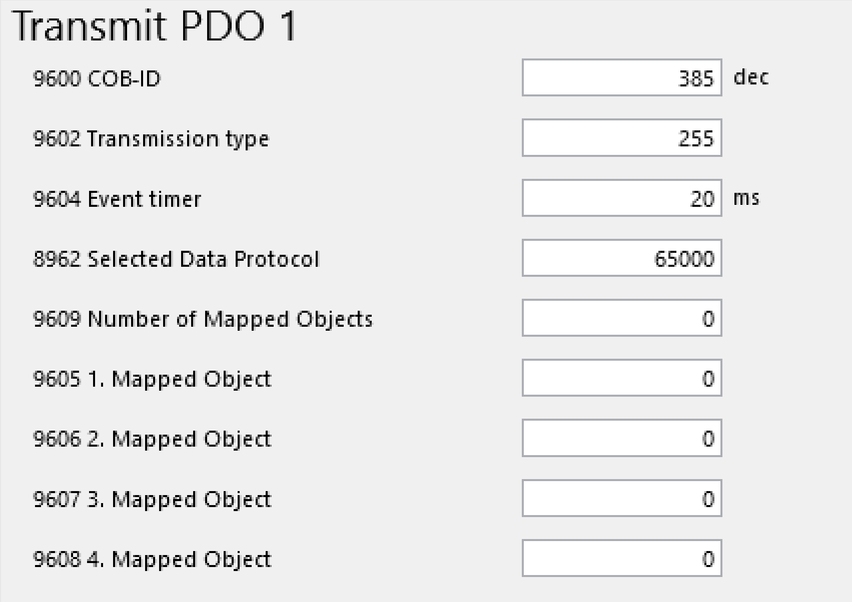


Fig. 95: TPDO configuration for IKD 1 (example ToolKit)

Receive PDO

The GC 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).

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 46: RPDO1 configuration

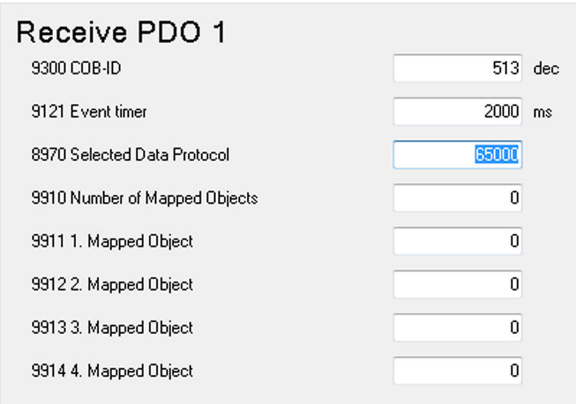


Fig. 96: RPDO configuration for IKD 1 (example ToolKit)

In addition, the IKDs themselves must be configured with the Woodward IKD configuration tool. (Refer to "6.4.5 IKD Configuration Tool")

Configuration for a second IKD 1

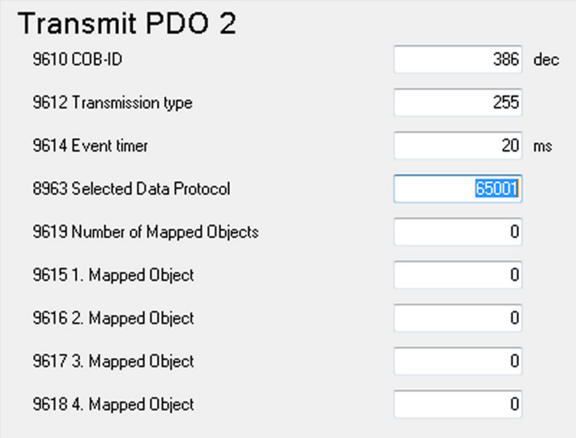


Fig. 97: TPDO configuration for 2nd IKD 1 (example ToolKit)

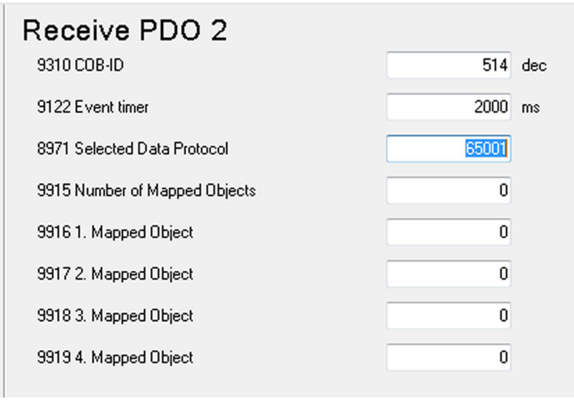


Fig. 98: RPDO configuration for 2nd IKD 1 (example ToolKit)

6.4.4 Setup Expansion Modules at CAN 2

General notes

The Group Controller is supporting two Woodward IKD-1 each with eight digital inputs and eight digital outputs.

To enable IKDs in the GC at CAN 2, only one parameter "15320 Select external terminals" must be set in the GC. (The baudrate is fixed to 250 kBd.)

ID	Parameter	CL	Setting range [Default]	Description
15320	**Select external terminals**	2	**[Off]**	No IKD enabled
			1IKD	One IKD enabled
			2IKD	Two IKDs enabled

In addition, the IKDs themselves must be configured with the **Woodward IKD configuration tool**.

6.4.5 IKD Configuration Tool

General notes

The IKD 1 is a Woodward I/O expansion board with 8 digital inputs and 8 digital outputs. 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.

Note: This tool cannot be used for **IKD-IN-16** and **IKD-OUT-16**. (These devices have Dip switches for configuration.)

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. ▷	Download IKD Configuration Tool 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

⚙	**How to use the 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 "ConfigIKD“
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:

⚙ **Configuring an IKD**

1. ▷

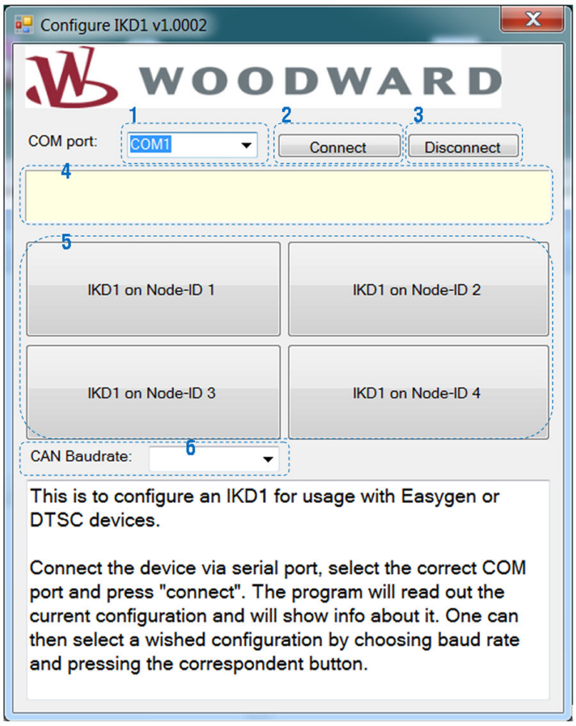


Fig. 99: IKD Configuration Tool

»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.

6.4.6 Connecting easYlite-200 on CAN Bus

An easYlite-200 device can be used as a remote control to annunciate configurable states and alarms.

If connecting an external horn to the relay output the easYlite-200 can also be used as remote alarm audible device.

The GC can configure up to 16 LEDs for each easYite-200 (device 1 and 2).

The configured LED states, the annunciation modes (flashing, color) and the active horn signal (new alarm) are transmitted over the configured CAN interface (1,2) to the easYlite-200.

NOTICE!

Do not connect more than one GC together with the easYlite-200 devices on the same CAN connection.

This will lead to unexpected behavior at the easYite-200 devices.

Configuration hints:

The configuration (behavior of the LEDs, CAN selection) for the easYlite-200 is only possible via ToolKit.

For the configuration of the digital output of the easYlite-200 (as "Horn", "Com. fail" or "Horn or Com. fail") and the device 1 or device 2, the easYlite itself must be configured with "ToolKit-SC" via USB.

By default the easYlite-200 itself is configured:

- Module = "Module 1" (Device 1); **For use as Device 2, the easYlite-200 must be configured via ToolKit-SC as "Module 2".**
- CAN baud rate = 250 kb
- Output = "Horn"

If these default settings match your application, no configuration with ToolKit-SC is necessary for the use as Device **1**.

For further information about the easYlite-200 please refer to the easYlite-200 manual.

The following tables show the different parameters to configure the easYlite-200 device 1 and 2.

For device 1 see: ⮡ Table 47, ⮡ Table 48 and ⮡ Table 49

For device 2 see: ⮡ Table 50, ⮡ Table 51 and ⮡ Table 52

easYlite-200 device 1 parameter

[PARAMETER / Configure HMI / Configure Others / easYlite-200 Device 1].

ID	Parameter	CL	Setting range [Default]	Description
767	**Horn reset allowed**	2	Yes **[No]**	This parameter defines if the GC horn acknowledge is allowed via easYlite-200. If set to "Yes", the mute button on the easYlite-200 device 1 will acknowledge the horn in the GC.
761	**CAN1**	2	On **[Off]**	If this parameter is set to "On", the GC will communicate via CAN1 with the easYlite-200 device 1.
762	**CAN2**	2	On **[Off]**	If this parameter is set to "On", the GC will communicate via CAN2 with the easYlite-200 device 1.

Table 47: easYlite-200 device 1 communication parameter

ID	Parameter	CL	Setting range [Default]	Description
601	**LED 1 source**	2	**[2.01]**	This parameter defines the source for LED 1 at the easYlite-200 device 1. The source can be any LogicsManager command variable by entering the according group number.
602	**LED 1 logic**	2	N.C. **[N.O.]**	This parameter defines the logic for LED 1 at the easYlite-200 device 1. The logic is combined with the defined source before sending to the easYlite-200 device.
603	**LED 1 flash**	2	Slow flashing Steady **[Fast flashing]**	This parameter defines the flash option for LED 1 at the easYlite-200 device 1.
604	**LED 1 color**	2	Red Yellow **[Green]**	This parameter defines the color for LED 1 at the easYlite-200 device 1.

Table 48: easYlite-200 device 1 LED configuration (example for LED 1)

LED #	Source	Logic	Flash Option	Color
1	601	602	603	604
2	606	607	608	609
3	611	612	613	614
4	616	617	618	619
5	621	622	623	624
6	626	627	628	629
7	631	632	633	634
8	636	637	638	639
9	641	642	643	644
10	646	647	648	649
11	651	652	653	654
12	656	657	658	659
13	661	662	663	664
14	666	667	668	669
15	671	672	673	674
16	676	677	678	679

Table 49: LED 1 -16 easYlite-200 device 1 - overview parameter IDs (LED 1 - 16)

easYlite-200 device 2 parameter

For use as Device2, the easYlite-200 itself must be configured via ToolKit-SC as "Module 2"

[PARAMETER / Configure HMI / Configure Others / easYlite-200 Device 2].

ID	Parameter	CL	Setting range [Default]	Description
768	**Horn reset allowed**	2	Yes **[No]**	This parameter defines if the GC horn acknowledge is allowed via easYlite-200. If set to "Yes", the mute button on the easYlite-200 device 2 will acknowledge the horn in the GC.
764	**CAN1**	2	On **[Off]**	If this parameter is set to "On", the GC will communicate via CAN1 with the easYlite-200 device 2.
765	**CAN2**	2	On **[Off]**	If this parameter is set to "On", the GC will communicate via CAN2 with the easYlite-200 device 2.

Table 50: easYlite-200 device 2 communication parameter

ID	Parameter	CL	Setting range [Default]	Description
681	**LED 1 source**	2	**[2.01]**	This parameter defines the source for LED 1 at the easYlite-200 device 2. The source can be any LogicsManager command variable by entering the according group number.
682	**LED 1 logic**	2	N.C. **[N.O.]**	This parameter defines the logic for LED 1 at the easYlite-200 device 2. The logic is combined with the defined source before sending to the easYlite-200 device.
683	**LED 1 flash**	2	Slow flashing Steady **[Fast flashing]**	This parameter defines the flash option for LED 1 at the easYlite-200 device 2.
684	**LED 1 color**	2	Red Yellow **[Green]**	This parameter defines the color for LED 1 at the easYlite-200 device 2.

Table 51: easYlite-200 device 2 LED configuration (example for LED 1)

LED #	Source	Logic	Flash Option	Color
1	681	682	683	684

LED #	Source	Logic	Flash Option	Color
2	686	687	688	689
3	691	692	693	694
4	696	697	698	699
5	701	702	703	704
6	706	707	708	709
7	711	712	713	714
8	716	717	718	719
9	721	722	723	724
10	726	727	728	729
11	731	732	733	734
12	736	737	738	739
13	749	670	671	672
14	746	747	748	748
15	751	752	753	754
16	756	757	758	759

Table 52: LED 1 -16 easYlite-200 device 2 - overview parameter IDs (LED 1 - 16)

6.4.7 Applications with Tie-breakers inside the Group

6.4.7.1 General

The “easYgen GC LSx” system allows also to place LSx devices as Tie-breaker controls into a Generator Group. This can be done independent on the GC application mode GGB/MCB or GCB/LSx. Before you continue to read this chapter you should be already familiar with the following Application Field Chapters

- Application Layers ⮡ “6.1 Application Layers”
- Application Mode GGB/MCB ⮡ “6.2 Application Mode GGB/MCB”
- Application Mode GGB/LSx ⮡ “6.3 Application Mode GGB/LSx”

> If there is a tie-breaker needed in the Generator Group the tie-breaker must be operated by a LSx device LS5 or LS-6XT.

> Be aware that there never can feed any utilities into the generator group over any LSx device installed in the group. The LSx devices acting only as tie-breaker controls.

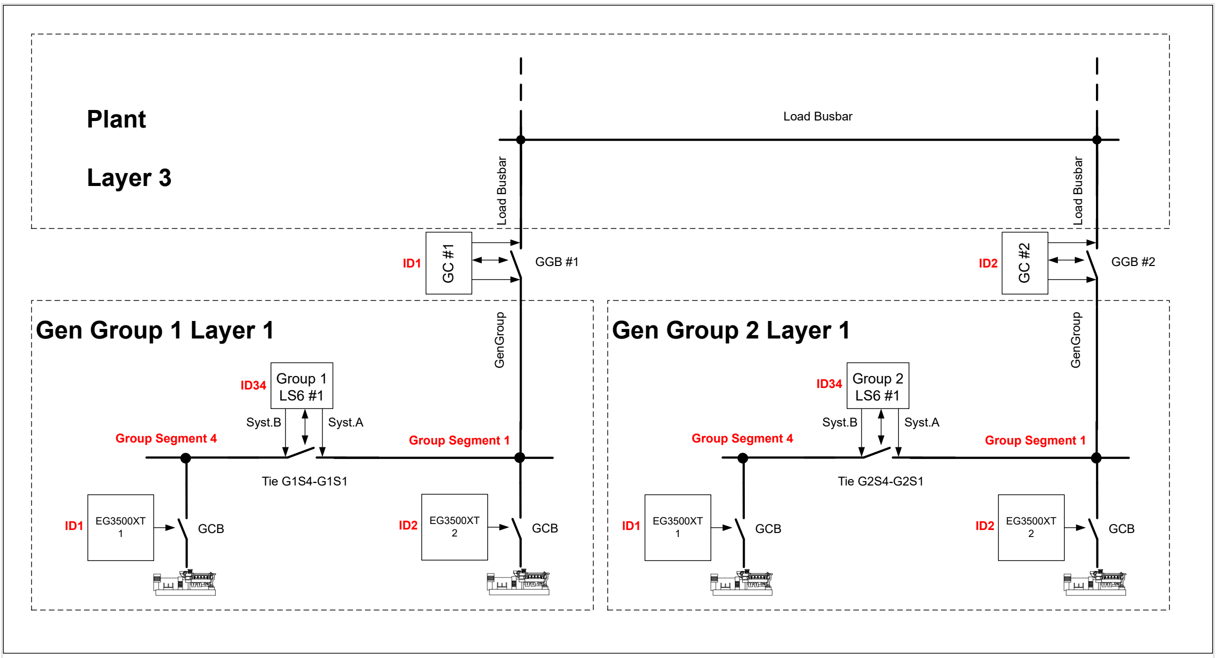


Fig. 100: Drawing of an application with 2 Groups containing 2 Gensets connected over Tie-breaker

6.4.7.2 Prerequisites

To get LSx devices run in a GC group there must be fulfilled following rules:

- The Group segment number 1 is used for the Group Segment on which the GC is connected to.
- The further usable Group Segment numbers beside the dedicated Group Segment number 1 are 4 up to 64.

> Do not use Group Segment numbers 2 and 3 inside the group. The numbers are already occupied by the GC.

- The easYgens needs to differentiate now on which Group Segment they are connected to.
- The LSx devices in the group are configured as “Layer 1” devices.
- For proper synchronization the variable system of the Group LS-6XT must be configured on the opposite side to the Group Segment number 1.
- The Device ID of the Group-LS6 must begin with number 34. The device ID can go up to 64.

> Do not use the Device ID 33 for the Group LS-6XT. The number is already occupied by the GC.

- As long the CAN bus is used inside the Group as load share and control bus the number of LSx is limited on 16.
- As long the Ethernet bus only is used inside the Group as load share and control bus the number of LSx is limited on 31.

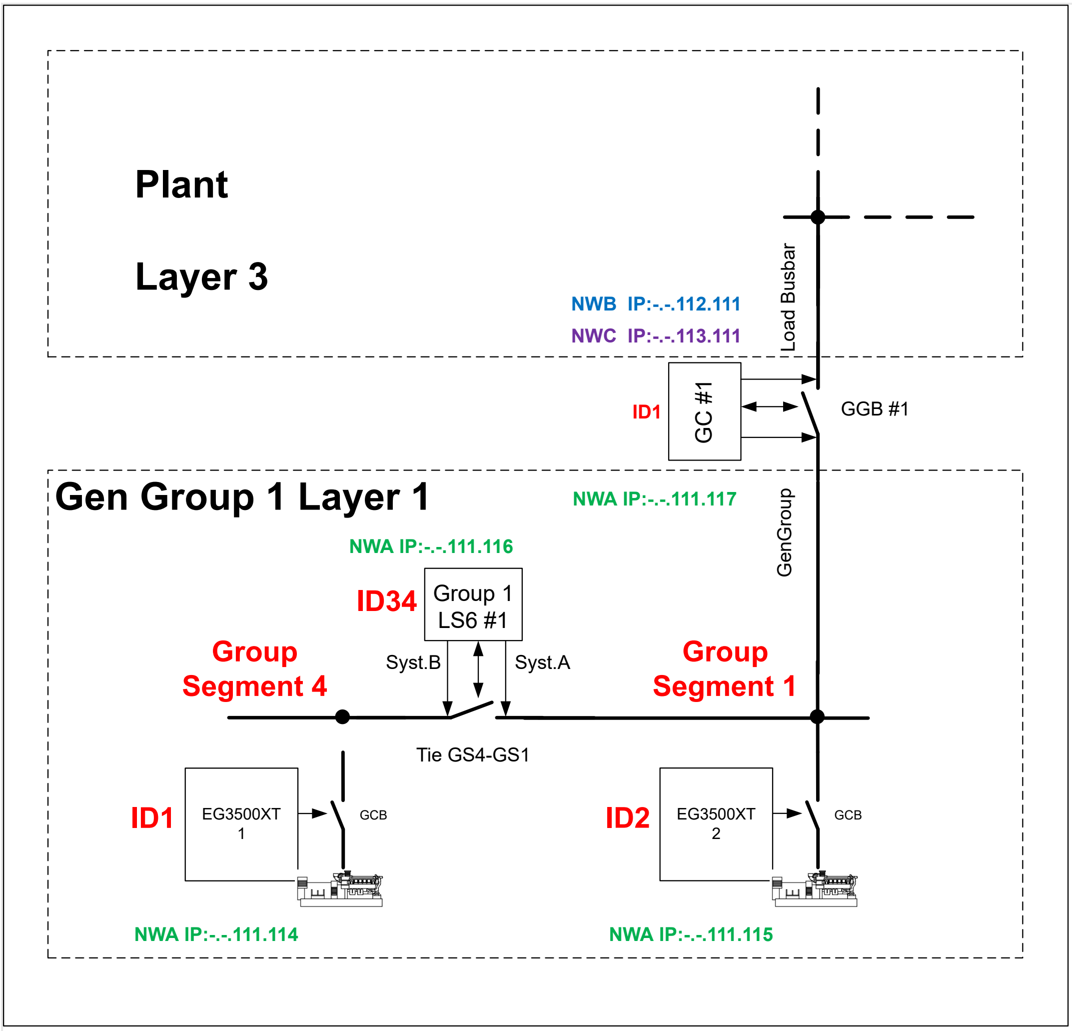


Fig. 101: The Group LS-6XT is connected to the group communication bus

6.4.7.3 Set up application

The LS-6XT device is incorporated into the group according the common rules. The communication interface is connected to the group communication interface in the same manner. Do not mix up physical layers or ports.

The following sections are related to the application example of this chapter.

- Communication inside the Group: CAN/Ethernet A
- Communication outside the Group: Ethernet B/C

6.4.7.4 Configure Devices

This chapter describes now what is especially to do in the application ⮡ Fig. 100. Generally the most settings should cover similarly applications.

The Device Application Modes (and HMI)

All devices supporting different application modes. So they must be adapted under each other. Please check:

easYgen

- Select in all devices the application mode “GCB/GC” via the parameter “3444 Application mode”
- Select in all devices the HMI to “Generator/LSx/GC” via the parameter “4103 Home screen data”
- Set the HMI parameter “4129 Oneline diagram with mains” to “On” when you want see mains values on the easYgen Home Page.
- For the easYgen installed on Group Segment number 1: Configure the HMI parameter “4147 GC Oneline diagram with GGB” to “On” when the GGB condition in the Home Page Oneline diagram shall be indicated
- For the easYgen installed on Group Segment number 4 and more: Configure the HMI parameter “4147 GC Oneline diagram with GGB” to “Off”.

These easYgen (Segment number > 1) cannot inform about the physical condition of the GGB breaker because they have no direct relation to the GC.

GC

- If you have equipped LSx devices as well on layer 3 then you have to select the application mode “GGB/LSx” via the parameter “3468 Application mode”. You have to do this in all devices. For configuration the LSx devices in layer 3 please refer to chapter “LSx controlled Utility and Tie-breaker on Layer 3”.

Group LS-6XT (Layer 1)

- Configure the breaker mode “CBA” via the parameter “9018 Breaker mode LS6”.
- Configure the breaker mode “LSx” via the parameter “8840 Application mode CBA”.
- Configure the application layer “Layer 1” via the parameter “8990 Application layer”.

To configure eventually LS-6XT devices in layer 3 please refer to ⮡ “6.3.2 System Application Example”.

Device IDs

easYgen

- Enter the device numbers 1, 2 in the easYgen 1, 2 per group via parameter “1702 Device number”.

GC

- Enter the device numbers 1, 2 in GC 1, 2 via the parameter “1702 Device number”.

Group LS-6XT (Layer 1)

- Enter the device number 34 in the parameter “1702 Device number”.

To configure eventually LS-6XT devices in layer 3 please refer to “6.3.2 System Application Example”.

Communication Interface

easYgen

- Select in all devices “CAN/Ethernet A” via the parameter "9924 Load share Interface".
- Set in all devices the "1895 Align device no. with Node-ID" on “Yes”. (As long the CAN Node ID can be similar to the device number), check all devices on same CAN baud rate.
- Enter in all devices the Ethernet A Network Address and the individual IP network address. The Ethernet A Network address can be equal in all easYgens of both groups because they will be not connected to each other.

GC

- Load share interface Layer 1:
  - Select in all devices “CAN1/Ethernet A” via the parameter "9924 Interface Layer 1".
  - Configure the parameter “8950 Node-ID CAN bus 1” on 32 for both devices. Check the CAN baud rate.
  - Enter in all devices for Ethernet A the Network Address and the individual IP network address. The Ethernet A Network address can be equal in both GCs because they will be not connected to each other.
- Load share interface Layer 3:
  - Select in all devices “Ethernet B/C” via the parameter "9929 Interface Layer 3".
  - Enter in all devices for the Ethernet B the Network Address (different to A and C) and the individual IP network address.
  - Enter in all devices for the Ethernet C the Network Address (different to A and B) and the individual IP network address.

Group LS-6XT (Layer 1)

- Select “CAN1/Ethernet A” via the parameter "9924 Load share Interface".
- Set the parameter "1894 Align device no. with Node-ID" on “Yes”. (As long the CAN Node ID can be similar to the device number), check CAN baud rate.
- Enter in all devices the Ethernet A Network Address and the individual IP network address. The Ethernet A Network address is the same like the easYgens.

To configure eventually LS-6XT devices in layer 3 please refer to “6.3.2 System Application Example”.

IP address example for the Group bus according to the application ***Fig. 100***

Device	ID	NW	IP	Subnet mask	Comment
easYgen-1	1	A	192.168.111.114	255.255.255.0	Group 1 (Layer 1)
easYgen-2	2	A	192.168.111.115	255.255.255.0	Group 1 (Layer 1)
Group LS6-1	34	A	192.168.111.116	255.255.255.0	Group 1 (Layer 1)
GC-1	32	A	192.168.111.117	255.255.255.0	Group 1 (Layer 1)
easYgen-4	1	A	192.168.111.114	255.255.255.0	Group 2 (Layer 1)
easYgen-5	2	A	192.168.111.115	255.255.255.0	Group 2 (Layer 1)
Group LS6-2	34	A	192.168.111.116	255.255.255.0	Group 2 (Layer 1)
GC-2	32	A	192.168.111.117	255.255.255.0	Group 2 (Layer 1)
GC-1	1	B	192.168.112.111	255.255.255.0	Plant (Layer 3)
GC-1	1	C	192.168.113.111	255.255.255.0	Plant (Layer 3)
GC-2	2	B	192.168.112.112	255.255.255.0	Plant (Layer 3)
GC-2	2	C	192.168.113.112	255.255.255.0	Plant (Layer 3)

NOTICE!

From now on all devices should be individually addressed and differentiated. So the next step is to commission the communication interface. This will be done through the system update function. Please refer to “6.5.3 Practicing the System Update Functionality” and execute the complete teach-in process for your system.

Segmenting

The segmenting is a very important part and must be performed very carefully. If the segmenting does not match the controls interpreting their bus connection wrong. This can lead to situations like:

- The easYgen does not recognize being parallel to utility OR
- The easYgen does not recognize being parallel to another generator OR
- The easYgen does not react on synchronization demands
- easYgen GC and LS6XT - a dead bus closure damage could occur

At next follow the configuration of the application example:

easYgen

- Navigate over Parameter/Configure Application/Configure controller/Configure load share to the parameter “1723 Segment number”.
  - The easYgen #1 is connected to the group segment 4. Enter here “4”.
  - The easYgen #2 is connected to the group segment 1. Enter here “1”.

GC

- As long the GC is running in GGB/LSx mode you navigate via Parameter/Configure Application/Configure load share/Segmenting to the parameter “7665 GC basic segment number”. For the GC #1 is to configure the number “1”. For the GC #2 is to configure the number “2”.
- As long the GC is running in GGB/MCB mode the individual GC segment number is passed by a PLC or logic from external anyway.

Group LS-6XT (Layer 1)

- To match the application example navigate via Parameter/Configure Application/ Configure segment to the segmenting parameters, which have to be configured as follows:

Device	Device ID	Parameter	Setting
1	34	8810 Segment number System A	4
		8811 Segment number System B	1
		8812 Segment number isol. switch	(not applicable)
		8813 Mains power measurement	Invalid
		8814 Mains connection	None
		8815 Isol. switch	None
		8816 Variable system	System A
		8799 Segment number load	(not applicable, faded out)

To configure eventually LS-6XT devices in layer 3 please refer to “6.3.2 System Application Example”.

6.4.7.5 Monitoring the Segmenting

The easYgen / GC / LSx system devices offering visualization screens to monitor the correct segmenting.

The chapter here focus on the LSx devices located inside the group. To learn about the segmenting monitoring outside the group please refer to the chapter: “LSx controlled Utility and Tie-breaker on Layer 3”.

Take these screens for double check the segmenting configuration in conjunction with your inner group constellation.

easYgen

- Navigate to STATUS MENU / Multi-unit / Multi-unit Layer 1 / States easYgen (Devices 1-8)

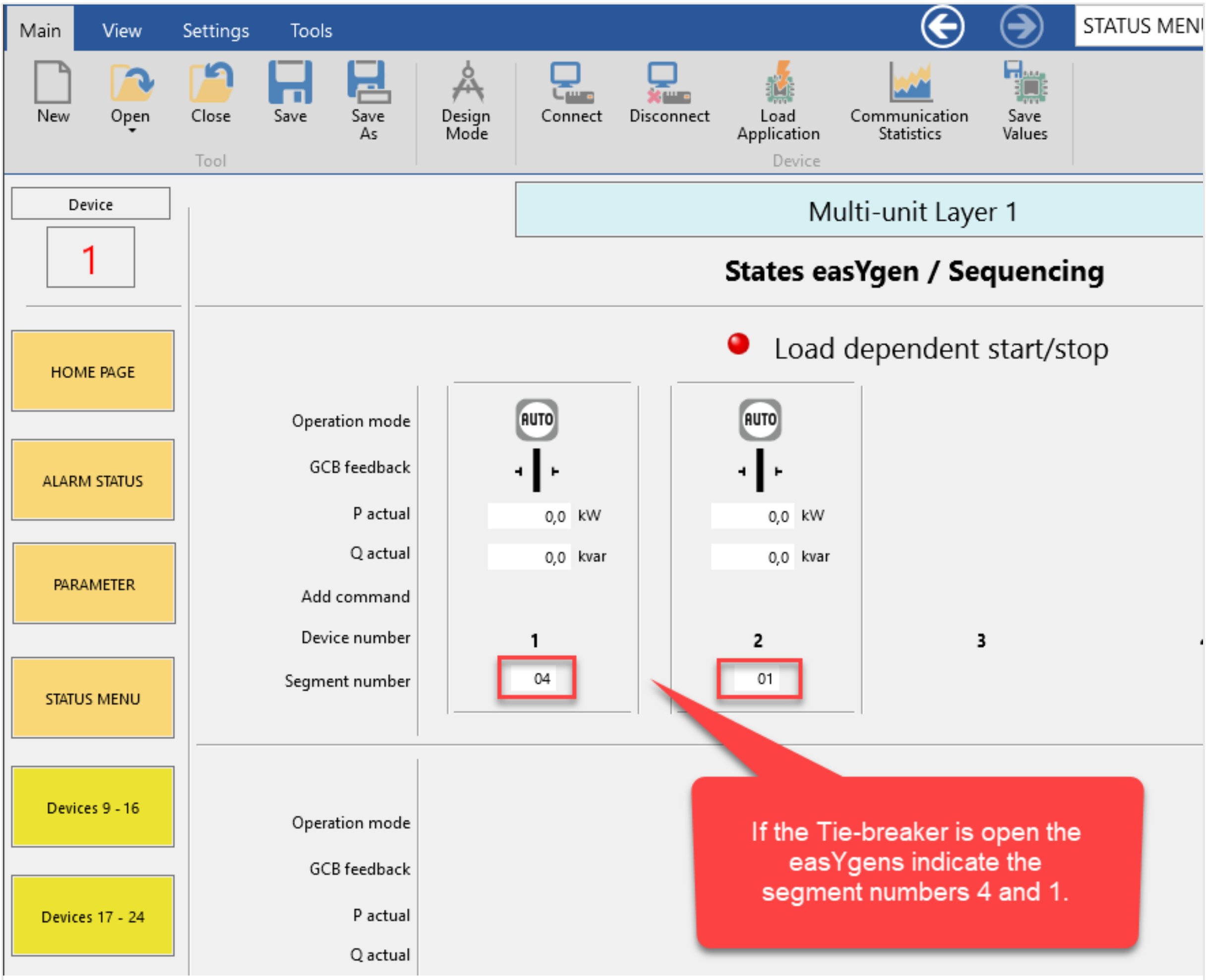


Fig. 102: ToolKit screen: 2 Generators in a group with open Tie-breaker

- Navigate to STATUS MENU / Multi-unit / Multi-unit Layer 1 / States easYgen (Devices 25-32)

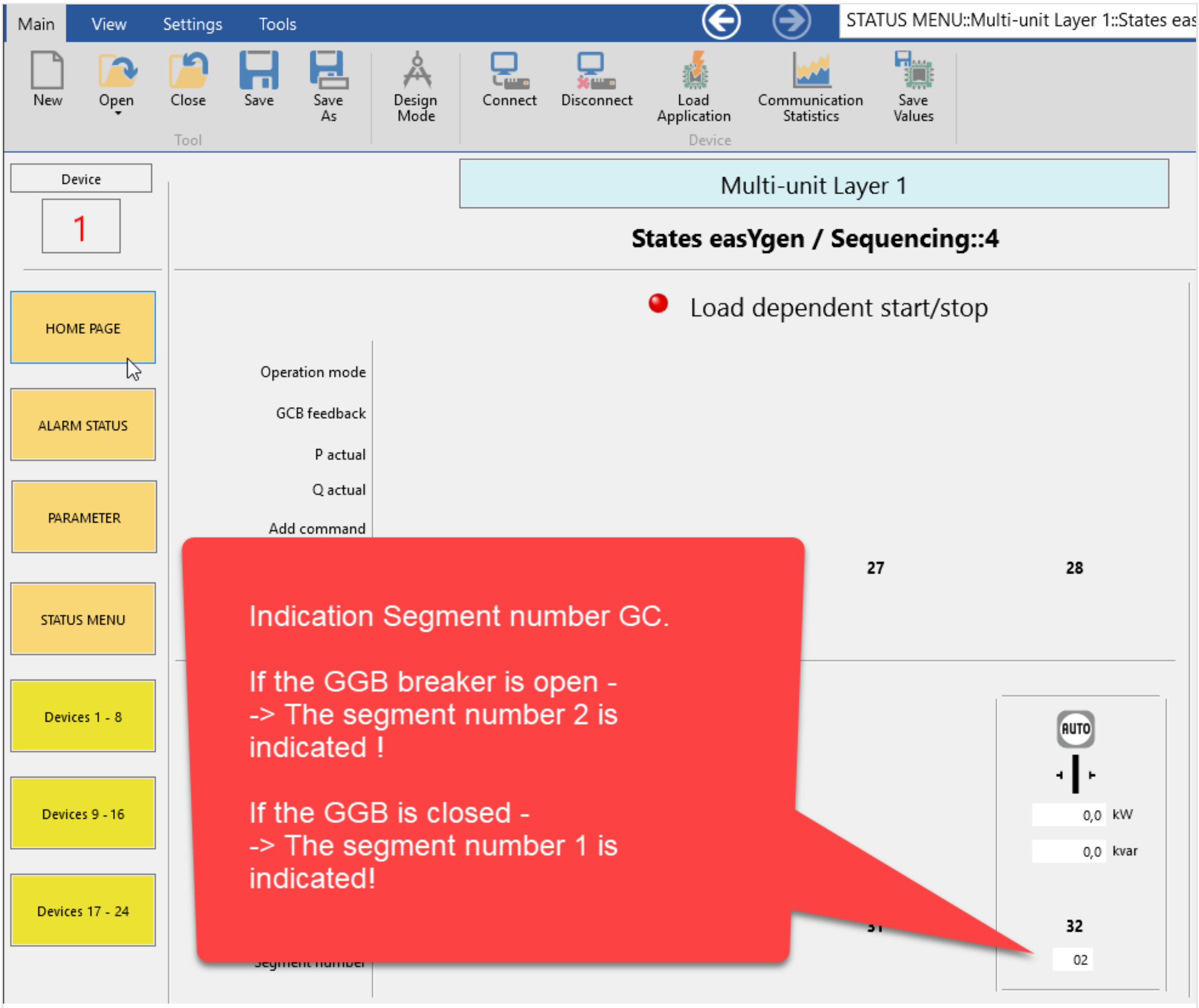


Fig. 103: *ToolKit screen: The GC is indicated as device 32 inside the group.*

GC

- Navigate to STATUS MENU / Multi-unit / Multi-unit Layer 1 / States easYgen

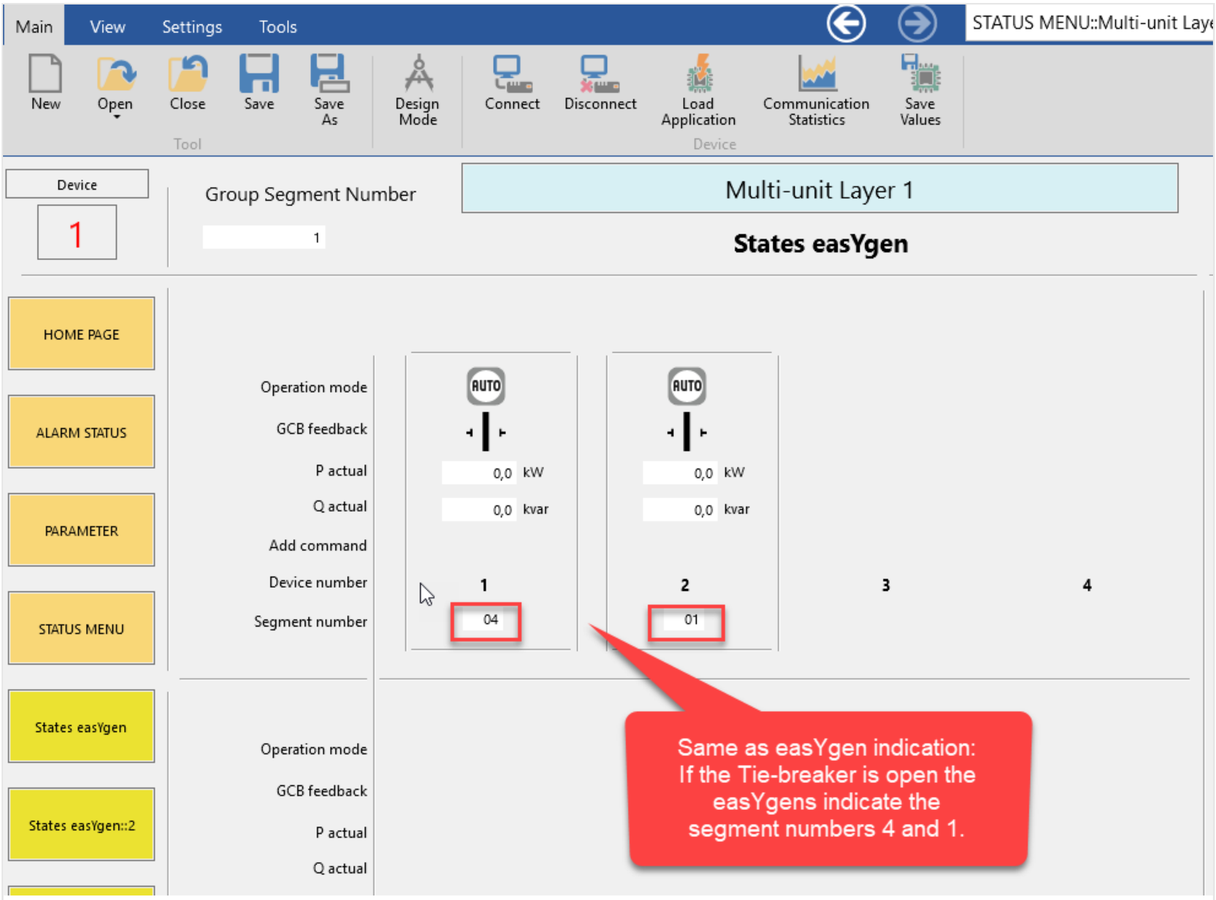


Fig. 104: ToolKit screen: The GC indicates the easYgens inside the group with the current segmenting situation.

- Navigate to STATUS MENU / Multi-unit / Multi-unit Layer 1 / States LSx
  - Device 33 (GC): MCB is open and GGB is closed
  - Device 34 (LSx): Tie-breaker is open

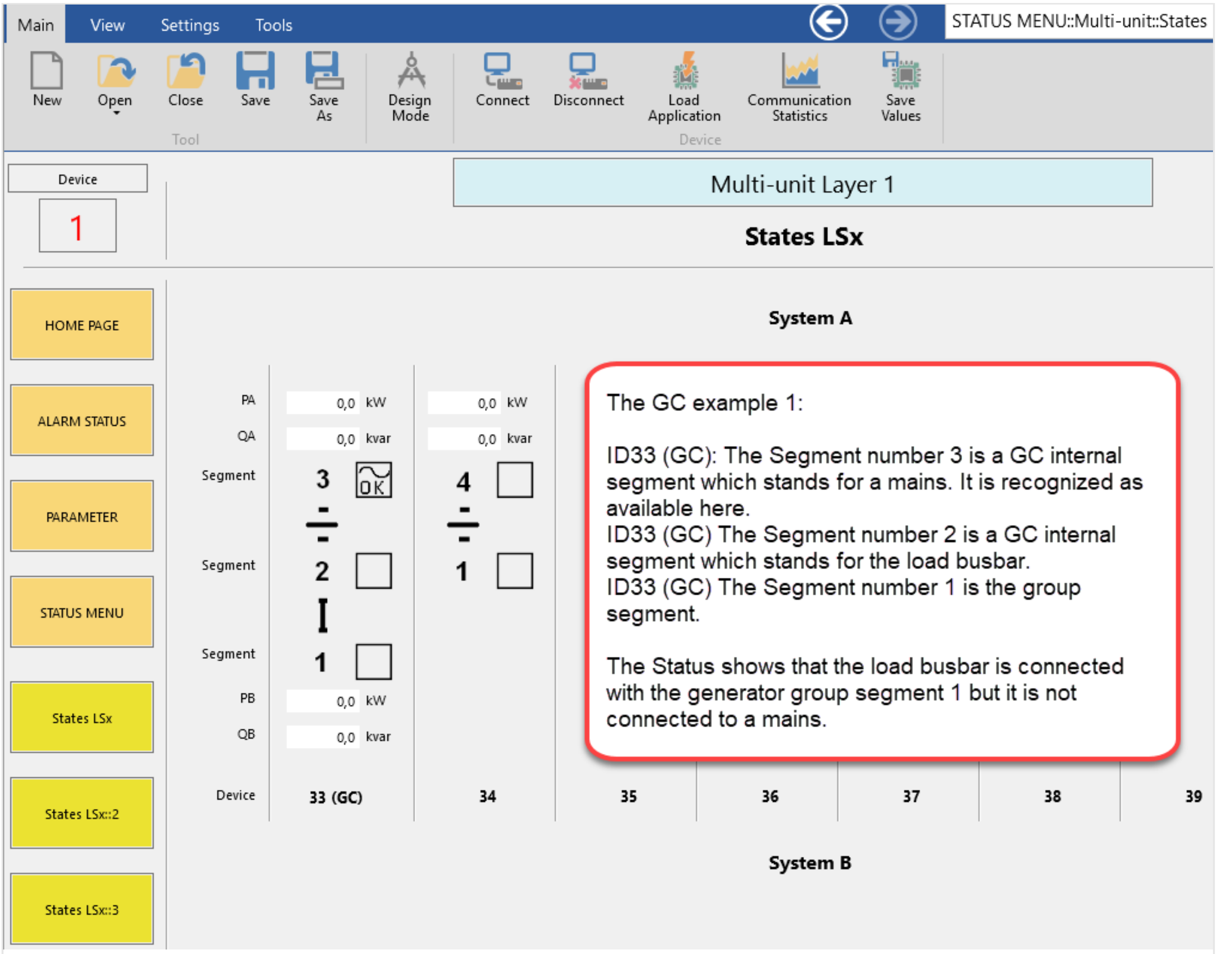


Fig. 105: ToolKit screen: Multi-unit Layer 1 – "States LSx" screen of GC 1 – GGB closed, MCB and Tie open

- STATUS MENU / Multi-unit / Multi-unit Layer 1 / States LSx
  - Device 33 (GC): MCB and GGB are closed
  - Device 34 (LSx): Tie-breaker is open

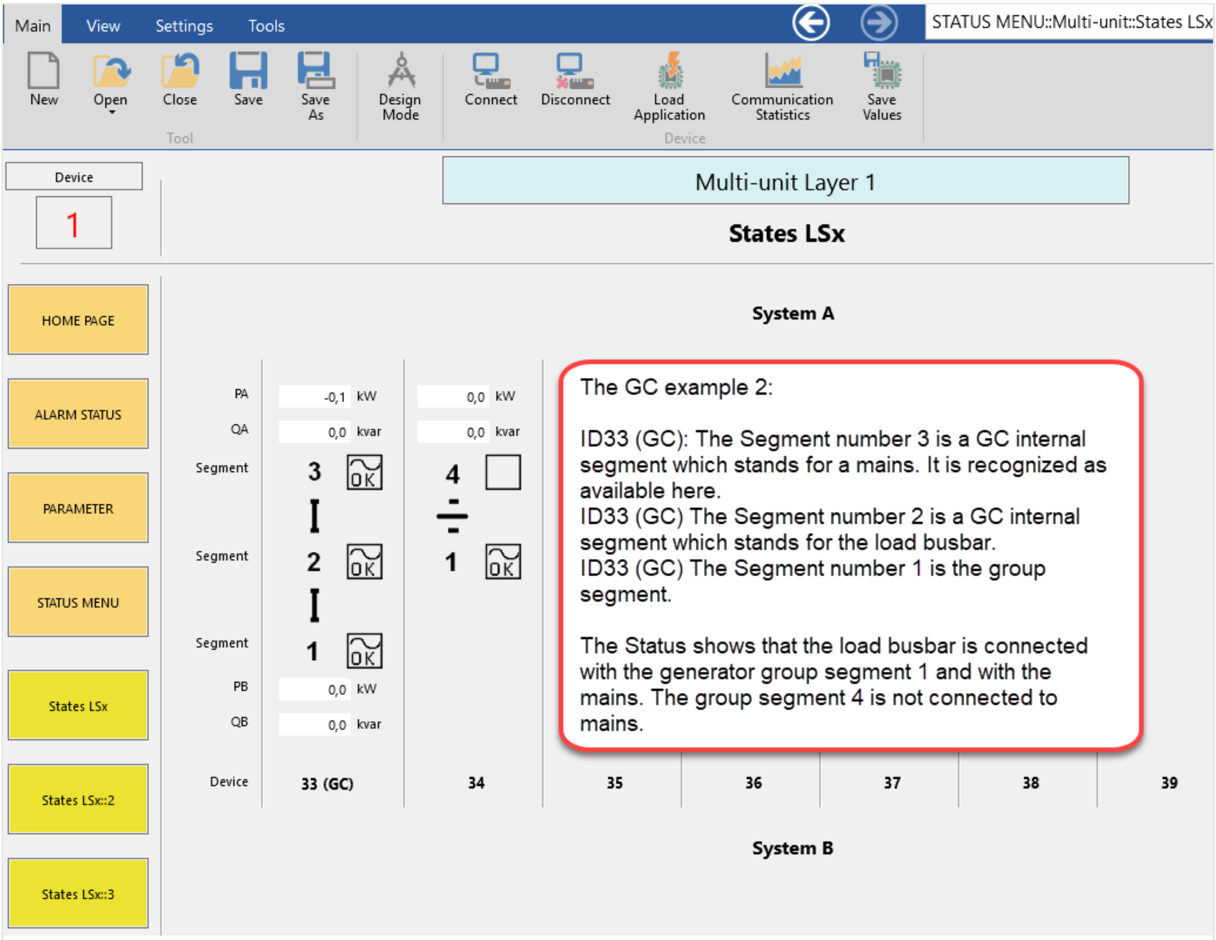


Fig. 106: ToolKit screen: Multi-unit Layer 1 – “States LSx” screen of GC 1 – MCB and GGB closed, Tie open

- STATUS MENU / Multi-unit / Multi-unit Layer 1 / States LSx
  - Device 33 (GC): MCB and GGB are closed
  - Device 34 (LSx): Tie-breaker is closed

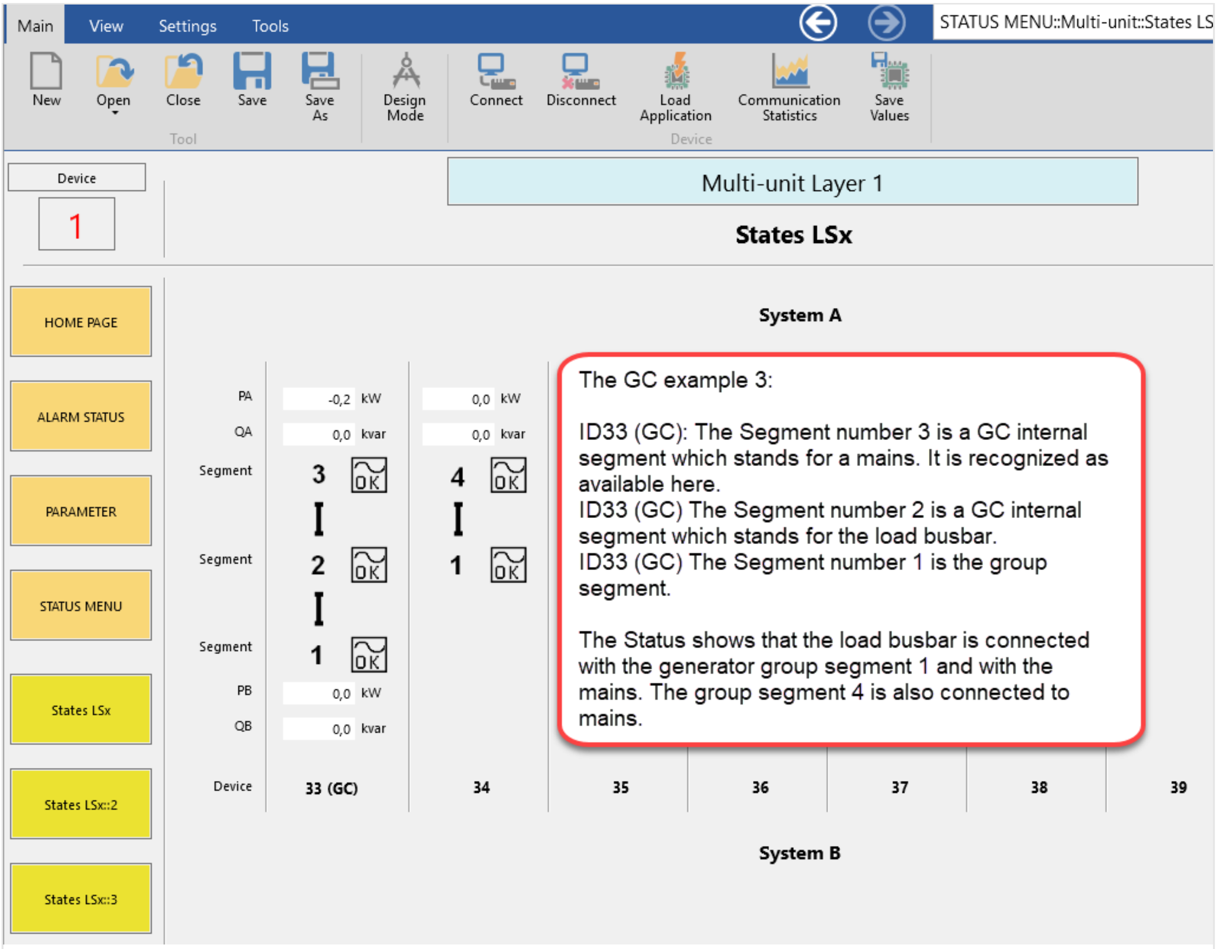


Fig. 107: ToolKit screen: Multi-unit Layer 1 – “States LSx” screen of GC 1 – MCB, GGB and Tie closed

6.4.8 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.

Example applications

The run-up synchronization can be applied in different applications. The following figures show some examples.

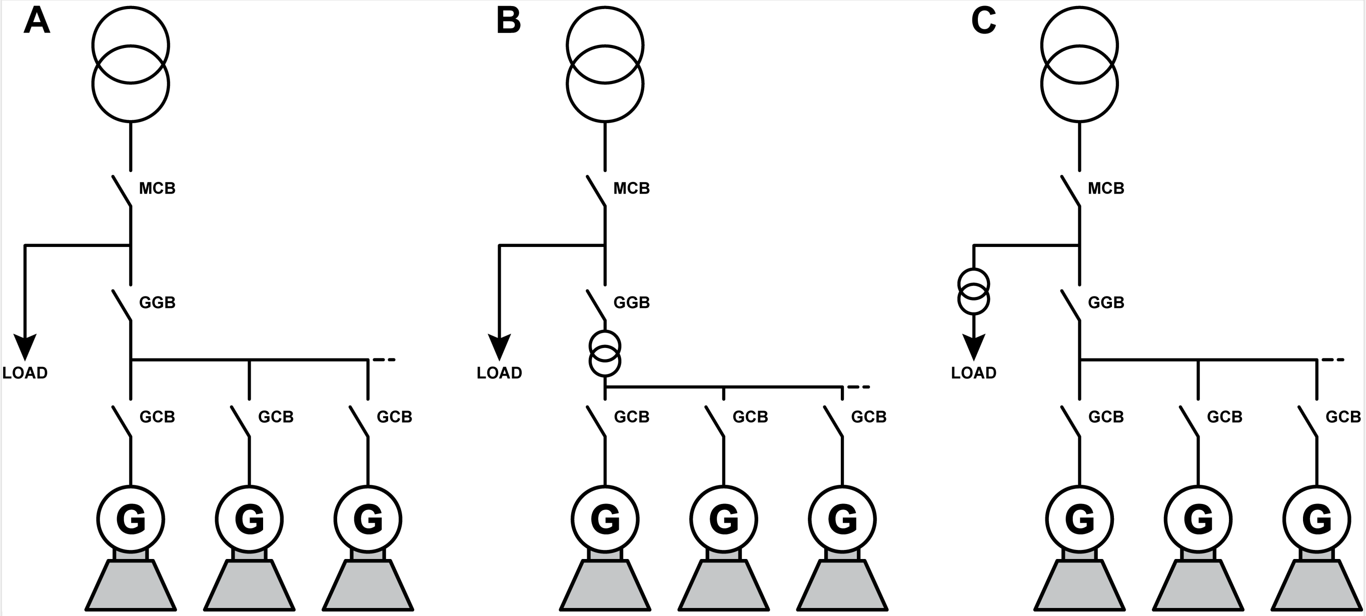


Fig. 108: Run-up synchronization examples

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

Functionality of the GC

Run-up synchronization in a GC System can be accomplished over the whole system (all groups together), each group individually or a mix of both. This depends on the precondition of the GGB of each group. All groups that have there busbar connected to each other (GGB closed, no open tie, same segment), will perform the run-up synchronization together. The groups with open GGB (or separated through any tie-breaker) will perform an isolated run-up synchronization only within there own group.

If the run-up synchronization shall run with simultaneous excitation (configurable in the easYgens) each GC will inform all connected GCs if its own group is ready for excitation. This allows to activate the excitation of all easYgens in the system (all groups) at the same time.

Each GC will also inform all other connected GCs that there is a run-up synchronization active which will avoid a deadbus closure request of any other GC or easYgen in the system.

In regards of run-up synchronization there are no requirements for the GC itself, but each easYgen which shall participate on the run-up synchronization needs to match the following requirements.

General easYgen requirements/preconditions

- The run-up synchronization is generally to release by configuration.
- Only the run-up synchronization mode GCB can be used. EasYgens with run up mode GCB/GGB will not participate at the run up synchronization.
- The LogicsManager "12937 Run-up sync." has to be set on TRUE.

- From the easYgen perspective an open connection to mains is required. Open connection to mains can be through an open MCB or GGB. This needs to be controlled by a PLC or GC configuration.
- An rpm speed source connection (MPU or J1939) is required and needs to be enabled.
- The easYgen busbar needs to be dead.
- There is no shutdown alarm present.
- Operating mode AUTOMATIC is active.
- An engine start command is active.
- No deadbus closure request of any easYgen (to same load busbar) is active.
- Start w/o load request is not active.
- Critical mode w/o closing GCB is not active.

For more information about how to configure an easYgen for the run-up synchronization, please refer to the easYgen manual.

Woodward strongly recommends to configure all gensets of a run-up synchronization system similar to avoid unexpected interruptions.

General notes

- The excitation of the easYgens can be simultaneous or individual. The simultaneous excitation can reduce the cross currents between generators in some critical situations.
- The Simultaneous excitation can be active for each group individual or for the whole system. This depends on the state of the GGB. A Group with open GGB will not participate at the Simultaneous Excitation for the whole system. But inside the group a simultaneous excitation is still available.
- After a easYgen is done with the run-up synchronization procedure it provides a "Run-Up synch. finished flag". This flag may be send via free command flags to the GC to start closing the GGB, for instance.
- A Group controller informs all other GCs about the run-up synchronization information of it own group (any run-up synch active, ready for excitation).
- The run-up synchronization is supported in application Mode GGB/MCB and GGB/LSx.
- The GC is not closing/open the GGB or MCB during run-up synchronization by it self. This has to be done by configuration and/or PLC commands.
- A LS-6XT in Layer 1 or Layer 3 will not effect the run-up synchronization logic. But they may change the constellation of participating units by separating easYgens or groups through tie-breakers.

6.4.9 Operating range voltage monitoring

For trouble shooting it is helpful to get a warning alarm from the group controller if it detects that measurement values are out of range. The monitoring detects also early defects on AC measurement connections.

This chapter gives a hint how to monitor Generator group voltage, Load busbar voltage and mains voltage if used. The resulting alarm can be taken into the communication protocol to a Master PLC or the issue can drive a common alarm class output.

6.4.9.1 Generator group and Load busbar voltage monitoring

First you consolidate your Generator group / Load busbar voltage window. These limits will be placed into the flexible limits 1 and 2 so that the correct operating range limits are monitored. The supervised variable shall be the generator group average L-L [%] voltage.

Both monitors are enabled with a release flag which becomes TRUE if the GGB close command is active AND the GGB is open. The monitors are driving a warning alarm to inform a Master PLC or to set any relay output.

Refer to figures below:

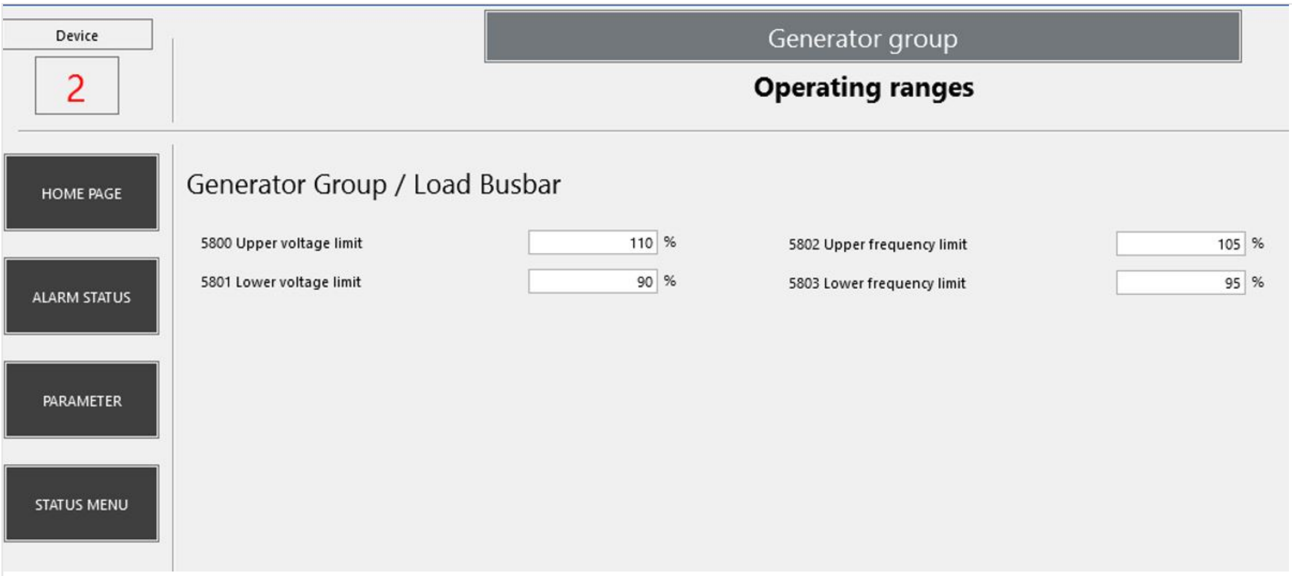


Fig. 109: Entering the operating range limit for generator group and busbar

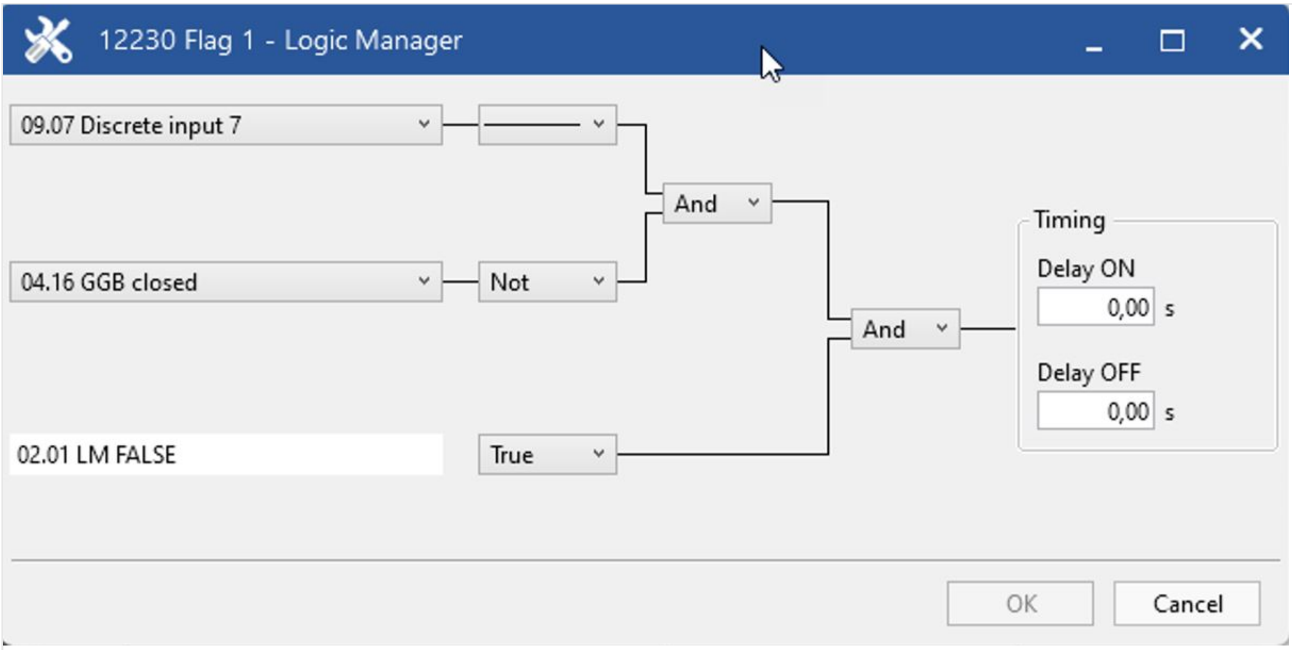


Fig. 110: LM internal flag 1: Release monitoring - (DI7 = Close order GGB refer to wiring diagram)

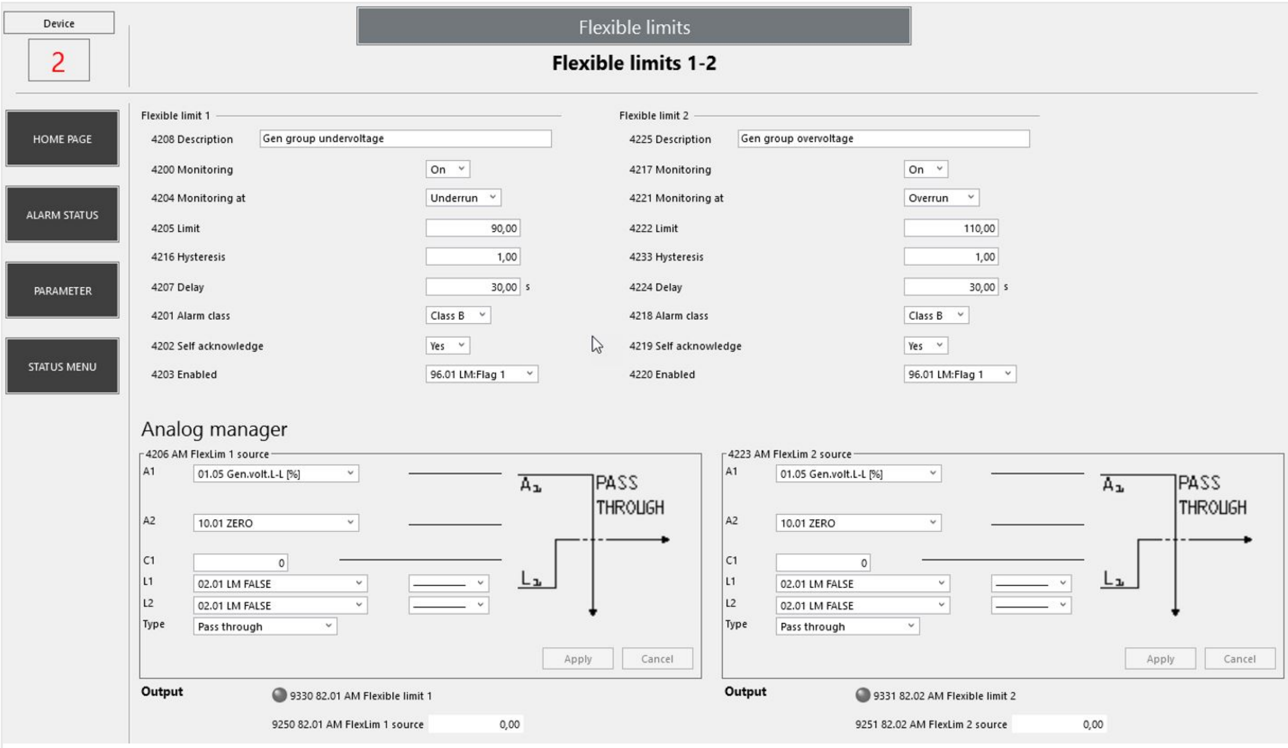


Fig. 111: The flexible limits 1 and 2 are resulting also into a class B alarm.

The limits of the Generator group / Load busbar voltage window will be placed into the flexible limits 3 and 4 so that the correct operating range limits are monitored. The supervised variable shall be Busbar L-L voltage. Both monitors are always enabled. The monitors are driving a warning alarm to inform a Master PLC or to set any relay output.

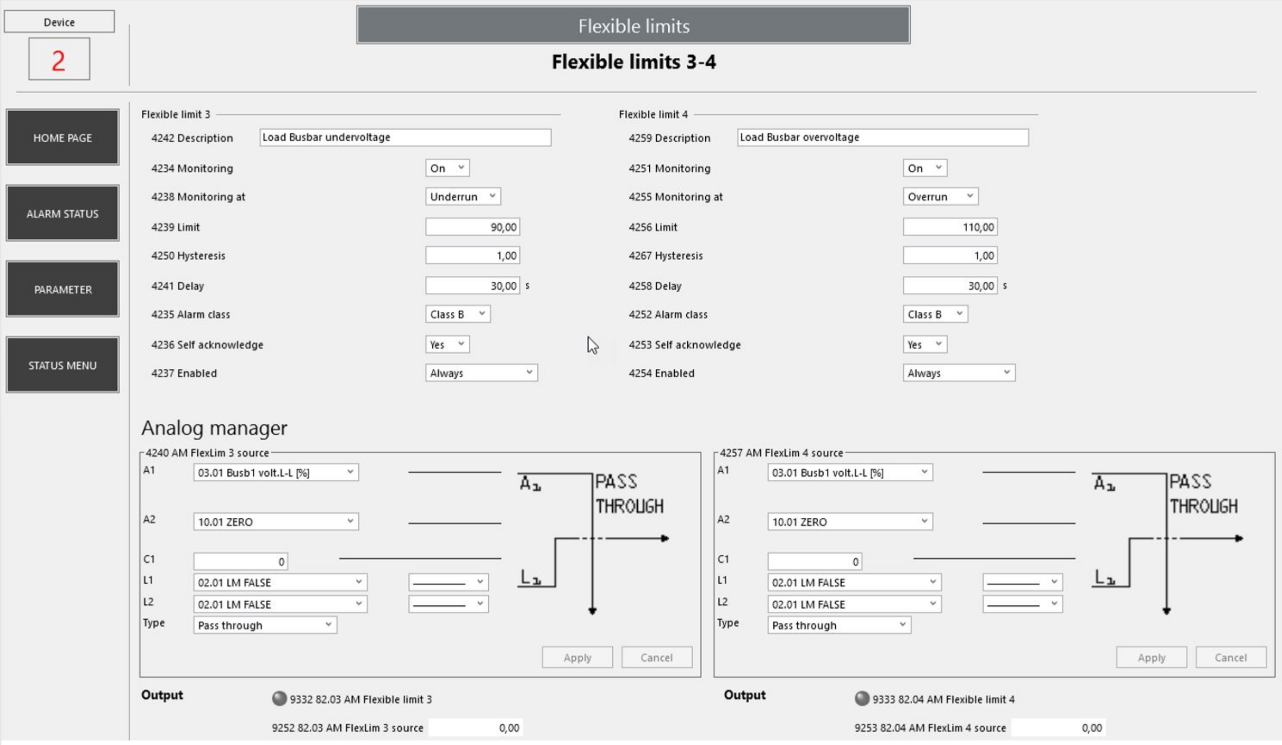


Fig. 112: The flexible limits 3 and 4 are resulting also into a class B alarm

6.4.9.2 Mains voltage monitoring

The flexible limits 5 and 6 will be configured with the operating range limits of the utility. The supervised variable is the Mains average L-L voltage. The monitors are driving a warning alarm to inform a Master PLC or to drive any relay output.

Refer to figures below:

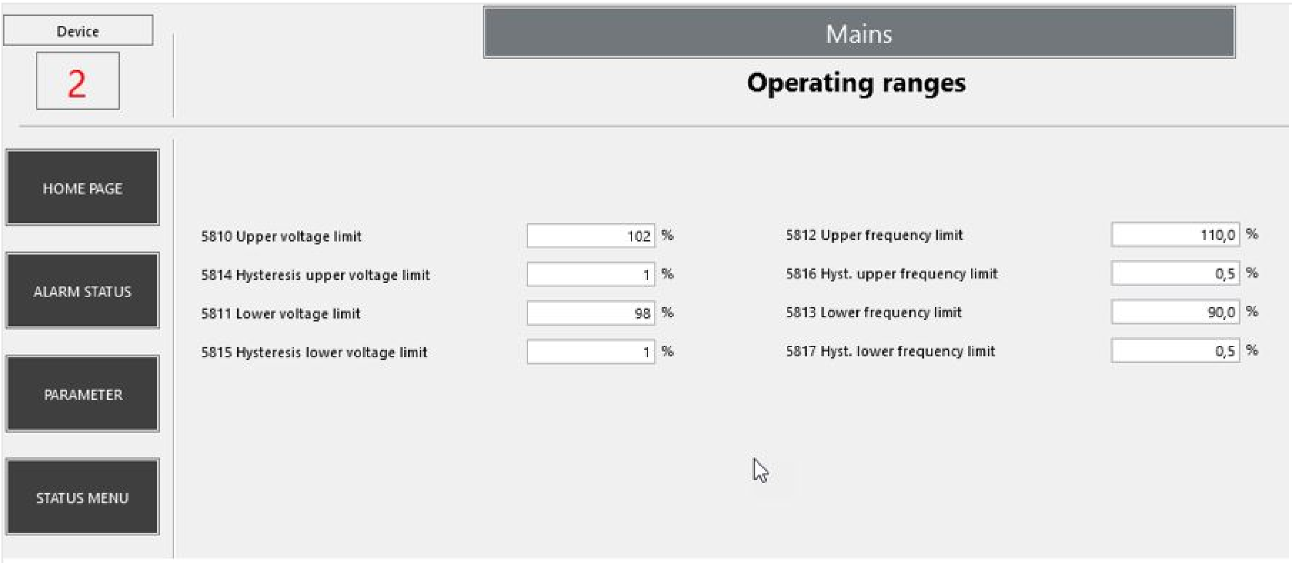


Fig. 113: Entering the operating range limit for mains

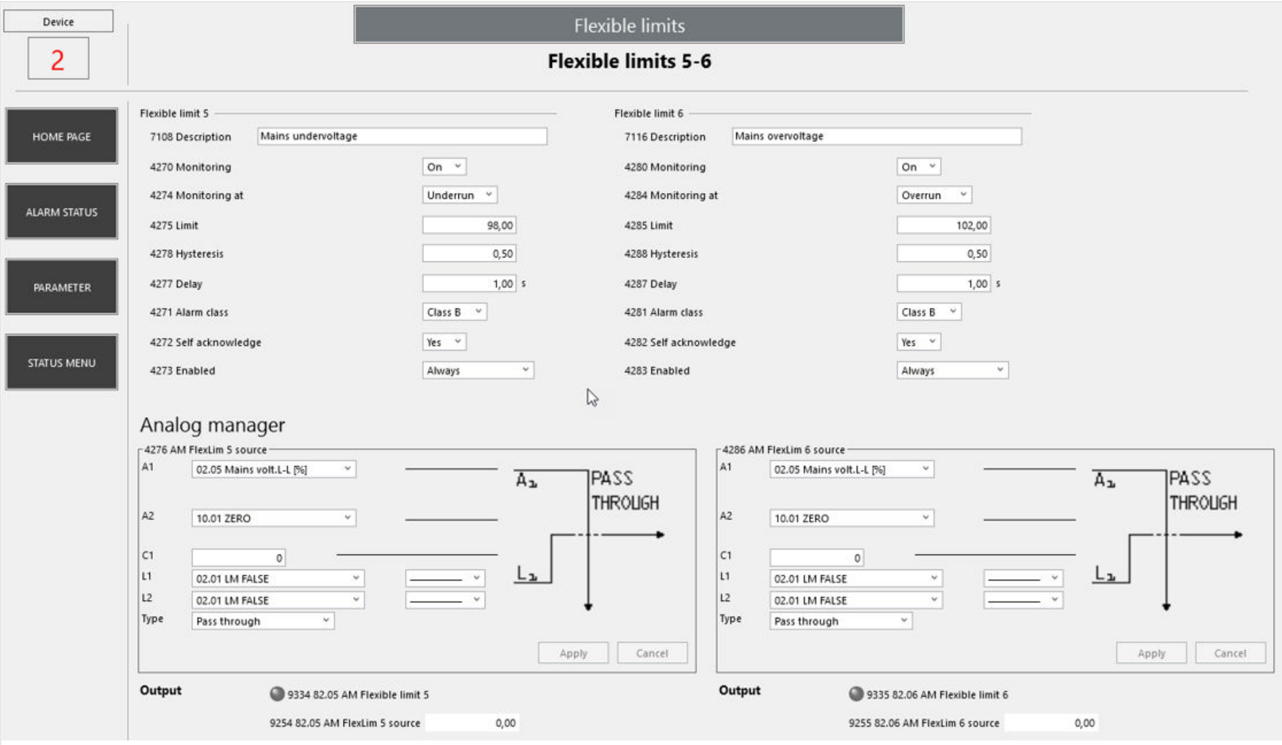


Fig. 114: The flexible limits 5 and 6 are resulting also into a class B alarm

6.4.9.3 Digital input monitoring (GGB reply)

There are existing critical digital inputs which needs to be monitored on proper function. The example in this chapter treats the GGB feedback. With this procedure the controller can recognize a wire break, a breaker issue, or an internal failure of the device. The GGB feedback determines the segmenting of the overall system and can negative influence the load sharing behavior of multiple gensets.

The example uses the digital input 9 as an inverted signal to the digital input 8, which is the GGB open feedback for the control. There are two breaker feedback signals to wire. At best with two auxiliary contacts.

First there will be created a failure flag if both signals are showing logically 0:0 respectively 1:1. This can never be with two inverted signals. Secondly the example drives a flexible limit to initiate an alarm. This alarm goes to a Power Management System (PMS) by a relay output or over communication interface to initiate proper actions like open the breaker physically and switch the GC to an unknown segment. The unknown segment guarantees that no other GC can recognize the broken GC.

Refer to figures below:

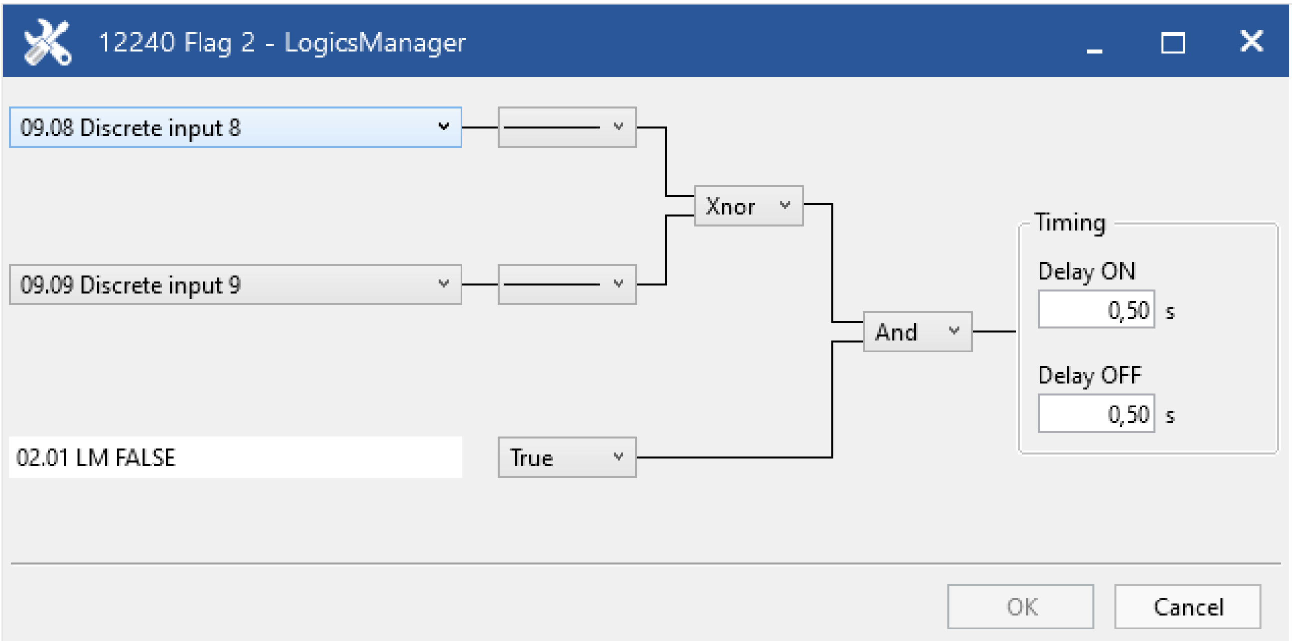


Fig. 115: DI8 and DI9 on same level causing after 0.5sec a failure flag

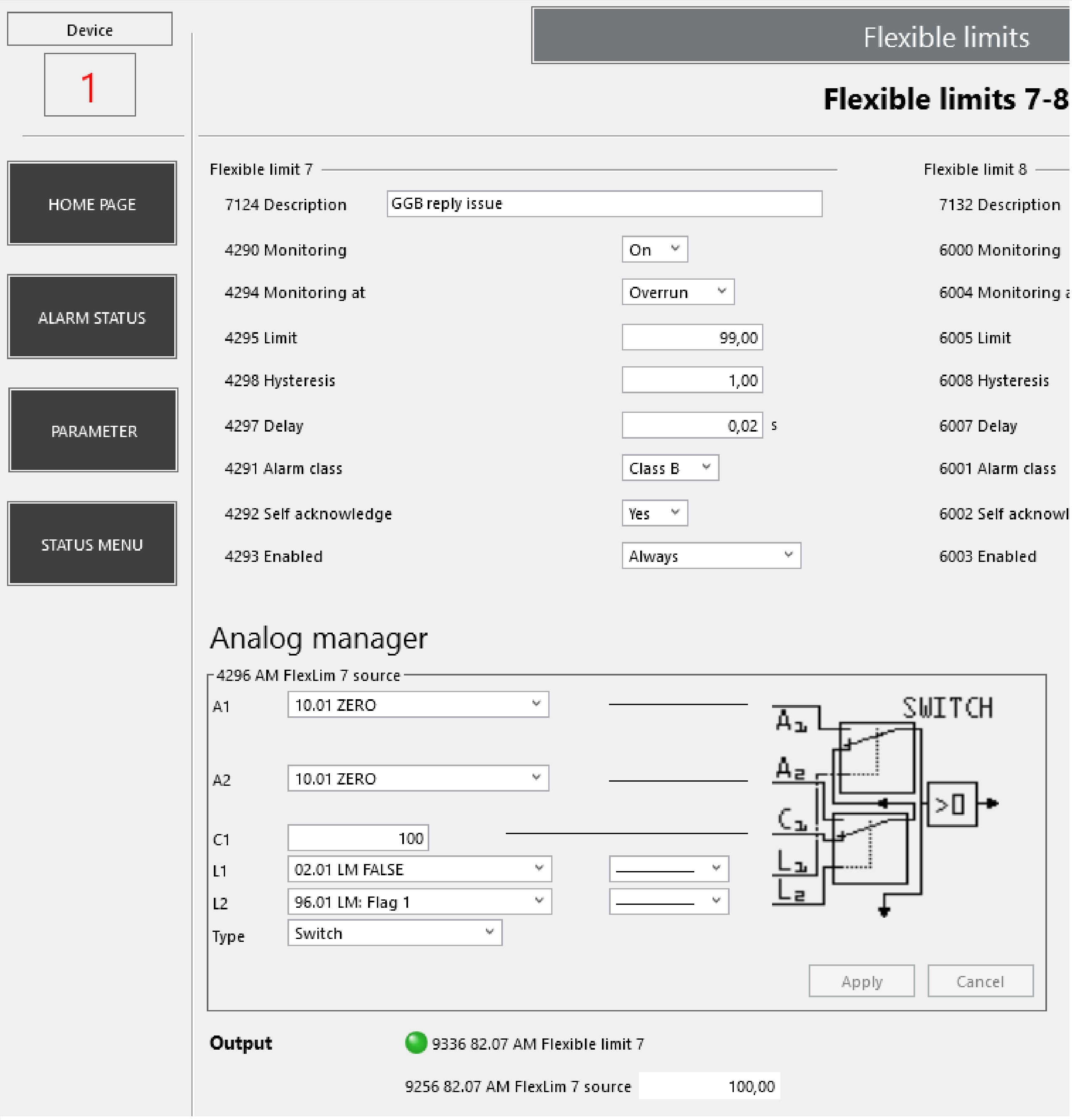


Fig. 116: The failure flag creates over the AnalogManager “Flexlim source” with operator “switch” the analog value 100. The 100 drives finally a warning alarm. This alarm can be sent to a PMS.

6.5 Communication Management

6.5.1 System Update

General notes

The Communication Management gives an overview of all devices on the load share bus in the system with regard to their different interfaces (Ethernet and CAN). See ⮱▷ "6.5.2 Diagnostic Screens".

Additionally it provides functions to monitor the communication members and the interface. The monitor not only detects missing members, it also monitors a defined and stored constellation with the current constellation for deviations. This function is called »System Update«.

The behavior and visualisation of the Communication Management differs according to the Application Layer. For more information about the application layers, see ⮱▷ "6.1 Application Layers"

For a better understanding there needs to be some expressions explained.

System update expressions and their meaning:

- **»System Update« or »System Update function«:**

  Is the overall procedure that, if triggered, saves after 30 seconds the actual constellation of members.

- **»System Update order«:**

  Triggers the System Update function. ⮱▷ "How to initiate a system update"

- **»System Update delay timer«:**

  A timer of 30 second that starts after the System Update order was triggered.

- **»System Update active«:**

  This flag is active while the System Update delay timer is running.

- **»System Update monitoring«:**

  After the System Update function was triggered and is finished, the saved constellation is monitored in regards of any change.

- **»System Update alarm«:**

  Occurs if an additional device is recognized that does not exist in the actual saved constellation. See ⮱▷ "9.6.4 Alarm Messages" for more details.

- **»Missing Member alarm«:**

  Occurs if a device is not recognized but exists in the actual saved constellation. See ⮱▷ "9.6.4 Alarm Messages" for more details.

With the System Update order, a delay timer of 30 seconds is triggered and a flag will be send to all other members on the load share and control bus. During this time the System Update and missing member monitoring is disable in all members to not interrupt a well working plant by upcoming alarm messages and control reactions on them due to shutting down a device for maintenance. Short before this delay timer ends, the System Update function saves the actual constellation of recognized devices.

During the delay time the LogicsManager flag *04.65 System update active* is active.

NOTICE!

A change of the Device ID or of the Load Share Interface parameter ⮱▷ 9929 will reset the saved constellation for Layer 3 and a new System Update order for Layer 3 needs to be triggered. For more information about the application layers, see ⮱▷ "6.1 Application Layers"

NOTICE!

A change of the Load Share Interface parameter ⮱▷ 9924 will reset the saved constellation of Layer 1 and a new System Update order for Layer 1 needs to be triggered. For more information about the application layers, see ⮱▷ "6.1 Application Layers"

After the System Update function is finished, the saved constellation will be monitored. Any deviation to this constellation will be recognized and noticed by an alarm that describes the type of change.

A missing member alarm is shown if a device, of the saved constellation, is not recognized anymore. If an additional device is recognized, that does not exist in the saved constellation, a System Update alarm is shown, see ⮱▷ "System update expressions and their meaning:"

Each Alarm is also available as flag for the LogicsManager system.

To configure the »System update« Monitoring for Layer 1, see ⮱▷ "4.4.5.3.1 Monitoring System update Layer 1".

To configure the »System update« Monitoring for Layer 3, see ⮱▷ "4.4.5.4.1 Monitoring system update Layer 3".

To configure the »Missing Member« Monitoring for Layer 1, see ⮱▷ "4.4.5.3.2 Multi-unit missing easYgen" and ⮱▷ "4.4.5.3.3 Multi-unit missing LSx".

To configure the »Missing Member« Monitoring for Layer 3, see ⮱▷ "4.4.5.4.2 Multi-unit GC" and ⮱▷ "4.4.5.4.3 Multi-unit missing LSx".

For Layer 1, the system update function incorporates all easYgen members and all LSx layer 1 members on the control bus inside the group. So with the system update order the amount and constellation of all devices (easYgen and LSx layer 1) on the load share and control bus will be saved.

For Layer 3, the system update function incorporates all GC members and all LSx layer 3 members on the control bus. So with the system update order the amount and constellation of all devices (GC and LSx layer 3) on the load share and control bus will be saved.

If a redundant Ethernet bus for load sharing is chosen, 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 screens

There are several overview screens to check all members on the load share and control bus and helps trouble shooting. These screens must be verified, before and after the system update order is executed. The Diagnostic screens are located under [Status Menu / Multi-unit / Diagnostic devices].

For more details see ⮡ "6.5.2 Diagnostic Screens".

Availability

The system update function is available for all choices of the Load Share Interface parameters:

Layer 1, parameter ⮡ 9924:

- Communication over CAN 1 bus
- Communication over Ethernet network A
- Communication over redundant CAN 1 bus and Ethernet network A

Layer 3, parameter ⮡ 9929:

- Communication over Ethernet network B
- Communication over redundant Ethernet network B and C

How to initiate a system update

In Layer 1, the system update order can be initiated with the following options:

- By ToolKit switch ⮡ 13356 »System update«. Navigate to [Status Menu / Multi-unit Layer 1: / Diagnostic easYgen (or Diagnostic LSx)]
- By LogicsManager 86.35 with parameter ⮡ 7801 »System update«. Navigate to [Parameter / Configuration: / Configure monitoring / Miscellaneous: / Multi-unit Layer 1]

In Layer 3, the system update order can be initiated with the following options:

- By ToolKit switch ⮡ 13349 »System update«. Navigate to [Status Menu / Multi-unit Layer 3: / Diagnostic GC (or Diagnostic LSx)]
- By LogicsManager 86.37 with parameter ⮡ 12892 »System update«. Navigate to [Parameter / Configuration: / Configure monitoring / Miscellaneous: / Multi-unit Layer 3]

NOTICE!

Please consider that the System Update gets triggered by a rising edge from FALSE to TRUE. If using the LogicsManager »7801 System update« or »12892 System update«, ensure that the signal goes back to FALSE after executing. Otherwise, all further system update executions will be blocked.

The actual constellation of all members on the loadshare and control bus are displayed in the according diagnostic screens in ToolKit.

6.5.2 Diagnostic Screens

The diagnostic screens are helping the operator to recognize the current communication state of the load share and control bus. These screens must be reviewed before and after executing a system update order. It is highly recommended to review the diagnostic screen of each device that is participating on the load share/control bus. The system update function will save exactly the states which are displayed in these screens.

In case of a missing member or system update alarm, these screens will also help the operator to detect the root cause and for general troubleshooting.

The status of each device in the system will be indicated by a status ”LED“ in conjunction with a status text.

There are different Diagnostic Screens available for Layer 1 and Layer 3, see below.

Diagnostic Screens Layer 1

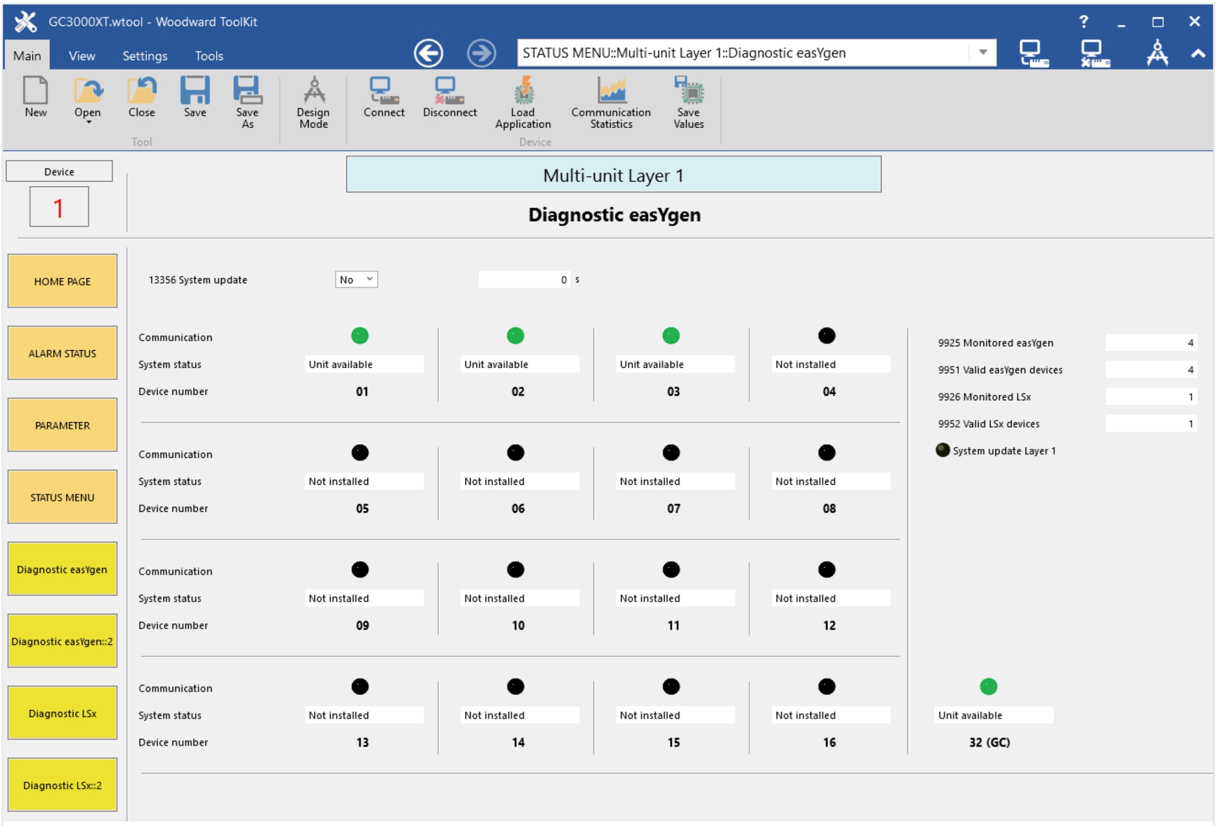


Fig. 117: Diagnostic screen easYgens of own GC group

In Layer 1 there are diagnostic screens for the following devices:

- easYgen
- LSx Layer 1

- The diagnostic screens of Layer 1 show only devices which belong to the same group (connection to the same Group Controller).
- In Layer 1 the Diagnostic Screen for LSx show the GC as device 33
- In Layer 1 the Diagnostic Screen for easYgen show the GC as device 32

Load Share Gateways (LSG) will be shown in the diagnostic screens as easYgen devices with number 15 (reactive power) and 16 (active power).

The ToolKit diagnostic screens in Layer 1 show, additional to the status of each device, the number of »Monitored devices«, the number of »Valid devices« and the parameter ⮱▷ 13356 to activate the System Update order, see also ⮱▷ Table 53. While the System Update is active, the remaining time will be shown. If there is an active System Update Alarm it is shown by the »System Update Layer 1« LED.

ID	Parameter	CL	Setting range [Default]	Description
13356	**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 13356.
9951	**Valid easYgen devices**	-/-	Actual count of valid devices	Actual count of devices that has send valid data.
9926	**Monitored LSx**	-/-	Latest result of members count	Result of members count driven by system update parameter 13356.
9952	**Valid LSx devices**	-/-	Actual count of valid devices	Actual count of devices that has send valid data.

Table 53: Parameter: Diagnostic Screen Layer 1

All Diagnostic Screen Parameters are accessible via communication interfaces. The system update command can be initiated through a free control flag.

Diagnostic Screens Layer 3

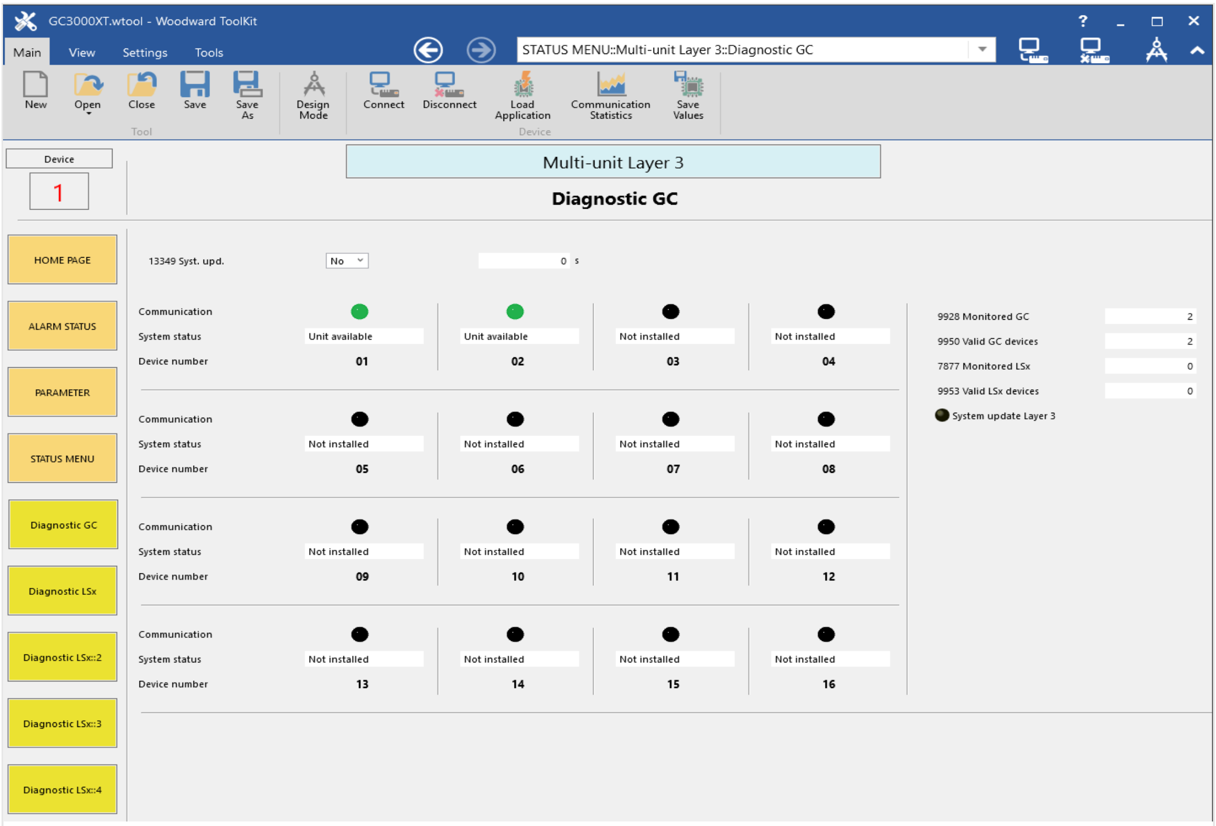


Fig. 118: Diagnostic screen GC

In Layer 3 there are diagnostic screens for the following devices:

- Group Controller,
- LSx Layer 3

The ToolKit diagnostic screens in Layer 3 show, additional to the status of each device, the number of »Monitored devices«, the number of »Valid devices« and the parameter ⮑ 13349 to activate the System Update order, see also ⮑ Table 54. While the System Update is active, the remaining time will be shown. If there is an active System Update Alarm it is shown by the »System Update Layer 3« LED.

ID	Parameter	CL	Setting range [Default]	Description
13349	**System update**	2	Yes	Network is checked for members and its states. Updated results become new status.
			[No]	Check and update is disabled.
9928	**Monitored GC**	-/-	Latest result of members count	Result of members count driven by system update parameter 13356.
9950	**Valid GC devices**	-/-	Actual count of valid devices	Actual count of devices that has send valid data.
7877	**Monitored LSx**	-/-	Latest result of members count	Result of members count driven by system update parameter 13356.

ID	Parameter	CL	Setting range [Default]	Description
9953	**Valid LSx devices**	-/-	Actual count of valid devices	Actual count of devices that has send valid data.

Table 54: Parameter: Diagnostic Screen Layer 3

All Diagnostic Screen Parameters are accessible via communication interfaces. The system update command can be initiated through a free control flag.

Diagnostic Screen status and messages

The following tables show the possible status and messages that are available on the Diagnostic Screens. They differ according to the configured Load Share Interface parameters 9924 and 9929 and the resulting bus topology (single or redundant).

Single bus topology means there is no redundant bus topology in use. This can be load share over CAN bus or a single Ethernet A or B network, see Table 55

Redundant bus topology means there are two load share busses connected between the devices. This can be CAN/EthernetA or EthernetB/C, see Table 56 and Table 57. A redundant bus topology provides more safety in regards of load share communication.

It is possible, that several system status messages are active at same time. So the indication is prioritized:

- Unit not recognized (highest priority)
- Add device
- Only NW X
- Not installed

It is possible, that several system status are causing different LED messages. So the indication is prioritized:

- Red LED (highest priority)
- Yellow LED
- Black (off) LED

System and Control bus (CAN or single Ethernet)		
LED	**ToolKit: displayed text**	**Explanation**
GREEN	Unit available	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 and Control bus (CAN or single Ethernet)		
LED	**ToolKit: displayed text**	**Explanation**
		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	This device is neither recognized nor registered through the latest system update order.
(/) RED / BLACK (twinkling)	Unit not recognized / Not installed (twinkling)	This only applies to the own device. There is no other device recognized according to the latest system update. This unit is suspected.

Table 55: Diagnostic Screen status and messages for single bus topology

System and Control bus (Redundant CAN/EthernetA)		
LED	**ToolKit: displayed text**	**Explanation**
GREEN	Unit available	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!**
YELLOW	Only NW CAN	This device is not recognized on the Ethernet A bus according to the latest system update. Therefore, a Redundancy Lost Alarm is triggered.
YELLOW / BLACK (twinkling)	Only NW CAN / Not installed (twinkling)	This only applies to the own device. There is no other device recognized on the Ethernet A bus according to the latest system update. This unit is suspected. A Redundancy Lost Alarm is triggered.
YELLOW	Only NW A	This device is not recognized on the CAN bus according to the latest system update. Therefore, a Redundancy Lost Alarm is triggered.
YELLOW / BLACK (twinkling)	Only NW A / Not installed (twinkling)	This only applies to the own device. There is no other device recognized on the CAN bus according to the latest system update. This unit is suspected. A Redundancy Lost Alarm is triggered.

System and Control bus (Redundant CAN/EthernetA)		
LED	**ToolKit:** **displayed text**	**Explanation**
RED	Unit not recognized	This device is not recognized according to the latest system update order. (Missing Member Alarm)
BLACK	Not installed	This device is neither recognized nor registered through the latest system update order.
(/) RED / BLACK (twinkling)	Unit not recognized / Not installed (twinkling)	This only applies to the own device. There is no other device recognized according to the latest system update. This unit is suspected. A Redundancy Lost Alarm is triggered.

Table 56: Diagnostic Screen status and messages for redundant bus topology CAN/EthernetA

System and Control bus (Redundant EthernetB/C)		
LED	**ToolKit:** **displayed text**	**Explanation**
GREEN	Unit available	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!**
YELLOW	Only NW B	This device is not recognized on the Ethernet C bus according to the latest system update. Therefore, a Redundancy Lost Alarm is triggered.
(/) YELLOW / BLACK (twinkling)	Only NW B / Not installed (twinkling)	This only applies to the own device. There is no other device recognized on the Ethernet C bus according to the latest system update. This unit is suspected. A Redundancy Lost Alarm is triggered.
YELLOW	Only NW C	This device is not recognized on the Ethernet B bus according to the latest system update. Therefore, a Redundancy Lost Alarm is triggered.
(/) YELLOW / BLACK (twinkling)	Only NW C / Not installed (twinkling)	This only applies to the own device. There is no other device recognized on the Ethernet B bus according to the latest system update. This unit is suspected. A Redundancy Lost Alarm is triggered.

System and Control bus (Redundant EthernetB/C)		
LED	**ToolKit: displayed text**	**Explanation**
RED	Unit not recognized	This device is not recognized according to the latest system update order. (Missing Member Alarm)
BLACK	Not installed	This device is neither recognized nor registered through the latest system update order.
(/) RED / BLACK (twinkling)	Unit not recognized / Not installed (twinkling)	This only applies to the own device. There is no other device recognized according to the latest system update. Communication error on network. This unit is suspected.

Table 57: Diagnostic Screen status and messages for redundant bus topology EthernetB/C

6.5.3 Practicing the System Update Functionality

⚙ **Commissioning of Layer 1 application**

1. ▷ 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.
   The sum of all easYgen devices inside a GC group must match the number shown at parameter »9951 Valid easYgen devices«, see ⮡▷ Table 53.
   The sum of all LS-6XT Layer 1 devices inside a GC group must match the number shown at parameter »9952 Valid LSx devices«, see ⮡▷ Table 53.
   If all these conditions are fulfilled the system update order can be executed. If any expected condition is not fulfilled do trouble shooting before you hit any system update order.

   NOTICE!

   It is highly recommended to verify the diagnostic screen of each device in the system.

2. ▷ Executing the System Update order for Layer 1, see ⮡▷ "How to initiate a system update"

▶ After 30 seconds all devices must be indicated with a green lamp in the diagnostic screens.
The sum of all easYgen devices must match the number shown at parameter »9925 Monitored easYgen« and »9951 Valid easYgen«.
The sum of all LSx devices must match the number shown at parameter »9926 Monitored LSx« and »9952 Valid LSx devices«.

⚙ Commissioning of Layer 3 application

1. ▷ A Layer 3 application always contains at least one GC and a Layer 1 part underneath it.
   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.
   Before observing the Layer 3 part it is recommended to first observe each group in Layer 1 of the application. For each group the procedure shown in ⮱ "6.5.3 Practicing the System Update Functionality" need to be executed.
2. ▷ If each groups in Layer 1 were stored successfully by a system update order, the diagnostic screens of Layer 3 need to be observed, whether all devices are recognized.
   The sum of all GC devices must match the number shown at parameter »9950 Valid GC devices«, see ⮱ Table 54.
   The sum of all LS-6XT Layer 3 devices must match the number shown at parameter »9953 Valid LSx devices«, see ⮱ Table 54.
   If all these conditions are fulfilled the system update order can be executed. If any expected condition is not fulfilled do trouble shooting before you hit any system update order.

   NOTICE!

   ! It is highly recommended to verify the diagnostic screen of each device in the system.
3. ▷ Executing System Update order for Layer 3, see ⮱ "How to initiate a system update"

   ▶ After 30 seconds all devices must be indicated with a green lamp in the diagnostic screens.
   The sum of all GC devices must match the number shown at parameter »9928 Monitored GC« and »9950 Valid GC devices«.
   The sum of all LSx devices must match the number shown at parameter »7877 Monitored LSx« and »9953 Valid LSx devices«.

⚙ Adding a device to an already running and commissioned Layer 1 network

1. ▷ Connect the additional device onto the network.
2. ▷ Check the availability in the diagnostic screen. The new device is indicated by a yellow LED and with status text »Add device«.
3. ▷ Executing the System Update order for Layer 1, see ⮱ "How to initiate a system update"

   ▶ After 30 seconds all devices must be indicated with a green lamp in the diagnostic screens.
   The sum of all easYgen devices must match the number shown at parameter »9925 Monitored easYgen« and »9951 Valid easYgen«.
   The sum of all LS-6XT Layer 1 devices must match the numbers shown at parameters »9926 Monitored LSx« and »9952 Valid LSx devices«, see ⮱ Table 53

⚙ Adding a device to an already running and commissioned Layer 3 network

1. ▷ Connect the additional device onto the network.
2. ▷ Check the availability in the diagnostic screen. The new device is indicated by a yellow LED and with status text »Add device«.
3. ▷ Executing the System Update order for Layer 3, see ⮡ "How to initiate a system update"

▶ After 30 seconds all devices must be indicated with a green lamp in the diagnostic screens.

The sum of all GC devices must match the number shown at parameter »9928 Monitored GC« and »9950 Valid GC devices«.

The sum of all LS-6XT Layer 3 devices must match the numbers shown at parameters »7877 Monitored LSx« and »9953 Valid LSx devices«, see ⮡ Table 54

⚙ **Removing a device from an already running and commissioned Layer 1 network**

1. ▷ Executing the System Update order for Layer 1, see ⮡ "How to initiate a system update"

> If you are removing the device before you hit the system update order, it is important to 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, this issue can be solved 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

⚙ **Removing a device from an already running and commissioned Layer 3 network**

1. ▷ Executing the System Update order for Layer 3, see ⮡ "How to initiate a system update"

> If you are removing the device before you hit the system update order, it is important to 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, this issue can be solved 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

6.5.4 Tips for commissioning load share communication via Ethernet

Preliminary notes

In cases where the system information (e.g. load sharing) is routed via Ethernet, UDP messages are exchanged. This Ethernet network can become relatively complicated. The complexity is generated among other things by the number of subscribers, switches, remote panels and gateways. Depending on the application, the GC can reach a limit at which the acceptance and transmission of the data cannot be implemented without exception with the configured transmission rate. This is usually not critical because the

UDP messages are constantly sent and thus the latest information is immediately available again.

However, to ensure and verify stable communication, the LS-6 offers various instruments listed below.

Instruments to monitor and adapt stable communication

Please note that changing one of these settings have to be changed in all members to the same value.

1. The System Update Diagnostic Screens (refer to ⮱▷ “6.5.2 Diagnostic Screens”). They indicate whether system data arrives at the GC at all.

2. **To monitor Layer 1 communication:**
   Use the flags "08.78 easYgen LS timeout", "08.79 LSx LS timeout layer1" and "08.80 Red.LS timeout layer1". The GC can store the configured and overflowed layer 1 timeouts as collective flag in the LogicsManager pool. It is also possible to display this collective flag temporarily in the event log during commissioning (see parameter "Load share timeout event" ⮱▷ 2442).
   To monitor Layer 3 communication:
   Use Use the flags "08.82 GC LS timeout", "08.83 LSx LS timeout layer3" and "08.84 Red.LS timeout layer3". The GC can store the configured and overflowed layer 3 timeouts as collective flag in the LogicsManager pool. It is also possible to display this collective flag temporarily in the event log during commissioning (see parameter "Load share timeout event" ⮱▷ 2446).

   In this way, the frequency and duration of the timeout can be observed over a longer period of time. (Refer to ⮱▷ “Load share timeouts”.)
   As a rule, this timeout event should be switched off again, because it could possibly fill up the event logger unnecessarily. The entries may well come once but are not critical if they come only a few times a day. There are the classic alarms for missing member and loss of redundancy anyway.

3. Set "Timeout cycles"(⮱▷ 7489): It is not uncommon to experience delays in sending and receiving UDP messages. At inopportune moments, too many UDP and TCP/IP messages can accumulate at a device/switch or gateway, which are then processed successively. This means that, on average, the news gets through, but it could be delayed for a short time. This circumstance can be monitored with an adjustable limit value in order to be able to balancing out the critical case.
   The default setting is 5 cycles. This means that this example results in a basic tolerance of 400ms at 80ms transmission rate before an LSx or easYgen timeout flag occurs.

4. Set "Timeout cycles data"(⮱▷ 7497): As already explained under point 3, so-called timeout flags can occur, which make a statement about how often data delays occur. As long as they are rare, they give a good picture of the nature of communication. However, if there is a long-pending timeout flag, this communication partner must be removed and its data deleted so that the system can continue to work correctly.
   This adjustable limit is now offered to determine when the data deletion should be triggered after the timeout has been determined with the "Missing Member" alarm.

The default setting is 12 cycles. This means that the generator is extinguished and thus removed after 1.36 seconds at a transmission rate of 80ms. Refer to note below.

5. Set "Transmission rate"(⮡ 7488): This is offered as a multiple of 80ms. The default setting is 80ms. If LSx, easYgen or GC timeout entries in conjunction with missing members come too often or the amount of devices expires 32 members in Ethernet B/C redundant mode the transmission rate is to increase. Refer also to chapter ⮡ "6.7 Ethernet Communication - General Measures to optimize bus load on GC devices" for more information.

Measures to monitor the communication

Base is the default setting:

"Transmission rate"(⮡ 7488): 80 ms

"Timeout cycles"(⮡ 7489): 5 -> (Timeout after 80ms x 5 =400ms)

"Timeout cycles data"(⮡ 7497: 12 -> (Timeout data after 80ms x 5 + 80ms x 12 = 1360ms)

1. If easYgen, LSx and/or GC have timeouts but there are **no** missing member alarms, you should increase only the "Timeout cycles". For example:

   7488 Transmission rate: 80 ms

   7489 Timeout cycles: **12** (increasing from 5 to 12 results in increasing the timeout from 400ms to 960ms.

   7497 Timeout cycles data: 5 -> (Timeout data after 80ms x 12 + 80ms x 5 = 1360ms). In order to prevent a large increase in the "missing member timeout", it is necessary to reduce parameter (in this example from 12 to 5).

2. If easYgen, LSx and/or GC have timeouts **and** missing member alarms, you should increase "Transmission rate"(⮡ 7488) in steps of 80 ms. For example:

   7488 Transmission rate: 160 ms

   7489 Timeout cycles: 5

   7497 Timeout cycles data: **4** -> (Timeout data after 160ms x 5 + 160ms x 4 = 1440ms)

6.6 Ethernet Interconnectivity

Introduction

The GC offers the possibility to send and receive data via the Ethernet communication bus. To configure the data transfer from GC to GC, EG3000XT or LS-6 there is to download the latest Windows PC Program "Interconnect Mapper" from Woodward.

The Interconnect Mapper tool allows creating setup files for GC, LS-6XT, EG3000XT and related devices, which allows them to communicate to each other using UDP messages by cyclically transmitting data between them. For each device in a setting, it can be defined who sends which data at which rate and every device in a setting can subscribe to this data, store it and use it for their purposes.

Up to 99 analog values of the AnalogManager group 54 and up to 99 Boolean values of the LogicsManager group 54 can be used for receiving data from other devices. All analog values which are present in the device as AnalogManager values and all flags which are present as LogicsManager values can be sent. Some data defined as indices and constants can also be send. Boolean flags can be grouped into 16 bit values.

These definitions will be packed into map files which can be uploaded to the devices. The tool will create SCP files for these to upload the mappings via Woodward Toolkit. The tool also allows the user to upload the map files directly. This is maintained by ftp access to the devices.

Note: Since the GC communicates to Layer 1 and Layer3 separately, two map files are needed. One map file which defines the sending and receiving for devices in Layer 1 and one map file which defines the sending and receiving for devices in Layer 3.

Note: The tool is designed for Windows 10 or higher. The tool requires a license. When unlicensed it will be functional but will not create mapping files.

Examples of Data Transfers

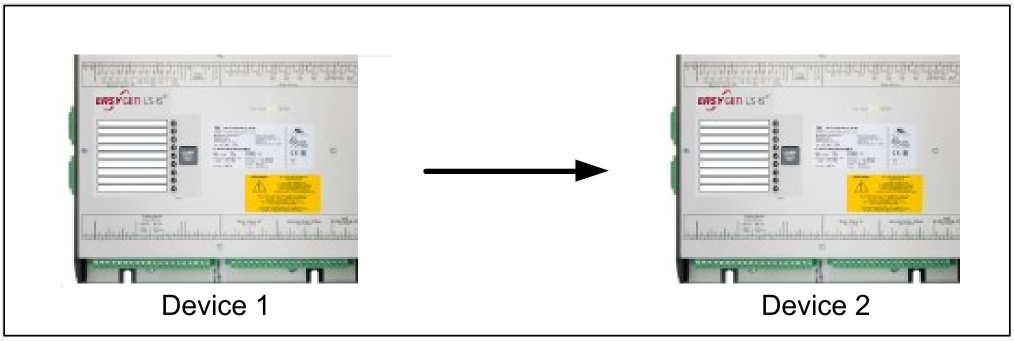


Fig. 119: Device 1 sends data to device 2

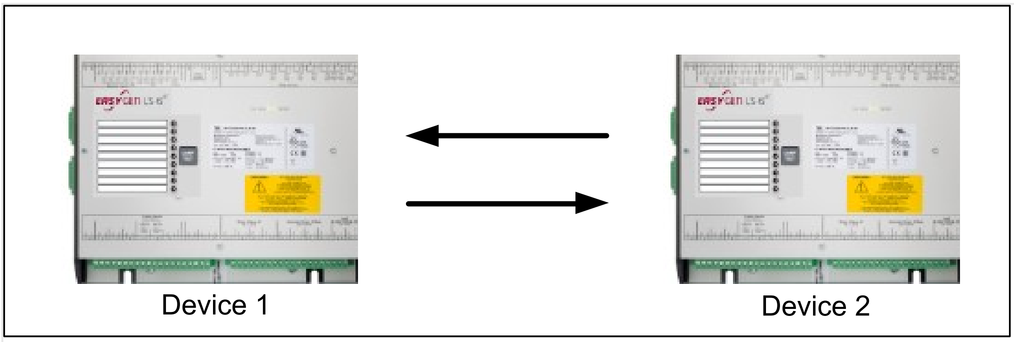


Fig. 120: Device 1 and Device 2 exchange their data

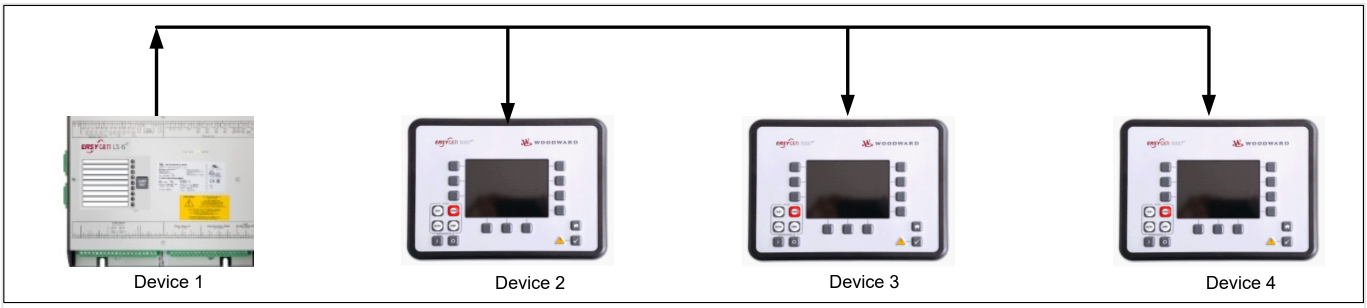


Fig. 121: Device 1 sends data to device 2, 3 and 4

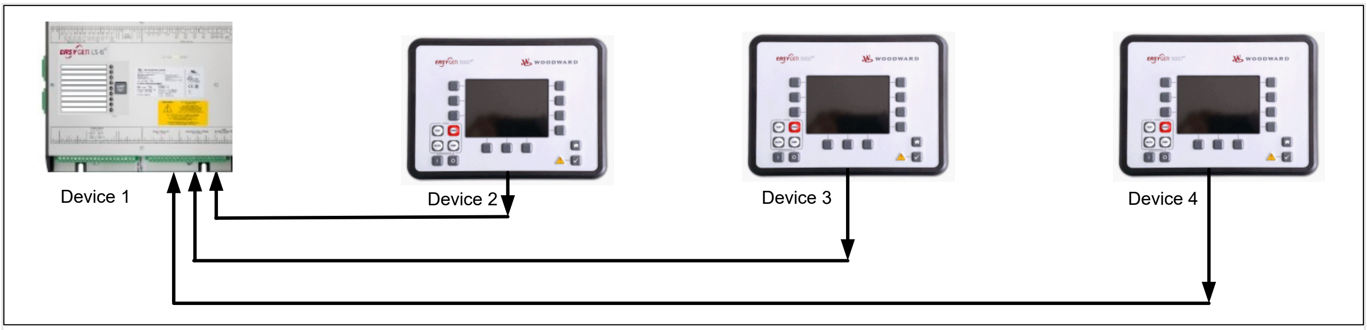


Fig. 122: Device 1 receives data from device 2, 3 and 4

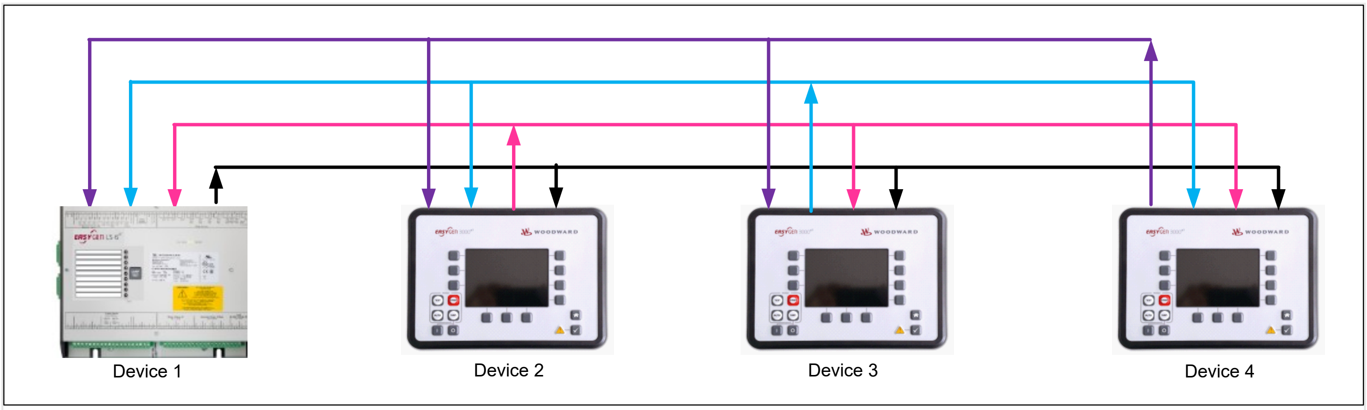


Fig. 123: Each Device receives data from the other devices

Installation of Interconnect Mapper software

Woodwards Interconnect Mapper software is required. To obtain this software you can either go over link: ⟹ http://www.woodward.com where you navigate to SUPPORT/ Industrial / Technical Help Desk / Software LOOKUP / ...and typing Interconnect Mapper into the search window.

or

you can download it from internet ⟹ https://wss.woodward.com/manuals/PGC/ easYgen-3000XT_series/SW_Tools/InterconnectMapper

Prepare the Interconnect Mapper software:

- Download the Interconnect Mapper Tool from the Woodward support page.
- Install this PC program on your Windows PC running Windows 10 or higher.
- Start the PC program and study at first the "HELP file". (To find under the TAB “Help”.)
- Check out the according license for the Interconnect Mapper Tool.

If you have no experience with the Interconnect Mapper Tool begin with a small project to send data from one device to the other. Keep the "HELP file" open to go forward step by step.

In the program you will be asked to specify a package zip software.

The Interconnect Mapper will ask for allocating package zip software. Each device type and revision has an own multilingual_package zip software. To obtain this software you can either go over ⇒ www.woodward.com where you navigate to SUPPORT/Industrial / Technical Help Desk / Control Configuration Files

or

you can download it from internet ⇒ https://wss.woodward.com/manuals/PGC/easYgen-3000XT_series

- Navigate to your model
- Navigate to 02_Config_Files_
- Navigate to your part number and revision
- Download XXXX-XXXX_Y_multilingual_package
- Store it into your project folder

Status/diagnostic Interconnectivity

Toolkit is providing a screen for some Ethernet Interconnect Mapper diagnostics for Layer 1 and Layer 3. You find it under STATUS MENU/Interfaces/Ethernet/Interconnectivity.

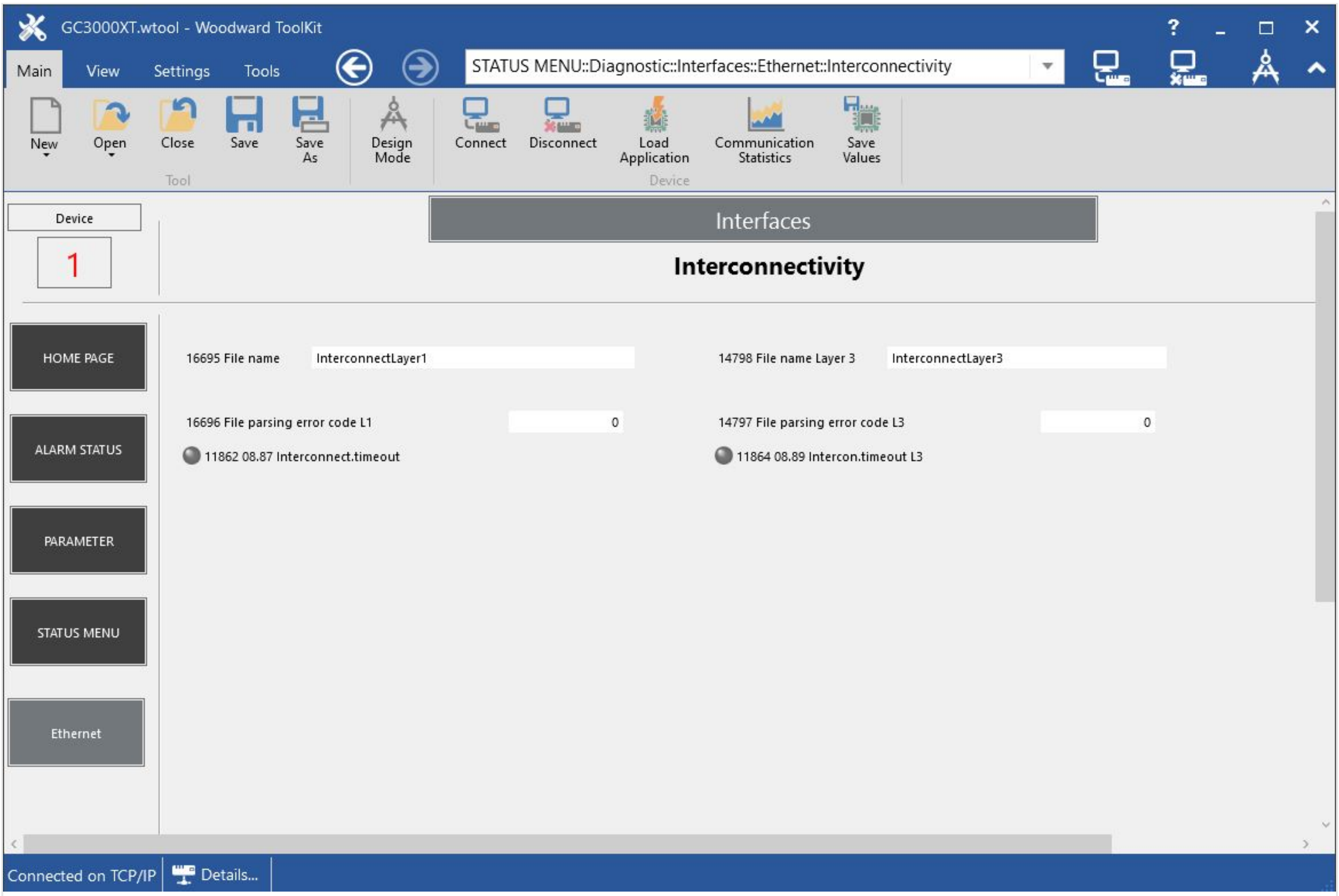


Fig. 124: Interconnectivity ToolKit status page

16695 File name / 14798 File name Layer 3:
This field shows the "Description". This is the comment in the map file for Layer 1 / Layer 3, text defined by the PC tool.

16696 File parsing error code L1 / 14797 File parsing error code L3:
This is a numeric code indicating whether the map file was parsed correctly. The code is a combination of errors which have the following meaning:

Error codes:	
Code	**Meaning**
0	No error (All values > 0 will result in interconnectivity not active)
1	File error: File was not found or could not be opened.
2	Not a mapping file: The file is not an interconnect mapping file or a malformed one.
4	Wrong version of mapping file: The version of the mapping file does not match. This can appear when the file was generated by an older version of the PC tool.
8	Mapping file has wrong checksum: The mapping file was corrupted and is invalid. It must be newly created.
16	APPLICATION line wrong in file. The file was created for an application which does not match to the application running on the device. This error is for future and is currently never produced.

Error codes:	
32	RELEASE line wrong in file. The file was created for a software release which does not match to the application running on the device. This error is for future and is currently never produced.

LED 11862 08.87 Interconnect.timeout / 11864 08.89 Intercon.timeout L3:
This is a flag for the receiving device to indicate if there is a timeout on the data it is to receive. Normally, this should be off.

6.7 Ethernet Communication - General Measures to optimize bus load on GC devices

General

The GC is a system device with increasing demand on its communication interfaces. So typical exercises are for example: Load sharing of up to 32 gensets, interacting with up to 32 LSx devices, Modbus TCP master and TCP slave activities, Ethernet interconnectivity function and RP3000XT connection. Furthermore the Ethernet communication bus can be performed redundant which doubles the amount of UDP messages and loads the GC additionally.

CPU System Load as Indicator

The GC provides the following CPU load diagnostic values.

CPU Load diagnostic indication		
10187	Rate Group Load 5ms	0 to 100 %
10188	Rate Group Load 10ms	0 to 100 %
10189	Rate Group Load 20ms	0 to 100 %
10293	Rate Group Load 40ms	0 to 100 %
10294	Rate Group Load 80ms	0 to 100 %
10295	Rate Group Load 160ms	0 to 100 %
10296	System load	0 to 100 %
10297	Idle load	0 to 100 %

NOTICE!

! The Ethernet communication influences the CPU system load. That's why it is important to keep an eye on the system load indication of the GC. The system load should not exceed 30% for longer than a few seconds.

What can be done to reduce Ethernet communication load

- Interconnectivity Function: Keep the number of UDP-messages low (messages from device to device)

- Interconnectivity Function: Increase the refresh rate of the UDP messages (refresh rates >= 500ms, via InterconnectMapper tool)
- Interconnectivity Function: Perform it without the redundancy feature (without Ethernet B/C)
- Load share communication: Increase the "Transmission rate" ⮡ 7488
- Load share communication: Set up the Ethernet redundancy externally.

Ethernet Load - Application Examples

The following table is intended to show examples of what GC can do if the appropriate parameters are observed.

Application	Set up	7488 Transmission rate	Max. System load	Min. Idle load
Load sharing and control with 32 Devices on Ethernet B	• Remote Panel on Ethernet A • Interconnectivity with 31 messages. Transmission rate is 100ms. • "7489 Timeout cycles" = 5 • "7497 Timeout cycles data" = 12	80 ms	20 %	37 %
Layer1: Load sharing and control with 64 devices on Ethernet A Layer3: Load sharing and control with 80 devices on Ethernet B or Ethernet C	• Layer1: Interconnectivity with 63 messages. Transmission rate 100ms. Layer3: Interconnectivity with 79 messages. Transmission rate 100ms. • "7489 Timeout cycles" = 5 • "7497 Timeout cycles data" = 12	80 ms	26 %	50 %
Layer1: Load sharing and control with 64 devices on Ethernet A Layer3: Load sharing and control with 40 devices on Ethernet B/C (redundant)	• Layer1: Interconnectivity with 63 messages. Transmission rate 100ms. Layer3: Interconnectivity with 39 messages (redundant). Transmission rate 100ms. • "7489 Timeout cycles" = 5 • "7497 Timeout cycles data" = 12	80 ms	29 %	47 %

Application	Set up	7488 Transmission rate	Max. System load	Min. Idle load
Layer1: Load sharing and control with 64 devices on Ethernet A Layer3: Load sharing and control with 80 devices on Ethernet B/C (redundant)	• Layer1: Interconnectivity with 63 messages. Transmission rate 100ms. Layer3: Interconnectivity with 79 messages (redundant). Transmission rate 100ms. • "7489 Timeout cycles" = 5 • "7497 Timeout cycles data" = 5	160 ms	24 %	52 %

GC-3400XT Software 2.13 and previous (without buffer): Maximal Number of Devices

Please take in mind that with GC-3400XT software version 2.13 and older an appropriate Ethernet network buffer was missing. This buffer is now installed in software 2.14. Through a special UDP sending management in the software 2.14 the performance could be further improved. This table informs you what number of devices can be achieved for a proper Ethernet communication.

Ethernet Communication		
GC-3400XT SW 2.13 and previous (without buffer)	**Maximal Number of Devices in Layer 1 or 3**	**7488 Transmission rate**
• Single Mode - Load sharing and control on Ethernet A or B • "7489 Timeout cycles" = 10	13 devices	80 ms
• Redundant Mode - Load sharing and control on Ethernet A or B • "7489 Timeout cycles" = 10	7 devices	80 ms

NOTICE!

In applications where software versions are to be mixed, it is recommended to update SW to 2.14 or higher. In cases, where an update is not possible the limits in the above tables applies.

6.8 CANopen Application

6.8.1 Remote Control

6.8.1.1 Example: Remote Acknowledgment via remote control bit

The Woodward controller may be configured to perform acknowledgment functions remotely through the CANopen RPDO. (SDOs are not supported.) This function is descripted in this chapter as an example for the usage of the remote control word 505 bit 0. ⮡ "Remote control word"

Configure CAN interface 1

CANopen Master (parameter ⮡ 8993) must be enabled, if there is no PLC taking over the master function.

⚙

1. ▷ With 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. ▷ With 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	00505	The 1st mapped object is set to control parameter 505.

▶ 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 505. The number of mapped objects is here 1.

Refer to ⮡ "9.3.2.1 Receive Data (sent from remote control to the Group Controller)" 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 GC address ID 505 bit 0.

ID (hex)	Description	Data (hex)
201	Remote Acknowledge	sequence of: 0000, 0001; 0000, 0001
		Notes The message 0001hex must be sent twice to acknowledge an alarm completely. The first rising edge (0000hex followed by 0001hex) disables the horn and the second rising edge resets the alarm.

Configuration of LogicsManager "External Acknowledge"

The following screenshot shows how the LogicsManager can be configured to allow acknowledgement via "Discrete input 2" or via "Remote control bit 1".

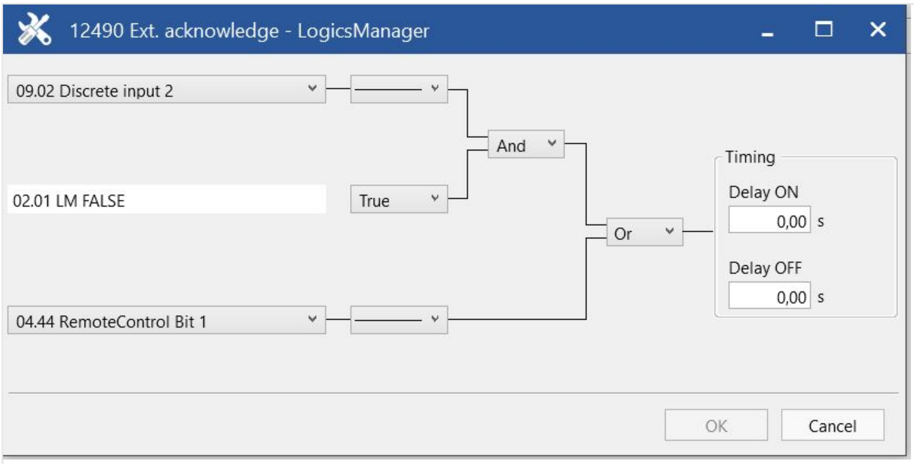


Fig. 125: LogicsManager 12490 external acknowledge

This LogicsManager 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.

6.8.2 Troubleshooting

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).
	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 LS-6XT already used in a PDO (COB-ID)?
	Are RPDOs or TPDOs higher then 580 (hex) or lower than 180 (hex) used?

6.9 Modbus Application

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.

6.9.1 Remote Control

6.9.1.1 Example: Remote Acknowledgment via remote control bit

The Woodward controller may be configured to perform acknowledgment functions remotely through the Modbus protocol. This function is descripted in this chapter as an example for the usage of the remote control word 505.

The following descriptions refer to the remote control parameter 505 as described in ⮑ "Remote control word".

It may be necessary to shift the address by 1 depending on the used PC software. In this case, the address would be 506 for example.

Be sure to check both possibilities in case of remote control problems.

ID	Parameter	Setting range	Data type
505	Remote control word	0 to 65535	UNSIGNED 16

- Modbus address = 40000 + (Par. ID) = 40505
- Modbus length = 1 (UNSIGNED 16)

In order to issue a command, one bit of object 21F9 (hex), parameter 505, must be enabled. In this example **bit 0** with the corresponding command variable ”04.44 Remote control bit 1“ is used. ”04.44 Remote control bit 1“ must be assigned to the LogicsManager ”12490 Ext acknowledge“. ⮡ Fig. 128

Set command via Modscan32

The following Modscan32 screenshots show the configurations made to remote control parameter 505. The Modscan application uses address + 1. It is possible to set the format to binary to view single bits using the "display options".

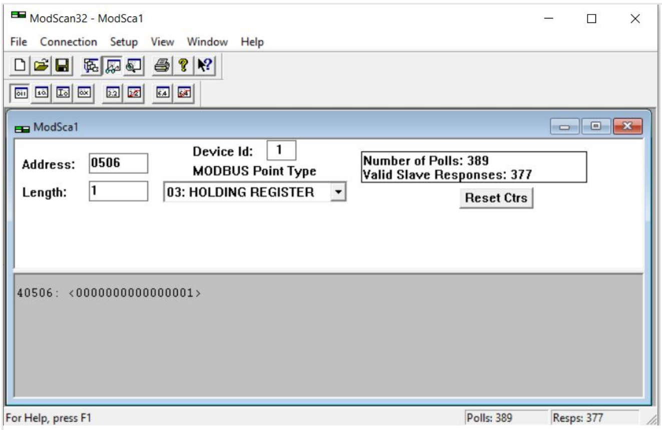


Fig. 126: Modbus - remote control parameter 505

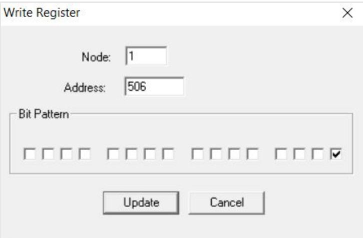


Fig. 127: Modbus - write register- 505 bit 0

By double-clicking the address, a Write Register command may be issued.

Configuration of LogicsManager ”External Acknowledge“

The following screenshot shows how the LogicsManager can be configured to allow acknowledgement via ”Discrete input 2“ or via ”Remote control bit 1“.

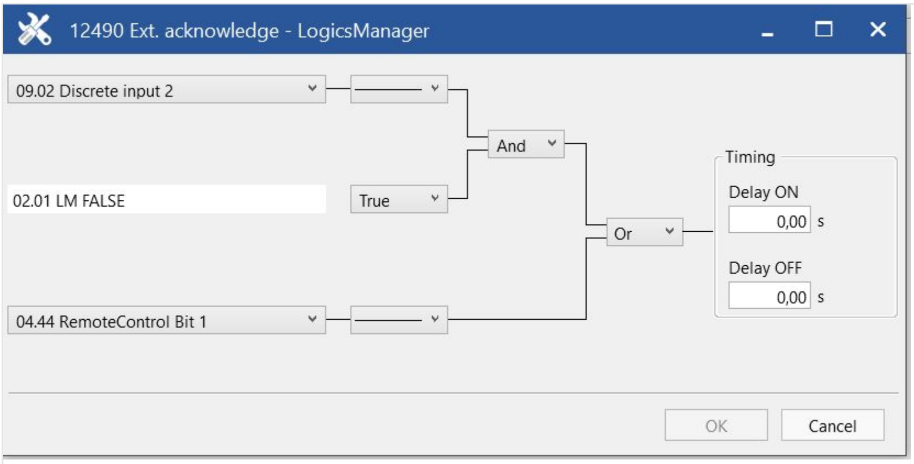


Fig. 128: LogicsManager 12490 external acknowledge

This LogicsManager 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.

6.9.2 Modbus Changing Parameter Settings

6.9.2.1 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) = 41706
- Modbus length = 1 (UNSIGNED 16)

⚙

>

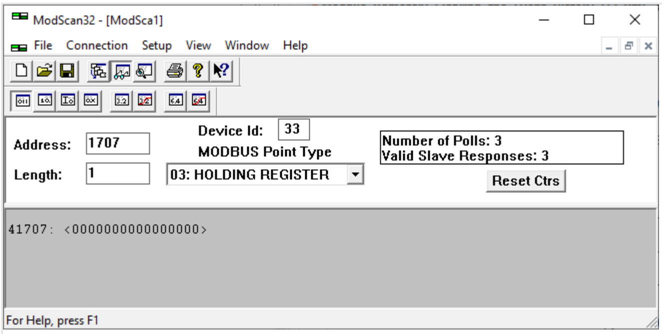


Fig. 129: Modscan32 at address 41707

1. ▷ Use the "display options" to set the value format to binary.
2. ▷ Double-click the address to issue a `Write Register` command.

▶

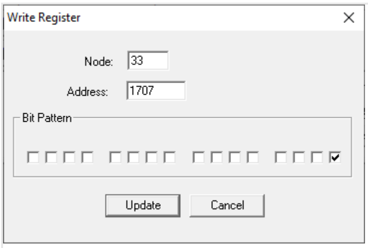


Fig. 130: Write register - clear event history

⮡▷ Fig. 130 shows how bit 0 is enabled using the ModScan32 Software.

6.9.3 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 58 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.

Modbus exception responses		
Code	**Name**	**Reason**
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 58: Modbus - exception responses

6.9.4 Modbus Telegram Mapper (Customer Written Data Protocols)

6.9.4.1 Introduction

The Modbus Telegram Mapper offers the possibility to generate customer defined Modbus protocols. It is possible to create individual Modbus Address Point lists for Modbus RTU and TCP. Therefore the address range (4)50000 can be taken. The user will be able to arrange contents from the GC database (Index No.), AnalogManager Variables and LogicsManager Command Variables to a customer specific protocol.

6.9.4.2 Configuration

Woodward offers the TelegramMapper PC software for free and enables GC 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 of the particular GC model will be available/selectable:

- AnalogManager variables
- LogicsManager variables
- the GC database (ID based)

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 GC device
- HTML-file for easy to read documentation of the (self) created data protocol
- MAP-file for further edits with the TelegramMapper software

The procedure to load a self created custom scp file into a GC device is the same as the normal firmware update process. The scp file has to be loaded to the GC device with the ToolKit.

To switch to your Data Protocol and use it for communication: Configure parameter ⮩ 3184 »Modbus protocol number« to your customer specific protocol number and reboot 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 like 5022, 5023 etc. Navigate to “Parameter/Configuration/Configure interfaces/Modbus protocol”.

6.9.4.3 Status/diagnostic Modbus Telegram Mapper

The GC provides an information whether the Modbus TelegramMapper mapping file could be successful parsed and interpreted. Navigate to “Status Menu/Interfaces/Ethernet/Modbus TCP/IP” to get an error code.

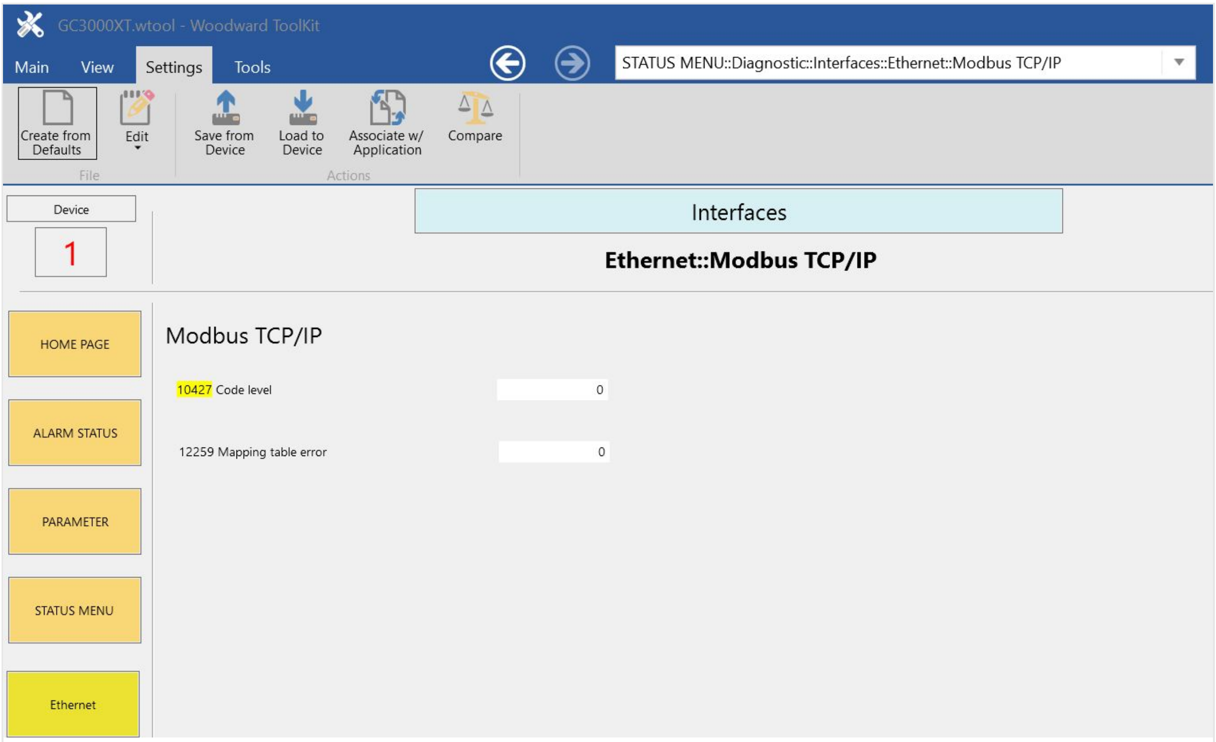


Fig. 131: Status Modbus mapping table error

Modbus: Mapping table error(12259):

Error codes:

- **0:** No error
- **100000 + error line:** There is a syntax error -- for any misformatted line
- **200000:** File not found -- when file corresponding to selected protocol does not exist
- **300000:** Too complex command discovered
- **700000:** Too many analog/logic manager indices (i.e. > 32)
- **800000:** Memory for the table exhausted (file too big)

6.9.5 Modbus master

6.9.5.1 Introduction

The device can act as a configurable Modbus master, for Modbus/TCP. Up to 5 independent slaves can be accessed simultaneously.

Note: For the configuration the licensed ModbusMasterMapper PC software is required.

> The Modbus Master does not work with the serial interface (RS-485, Modbus RTU).

Up to 99 analog values can be read and transferred into **AnalogManager group 54** ("54.01 Mapped AM value 1" to "54.99 Mapped AM value 99") and up to 99 boolean values can be read and transferred into **LogicsManager group 54** ("54.01 Mapped LM flag 1" to "54.99 Mapped LM flag 99").

All analog values which are present in the device as AnalogManager values and all flags which are present as LogicsManager values can be written. Boolean flags can be grouped into 16 bit values. Reading and writing each can be combined to read/write multiple values in one command. Different variable types and Modbus modes are supported.

Multiple write and read rates can be defined, in order to access some datapoints more often than others.

6.9.5.2 Configuration with MasterMapper Tool

Woodward offers a ModbusMasterMapper PC software to configure the Modbus Master behavior for free and enables the device to import, make accessible and proceed customer specific settings. The ModbusMasterMapper software can be installed separately from other Woodward software.

> Woodwards MasterMapper Tool software is required. To obtain this software you can either go over ⟹ https://www.woodward.com where you navigate to Industrial / Technical Help Desk / Software LOOKUP / ...and typing master mapper into the search window.
>
> **or**
>
> you can download it from internet ⟹ https://wss.woodward.com/manuals/PGC/easYgen-3000XT_series/SW_Tools/MasterMapper

After starting the program the HELP file can guide through the required settings.

Data of the particular device will be available/selectable:

- AnalogManager variables
- LogicsManager variables
- the database (ID based)

The according data types, addresses, rates must be defined and each read/write entry can be commented.

Note: Modbus master has for read and write a limitation of maximum about 120 words. The ModbusMasterMapper PC software detects an overrun and will issue a warning.

The final protocol can be saved as a mapping file (*.mmap) file for further processing. The tool creates a *. SCP-file for uploading the Modbus Master control file into the device using Toolkit. After uploading and restarting the Modbus Master process can be started via configuring parameter 3219 to “On”. Now the configured communication will be executed.

The MasterMapper will ask for loading a package zip software. Each easYgen type and revision has an own multilingual_package zip software. To obtain this software you can either go over ⟹ https://www.woodward com where you navigate to Industrial / Technical Help Desk / Control Configuration Files

or

you can download it from internet you can download it from internet ⟹ https://wss.woodward.com/manuals/PGC/easYgen-3000XT_series/SW_Tools/ModbusMasterMapper

- Navigate to your model
- Navigate to 02_Config_Files_
- Navigate to your part number and revision
- Download XXXX-XXXX_Y_multilingual_package
- Store it into your project folder

ID	Parameter	CL	Setting range [Default]	Description
3219	**Modbus master**	2	**[Off]**	The Modbus master function is disabled and no Modbus master requests are sent.
			On	The Modbus master function is requesting data according to the control file. **Note** Take care that a Modbus master control file is already load into the device.

6.9.5.3 Status/diagnostic Modbus master

Toolkit is providing a screen for some Modbus master diagnostics.

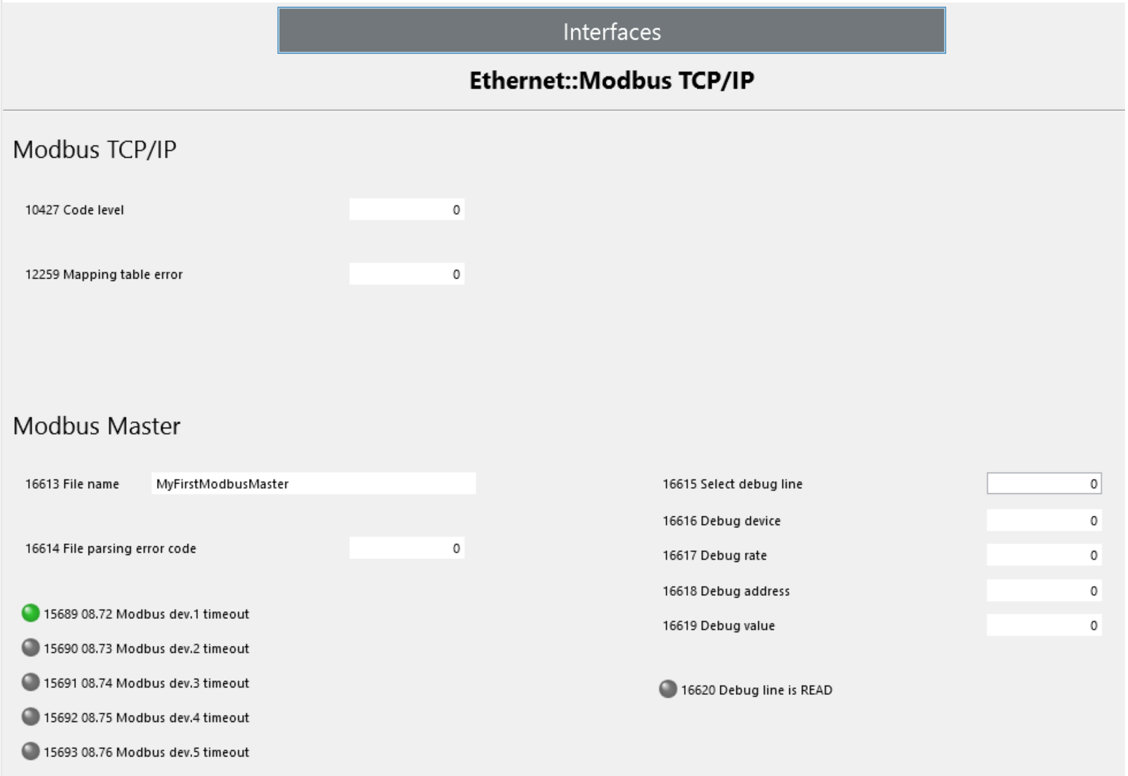


Fig. 132: Status Modbus

File name (16613):

This field shows the "Description" from the loaded Modbus Master config file. This will be read in at start-up.

File parsing error code (16614):

File parsing error code (16614)	
Code	**Meaning**
0	No error
1	File error: File was not found or could not be opened
2	Not a mapping file: The file is not a Modbus master mapping file or a malformed one.
4	Wrong version of mapping file: The version of the mapping file does not match. This can appear when the file was generated by an older version of the PC tool.
8	Mapping file has wrong check-sum: The mapping file was corrupted and is invalid. It has to be newly created.
16	Wrong SIZES statement: This is an internal file error, this shall not happen when the file was correctly created by the PC tool.
32	APPLICATION line wrong in file. The file was created for an application which does not match to the application running on the device. It has to be newly created for this application.

File parsing error code (16614)	
Code	**Meaning**
64	RELEASE line wrong in file. The file was created for a software release which does not match to the application running on the device. It has to be newly created for this release.

"Select debug line"(16615):

This “parameter” activates a debug mode when a number is entered higher than 0. This function enables the user to test the connections to different devices separately.

Valid values are:

- 0: Debug mode off (default)
- 1000+x: WRITE line 1000+x will be executed
- 2000+x: READ line 2000+x will be executed

Only the selected WRITE or READ line of the mapping file will be executed. All other reads and writes are suppressed.

"Select debug line" (16615)	
Indication	**Meaning**
16616 Debug device	This output shows the device number [1..] as defined in the mapping file of the selected debug line command. It is 0, if "Select debug line" set to 0.
16617 Debug rate	This output shows the rate in [s] of the selected debug line command. It is 0, if "Select debug line" set to 0.
16618 Debug address	This output shows the Modbus address of the selected debug line command. It is 0, if "Select debug line" set to 0.
16619 Debug value	This output shows the read or wrote value for the selected Debug line command. When multiple read or multiple write was selected, it shows the first value. It is 0, if "Select debug line" set to 0.
16620 Debug line is READ	This output is TRUE (LED is green), if the selected Debug line command was a read, otherwise FALSE. It is FALSE too if "Select debug line" set to 0.

Modbus Slave Devices 1-5 timeouts:

The LED s of LM variables "08.72 Modbus dev.1 timeout" to "08.76 Modbus dev.5 timeout" inform about time outs of the corresponding slave devices.

Timeouts can happen e.g. in this cases:

- The slave is not answering at all
- The slave is answering but in a rate slower than defined in the mapping file. This can happen, when the slave is inherently slow or when the mapping was set up in a way that too many requests were scheduled in the scheduled rate time.

One Modbus read or write command to one slave will take at least 50 msec. The minimum permitted rate group is 100 msec. If now a mapping is configured in a way that it requires more writes to a device than fits into the required rate, or the slave has very long answer times, there will be a timeout error. The device will still read/write but it will not do it as quickly as required. This issue can be mitigated by defining slower rate groups or reducing the number of read/write commands.

7 Interfaces and Protocols

7.1 Communication Network

7.1.1 Overview

The interface ports

- Interface USB slave (Service port)
- Interface CAN #1 (CANopen load share bus)
- Interface CAN #2 (dedicated to external terminal IKD)
- Interface Ethernet A (UDP Genset load share bus, Modbus TCP, Servlink TCP ToolKit)
- Interface Ethernet B (UDP GC-3400XT-P1 load share bus, Modbus TCP, Servlink TCP ToolKit)
- Interface Ethernet C (UDP GC-3400XT-P1 load share bus, Modbus TCP, Servlink TCP ToolKit)

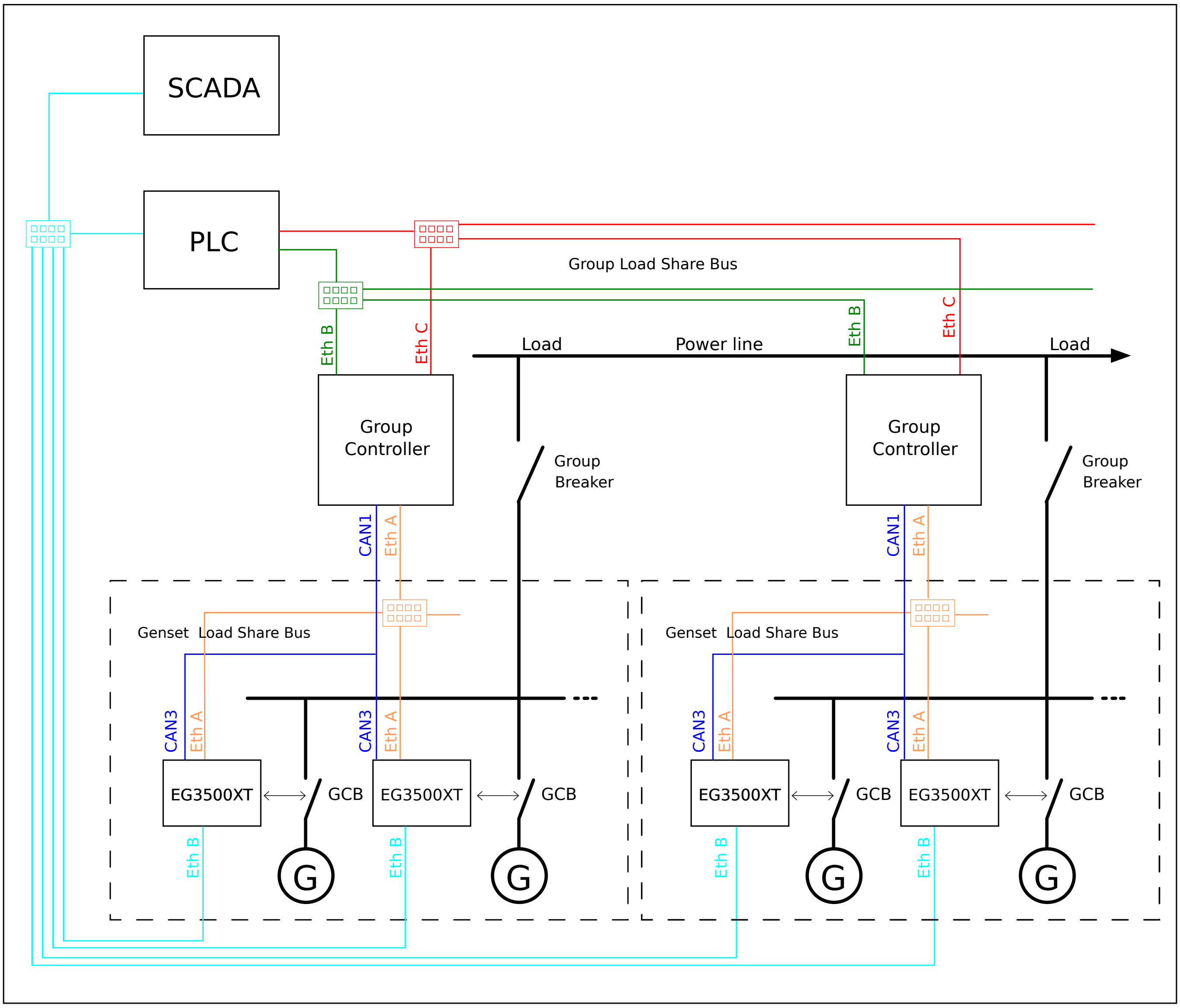


Fig. 133: Example of a GC-3400XT-P1 system including load share line redundancy

7.1.2 Data Protocols

GC-3400XT-P1	CAN1	ETH A	ETH B	ETH C
CANopen protocols	x	-	-	-
Modbus Slave	-	TCP	TCP	TCP
Genset Load share	x	x	x	x
Group Controller Load share			x	x
Servlink - ToolKit	-	x	x	x

7.1.3 Data Telegram

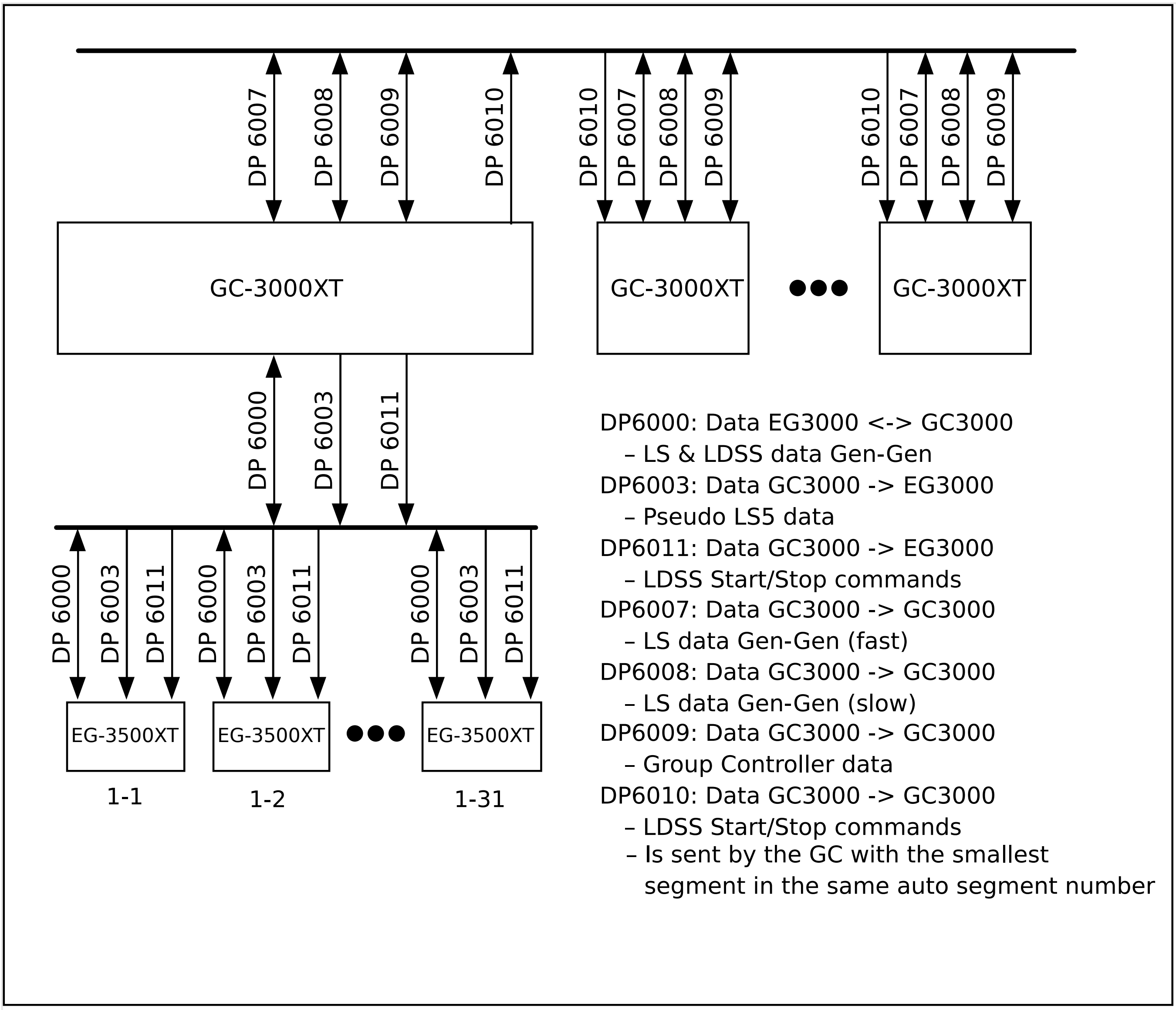


Fig. 134: Data Telegram

7.1.4 The Modbus Visualization Protocol 5023

GC-3400XT-P1 Visualization Data

The GC-3400XT-P1 provides data for control and visualization purposes. Therefore the protocol 5023 is introduced to provide all relevant data. These data are:

- AC measurement
- DI condition
- DO condition
- Current operating task
- Warning alarms

- Critical alarms
- Communication Diagnostic
- LDSS Start/Stop commands
- .....

(Refer to excel file protocol 5023 for more information.)

7.2 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/de-segmentation.

Protocol description

If a data protocol is used, a CAN message has the following byte structure.

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. (For details refer to ⮑ "9.3 Data Protocols").

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) = $b_{-1} * 2^{-1} + \ldots + b_1 * 2^1 + b_0 * 2^0$

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							

Octet Number	**1.**	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**
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 59: 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}	

Octet Number	1.	2.	3.	4.	5.	6.	7.	8.
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 60: Transfer syntax for data type INTEGER

7.3 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.

Detailed information about the Modbus protocol is available on the following website:

- ⟹ https://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:

- ⟹ https://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. 135)

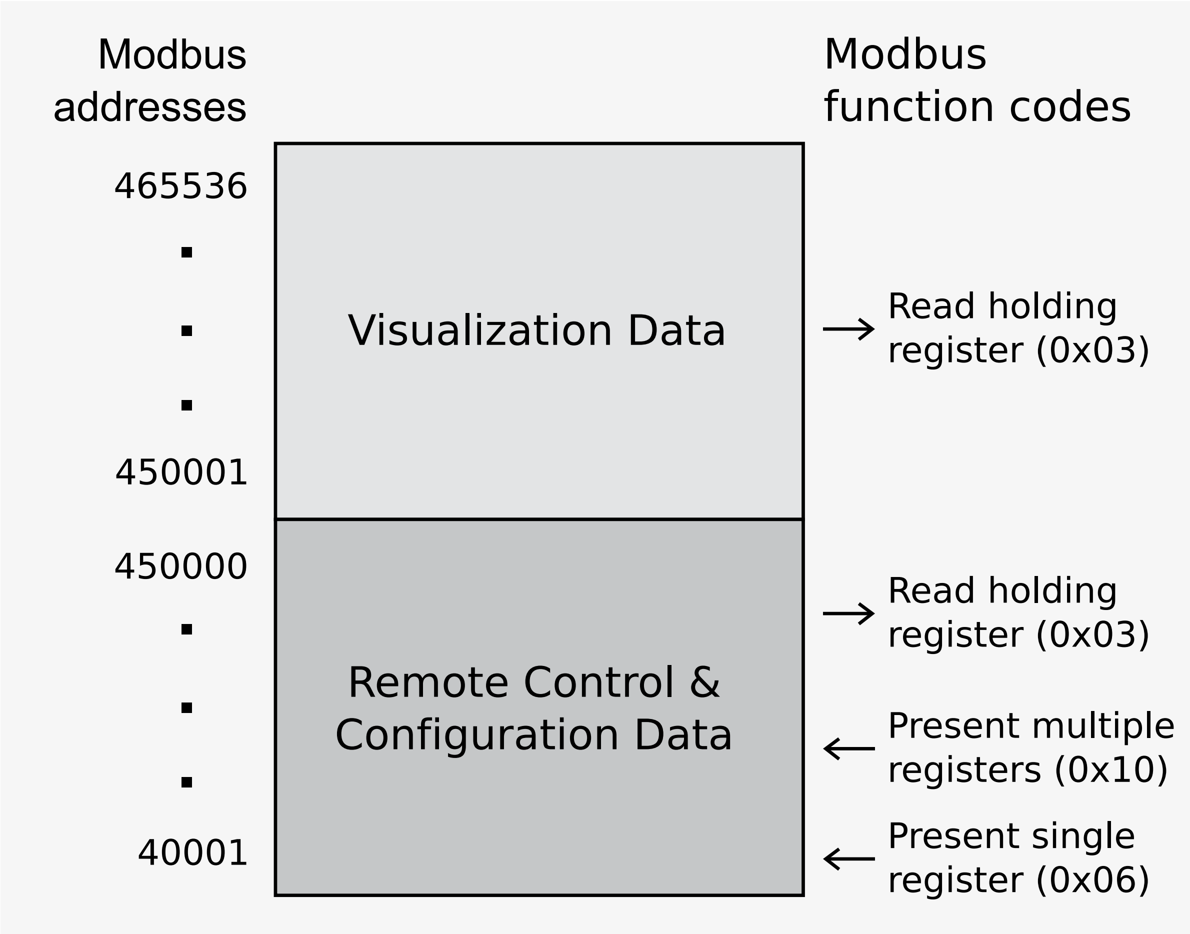


Fig. 135: Address range

All addresses in this chapter 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 125 Modbus registers at a time.

Modbus read addresses	Description	Multiplier	Units
450001	Protocol-ID, always 5023		–
450002	Scaling Power (16 bits) Exponent 10x W (5;4;3;2)		

Modbus read addresses	Description	Multiplier	Units
....	....	.....	.....
	....		
....	....	.....	.....
450537	Internal (long)	-	-

Table 61: Address range block read

↳ "4.6.3 Modbus Protocol" is only an excerpt of the data protocol. It conforms to the data protocol 5023.

Please refer to the Data Protocols chapter, ↳ "9.3 Data Protocols"

The following ModScan32 screenshot shows the configurations made to read the visualization protocol with a block read of 125 registers.

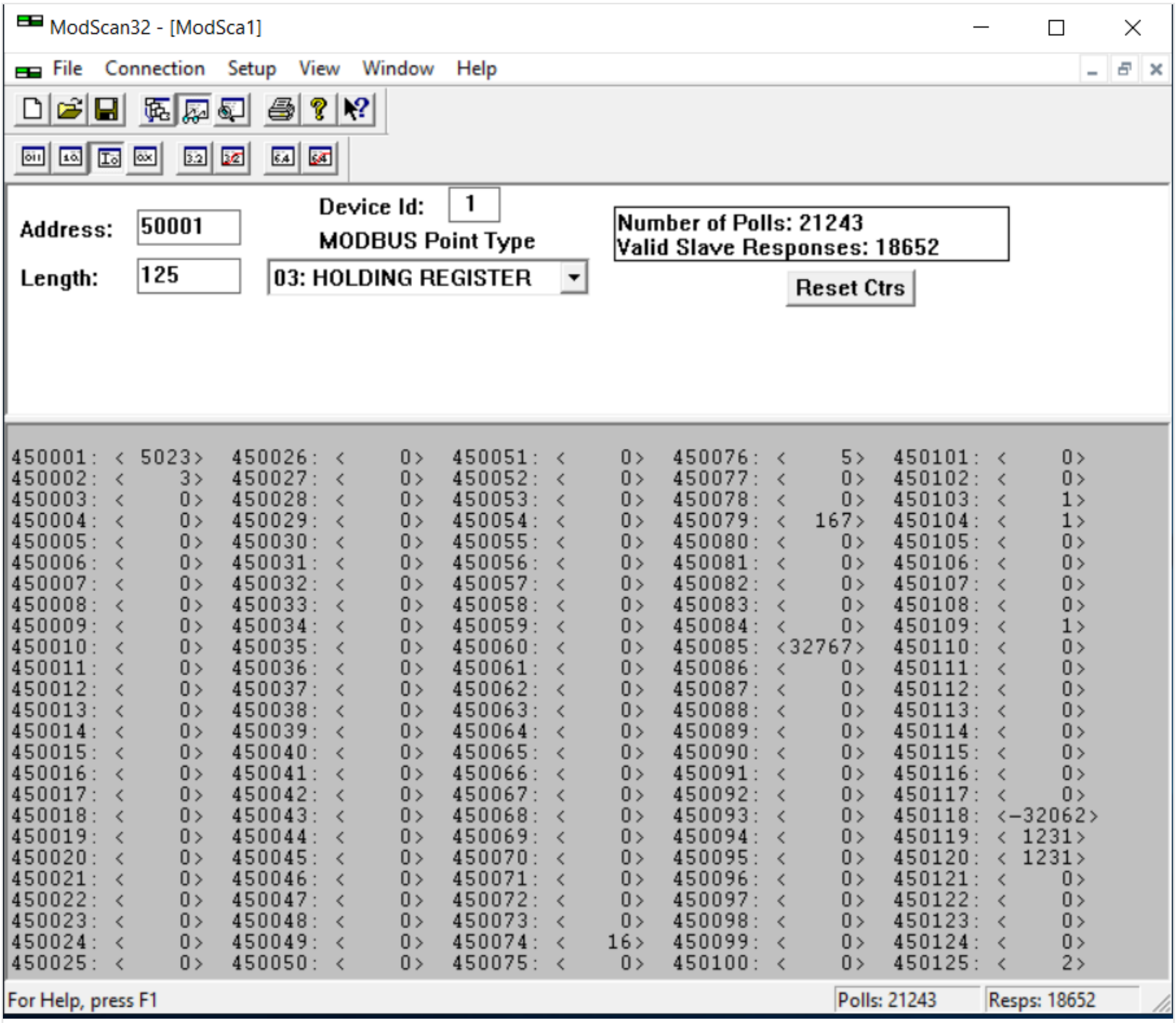


Fig. 136: Visualization configurations

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.

Configuration

The Modbus interface can be used to read/write parameters. According the Modbus addressing range for the configuration addresses, the range starts at 40001 and ends at 450000. 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 =	40000 + (Par. ID+1)	400000 + (Par. ID+1)

Table 62: 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 63 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
ANALOGMANAGER	7	Big-endian is used for AnalogManager because it is the regular format for Modbus
TEXT/X	X/2	

Table 63: Data types

Woodward recommends to make a break time of 10 ms after receiving the data of the last Modbus request.

7.4 Load Sharing

General information

The maximum number of participating load sharing devices depends on the application interface.

- **Interface Layer 1**

  31 participating easYgens and 31 participating LS-6XT devices for each group. The GC-3000XT acts as the number 32.

  Both CAN and Ethernet interfaces can handle load share.

- **Interface Layer 3**

  16 participating GC-3000XT and 64 participating LS-6XT devices.

  Ethernet interfaces handle the load share (UDP broadcast messages).

Load share timeouts

The GC provides different timeout events to monitor a lost of loadshare messages. A lost of single loadshare messages may happen through bad connections, too much traffic on the bus or any other disturbances.

In general a timeout mark occurs if no load share message was received for a configured timeout. An according LogicsManager flag goes "TRUE" and a special entry can be activated in the Event History, see listed below. With parameter 2442 Load share timeout event set to "OFF" the timeout events will not show up in the Event History.

The timeout depends on the configured »Load share interface « ⮡ 9924 and the related parameters, as follow:

- **CAN:**

  Timeout = ⮡ 9921 * ⮡ 9999

  Default Setting: CAN Timeout = (0.1s * 2) = 0.2s

- **ETHERNET A, B or B/C:**

  Timeout = ⮡ 7488 * ⮡ 7489

  Default Setting: ETHERNET Timeout = (0.08s * 5) = 0.4s

- **CAN/ETHERNET A:**

  With the assumption that both interfaces get lost to the same time, the shorter timeout of both is taken.

  Default Setting: CAN Timeout = 0.2s and ETHERNET Timeout = 0.4s. The CAN Timeout with 0.2s will take place.

Available timeout events:

- **Layer 1**
  - <u>LSx LS timeout</u>

    Occurs if no loadshare message is received for the configured timeout of any taught-in LSx.

    In the Event History "LSx LS timeout L1" is shown with state True and the LogicsManager flag "08.79 LSx LS timeout layer1" is "TRUE" until the loadshare message is received again.

  - <u>easYgen LS timeout</u>

Occurs if no loadshare message is received for the configured timeout of any taught-in easYgen.

In the Event History "easYgen LS timeout" is shown with state True and the LogicsManager flag "08.78 easYgen LS timeout" is "TRUE" until the loadshare message is received again.

- **Layer 3**
  - LSx LS timeout

    Occurs if no loadshare message is received for the configured timeout of any taught-in LSx.

    In the Event History "LSx LS timeout L3" is shown with state True and the LogicsManager flag "08.83 LSx LS timeout layer3" is "TRUE" until the loadshare message is received again.
  - GC LS timeout

    Occurs if no loadshare message is received for the configured timeout of any taught-in GC.

    In the Event History "GC LS timeout" is shown with state True and the LogicsManager flag "08.82 GC LS timeout" is "TRUE" until the loadshare message is received again.
- **Redundancy LS timeout**

  Occurs if no loadshare message (of one of the redundant interfaces) is received for the configured timeout of any taught-in device.

  In the Event History "Red. LS timeout L1" is shown with state True and the LogicsManager flag "08.80 Red.LS timeout layer1" is "TRUE" until the loadshare message is received again.

Load share monitoring

The GC-3000XT provides parameters for monitoring load sharing:

- **Multi-unit LDSS 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 ⮡ "4.4.5.4.4 Multi-unit parameter alignment (LDSS Parameter Alignment Monitoring)".
- **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
  - Mult unit Layer 1

    ⮡ "4.4.5.3.2 Multi-unit missing easYgen"

    ⮡ "4.4.5.3.3 Multi-unit missing LSx"
  - Multi unit Layer 3

"4.4.5.4.2 Multi-unit GC"

"4.4.5.4.3 Multi-unit missing LSx"

- **Multi-unit System update**

  The multi-unit system update monitoring function checks whether only the participating units are available (sending data on the load share line). For additional information refer to

  - Mult unit Layer 1

    "4.4.5.3.1 Monitoring System update Layer 1"

  - Mult unit Layer 3

    "4.4.5.4.1 Monitoring system update Layer 3"

- **Load Share Interface Redundancy is Lost**

  Beside the automatic handling of redundant load share line messages the GC-3000XT can inform the operator if a redundant load share communication line gets lost. Preassumption for that is an enabled redundant load share line in conjunction with a successful system update procedure. For additional information refer to

  - Mult unit Layer 1 (CAN1/Ethernet A)

    "4.4.5.3.4 Load share interface monitoring"

  - Multi unit Layer 3 (Ethernet B/C)

    "4.4.5.4.5 Load share interface monitoring"

- **Group ok monitroing**

  The device observes the communication diagnositc inside the own group. For additional information refer to "4.4.5.3.5 Group ok monitoring"

Load share communication

The following parameters allows to select the interface for load share communication. Refer to "4.3.1.2 Configure Load Share Interface" for detailed information.

ID	Text	Setting range	Default value
9924	Interface Layer 1	**CAN1/Ethernet A** Off CAN1 Ethernet A CAN1/Ethernet A	CAN1/Ethernet A
9929	Interface Layer 3	**Ethernet B/C** Off Ethernet B Ethernet B/C	Ethernet B/C

Woodward recommends to configure the CAN Node-IDs (parameter ⮡ 8950) for those CAN units, which participate in load sharing, as low as possible to facilitate a fast establishing of communication.

7.4.1 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 Ethernet interface (Modbus TCP) 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) under consideration of the bus length (refer to ⮡ "3.3.3 CAN Bus Interfaces").
- Reduce the transfer rate of the load share message (parameter ⮡ 9921).
- Reduce the transfer rate of the visualization message, i.e. the event timer (parameter ⮡ 9604).
- Disable the transmission visualization data on the CAN bus and use the Ethernet interface (Modbus TCP) to transmit visualization data.
- Disable SYNC message (parameter ⮡ 9100) and/or TIME message (parameter ⮡ 9101) and/or the producer heartbeat time SYNC message (parameter ⮡ 9120), if possible.

CAN load share configuration

The following parameters are available for configuring the CAN bus interfaces. Refer to ⮡ "4.6.1.3 Load Share Parameters" for detailed information.

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

7.4.2 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 ⮱ "4.6.2 Ethernet Interfaces".

8 Technical Specifications

8.1 Technical Data

Product label

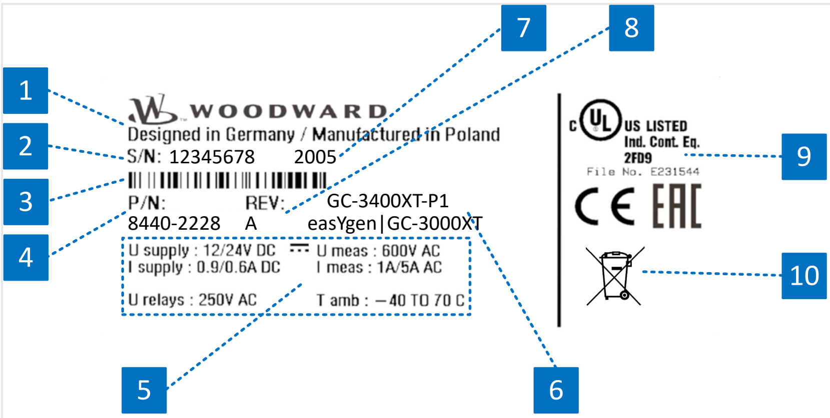


Fig. 137: Product label

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	Details	Technical data
6	Type Description	Description (product name)
7	S/N	Date of production (year-month)
8	REV	Item revision number
9	Approval	Approvals
10	Environment	Separate collection symbol

Battery inside

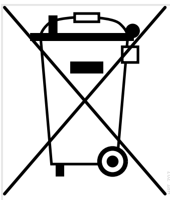


Fig. 138: Waste Disposal

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 ⅄ / Δ	**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		Galvanically isolated
Contact material		AgNi
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} Not suitable for USA and Canada applications. Not evaluated by UL.
		0.18 A_{DC}@250 V_{DC}

		Not suitable for USA and Canada applications. Not evaluated by UL.
Pilot Duty	AC	B300

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

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

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 Housing

Housing type

Type		**Sheet metal**
		Custom
Dimensions (W × H × D)		250 × 227 × 50 mm
Front cutout (W × H)		-/-
Weight		approx. 1630 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	Sheet metal	IP20

8.1.7 Approvals

EMC test (CE)	Tested according to applicable EMC standards. Refer to "8.2 Environmental Data" for details	
Listings	CE marking UL, Ordinary Locations, File No.: E231544 UL recognized component, category FTPM2/8, File No.: E347132 cUL CSA EAC - pending	
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			
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		

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): Offshore and Industrial applications for use in environmental categories ENV2, ENV3 and ENV4, as defined in Lloyd’s Register Type Approval System, Test Specification Number 1 – December 2021

Electromagnetic Compatibility

EN 61000-6-2	2019 - 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)	1.5% (of PT secondary voltage setting)[1]	
Delta generator / mains / busbar			2% (of PT secondary voltage setting)[1]	

Measuring value	Display	Accuracy	Measuring start	Notes
		120/480/690 V (Delta)		
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)
Miscellaneous				
Battery voltage	8 to 40 V	±0.5% (of measurement range 0 to 40 V_{DC})		
Phase angle	-180 to 180°	± 1 degree	1.25% (of PT secondary volt. setting)	180° is displayed for measuring values below measuring start

[1] Setting of the parameter for the PT secondary rated voltage

[2] Depending on the used measuring range (120/480/690 V)

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%
Ambient temperature	23 °C ± 2 K
Warm-up period	20 minutes

9 Appendix

9.1 Paper strip

For labeling the LEDs, either the supplied paper strip or a paper strip labeled by the user can be inserted into the pocket of the front foil. The dimensions for a suitable paper strip can be taken from the following drawing.

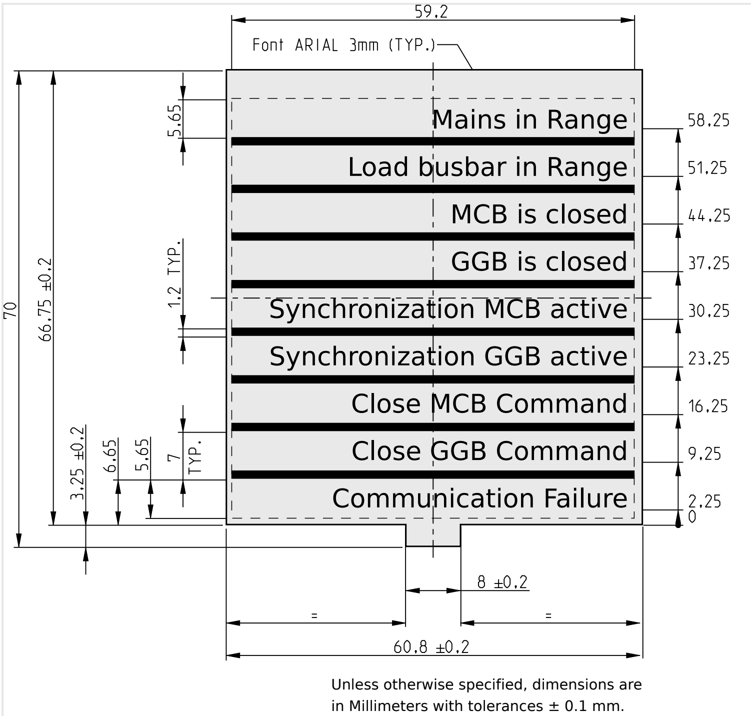


Fig. 139: Dimension of paper strip for easYgen | GC-3000XT-P1

9.2 Characteristics

9.2.1 Triggering Characteristics

Two-level overshoot monitoring

This triggering characteristic is used for battery overvoltage.

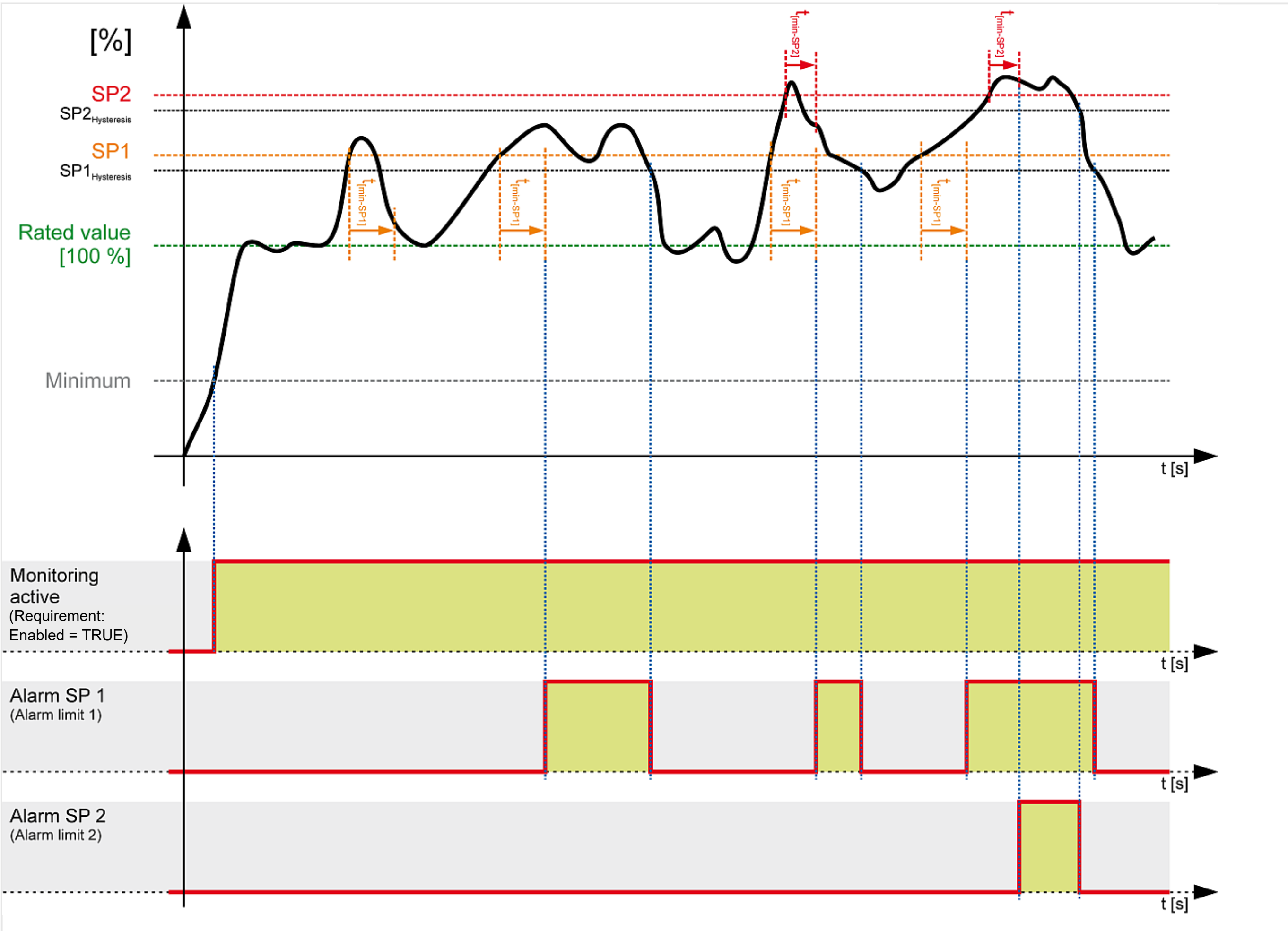


Fig. 140: Two-level overshoot monitoring

Two-level undershoot monitoring

This triggering characteristic is used for battery undervoltage.

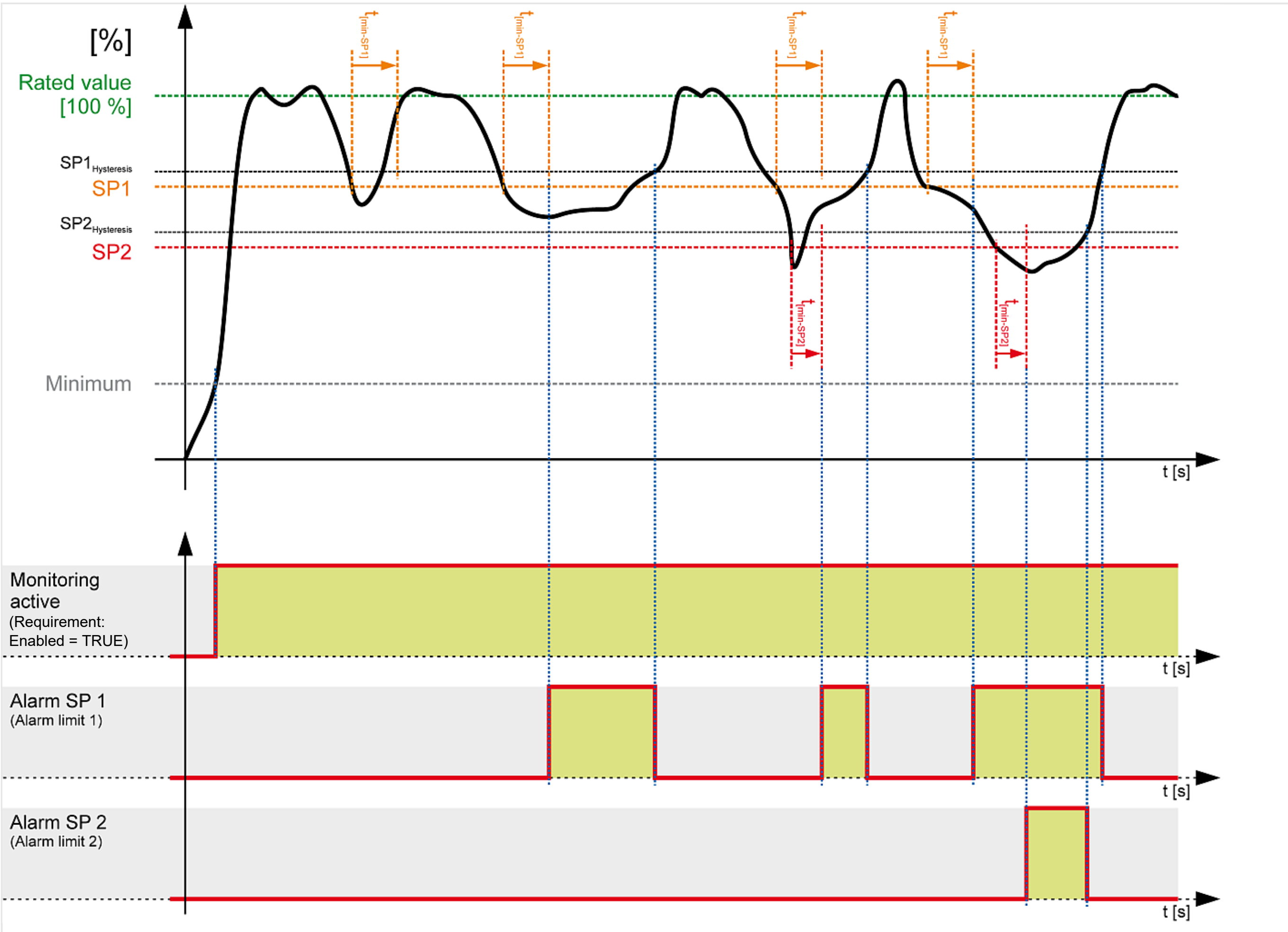


Fig. 141: Two-level undershoot monitoring

9.3 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

- 6000: Load Share Message
- 6003: LS-6XT Communication
- 6011: LDSS and Diagnostic

- 65000: External Discrete I/O 1 to 8 (IKD1)
- 65001: External Discrete I/O 9 to 16 (IKD1)

Modbus

- 5023: Basic Visualization

Protocol tables

Please browse the documentation server for data protocol tables as separate MS Excel files (for url see "QR Code") .

9.3.1 Protocol 5023 (Basic Visualization)

Modbus-Address	Size	Index	Description	Unit	Scale	Model
50000	int16		Protocol-ID, always 5300			All
Topic General						
50001	int16	3181	Skaling Power (16 bits) Exponent 10x W (5;4;3;2)			
50002	int16	3182	Skaling Volts (16 bits) Exponent 10x V (2;1;0;-1)			
50003	int16	3183	Skaling Amps (16 bits) Exponent 10x A (0;-1)			
50004			Internal			
50005			Internal			
50006			Internal			
50007			Internal			
50008			Internal			
50009			Internal			
50010			Internal			
50011			Internal			
50012			Internal			
50013			Internal			
50014			Internal			
50015			Internal			
Topic AC Generator group values						
50016	int16	144	Generator Group frequency	Hz	*100	
50017	int16	248	Generator Group voltage L1-L2	V	format defined by index 3182 (Modbus-Address 50002)	
50018	int16	249	Generator Group voltage L2-L3	V	format defined by index 3182 (Modbus-	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
					Address 50002)	
50019	int16	250	Generator Group voltage L3-L1	V	format defined by index 3182 (Modbus-Address 50002)	
50020	int16	251	Generator Group voltage L1-N	V	format defined by index 3182 (Modbus-Address 50002)	
50021	int16	252	Generator Group voltage L2-N	V	format defined by index 3182 (Modbus-Address 50002)	
50022	int16	253	Generator Group voltage L3-N	V	format defined by index 3182 (Modbus-Address 50002)	
50023	int16	255	Generator current 1	A	format defined by index 3183 (Modbus-Address 50003)	
50024	int16	256	Generator current 2	A	format defined by index 3183 (Modbus-Address 50003)	
50025	int16	257	Generator current 3	A	format defined by index 3183 (Modbus-Address 50003)	
50026			Internal			
50027			Internal			
50028			Internal			
50029			Internal			
50030			Internal			
50031			Internal			
50032			Internal			
50033			Internal			
50034			Internal			
50035			Internal			
50036			Internal			

Modbus-Address	Size	Index	Description	Unit	Scale	Model
Topic AC Load Busbar values						
50037	int16	209	Load Busbar: Frequency	Hz	*100	
50038	int16	254	Load busbar voltage L1-L2	V	format defined by index 3182 (Modbus-Address 50002)	
50039			Internal			
50040			Internal			
50041	int16	281	Load busbar voltage L1-N	V	format defined by index 3182 (Modbus-Address 50002)	
50042			Internal			
50043			Internal			
50044			Internal			
50045			Internal			
50046			Internal			
50047			Internal			
50048			Internal			
50049			Internal			
50050			Internal			
50051			Internal			
Topic AC Mains values						
50052	int16	147	Mains frequency	Hz	*100	
50053	int16	260	Mains voltage L1-L2	V	format defined by index 3182 (Modbus-Address 50002)	
50054	int16	261	Mains voltage L2-L3	V	format defined by index 3182 (Modbus-Address 50002)	
50055	int16	262	Mains voltage L3-L1	V	format defined by index 3182 (Modbus-Address 50002)	
50056	int16	263	Mains voltage L1-N	V	format defined by index 3182 (Modbus-Address 50002)	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
50057	int16	264	Mains voltage L2-N	V	format defined by index 3182 (Modbus-Address 50002)	
50058	int16	265	Mains voltage L3-N	V	format defined by index 3182 (Modbus-Address 50002)	
50059			Internal			
50060			Internal			
50061			Internal			
50062			Internal			
50063			Internal			
50064			Internal			
50065			Internal			
50066			Internal			
50067			Internal			
50068			Internal			
50069			Internal			
50070			Internal			
50071			Internal			
50072			Internal			
Topic Discrete inputs						
50073	uint16	284	BITLIST Digital Inputs 1 active			
			internal		Mask: 8000h	
			internal		Mask: 4000h	
			internal		Mask: 2000h	
			internal		Mask: 1000h	
			09.12 Discrete input 12		Mask: 0800h	
			09.11 Discrete input 11		Mask: 0400h	
			09.10 Discrete input 10		Mask: 0200h	
			09.09 Discrete input 9		Mask: 0100h	
			09.08 Discrete input 8		Mask: 0080h	
			09.07 Discrete input 7		Mask: 0040h	
			09.06 Discrete input 6		Mask: 0020h	
			09.05 Discrete input 5		Mask: 0010h	
			09.04 Discrete input 4		Mask: 0008h	
			09.03 Discrete input 3		Mask: 0004h	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			09.02 Discrete input 2		Mask: 0002h	
			09.01 Discrete input 1		Mask: 0001h	
50074			internal			
Topic Discrete outputs						
50075	uint16	286	BITLIST Relay Outputs 1			
			internal		Mask: 8000h	
			internal		Mask: 4000h	
			internal		Mask: 2000h	
			internal		Mask: 1000h	
			13.12 Relay-Output 12		Mask: 0800h	
			13.11 Relay-Output 11		Mask: 0400h	
			13.10 Relay-Output 10		Mask: 0200h	
			13.09 Relay-Output 9		Mask: 0100h	
			13.08 Relay-Output 8		Mask: 0080h	
			13.07 Relay-Output 7		Mask: 0040h	
			13.06 Relay-Output 6		Mask: 0020h	
			13.05 Relay-Output 5		Mask: 0010h	
			13.04 Relay-Output 4		Mask: 0008h	
			13.03 Relay-Output 3		Mask: 0004h	
			13.02 Relay-Output 2		Mask: 0002h	
			13.01 Relay-Output 1 (Self-test-relay)		Mask: 0001h	
50076			internal			
Topic DC Analogue Values						
50077			internal			
50078	int16	10110	Battery voltage	V	*10	
50079			internal			
50080			internal			
50081			internal			
50082	int16	1033	Analog input 1		configurable	
50083	int16	1083	Analog input 2		configurable	
50084	int16	1133	Analog input 3		configurable	
50085			internal			
50086			internal			
50087			internal			
50088			internal			
50089			internal			
50090			internal			

Modbus-Address	Size	Index	Description	Unit	Scale	Model
50091			internal			
50092			internal			
50093			internal			
50094			internal			
50095			internal			
50096			internal			
50097			internal			
50098			internal			
50099			internal			
50100			internal			
50101			internal			
Topic Segmenting						
50102	int16	7665	GC Basic Segment number			
50103	int16	7666	GC Allocated Segment number			
50104			internal			
50105			internal			
50106			internal			
50107			internal			
Topic State my Group						
50108	uint16	388	BITLIST Binary states			
			04.06 Min. one GCB closed		Mask: 8000h	
			internal		Mask: 4000h	
			internal		Mask: 2000h	
			internal		Mask: 1000h	
			internal		Mask: 0800h	
			internal		Mask: 0400h	
			internal		Mask: 0200h	
			internal		Mask: 0100h	
			internal		Mask: 0080h	
			internal		Mask: 0040h	
			internal		Mask: 0020h	
			internal		Mask: 0010h	
			internal		Mask: 0008h	
			internal		Mask: 0004h	
			internal		Mask: 0002h	
			04.16 GGB is closed		Mask: 0001h	
50109	int16	9183	P nominal	kW	format defined by	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
					index 3181 (Modbus-Address 50001)	
50110	int16	9724	P actual	kW	format defined by index 3181 (Modbus-Address 50001)	
50111	int16	9184	Load in %	%	*10	
50112	int16	9725	Q actual	kvar	format defined by index 3181 (Modbus-Address 50001)	
50113	int16	9185	Reactive load in %	%	*10	
50114	int16	9186	External Mains active power	kW	format defined by index 3181 (Modbus-Address 50001)	
50115	int16	9187	External Mains reactive power	kvar	format defined by index 3181 (Modbus-Address 50001)	
50116			internal			
Topic Alarm Management						
50117	uint16	10131	BITLIST General Alarms			
			01.11 New Alarm triggered		Mask: 8000h	
			internal		Mask: 4000h	
			internal		Mask: 2000h	
			internal		Mask: 1000h	
			04.05 Acknowledge		Mask: 0800h	
			03.05 Horn		Mask: 0400h	
			01.10 Centralized alarm		Mask: 0200h	
			01.09 Critical alarm		Mask: 0100h	
			01.08 Warning alarm		Mask: 0080h	
			01.07 All alarm classes		Mask: 0040h	
			01.06 Alarm class F		Mask: 0020h	
			01.05 Alarm class E		Mask: 0010h	
			01.04 Alarm class D		Mask: 0008h	
			01.03 Alarm class C		Mask: 0004h	
			01.02 Alarm class B		Mask: 0002h	
			01.01 Alarm class A		Mask: 0001h	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
50118	uint16	10149	BITLIST Alarms Interfaces latched			
			08.62 Ethernet issue		Mask: 8000h	
			08.19 CANopen Interface 2		Mask: 4000h	
			08.18 CANopen interface 1		Mask: 2000h	
			08.28 Missing LSx Layer 1		Mask: 1000h	
			08.64 Missing LSx Layer 3		Mask: 0800h	
			08.67 Group not ok		Mask: 0400h	
			08.63 Missing GC		Mask: 0200h	
			08.27 Missing easYgen		Mask: 0100h	
			08.66 Syst.update Layer 3		Mask: 0080h	
			08.65 Syst.update Layer 1		Mask: 0040h	
			08.53 EthB EthC redundancy		Mask: 0020h	
			08.70 CAN1 EthA redundancy		Mask: 0010h	
			08.42 Ethernet C LS fault		Mask: 0008h	
			08.41 Ethernet B LS fault		Mask: 0004h	
			08.52 Ethernet A LS fault		Mask: 0002h	
			08.51 CAN LS fault		Mask: 0001h	
50119	uint16	4169	BITLIST Alarms Interfaces actual			
			Ethernet issue		Mask: 8000h	
			CANopen Interface 2		Mask: 4000h	
			CANopen interface 1		Mask: 2000h	
			Missing LSx Layer 3		Mask: 1000h	
			Missing LSx Layer 1		Mask: 0800h	
			Group not ok		Mask: 0400h	
			Missing GC		Mask: 0200h	
			Missing easYgen		Mask: 0100h	
			Syst.update Layer 3		Mask: 0080h	
			Syst.update Layer 1		Mask: 0040h	
			EthB EthC redundancy		Mask: 0020h	
			CAN1 EthA redundancy		Mask: 0010h	
			Ethernet C LS fault		Mask: 0008h	
			Ethernet B LS fault		Mask: 0004h	
			Ethernet A LS fault		Mask: 0002h	
			CAN LS fault		Mask: 0001h	
50120	uint16	10190	BITLIST Alarms 1 latched			
			internal		Mask: 8000h	
			08.16 Parameter alignment		Mask: 4000h	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			10.03 AI 3 wire break		Mask: 2000h	
			10.02 AI 2 wire break		Mask: 1000h	
			10.01 AI 1 wire break		Mask: 0800h	
			08.08 MCB fail to open		Mask: 0400h	
			08.07 MCB fail to close		Mask: 0200h	
			07.32 Mains AC wiring		Mask: 0100h	
			internal		Mask: 0080h	
			06.32 GenGroup AC wiring		Mask: 0040h	
			08.68 GGB plausibilty		Mask: 0020h	
			08.33 Phase rot. Mismatch		Mask: 0010h	
			07.05 Mns.ph.rot. mismatch		Mask: 0008h	
			06.21 GenGroup ph.rotation		Mask: 0004h	
			08.35 GGB fail to open		Mask: 0002h	
			08.34 GGB fail to close		Mask: 0001h	
50121	uint16	4193	BITLIST Alarms 1 actual			
			internal		Mask: 8000h	
			Parameter alignment		Mask: 4000h	
			AI 3 wire break		Mask: 2000h	
			AI 2 wire break		Mask: 1000h	
			AI 1 wire break		Mask: 0800h	
			MCB fail to open		Mask: 0400h	
			MCB fail to close		Mask: 0200h	
			Mains AC wiring		Mask: 0100h	
			internal		Mask: 0080h	
			GenGroup AC wiring		Mask: 0040h	
			GGB plausibilty		Mask: 0020h	
			Phase rot. Mismatch		Mask: 0010h	
			Mns.ph.rot. mismatch		Mask: 0008h	
			GenGroup ph.rotation		Mask: 0004h	
			GGB fail to open		Mask: 0002h	
			GGB fail to close		Mask: 0001h	
50122	uint16	4210	BITLIST Alarms 2 latched			
			internal		Mask: 8000h	
			internal		Mask: 4000h	
			internal		Mask: 2000h	
			internal		Mask: 1000h	
			internal		Mask: 0800h	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			internal		Mask: 0400h	
			internal		Mask: 0200h	
			internal		Mask: 0100h	
			internal		Mask: 0080h	
			GenGr. overcurrent 3		Mask: 0040h	
			GenGr. overcurrent 2		Mask: 0020h	
			GenGr. overcurrent 1		Mask: 0010h	
			Inverse time overcurrent		Mask: 0008h	
			GGB unload mismatch		Mask: 0004h	
			Synchron. time GGB		Mask: 0002h	
			Synchron. time MCB		Mask: 0001h	
50123	uint16	4209	BITLIST Alarms 2 actual			
			internal		Mask: 8000h	
			internal		Mask: 4000h	
			internal		Mask: 2000h	
			internal		Mask: 1000h	
			internal		Mask: 0800h	
			internal		Mask: 0400h	
			internal		Mask: 0200h	
			internal		Mask: 0100h	
			internal		Mask: 0080h	
			GenGr. overcurrent 3		Mask: 0040h	
			GenGr. overcurrent 2		Mask: 0020h	
			GenGr. overcurrent 1		Mask: 0010h	
			Inverse time overcurrent		Mask: 0008h	
			GGB unload mismatch		Mask: 0004h	
			Synchron. time GGB		Mask: 0002h	
			Synchron. time MCB		Mask: 0001h	
Topic Control Flags						
50124	uint16	4156	BITLIST Flags			
			internal		Mask: 8000h	
			04.65 Any system update active		Mask: 4000h	
			86.86 LM: LDSS is enabled		Mask: 2000h	
			04.09 Emerg.run request		Mask: 1000h	
			04.26 Closing GGB active		Mask: 0800h	
			04.25 Opening GGB active		Mask: 0400h	
			04.24 Syn. GGB active		Mask: 0200h	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			04.23 Closing MCB active		Mask: 0100h	
			04.22 Opening MCB active		Mask: 0080h	
			04.17 GGB released		Mask: 0040h	
			04.11 Mains settling		Mask: 0020h	
			02.11 Mains ok		Mask: 0010h	
			04.07 MCB is closed		Mask: 0008h	
			02.08 Load busbar ok		Mask: 0004h	
			04.16 GGB closed		Mask: 0002h	
			02.05 Gen Group ok		Mask: 0001h	
50125	int16	9925	Layer 1: Monitored easYgens (including own GC)			
50126	int16	9928	Layer 3: Monitored GCs			
50127	uint16	10315	BITLIST Control States			
			internal		Mask: 8000h	
			internal		Mask: 4000h	
			internal		Mask: 2000h	
			internal		Mask: 1000h	
			internal		Mask: 0800h	
			internal		Mask: 0400h	
			internal		Mask: 0200h	
			internal		Mask: 0100h	
			internal		Mask: 0080h	
			internal		Mask: 0040h	
			Control State: Unload mains / MCB open		Mask: 0020h	
			Control State: MCB synchronization		Mask: 0010h	
			Control State: GGB dead bus closure		Mask: 0008h	
			Control State: GGB synchronization MOP		Mask: 0004h	
			Control State: GGB synchronization IOP		Mask: 0002h	
			Control State: Initial		Mask: 0001h	
50128	uint16	7873	BITLIST LSx Commands Layer 1			
			28.01 Command 1 to LSx Layer 1 (OR)		Mask: 8000h	
			28.02 Command 2 to LSx Layer 1 (OR)		Mask: 4000h	
			28.03 Command 3 to LSx Layer 1 (OR)		Mask: 2000h	
			28.04 Command 4 to LSx Layer 1 (OR)		Mask: 1000h	
			28.05 Command 5 to LSx Layer 1 (OR)		Mask: 0800h	
			28.06 Command 6 to LSx Layer 1 (OR)		Mask: 0400h	
			internal		Mask: 0200h	
			internal		Mask: 0100h	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			internal		Mask: 0080h	
			internal		Mask: 0040h	
			internal		Mask: 0020h	
			internal		Mask: 0010h	
			internal		Mask: 0008h	
			internal		Mask: 0004h	
			internal		Mask: 0002h	
			internal		Mask: 0001h	
50129	int16	9926	Layer 1: Monitored LSx (including own GC)			
50130	int16	7877	Layer 3: Monitored LSx			
50131			internal			
50132			internal			
50133			internal			
50134			internal			
50135			internal			
50136			internal			
50137			internal			
50138			internal			
Topic Values my own Segment						
50139	int16	294	Own Segment: P nominal	kW	format defined by index 3181 (Modbus-Address 50001)	
50140	int16	295	Own Segment: P actual	kW	format defined by index 3181 (Modbus-Address 50001)	
50141	int16	296	Own Segment: P reserve	kW	format defined by index 3181 (Modbus-Address 50001)	
50142	int16	297	Own Segment: P load	%	*10	
50143	int16	298	Own Segment: Q actual	kvar	format defined by index 3181 (Modbus-Address 50001)	
50144	int16	299	Own Segment: Q load	%	*10	
50145	int16	300	Own Segment: Power factor		*1000	
50146			internal			

Modbus-Address	Size	Index	Description	Unit	Scale	Model
50147			internal			
50148			internal			
50149			internal			
50150			internal			
50151			internal			
50152			internal			
50153			internal			
Topic External discrete inputs						
50154			internal			
50155	uint16	8021	BITLIST External DI 1-16 active			
			12.16 External discrete input 16		Mask: 8000h	
			12.15 External discrete input 15		Mask: 4000h	
			12.14 External discrete input 14		Mask: 2000h	
			12.13 External discrete input 13		Mask: 1000h	
			12.12 External discrete input 12		Mask: 0800h	
			12.11 External discrete input 11		Mask: 0400h	
			12.10 External discrete input 10		Mask: 0200h	
			12.09 External discrete input 9		Mask: 0100h	
			12.08 External discrete input 8		Mask: 0080h	
			12.07 External discrete input 7		Mask: 0040h	
			12.06 External discrete input 6		Mask: 0020h	
			12.05 External discrete input 5		Mask: 0010h	
			12.04 External discrete input 4		Mask: 0008h	
			12.03 External discrete input 3		Mask: 0004h	
			12.02 External discrete input 2		Mask: 0002h	
			12.01 External discrete input 1		Mask: 0001h	
50156			internal			
50157	int16		internal			
Topic External discrete outputs						
50158	uint16	8005	BITLIST Relay Outputs 3			
			98.16 LM External DO 16		Mask: 8000h	
			98.15 LM External DO 15		Mask: 4000h	
			98.14 LM External DO 14		Mask: 2000h	
			98.13 LM External DO 13		Mask: 1000h	
			98.12 LM External DO 12		Mask: 0800h	
			98.11 LM External DO 11		Mask: 0400h	
			98.10 LM External DO 10		Mask: 0200h	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			98.09 LM External DO 9		Mask: 0100h	
			98.08 LM External DO 8		Mask: 0080h	
			98.07 LM External DO 7		Mask: 0040h	
			98.06 LM External DO 6		Mask: 0020h	
			98.05 LM External DO 5		Mask: 0010h	
			98.04 LM External DO 4		Mask: 0008h	
			98.03 LM External DO 3		Mask: 0004h	
			98.02 LM External DO 2		Mask: 0002h	
			98.01 LM External DO 1		Mask: 0001h	
50159			internal			
Topic Flexible Thresholds						
50160	uint16	10279	BITLIST Alarms Flex.Thresholds 1-16 latched			
			15.16 Flexible limit 16 latched		Mask: 8000h	
			15.15 Flexible limit 15 latched		Mask: 4000h	
			15.14 Flexible limit 14 latched		Mask: 2000h	
			15.13 Flexible limit 13 latched		Mask: 1000h	
			15.12 Flexible limit 12 latched		Mask: 0800h	
			15.11 Flexible limit 11 latched		Mask: 0400h	
			15.10 Flexible limit 10 latched		Mask: 0200h	
			15.09 Flexible limit 9 latched		Mask: 0100h	
			15.08 Flexible limit 8 latched		Mask: 0080h	
			15.07 Flexible limit 7 latched		Mask: 0040h	
			15.06 Flexible limit 6 latched		Mask: 0020h	
			15.05 Flexible limit 5 latched		Mask: 0010h	
			15.04 Flexible limit 4 latched		Mask: 0008h	
			15.03 Flexible limit 3 latched		Mask: 0004h	
			15.02 Flexible limit 2 latched		Mask: 0002h	
			15.01 Flexible limit 1 latched		Mask: 0001h	
50161	uint16	4175	BITLIST Alarms Flex.Thresholds 1-16 active			
			Flexible limit 16 active		Mask: 8000h	
			Flexible limit 15 active		Mask: 4000h	
			Flexible limit 14 active		Mask: 2000h	
			Flexible limit 13 active		Mask: 1000h	
			Flexible limit 12 active		Mask: 0800h	
			Flexible limit 11 active		Mask: 0400h	
			Flexible limit 10 active		Mask: 0200h	
			Flexible limit 9 active		Mask: 0100h	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			Flexible limit 8 active		Mask: 0080h	
			Flexible limit 7 active		Mask: 0040h	
			Flexible limit 6 active		Mask: 0020h	
			Flexible limit 5 active		Mask: 0010h	
			Flexible limit 4 active		Mask: 0008h	
			Flexible limit 3 active		Mask: 0004h	
			Flexible limit 2 active		Mask: 0002h	
			Flexible limit 1 active		Mask: 0001h	
50162	uint16	10280	BITLIST Alarms Flex.Thresholds 17-32 latched			
			15.32 Flexible limit 32 latched		Mask: 8000h	
			15.31 Flexible limit 31 latched		Mask: 4000h	
			15.30 Flexible limit 30 latched		Mask: 2000h	
			15.29 Flexible limit 29 latched		Mask: 1000h	
			15.28 Flexible limit 28 latched		Mask: 0800h	
			15.27 Flexible limit 27 latched		Mask: 0400h	
			15.26 Flexible limit 26 latched		Mask: 0200h	
			15.25 Flexible limit 25 latched		Mask: 0100h	
			15.24 Flexible limit 24 latched		Mask: 0080h	
			15.23 Flexible limit 23 latched		Mask: 0040h	
			15.22 Flexible limit 22 latched		Mask: 0020h	
			15.21 Flexible limit 21 latched		Mask: 0010h	
			15.20 Flexible limit 20 latched		Mask: 0008h	
			15.19 Flexible limit 19 latched		Mask: 0004h	
			15.18 Flexible limit 18 latched		Mask: 0002h	
			15.17 Flexible limit 17 latched		Mask: 0001h	
50163	uint16	4177	BITLIST Alarms Flex.Thresholds 17-32 active			
			Flexible limit 32 active		Mask: 8000h	
			Flexible limit 31 active		Mask: 4000h	
			Flexible limit 30 active		Mask: 2000h	
			Flexible limit 29 active		Mask: 1000h	
			Flexible limit 28 active		Mask: 0800h	
			Flexible limit 27 active		Mask: 0400h	
			Flexible limit 26 active		Mask: 0200h	
			Flexible limit 25 active		Mask: 0100h	
			Flexible limit 24 active		Mask: 0080h	
			Flexible limit 23 active		Mask: 0040h	
			Flexible limit 22 active		Mask: 0020h	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			Flexible limit 21 active		Mask: 0010h	
			Flexible limit 20 active		Mask: 0008h	
			Flexible limit 19 active		Mask: 0004h	
			Flexible limit 18 active		Mask: 0002h	
			Flexible limit 17 active		Mask: 0001h	
50164	uint16	10281	BITLIST Alarms Flex.Thresholds 33-40 latched			
			Internal		Mask: 8000h	
			Internal		Mask: 4000h	
			Internal		Mask: 2000h	
			Internal		Mask: 1000h	
			Internal		Mask: 0800h	
			Internal		Mask: 0400h	
			Internal		Mask: 0200h	
			Internal		Mask: 0100h	
			15.40 Flexible limit 40 latched		Mask: 0080h	
			15.39 Flexible limit 39 latched		Mask: 0040h	
			15.38 Flexible limit 38 latched		Mask: 0020h	
			15.37 Flexible limit 37 latched		Mask: 0010h	
			15.36 Flexible limit 36 latched		Mask: 0008h	
			15.35 Flexible limit 35 latched		Mask: 0004h	
			15.34 Flexible limit 34 latched		Mask: 0002h	
			15.33 Flexible limit 33 latched		Mask: 0001h	
50165	uint16	4179	BITLIST Alarms Flex.Thresholds 33-40 active			
			Internal		Mask: 8000h	
			Internal		Mask: 4000h	
			Internal		Mask: 2000h	
			Internal		Mask: 1000h	
			Internal		Mask: 0800h	
			Internal		Mask: 0400h	
			Internal		Mask: 0200h	
			Internal		Mask: 0100h	
			Flexible limit 40 active		Mask: 0080h	
			Flexible limit 39 active		Mask: 0040h	
			Flexible limit 38 active		Mask: 0020h	
			Flexible limit 37 active		Mask: 0010h	
			Flexible limit 36 active		Mask: 0008h	
			Flexible limit 35 active		Mask: 0004h	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			Flexible limit 34 active		Mask: 0002h	
			Flexible limit 33 active		Mask: 0001h	
50166			Internal			
50167			Internal			
50168			Internal			
50169			Internal			
Topic Internal Flags						
50170	uint16	4085	BITLIST 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	
50171	uint16	4095	BITLIST Internal Flags 17-32			
			96.32 LM Internal Flag 32		Mask: 8000h	
			96.31 LM Internal Flag 31		Mask: 4000h	
			96.30 LM Internal Flag 30		Mask: 2000h	
			96.29 LM Internal Flag 29		Mask: 1000h	
			96.28 LM Internal Flag 28		Mask: 0800h	
			96.27 LM Internal Flag 27		Mask: 0400h	
			96.26 LM Internal Flag 26		Mask: 0200h	
			96.25 LM Internal Flag 25		Mask: 0100h	
			96.24 LM Internal Flag 24		Mask: 0080h	
			96.23 LM Internal Flag 23		Mask: 0040h	
			96.22 LM Internal Flag 22		Mask: 0020h	
			96.21 LM Internal Flag 21		Mask: 0010h	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			96.20 LM Internal Flag 20		Mask: 0008h	
			96.19 LM Internal Flag 19		Mask: 0004h	
			96.18 LM Internal Flag 18		Mask: 0002h	
			96.17 LM Internal Flag 17		Mask: 0001h	
50172	uint16	4199	BITLIST LED 1-9 (paperstrip)			
			Internal		Mask: 8000h	
			Internal		Mask: 4000h	
			Internal		Mask: 2000h	
			Internal		Mask: 1000h	
			Internal		Mask: 0800h	
			Internal		Mask: 0400h	
			Internal		Mask: 0200h	
			LED 9 (Missing member)		Mask: 0100h	
			LED 8 (87.58 LM LED 8)		Mask: 0080h	
			LED 7 (87.57 LM LED 7)		Mask: 0040h	
			LED 6 (87.56 LM LED 6)		Mask: 0020h	
			LED 5 (87.55 LM LED 5)		Mask: 0010h	
			LED 4 (87.54 LM LED 4)		Mask: 0008h	
			LED 3 (87.53 LM LED 3)		Mask: 0004h	
			LED 2 (87.52 LM LED 2)		Mask: 0002h	
			LED 1 (87.51 LM LED 1)		Mask: 0001h	
50173			Internal			
Topic						
50174			Internal			
50175			Internal			
50176			Internal			
50177			Internal			
Topic Miscellenous						
50178	int16	9642	91.01 AM Internal value 1			
50179	int16	9646	91.02 AM Internal value 2			
50180	int16	9650	91.03 AM Internal value 3			
50181	int16	9654	91.04 AM Internal value 4			
50182	int16	9658	91.05 AM Internal value 5			
50183	int16	9662	91.06 AM Internal value 6			
50184	int16	9666	91.07 AM Internal value 7			
50185	int16	9670	91.08 AM Internal value 8			
50186	int16	9674	91.09 AM Internal value 9			

Modbus-Address	Size	Index	Description	Unit	Scale	Model
50187	int16	9678	91.10 AM Internal value 10			
50188	int16	9682	91.11 AM Internal value 11			
50189	int16	9686	91.12 AM Internal value 12			
50190	int16	9690	91.13 AM Internal value 13			
50191	int16	9694	91.14 AM Internal value 14			
50192	int16	9698	91.15 AM Internal value 15			
50193	int16	9702	91.16 AM Internal value 16			
50194			Internal			
50195			Internal			
50196			Internal			
50197			Internal			
50198			Internal			
50199			Internal			
50200			Internal			
50201			Internal			
50202			Internal			
50203			Internal			
50204			Internal			
50205			Internal			
50206			Internal			
50207			Internal			
Topic LDSS Status						
For explanation please refer to manual chapter "LDSS Status"						
50208	uint16	8031	BITLIST Visu LDSS Status GC1 Gen 1 to 4			
50209	uint16	8032	BITLIST Visu LDSS Status GC1 Gen 5 to 8			
50210	uint16	8033	BITLIST Visu LDSS Status GC1 Gen 9 to 12			
50211	uint16	8034	BITLIST Visu LDSS Status GC1 Gen 13 to 16			
50212	uint16	8035	BITLIST Visu LDSS Status GC1 Gen 17 to 20			
50213	uint16	8036	BITLIST Visu LDSS Status GC1 Gen 21 to 24			
50214	uint16	8037	BITLIST Visu LDSS Status GC1 Gen 25 to 28			
50215	uint16	8038	BITLIST Visu LDSS Status GC1 Gen 29 to 31			
50216	uint16	8039	BITLIST Visu LDSS Status GC2 Gen 1 to 4			
50217	uint16	8040	BITLIST Visu LDSS Status GC2 Gen 5 to 8			
50218	uint16	8041	BITLIST Visu LDSS Status GC2 Gen 9 to 12			
50219	uint16	8042	BITLIST Visu LDSS Status GC2 Gen 13 to 16			
50220	uint16	8043	BITLIST Visu LDSS Status GC2 Gen 17 to 20			
50221	uint16	8044	BITLIST Visu LDSS Status GC2 Gen 21 to 24			

Modbus-Address	Size	Index	Description	Unit	Scale	Model
50222	uint16	8045	BITLIST Visu LDSS Status GC2 Gen 25 to 28			
50223	uint16	8046	BITLIST Visu LDSS Status GC2 Gen 29 to 31			
50224	uint16	8047	BITLIST Visu LDSS Status GC3 Gen 1 to 4			
50225	uint16	8048	BITLIST Visu LDSS Status GC3 Gen 5 to 8			
50226	uint16	8049	BITLIST Visu LDSS Status GC3 Gen 9 to 12			
50227	uint16	8050	BITLIST Visu LDSS Status GC3 Gen 13 to 16			
50228	uint16	8051	BITLIST Visu LDSS Status GC3 Gen 17 to 20			
50229	uint16	8052	BITLIST Visu LDSS Status GC3 Gen 21 to 24			
50230	uint16	8053	BITLIST Visu LDSS Status GC3 Gen 25 to 28			
50231	uint16	8054	BITLIST Visu LDSS Status GC3 Gen 29 to 31			
50232	uint16	8055	BITLIST Visu LDSS Status GC4 Gen 1 to 4			
50233	uint16	8056	BITLIST Visu LDSS Status GC4 Gen 5 to 8			
50234	uint16	8057	BITLIST Visu LDSS Status GC4 Gen 9 to 12			
50235	uint16	8058	BITLIST Visu LDSS Status GC4 Gen 13 to 16			
50236	uint16	8059	BITLIST Visu LDSS Status GC4 Gen 17 to 20			
50237	uint16	8060	BITLIST Visu LDSS Status GC4 Gen 21 to 24			
50238	uint16	8061	BITLIST Visu LDSS Status GC4 Gen 25 to 28			
50239	uint16	8062	BITLIST Visu LDSS Status GC4 Gen 29 to 31			
50240	uint16	8063	BITLIST Visu LDSS Status GC5 Gen 1 to 4			
50241	uint16	8064	BITLIST Visu LDSS Status GC5 Gen 5 to 8			
50242	uint16	8065	BITLIST Visu LDSS Status GC5 Gen 9 to 12			
50243	uint16	8066	BITLIST Visu LDSS Status GC5 Gen 13 to 16			
50244	uint16	8067	BITLIST Visu LDSS Status GC5 Gen 17 to 20			
50245	uint16	8068	BITLIST Visu LDSS Status GC5 Gen 21 to 24			
50246	uint16	8069	BITLIST Visu LDSS Status GC5 Gen 25 to 28			
50247	uint16	8070	BITLIST Visu LDSS Status GC5 Gen 29 to 31			
50248	uint16	8071	BITLIST Visu LDSS Status GC6 Gen 1 to 4			
50249	uint16	8072	BITLIST Visu LDSS Status GC6 Gen 5 to 8			
50250	uint16	8073	BITLIST Visu LDSS Status GC6 Gen 9 to 12			
50251	uint16	8074	BITLIST Visu LDSS Status GC6 Gen 13 to 16			
50252	uint16	8075	BITLIST Visu LDSS Status GC6 Gen 17 to 20			
50253	uint16	8076	BITLIST Visu LDSS Status GC6 Gen 21 to 24			
50254	uint16	8077	BITLIST Visu LDSS Status GC6 Gen 25 to 28			
50255	uint16	8078	BITLIST Visu LDSS Status GC6 Gen 29 to 31			
50256	uint16	8079	BITLIST Visu LDSS Status GC7 Gen 1 to 4			
50257	uint16	8080	BITLIST Visu LDSS Status GC7 Gen 5 to 8			
50258	uint16	8081	BITLIST Visu LDSS Status GC7 Gen 9 to 12			

Modbus-Address	Size	Index	Description	Unit	Scale	Model
50259	uint16	8082	BITLIST Visu LDSS Status GC7 Gen 13 to 16			
50260	uint16	8083	BITLIST Visu LDSS Status GC7 Gen 17 to 20			
50261	uint16	8084	BITLIST Visu LDSS Status GC7 Gen 21 to 24			
50262	uint16	8085	BITLIST Visu LDSS Status GC7 Gen 25 to 28			
50263	uint16	8086	BITLIST Visu LDSS Status GC7 Gen 29 to 31			
50264	uint16	8087	BITLIST Visu LDSS Status GC8 Gen 1 to 4			
50265	uint16	8088	BITLIST Visu LDSS Status GC8 Gen 5 to 8			
50266	uint16	8089	BITLIST Visu LDSS Status GC8 Gen 9 to 12			
50267	uint16	8090	BITLIST Visu LDSS Status GC8 Gen 13 to 16			
50268	uint16	8091	BITLIST Visu LDSS Status GC8 Gen 17 to 20			
50269	uint16	8092	BITLIST Visu LDSS Status GC8 Gen 21 to 24			
50270	uint16	8093	BITLIST Visu LDSS Status GC8 Gen 25 to 28			
50271	uint16	8094	BITLIST Visu LDSS Status GC8 Gen 29 to 31			
50272	uint16	16549	BITLIST Visu LDSS Status GC9 Gen 1 to 4			
50273	uint16	16550	BITLIST Visu LDSS Status GC9 Gen 5 to 8			
50274	uint16	16551	BITLIST Visu LDSS Status GC9 Gen 9 to 12			
50275	uint16	16552	BITLIST Visu LDSS Status GC9 Gen 13 to 16			
50276	uint16	16553	BITLIST Visu LDSS Status GC9 Gen 17 to 20			
50277	uint16	16554	BITLIST Visu LDSS Status GC9 Gen 21 to 24			
50278	uint16	16555	BITLIST Visu LDSS Status GC9 Gen 25 to 28			
50279	uint16	16556	BITLIST Visu LDSS Status GC9 Gen 29 to 31			
50280	uint16	16557	BITLIST Visu LDSS Status GC10 Gen 1 to 4			
50281	uint16	16558	BITLIST Visu LDSS Status GC10 Gen 5 to 8			
50282	uint16	16559	BITLIST Visu LDSS Status GC10 Gen 9 to 12			
50283	uint16	16560	BITLIST Visu LDSS Status GC10 Gen 13 to 16			
50284	uint16	16561	BITLIST Visu LDSS Status GC10 Gen 17 to 20			
50285	uint16	16562	BITLIST Visu LDSS Status GC10 Gen 21 to 24			
50286	uint16	16563	BITLIST Visu LDSS Status GC10 Gen 25 to 28			
50287	uint16	16564	BITLIST Visu LDSS Status GC10 Gen 29 to 31			
50288	uint16	16565	BITLIST Visu LDSS Status GC11 Gen 1 to 4			
50289	uint16	16566	BITLIST Visu LDSS Status GC11 Gen 5 to 8			
50290	uint16	16567	BITLIST Visu LDSS Status GC11 Gen 9 to 12			
50291	uint16	16568	BITLIST Visu LDSS Status GC11 Gen 13 to 16			
50292	uint16	16569	BITLIST Visu LDSS Status GC11 Gen 17 to 20			
50293	uint16	16570	BITLIST Visu LDSS Status GC11 Gen 21 to 24			
50294	uint16	16571	BITLIST Visu LDSS Status GC11 Gen 25 to 28			
50295	uint16	16572	BITLIST Visu LDSS Status GC11 Gen 29 to 31			

Modbus-Address	Size	Index	Description	Unit	Scale	Model
50296	uint16	16573	BITLIST Visu LDSS Status GC12 Gen 1 to 4			
50297	uint16	16574	BITLIST Visu LDSS Status GC12 Gen 5 to 8			
50298	uint16	16575	BITLIST Visu LDSS Status GC12 Gen 9 to 12			
50299	uint16	16576	BITLIST Visu LDSS Status GC12 Gen 13 to 16			
50300	uint16	16577	BITLIST Visu LDSS Status GC12 Gen 17 to 20			
50301	uint16	16578	BITLIST Visu LDSS Status GC12 Gen 21 to 24			
50302	uint16	16579	BITLIST Visu LDSS Status GC12 Gen 25 to 28			
50303	uint16	16580	BITLIST Visu LDSS Status GC12 Gen 29 to 31			
50304	uint16	16581	BITLIST Visu LDSS Status GC13 Gen 1 to 4			
50305	uint16	16582	BITLIST Visu LDSS Status GC13 Gen 5 to 8			
50306	uint16	16583	BITLIST Visu LDSS Status GC13 Gen 9 to 12			
50307	uint16	16584	BITLIST Visu LDSS Status GC13 Gen 13 to 16			
50308	uint16	16585	BITLIST Visu LDSS Status GC13 Gen 17 to 20			
50309	uint16	16586	BITLIST Visu LDSS Status GC13 Gen 21 to 24			
50310	uint16	16587	BITLIST Visu LDSS Status GC13 Gen 25 to 28			
50311	uint16	16588	BITLIST Visu LDSS Status GC13 Gen 29 to 31			
50312	uint16	16589	BITLIST Visu LDSS Status GC14 Gen 1 to 4			
50313	uint16	16590	BITLIST Visu LDSS Status GC14 Gen 5 to 8			
50314	uint16	16591	BITLIST Visu LDSS Status GC14 Gen 9 to 12			
50315	uint16	16592	BITLIST Visu LDSS Status GC14 Gen 13 to 16			
50316	uint16	16593	BITLIST Visu LDSS Status GC14 Gen 17 to 20			
50317	uint16	16594	BITLIST Visu LDSS Status GC14 Gen 21 to 24			
50318	uint16	16595	BITLIST Visu LDSS Status GC14 Gen 25 to 28			
50319	uint16	16596	BITLIST Visu LDSS Status GC14 Gen 29 to 31			
50320	uint16	16597	BITLIST Visu LDSS Status GC15 Gen 1 to 4			
50321	uint16	16598	BITLIST Visu LDSS Status GC15 Gen 5 to 8			
50322	uint16	16599	BITLIST Visu LDSS Status GC15 Gen 9 to 12			
50323	uint16	16600	BITLIST Visu LDSS Status GC15 Gen 13 to 16			
50324	uint16	16601	BITLIST Visu LDSS Status GC15 Gen 17 to 20			
50325	uint16	16602	BITLIST Visu LDSS Status GC15 Gen 21 to 24			
50326	uint16	16603	BITLIST Visu LDSS Status GC15 Gen 25 to 28			
50327	uint16	16604	BITLIST Visu LDSS Status GC15 Gen 29 to 31			
50328	uint16	16605	BITLIST Visu LDSS Status GC16 Gen 1 to 4			
50329	uint16	16606	BITLIST Visu LDSS Status GC16 Gen 5 to 8			
50330	uint16	16607	BITLIST Visu LDSS Status GC16 Gen 9 to 12			
50331	uint16	16608	BITLIST Visu LDSS Status GC16 Gen 13 to 16			
50332	uint16	16609	BITLIST Visu LDSS Status GC16 Gen 17 to 20			

Modbus-Address	Size	Index	Description	Unit	Scale	Model
50333	uint16	16610	BITLIST Visu LDSS Status GC16 Gen 21 to 24			
50334	uint16	16611	BITLIST Visu LDSS Status GC16 Gen 25 to 28			
50335	uint16	16612	BITLIST Visu LDSS Status GC16 Gen 29 to 31			
50336	int16		Internal			
50337	int16		Internal			
Topic Communication Diagnostic						
For explanation please refer to manual chapter "Status Communication Diagnostic"						
Diagnostic easYgens in own group						
50338	uint16	7802	BITLIST 1-5 System status			
50339	uint16	7835	BITLIST easYgen 1-5 Communication (LED)			
50340	uint16	7803	BITLIST easYgen 6-10 System status			
50341	uint16	7836	BITLIST easYgen 6-10 Communication (LED)			
50342	uint16	7804	BITLIST easYgen 11-15 System status			
50343	uint16	7837	BITLIST easYgen 11-15 Communication (LED)			
50344	uint16	7805	BITLIST easYgen 16-20 System status			
50345	uint16	7838	BITLIST easYgen 16-20 Communication (LED)			
50346	uint16	7806	BITLIST easYgen 21-25 System status			
50347	uint16	7839	BITLIST easYgen 21-25 Communication (LED)			
50348	uint16	7807	BITLIST easYgen 26-30 System status			
50349	uint16	7840	BITLIST easYgen 26-30 Communication (LED)			
50350	uint16	7808	BITLIST easYgen 31-32 System status			
50351	uint16	7841	BITLIST easYgen 31-32 Communication (LED)			
Diagnostic Groups						
50352	uint16	7882	BITLIST Group Controller 1-5 System status			
50353	uint16	7889	BITLIST Group Controller 1-5 Communication (LED)			
50354	uint16	7883	BITLIST Group Controller 6-10 System status			
50355	uint16	7890	BITLIST Group Controller 6-10 Communication (LED)			
50356	uint16	7884	BITLIST Group Controller 11-15 System status			
50357	uint16	7891	BITLIST Group Controller 11-15 Communication (LED)			
50358	uint16	7885	BITLIST Group Controller 16 System status			
50359	uint16	7892	BITLIST Group Controller 16 Communication (LED)			
50360			Internal			
50361			Internal			
50362			Internal			
50363			Internal			

Modbus-Address	Size	Index	Description	Unit	Scale	Model
50364			Internal			
50365			Internal			
50366			Internal			
50367			Internal			
50368			Internal			
50369			Internal			
Int32 (Long)						
Topic AC Generator Group and Busbar values						
50370			Internal			
50372			Internal			
50374			Internal			
50376	int32	170	Av.Gen.Group Wye-Voltage	V	*10	
50378	int32	171	Av.Gen.Group Delta-Voltage	V	*10	
50380	int32	216	Av.Load Busbar Delta-Voltage	V	*10	
50382	int32	185	Av. Gen. Current	A	*1000	
50384	int32	111	Gen. current 1	A	*1000	
50386	int32	112	Gen. current 2	A	*1000	
50388	int32	113	Gen. current 3	A	*1000	
50390			Internal			
50392			Internal			
50394	int32	108	Gen.Group voltage L1-L2	V	*10	
50396	int32	109	Gen.Group voltage L2-L3	V	*10	
50398	int32	110	Gen.Group voltage L3-L1	V	*10	
50400	int32	114	Gen.Group voltage L1-N	V	*10	
50402	int32	115	Gen.Group voltage L2-N	V	*10	
50404	int32	116	Gen.Group voltage L3-N	V	*10	
50406			Internal			
50408			Internal			
50410			Internal			
50412	int32	182	Load Busbar: voltage L1-L2	V	*10	
50414			Internal			
50416			Internal			
50418			Internal			
50420			Internal			
50422			Internal			
50424			Internal			
50426			Internal			

Modbus-Address	Size	Index	Description	Unit	Scale	Model
50428			Internal			
50430			Internal			
Topic AC Mains values						
50432			Internal			
50434			Internal			
50436	int32	173	Av. Mains Wye-Voltage	V	*10	
50438	int32	174	Av. Mains Delta-Voltage	V	*10	
50440			Internal			
50442			Internal			
50444			Internal			
50446			Internal			
50448	int32	118	Mains voltage L1-L2	V	*10	
50450	int32	119	Mains voltage L2-L3	V	*10	
50452	int32	120	Mains voltage L3-L1	V	*10	
50454	int32	121	Mains voltage L1-N	V	*10	
50456	int32	122	Mains voltage L2-N	V	*10	
50458	int32	123	Mains voltage L3-N	V	*10	
50460			Internal			
50462			Internal			
50464			Internal			
50466			Internal			
50468			Internal			
50470			Internal			
50472			Internal			
50474			Internal			
50476			Internal			
Topic LSx (Layer 3)						
50478	int32	267	Average LSx Delta Mains voltage L-L	V	*10	
50480	int32	268	Average LSx Wye Mains voltage L-N	V	*10	
50482	int32	269	Active power LSx	W	*1	
50484	int32	270	Reactive power LSx	var	*1	
50486			Internal			
50488			Internal			
50490			Internal			
50492			Internal			
50494			Internal			
50496			Internal			

Modbus-Address	Size	Index	Description	Unit	Scale	Model
Topic Miscellenous						
50498			Internal			
50500			Internal			
50502			Internal			
50504	int32		Internal			
50506	int32	9698	91.15 AM Internal value 15 (long)			
50508	int32	9702	91.16 AM Internal value 16 (long)			
50510			Internal			
50512			Internal			
50514			Internal			
50516			Internal			
50518			Internal			
50520			Internal			
50522			Internal			
50524			Internal			
50526			Internal			
50528			Internal			
50530			Internal			
50532			Internal			
50534			Internal			
50536			Internal			

9.3.2 Additional Data Identifier

9.3.2.1 Receive Data (sent from remote control to the Group Controller)

General notes

The device accepts receive 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 GC 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

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 GC. The data type is UNSIGNED16.

Bit 15	Remote control bit 16 (command variable 04.59)
Bit 14	Remote control bit 15 (command variable 04.58)
Bit 13	Remote control bit 14 (command variable 04.57)
Bit 12	Remote control bit 13 (command variable 04.56)
Bit 11	Remote control bit 12 (command variable 04.55)
Bit 10	Remote control bit 11 (command variable 04.54)
Bit 9	Remote control bit 10 (command variable 04.53)
Bit 8	Remote control bit 9 (command variable 04.52)
Bit 7	Remote control bit 8 (command variable 04.51)
Bit 6	Remote control bit 7 (command variable 04.50)
Bit 5	Remote control bit 6 (command variable 04.49)
Bit 4	Remote control bit 5 (command variable 04.48)
Bit 3	Remote control bit 4 (command variable 04.47)
Bit 2	Remote control bit 3 (command variable 04.46)
Bit 1	Remote control bit 2 (command variable 04.45)
Bit 0	Remote control bit 1 (command variable 04.44)

Object 21FAh (Parameter 506)

This object is required for remote control if the "Remote control ID 505" is configured to 8 bit ⮡ 3160. 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 9-16 in the LogicsManager to control the GC. The data type is UNSIGNED16.

Bit 7 = 1 (ID 541)	Remote control bit 16 (command variable 04.59)
Bit 6 = 1 (ID 542)	Remote control bit 15 (command variable 04.58)
Bit 5 = 1 (ID 543)	Remote control bit 14 (command variable 04.57)
Bit 4 = 1 (ID 544)	Remote control bit 13 (command variable 04.56)
Bit 3 = 1 (ID 545)	Remote control bit 12 (command variable 04.55)
Bit 2 = 1 (ID 546)	Remote control bit 11 (command variable 04.54)
Bit 1 = 1 (ID 547)	Remote control bit 10 (command variable 04.53)
Bit 0 = 1 (ID 548)	Remote control bit 9 (command variable 04.52)

Free analog values

The device provides identifier “Free analog values” for receiving 16 bit signed integers for free purposes. The values are available in the AnalogManager group 24. Refer to ⮡ “9.3.2.3.4 Free Analog Values”)

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 (IKD). The data type is UNSIGNED16.

Bit 15	External discrete input 16 (command variable 12.16)
Bit 14	External discrete input 15 (command variable 12.15)
Bit 13	External discrete input 14 (command variable 12.14)
Bit 12	External discrete input 13 (command variable 12.13)
Bit 11	External discrete input 12 (command variable 12.12)
Bit 10	External discrete input 11 (command variable 12.11)
Bit 9	External discrete input 10 (command variable 12.10)
Bit 8	External discrete input 9 (command variable 12.9)
Bit 7	External discrete input 8 (command variable 12.8)
Bit 6	External discrete input 7 (command variable 12.7)
Bit 5	External discrete input 6 (command variable 12.6)
Bit 4	External discrete input 5 (command variable 12.5)
Bit 3	External discrete input 4 (command variable 12.4)
Bit 2	External discrete input 3 (command variable 12.3)
Bit 1	External discrete input 2 (command variable 12.2)
Bit 0	External discrete input 1 (command variable 12.1)

9.3.2.2 Transmit Data (sent from GC 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 (IKD relays) 1 to 16. The data type is UNSIGNED16.

Bit 15	External discrete output 16
Bit 14	External discrete output 15
Bit 13	External discrete output 14

Bit 12	External discrete output 13
Bit 11	External discrete output 12
Bit 10	External discrete output 11
Bit 9	External discrete output 10
Bit 8	External discrete output 9
Bit 7	External discrete output 8
Bit 6	External discrete output 7
Bit 5	External discrete output 6
Bit 4	External discrete output 5
Bit 3	External discrete output 4
Bit 2	External discrete output 3
Bit 1	External discrete output 2
Bit 0	External discrete output 1

9.3.2.3 Data Receive (interconnectivity)

9.3.2.3.1 Introduction

The Group Controller provides different possibilities to receive data from other CAN or Modbus devices. The received data are available in the AnalogManager or LogicsManager system.

There are:

- Analog variables called CAN1 RPDO...
- Command variables (single bits of some Analog variables)
- Free analog values

9.3.2.3.2 Analog variables CAN1 RPDO

The table below shows data which can be received via **CAN RPDO** or **Modbus** from any other devices. These data are available as analog variables (of group 21) and can be assigned to analog manager equations e.g. for flexible limits. For usage with CAN the corresponding indices must be mapped to the RPDOs. It is also possible to write via Modbus to these indices.

Analog variable	Receive PDO	Index
21.01 CAN1 RPDO1.1	RPDO1 Word1 (signed short)	3371
21.02 CAN1 RPDO1.2	RPDO1 Word2 (signed short)	3372
21.03 CAN1 RPDO1.3	RPDO1 Word3 (signed short)	3373
21.04 CAN1 RPDO1.4	RPDO1 Word4 (signed short)	3374
21.05 CAN1 RPDO2.1	RPDO2 Word1 (signed short)	3375
21.06 CAN1 RPDO2.2	RPDO2 Word2 (signed short)	3376
21.07 CAN1 RPDO2.3	RPDO2 Word3 (signed short)	3377

Analog variable	Receive PDO	Index
21.08 CAN1 RPDO2.4	RPDO2 Word4 (signed short)	3378
21.09 CAN1 RPDO3.1	RPDO3 Word1 (signed short)	3379
21.10 CAN1 RPDO3.2	RPDO3 Word2 (signed short)	3380
21.11 CAN1 RPDO3.3	RPDO3 Word3 (signed short)	3381
21.12 CAN1 RPDO3.4	RPDO3 Word4 (signed short)	3382
21.13 CAN1 RPDO4.1	RPDO4 Word1 (signed short)	3383
21.14 CAN1 RPDO4.2	RPDO4 Word2 (signed short)	3384
21.15 CAN1 RPDO4.3	RPDO4 Word3 (signed short)	3385
21.16 CAN1 RPDO4.4	RPDO4 Word4 (signed short)	3386
21.17 CAN1 RPDO5.4	RPDO5 Word1 (signed short)	3387
21.18 CAN1 RPDO5.4	RPDO5 Word2 (signed short)	3388
21.19 CAN1 RPDO5.4	RPDO5 Word3 (signed short)	3389
21.20 CAN1 RPDO5.4	RPDO5 Word4 (signed short)	3390

9.3.2.3.3 Command variables CAN1 RPDO

The single bits 1-16 of RPDO1 Word1 (3371), RPDO2 Word1 (3375), RPDO3 Word1 (3379), RPDO4 Word1 (3383) and RPDO5 Word1 (3387) are available as command variables of groups 32 to 36 which can be assigned to LogicsManagers.

LogicsManager variable	Index
32.01 CAN1 RPDO1.1.01	3371
32.02 CAN1 RPDO1.1.02	
32.03 CAN1 RPDO1.1.03	
32.04 CAN1 RPDO1.1.04	
32.05 CAN1 RPDO1.1.05	
32.06 CAN1 RPDO1.1.06	
32.07 CAN1 RPDO1.1.07	
32.08 CAN1 RPDO1.1.08	
32.09 CAN1 RPDO1.1.09	
32.10 CAN1 RPDO1.1.10	
32.11 CAN1 RPDO1.1.11	
32.12 CAN1 RPDO1.1.12	
32.13 CAN1 RPDO1.1.13	
32.14 CAN1 RPDO1.1.14	
32.15 CAN1 RPDO1.1.15	
32.16 CAN1 RPDO1.1.16	
33.01CAN1 RPDO2.1.01	3375
33.02 CAN1 RPDO2.1.02	
33.03 CAN1 RPDO2.1.03	

LogicsManager variable	Index
33.04 CAN1 RPDO2.1.04	
33.05 CAN1 RPDO2.1.05	
33.06 CAN1 RPDO2.1.06	
33.07 CAN1 RPDO2.1.07	
33.08 CAN1 RPDO2.1.08	
33.09 CAN1 RPDO2.1.09	
33.10 CAN1 RPDO2.1.10	
33.11 CAN1 RPDO2.1.11	
33.12 CAN1 RPDO2.1.12	
33.13 CAN1 RPDO2.1.13	
33.14 CAN1 RPDO2.1.14	
33.15 CAN1 RPDO2.1.15	
33.16 CAN1 RPDO2.1.16	
34.01 CAN1 RPDO3.1.01	3379
34.02 CAN1 RPDO3.1.02	
34.03 CAN1 RPDO3.1.03	
34.04 CAN1 RPDO3.1.04	
34.05 CAN1 RPDO3.1.05	
34.06 CAN1 RPDO3.1.06	
34.07 CAN1 RPDO3.1.07	
34.08 CAN1 RPDO3.1.08	
34.09 CAN1 RPDO3.1.09	
34.10 CAN1 RPDO3.1.10	
34.11 CAN1 RPDO3.1.11	
34.12 CAN1 RPDO3.1.12	
34.13 CAN1 RPDO3.1.13	
34.14 CAN1 RPDO3.1.14	
34.15 CAN1 RPDO3.1.15	
34.16 CAN1 RPDO3.1.16	
35.01 CAN1 RPDO4.1.01	3383
35.02 CAN1 RPDO4.1.02	
35.03 CAN1 RPDO4.1.03	
35.04 CAN1 RPDO4.1.04	
35.05 CAN1 RPDO4.1.05	
35.06 CAN1 RPDO4.1.06	
35.07 CAN1 RPDO4.1.07	
35.08 CAN1 RPDO4.1.08	
35.09 CAN1 RPDO4.1.09	

LogicsManager variable	Index
35.10 CAN1 RPDO4.1.10	
35.11 CAN1 RPDO4.1.11	
35.12 CAN1 RPDO4.1.12	
35.13 CAN1 RPDO4.1.13	
35.14 CAN1 RPDO4.1.14	
35.15 CAN1 RPDO4.1.15	
35.16 CAN1 RPDO4.1.16	
36.01 CAN1 RPDO5.1.01	3387
36.02 CAN1 RPDO5.1.02	
36.03 CAN1 RPDO5.1.03	
36.04 CAN1 RPDO5.1.04	
36.05 CAN1 RPDO5.1.05	
36.06 CAN1 RPDO5.1.06	
36.07 CAN1 RPDO5.1.07	
36.08 CAN1 RPDO5.1.08	
36.09 CAN1 RPDO5.1.09	
36.10 CAN1 RPDO5.1.10	
36.11 CAN1 RPDO5.1.11	
36.12 CAN1 RPDO5.1.12	
36.13 CAN1 RPDO5.1.13	
36.14 CAN1 RPDO5.1.14	
36.15 CAN1 RPDO5.1.15	
36.16 CAN1 RPDO5.1.16	

The figure below shows how the name of these Command Variables are composed. (The naming of the variables was chosen with regard to their usage as CAN1 RPDOs.)

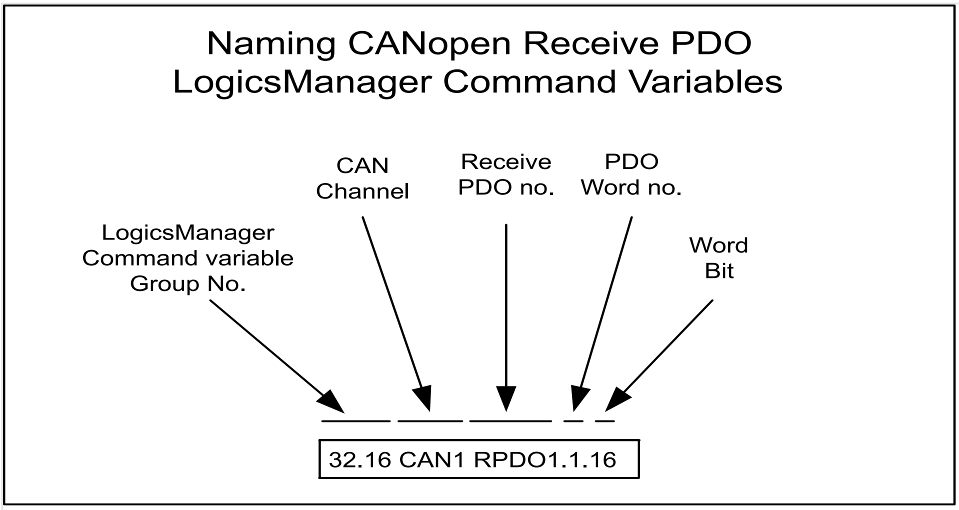


Fig. 142: Naming of the Command Variables.

The figure below shows an example of how CAN 1 RPDOs can be configured for interconnectivity. The 4 data words received at

- COB-ID 1026 (dec) are assigned to the Analog Variables 21.01, 21.02, 21.03 and 21.04 via configuration. The bits of 21.01 are assigned internally to the Command Variables 32.01 - 32.16.
- COB-ID 1030 (dec) are assigned to the Analog Variables 21.17, 21.18, 21.19 and 21.20 via configuration. The bits of 21.17 are assigned internally to the Command Variables 36.01 - 36.16.

These Analog Variables and Command Variables can be used in AnalogManagers and LogicsManagers equations to control different functions.

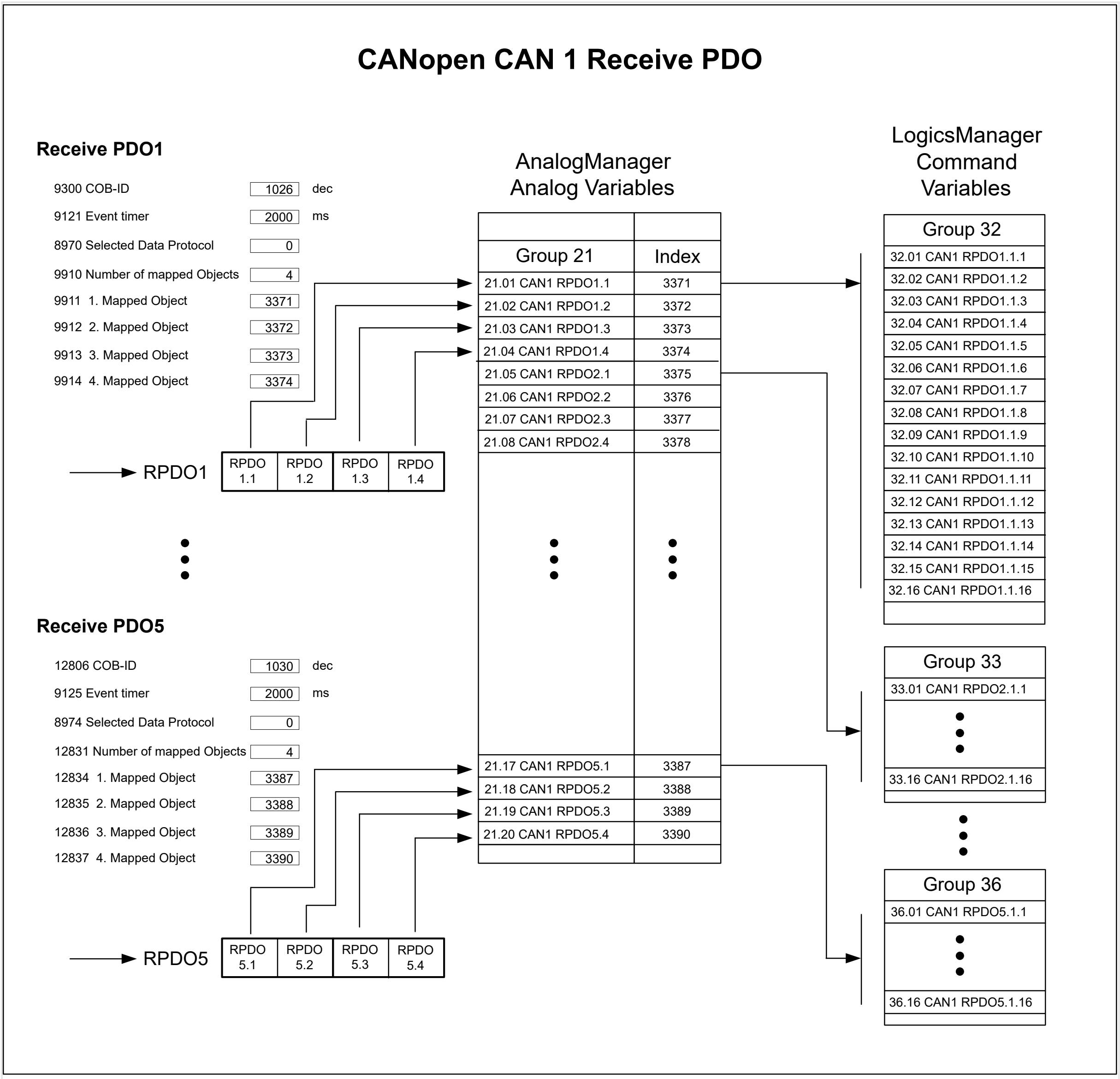


Fig. 143: Example of a CAN 1 RPDO configuration for interconnectivity.

9.3.2.3.4 Free Analog Values

Additionally the device provides “**Free analog values**” for receiving data for free purposes. These indices can be mapped to RPDOs or can be written via Modbus. The values are available in the AnalogManager group 24.

The variables 24.05-24.08 are write-protected with code level CL1.

Index	Name	Format	Usable as
587	Free analog value 1	INT16 signed	AnalogManager 24.01
588	Free analog value 2	INT16 signed	AnalogManager 24.02
589	Free analog value 3	INT16 signed	AnalogManager 24.03
590	Free analog value 4	INT16 signed	AnalogManager 24.04
591	Free analog value 5	INT16 signed	AnalogManager 24.05
592	Free analog value 6	INT16 signed	AnalogManager 24.06
593	Free analog value 7	INT16 signed	AnalogManager 24.07
594	Free analog value 8	INT16 signed	AnalogManager 24.08

9.4 LogicsManager Reference

9.4.1 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

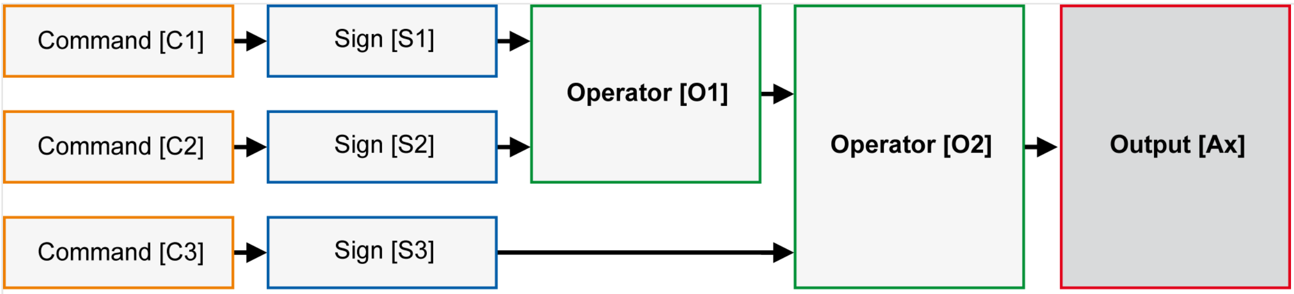


Fig. 144: LogicsManager - function overview

- **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 ⮡ "9.4.2 Logical Command Variables" 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 ⮡ "9.4.3 Logical Outputs".

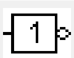
[Sx] - Sign {x}		
	Value {[Cx]}	The value [Cx] is passed 1:1.
	NOT Value {[Cx]}	The opposite of the value [Cx] is passed.
	0 [False; always "0"]	The value [Cx] is ignored and this logic path will always be FALSE.
	1 [True; always "1"]	The value [Cx] is ignored and this logic path will always be TRUE.

Table 64: Signs

[Ox] - Operator {x}	
AND	Logical AND

[Ox] - Operator {x}	
NAND	Logical negated AND
OR	Logical OR
NOR	Logical negated OR
XOR	Exclusive OR
NXOR	Exclusive negated OR

Table 65: Operators

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
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 66: Truth table

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**

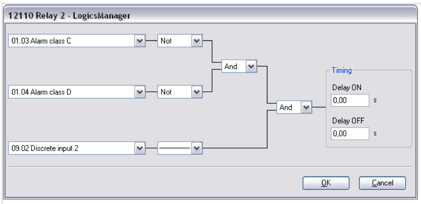


Fig. 145: Programming example (ToolKit)

- 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"

The logical command variables are grouped into different categories.

Part 1: LM variables (1 to 39)

Part 2: LM variables (40 to 79)

Part 3: AM and LM results (80 to 99)

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. The calculation of cascading goes in the sequence from 80 to 99.

9.4.2 Logical Command Variables

9.4.2.1 Group 01: Global alarms

For the description of the alarm classes refer to chapter "Alarm classes".

HMI Text	Note
01.01 Alarm class A	TRUE as long as an alarm of alarm class A is active or latched.
01.02 Alarm class B	TRUE as long as an alarm of alarm class B is active or latched.
01.03 Alarm class C	TRUE as long as an alarm of alarm class C is active or latched.
01.04 Alarm class D	TRUE as long as an alarm of alarm class D is active or latched.
01.05 Alarm class E	TRUE as long as an alarm of alarm class E is active or latched.
01.06 Alarm class F	TRUE as long as an alarm of alarm class F is active or latched.
01.07 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.
01.08 Warning alarm	TRUE as long as at least one alarm of the alarm classes A/B is active or latched.
01.09 Critical alarm	TRUE as long as at least one alarm of the alarm classes C/D/E/F is active or latched.
01.10 Centralized alarm	TRUE as long as at least one alarm of the alarm classes B/C/D/E/F is active or latched.
01.11 New alarm triggered	TRUE if any alarm of the Alarm classes B/C/D/E/F has been triggered until it is acknowledged.

9.4.2.2 Group 02: System conditions

HMI Text	Note
02.01 LM FALSE	Fixed value - often used for default setting
02.02 LM TRUE	Fixed value - often used for default setting
02.03 GenGroup voltage ok	TRUE as long as the generator group voltage is within the operating range.
02.04 GenGroup freq. ok	TRUE as long as the generator group frequency is within the operating range.
02.05 GenGroup volt/freq ok	TRUE as long as the generator group voltage and frequency are within the operating ranges (02.03. and 02.04 are TRUE).
02.06 Load bus voltage ok	TRUE as long as the load busbar voltage is within the operating range.
02.07 Load bus freq. ok	TRUE as long as the load busbar frequency is within the operating range.
02.08 Load bus volt/freq ok	TRUE as long as the load busbar voltage and frequency are within the operating ranges (02.06. and 02.07 are TRUE).
02.09 Mains voltage ok	TRUE as long as the mains voltage is within the operating range.
02.10 Mains frequency ok	TRUE as long as the mains frequency is within the operating range.
02.11 Mains volt./freq. ok	TRUE as long as the mains voltage and frequency are within the operating ranges (02.09. and 02.10 are TRUE).
02.12 GenGroup rot. 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 GenGroup rot. CW	TRUE as long as the respective rotation field is detected in case of a three-phase voltage measurement at the respective measuring location.
02.14 Mains rotation CCW	TRUE as long as the respective rotation field is detected in case of a three-phase voltage measurement at the respective measuring location.
02.15 Mains rotation CW	TRUE as long as the respective rotation field is detected in case of a three-phase voltage measurement at the respective measuring location.
02.21 Load bus is dead	TRUE as long as the busbar voltage is below the value configured in parameter 5820 (Dead

HMI Text	Note
	bus detection max. volt.)

9.4.2.3 Group 03: Miscellaneous

HMI Text	Note
03.05 Horn	True if a new alarm (higher A) is triggered and time (parameter 1756) for horn reset has not exceeded.

9.4.2.4 Group 04: Application conditions

HMI Text	Note
04.05 Acknowledge	TRUE if "Acknowledge" push button has been pressed or an external acknowledgment via LogicsManager is active. (This condition is TRUE for approx. 40 ms and must be extended utilizing a delay time.)
04.06 Min. one GCB closed	TRUE if at least one GCB in the own group is closed.
04.07 MCB closed	TRUE if DI 5 (Reply MCB) is de-energized.
04.09 Emerg.run request	TRUE if mains failure is detected.
04.11 Mains settling	TRUE if a mains failure detected. FALSE if the mains settling timer has expired. (Only in GGB/LSx mode.)
04.16 GGB closed	TRUE if DI 8 (Reply GGB) is de-energized.
04.17 GGB released	TRUE if, - any GGB dead bus closure is released OR - any GGB synchronization activity is going on.
04.21 Syn. MCB is active	TRUE if the MCB shall be synchronized.
04.22 Opening MCB active	TRUE if an MCB open command is active.
04.23 Closing MCB active	TRUE if an MCB close command is active.
04.24 Syn. GGB active	TRUE if the GGB shall be synchronized.
04.25 Opening GGB active	TRUE if a GGB open command is active.
04.26 Closing GGB active	TRUE if a GGB close command is active.
04.29 Mains unloading	TRUE if mains unloading is active.
04.44 RemoteControl Bit 1	TRUE if remote control bit 1 is activated. (Control word 505)
04.45 RemoteControl Bit 2	TRUE if remote control bit 2 is activated. (Control word 505)
04.46 RemoteControl Bit 3	TRUE if remote control bit 3 is activated. (Control word 505)

HMI Text	Note
04.47 RemoteControl Bit 4	TRUE if remote control bit 4 is activated. (Control word 505)
04.48 RemoteControl Bit 5	TRUE if remote control bit 5 is activated. (Control word 505)
04.49 RemoteControl Bit 6	TRUE if remote control bit 6 is activated. (Control word 505)
04.50 RemoteControl Bit 7	TRUE if remote control bit 7 is activated. (Control word 505)
04.51 RemoteControl Bit 8	TRUE if remote control bit 8 is activated. (Control word 505)
04.52 RemoteControl Bit 9	TRUE if remote control bit 9 is activated. (Control word 505)
04.53 RemoteControl Bit 10	TRUE if remote control bit 10 is activated. (Control word 505)
04.54 RemoteControl Bit 11	TRUE if remote control bit 11 is activated. (Control word 505)
04.55 RemoteControl Bit 12	TRUE if remote control bit 12 is activated. (Control word 505)
04.56 RemoteControl Bit 13	TRUE if remote control bit 13 is activated. (Control word 505)
04.57 RemoteControl Bit 14	TRUE if remote control bit 14 is activated. (Control word 505)
04.58 RemoteControl Bit 15	TRUE if remote control bit 15 is activated. (Control word 505)
04.59 RemoteControl Bit 16	TRUE if remote control bit 16 is activated. (Control word 505)
04.61 Lamp test	TRUE if lamp test is active.
04.65 System update active	TRUE if System Update (teach in process) is active.

9.4.2.5 Group 06: Generator Group related alarms

TRUE if the alarm is active or latched.

HMI Text	Note
06.09 GenGr. overcurrent 1	Generator group over current threshold 1
06.10 GenGr. overcurrent 2	Generator group over current threshold 2
06.11 GenGr. overcurrent 3	Generator group over current threshold 3
06.21 GenGroup ph. rotation	Generator Group phase rotation mismatch
06.22 Inv. time overcurr.	Inverse time over current
06.32 GenGroup AC wiring	Generator Group AC wiring plausibility

9.4.2.6 Group 07: Mains related alarms

TRUE if the alarm is active or latched.

HMI Text	Note
07.05 Mns.ph.rot. mismatch	Mains Phase rotation mismatch
07.32 Mains AC wiring	Mains AC wiring plausibility

9.4.2.7 Group 08: Syst. related alarms

TRUE if the alarm is active or latched.

HMI Text	Note
08.01 Bat. overvoltage 1	Battery over voltage threshold 1
08.02 Bat. overvoltage 2	Battery over voltage threshold 2
08.03 Bat. undervoltage 1	Battery under voltage threshold 1
08.04 Bat. undervoltage 2	Battery under voltage threshold 2
08.07 MCB fail to close	MCB close not successful
08.08 MCB fail to open	MCB open not successful
08.16 Parameter alignment	Parameter Alignment LDSS
08.17 Missing members	Number of members mismatched
08.18 CANopen Interface 1	CANopen error interface 1
08.19 CANopen Interface 2	CANopen error interface 2
08.27 Missing easYgen	At least one easYgen is missing.
08.28 Missing LSx Layer 1	At least one LSx Layer 1 is missing.
08.31 Synchron. time MCB	Timeout Synchronization MCB
08.32 Synchron. time GGB	Timeout Synchronization GGB
08.33 Phase rot. mismatch	Phase rotation mismatch monitoring
08.34 GGB fail to close	GGB close not successful
08.35 GGB fail to open	GGB open not successful
08.41 Ethernet B LS fault	Ethernet B loadshare fault if load sharing with Ethernet B is selected and no device detected.
08.42 Ethernet C LS fault	Ethernet C loadshare fault if load sharing with Ethernet C is selected and no device detected.
08.45 CPU overload R1 trip	CPU overload R1 trip (alarm class B, not selfackn.) becomes active if CPU overload is longer than 10s.
08.51 CAN LS fault	CAN loadshare fault if load sharing with CAN is selected and no device detected.
08.52 Ethernet A LS fault	Ethernet A loadshare fault if load sharing with Ethernet A is selected and no device detected.
08.53 EthB EthC redundancy	Load share interface redundancy (Ethernet B/C) lost
08.54 Eth. configuration	Ethernet configuration mismatch There is configuration mismatch between Eth A/B OR Eth. A/C OR Eth. B/C
08.62 Ethernet issue	Ethernet issue (E.g. broadcast storm)
08.63 Missing GC	At least one GC is missing
08.64 Missing LSx Layer 3	At least one LSx Layer 3 is missing
08.65 Syst.Upd.Alm.Layer 1	System Update Layer 1 There is a device detected in the layer 1 communication network which is not taught in. (A system update is required.)
08.66 Syst.Upd.Alm.Layer 3	System Update Layer 3

HMI Text	Note
	There is a device detected in the layer 3 communication network which is not taught in. (A system update is required.)
08.67 Group not ok	Group of at least one GC is not ok.
08.68 GGB plausibility	If GGB is recognized as closed but voltage or phase angle "Generator Group / Load Busbar" is different.
08.70 CAN EthA redundancy	Load share interface redundancy CAN1 / Ethernet A lost
08.72 Modbus dev.1 timeout	Modbus Master communication timeout device 1 (This is no alarm, only a LM.)
08.73 Modbus dev.2 timeout	Modbus Master communication timeout device 2 (This is no alarm, only a LM.)
08.74 Modbus dev.3 timeout	Modbus Master communication timeout device 3 (This is no alarm, only a LM.)
08.75 Modbus dev.4 timeout	Modbus Master communication timeout device 4 (This is no alarm, only a LM.)
08.76 Modbus dev.5 timeout	Modbus Master communication timeout device 5 (This is no alarm, only a LM.)
08.78 easYgen LS timeout	No received loadshare message for a specified timeout of any teached in easYgen
08.79 LSx LS timeout layer1	No received loadshare message for a specified timeout of any teached in LSx layer 1
08.80 Red.LS timeout layer1	No received loadshare message (of one of the redundant interfaces) for a specified timeout of any teached in device layer 1
08.81 GGB unload mismatch	GGB unloading mismatch
08.82 GC LS timeout	No received loadshare message for a specified timeout of any teached in GC
08.83 LSx LS timeout layer3	No received loadshare message for a specified timeout of any teached in LSx layer 3
08.84 Red.LS timeout layer3	No received loadshare message (of one of the redundant interfaces) for a specified timeout of any teached in device layer 3
08.87 Interconnect.timeout	Timeout status from the interconnectivity layer 1.
08.89 Intercon.timeout L3	Timeout status from the interconnectivity layer 3.

9.4.2.8 Group 09: Discrete inputs states

TRUE if the digital input is energized.

HMI Text	Note
09.01 Discrete input 1	
09.02 Discrete input 2	
09.03 Discrete input 3	
09.04 Discrete input 4	
09.05 Discrete input 5	
09.06 Discrete input 6	
09.07 Discrete input 7	
09.08 Discrete input 8	
09.09 Discrete input 9	
09.10 Discrete input 10	
09.11 Discrete input 11	

HMI Text	Note
09.12 Discrete input 12	

9.4.2.9 Group 10: Alarms analog inputs

TRUE if the alarm is active or latched.

HMI Text	Note
10.01 AI 1 wire break	Analog Input 1 out of range
10.02 AI 2 wire break	Analog Input 2 out of range
10.03 AI 3 wire break	Analog Input 3 out of range

9.4.2.10 Group 12: External discrete inputs (physical state)

TRUE if the digital input is energized.

HMI Text	Note
12.01 External DI 1	External discrete input 1
12.02 External DI 2	External discrete input 2
12.03 External DI 3	External discrete input 3
12.04 External DI 4	External discrete input 4
12.05 External DI 5	External discrete input 5
12.06 External DI 6	External discrete input 6
12.07 External DI 7	External discrete input 7
12.08 External DI 8	External discrete input 8
12.09 External DI 9	External discrete input 9
12.10 External DI 10	External discrete input 10
12.11 External DI 11	External discrete input 11
12.12 External DI 12	External discrete input 12
12.13 External DI 13	External discrete input 13
12.14 External DI 14	External discrete input 14
12.15 External DI 15	External discrete input 15
12.16 External DI 16	External discrete input 16

9.4.2.11 Group 13: Discrete outputs (physical state)

TRUE if relay is energized

HMI Text	Note
13.01 Discrete output 1	Relay 1 (ready for operation)
13.02 Discrete output 2	Relay 2
13.03 Discrete output 3	Relay 3

HMI Text	Note
13.04 Discrete output 4	Relay 4
13.05 Discrete output 5	Relay 5
13.06 Discrete output 6	Relay 6
13.07 Discrete output 7	Relay 7
13.08 Discrete output 8	Relay 8
13.09 Discrete output 9	Relay 9
13.10 Discrete output 10	Relay 10
13.11 Discrete output 11	Relay 11
13.12 Discrete output 12	Relay 12

9.4.2.12 Group 15: Flexible limits

TRUE if the alarm is active or latched.

HMI Text	Note
15.01 Flexible limit 1	
15.02 Flexible limit 2	
15.03 Flexible limit 3	
15.04 Flexible limit 4	
15.05 Flexible limit 5	
15.06 Flexible limit 6	
15.07 Flexible limit 7	
15.08 Flexible limit 8	
15.09 Flexible limit 9	
15.10 Flexible limit 10	
15.11 Flexible limit 11	
15.12 Flexible limit 12	
15.13 Flexible limit 13	
15.14 Flexible limit 14	
15.15 Flexible limit 15	
15.16 Flexible limit 16	
15.17 Flexible limit 17	
15.18 Flexible limit 18	
15.19 Flexible limit 19	
15.20 Flexible limit 20	
15.21 Flexible limit 21	
15.22 Flexible limit 22	
15.23 Flexible limit 23	
15.24 Flexible limit 24	

HMI Text	Note
15.25 Flexible limit 25	
15.26 Flexible limit 26	
15.27 Flexible limit 27	
15.28 Flexible limit 28	
15.29 Flexible limit 29	
15.30 Flexible limit 30	
15.31 Flexible limit 31	
15.32 Flexible limit 32	
15.33 Flexible limit 33	
15.34 Flexible limit 34	
15.35 Flexible limit 35	
15.36 Flexible limit 36	
15.37 Flexible limit 37	
15.38 Flexible limit 38	
15.39 Flexible limit 39	
15.40 Flexible limit 40	

9.4.2.13 Group 28: GC System conditions (Layer 1)

TRUE if at least one easYgen sets the command variable to TRUE (OR operation)

HMI Text	Note
28.01 Command 1 to GC (OR)	
28.02 Command 2 to GC (OR)	
28.03 Command 3 to GC (OR)	
28.04 Command 4 to GC (OR)	
28.05 Command 5 to GC (OR)	
28.06 Command 6 to GC (OR)	

9.4.2.14 Group 29: Command flags of easYgens 1-16

TRUE if the LM in the corresponding easYgen is true.

HMI Text	Note
29.01 Command 1 easYgen 1	
29.02 Command 2 easYgen 1	
29.03 Command 3 easYgen 1	
29.04 Command 4 easYgen 1	
29.05 Command 5 easYgen 1	
29.06 Command 6 easYgen 1	

HMI Text	Note
29.07 Command 1 easYgen 2	
29.08 Command 2 easYgen 2	
29.09 Command 3 easYgen 2	
29.10 Command 4 easYgen 2	
29.11 Command 5 easYgen 2	
29.12 Command 6 easYgen 2	
29.13 Command 1 easYgen 3	
29.14 Command 2 easYgen 3	
29.15 Command 3 easYgen 3	
29.16 Command 4 easYgen 3	
29.17 Command 5 easYgen 3	
29.18 Command 6 easYgen 3	
29.19 Command 1 easYgen 4	
29.20 Command 2 easYgen 4	
29.21 Command 3 easYgen 4	
29.22 Command 4 easYgen 4	
29.23 Command 5 easYgen 4	
29.24 Command 6 easYgen 4	
29.25 Command 1 easYgen 5	
29.26 Command 2 easYgen 5	
29.27 Command 3 easYgen 5	
29.28 Command 4 easYgen 5	
29.29 Command 5 easYgen 5	
29.30 Command 6 easYgen 5	
29.31 Command 1 easYgen 6	
29.32 Command 2 easYgen 6	
29.33 Command 3 easYgen 6	
29.34 Command 4 easYgen 6	
29.35 Command 5 easYgen 6	
29.36 Command 6 easYgen 6	
29.37 Command 1 easYgen 7	
29.38 Command 2 easYgen 7	
29.39 Command 3 easYgen 7	
29.40 Command 4 easYgen 7	
29.41 Command 5 easYgen 7	
29.42 Command 6 easYgen 7	
29.43 Command 1 easYgen 8	
29.44 Command 2 easYgen 8	

HMI Text	Note
29.45 Command 3 easYgen 8	
29.46 Command 4 easYgen 8	
29.47 Command 5 easYgen 8	
29.48 Command 6 easYgen 8	
29.49 Command 1 easYgen 9	
29.50 Command 2 easYgen 9	
29.51 Command 3 easYgen 9	
29.52 Command 4 easYgen 9	
29.53 Command 5 easYgen 9	
29.54 Command 6 easYgen 9	
29.55 Command 1 easYgen 10	
29.56 Command 2 easYgen 10	
29.57 Command 3 easYgen 10	
29.58 Command 4 easYgen 10	
29.59 Command 5 easYgen 10	
29.60 Command 6 easYgen 10	
29.61 Command 1 easYgen 11	
29.62 Command 2 easYgen 11	
29.63 Command 3 easYgen 11	
29.64 Command 4 easYgen 11	
29.65 Command 5 easYgen 11	
29.66 Command 6 easYgen 11	
29.67 Command 1 easYgen 12	
29.68 Command 2 easYgen 12	
29.69 Command 3 easYgen 12	
29.70 Command 4 easYgen 12	
29.71 Command 5 easYgen 12	
29.72 Command 6 easYgen 12	
29.73 Command 1 easYgen 13	
29.74 Command 2 easYgen 13	
29.75 Command 3 easYgen 13	
29.76 Command 4 easYgen 13	
29.77 Command 5 easYgen 13	
29.78 Command 6 easYgen 13	
29.79 Command 1 easYgen 14	
29.80 Command 2 easYgen 14	
29.81 Command 3 easYgen 14	
29.82 Command 4 easYgen 14	

HMI Text	Note
29.83 Command 5 easYgen 14	
29.84 Command 6 easYgen 14	
29.85 Command 1 easYgen 15	
29.86 Command 2 easYgen 15	
29.87 Command 3 easYgen 15	
29.88 Command 4 easYgen 15	
29.89 Command 5 easYgen 15	
29.90 Command 6 easYgen 15	
29.91 Command 1 easYgen 16	
29.92 Command 2 easYgen 16	
29.93 Command 3 easYgen 16	
29.94 Command 4 easYgen 16	
29.95 Command 5 easYgen 16	
29.96 Command 6 easYgen 16	

9.4.2.15 Group 30: Command flags of easYgens 17-32

TRUE if the LM in the corresponding easYgen is true.

HMI Text	Note
30.01 Command 1 easYgen 17	
30.02 Command 2 easYgen 17	
30.03 Command 3 easYgen 17	
30.04 Command 4 easYgen 17	
30.05 Command 5 easYgen 17	
30.06 Command 6 easYgen 17	
30.07 Command 1 easYgen 18	
30.08 Command 2 easYgen 18	
30.09 Command 3 easYgen 18	
30.10 Command 4 easYgen 18	
30.11 Command 5 easYgen 18	
30.12 Command 6 easYgen 18	
30.13 Command 1 easYgen 19	
30.14 Command 2 easYgen 19	
30.15 Command 3 easYgen 19	
30.16 Command 4 easYgen 19	
30.17 Command 5 easYgen 19	
30.18 Command 6 easYgen 19	
30.19 Command 1 easYgen 20	

HMI Text	Note
30.20 Command 2 easYgen 20	
30.21 Command 3 easYgen 20	
30.22 Command 4 easYgen 20	
30.23 Command 5 easYgen 20	
30.24 Command 6 easYgen 20	
30.25 Command 1 easYgen 21	
30.26 Command 2 easYgen 21	
30.27 Command 3 easYgen 21	
30.28 Command 4 easYgen 21	
30.29 Command 5 easYgen 21	
30.30 Command 6 easYgen 21	
30.31 Command 1 easYgen 22	
30.32 Command 2 easYgen 22	
30.33 Command 3 easYgen 22	
30.34 Command 4 easYgen 22	
30.35 Command 5 easYgen 22	
30.36 Command 6 easYgen 22	
30.37 Command 1 easYgen 23	
30.38 Command 2 easYgen 23	
30.39 Command 3 easYgen 23	
30.40 Command 4 easYgen 23	
30.41 Command 5 easYgen 23	
30.42 Command 6 easYgen 23	
30.43 Command 1 easYgen 24	
30.44 Command 2 easYgen 24	
30.45 Command 3 easYgen 24	
30.46 Command 4 easYgen 24	
30.47 Command 5 easYgen 24	
30.48 Command 6 easYgen 24	
30.49 Command 1 easYgen 25	
30.50 Command 2 easYgen 25	
30.51 Command 3 easYgen 25	
30.52 Command 4 easYgen 25	
30.53 Command 5 easYgen 25	
30.54 Command 6 easYgen 25	
30.55 Command 1 easYgen 26	
30.56 Command 2 easYgen 26	
30.57 Command 3 easYgen 26	

HMI Text	Note
30.58 Command 4 easYgen 26	
30.59 Command 5 easYgen 26	
30.60 Command 6 easYgen 26	
30.61 Command 1 easYgen 27	
30.62 Command 2 easYgen 27	
30.63 Command 3 easYgen 27	
30.64 Command 4 easYgen 27	
30.65 Command 5 easYgen 27	
30.66 Command 6 easYgen 27	
30.67 Command 1 easYgen 28	
30.68 Command 2 easYgen 28	
30.69 Command 3 easYgen 28	
30.70 Command 4 easYgen 28	
30.71 Command 5 easYgen 28	
30.72 Command 6 easYgen 28	
30.73 Command 1 easYgen 29	
30.74 Command 2 easYgen 29	
30.75 Command 3 easYgen 29	
30.76 Command 4 easYgen 29	
30.77 Command 5 easYgen 29	
30.78 Command 6 easYgen 29	
30.79 Command 1 easYgen 30	
30.80 Command 2 easYgen 30	
30.81 Command 3 easYgen 30	
30.82 Command 4 easYgen 30	
30.83 Command 5 easYgen 30	
30.84 Command 6 easYgen 30	
30.85 Command 1 easYgen 31	
30.86 Command 2 easYgen 31	
30.87 Command 3 easYgen 31	
30.88 Command 4 easYgen 31	
30.89 Command 5 easYgen 31	
30.90 Command 6 easYgen 31	

9.4.2.16 Group 32: CAN1 Receive PDO1

Bits of CAN RPDO1 WORD 1 (ID 3371)

HMI Text	Note
32.01 CAN1 RPDO1.1.1	CAN1 RPDO1 Word1 Bit1
32.02 CAN1 RPDO1.1.2	CAN1 RPDO1 Word1 Bit2
32.03 CAN1 RPDO1.1.3	CAN1 RPDO1 Word1 Bit3
32.04 CAN1 RPDO1.1.4	CAN1 RPDO1 Word1 Bit4
32.05 CAN1 RPDO1.1.5	CAN1 RPDO1 Word1 Bit5
32.06 CAN1 RPDO1.1.6	CAN1 RPDO1 Word1 Bit6
32.07 CAN1 RPDO1.1.7	CAN1 RPDO1 Word1 Bit7
32.08 CAN1 RPDO1.1.8	CAN1 RPDO1 Word1 Bit8
32.09 CAN1 RPDO1.1.9	CAN1 RPDO1 Word1 Bit9
32.10 CAN1 RPDO1.1.10	CAN1 RPDO1 Word1 Bit10
32.11 CAN1 RPDO1.1.11	CAN1 RPDO1 Word1 Bit11
32.12 CAN1 RPDO1.1.12	CAN1 RPDO1 Word1 Bit12
32.13 CAN1 RPDO1.1.13	CAN1 RPDO1 Word1 Bit13
32.14 CAN1 RPDO1.1.14	CAN1 RPDO1 Word1 Bit14
32.15 CAN1 RPDO1.1.15	CAN1 RPDO1 Word1 Bit15
32.16 CAN1 RPDO1.1.16	CAN1 RPDO1 Word1 Bit16

9.4.2.17 Group 33: CAN1 Receive PDO2

Bits of CAN RPDO2 WORD 1 (ID 3375)

HMI Text	Note
33.01 CAN1 RPDO2.1.1	CAN1 RPDO2 Word1 Bit1
33.02 CAN1 RPDO2.1.2	CAN1 RPDO2 Word1 Bit2
33.03 CAN1 RPDO2.1.3	CAN1 RPDO2 Word1 Bit3
33.04 CAN1 RPDO2.1.4	CAN1 RPDO2 Word1 Bit4
33.05 CAN1 RPDO2.1.5	CAN1 RPDO2 Word1 Bit5
33.06 CAN1 RPDO2.1.6	CAN1 RPDO2 Word1 Bit6
33.07 CAN1 RPDO2.1.7	CAN1 RPDO2 Word1 Bit7
33.08 CAN1 RPDO2.1.8	CAN1 RPDO2 Word1 Bit8
33.09 CAN1 RPDO2.1.9	CAN1 RPDO2 Word1 Bit9
33.10 CAN1 RPDO2.1.10	CAN1 RPDO2 Word1 Bit10
33.11 CAN1 RPDO2.1.11	CAN1 RPDO2 Word1 Bit11
33.12 CAN1 RPDO2.1.12	CAN1 RPDO2 Word1 Bit12
33.13 CAN1 RPDO2.1.13	CAN1 RPDO2 Word1 Bit13
33.14 CAN1 RPDO2.1.14	CAN1 RPDO2 Word1 Bit14
33.15 CAN1 RPDO2.1.15	CAN1 RPDO2 Word1 Bit15

HMI Text	Note
33.16 CAN1 RPDO2.1.16	CAN1 RPDO2 Word1 Bit16

9.4.2.18 Group 34: CAN1 Receive PDO3

Bits of CAN RPDO3 WORD 1 (ID 3379)

HMI Text	Note
34.01 CAN1 RPDO3.1.1	CAN1 RPDO3 Word1 Bit1
34.02 CAN1 RPDO3.1.2	CAN1 RPDO3 Word1 Bit2
34.03 CAN1 RPDO3.1.3	CAN1 RPDO3 Word1 Bit3
34.04 CAN1 RPDO3.1.4	CAN1 RPDO3 Word1 Bit4
34.05 CAN1 RPDO3.1.5	CAN1 RPDO3 Word1 Bit5
34.06 CAN1 RPDO3.1.6	CAN1 RPDO3 Word1 Bit6
34.07 CAN1 RPDO3.1.7	CAN1 RPDO3 Word1 Bit7
34.08 CAN1 RPDO3.1.8	CAN1 RPDO3 Word1 Bit8
34.09 CAN1 RPDO3.1.9	CAN1 RPDO3 Word1 Bit9
34.10 CAN1 RPDO3.1.10	CAN1 RPDO3 Word1 Bit10
34.11 CAN1 RPDO3.1.11	CAN1 RPDO3 Word1 Bit11
34.12 CAN1 RPDO3.1.12	CAN1 RPDO3 Word1 Bit12
34.13 CAN1 RPDO3.1.13	CAN1 RPDO3 Word1 Bit13
34.14 CAN1 RPDO3.1.14	CAN1 RPDO3 Word1 Bit14
34.15 CAN1 RPDO3.1.15	CAN1 RPDO3 Word1 Bit15
34.16 CAN1 RPDO3.1.16	CAN1 RPDO3 Word1 Bit16

9.4.2.19 Group 35: CAN1 Receive PDO4

Bits of CAN RPDO4 WORD 1 (ID 3383)

HMI Text	Note
35.01 CAN1 RPDO4.1.1	CAN1 RPDO4 Word1 Bit1
35.02 CAN1 RPDO4.1.2	CAN1 RPDO4 Word1 Bit2
35.03 CAN1 RPDO4.1.3	CAN1 RPDO4 Word1 Bit3
35.04 CAN1 RPDO4.1.4	CAN1 RPDO4 Word1 Bit4
35.05 CAN1 RPDO4.1.5	CAN1 RPDO4 Word1 Bit5
35.06 CAN1 RPDO4.1.6	CAN1 RPDO4 Word1 Bit6
35.07 CAN1 RPDO4.1.7	CAN1 RPDO4 Word1 Bit7
35.08 CAN1 RPDO4.1.8	CAN1 RPDO4 Word1 Bit8
35.09 CAN1 RPDO4.1.9	CAN1 RPDO4 Word1 Bit9
35.10 CAN1 RPDO4.1.10	CAN1 RPDO4 Word1 Bit10
35.11 CAN1 RPDO4.1.11	CAN1 RPDO4 Word1 Bit11

HMI Text	Note
35.12 CAN1 RPDO4.1.12	CAN1 RPDO4 Word1 Bit12
35.13 CAN1 RPDO4.1.13	CAN1 RPDO4 Word1 Bit13
35.14 CAN1 RPDO4.1.14	CAN1 RPDO4 Word1 Bit14
35.15 CAN1 RPDO4.1.15	CAN1 RPDO4 Word1 Bit15
35.16 CAN1 RPDO4.1.16	CAN1 RPDO4 Word1 Bit16

9.4.2.20 Group 36: CAN1 Receive PDO5

Bits of CAN RPDO5 WORD 1 (ID 3387)

HMI Text	Note
36.01 CAN1 RPDO5.1.1	CAN1 RPDO5 Word1 Bit1
36.02 CAN1 RPDO5.1.2	CAN1 RPDO5 Word1 Bit2
36.03 CAN1 RPDO5.1.3	CAN1 RPDO5 Word1 Bit3
36.04 CAN1 RPDO5.1.4	CAN1 RPDO5 Word1 Bit4
36.05 CAN1 RPDO5.1.5	CAN1 RPDO5 Word1 Bit5
36.06 CAN1 RPDO5.1.6	CAN1 RPDO5 Word1 Bit6
36.07 CAN1 RPDO5.1.7	CAN1 RPDO5 Word1 Bit7
36.08 CAN1 RPDO5.1.8	CAN1 RPDO5 Word1 Bit8
36.09 CAN1 RPDO5.1.9	CAN1 RPDO5 Word1 Bit9
36.10 CAN1 RPDO5.1.10	CAN1 RPDO5 Word1 Bit10
36.11 CAN1 RPDO5.1.11	CAN1 RPDO5 Word1 Bit11
36.12 CAN1 RPDO5.1.12	CAN1 RPDO5 Word1 Bit12
36.13 CAN1 RPDO5.1.13	CAN1 RPDO5 Word1 Bit13
36.14 CAN1 RPDO5.1.14	CAN1 RPDO5 Word1 Bit14
36.15 CAN1 RPDO5.1.15	CAN1 RPDO5 Word1 Bit15
36.16 CAN1 RPDO5.1.16	CAN1 RPDO5 Word1 Bit16

9.4.2.21 Group 47: Flags from LSx 33-48 (Layer 3)

HMI Text	Note
47.01 Flag 1 LSx device 33	Logic flag 1 LSx device number 33 (Layer 3)
47.02 Flag 2 LSx device 33	Logic flag 2 LSx device number 33 (Layer 3)
47.03 Flag 3 LSx device 33	Logic flag 3 LSx device number 33 (Layer 3)
47.04 Flag 4 LSx device 33	Logic flag 4 LSx device number 33 (Layer 3)
47.05 Flag 5 LSx device 33	Logic flag 5 LSx device number 33 (Layer 3)
47.06 Flag 1 LSx device 34	Logic flag 1 LSx device number 34 (Layer 3)
47.07 Flag 2 LSx device 34	Logic flag 2 LSx device number 34 (Layer 3)
47.08 Flag 3 LSx device 34	Logic flag 3 LSx device number 34 (Layer 3)

HMI Text	Note
47.09 Flag 4 LSx device 34	Logic flag 4 LSx device number 34 (Layer 3)
47.10 Flag 5 LSx device 34	Logic flag 5 LSx device number 34 (Layer 3)
47.11 Flag 1 LSx device 35	Logic flag 1 LSx device number 35 (Layer 3)
47.12 Flag 2 LSx device 35	Logic flag 2 LSx device number 35 (Layer 3)
47.13 Flag 3 LSx device 35	Logic flag 3 LSx device number 35 (Layer 3)
47.14 Flag 4 LSx device 35	Logic flag 4 LSx device number 35 (Layer 3)
47.15 Flag 5 LSx device 35	Logic flag 5 LSx device number 35 (Layer 3)
47.16 Flag 1 LSx device 36	Logic flag 1 LSx device number 36 (Layer 3)
47.17 Flag 2 LSx device 36	Logic flag 2 LSx device number 36 (Layer 3)
47.18 Flag 3 LSx device 36	Logic flag 3 LSx device number 36 (Layer 3)
47.19 Flag 4 LSx device 36	Logic flag 4 LSx device number 36 (Layer 3)
47.20 Flag 5 LSx device 36	Logic flag 5 LSx device number 36 (Layer 3)
47.21 Flag 1 LSx device 37	Logic flag 1 LSx device number 37 (Layer 3)
47.22 Flag 2 LSx device 37	Logic flag 2 LSx device number 37 (Layer 3)
47.23 Flag 3 LSx device 37	Logic flag 3 LSx device number 37 (Layer 3)
47.24 Flag 4 LSx device 37	Logic flag 4 LSx device number 37 (Layer 3)
47.25 Flag 5 LSx device 37	Logic flag 5 LSx device number 37 (Layer 3)
47.26 Flag 1 LSx device 38	Logic flag 1 LSx device number 38 (Layer 3)
47.27 Flag 2 LSx device 38	Logic flag 2 LSx device number 38 (Layer 3)
47.28 Flag 3 LSx device 38	Logic flag 3 LSx device number 38 (Layer 3)
47.29 Flag 4 LSx device 38	Logic flag 4 LSx device number 38 (Layer 3)
47.30 Flag 5 LSx device 38	Logic flag 5 LSx device number 38 (Layer 3)
47.31 Flag 1 LSx device 39	Logic flag 1 LSx device number 39 (Layer 3)
47.32 Flag 2 LSx device 39	Logic flag 2 LSx device number 39 (Layer 3)
47.33 Flag 3 LSx device 39	Logic flag 3 LSx device number 39 (Layer 3)
47.34 Flag 4 LSx device 39	Logic flag 4 LSx device number 39 (Layer 3)
47.35 Flag 5 LSx device 39	Logic flag 5 LSx device number 39 (Layer 3)
47.36 Flag 1 LSx device 40	Logic flag 1 LSx device number 40 (Layer 3)
47.37 Flag 2 LSx device 40	Logic flag 2 LSx device number 40 (Layer 3)
47.38 Flag 3 LSx device 40	Logic flag 3 LSx device number 40 (Layer 3)
47.39 Flag 4 LSx device 40	Logic flag 4 LSx device number 40 (Layer 3)
47.40 Flag 5 LSx device 40	Logic flag 5 LSx device number 40 (Layer 3)
47.41 Flag 1 LSx device 41	Logic flag 1 LSx device number 41 (Layer 3)
47.42 Flag 2 LSx device 41	Logic flag 2 LSx device number 41 (Layer 3)
47.43 Flag 3 LSx device 41	Logic flag 3 LSx device number 41 (Layer 3)
47.44 Flag 4 LSx device 41	Logic flag 4 LSx device number 41 (Layer 3)
47.45 Flag 5 LSx device 41	Logic flag 5 LSx device number 41 (Layer 3)
47.46 Flag 1 LSx device 42	Logic flag 1 LSx device number 42 (Layer 3)

HMI Text	Note
47.47 Flag 2 LSx device 42	Logic flag 2 LSx device number 42 (Layer 3)
47.48 Flag 3 LSx device 42	Logic flag 3 LSx device number 42 (Layer 3)
47.49 Flag 4 LSx device 42	Logic flag 4 LSx device number 42 (Layer 3)
47.50 Flag 5 LSx device 42	Logic flag 5 LSx device number 42 (Layer 3)
47.51 Flag 1 LSx device 43	Logic flag 1 LSx device number 43 (Layer 3)
47.52 Flag 2 LSx device 43	Logic flag 2 LSx device number 43 (Layer 3)
47.53 Flag 3 LSx device 43	Logic flag 3 LSx device number 43 (Layer 3)
47.54 Flag 4 LSx device 43	Logic flag 4 LSx device number 43 (Layer 3)
47.55 Flag 5 LSx device 43	Logic flag 5 LSx device number 43 (Layer 3)
47.56 Flag 1 LSx device 44	Logic flag 1 LSx device number 44 (Layer 3)
47.57 Flag 2 LSx device 44	Logic flag 2 LSx device number 44 (Layer 3)
47.58 Flag 3 LSx device 44	Logic flag 3 LSx device number 44 (Layer 3)
47.59 Flag 4 LSx device 44	Logic flag 4 LSx device number 44 (Layer 3)
47.60 Flag 5 LSx device 44	Logic flag 5 LSx device number 44 (Layer 3)
47.61 Flag 1 LSx device 45	Logic flag 1 LSx device number 45 (Layer 3)
47.62 Flag 2 LSx device 45	Logic flag 2 LSx device number 45 (Layer 3)
47.63 Flag 3 LSx device 45	Logic flag 3 LSx device number 45 (Layer 3)
47.64 Flag 4 LSx device 45	Logic flag 4 LSx device number 45 (Layer 3)
47.65 Flag 5 LSx device 45	Logic flag 5 LSx device number 45 (Layer 3)
47.66 Flag 1 LSx device 46	Logic flag 1 LSx device number 46 (Layer 3)
47.67 Flag 2 LSx device 46	Logic flag 2 LSx device number 46 (Layer 3)
47.68 Flag 3 LSx device 46	Logic flag 3 LSx device number 46 (Layer 3)
47.69 Flag 4 LSx device 46	Logic flag 4 LSx device number 46 (Layer 3)
47.70 Flag 5 LSx device 46	Logic flag 5 LSx device number 46 (Layer 3)
47.71 Flag 1 LSx device 47	Logic flag 1 LSx device number 47 (Layer 3)
47.72 Flag 2 LSx device 47	Logic flag 2 LSx device number 47 (Layer 3)
47.73 Flag 3 LSx device 47	Logic flag 3 LSx device number 47 (Layer 3)
47.74 Flag 4 LSx device 47	Logic flag 4 LSx device number 47 (Layer 3)
47.75 Flag 5 LSx device 47	Logic flag 5 LSx device number 47 (Layer 3)
47.76 Flag 1 LSx device 48	Logic flag 1 LSx device number 48 (Layer 3)
47.77 Flag 2 LSx device 48	Logic flag 2 LSx device number 48 (Layer 3)
47.78 Flag 3 LSx device 48	Logic flag 3 LSx device number 48 (Layer 3)
47.79 Flag 4 LSx device 48	Logic flag 4 LSx device number 48 (Layer 3)
47.80 Flag 5 LSx device 48	Logic flag 5 LSx device number 48 (Layer 3)

9.4.2.22 Group 48: Flags from LSx 49-64 (Layer 3)

HMI Text	Note
48.01 Flag 1 LSx device 49	Logic flag 1 LSx device number 49 (Layer 3)
48.02 Flag 2 LSx device 49	Logic flag 2 LSx device number 49 (Layer 3)
48.03 Flag 3 LSx device 49	Logic flag 3 LSx device number 49 (Layer 3)
48.04 Flag 4 LSx device 49	Logic flag 4 LSx device number 49 (Layer 3)
48.05 Flag 5 LSx device 49	Logic flag 5 LSx device number 49 (Layer 3)
48.06 Flag 1 LSx device 50	Logic flag 1 LSx device number 50 (Layer 3)
48.07 Flag 2 LSx device 50	Logic flag 2 LSx device number 50 (Layer 3)
48.08 Flag 3 LSx device 50	Logic flag 3 LSx device number 50 (Layer 3)
48.09 Flag 4 LSx device 50	Logic flag 4 LSx device number 50 (Layer 3)
48.10 Flag 5 LSx device 50	Logic flag 5 LSx device number 50 (Layer 3)
48.11 Flag 1 LSx device 51	Logic flag 1 LSx device number 51 (Layer 3)
48.12 Flag 2 LSx device 51	Logic flag 2 LSx device number 51 (Layer 3)
48.13 Flag 3 LSx device 51	Logic flag 3 LSx device number 51 (Layer 3)
48.14 Flag 4 LSx device 51	Logic flag 4 LSx device number 51 (Layer 3)
48.15 Flag 5 LSx device 51	Logic flag 5 LSx device number 51 (Layer 3)
48.16 Flag 1 LSx device 52	Logic flag 1 LSx device number 52 (Layer 3)
48.17 Flag 2 LSx device 52	Logic flag 2 LSx device number 52 (Layer 3)
48.18 Flag 3 LSx device 52	Logic flag 3 LSx device number 52 (Layer 3)
48.19 Flag 4 LSx device 52	Logic flag 4 LSx device number 52 (Layer 3)
48.20 Flag 5 LSx device 52	Logic flag 5 LSx device number 52 (Layer 3)
48.21 Flag 1 LSx device 53	Logic flag 1 LSx device number 53 (Layer 3)
48.22 Flag 2 LSx device 53	Logic flag 2 LSx device number 53 (Layer 3)
48.23 Flag 3 LSx device 53	Logic flag 3 LSx device number 53 (Layer 3)
48.24 Flag 4 LSx device 53	Logic flag 4 LSx device number 53 (Layer 3)
48.25 Flag 5 LSx device 53	Logic flag 5 LSx device number 53 (Layer 3)
48.26 Flag 1 LSx device 54	Logic flag 1 LSx device number 54 (Layer 3)
48.27 Flag 2 LSx device 54	Logic flag 2 LSx device number 54 (Layer 3)
48.28 Flag 3 LSx device 54	Logic flag 3 LSx device number 54 (Layer 3)
48.29 Flag 4 LSx device 54	Logic flag 4 LSx device number 54 (Layer 3)
48.30 Flag 5 LSx device 54	Logic flag 5 LSx device number 54 (Layer 3)
48.31 Flag 1 LSx device 55	Logic flag 1 LSx device number 55 (Layer 3)
48.32 Flag 2 LSx device 55	Logic flag 2 LSx device number 55 (Layer 3)
48.33 Flag 3 LSx device 55	Logic flag 3 LSx device number 55 (Layer 3)
48.34 Flag 4 LSx device 55	Logic flag 4 LSx device number 55 (Layer 3)
48.35 Flag 5 LSx device 55	Logic flag 5 LSx device number 55 (Layer 3)
48.36 Flag 1 LSx device 56	Logic flag 1 LSx device number 56 (Layer 3)
48.37 Flag 2 LSx device 56	Logic flag 2 LSx device number 56 (Layer 3)
48.38 Flag 3 LSx device 56	Logic flag 3 LSx device number 56 (Layer 3)

HMI Text	Note
48.39 Flag 4 LSx device 56	Logic flag 4 LSx device number 56 (Layer 3)
48.40 Flag 5 LSx device 56	Logic flag 5 LSx device number 56 (Layer 3)
48.41 Flag 1 LSx device 57	Logic flag 1 LSx device number 57 (Layer 3)
48.42 Flag 2 LSx device 57	Logic flag 2 LSx device number 57 (Layer 3)
48.43 Flag 3 LSx device 57	Logic flag 3 LSx device number 57 (Layer 3)
48.44 Flag 4 LSx device 57	Logic flag 4 LSx device number 57 (Layer 3)
48.45 Flag 5 LSx device 57	Logic flag 5 LSx device number 57 (Layer 3)
48.46 Flag 1 LSx device 58	Logic flag 1 LSx device number 58 (Layer 3)
48.47 Flag 2 LSx device 58	Logic flag 2 LSx device number 58 (Layer 3)
48.48 Flag 3 LSx device 58	Logic flag 3 LSx device number 58 (Layer 3)
48.49 Flag 4 LSx device 58	Logic flag 4 LSx device number 58 (Layer 3)
48.50 Flag 5 LSx device 58	Logic flag 5 LSx device number 58 (Layer 3)
48.51 Flag 1 LSx device 59	Logic flag 1 LSx device number 59 (Layer 3)
48.52 Flag 2 LSx device 59	Logic flag 2 LSx device number 59 (Layer 3)
48.53 Flag 3 LSx device 59	Logic flag 3 LSx device number 59 (Layer 3)
48.54 Flag 4 LSx device 59	Logic flag 4 LSx device number 59 (Layer 3)
48.55 Flag 5 LSx device 59	Logic flag 5 LSx device number 59 (Layer 3)
48.56 Flag 1 LSx device 60	Logic flag 1 LSx device number 60 (Layer 3)
48.57 Flag 2 LSx device 60	Logic flag 2 LSx device number 60 (Layer 3)
48.58 Flag 3 LSx device 60	Logic flag 3 LSx device number 60 (Layer 3)
48.59 Flag 4 LSx device 60	Logic flag 4 LSx device number 60 (Layer 3)
48.60 Flag 5 LSx device 60	Logic flag 5 LSx device number 60 (Layer 3)
48.61 Flag 1 LSx device 61	Logic flag 1 LSx device number 61 (Layer 3)
48.62 Flag 2 LSx device 61	Logic flag 2 LSx device number 61 (Layer 3)
48.63 Flag 3 LSx device 61	Logic flag 3 LSx device number 61 (Layer 3)
48.64 Flag 4 LSx device 61	Logic flag 4 LSx device number 61 (Layer 3)
48.65 Flag 5 LSx device 61	Logic flag 5 LSx device number 61 (Layer 3)
48.66 Flag 1 LSx device 62	Logic flag 1 LSx device number 62 (Layer 3)
48.67 Flag 2 LSx device 62	Logic flag 2 LSx device number 62 (Layer 3)
48.68 Flag 3 LSx device 62	Logic flag 3 LSx device number 62 (Layer 3)
48.69 Flag 4 LSx device 62	Logic flag 4 LSx device number 62 (Layer 3)
48.70 Flag 5 LSx device 62	Logic flag 5 LSx device number 62 (Layer 3)
48.71 Flag 1 LSx device 63	Logic flag 1 LSx device number 63 (Layer 3)
48.72 Flag 2 LSx device 63	Logic flag 2 LSx device number 63 (Layer 3)
48.73 Flag 3 LSx device 63	Logic flag 3 LSx device number 63 (Layer 3)
48.74 Flag 4 LSx device 63	Logic flag 4 LSx device number 63 (Layer 3)
48.75 Flag 5 LSx device 63	Logic flag 5 LSx device number 63 (Layer 3)
48.76 Flag 1 LSx device 64	Logic flag 1 LSx device number 64 (Layer 3)

HMI Text	Note
48.77 Flag 2 LSx device 64	Logic flag 2 LSx device number 64 (Layer 3)
48.78 Flag 3 LSx device 64	Logic flag 3 LSx device number 64 (Layer 3)
48.79 Flag 4 LSx device 64	Logic flag 4 LSx device number 64 (Layer 3)
48.80 Flag 5 LSx device 64	Logic flag 5 LSx device number 64 (Layer 3)

9.4.2.23 Group 49: Flags from LSx 65-80 (Layer 3)

HMI Text	Note
49.01 Flag 1 LSx device 65	Logic flag 1 LSx device number 65 (Layer 3)
49.02 Flag 2 LSx device 65	Logic flag 2 LSx device number 65 (Layer 3)
49.03 Flag 3 LSx device 65	Logic flag 3 LSx device number 65 (Layer 3)
49.04 Flag 4 LSx device 65	Logic flag 4 LSx device number 65 (Layer 3)
49.05 Flag 5 LSx device 65	Logic flag 5 LSx device number 65 (Layer 3)
49.06 Flag 1 LSx device 66	Logic flag 1 LSx device number 66 (Layer 3)
49.07 Flag 2 LSx device 66	Logic flag 2 LSx device number 66 (Layer 3)
49.08 Flag 3 LSx device 66	Logic flag 3 LSx device number 66 (Layer 3)
49.09 Flag 4 LSx device 66	Logic flag 4 LSx device number 66 (Layer 3)
49.10 Flag 5 LSx device 66	Logic flag 5 LSx device number 66 (Layer 3)
49.11 Flag 1 LSx device 67	Logic flag 1 LSx device number 67 (Layer 3)
49.12 Flag 2 LSx device 67	Logic flag 2 LSx device number 67 (Layer 3)
49.13 Flag 3 LSx device 67	Logic flag 3 LSx device number 67 (Layer 3)
49.14 Flag 4 LSx device 67	Logic flag 4 LSx device number 67 (Layer 3)
49.15 Flag 5 LSx device 67	Logic flag 5 LSx device number 67 (Layer 3)
49.16 Flag 1 LSx device 68	Logic flag 1 LSx device number 68 (Layer 3)
49.17 Flag 2 LSx device 68	Logic flag 2 LSx device number 68 (Layer 3)
49.18 Flag 3 LSx device 68	Logic flag 3 LSx device number 68 (Layer 3)
49.19 Flag 4 LSx device 68	Logic flag 4 LSx device number 68 (Layer 3)
49.20 Flag 5 LSx device 68	Logic flag 5 LSx device number 68 (Layer 3)
49.21 Flag 1 LSx device 69	Logic flag 1 LSx device number 69 (Layer 3)
49.22 Flag 2 LSx device 69	Logic flag 2 LSx device number 69 (Layer 3)
49.23 Flag 3 LSx device 69	Logic flag 3 LSx device number 69 (Layer 3)
49.24 Flag 4 LSx device 69	Logic flag 4 LSx device number 69 (Layer 3)
49.25 Flag 5 LSx device 69	Logic flag 5 LSx device number 69 (Layer 3)
49.26 Flag 1 LSx device 70	Logic flag 1 LSx device number 70 (Layer 3)
49.27 Flag 2 LSx device 70	Logic flag 2 LSx device number 70 (Layer 3)
49.28 Flag 3 LSx device 70	Logic flag 3 LSx device number 70 (Layer 3)
49.29 Flag 4 LSx device 70	Logic flag 4 LSx device number 70 (Layer 3)
49.30 Flag 5 LSx device 70	Logic flag 5 LSx device number 70 (Layer 3)

HMI Text	Note
49.31 Flag 1 LSx device 71	Logic flag 1 LSx device number 71 (Layer 3)
49.32 Flag 2 LSx device 71	Logic flag 2 LSx device number 71 (Layer 3)
49.33 Flag 3 LSx device 71	Logic flag 3 LSx device number 71 (Layer 3)
49.34 Flag 4 LSx device 71	Logic flag 4 LSx device number 71 (Layer 3)
49.35 Flag 5 LSx device 71	Logic flag 5 LSx device number 71 (Layer 3)
49.36 Flag 1 LSx device 72	Logic flag 1 LSx device number 72 (Layer 3)
49.37 Flag 2 LSx device 72	Logic flag 2 LSx device number 72 (Layer 3)
49.38 Flag 3 LSx device 72	Logic flag 3 LSx device number 72 (Layer 3)
49.39 Flag 4 LSx device 72	Logic flag 4 LSx device number 72 (Layer 3)
49.40 Flag 5 LSx device 72	Logic flag 5 LSx device number 72 (Layer 3)
49.41 Flag 1 LSx device 73	Logic flag 1 LSx device number 73 (Layer 3)
49.42 Flag 2 LSx device 73	Logic flag 2 LSx device number 73 (Layer 3)
49.43 Flag 3 LSx device 73	Logic flag 3 LSx device number 73 (Layer 3)
49.44 Flag 4 LSx device 73	Logic flag 4 LSx device number 73 (Layer 3)
49.45 Flag 5 LSx device 73	Logic flag 5 LSx device number 73 (Layer 3)
49.46 Flag 1 LSx device 74	Logic flag 1 LSx device number 74 (Layer 3)
49.47 Flag 2 LSx device 74	Logic flag 2 LSx device number 74 (Layer 3)
49.48 Flag 3 LSx device 74	Logic flag 3 LSx device number 74 (Layer 3)
49.49 Flag 4 LSx device 74	Logic flag 4 LSx device number 74 (Layer 3)
49.50 Flag 5 LSx device 74	Logic flag 5 LSx device number 74 (Layer 3)
49.51 Flag 1 LSx device 75	Logic flag 1 LSx device number 75 (Layer 3)
49.52 Flag 2 LSx device 75	Logic flag 2 LSx device number 75 (Layer 3)
49.53 Flag 3 LSx device 75	Logic flag 3 LSx device number 75 (Layer 3)
49.54 Flag 4 LSx device 75	Logic flag 4 LSx device number 75 (Layer 3)
49.55 Flag 5 LSx device 75	Logic flag 5 LSx device number 75 (Layer 3)
49.56 Flag 1 LSx device 76	Logic flag 1 LSx device number 76 (Layer 3)
49.57 Flag 2 LSx device 76	Logic flag 2 LSx device number 76 (Layer 3)
49.58 Flag 3 LSx device 76	Logic flag 3 LSx device number 76 (Layer 3)
49.59 Flag 4 LSx device 76	Logic flag 4 LSx device number 76 (Layer 3)
49.60 Flag 5 LSx device 76	Logic flag 5 LSx device number 76 (Layer 3)
49.61 Flag 1 LSx device 77	Logic flag 1 LSx device number 77 (Layer 3)
49.62 Flag 2 LSx device 77	Logic flag 2 LSx device number 77 (Layer 3)
49.63 Flag 3 LSx device 77	Logic flag 3 LSx device number 77 (Layer 3)
49.64 Flag 4 LSx device 77	Logic flag 4 LSx device number 77 (Layer 3)
49.65 Flag 5 LSx device 77	Logic flag 5 LSx device number 77 (Layer 3)
49.66 Flag 1 LSx device 78	Logic flag 1 LSx device number 78 (Layer 3)
49.67 Flag 2 LSx device 78	Logic flag 2 LSx device number 78 (Layer 3)
49.68 Flag 3 LSx device 78	Logic flag 3 LSx device number 78 (Layer 3)

HMI Text	Note
49.69 Flag 4 LSx device 78	Logic flag 4 LSx device number 78 (Layer 3)
49.70 Flag 5 LSx device 78	Logic flag 5 LSx device number 78 (Layer 3)
49.71 Flag 1 LSx device 79	Logic flag 1 LSx device number 79 (Layer 3)
49.72 Flag 2 LSx device 79	Logic flag 2 LSx device number 79 (Layer 3)
49.73 Flag 3 LSx device 79	Logic flag 3 LSx device number 79 (Layer 3)
49.74 Flag 4 LSx device 79	Logic flag 4 LSx device number 79 (Layer 3)
49.75 Flag 5 LSx device 79	Logic flag 5 LSx device number 79 (Layer 3)
49.76 Flag 1 LSx device 80	Logic flag 1 LSx device number 80 (Layer 3)
49.77 Flag 2 LSx device 80	Logic flag 2 LSx device number 80 (Layer 3)
49.78 Flag 3 LSx device 80	Logic flag 3 LSx device number 80 (Layer 3)
49.79 Flag 4 LSx device 80	Logic flag 4 LSx device number 80 (Layer 3)
49.80 Flag 5 LSx device 80	Logic flag 5 LSx device number 80 (Layer 3)

9.4.2.24 Group 50: Flags from LSx 81-96 (Layer 3)

HMI Text	Note
50.01 Flag 1 LSx device 81	Logic flag 1 LSx device number 81 (Layer 3)
50.02 Flag 2 LSx device 81	Logic flag 2 LSx device number 81 (Layer 3)
50.03 Flag 3 LSx device 81	Logic flag 3 LSx device number 81 (Layer 3)
50.04 Flag 4 LSx device 81	Logic flag 4 LSx device number 81 (Layer 3)
50.05 Flag 5 LSx device 81	Logic flag 5 LSx device number 81 (Layer 3)
50.06 Flag 1 LSx device 82	Logic flag 1 LSx device number 82 (Layer 3)
50.07 Flag 2 LSx device 82	Logic flag 2 LSx device number 82 (Layer 3)
50.08 Flag 3 LSx device 82	Logic flag 3 LSx device number 82 (Layer 3)
50.09 Flag 4 LSx device 82	Logic flag 4 LSx device number 82 (Layer 3)
50.10 Flag 5 LSx device 82	Logic flag 5 LSx device number 82 (Layer 3)
50.11 Flag 1 LSx device 83	Logic flag 1 LSx device number 83 (Layer 3)
50.12 Flag 2 LSx device 83	Logic flag 2 LSx device number 83 (Layer 3)
50.13 Flag 3 LSx device 83	Logic flag 3 LSx device number 83 (Layer 3)
50.14 Flag 4 LSx device 83	Logic flag 4 LSx device number 83 (Layer 3)
50.15 Flag 5 LSx device 83	Logic flag 5 LSx device number 83 (Layer 3)
50.16 Flag 1 LSx device 84	Logic flag 1 LSx device number 84 (Layer 3)
50.17 Flag 2 LSx device 84	Logic flag 2 LSx device number 84 (Layer 3)
50.18 Flag 3 LSx device 84	Logic flag 3 LSx device number 84 (Layer 3)
50.19 Flag 4 LSx device 84	Logic flag 4 LSx device number 84 (Layer 3)
50.20 Flag 5 LSx device 84	Logic flag 5 LSx device number 84 (Layer 3)
50.21 Flag 1 LSx device 85	Logic flag 1 LSx device number 85 (Layer 3)
50.22 Flag 2 LSx device 85	Logic flag 2 LSx device number 85 (Layer 3)

HMI Text	Note
50.23 Flag 3 LSx device 85	Logic flag 3 LSx device number 85 (Layer 3)
50.24 Flag 4 LSx device 85	Logic flag 4 LSx device number 85 (Layer 3)
50.25 Flag 5 LSx device 85	Logic flag 5 LSx device number 85 (Layer 3)
50.26 Flag 1 LSx device 86	Logic flag 1 LSx device number 86 (Layer 3)
50.27 Flag 2 LSx device 86	Logic flag 2 LSx device number 86 (Layer 3)
50.28 Flag 3 LSx device 86	Logic flag 3 LSx device number 86 (Layer 3)
50.29 Flag 4 LSx device 86	Logic flag 4 LSx device number 86 (Layer 3)
50.30 Flag 5 LSx device 86	Logic flag 5 LSx device number 86 (Layer 3)
50.31 Flag 1 LSx device 87	Logic flag 1 LSx device number 87 (Layer 3)
50.32 Flag 2 LSx device 87	Logic flag 2 LSx device number 87 (Layer 3)
50.33 Flag 3 LSx device 87	Logic flag 3 LSx device number 87 (Layer 3)
50.34 Flag 4 LSx device 87	Logic flag 4 LSx device number 87 (Layer 3)
50.35 Flag 5 LSx device 87	Logic flag 5 LSx device number 87 (Layer 3)
50.36 Flag 1 LSx device 88	Logic flag 1 LSx device number 88 (Layer 3)
50.37 Flag 2 LSx device 88	Logic flag 2 LSx device number 88 (Layer 3)
50.38 Flag 3 LSx device 88	Logic flag 3 LSx device number 88 (Layer 3)
50.39 Flag 4 LSx device 88	Logic flag 4 LSx device number 88 (Layer 3)
50.40 Flag 5 LSx device 88	Logic flag 5 LSx device number 88 (Layer 3)
50.41 Flag 1 LSx device 89	Logic flag 1 LSx device number 89 (Layer 3)
50.42 Flag 2 LSx device 89	Logic flag 2 LSx device number 89 (Layer 3)
50.43 Flag 3 LSx device 89	Logic flag 3 LSx device number 89 (Layer 3)
50.44 Flag 4 LSx device 89	Logic flag 4 LSx device number 89 (Layer 3)
50.45 Flag 5 LSx device 89	Logic flag 5 LSx device number 89 (Layer 3)
50.46 Flag 1 LSx device 90	Logic flag 1 LSx device number 90 (Layer 3)
50.47 Flag 2 LSx device 90	Logic flag 2 LSx device number 90 (Layer 3)
50.48 Flag 3 LSx device 90	Logic flag 3 LSx device number 90 (Layer 3)
50.49 Flag 4 LSx device 90	Logic flag 4 LSx device number 90 (Layer 3)
50.50 Flag 5 LSx device 90	Logic flag 5 LSx device number 90 (Layer 3)
50.51 Flag 1 LSx device 91	Logic flag 1 LSx device number 91 (Layer 3)
50.52 Flag 2 LSx device 91	Logic flag 2 LSx device number 91 (Layer 3)
50.53 Flag 3 LSx device 91	Logic flag 3 LSx device number 91 (Layer 3)
50.54 Flag 4 LSx device 91	Logic flag 4 LSx device number 91 (Layer 3)
50.55 Flag 5 LSx device 91	Logic flag 5 LSx device number 91 (Layer 3)
50.56 Flag 1 LSx device 92	Logic flag 1 LSx device number 92 (Layer 3)
50.57 Flag 2 LSx device 92	Logic flag 2 LSx device number 92 (Layer 3)
50.58 Flag 3 LSx device 92	Logic flag 3 LSx device number 92 (Layer 3)
50.59 Flag 4 LSx device 92	Logic flag 4 LSx device number 92 (Layer 3)
50.60 Flag 5 LSx device 92	Logic flag 5 LSx device number 92 (Layer 3)

HMI Text	Note
50.61 Flag 1 LSx device 93	Logic flag 1 LSx device number 93 (Layer 3)
50.62 Flag 2 LSx device 93	Logic flag 2 LSx device number 93 (Layer 3)
50.63 Flag 3 LSx device 93	Logic flag 3 LSx device number 93 (Layer 3)
50.64 Flag 4 LSx device 93	Logic flag 4 LSx device number 93 (Layer 3)
50.65 Flag 5 LSx device 93	Logic flag 5 LSx device number 93 (Layer 3)
50.66 Flag 1 LSx device 94	Logic flag 1 LSx device number 94 (Layer 3)
50.67 Flag 2 LSx device 94	Logic flag 2 LSx device number 94 (Layer 3)
50.68 Flag 3 LSx device 94	Logic flag 3 LSx device number 94 (Layer 3)
50.69 Flag 4 LSx device 94	Logic flag 4 LSx device number 94 (Layer 3)
50.70 Flag 5 LSx device 94	Logic flag 5 LSx device number 94 (Layer 3)
50.71 Flag 1 LSx device 95	Logic flag 1 LSx device number 95 (Layer 3)
50.72 Flag 2 LSx device 95	Logic flag 2 LSx device number 95 (Layer 3)
50.73 Flag 3 LSx device 95	Logic flag 3 LSx device number 95 (Layer 3)
50.74 Flag 4 LSx device 95	Logic flag 4 LSx device number 95 (Layer 3)
50.75 Flag 5 LSx device 95	Logic flag 5 LSx device number 95 (Layer 3)
50.76 Flag 1 LSx device 96	Logic flag 1 LSx device number 96 (Layer 3)
50.77 Flag 2 LSx device 96	Logic flag 2 LSx device number 96 (Layer 3)
50.78 Flag 3 LSx device 96	Logic flag 3 LSx device number 96 (Layer 3)
50.79 Flag 4 LSx device 96	Logic flag 4 LSx device number 96 (Layer 3)
50.80 Flag 5 LSx device 96	Logic flag 5 LSx device number 96 (Layer 3)

9.4.2.25 Group 51: GC system conditions (Layer 3)

TRUE if at least one GCs sets the command variable to TRUE (OR operation)

HMI Text	Note
51.01 Command 1 to LSx (OR)	Command 1 to LSx layer 3 (OR)
51.02 Command 2 to LSx (OR)	Command 2 to LSx layer 3 (OR)
51.03 Command 3 to LSx (OR)	Command 3 to LSx layer 3 (OR)
51.04 Command 4 to LSx (OR)	Command 4 to LSx layer 3 (OR)
51.05 Command 5 to LSx (OR)	Command 5 to LSx layer 3 (OR)
51.06 Command 6 to LSx (OR)	Command 6 to LSx layer 3 (OR)

9.4.2.26 Group 52: Flags from GC 1-16

HMI Text	Note
52.01 Command 1 from GC 1	Command bit 1 from GC 1 (Layer 3)
52.02 Command 2 from GC 1	Command bit 2 from GC 1 (Layer 3)
52.03 Command 3 from GC 1	Command bit 3 from GC 1 (Layer 3)

HMI Text	Note
52.04 Command 4 from GC 1	Command bit 4 from GC 1 (Layer 3)
52.05 Command 5 from GC 1	Command bit 5 from GC 1 (Layer 3)
52.06 Command 6 from GC 1	Command bit 6 from GC 1 (Layer 3)
52.07 Command 1 from GC 2	Command bit 1 from GC 2 (Layer 3)
52.08 Command 2 from GC 2	Command bit 2 from GC 2 (Layer 3)
52.09 Command 3 from GC 2	Command bit 3 from GC 2 (Layer 3)
52.10 Command 4 from GC 2	Command bit 4 from GC 2 (Layer 3)
52.11 Command 5 from GC 2	Command bit 5 from GC 2 (Layer 3)
52.12 Command 6 from GC 2	Command bit 6 from GC 2 (Layer 3)
52.13 Command 1 from GC 3	Command bit 1 from GC 3 (Layer 3)
52.14 Command 2 from GC 3	Command bit 2 from GC 3 (Layer 3)
52.15 Command 3 from GC 3	Command bit 3 from GC 3 (Layer 3)
52.16 Command 4 from GC 3	Command bit 4 from GC 3 (Layer 3)
52.17 Command 5 from GC 3	Command bit 5 from GC 3 (Layer 3)
52.18 Command 6 from GC 3	Command bit 6 from GC 3 (Layer 3)
52.19 Command 1 from GC 4	Command bit 1 from GC 4 (Layer 3)
52.20 Command 2 from GC 4	Command bit 2 from GC 4 (Layer 3)
52.21 Command 3 from GC 4	Command bit 3 from GC 4 (Layer 3)
52.22 Command 4 from GC 4	Command bit 4 from GC 4 (Layer 3)
52.23 Command 5 from GC 4	Command bit 5 from GC 4 (Layer 3)
52.24 Command 6 from GC 4	Command bit 6 from GC 4 (Layer 3)
52.25 Command 1 from GC 5	Command bit 1 from GC 5 (Layer 3)
52.26 Command 2 from GC 5	Command bit 2 from GC 5 (Layer 3)
52.27 Command 3 from GC 5	Command bit 3 from GC 5 (Layer 3)
52.28 Command 4 from GC 5	Command bit 4 from GC 5 (Layer 3)
52.29 Command 5 from GC 5	Command bit 5 from GC 5 (Layer 3)
52.30 Command 6 from GC 5	Command bit 6 from GC 5 (Layer 3)
52.31 Command 1 from GC 6	Command bit 1 from GC 6 (Layer 3)
52.32 Command 2 from GC 6	Command bit 2 from GC 6 (Layer 3)
52.33 Command 3 from GC 6	Command bit 3 from GC 6 (Layer 3)
52.34 Command 4 from GC 6	Command bit 4 from GC 6 (Layer 3)
52.35 Command 5 from GC 6	Command bit 5 from GC 6 (Layer 3)
52.36 Command 6 from GC 6	Command bit 6 from GC 6 (Layer 3)
52.37 Command 1 from GC 7	Command bit 1 from GC 7 (Layer 3)
52.38 Command 2 from GC 7	Command bit 2 from GC 7 (Layer 3)
52.39 Command 3 from GC 7	Command bit 3 from GC 7 (Layer 3)
52.40 Command 4 from GC 7	Command bit 4 from GC 7 (Layer 3)
52.41 Command 5 from GC 7	Command bit 5 from GC 7 (Layer 3)

HMI Text	Note
52.42 Command 6 from GC 7	Command bit 6 from GC 7 (Layer 3)
52.43 Command 1 from GC 8	Command bit 1 from GC 8 (Layer 3)
52.44 Command 2 from GC 8	Command bit 2 from GC 8 (Layer 3)
52.45 Command 3 from GC 8	Command bit 3 from GC 8 (Layer 3)
52.46 Command 4 from GC 8	Command bit 4 from GC 8 (Layer 3)
52.47 Command 5 from GC 8	Command bit 5 from GC 8 (Layer 3)
52.48 Command 6 from GC 8	Command bit 6 from GC 8 (Layer 3)
52.49 Command 1 from GC 9	Command bit 1 from GC 9 (Layer 3)
52.50 Command 2 from GC 9	Command bit 2 from GC 9 (Layer 3)
52.51 Command 3 from GC 9	Command bit 3 from GC 9 (Layer 3)
52.52 Command 4 from GC 9	Command bit 4 from GC 9 (Layer 3)
52.53 Command 5 from GC 9	Command bit 5 from GC 9 (Layer 3)
52.54 Command 6 from GC 9	Command bit 6 from GC 9 (Layer 3)
52.55 Command 1 from GC 10	Command bit 1 from GC 10 (Layer 3)
52.56 Command 2 from GC 10	Command bit 2 from GC 10 (Layer 3)
52.57 Command 3 from GC 10	Command bit 3 from GC 10 (Layer 3)
52.58 Command 4 from GC 10	Command bit 4 from GC 10 (Layer 3)
52.59 Command 5 from GC 10	Command bit 5 from GC 10 (Layer 3)
52.60 Command 6 from GC 10	Command bit 6 from GC 10 (Layer 3)
52.61 Command 1 from GC 11	Command bit 1 from GC 11 (Layer 3)
52.62 Command 2 from GC 11	Command bit 2 from GC 11 (Layer 3)
52.63 Command 3 from GC 11	Command bit 3 from GC 11 (Layer 3)
52.64 Command 4 from GC 11	Command bit 4 from GC 11 (Layer 3)
52.65 Command 5 from GC 11	Command bit 5 from GC 11 (Layer 3)
52.66 Command 6 from GC 11	Command bit 6 from GC 11 (Layer 3)
52.67 Command 1 from GC 12	Command bit 1 from GC 12 (Layer 3)
52.68 Command 2 from GC 12	Command bit 2 from GC 12 (Layer 3)
52.69 Command 3 from GC 12	Command bit 3 from GC 12 (Layer 3)
52.70 Command 4 from GC 12	Command bit 4 from GC 12 (Layer 3)
52.71 Command 5 from GC 12	Command bit 5 from GC 12 (Layer 3)
52.72 Command 6 from GC 12	Command bit 6 from GC 12 (Layer 3)
52.73 Command 1 from GC 13	Command bit 1 from GC 13 (Layer 3)
52.74 Command 2 from GC 13	Command bit 2 from GC 13 (Layer 3)
52.75 Command 3 from GC 13	Command bit 3 from GC 13 (Layer 3)
52.76 Command 4 from GC 13	Command bit 4 from GC 13 (Layer 3)
52.77 Command 5 from GC 13	Command bit 5 from GC 13 (Layer 3)
52.78 Command 6 from GC 13	Command bit 6 from GC 13 (Layer 3)
52.79 Command 1 from GC 14	Command bit 1 from GC 14 (Layer 3)

HMI Text	Note
52.80 Command 2 from GC 14	Command bit 2 from GC 14 (Layer 3)
52.81 Command 3 from GC 14	Command bit 3 from GC 14 (Layer 3)
52.82 Command 4 from GC 14	Command bit 4 from GC 14 (Layer 3)
52.83 Command 5 from GC 14	Command bit 5 from GC 14 (Layer 3)
52.84 Command 6 from GC 14	Command bit 6 from GC 14 (Layer 3)
52.85 Command 1 from GC 15	Command bit 1 from GC 15 (Layer 3)
52.86 Command 2 from GC 15	Command bit 2 from GC 15 (Layer 3)
52.87 Command 3 from GC 15	Command bit 3 from GC 15 (Layer 3)
52.88 Command 4 from GC 15	Command bit 4 from GC 15 (Layer 3)
52.89 Command 5 from GC 15	Command bit 5 from GC 15 (Layer 3)
52.90 Command 6 from GC 15	Command bit 6 from GC 15 (Layer 3)
52.91 Command 1 from GC 16	Command bit 1 from GC 16 (Layer 3)
52.92 Command 2 from GC 16	Command bit 2 from GC 16 (Layer 3)
52.93 Command 3 from GC 16	Command bit 3 from GC 16 (Layer 3)
52.94 Command 4 from GC 16	Command bit 4 from GC 16 (Layer 3)
52.95 Command 5 from GC 16	Command bit 5 from GC 16 (Layer 3)
52.96 Command 6 from GC 16	Command bit 6 from GC 16 (Layer 3)

9.4.2.27 Group 54: Modbus Master flags

HMI Text	Note
54.01 Mapped LM flag 1	Modbus Master mapped flag 1
54.02 Mapped LM flag 2	Modbus Master mapped flag 2
54.03 Mapped LM flag 3	Modbus Master mapped flag 3
54.04 Mapped LM flag 4	Modbus Master mapped flag 4
54.05 Mapped LM flag 5	Modbus Master mapped flag 5
54.06 Mapped LM flag 6	Modbus Master mapped flag 6
54.07 Mapped LM flag 7	Modbus Master mapped flag 7
54.08 Mapped LM flag 8	Modbus Master mapped flag 8
54.09 Mapped LM flag 9	Modbus Master mapped flag 9
54.10 Mapped LM flag 10	Modbus Master mapped flag 10
54.11 Mapped LM flag 11	Modbus Master mapped flag 11
54.12 Mapped LM flag 12	Modbus Master mapped flag 12
54.13 Mapped LM flag 13	Modbus Master mapped flag 13
54.14 Mapped LM flag 14	Modbus Master mapped flag 14
54.15 Mapped LM flag 15	Modbus Master mapped flag 15
54.16 Mapped LM flag 16	Modbus Master mapped flag 16
54.17 Mapped LM flag 17	Modbus Master mapped flag 17

HMI Text	Note
54.18 Mapped LM flag 18	Modbus Master mapped flag 18
54.19 Mapped LM flag 19	Modbus Master mapped flag 19
54.20 Mapped LM flag 20	Modbus Master mapped flag 20
54.21 Mapped LM flag 21	Modbus Master mapped flag 21
54.22 Mapped LM flag 22	Modbus Master mapped flag 22
54.23 Mapped LM flag 23	Modbus Master mapped flag 23
54.24 Mapped LM flag 24	Modbus Master mapped flag 24
54.25 Mapped LM flag 25	Modbus Master mapped flag 25
54.26 Mapped LM flag 26	Modbus Master mapped flag 26
54.27 Mapped LM flag 27	Modbus Master mapped flag 27
54.28 Mapped LM flag 28	Modbus Master mapped flag 28
54.29 Mapped LM flag 29	Modbus Master mapped flag 29
54.30 Mapped LM flag 30	Modbus Master mapped flag 30
54.31 Mapped LM flag 31	Modbus Master mapped flag 31
54.32 Mapped LM flag 32	Modbus Master mapped flag 32
54.33 Mapped LM flag 33	Modbus Master mapped flag 33
54.34 Mapped LM flag 34	Modbus Master mapped flag 34
54.35 Mapped LM flag 35	Modbus Master mapped flag 35
54.36 Mapped LM flag 36	Modbus Master mapped flag 36
54.37 Mapped LM flag 37	Modbus Master mapped flag 37
54.38 Mapped LM flag 38	Modbus Master mapped flag 38
54.39 Mapped LM flag 39	Modbus Master mapped flag 39
54.40 Mapped LM flag 40	Modbus Master mapped flag 40
54.41 Mapped LM flag 41	Modbus Master mapped flag 41
54.42 Mapped LM flag 42	Modbus Master mapped flag 42
54.43 Mapped LM flag 43	Modbus Master mapped flag 43
54.44 Mapped LM flag 44	Modbus Master mapped flag 44
54.45 Mapped LM flag 45	Modbus Master mapped flag 45
54.46 Mapped LM flag 46	Modbus Master mapped flag 46
54.47 Mapped LM flag 47	Modbus Master mapped flag 47
54.48 Mapped LM flag 48	Modbus Master mapped flag 48
54.49 Mapped LM flag 49	Modbus Master mapped flag 49
54.50 Mapped LM flag 50	Modbus Master mapped flag 50
54.51 Mapped LM flag 51	Modbus Master mapped flag 51
54.52 Mapped LM flag 52	Modbus Master mapped flag 52
54.53 Mapped LM flag 53	Modbus Master mapped flag 53
54.54 Mapped LM flag 54	Modbus Master mapped flag 54
54.55 Mapped LM flag 55	Modbus Master mapped flag 55

HMI Text	Note
54.56 Mapped LM flag 56	Modbus Master mapped flag 56
54.57 Mapped LM flag 57	Modbus Master mapped flag 57
54.58 Mapped LM flag 58	Modbus Master mapped flag 58
54.59 Mapped LM flag 59	Modbus Master mapped flag 59
54.60 Mapped LM flag 60	Modbus Master mapped flag 60
54.61 Mapped LM flag 61	Modbus Master mapped flag 61
54.62 Mapped LM flag 62	Modbus Master mapped flag 62
54.63 Mapped LM flag 63	Modbus Master mapped flag 63
54.64 Mapped LM flag 64	Modbus Master mapped flag 64
54.65 Mapped LM flag 65	Modbus Master mapped flag 65
54.66 Mapped LM flag 66	Modbus Master mapped flag 66
54.67 Mapped LM flag 67	Modbus Master mapped flag 67
54.68 Mapped LM flag 68	Modbus Master mapped flag 68
54.69 Mapped LM flag 69	Modbus Master mapped flag 69
54.70 Mapped LM flag 70	Modbus Master mapped flag 70
54.71 Mapped LM flag 71	Modbus Master mapped flag 71
54.72 Mapped LM flag 72	Modbus Master mapped flag 72
54.73 Mapped LM flag 73	Modbus Master mapped flag 73
54.74 Mapped LM flag 74	Modbus Master mapped flag 74
54.75 Mapped LM flag 75	Modbus Master mapped flag 75
54.76 Mapped LM flag 76	Modbus Master mapped flag 76
54.77 Mapped LM flag 77	Modbus Master mapped flag 77
54.78 Mapped LM flag 78	Modbus Master mapped flag 78
54.79 Mapped LM flag 79	Modbus Master mapped flag 79
54.80 Mapped LM flag 80	Modbus Master mapped flag 80
54.81 Mapped LM flag 81	Modbus Master mapped flag 81
54.82 Mapped LM flag 82	Modbus Master mapped flag 82
54.83 Mapped LM flag 83	Modbus Master mapped flag 83
54.84 Mapped LM flag 84	Modbus Master mapped flag 84
54.85 Mapped LM flag 85	Modbus Master mapped flag 85
54.86 Mapped LM flag 86	Modbus Master mapped flag 86
54.87 Mapped LM flag 87	Modbus Master mapped flag 87
54.88 Mapped LM flag 88	Modbus Master mapped flag 88
54.89 Mapped LM flag 89	Modbus Master mapped flag 89
54.90 Mapped LM flag 90	Modbus Master mapped flag 90
54.91 Mapped LM flag 91	Modbus Master mapped flag 91
54.92 Mapped LM flag 92	Modbus Master mapped flag 92
54.93 Mapped LM flag 93	Modbus Master mapped flag 93

HMI Text	Note
54.94 Mapped LM flag 94	Modbus Master mapped flag 94
54.95 Mapped LM flag 95	Modbus Master mapped flag 95
54.96 Mapped LM flag 96	Modbus Master mapped flag 96
54.97 Mapped LM flag 97	Modbus Master mapped flag 97
54.98 Mapped LM flag 98	Modbus Master mapped flag 98
54.99 Mapped LM flag 99	Modbus Master mapped flag 99

9.4.2.28 Group 81: AnalogManager boolean results 1

TRUE if the boolean result of the corresponding AnalogManager equation is true.

HMI Text	Note
81.19 AM Ext.mains act.pwr.	AM External measured mains active power
81.20 AM Ext.mains RPower	AM External measured mains reactive power

9.4.2.29 Group 82: AnalogManager boolean results 2 (Flexible Limits)

TRUE if the boolean result of the corresponding AnalogManager equation is true.

HMI Text	Note
82.01 AM Flexible limit 1	AM Monitored flexible limit 1
82.02 AM Flexible limit 2	AM Monitored flexible limit 2
82.03 AM Flexible limit 3	AM Monitored flexible limit 3
82.04 AM Flexible limit 4	AM Monitored flexible limit 4
82.05 AM Flexible limit 5	AM Monitored flexible limit 5
82.06 AM Flexible limit 6	AM Monitored flexible limit 6
82.07 AM Flexible limit 7	AM Monitored flexible limit 7
82.08 AM Flexible limit 8	AM Monitored flexible limit 8
82.09 AM Flexible limit 9	AM Monitored flexible limit 9
82.10 AM Flexible limit 10	AM Monitored flexible limit 10
82.11 AM Flexible limit 11	AM Monitored flexible limit 11
82.12 AM Flexible limit 12	AM Monitored flexible limit 12
82.13 AM Flexible limit 13	AM Monitored flexible limit 13
82.14 AM Flexible limit 14	AM Monitored flexible limit 14
82.15 AM Flexible limit 15	AM Monitored flexible limit 15
82.16 AM Flexible limit 16	AM Monitored flexible limit 16
82.17 AM Flexible limit 17	AM Monitored flexible limit 17
82.18 AM Flexible limit 18	AM Monitored flexible limit 18
82.19 AM Flexible limit 19	AM Monitored flexible limit 19
82.20 AM Flexible limit 20	AM Monitored flexible limit 20

HMI Text	Note
82.21 AM Flexible limit 21	AM Monitored flexible limit 21
82.22 AM Flexible limit 22	AM Monitored flexible limit 22
82.23 AM Flexible limit 23	AM Monitored flexible limit 23
82.24 AM Flexible limit 24	AM Monitored flexible limit 24
82.25 AM Flexible limit 25	AM Monitored flexible limit 25
82.26 AM Flexible limit 26	AM Monitored flexible limit 26
82.27 AM Flexible limit 27	AM Monitored flexible limit 27
82.28 AM Flexible limit 28	AM Monitored flexible limit 28
82.29 AM Flexible limit 29	AM Monitored flexible limit 29
82.30 AM Flexible limit 30	AM Monitored flexible limit 30
82.31 AM Flexible limit 31	AM Monitored flexible limit 31
82.32 AM Flexible limit 32	AM Monitored flexible limit 32
82.33 AM Flexible limit 33	AM Monitored flexible limit 33
82.34 AM Flexible limit 34	AM Monitored flexible limit 34
82.35 AM Flexible limit 35	AM Monitored flexible limit 35
82.36 AM Flexible limit 36	AM Monitored flexible limit 36
82.37 AM Flexible limit 37	AM Monitored flexible limit 37
82.38 AM Flexible limit 38	AM Monitored flexible limit 38
82.39 AM Flexible limit 39	AM Monitored flexible limit 39
82.40 AM Flexible limit 40	AM Monitored flexible limit 40

9.4.2.30 Group 86: LM Results 1

TRUE if the result of the corresponding LogicsManager equation is true.

HMI Text	Note
86.15 LM: Ext. acknowledge	LM External acknowledge
86.35 LM: Syst.upd.Layer 1	LM: System update Layer 1
86.37 LM: Syst.upd.Layer 3	LM: System update Layer 3
86.47 LM: Unloading Mains	LM: Unloading mains / open MCB
86.85 LM: Enable close MCB	LM Enable close MCB
86.86 LM: LDSS enabled	TRUE if the result LM "12930 Load dependent start/stop" is true.

9.4.2.31 Group 87: LM Results 2

TRUE if the result of the corresponding LogicsManager equation is true.

HMI Text	Note
87.01 LM: Segment code bit 1	LM: Segment No. coding bit 1

HMI Text	Note
87.02 LM: Segment code bit 2	LM: Segment No. coding bit 2
87.03 LM: Segment code bit 3	LM: Segment No. coding bit 3
87.04 LM: Segment code bit 4	LM: Segment No. coding bit 4
87.23 LM: easYgen command 1	LM: easYgen command flag 1 in Layer 1
87.24 LM: easYgen command 2	LM: easYgen command flag 2 in Layer 1
87.25 LM: easYgen command 3	LM: easYgen command flag 3 in Layer 1
87.26 LM: easYgen command 4	LM: easYgen command flag 4 in Layer 1
87.27 LM: easYgen command 5	LM: easYgen command flag 5 in Layer 1
87.28 LM: easYgen command 6	LM: easYgen command flag 6 in Layer 1
87.35 LM: Open GGB unload	LM: Open GGB with unloading
87.36 LM: Open GGB immed.	LM: Open GGB immediately
87.37 LM: Enable close GGB	LM: Enable close GGB
87.51 LM: LED 1	
87.52 LM: LED 2	
87.53 LM: LED 3	
87.54 LM: LED 4	
87.55 LM: LED 5	
87.56 LM: LED 6	
87.57 LM: LED 7	
87.58 LM: LED 8	
87.90 LM: GC command 1	LM: GC command flag 1 in Layer 3
87.91 LM: GC command 2	LM: GC command flag 2 in Layer 3
87.92 LM: GC command 3	LM: GC command flag 3 in Layer 3
87.93 LM: GC command 4	LM: GC command flag 4 in Layer 3
87.94 LM: GC command 5	LM: GC command flag 5 in Layer 3
87.95 LM: GC command 6	LM: GC command flag 6 in Layer 3

9.4.2.32 Group 91: AnalogManager Internal values 1

TRUE if the boolean result of the corresponding AnalogManager equation is true.

HMI Text	Note
91.01 AM Internal value 1	
91.02 AM Internal value 2	
91.03 AM Internal value 3	
91.04 AM Internal value 4	
91.05 AM Internal value 5	
91.06 AM Internal value 6	
91.07 AM Internal value 7	

HMI Text	Note
91.08 AM Internal value 8	
91.09 AM Internal value 9	
91.10 AM Internal value 10	
91.11 AM Internal value 11	
91.12 AM Internal value 12	
91.13 AM Internal value 13	
91.14 AM Internal value 14	
91.15 AM Internal value 15	
91.16 AM Internal value 16	

9.4.2.33 Group 96: LM Internal flags 1

TRUE if the result of the corresponding LogicsManager equation is true.

HMI Text	Note
96.01 LM: Flag 1	LM Internal flag 1
96.02 LM: Flag 2	LM Internal flag 2
96.03 LM: Flag 3	LM Internal flag 3
96.04 LM: Flag 4	LM Internal flag 4
96.05 LM: Flag 5	LM Internal flag 5
96.06 LM: Flag 6	LM Internal flag 6
96.07 LM: Flag 7	LM Internal flag 7
96.08 LM: Flag 8	LM Internal flag 8
96.09 LM: Flag 9	LM Internal flag 9
96.10 LM: Flag 10	LM Internal flag 10
96.11 LM: Flag 11	LM Internal flag 11
96.12 LM: Flag 12	LM Internal flag 12
96.13 LM: Flag 13	LM Internal flag 13
96.14 LM: Flag 14	LM Internal flag 14
96.15 LM: Flag 15	LM Internal flag 15
96.16 LM: Flag 16	LM Internal flag 16
96.17 LM: Flag 17	LM Internal flag 17
96.18 LM: Flag 18	LM Internal flag 18
96.19 LM: Flag 19	LM Internal flag 19
96.20 LM: Flag 20	LM Internal flag 20
96.21 LM: Flag 21	LM Internal flag 21
96.22 LM: Flag 22	LM Internal flag 22
96.23 LM: Flag 23	LM Internal flag 23
96.24 LM: Flag 24	LM Internal flag 24

HMI Text	Note
96.25 LM: Flag 25	LM Internal flag 25
96.26 LM: Flag 26	LM Internal flag 26
96.27 LM: Flag 27	LM Internal flag 27
96.28 LM: Flag 28	LM Internal flag 28
96.29 LM: Flag 29	LM Internal flag 29
96.30 LM: Flag 30	LM Internal flag 30
96.31 LM: Flag 31	LM Internal flag 31
96.32 LM: Flag 32	LM Internal flag 32

9.4.2.34 Group 98: LM External DOs 1

TRUE if the result of the corresponding LogicsManager equation is true.

HMI Text	Note
98.01 LM: External DO 1	
98.02 LM: External DO 2	
98.03 LM: External DO 3	
98.04 LM: External DO 4	
98.05 LM: External DO 5	
98.06 LM: External DO 6	
98.07 LM: External DO 7	
98.08 LM: External DO 8	
98.09 LM: External DO 9	
98.10 LM: External DO 10	
98.11 LM: External DO 11	
98.12 LM: External DO 12	
98.13 LM: External DO 13	
98.14 LM: External DO 14	
98.15 LM: External DO 15	
98.16 LM: External DO 16	

9.4.2.35 Group 99: LM Internal DOs 1

TRUE if the result of the corresponding LogicsManager equation is true.

HMI Text	Note
99.01 LM: Ready for op. OFF	LM Relay 1 ready for operation (This flag has negative logic: if the LM flag is true, the relay is not energized.)
99.02 LM: Relay 2	
99.03 LM: Relay 3	

HMI Text	Note
99.04 LM: Relay 4	
99.05 LM: Relay 5	
99.06 LM: Relay 6	Fixed function for close GGB
99.07 LM: Relay 7	
99.08 LM: Relay 8	
99.09 LM: Relay 9	
99.10 LM: Relay 10	
99.11 LM: Relay 11	
99.12 LM: Relay 12	

9.4.3 Logical Outputs

The logical outputs or combinations may be grouped into three categories:

- Internal logical flags
- Internal functions
- Relay outputs
- LEDs

> 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

Name	Function	Number	ID
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
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

GC flags

6 internal logical GC 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".

These flags are transmitted via the loadshare bus. The flags of all GCs are received by the GCs and the LS-6XT. The flags (LM 52.01 to 52.96) can be used as inputs for the LogicsManager.

Name	Function	Number	ID
LM: GC Command 1	GC Command flag 1	87.90	11344
LM: GC Command 2	GC Command flag 2	87.91	11345
LM: GC Command 3	GC Command flag 3	87.92	11346
LM: GC Command 4	GC Command flag 4	87.93	11347
LM: GC Command 5	GC Command flag 5	87.94	11348
LM: GC Command 6	GC Command flag 6	87.95	11349

Internal functions

The following logical functions may be used to activate/deactivate functions.

Name	Function	Number	ID
LM: Ext. acknowledge	The alarm acknowledgement is performed from an external source (parameter ⮑ 12490)	86.15	10714
LM: System update Layer 1	Trigger a system update of devices "Layer 1" (parameter ⮑ 7801)	86.35	11974
LM: System update Layer 3	Trigger a system update of devices "Layer 3" (parameter ⮑ 12892)	86.37	11968
LM: Unloading Mains	(parameter ⮑ 12893)	86.47	11969
LM: Enable close MCB	(parameter ⮑ 12923)	86.85	11914
LM: LDSS enabled	(parameter ⮑ 12930)	86.86	11915
LM: Open GGB immed.	(parameter ⮑ 12947)	87.36	11425
LM: Enable close GGB	(parameter ⮑ 12948)	87.37	11426

Relay outputs

All relays may be controlled directly by the LogicsManager depending on the respective application mode.

Name	Function	Number	ID
LM: Ready for op. OFF (Relay 1)	LogicsManager; combined with 'Ready for operation OFF' If this logical output becomes true, the relay output 1 will be **de**activated	99.01	11870
LM: Relay 2	LogicsManager; pre-assigned with 'Horn' If this logical output becomes true, the relay output 2 will be activated	99.02	11871
LM: Relay 3	LogicsManager; pre-assigned with 'Warning alarm' If this logical output becomes true, the relay output 3 will be activated	99.03	11872
LM: Relay 4	LogicsManager; pre-assigned with 'Critical alarm' If this logical output becomes true, the relay output 4 will be activated	99.04	11873
(Relays 5 - 8)	Fixed (no LogicsManager)	-	-
LM: Relay 9	LogicsManager; not pre-assigned If this logical output becomes true, the relay output 9 will be activated	99.09	11878
LM: Relay 10	LogicsManager; not pre-assigned If this logical output becomes true, the relay output 10 will be activated	99.10	11879
LM: Relay 11	LogicsManager; not pre-assigned If this logical output becomes true, the relay output 11 will be activated	99.11	11880
LM: Relay 12	LogicsManager; not pre-assigned If this logical output becomes true, the relay output 12 will be activated	99.12	11881

External discrete outputs

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

LEDs

LEDs 1 - 8 may be controlled directly by the LogicsManager.

Name	Function	Number	ID
LM: LED 1	LogicsManager; pre-assigned with ' 02.11 Mains volt./freq. ok' If this logical output becomes true, LED 1 will be activated	87.52	11440
LM: LED 2	LogicsManager; pre-assigned with ' 02.08 Load bus volt/freq ok' If this logical output becomes true, LED 2 will be activated	87.52	11441
LM: LED 3	LogicsManager; pre-assigned with '04.07 MCB closed' If this logical output becomes true, LED 3 will be activated	87.53	11442

Name	Function	Number	ID
LM: LED 4	LogicsManager; pre-assigned with '04.16 GGB closed' If this logical output becomes true, LED 4 will be activated	87.54	11443
LM: LED 5	LogicsManager; pre-assigned with '04.21 Syn. MCB is active'' If this logical output becomes true, LED 5 will be activated	87.55	11444
LM: LED 6	LogicsManager; pre-assigned with '04.24 Syn. GGB is active' If this logical output becomes true, LED 6 will be activated	87.56	11445
LM: LED 7	LogicsManager; pre-assigned with '04.23 Closing MCB active' If this logical output becomes true, LED 7 will be activated	87.57	11446
LM: LED 8	LogicsManager; pre-assigned with '04.26 Closing GGB active' If this logical output becomes true, LED 8 will be activated	87.58	11447

9.4.4 Factory Settings

LogicsManager's default definition

ID	Name	Function
7801	System update Layer 1	(02.01 LM FALSE And True) And True
12110	Relay 2	(03.05 Horn And True) And True
12130	Relay 5	(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	((02.21 Load bus is dead) NOT And True) And True
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

ID	Name	Function
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
12270	Flag 5	(02.01 LM 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	(01.08 Warning alarm And True) And True
12320	Relay 4	(01.09 Critical alarm And True) And True
12330	External DO 1	(False And True) And True
12340	External DO 2	(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	(09.02 Discrete input 2 And True) And True
12560	Relay 11	(False And True) And True
12580	Ready for op. OFF (Relay 1)	(False And False) And True
12590	Relay 12	(False And True) And True
12892	System update Layer 3	(09.01 Discrete input 1 And True) And True
12893	Unloading mains/Open MCB	(09.04 Discrete input 4 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

ID	Name	Function
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
12923	Enable close MCB	(09.03 Discrete input 3 And True) And True
12930	LD start stop	(False And True) And True
12946	Open GGB unload	(02.01 LM FALSE And 02.01 LM FALSE) And 02.01 LM FALSE
12947	Open GGB immed.	(09.06 Discrete input 6 And True) And True
12948	Enable close GGB	(09.07 Discrete input 7 And True) And True
12962	LED 1	(02.11 Mains volt./freq. ok And True) And True
12963	LED 2	(02.08 Load bus volt/freq ok And True) And True
12964	LED 3	(04.07 MCB closed And True) And True
12965	LED 4	(04.16 GGB closed And True) And True
12966	LED 5	(04.21 Syn. MCB is active And True) And True
12967	LED 6	(04.24 Syn. GGB is active And True) And True
12968	LED 7	(04.23 Closing MCB active And True) And True
12969	LED 8	(04.26 Closing GGB active And True) And True
12979	easYgen command 1	(02.01 LM FALSE And True) And True
12980	easYgen command 2	(02.01 LM FALSE And True) And True
12981	easYgen command 3	(02.01 LM FALSE And True) And True
12982	easYgen command 4	(02.01 LM FALSE And True) And True
12983	easYgen command 5	(02.01 LM FALSE And True) And True
12984	easYgen command 6	(02.01 LM FALSE And True) And True
12992	GC command 1	(02.01 LM FALSE And True) And True
12993	GC command 2	(02.01 LM FALSE And True) And True
12994	GC command 3	(02.01 LM FALSE And True) And True
12995	GC command 4	(02.01 LM FALSE And True) And True
12996	GC command 5	(02.01 LM FALSE And True) And True
12997	GC command 6	(02.01 LM FALSE And True) And True

Table 67: Factory settings by ID: LogicsManager

Overview pre-configuation Relay Outputs

Simple (function)	Extended (configuration)	Result
[99.01] Relay 1 [R01] - Ready for operation OFF	(False And False) And True (Delay ON, Delay OFF = 0 s	FALSE

Simple (function)	Extended (configuration)	Result
Relay will be de-energized if unit is not ready for operation or the logics manager output is TRUE. Deactivated by default		
[99.02] Relay 2 [R02] - Horn / freely configurable Relay energizes if the internal condition 'Horn' is TRUE	(03.05 Horn And True) And True (Delay ON, Delay OFF = 0 s)	dependent on Logics Command Variable [03.05]
[99.03] Relay 3 [R03] - Warning alarm / freely configurable Relay energizes if the internal condition 'Warning alarm' is TRUE	(01.08 Warning alarm And True) And True (Delay ON, Delay OFF = 0 s)	dependent on Logics Command Variable [01.08]
[99.04] Relay 4 [R04] - Critical alarm / freely configurable Relay energizes if the internal condition 'Critical alarm' is TRUE	(Not 01.09 Critical alarm And True) And True (Delay ON, Delay OFF = 0 s)	dependent on Logics Command Variable [01.09]
[99.05] Relay 5 [R05] -Restricted to Command: Open GGB Relay energizes if 'Opening GGB active' is active.	(Restricted)	dependent on Logics Command Variable [04.25]
[99.06] Relay 6 [R06] -Restricted to Command: Close GGB Relay energizes if a 'Closing GGB active' is active.	(Restricted)	dependent on Logics Command Variable [04.26]
[99.07] Relay 7 [R07] - Restricted to Command: Open MCB Relay energizes if 'Opening MCB active' is active.	(Restricted)	dependent on application mode and Logics Command Variable [04.22]
[99.08] Relay 8 [R08] - Restricted to Command: Close MCB Relay energizes if 'Closing MCB active' is active.	(Restricted)	dependent on application mode and Logics Command Variable [04.23]
[99.09] Relay 9 [R09] - freely configurable No pre-configuration	(False And False) And True (Delay ON, Delay OFF = 0 s	dependent on configuration
[99.10] Relay 10 [R10] - Load bus is dead / freely configurable Relay energizes if the internal condition 'Load bus is dead' is TRUE	(02.21 Load bus is dead And False) And True (Delay ON, Delay OFF = 0 s	dependent on Logics Command Variable [02.21]
[99.11] Relay 11 [R11] - freely configurable No pre-configuration	(False And False) And True (Delay ON, Delay OFF = 0 s	dependent on configuration
[99.12] Relay 12 [R12] - freely configurable	(False And False) And True (Delay ON, Delay OFF = 0 s	dependent on configuration

Simple (function)	Extended (configuration)	Result
No pre-configuration		

9.5 AnalogManager Reference

9.5.1 AnalogManager Overview

To enhance flexibility of programming the functions of the Group Controller, an AnalogManager is used.

All analog values may be used as data sources for the flexible limit monitoring (refer to ⮑ "4.4.4 Flexible Limits").

- Every data source is indicated by a group number and a sub-number.
- Many values are available as "AnalogManager Variables" in SI units and as percentage values related to reference values.

AnalogManager Variables

Groups 1 to 79 make available even more than the already arranged analog variables out of the easYgen system.

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 calculation of cascading goes in the sequence from 80 to 99.

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 AnalogManagers.

The description/name of these analog variables starts always with 'AM ...'.

9.5.2 Data Sources AM

9.5.2.1 Group 01: Generator group values

The percentage value is related on the following values:

- generator group rated voltage

- system rated frequency
- generator group rated current
- power factor 1
- generator group rated active power
- generator group rated reactive power
- generator group rated active and generator group rated reactive power

HMI Text	Note
01.01 Gen.volt.L-N [%]	Generator group voltage wye average
01.02 Gen.volt.L1-N [%]	Generator group voltage L1-N
01.03 Gen.volt.L2-N [%]	Generator group voltage L2-N
01.04 Gen.volt.L3-N [%]	Generator group voltage L3-N
01.05 Gen.volt.L-L [%]	Generator group voltage delta average
01.06 Gen.volt.L1-L2 [%]	Generator group voltage L1-L2
01.07 Gen.volt.L2-L3 [%]	Generator group voltage L2-L3
01.08 Gen.volt.L3-L1 [%]	Generator group voltage L3-L1
01.09 Gen.frequency [%]	Generator group frequency
01.10 Gen.freq.L1-L2 [%]	Generator group frequency L1-L2
01.11 Gen.freq.L2-L3 [%]	Generator group frequency L2-L3
01.12 Gen.freq.L3-L1 [%]	Generator group frequency L3-L1
01.13 Gen.current [%]	Generator average current
01.14 Gen.current L1 [%]	Generator current L1
01.15 Gen.current L2 [%]	Generator current L2
01.16 Gen.current L3 [%]	Generator current L3
01.17 Gen.curr.max. L1 [%]	Dragged generator current L1
01.18 Gen.curr.max. L2 [%]	Dragged generator current L2
01.19 Gen.curr.max. L3 [%]	Dragged generator current L3
01.20 Gen. PF [%]	Generator power factor
01.21 Gen. PF L1 [%]	Generator power factor L1
01.22 Gen. PF L2 [%]	Generator power factor L2
01.23 Gen. PF L3 [%]	Generator power factor L3
01.24 Gen.act.power [%]	Total generator active power
01.25 Gen.act.pwr. L1 [%]	Generator active power L1-N
01.26 Gen.act.pwr. L2 [%]	Generator active power L2-N
01.27 Gen.act.pwr. L3 [%]	Generator active power L3-N
01.28 Gen.react.pwr. [%]	Total generator reactive power
01.29 Gen.react.pwr.L1 [%]	Generator reactive power L1-N
01.30 Gen.react.pwr.L2 [%]	Generator reactive power L2-N
01.31 Gen.react.pwr.L3 [%]	Generator reactive power L3-N

HMI Text	Note
01.32 Gen.app.power [%]	Total generator apparent power
01.33 Gen.app.pwr. L1 [%]	Generator apparent power L1-N
01.34 Gen.app.pwr. L2 [%]	Generator apparent power L2-N
01.35 Gen.app.pwr. L3 [%]	Generator apparent power L3-N
01.51 Gen.volt.L-N [V]	Generator group voltage wye average
01.52 Gen.volt.L1-N [V]	Generator group voltage L1-N
01.53 Gen.volt.L2-N [V]	Generator group voltage L2-N
01.54 Gen.volt.L3-N [V]	Generator group voltage L3-N
01.55 Gen.volt.L-L [V]	Generator group voltage delta average
01.56 Gen.volt.L1-L2 [V]	Generator group voltage L1-L2
01.57 Gen.volt.L2-L3 [V]	Generator group voltage L2-L3
01.58 Gen.volt.L3-L1 [V]	Generator group voltage L3-L1
01.59 Gen.frequency [Hz]	Generator group frequency
01.60 Gen.freq.L1-L2 [Hz]	Generator group frequency L1-L2
01.61 Gen.freq.L2-L3 [Hz]	Generator group frequency L2-L3
01.62 Gen.freq.L3-L1 [Hz]	Generator group frequency L3-L1
01.63 Gen.current [A]	Generator average current
01.64 Gen.current L1 [A]	Generator current L1
01.65 Gen.current L2 [A]	Generator current L2
01.66 Gen.current L3 [A]	Generator current L3
01.67 Gen.curr.max. L1 [A]	Dragged generator current L1
01.68 Gen.curr.max. L2 [A]	Dragged generator current L2
01.69 Gen.curr.max. L3 [A]	Dragged generator current L3
01.70 Gen. PF	Generator power factor
01.71 Gen. PF L1	Generator power factor L1
01.72 Gen. PF L2	Generator power factor L2
01.73 Gen. PF L3	Generator power factor L3
01.74 Gen.act.power [W]	Total Generator active power
01.75 Gen.act.pwr. L1 [W]	Generator active power L1-N
01.76 Gen.act.pwr. L2 [W]	Generator active power L2-N
01.77 Gen.act.pwr. L3 [W]	Generator active power L3-N
01.78 Gen.react.pwr. [var]	Total generator reactive power
01.79 Gen.react.pwr.L1[var]	Generator reactive power L1-N
01.80 Gen.react.pwr.L2[var]	Generator reactive power L2-N
01.81 Gen.react.pwr.L3[var]	Generator reactive power L3-N
01.82 Gen.app.power [VA]	Total generator apparent power
01.83 Gen.app.pwr. L1 [VA]	Generator apparent power L1-N
01.84 Gen.app.pwr. L2 [VA]	Generator apparent power L2-N

HMI Text	Note
01.85 Gen.app.pwr. L3 [VA]	Generator apparent power L3-N
01.88 Gen.act.power [kW]	Total Generator active power in kW
01.89 Gen.react.pwr. [kvar]	Total generator reactive power in kvar
01.90 Gen.app.power [kVA]	Total generator apparent power in kVA
02.86 Mains ext. pwr [kW]	Mains external measured active power by AI
02.87 Mains ext. pwr [kvar]	Mains external measured reactive power by AI

9.5.2.2 Group 03: Busbar 1 values

The percentage value is related on the following values:

- load busbar rated voltage
- system rated frequency

HMI Text	Note

9.5.2.3 Group 06: DC analog inputs

HMI Text	Note
06.01 Analog input 1	Analog input 1
06.02 Analog input 2	Analog input 2
06.03 Analog input 3	Analog input 3

9.5.2.4 Group 10: Internal values

HMI Text	Note
10.61 System nominal P [kW]	Active nominal power in system [kW]
10.62 System real P [kW]	Total real power in system [kW]
10.63 System.res.real P[kW]	Reserve real power in system [kW] Psyst.reserve = Psyst.nominal - Psyst.active
10.64 Act.power LSx [kW]	Active power LSx (Segment dependent)
10.65 React.power LSx[kvar]	Reactive power LSx (Segment dependent)
10.70 LSx freq.L-L [Hz]	LSx frequency L-L
10.71 LSx volt.L-L [V]	LSx voltage L-L
10.72 LSx volt.L-N [V]	LSx voltage L-N
10.86 Group nominal P [kW]	Active nominal power in own group [kW] (Group Segment 1)
10.87 Group real P [kW]	Total real power in own group [kW]

HMI Text	Note
	(Group Segment 1)
10.88 Group.res.real P [kW]	Reserve real power in own group [kW] (Group Segment 1)
10.91 Closed GCBs seg.1	Closed GCBs in segment 1 in own group

9.5.2.5 Group 13: Constants

HMI Text	Note
13.01 Free constant 1	Free constant 1
13.02 Free constant 2	Free constant 2
13.03 Free constant 3	Free constant 3
13.04 Free constant 4	Free constant 4
13.05 Free constant 5	Free constant 5
13.06 Free constant 6	Free constant 6
13.07 Free constant 7	Free constant 7
13.08 Free constant 8	Free constant 8
13.09 Free constant 9	Free constant 9
13.10 Free constant 10	Free constant 10
13.11 Free constant 11	Free constant 11
13.12 Free constant 12	Free constant 12
13.13 Free constant 13	Free constant 13
13.14 Free constant 14	Free constant 14
13.15 Free constant 15	Free constant 15
13.16 Free constant 16	Free constant 16

9.5.2.6 Group 16: Internal values 2

HMI Text	Note
16.01 P load in segm. [%]	Average active power from load sharing in own segment [%]
16.02 Q load in segm. [%]	Average reactive power from load sharing in own segment [%]
16.59 Closed GGBs own seg.	Number of all closed GGBs in the same GC segment
16.60 Closed GCBs own seg.	Number of all closed GCBs in all groups which are in the same GC segment.

9.5.2.7 Group 21: CAN1 Receive

HMI Text	Note
21.01 CAN1 RPDO1.1	CAN1 RPDO1.1

HMI Text	Note
21.02 CAN1 RPDO1.2	CAN1 RPDO1.2
21.03 CAN1 RPDO1.3	CAN1 RPDO1.3
21.04 CAN1 RPDO1.4	CAN1 RPDO1.4
21.05 CAN1 RPDO2.1	CAN1 RPDO2.1
21.06 CAN1 RPDO2.2	CAN1 RPDO2.2
21.07 CAN1 RPDO2.3	CAN1 RPDO2.3
21.08 CAN1 RPDO2.4	CAN1 RPDO2.4
21.09 CAN1 RPDO3.1	CAN1 RPDO3.1
21.10 CAN1 RPDO3.2	CAN1 RPDO3.2
21.11 CAN1 RPDO3.3	CAN1 RPDO3.3
21.12 CAN1 RPDO3.4	CAN1 RPDO3.4
21.13 CAN1 RPDO4.1	CAN1 RPDO4.1
21.14 CAN1 RPDO4.2	CAN1 RPDO4.2
21.15 CAN1 RPDO4.3	CAN1 RPDO4.3
21.16 CAN1 RPDO4.4	CAN1 RPDO4.4
21.17 CAN1 RPDO5.1	CAN1 RPDO5.1
21.18 CAN1 RPDO5.2	CAN1 RPDO5.2
21.19 CAN1 RPDO5.3	CAN1 RPDO5.3
21.20 CAN1 RPDO5.4	CAN1 RPDO5.4

9.5.2.8 Group 24: Free analog values

HMI Text	Note
24.01 Free analog value 1	Free analog value 1
24.02 Free analog value 2	Free analog value 2
24.03 Free analog value 3	Free analog value 3
24.04 Free analog value 4	Free analog value 4
24.05 Free analog value 5	Free analog value 5
24.06 Free analog value 6	Free analog value 6
24.07 Free analog value 7	Free analog value 7
24.08 Free analog value 8	Free analog value 8

9.5.2.9 Group 54: Modbus Master pulled flags

HMI Text	Note
54.01 Mapped AM value 1	
54.02 Mapped AM value 2	
54.03 Mapped AM value 3	

HMI Text	Note
54.04 Mapped AM value 4	
54.05 Mapped AM value 5	
54.06 Mapped AM value 6	
54.07 Mapped AM value 7	
54.08 Mapped AM value 8	
54.09 Mapped AM value 9	
54.10 Mapped AM value 10	
54.11 Mapped AM value 11	
54.12 Mapped AM value 12	
54.13 Mapped AM value 13	
54.14 Mapped AM value 14	
54.15 Mapped AM value 15	
54.16 Mapped AM value 16	
54.17 Mapped AM value 17	
54.18 Mapped AM value 18	
54.19 Mapped AM value 19	
54.20 Mapped AM value 20	
54.21 Mapped AM value 21	
54.22 Mapped AM value 22	
54.23 Mapped AM value 23	
54.24 Mapped AM value 24	
54.25 Mapped AM value 25	
54.26 Mapped AM value 26	
54.27 Mapped AM value 27	
54.28 Mapped AM value 28	
54.29 Mapped AM value 29	
54.30 Mapped AM value 30	
54.31 Mapped AM value 31	
54.32 Mapped AM value 32	
54.33 Mapped AM value 33	
54.34 Mapped AM value 34	
54.35 Mapped AM value 35	
54.36 Mapped AM value 36	
54.37 Mapped AM value 37	
54.38 Mapped AM value 38	
54.39 Mapped AM value 39	
54.40 Mapped AM value 40	
54.41 Mapped AM value 41	

HMI Text	Note
54.42 Mapped AM value 42	
54.43 Mapped AM value 43	
54.44 Mapped AM value 44	
54.45 Mapped AM value 45	
54.46 Mapped AM value 46	
54.47 Mapped AM value 47	
54.48 Mapped AM value 48	
54.49 Mapped AM value 49	
54.50 Mapped AM value 50	
54.51 Mapped AM value 51	
54.52 Mapped AM value 52	
54.53 Mapped AM value 53	
54.54 Mapped AM value 54	
54.55 Mapped AM value 55	
54.56 Mapped AM value 56	
54.57 Mapped AM value 57	
54.58 Mapped AM value 58	
54.59 Mapped AM value 59	
54.60 Mapped AM value 60	
54.61 Mapped AM value 61	
54.62 Mapped AM value 62	
54.63 Mapped AM value 63	
54.64 Mapped AM value 64	
54.65 Mapped AM value 65	
54.66 Mapped AM value 66	
54.67 Mapped AM value 67	
54.68 Mapped AM value 68	
54.69 Mapped AM value 69	
54.70 Mapped AM value 70	
54.71 Mapped AM value 71	
54.72 Mapped AM value 72	
54.73 Mapped AM value 73	
54.74 Mapped AM value 74	
54.75 Mapped AM value 75	
54.76 Mapped AM value 76	
54.77 Mapped AM value 77	
54.78 Mapped AM value 78	
54.79 Mapped AM value 79	

HMI Text	Note
54.80 Mapped AM value 80	
54.81 Mapped AM value 81	
54.82 Mapped AM value 82	
54.83 Mapped AM value 83	
54.84 Mapped AM value 84	
54.85 Mapped AM value 85	
54.86 Mapped AM value 86	
54.87 Mapped AM value 87	
54.88 Mapped AM value 88	
54.89 Mapped AM value 89	
54.90 Mapped AM value 90	
54.91 Mapped AM value 91	
54.92 Mapped AM value 92	
54.93 Mapped AM value 93	
54.94 Mapped AM value 94	
54.95 Mapped AM value 95	
54.96 Mapped AM value 96	
54.97 Mapped AM value 97	
54.98 Mapped AM value 98	
54.99 Mapped AM value 99	

9.5.2.10 Group 81: Results 1

Analog outputs of function-related AnalogManagers.

HMI Text	Note
81.19 AM Ext.mains act.pwr.	External measured mains active power
81.20 AM Ext.mains RPower	External measured mains reactive power

9.5.2.11 Group 82: Results 2

Analog outputs of function-related AnalogManagers.

HMI Text	Note
82.01 AM FlexLim 1 source	Flexible Limit 1 data source
82.02 AM FlexLim 2 source	Flexible Limit 2 data source
82.03 AM FlexLim 3 source	Flexible Limit 3 data source
82.04 AM FlexLim 4 source	Flexible Limit 4 data source
82.05 AM FlexLim 5 source	Flexible Limit 5 data source
82.06 AM FlexLim 6 source	Flexible Limit 6 data source

HMI Text	Note
82.07 AM FlexLim 7 source	Flexible Limit 7 data source
82.08 AM FlexLim 8 source	Flexible Limit 8 data source
82.09 AM FlexLim 9 source	Flexible Limit 9 data source
82.10 AM FlexLim 10 source	Flexible Limit 10 data source
82.11 AM FlexLim 11 source	Flexible Limit 11 data source
82.12 AM FlexLim 12 source	Flexible Limit 12 data source
82.13 AM FlexLim 13 source	Flexible Limit 13 data source
82.14 AM FlexLim 14 source	Flexible Limit 14 data source
82.15 AM FlexLim 15 source	Flexible Limit 15 data source
82.16 AM FlexLim 16 source	Flexible Limit 16 data source
82.17 AM FlexLim 17 source	Flexible Limit 17 data source
82.18 AM FlexLim 18 source	Flexible Limit 18 data source
82.19 AM FlexLim 19 source	Flexible Limit 19 data source
82.20 AM FlexLim 20 source	Flexible Limit 20 data source
82.21 AM FlexLim 21 source	Flexible Limit 21 data source
82.22 AM FlexLim 22 source	Flexible Limit 22 data source
82.23 AM FlexLim 23 source	Flexible Limit 23 data source
82.24 AM FlexLim 24 source	Flexible Limit 24 data source
82.25 AM FlexLim 25 source	Flexible Limit 25 data source
82.26 AM FlexLim 26 source	Flexible Limit 26 data source
82.27 AM FlexLim 27 source	Flexible Limit 27 data source
82.28 AM FlexLim 28 source	Flexible Limit 28 data source
82.29 AM FlexLim 29 source	Flexible Limit 29 data source
82.30 AM FlexLim 30 source	Flexible Limit 30 data source
82.31 AM FlexLim 31 source	Flexible Limit 31 data source
82.32 AM FlexLim 32 source	Flexible Limit 32 data source
82.33 AM FlexLim 33 source	Flexible Limit 33 data source
82.34 AM FlexLim 34 source	Flexible Limit 34 data source
82.35 AM FlexLim 35 source	Flexible Limit 35 data source
82.36 AM FlexLim 36 source	Flexible Limit 36 data source
82.37 AM FlexLim 37 source	Flexible Limit 37 data source
82.38 AM FlexLim 38 source	Flexible Limit 38 data source
82.39 AM FlexLim 39 source	Flexible Limit 39 data source
82.40 AM FlexLim 40 source	Flexible Limit 40 data source

9.5.2.12 Group 91: Internal Values 1

Analog outputs of function-related AnalogManagers.

HMI Text	Note
91.01 AM Internal value 1	Internal value 1
91.02 AM Internal value 2	Internal value 2
91.03 AM Internal value 3	Internal value 3
91.04 AM Internal value 4	Internal value 4
91.05 AM Internal value 5	Internal value 5
91.06 AM Internal value 6	Internal value 6
91.07 AM Internal value 7	Internal value 7
91.08 AM Internal value 8	Internal value 8
91.09 AM Internal value 9	Internal value 9
91.10 AM Internal value 10	Internal value 10
91.11 AM Internal value 11	Internal value 11
91.12 AM Internal value 12	Internal value 12
91.13 AM Internal value 13	Internal value 13
91.14 AM Internal value 14	Internal value 14
91.15 AM Internal value 15	Internal value 15
91.16 AM Internal value 16	Internal value 16

9.5.3 Reference Values

9.5.3.1 Generator Group Rated Voltage

Generator group voltage values

(Wye and Delta and average values)

User defined max. output value = 100% means, that the 100% refer to the “Generator group 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.

9.5.3.2 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.

9.5.3.3 System Rated Frequency

Generator group, Load busbar, Mains frequency values

User defined max. output value = 100% means, that the 100% refer to the “System rated 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 50 Hz are the nominal value and 50 Hz are measured. If only 40 Hz are measured this will result in an analog output value of 80% end scale.

9.5.3.4 Battery Voltage

Battery voltage

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.

9.5.3.5 Load Busbar Rated Voltage

Load busbar voltages (delta values)

User defined max. output value = 100% means, that the 100% refer to the “Load busbar rated voltage 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. If only 200 V are measured this will result in an analog output value of 50% end scale.

9.5.4 Factory Settings

AnalogManager's default settings

ID	Name	Operator	Default setting/value
5780	AM Ext.mains act.pwr (External mains active power)	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 Rpwr (External mains reactive power)	Analog1 ("A1 =")	06.02 Analog input 2
		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	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	Constant1 ("C1 =")	0
4257	AM FlexLim 4 source	Function Type ("Type =")	Pass through
4276	AM FlexLim 5 source	Logic1 "L1"	02.01 LM FALSE
4286	AM FlexLim 6 source	Logic2 "L2"	02.01 LM FALSE
4296	AM FlexLim 7 source	Operators	5
		Operators-Unary1	——–———
		Operators-Unary2	——–———
6006	AM FlexLim 8 source	Analog1 ("A1 =")	10.01 ZERO
6016	AM FlexLim 9 source	Analog2 ("A2 =")	10.01 ZERO
6026	AM FlexLim 10 source	Constant1 ("C1 =")	0
6026 + (N * 10)	AM FlexLim 10 + N source (N = 1, 2, ...30)	Function Type ("Type =")	Pass through
...	...	Logic1 "L1"	02.01 LM FALSE
6326	AM FlexLim 40 source	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		

ID	Name	Operator	Default setting/value
9696	AM Internal value 15		
9700	AM Internal value 16		

Table 68: Factory settings: AnalogManager

9.6 Event And Alarm Reference

9.6.1 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.

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 ⮱▷ “4.2.3.1 Password System - Parameter Overview”).

Two ways to reset Event History

- **ToolKit**: Click the »Clear all « button at [STATUS MENU / Diagnostic: Event History].

  (Read Event History at the same page)

- **Parameter/remote**:Set parameter ⮱▷ 1706»Clear eventlog«) to "TRUE" (1)

The complete event history is now being cleared

9.6.2 Event Message

Message text	ID	Meaning
Start up power	14778	Start up power supply
easYgen LS timeout	2440	easYgen loadshare timeout detected. This event log entry can be enabled by parameter "2442 Load share timeout event ".
LSx LS timeout L1	2441	LSx loadshare layer 1 timeout detected. This event log entry can be enabled by parameter "2442 Load share timeout event ".
Red. LS timeout L1	2443	Redundancy loadshare layer 1 timeout detected. This event log entry can be enabled by parameter "2442 Load share timeout event ".
GC LS timeout	2444	GC loadshare timeout detected. This event log entry can be enabled by parameter "2446 Load share timeout event ".
LSx LS timeout L3	2445	LSx loadshare layer 3 timeout detected. This event log entry can be enabled by parameter "2446 Load share timeout event ".

Message text	ID	Meaning
Red. LS timeout L3	2447	Redundancy loadshare layer 3 timeout detected. This event log entry can be enabled by parameter "2446 Load share timeout event ".
System update	14763	System update is active

9.6.3 Alarm Classes

An alarm class triggered in the GC will not trigger any action such as opening a breaker. It activates logical command variables that can be assigned to a function via LogicsManagers. Some of these variables are assigned to relays by default.

Each alarm class causes an entry in the 'Alarm Status' list and in the 'Event History'.

(The 'Alarm class' **Control** issues only a command variable 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 'Enable' condition.)

In addtion to command variable '01.07 All alarm classes' the following command variables are activated:

- Alarm class **A**: '01.08 Warning alarm' + **'1.01 Alarm class A'**
- Alarm class **B**: '01.08 Warning alarm' + **'1.02 Alarm class B'** + '01.10 Centralized Alarm' + '03.05 Horn'[1]
- Alarm class **C**: '01.09 Critical alarm' + **'1.03 Alarm class C'** + '01.10 Centralized Alarm' + '03.05 Horn'[1]
- Alarm class **D**: '01.09 Critical alarm' + **'1.04 Alarm class D'** + '01.10 Centralized Alarm' + '03.05 Horn'[1]
- Alarm class **E**: '01.09 Critical alarm' + **'1.05 Alarm class E'** + '01.10 Centralized Alarm' + '03.05 Horn'[1]
- Alarm class **F**: '01.09 Critical alarm' + **'1.06 Alarm class F'** + '01.10 Centralized Alarm' + '03.05 Horn'[1]

[1] The activation of '03.05 Horn' depends on parameter ⮡ 1756.

9.6.4 Alarm Messages

9.6.4.1 No alarm

Message text	ID	Meaning
No alarm active	13328	There is no alarm active.

9.6.4.2 Generator monitoring

Message text	ID	Meaning
Gen. overcurrent 1	2218	Generator overcurrent, limit value 1 The generator current has exceeded the limit value 1 for the generator overcurrent.
Gen. overcurrent 2	2219	Generator overcurrent, limit value 2 The generator current has exceeded the limit value 2 for the generator overcurrent.
Gen. overcurrent 3	2220	Generator overcurrent, limit value 3 The generator current has exceeded the limit value 3 for the generator overcurrent.
Inv. time overcurr.	4038	Generator inverse time-overcurrent The generator current has exceeded the limit based on the inverse time overcurrent setting.
Gen.Gr. ph.rot.mism.	3955	Generator group rotating field mismatch The generator rotating field does not correspond with the configured direction.

9.6.4.3 Mains monitoring

Message text	ID	Meaning
Mns.ph.rot. mismatch	3975	Mains rotating field mismatch The mains rotating field does not correspond with the configured direction.

9.6.4.4 Breaker Monitoring

Message text	ID	Meaning
GGB fail to open	3090	Failed GGB open The GC is still receiving the reply "GGB closed" after the GGB open monitoring timer has expired.
GGB fail to close	3089	Failed GGB close The GC is still receiving the reply "GGB opened" after the configured maximum number of close attempts and failed.
Timeout syn. GGB	3084	GGB synchronization time exceeded The easYgen has failed to synchronize the GGB within the configured synchronization time.
GGB unload mismatch	3124	GGB unloading mismatch While unloading GGB the defined limit of load is not reached in the defined time.
GGB plausibility	10326	GGB close feedback does not match with the conditions of connected AC measurements.

Message text	ID	Meaning
MCB fail to close	2623	MCB failed to close The GC has attempted to close the MCB the configured maximum number of attempts and failed. Depending on the configuration, the GC 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 GC 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.
Ph.rotation mismatch	2944	Generator group voltage / Mains voltage phase rotation difference. Generator group and mains have different rotating fields. A breaker closure is blocked.

9.6.4.5 CANopen Monitoring

Message text	ID	Meaning
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.

9.6.4.6 Ethernet Communication Monitoring

Message text	ID	Meaning
Ethernet issue	11852	Abnormal rate of Ethernet messages. The device detects an abnormal high rate of Ethernet UDP-messages per time scale.
Eth. configuration	15055	Wrong configuration of Ethernet network address performed.

9.6.4.7 Multi-unit Monitoring

Message text	ID	Meaning
Parameter alignment	4073	LDSS parameter mismatch detected The Group Controller has detected that not all LDSS parameters are configured identically at all participating GC units. Refer in the manual to the chapter "LDSS Parameter Alignment Check" to see the relevant LDSS parameter.

Message text	ID	Meaning
Missing easYgen	4059	Missing easYgen At least one easYgen or easY-I is missing. Check the status of the communication diagnostic.
Missing LSx Layer 1	4069	Missing LSx device in layer 1 region At least one LSx device in layer 1 region is missing. Check the status of the communication diagnostic.
Missing LSx Layer 3	4159	Missing LSx device in layer 3 region At least one LSx device in layer 1 region is missing. Check the status of the communication diagnostic.
Missing GC	4043	Missing Group Controller At least one GC is missing. Check the status of the communication diagnostic.
Group not ok	2437	There is a communication issue in the group. Check the status of the communication diagnostic inside of the particular group.
Syst.update Layer1	4197	System update Layer 1 The communication topology within of communication Layer 1 has changed. Check the communication easYgen and/or easY-I respectively LSx devices in Layer 1.
Syst.update Layer3	4198	System update Layer 3 The communication topology within of communication Layer 3 has changed. Check the communication GC respectively LSx devices in Layer 3.
CAN EthA redundancy	2439	The Load share interface CAN / Ethernet A redundancy is lost. The device warns that the Ethernet redundancy CAN/EthA is lost. Check the communication diagnostic screen of the layer 1.
EthB EthC redundancy	2430	The Load share interface Ethernet B / Ethernet C redundancy is lost. The device warns that the Ethernet redundancy B/C is lost. Check the communication diagnostic screen of the according layer.
CAN LS fault	2431	The Load share and control bus communication over CAN has a fault. The expected CAN messages are not recognized. Refer to the communication diagnostic screen for more information.
Ethernet A LS fault	2432	The Load share and control bus communication over Ethernet A port has a fault. The expected UDP messages are not recognized. Refer to the communication diagnostic screen for more information.
Ethernet B LS fault	2433	The Load share and control bus communication over Ethernet A port has a fault. The expected UDP messages are not recognized. Refer to the communication diagnostic screen for more information.
Ethernet C LS fault	2434	The Load share and control bus communication over Ethernet A port has a fault. The expected UDP messages are not recognized. Refer to the communication diagnostic screen for more information.

9.6.4.8 Flexible Limits Monitoring

Message text	ID	Meaning
		40 flexible limits. This text may be assigned customer defined. The Indication here is the default text.
Flexible limit 1	10018	
Flexible limit 2	10019	
Flexible limit 3	10020	
Flexible limit 4	10021	
Flexible limit 5	10022	
Flexible limit 6	10023	
Flexible limit 7	10024	
Flexible limit 8	10025	
Flexible limit 9	10026	
Flexible limit 10	10027	
Flexible limit 11	10028	
Flexible limit 12	10029	
Flexible limit 13	10030	
Flexible limit 14	10031	
Flexible limit 15	10032	
Flexible limit 16	10033	
Flexible limit 17	10034	
Flexible limit 18	10035	
Flexible limit 19	10036	
Flexible limit 20	10037	
Flexible limit 21	10038	
Flexible limit 22	10039	
Flexible limit 23	10040	
Flexible limit 24	10041	
Flexible limit 25	10042	
Flexible limit 26	10043	
Flexible limit 27	10044	
Flexible limit 28	10045	
Flexible limit 29	10046	
Flexible limit 30	10047	
Flexible limit 31	10048	
Flexible limit 32	10049	
Flexible limit 33	10050	
Flexible limit 34	10051	
Flexible limit 35	10052	

Message text	ID	Meaning
Flexible limit 36	10053	
Flexible limit 37	10054	
Flexible limit 38	10055	
Flexible limit 39	10056	
Flexible limit 40	10057	
Discrete input 1	10600	
Discrete input 2	10601	
Discrete input 3	10602	
Discrete input 4	10603	
Discrete input 5	10604	
Discrete input 6	10605	
Discrete input 7	10607	
Discrete input 8	10608	
Discrete input 9	10609	
Discrete input 10	10610	
Discrete input 11	10611	
Discrete input 12	10612	

9.6.4.9 Wire Break Monitoring (of internal and external analog inputs)

Message text	ID	Meaning
		Wb: Analog input 1-3, wire break During the measurement of the analog input a wire break was detected. The text begins with Wb: for wire break. The second part of the text may be assigned customer defined. The Indication here is the default text.
Wb:Analog input 1	10014	
Wb:Analog input 2	10015	
Wb:Analog input 3	10060	

9.6.4.10 Miscellaneous Monitoring

Message text	ID	Meaning
Bat. overvoltage 1	10007	Battery overvoltage, limit value 1 The battery voltage has exceeded the limit value 1 for battery overvoltage.
Bat. overvoltage 2	10008	Battery overvoltage, limit value 2 The battery voltage has exceeded the limit value 2 for battery overvoltage.
Bat. undervoltage 1	10005	Battery undervoltage, limit value 1 The battery voltage has fallen below the limit value 1 for battery undervoltage.

Message text	ID	Meaning
Bat. undervoltage 2	10006	Battery undervoltage, limit value 2 The battery voltage has fallen below the limit value 2 for battery undervoltage.
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).
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).
CPU overload R1 trip	14799	A CPU overload has occured. With the CPU overload the self-test relais R1 was tripped.

9.7 Additional Application Information

9.7.1 Synchronization Of Generator Group (GGB) or Mains (MCB)

Synchronization Table

The table below gives an overview about the synchronization possibilies of the generator group or mains to the load busbar.

Drawing index:

- Yes: The synchronization is executed
- blocked: The synchronization is blocked
- n.a.: not applicable (not possible to configure)
- 1) Not allowed:

  The neutral could not be located in the middle of the delta voltages
- 2) Not allowed :

  These constellations are not applicable

Gen. group or Mains \ Load busbar		1Ph2W			
		Ph-Ph		Ph-N	
		left	right	left	right
1Ph2W Ph-Ph	left	Yes	n.a.	n.a.	n.a.
	right	n.a.	Yes	n.a.	n.a.
1Ph2W Ph-N	left	n.a.	n.a.	Yes	n.a.
	right	n.a.	n.a.	n.a.	Yes
3Ph4W 3Ph4W OD	left	Yes	blocked	Yes	blocked
	right	blocked	Yes	blocked	Yes
3Ph3W	left	Yes	blocked	Not allowed 1)	blocked
	right	blocked	Yes	blocked	Not allowed 1)
1Ph3W (Ph-N)		Not allowed 2)	Not allowed 2)	Yes	Yes

Fig. 146: GC Synchronization Table - generator group or mains to the load busbar

9.7.2 Safety measures (UL mandatory)

General

This chapter provides recommendations on how to configure the GC-3000XT device in order to meet the requirements for safety functions in accordance with UL6200 certification. Refer to the table below.

Table for check marks

Item	Measure	OK
1	The relay output R1 "Ready for operation" (Self-test relay) must be wired in series with an emergency stop function. This means that it must be ensured that the generator circuit	☐

Item	Measure	OK
	breaker is opened, and the engine is stopped if this relay output is de-energize. It is recommended to signal this fault independently from the unit if the availability of the genset is important.	
2	• Two feedback lines should be used to achieve a higher level of safety for the breaker feedback. This makes it possible to detect at any time whether there is a wire break or similar defect. For more information refer to ⮱ "6.4.9.3 Digital input monitoring (GGB reply)". • When you have configured discrete inputs with monitoring functions (alarm class B to F) select the normally closed logic (n.c.). This ensures that wire break is considered. If you cannot use n.c. logic, take a redundant sensing on another DI or AI into account. • When you have a DI command from the power management system which is crucial for the functionality, like close or open GGB, monitor the successful execution.	☐
3	If the GGB shall be opened by the GC-3000-XT, the GGB fail to open alarm must be routed to R1 output "Ready for operation" (Self-test relay, refer to item 1). • Enable the GGB monitoring alarm. ⮱ 3085 • Include into the LogicsManager of the relay 1 "Ready for op. OFF" ⮱ 12580 the "08.35 GGB fail to open" alarm or place a second relay to force the opening of the breaker. • Additionally, in case of multiple generator operation with a "08.35 GGB fail to open" alarm you must switch the load share segment on a not used segment. So, the other devices are not negative influenced by a potential wrong feedback.	☐
4	Further monitoring functions in the GC-3000XT are to consider for security purposes: • Generator group / Load Busbar voltage monitoring (⮱ 1770 • Generator group voltage monitoring (⮱ 1770, ⮱ 5800), (⮱ 5801. This can be conducted with 4 flexible limits initiating a warning alarm. For more information refer to ⮱ "6.4.9.1 Generator group and Load busbar voltage monitoring" • Generator group frequency monitoring (⮱ 5802, ⮱ 5803) • Generator group current monitoring (⮱ 2200, ⮱ 2206 , ⮱ 2212, ⮱ 4030) • Generator unload mismatch monitoring (⮱ 3120) • Generator phase rotation monitoring (⮱ 3954) In case of Application mode **GCB/MCB** additionally: • Mains phase rotation monitoring (⮱ 3974) • Mains voltage monitoring (⮱ 5810, ⮱ 5811) This can be conducted with 2 flexible limits initiating a warning alarm. For more information refer to "⮱ "6.4.9.2 Mains voltage monitoring". • Monitor with the PMS a correct Import/Export power regulation at the interchange point if the function is configured on GC.	☐
5	Recommended monitoring functions in the GC-3000-XT for availability purposes: • Power supply (Battery) voltage monitoring (⮱ 3500, ⮱ 3506) • GGB close monitoring (⮱ 3085) • Analog inputs operating range monitoring	☐
6	Communication interface monitoring: • Load share bus (CAN/Ethernet) Missing Member monitoring (⮱ 4060, ⮱ 4136) • CAN2 expansion board by CAN interface 2 timeout monitoring (⮱ 16187)	☐

Item	Measure	OK
	• CAN1 RPDO timeout monitoring (⮡ 3150)	

10 List Of Abbreviations

AC	Alternating current
AI	Analog input
AM	AnalogManager
AO	Analog output
AVR	Automatic voltage regulator
BDEW	German community of 1,800 companies represented by the German Association of Energy and Water Industries (Bundesverband der Energie- und Wasserwirtschaft)
BMS	Battery management system
CB	Circuit Breaker
CCW	Counter clock wise
CL	Code Level
COB-ID	Communication Object Identifier (CAN)
CT	Current Transformer
CW	Clock wise
DBCL	Dead bus closure
DI	Discrete Input
DO	Discrete (Relay) Output
DEF	Diesel exhaust fluid
DPF	Diesel Particulate Filter
ECU	Engine Control Unit
EG	Name of device ‘easYgen’
EIO	Emergency inducement override
EX-10	Woodward excitation module “easYgen | exciter 10"
FMI	Failure Mode Indicator (J1939)
FRT	Fault ride through
GAP	Graphical Application Programmer (GAP™)
GC	Name of device ‘Group Controller’
GCB	Generator Circuit Breaker
GCP	Woodward device series (Genset Control) - not preferred for new design!
GGB	Generator Group Breaker
GOV	(speed) Governor; rpm regulator

Hc	Hydrocarbon
HMI	Human Machine Interface e.g., a front panel with display and buttons for interaction
I	Current
IOP	Island Operation
LDSS	Load-Dependent Start/Stop operation
LM	LogicsManager©
LS	Load share
LSG	Woodward device: Load Share Gateway (communication converter)
LS5	Name of a device LS-5
LSx	Name of a device LS-5 or LS-6XT
MCB	Mains Circuit Breaker
MFR	Woodward device series (multifunctional relays) - not preferred for new design!
MOP	Mains Operation in Parallel
MPU	Magnetic Pickup Unit
MS	Mobile systems
N.C.	Normally Closed (break) contact
N.O.	Normally Open (make) contact
NC	Neutral Contactor
NOx	Nitrogen oxide
NW	Network
OC	Occurrence Count
P	Active power
P/N	Part Number
PDO	Process Data Object (CAN)
PF	Power Factor
PGN	Parameter Group Number (J1939)
PID	Proportional and Integral and Differential
PLC	Programmable Logic Control
PT	Potential (Voltage) Transformer
PV	Photovoltaic
Q	Reactive power
S	Apparent power

SAE	Society of Automotive Engineers (defines J1939 CAN protocol standard)
SCR	Selective Catalytic Reduction
SDO	Service Data Object (CAN)
S/N	Serial Number
SNTP	Simple Network Time Protocol
SOC	State of charge
SOH	State of health
SP	Setpoint
SPN	Suspect Parameter Number (J1939)
V	Voltage
va	Unit of apparent power (S). Often also as kva
var	Unit of reactive power (Q). Often also as kvar
W	Unit of active power (P). Often also as kW
Wb	Wire break

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