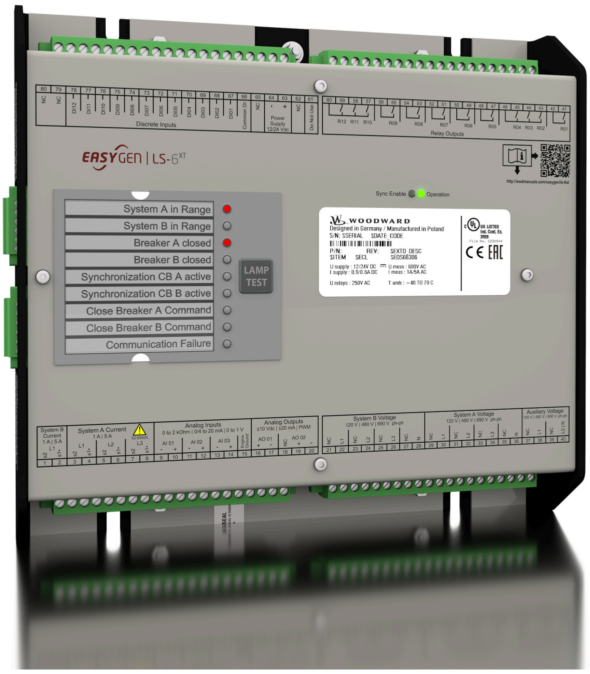
Released

easYgen|LS-6XT

Technical Manual | Circuit Breaker Control



easYgen|LS-612XT-P1

Release 2.14-0

Document ID: B37914, Revision G - Build Build 54351

Manual (original)

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

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Brief Overview

The LS-6XT Series are circuit breaker control units for engine-generator system management applications.

> The control units can be used stand-alone or in applications in combination with Woodward easYgen-3400/3500XT genset control units and/or easYgen | GC-3400XT .

> For a listing of all available application modes please refer to “6 Application Field”.

Scope of delivery

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

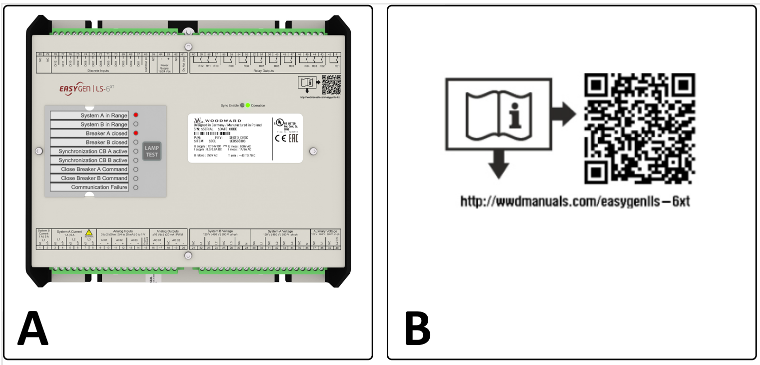

Fig. 1: *easYgen LS-612XT*

A Device easYgen | LS-6XT. All screwable terminal connectors are delivered with plug and jack.

B IPS (Installation Procedure Supplement) and printed QR Code sticker - 2 x

> Configuration files and Technical Manual are available on device internal memory. Opening USB connection via ToolKit to the LS-6XT offers read access to the files listed below but with status "delivery" -- please be aware that these files are not updated. The latest versions are available at the Woodward web site.
>
> Files stored at LS-6XT device:
>
> - Configuration
>   - msi-file (installing application files and ToolKit)
>   - eds-file (zipped)
> - Technical Manual (PDF)

QR Code

To get access to the complete product documentation, scan this QR code or use the following link: ⟹ http://wwdmanuals.com/easygenlls-6xt.

Naming convention

To keep the simplicity in reading **easYgen | LS-6XT** is referred as "**LS-6XT**"

Table of Contents

1 General Information

1.1 About This Manual

1.1.1 Revision History

Rev.	Date	Editor	Changes in chronological descending order
G	2024-08	Lu	**Document update** • Added chapter 'Safety measures (UL mandatory)' • Added chapter 'Digital input monitoring (CBA reply)'
F	2024-05	MK	**Document update** • Deleted 'pending' at type approvals • Updated marine environmental categories
E	2024-02	AS	**NEW Software Revision Release 2.14-0 or higher** **NEW features & functions** • Introduction of the Ethernet Interconnectivity Function (refer to {?Configure_XT_Interconnectivity_LS6}. • External reactive power measurement for System A and System B. ◦ System A ⮱ "4.6.2.3 External reactive power" ◦ System B ⮱ "4.6.3.3 External reactive power" • Introduction of a Modbus Master functionality. ⮱ "6.10.5 Modbus master" • 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 of the online diagram at the Homepage changed. • Introduction of Logic Commands for an AMF functionality. ⮱ "4.4.2.8 Configure Logic commands" • The circuit-breaker replies handling can be configured as "normally closed" or "normally open". (refer to CBA ⮱ 3476, CBB ⮱ 3474) • Configuration: The parameter "Parameter update rate" is now accessible in ToolKit (refer to ⮱ 1896). • 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 ⮱ "6.6.4 Tips for commissioning load share communication via Ethernet". ◦ Refer to ⮱ "6.8 Ethernet Communication - General Measures to optimize bus load on LS-6 devices". • Introduction of System plausibility monitoring (refer to ⮱ "4.5.5.11 System plausibility". • The LS-6XT provides a "Reboot" function in ToolKit and HMI. (refer to ⮱ "4.3.6 Reboot Function". • QR code in the HMI (VNC) shows the access to the online documentation. Navigate to "Next page/Diagnostic/Miscellaneous/ Online Documentation".

Rev.	Date	Editor	Changes in chronological descending order
			• The CAN Timeout handling is improved. Now it can be clear determined when the CAN Loadhare data shall be declared invalid 9990. • The 5300 Modbus protocol contains now the system A energy counter and the breaker closure counter CBA and CBB. • Introduction of a new CAN protocol 5303 to provide IKD information “9.3.4 Protocol 5303 (Basic Visualization)”. **Corrections/Repairs** • The synchroscope displays the maximum values if the 3-phase synchronization is active. • The LS-6XT removes the "Open wish request" flag over the load share bus if the breaker open command is active. • The LS-6XT installed inside the GC group indicates now in the overview page the GC instead of an easYgen32.
D	2022-10	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/easygenlls-6xt. **NEW features & functions** • The LS-6XT allows to connect up to **2** IKDs on **CAN 1** interface. “2.6 External I/O module IKD1, IKD-IN-16 and IKD-OUT-16” • The AM group 10 provides generator values with have a connection to System B. • The communication timeout limit for CAN load share and control messages is now configurable (refer to 9999).
C	2022-01	AS	**NEW Software Revision Release 2.10-2 or higher** **Corrections/Repairs** • The unloading function works now even if the synchronization mode is "Off". • Toolkit latest alarm shows now "No alarm active" instead of "---" if no alarm is active. • The operating alarm 3 and 5 (deadbus closure CBA/CBB) considers now the running mains settling time. “4.5.5.9 Operating range failure” • Breaker open failure doesn't blocks now the opening from other devices. The device with an active open failure removes the breaker open wish. • Additional possibilities to leave the breaker open state. Breaker CBA “4.4.2.1.7 Open CBA” Breaker CBB “4.4.2.1.8 Open CBB”
B	2020-09	AS	**NEW Software Revision Release 2.10-1 or higher** **Corrections/Repairs** • Installation / Power Measuring Changed sign of the power measurement according to the CT connection of the easYgen platform. “3.2.6 Power Measuring” • Connect synchronous mains considers now the mains settling time • Changed protocols 5300, 5301, 5302 50112 Added Alarms DI 9-12 (see ID10132) 50086 Included States DI1-12

Rev.	Date	Editor	Changes in chronological descending order
			50068 Added Aux.Voltage operating range flags
A	2020-06	AS	Technical Manual - 1st issue • Describing device software release 2.10-0

1.2 Depiction Of Notes And Instructions

Safety instructions

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

DANGER!

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

WARNING!

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

CAUTION!

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

NOTICE!

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

Tips and recommendations

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

Additional markings

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

Marking	Explanation
⚙	Start of a procedure list
>	Prerequisite for a procedure list
▷	Step-by-step instructions
▶	Results of action steps
↳▷	References to sections of these instructions and to other relevant documents
•	Listing without fixed sequence
☼	Example
»Buttons«	Operating elements (e.g. buttons, switches), display elements (e.g. signal lamps)
»Display«	Screen elements (e.g. buttons, programming of function keys)
[Screen xx / Screen xy / Screen xz] ...	Menu path. The following information and setting refer to a page on HMI screen or ToolKit located as described here.
TKit HMI	Some parameters/settings/screens are available only either in ToolKit **or** in HMI/display.

Dimensions in Figures

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

1.2.1 Copyright And Disclaimer

Disclaimer

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

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

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

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

1.2.2 Service And Warranty

Our Customer Service is available for technical information.

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

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

Warranty terms

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

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

1.3 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.

1.3.1 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.

1.3.2 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".

1.3.3 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 Display And Status Indicators

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

Restrictions

Full access to all parameters and settings with ToolKit only!

LEDs Indicate State of Metal Housing Variant

The LS-612XT-P1 variant is coming with two DUO LEDs red/green/orange (orange = red/green simultaneously) and nine LEDs red.

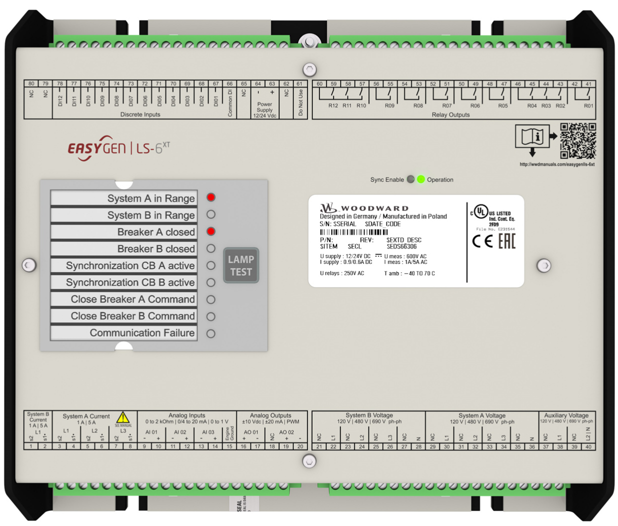


Fig. 2: LS-612XT-P1 metal housing

LEDs on top view

- »Sync. Enable« for device state indication:
  - Off: the synchronization is not active
  - Green: indicates the CBA or CBB synchronization close pulse.
- »Operation« for device state indication (the states are listed by the priority order):
  - Off: the unit is not ready for operation
  - Green: the unit is ready for operation
  - Toggling red/green: warning alarm (alarm class A, or B) is active

- Red: critical alarm (alarm class C, D, E or F) is active
- Toggling green/off: the "System update" procedure is active
- Toggling green: loading "Default settings" is active

LEDs closed to the Paper strip

The LEDs 1 to 8 can be configured via LogicsManager, they are preconfigured as

- System A in range
- System B in range
- Breaker A is closed
- Breaker B is closed
- Synchronization CBA is active
- Synchronization CBB is active
- Close breaker A command
- Close breaker B command

LED 9 is fixed as

- Communication failure

For the LEDs configuration refer to ⮑ "4.8.3 Configure LEDs"

For paper strip refer to ⮑ "9.1 Paper strip"

2.2 Application Layer Overview

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

For detailed information on the application modes and special applications refer to ⮑ "6 Application Field".

Application layer	Function
Layer 1	Genset Layer This application layer provides the following functions: • Communication with easYgen-3000XT and other LS-6XT • Breaker mode "CBA" or "CBA/CBB" (application mode LSx) • Special application modes, like L-MCB, L-GGB or L-MCB/GGB • Mains failure detection with mains decoupling

Application layer	Function
Layer 3	Plant Layer This application layer provides the following functions: • Communication with group controller (GC) and other LS-6XT • Breaker mode "CBA" or "CBA/CBB" (application mode LSx) • Mains failure detection with mains decoupling (GCB)

2.3 Packages

There are two different packages for the LS6 available. The following table indicates the difference between those two packages.

Function	LS-612XT-P1	LS-612XT-P2
External discrete inputs	Up to 2 IKDs (16 DI, 16 DO) connected on CAN1.	Up to 4 IKDs (32 DI, 32 DO) connected on CAN1 or CAN2.
EasYlite-200	n/a	Up to 2 easYlite connected on CAN1 or CAN2.
Current and Load monitoring	n/a	• Overcurrent • Inverse time overcurrent • Voltage restraint overcurrent • Import-/Export power • Unbalanced load
Active synchronization	n/a	Active synchronization with frequency and voltage adjustment. The variable system is selectable.

2.4 Operation Modes

The LS-6XT offers two operation modes:

- AUTO
- MANUAL (MAN)
- ... and an internal (non) operating phase during the start-up of the device.

For more information about the operation modes please see “5.2 Change Operating Modes”.

2.5 Synch. Check Functionality

General notes

To use the LS-6XT synchronization check functionality (Sync. Check) there are three command variables available for the LogicsManager™ system:

- **02.29 Sync. Condition**
- **02.30 Dead Bus Closure Condition**
- **02.28 Sync. Check Relay**

WARNING!

No dead bus interlocking!

Synch. Check is intended to be a redundant check function enhancing system security. Don't use for CBA or CBB control!

The Sync. Check functionality is available in every application mode, but be aware that some application modes can change parameters being relevant for this functionality. The according application modes are L-MCB (A03), L-GGB (A04) and L-GGBMCB (A05)

Synchronization mode is always “Phase Matching” (Parameters ⮡ 5730 'Synchronization CBA' and ⮡ 5729 'Synchronization CBB' are not considered).

Synch. Check command variables do not consider the following:

- System conditions like blocking from other devices e.g. dead bus interlocking
- Synchronization signals from discrete inputs (DI) like enable close CBA or open CBA
- Synchronization control conditions like mains settling time

Variables and Parameters

02.29 Sync Condition

depends on

- Voltage,
- Frequency and
- Phase angle.

The command variable Sync Condition 02.29) is true, if the "System A is okay", "System B is okay" and the phase matching synchronisation conditions are met according to:

The following parameters

- Pos. freq. differential CBA (parameter ⮡ 5711) and Neg. freq. differential CBA (parameter ⮡ 5712)
- Voltage differentilal CBA (parameter ⮡ 5710)

- Max. positive phase angle CBA (parameter ⮱▷ 5713) and Max. negative phase angle CBA (parameter ⮱▷ 5714)
- Phase matching CBA dwell time (parameter ⮱▷ 5717)

For more details refer to ⮱▷ "4.4.2.3 Configure CBA".

02.30 Dead Bus Closure Condition

depends on

- Voltage System A and System B and
- Dead Bus configuration.

The command variable Dead Bus Closure Condition (02.30) is true, if the dead bus closure conditions are met.

For more details refer to ⮱▷ "4.4.2.2.3 Dead Bus Closure".

02.28 Sync. Check Relay depends on

- Sync. Condition and
- Dead Bus Closure Condition

The command variable Sync. Check Relay (02.28) is true, if the phase matching synchronisation conditions **or** dead bus closure conditions are met according to "*02.29 Sync. Condition*" or "*02.30 Dead Bus Closure Condition*".

2.6 External I/O module IKD1, IKD-IN-16 and IKD-OUT-16

With Woodward's IKDs external digital I/O module expansion are available, which can provide digital inputs and digital outputs.

These modules can be connected via the CAN1 bus.

The IKD1 can read the status of eight discrete inputs and transmit these via the CAN bus to the LS-6XT. In the opposite direction the LS6 can control the eight relay outputs situated on the IKD1 via the CAN bus.

Following External I/O modules are possible:

- Up to two IKD1 to provide up 16 DIs and 16 DOs. For the IKD1 configuration tool refer to ⮱▷ "6.5.2 IKD Configuration Tool".
- IKD-IN-16 can read the status of 16 discrete inputs. It is possible to connect one IKD-IN-16 to provide 16 DIs.
- IKD-OUT-16 provides 16 relay outputs which can be controlled by the LS6. It is possible to connect one IKD-OUT-16 to provide 16 DOs.

For configuration of IKDs at CAN 1 see ⮱▷ "4.4.1.1.3 External Discrete Inputs (IKD)".

For configuration of the alarms of the external digital inputs see ⮱▷ "4.4.1.1.3 External Discrete Inputs (IKD)".

Unless otherwise stated, the descriptions for IKDs analogously apply to IKD-IN-16 and IKD-OUT-16.

3 Installation

3.1 Mount Unit (Sheet Metal Housing)

Dimensions

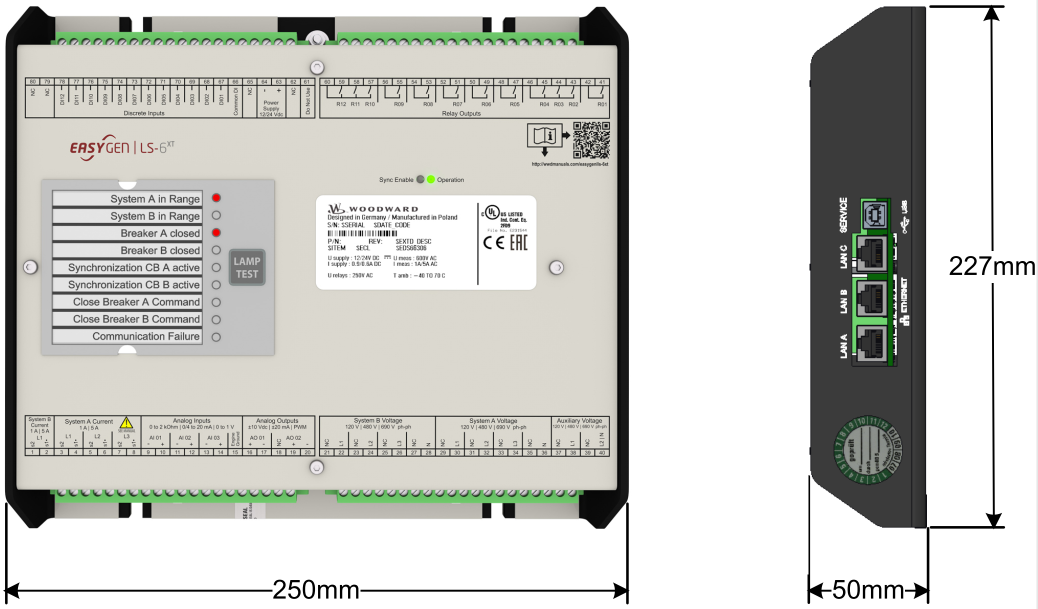


Fig. 3: Sheet metal housing - dimensions

Mounting into a cabinet

⚙

>

- Special tool: Torque screwdriver

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

1. ▷

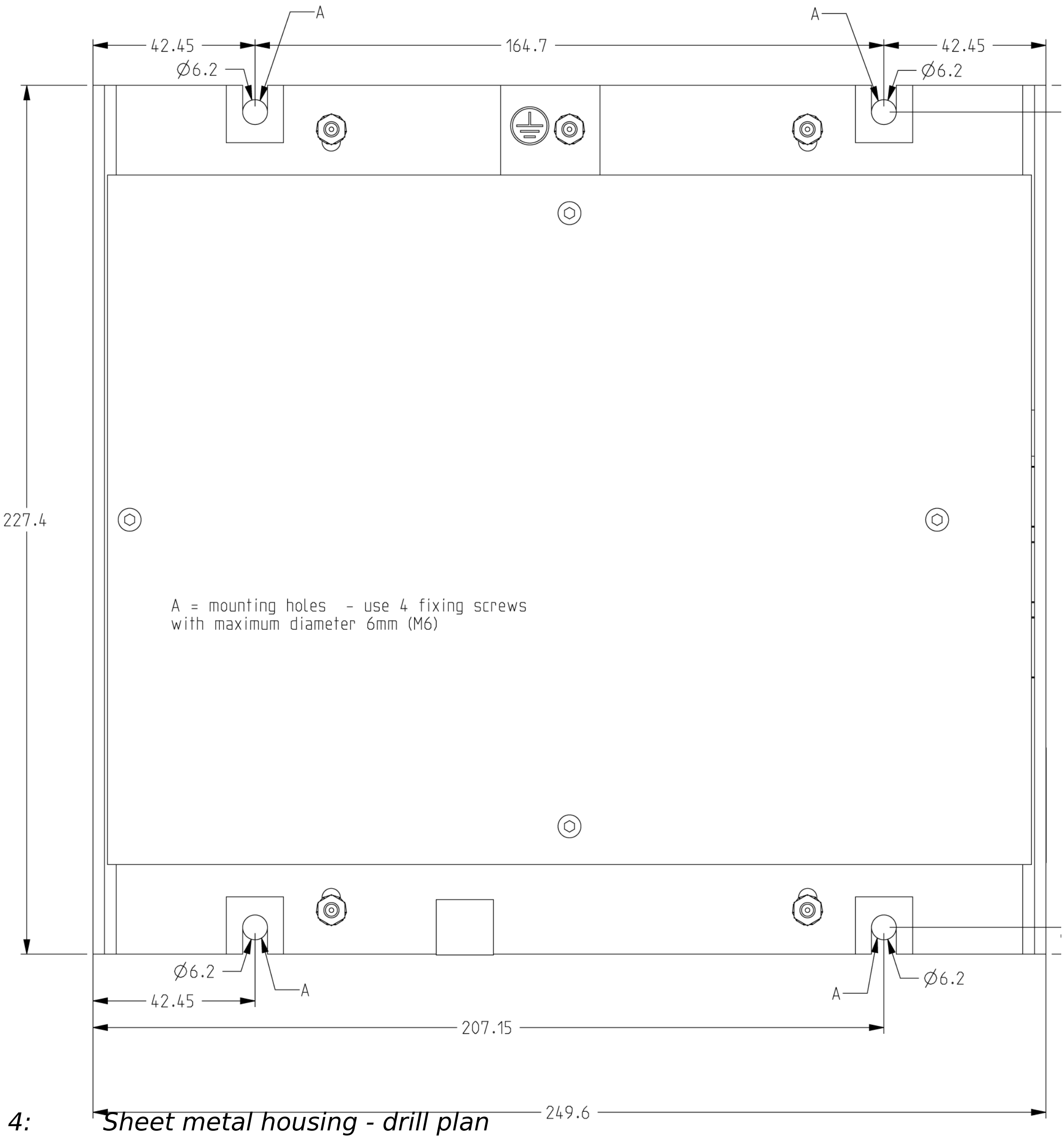


Fig. 4: Sheet metal housing - drill plan

Drill the holes according to the dimensions in ⮑ Fig. 4 (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.

NOTICE!

For UL:

Suitable for use on a flat surface of a Type 1 Enclosure!

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 Technical Specifications".

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.

NOTICE!

For UL:

Suitable for use on a flat surface of a Type 1 Enclosure!

The max. possible conductor cross-section of the terminals used is A $_{max}$ = 2.5 mm^2!

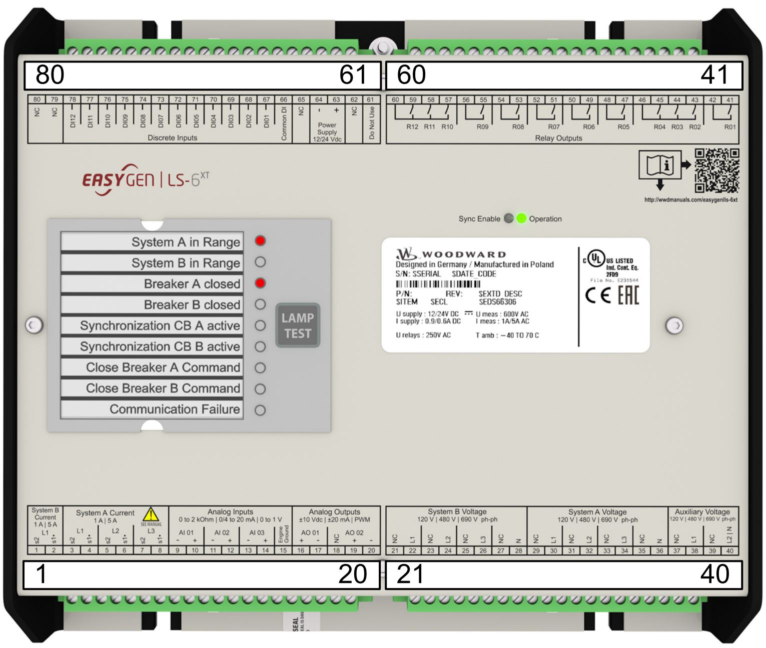


Fig. 5: Terminals LS-612XT-P1 sheet metal housing

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 "Top Center" of the sheet metal housing instead.

Common terminal for AC measurement voltages

System A, System B, and Auxiliary voltage measuring terminals no longer differentiate with separate terminals for each voltage range.

General recommendations

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

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

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

- 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.

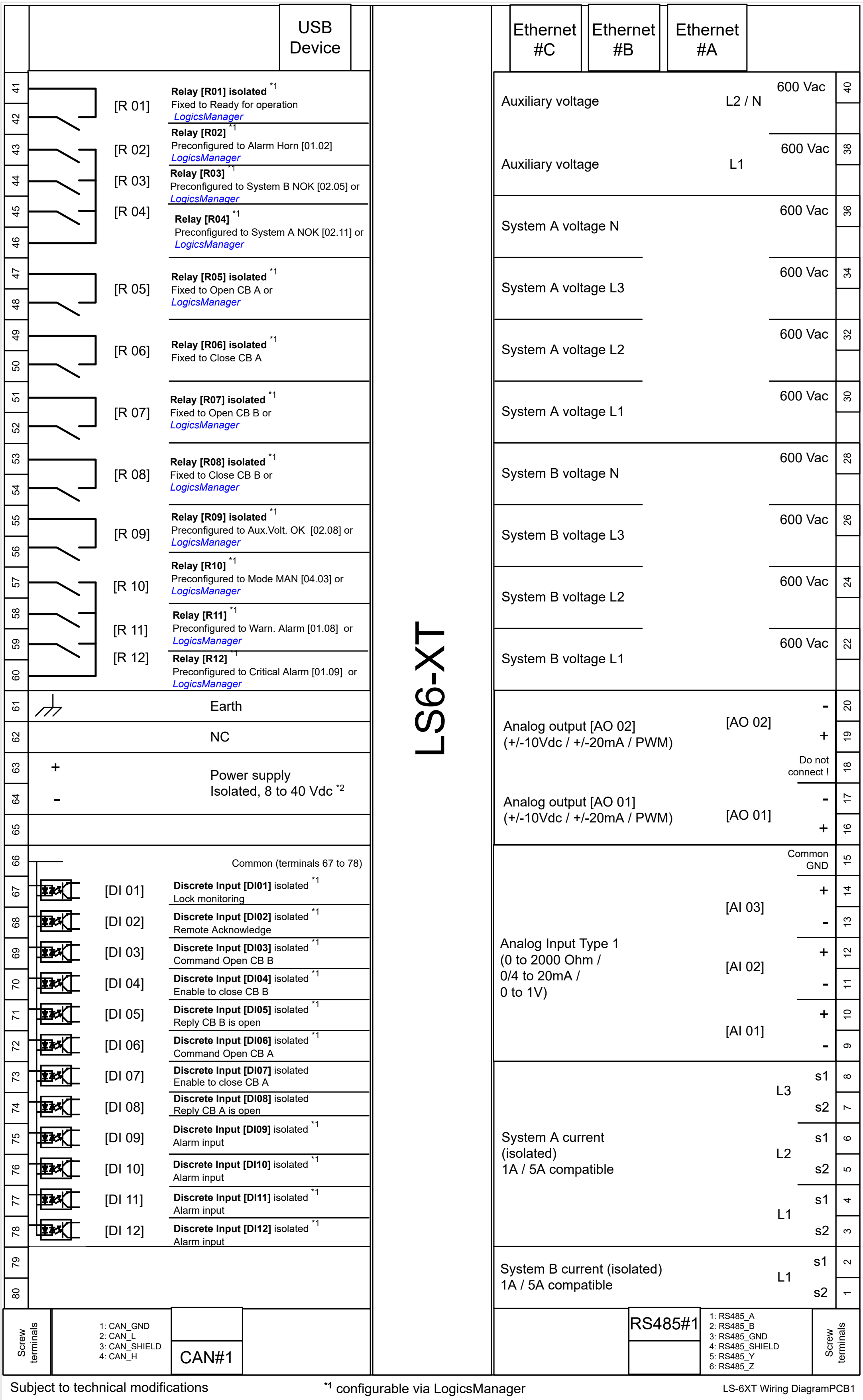


Fig. 6: *WiringDiagram_LS-6XT*

1) Configurable by LogicsManager

2) V_{nom} = 12/24 V SELV

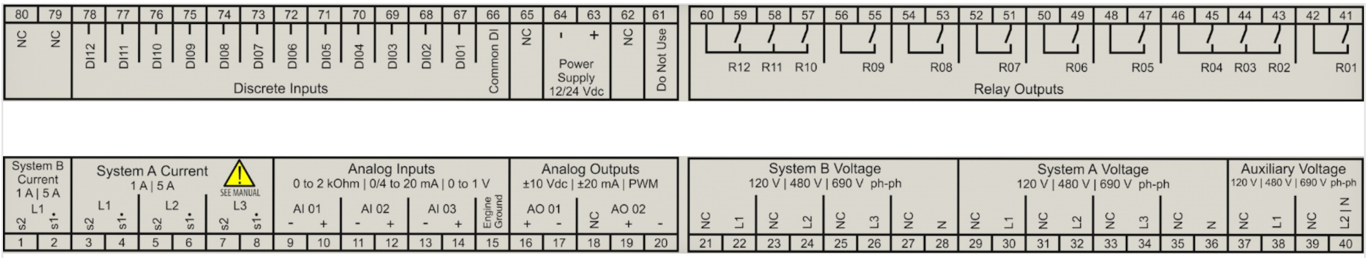


Fig. 7: Label/print LS-6XT

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 mm² (14 AWG). The cable length should be as short as possible.
- The connection must be performed properly.

WARNING!

Permissible differential voltage

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

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

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

- Fuse NEOZED D01 6A or equivalent **or**
- Miniature Circuit Breaker 6A / Type C

  (for example: ABB type: S271C6 or equivalent)

Schematic and terminals

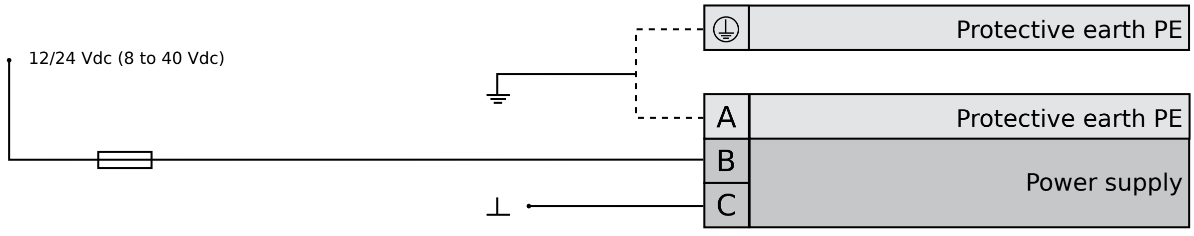


Fig. 8: Power supply – wiring

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

Table 2: Power supply - terminal assignment

Characteristics

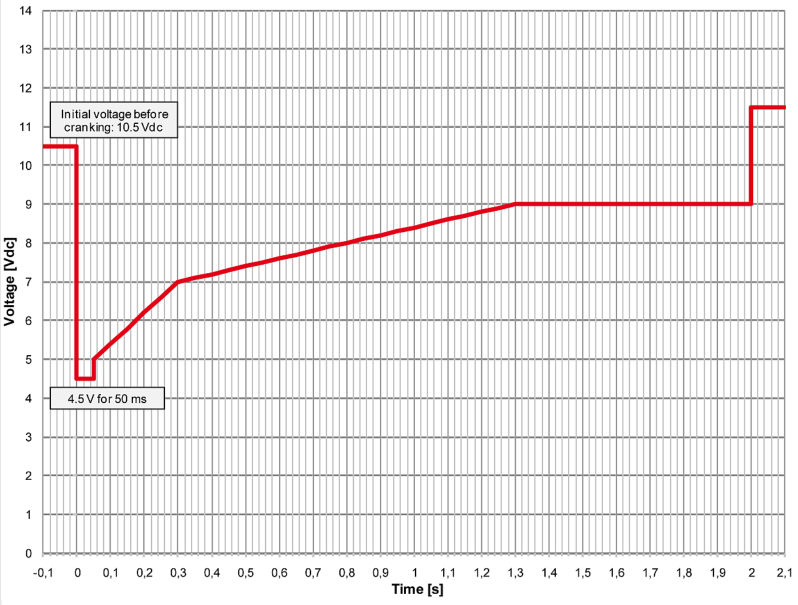


Fig. 9: Power supply – crank waveform

3.2.4 Voltage Measuring

General notes

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

The wide range terminals allow several voltages. The current voltage (range) of the application must be "told" to the LS-6XT. Settings are described in chapter ⮱▷ "4.6 Configure Measurement".

3.2.4.1 System A Voltage

General notes

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

Parameter ⮱▷ 1800 (« Systeme A PT secondary rated volt. ») must be configured to the correct value to ensure proper measurement.

Schematic and terminals

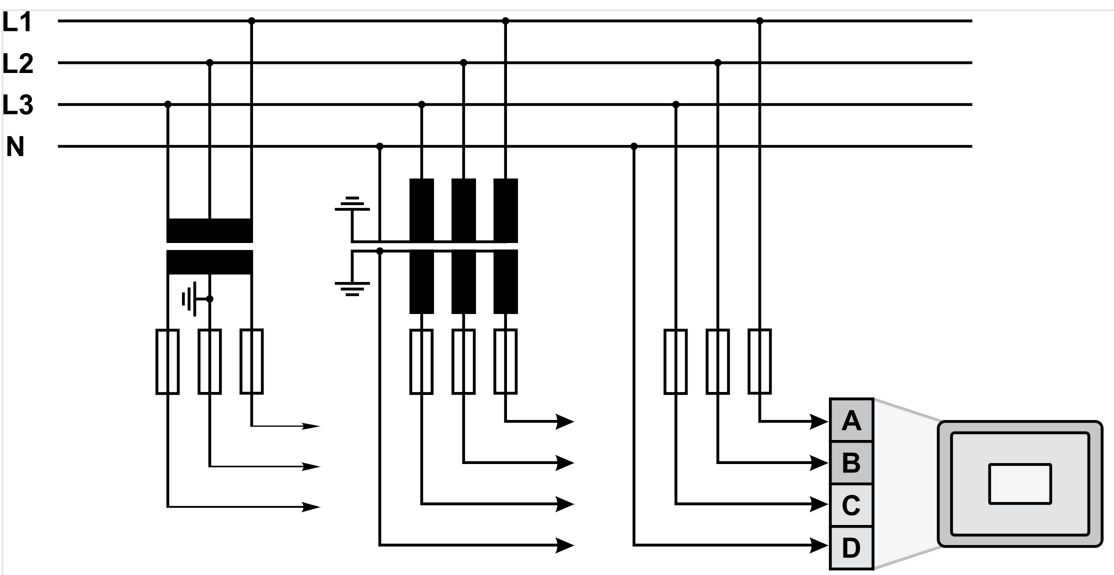


Fig. 10: Voltage measuring - System A - wiring

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

Measuring input / Phase	Terminal	
System A voltage - N	D	36

Table 3: Voltage measuring - System A - terminal assignment

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

System A windings

A System A 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.

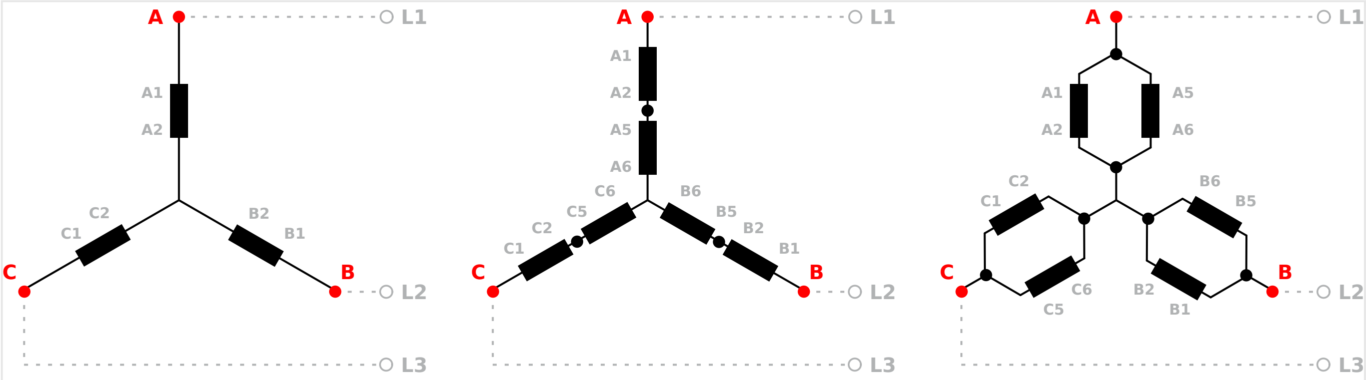


Fig. 11: System A windings - 3Ph 4W OD

Measuring inputs

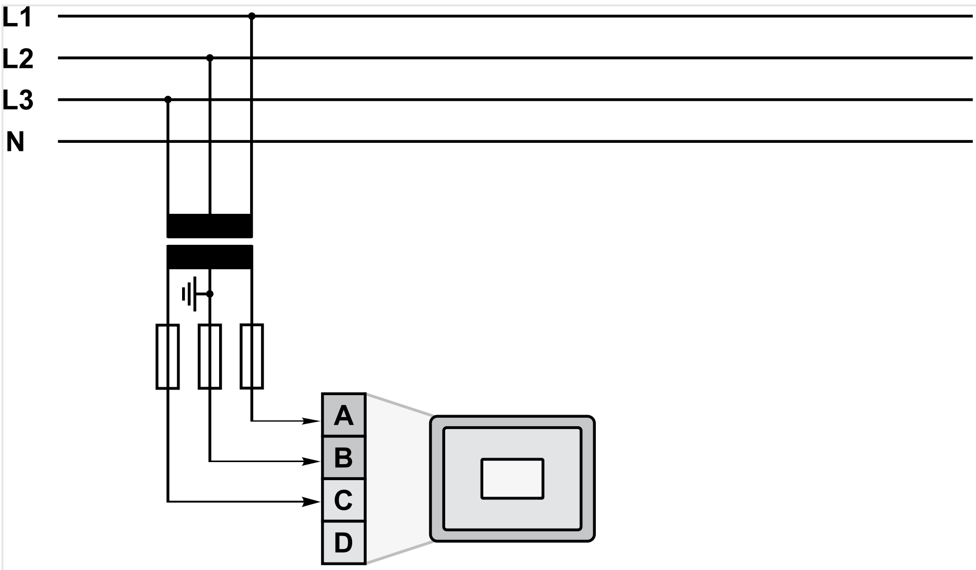


Fig. 12: Measuring inputs - 3Ph 4W OD

Terminal assignment

Measuring input / Phase	Terminal	
System A voltage - L1	A	30

Measuring input / Phase	Terminal	
System A voltage - L2	B	32
System A voltage - L3	C	34
System A voltage - N	-/-	

Table 4: System A terminal assignment 3Ph 4W OD

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

System A windings

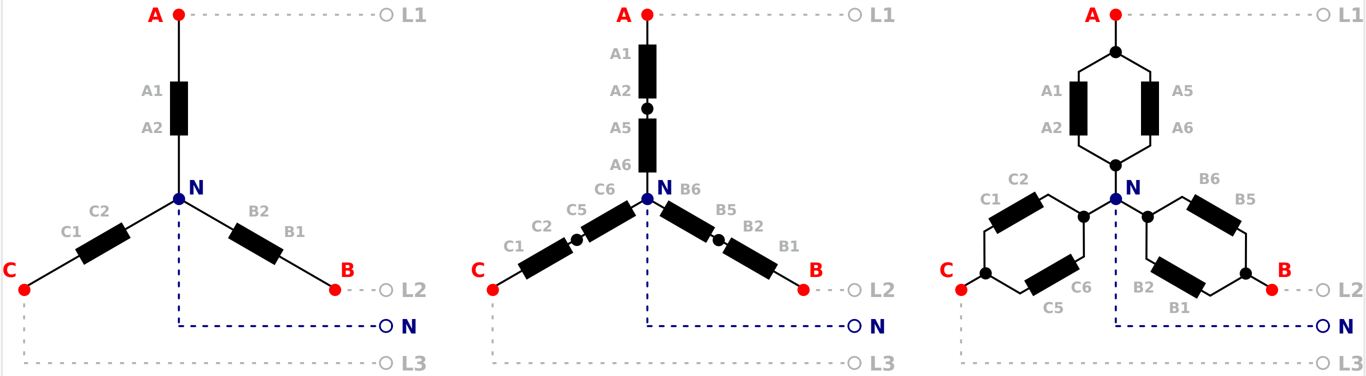


Fig. 13: System A windings - 3Ph 4W

Measuring inputs

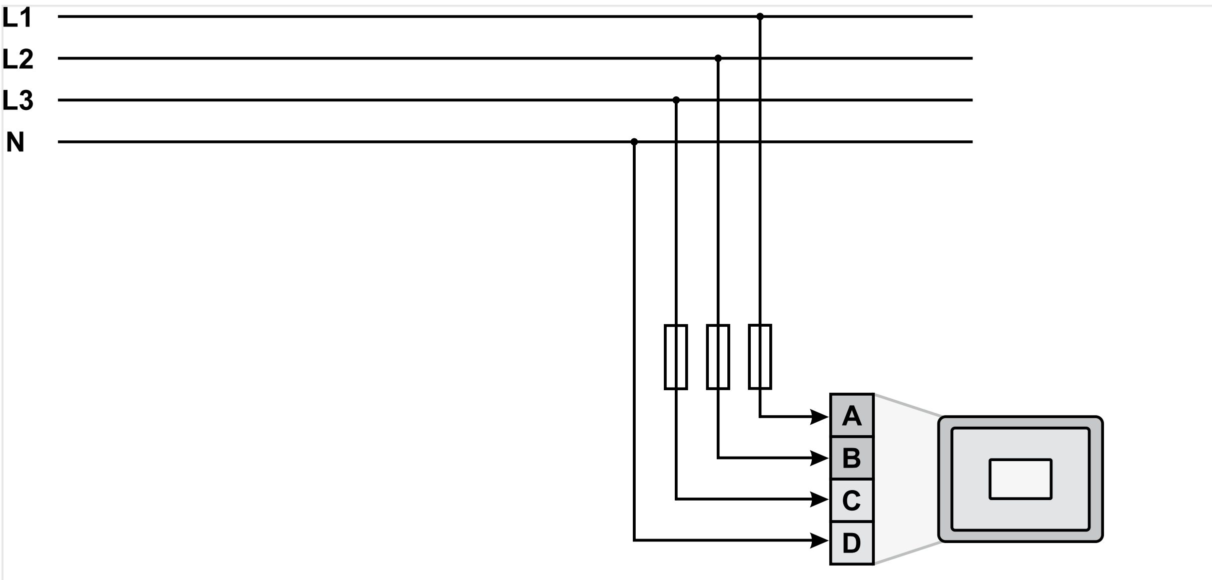


Fig. 14: Measuring inputs - 3Ph 4W

Terminal assignment

Measuring input / Phase	Terminal	
System A voltage - L1	A	30

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

Table 5: System A terminal assignment 3Ph 4W

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

System A windings

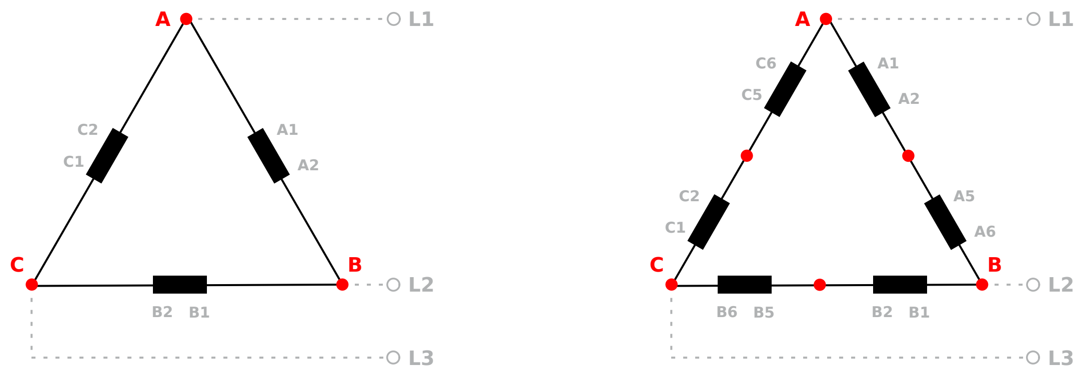


Fig. 15: System A windings - 3Ph 3W

Measuring inputs

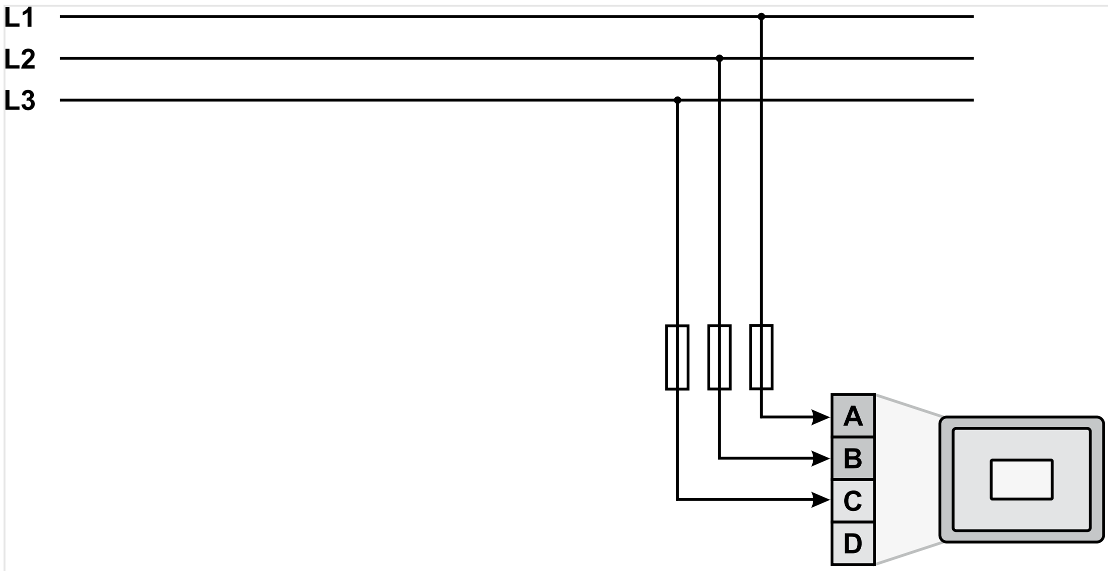


Fig. 16: Measuring inputs - 3Ph 3W

Terminal assignment

Measuring input / Phase	Terminal	
System A voltage - L1	A	30

Measuring input / Phase	Terminal	
System A voltage - L2	B	32
System A voltage - L3	C	34
-/-	-/-	36

Table 6: System A terminal assignment 3Ph 3W

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

System A windings

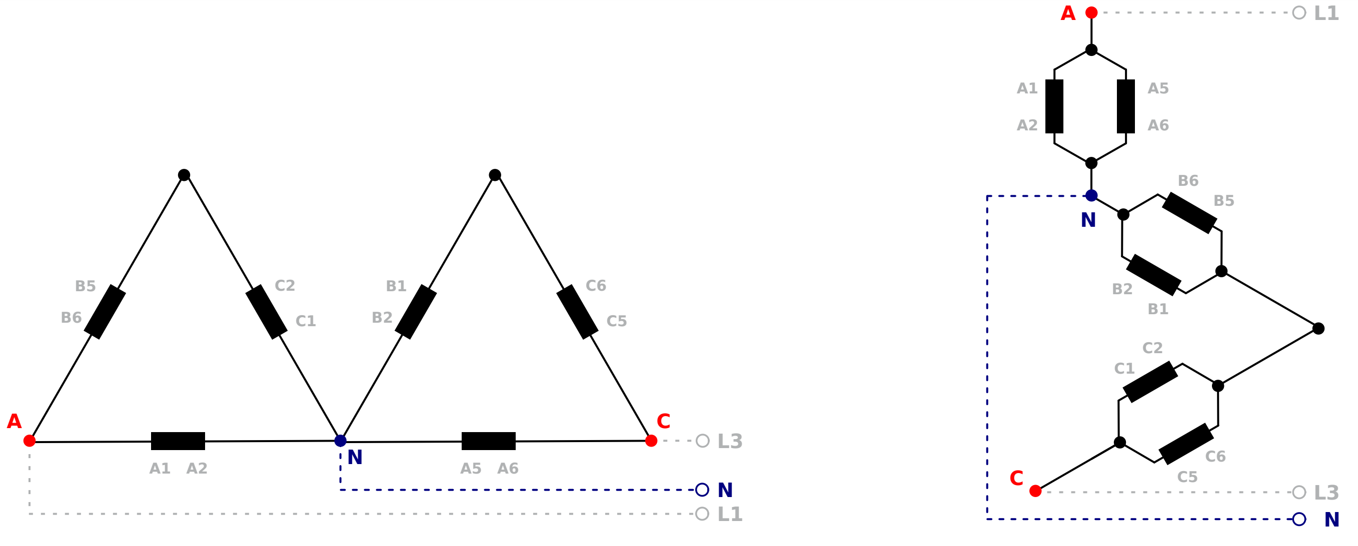


Fig. 17: System A windings - 1Ph 3W

Measuring inputs

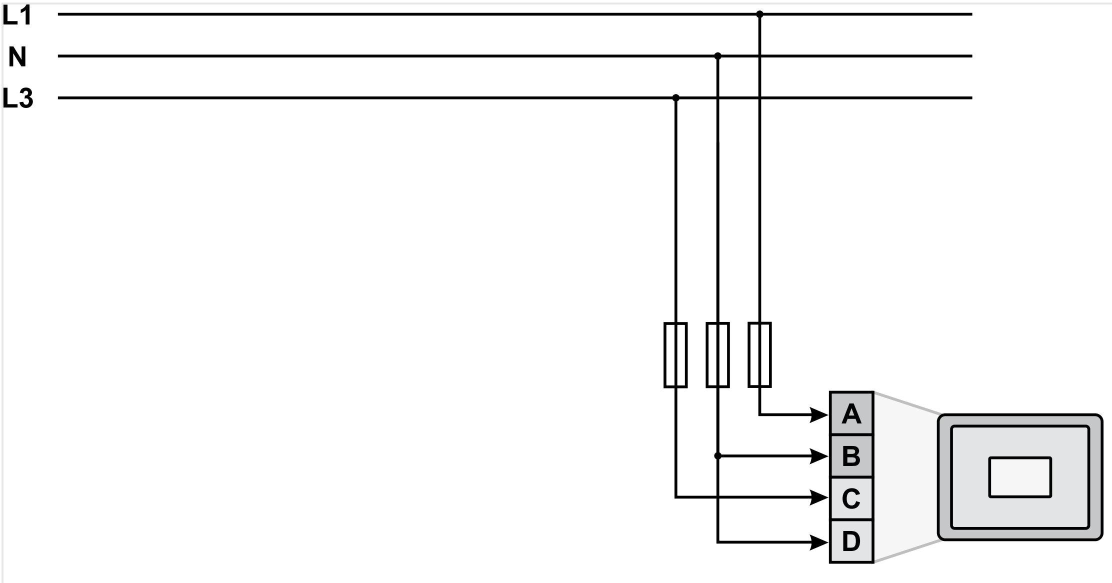


Fig. 18: Measuring inputs - 1Ph 3W

Terminal assignment

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

Table 7: System A 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 LS-6XT consistently.

3.2.4.1.5.1 '1Ph 2W' Phase-Neutral Measuring

System A windings

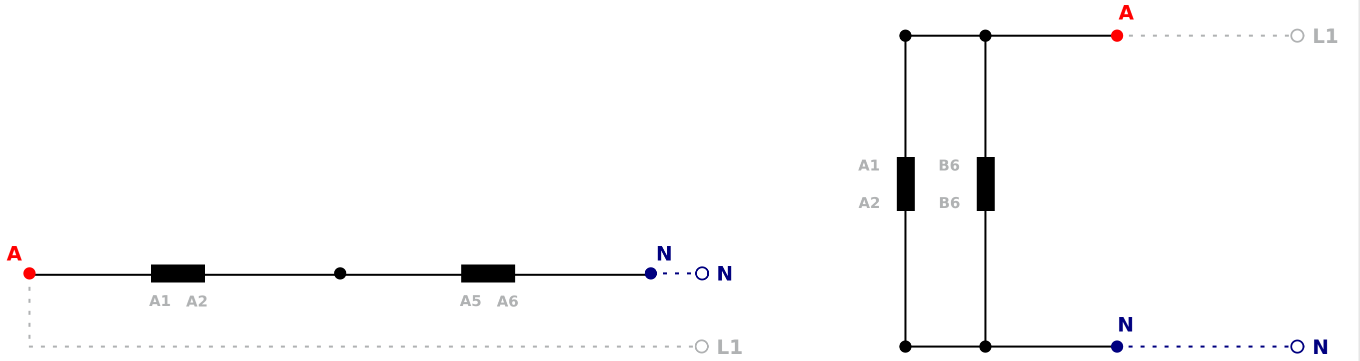


Fig. 19: System A windings - 1Ph 2W (phase-neutral)

Measuring inputs

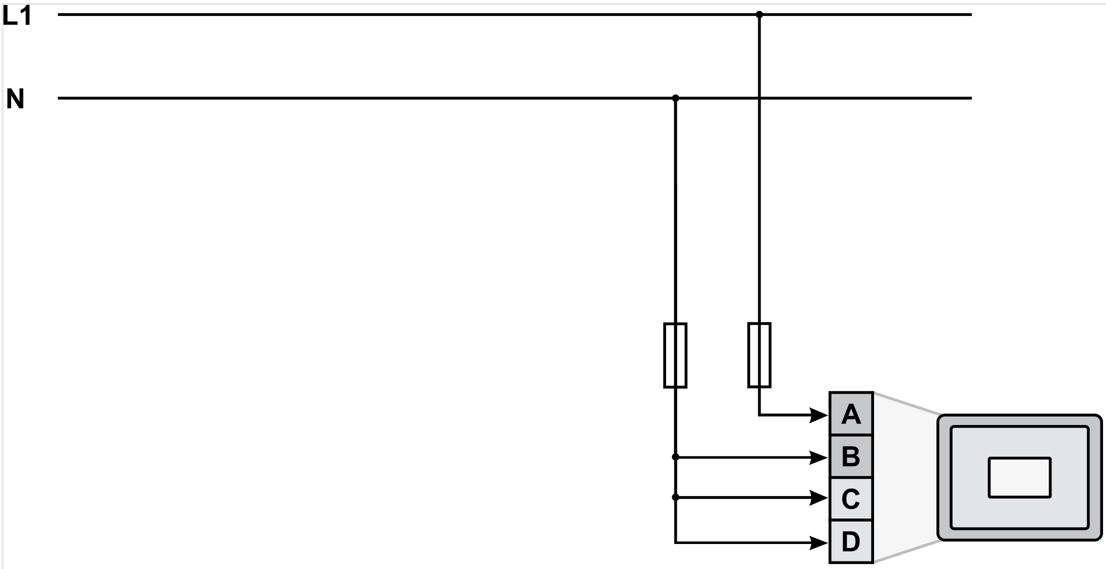


Fig. 20: Measuring inputs - 1Ph 2W (phase-neutral)

Terminal assignment

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

Table 8: System A terminal assignment 1Ph 2W (phase neutral)

Never configure the Auxiliary measurement for phase-neutral, if the other systems like System A and System B are configured as 3ph 3W or 3ph 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

System A windings

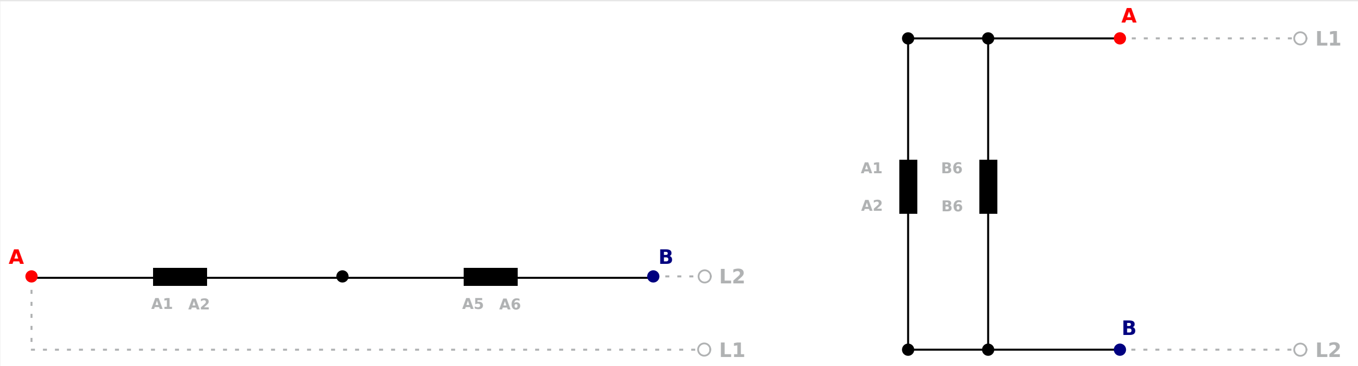


Fig. 21: System A windings - 1Ph 2W (phase-phase)

Measuring inputs

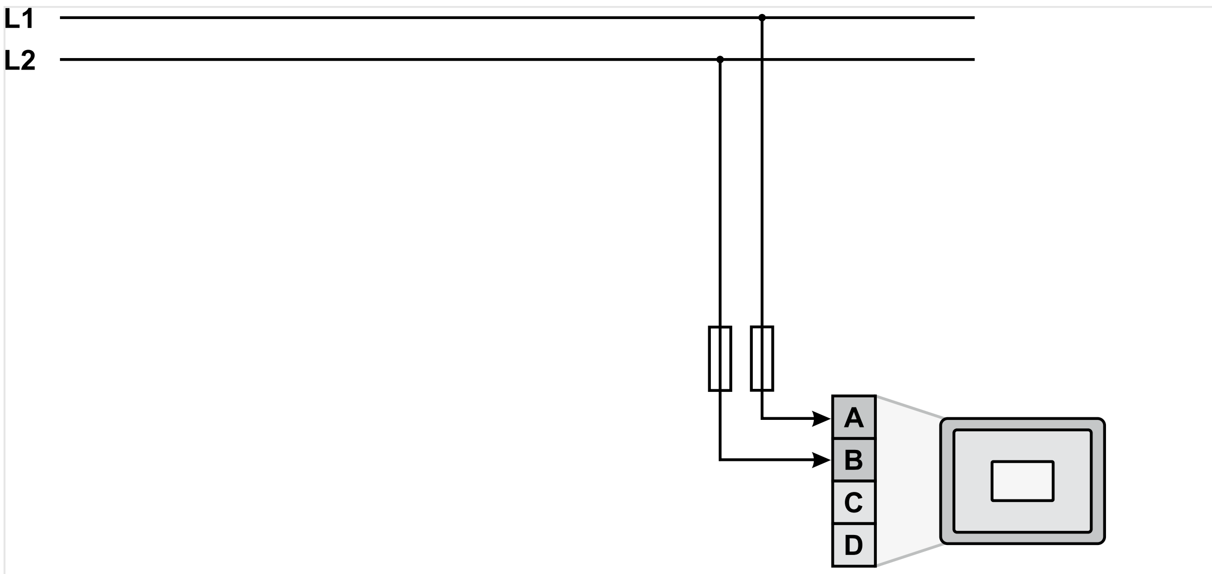


Fig. 22: Measuring inputs - 1Ph 2W (phase-phase)

Terminal assignment

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

Table 9: System A terminal assignment 1Ph 2W (phase-phase)

3.2.4.2 System B Voltage

General notes

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

Parameter ⮱▷ 1803 (« Systeme B PT secondary rated volt. ») must be configured with the correct value to ensure proper measurement.

Schematic and terminals

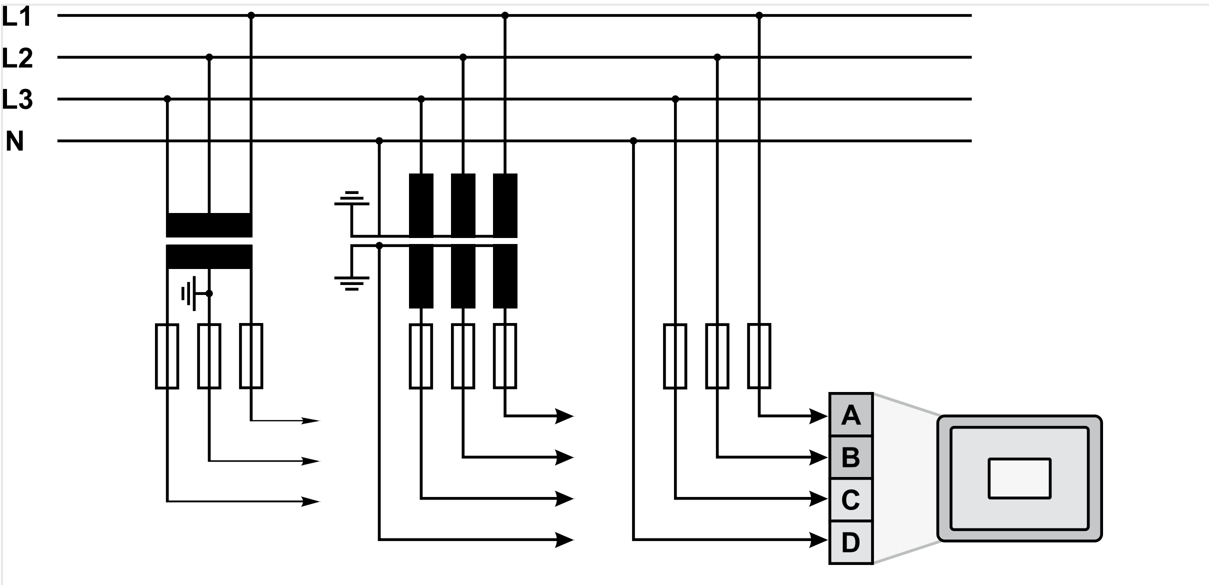


Fig. 23: Voltage measuring - System B - wiring

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

Table 10: Voltage measuring - System B - terminal assignment

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

System B windings

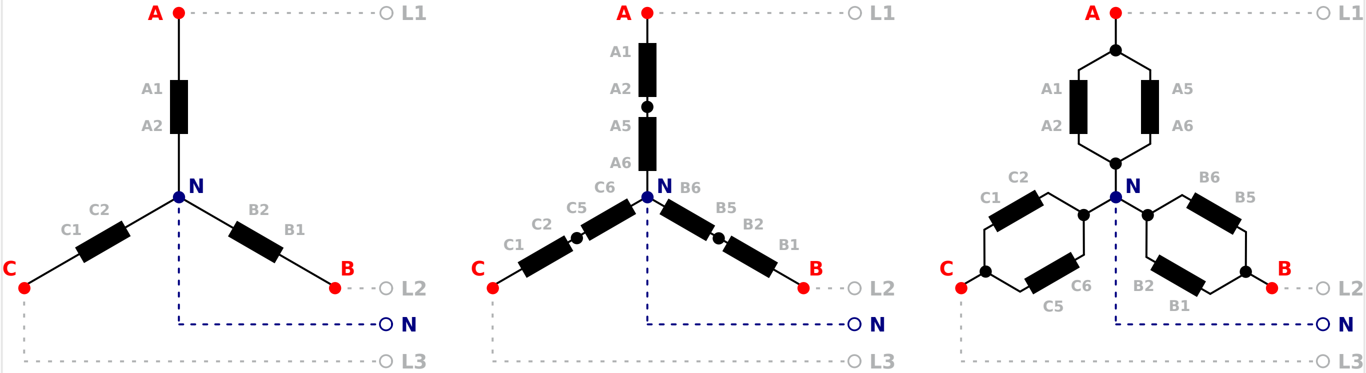


Fig. 24: System B windings - 3Ph 4W

Measuring inputs

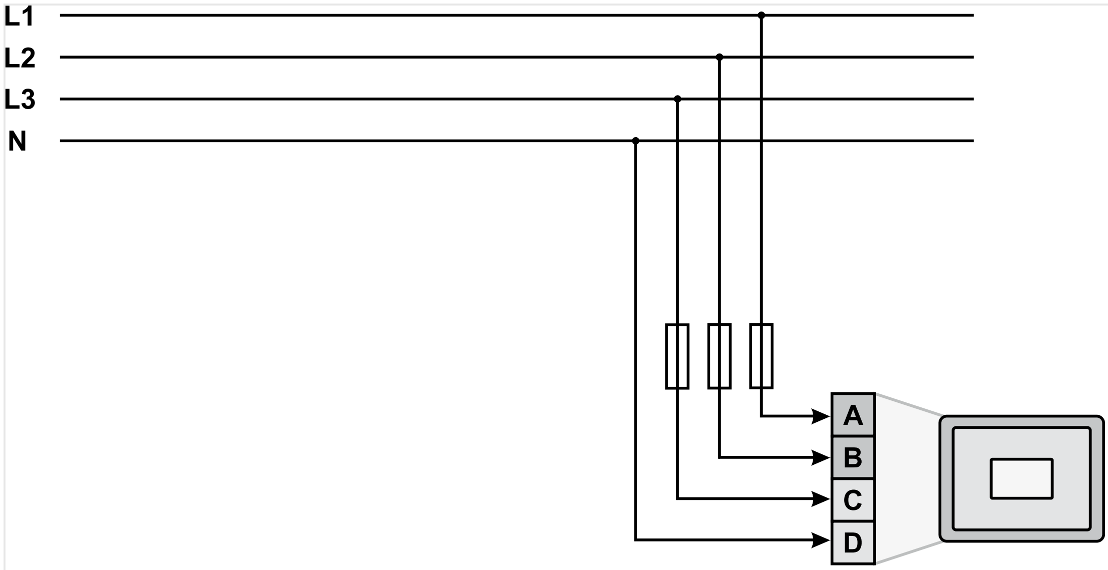


Fig. 25: Measuring inputs - 3Ph 4W

Terminal assignment

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

Table 11: System B terminal assignment 3Ph 4W

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

System B windings

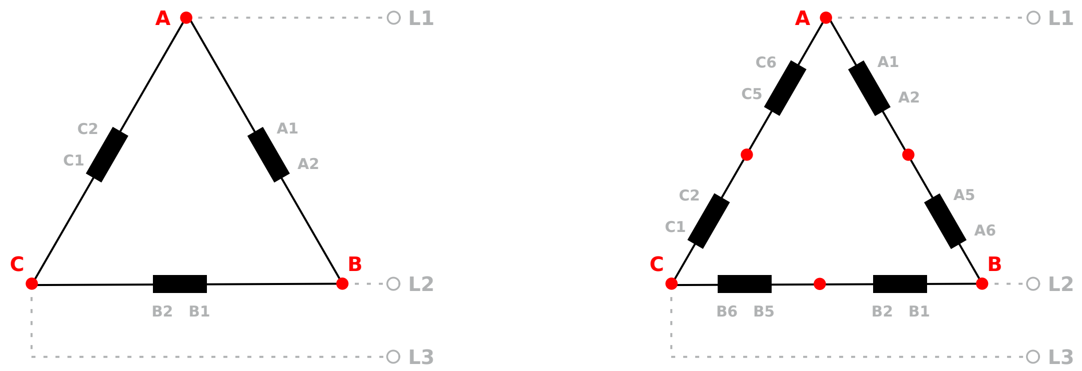


Fig. 26: System B windings - 3Ph 3W

Measuring inputs

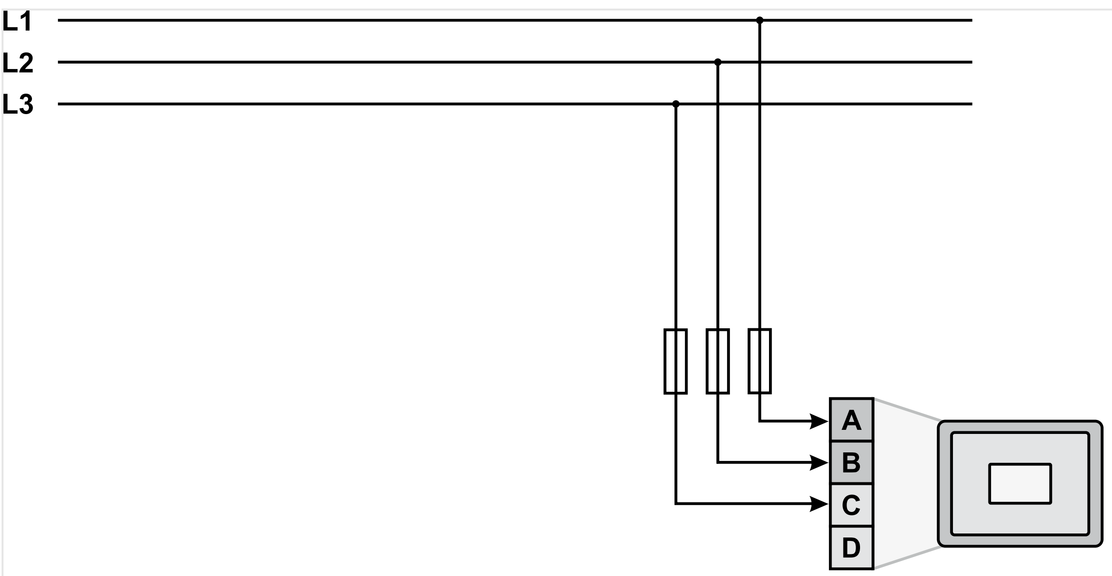


Fig. 27: Measuring inputs - 3Ph 3W

Terminal assignment

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

Table 12: System B terminal assignment 3Ph 3W

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

System B windings

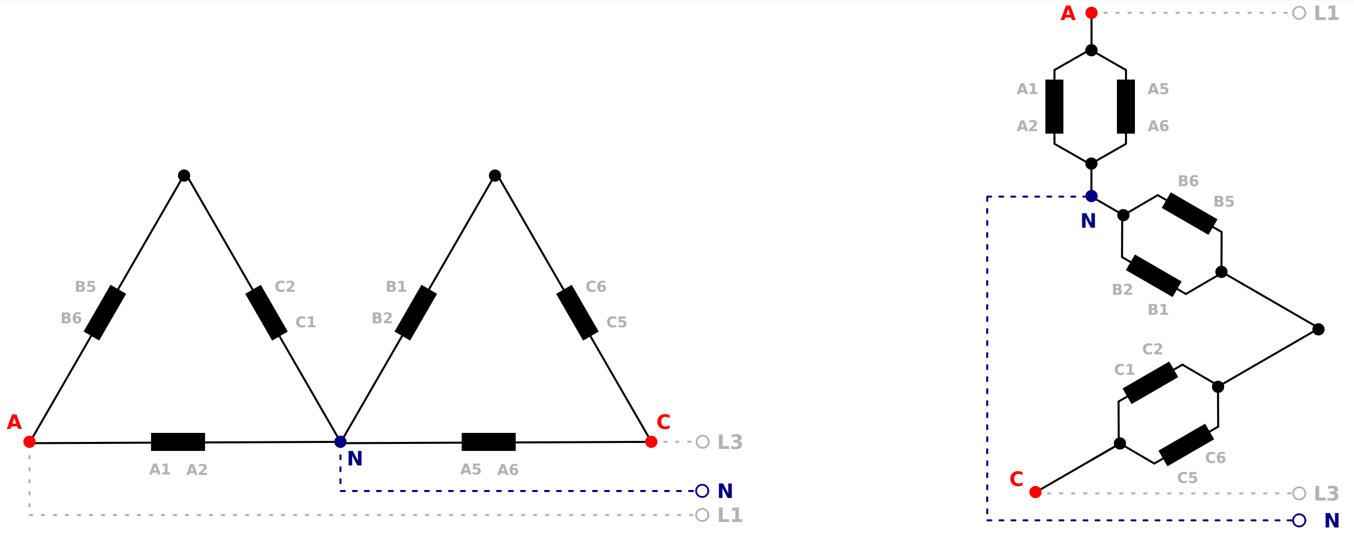


Fig. 28: System B windings - 1Ph 3W

Measuring inputs

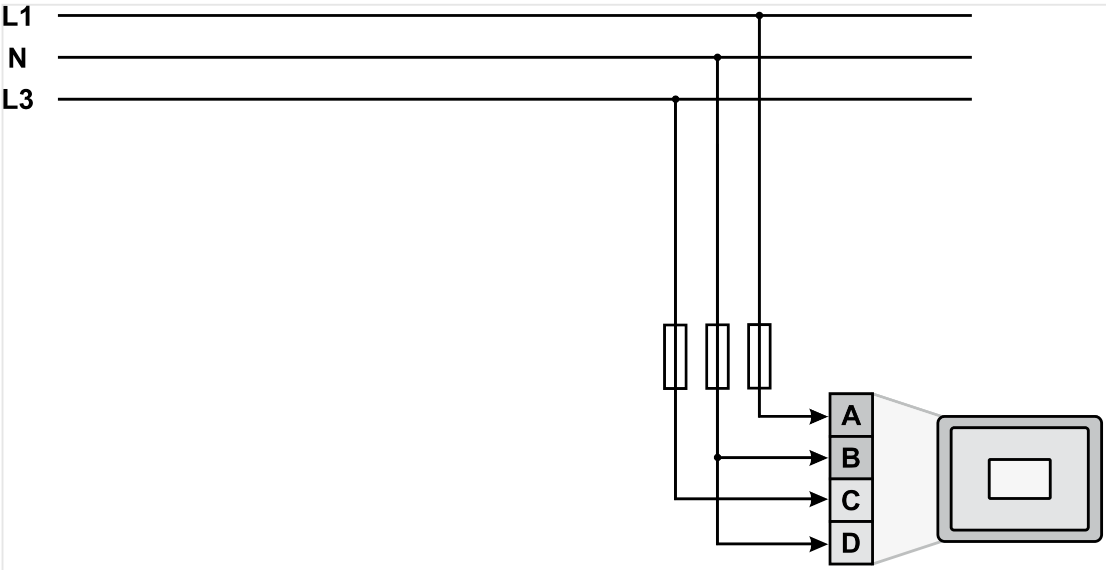


Fig. 29: Measuring inputs - 1Ph 3W

Terminal assignment

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

Measuring input / Phase	Terminal	
	D	28

Table 13: System B 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 LS-6XT consistently.

3.2.4.2.4.1 '1Ph 2W' Phase-Neutral Measuring

System B windings

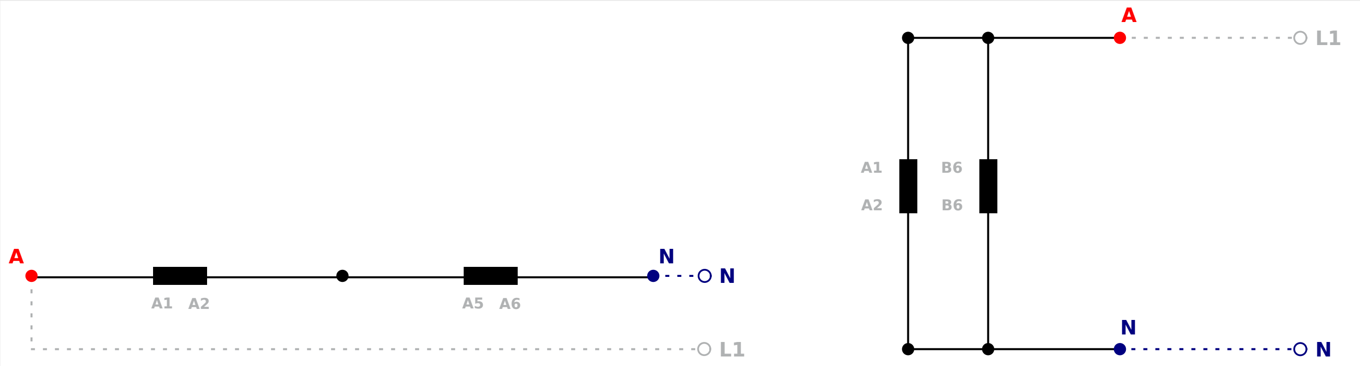


Fig. 30: System B windings - 1Ph 2W (phase neutral)

Measuring inputs

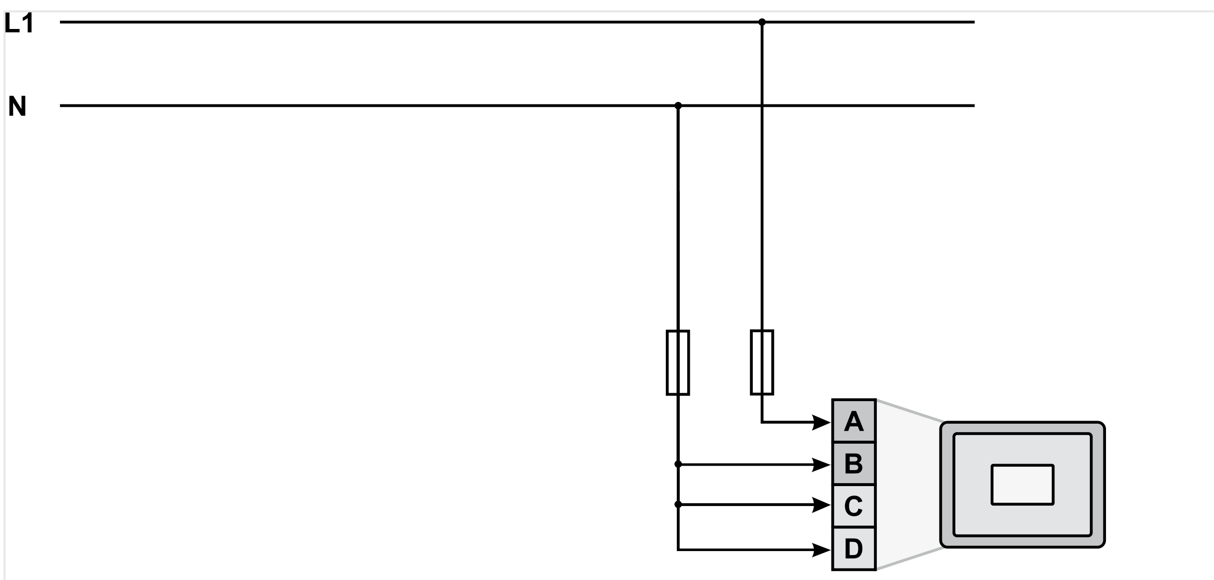


Fig. 31: Measuring inputs - 1Ph 2W (phase neutral)

Terminal assignment

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

Table 14: System B terminal assignment 1Ph 2W phase neutral

3.2.4.2.4.2 '1Ph 2W' Phase-Phase Measuring

System B windings

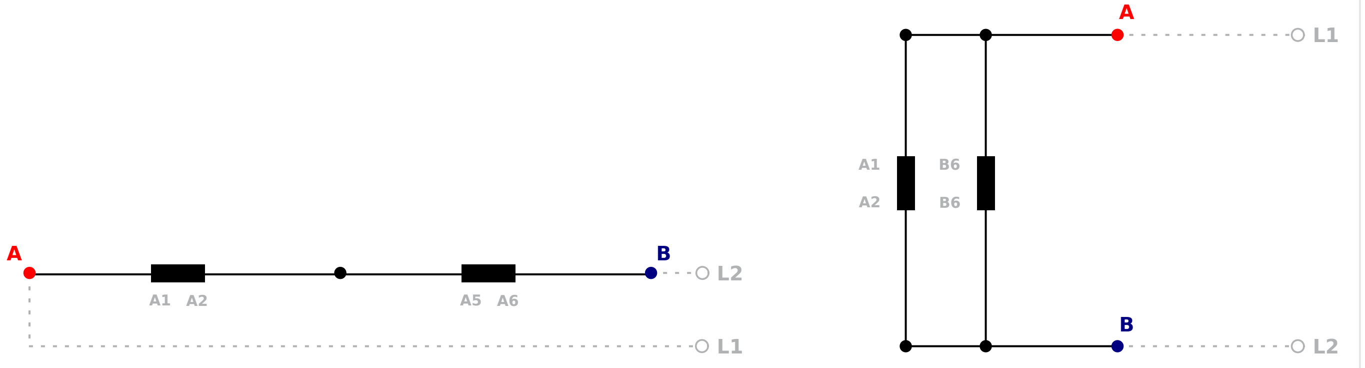


Fig. 32: System B windings - 1Ph 2W (phase-phase)

Measuring inputs

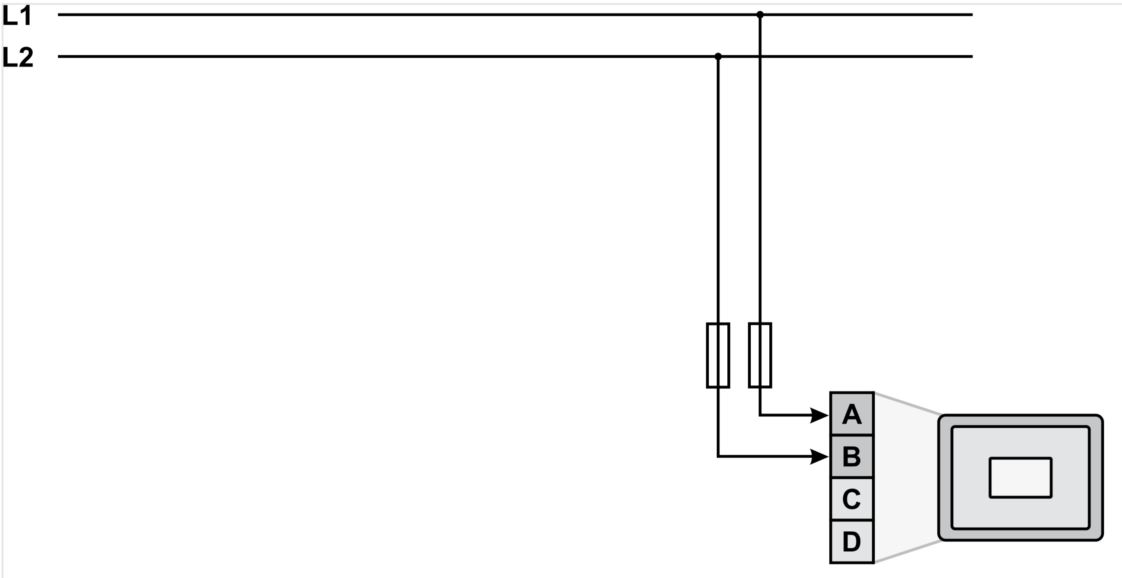


Fig. 33: Measuring inputs - 1Ph 2W (phase-phase)

Terminal assignment

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

Table 15: System B terminal assignment 1Ph 2W phase-phase

3.2.4.3 Auxiliary Voltage

General notes

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

Parameter ⮱▷ 1812 ("Aux.volt PT secondary rated volt.") must be configured to the correct value to ensure proper measurement.

Schematic and terminals

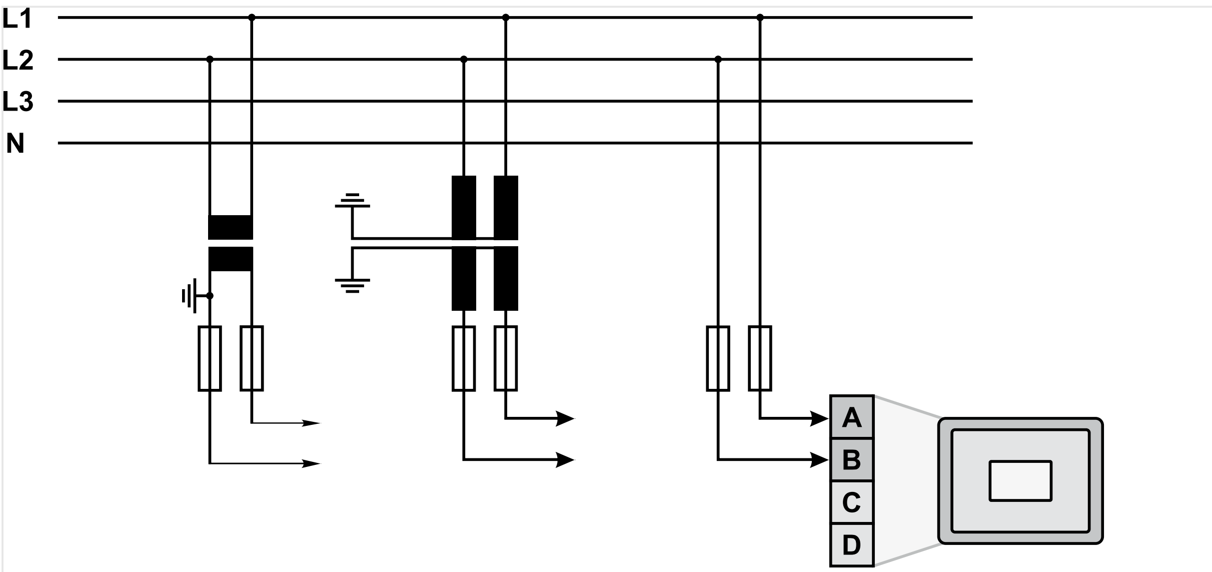


Fig. 34: Voltage measuring - Auxiliary - wiring

Measuring input / Phase	Terminal		A_{max}
Auxiliary voltage (system 1) - L1	A	38	2.5 mm²

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

Table 16: Voltage measuring - Auxiliary - terminal assignment

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

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

- Please note to configure and wire the LS-6XT consistently.

3.2.4.3.1.1 '1Ph 2W' Phase-Neutral Measuring

Auxiliary windings

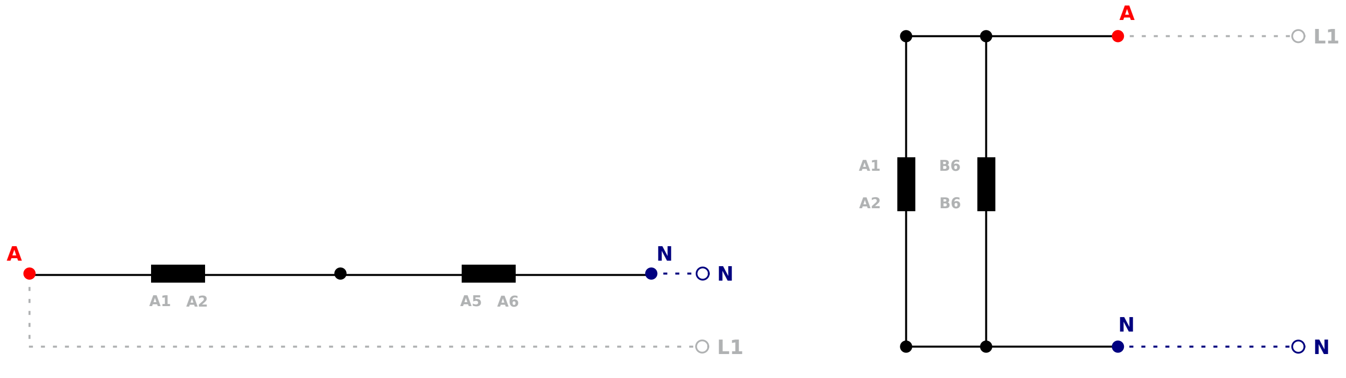


Fig. 35: Auxiliary windings - 1Ph 2W (phase-neutral)

Measuring inputs

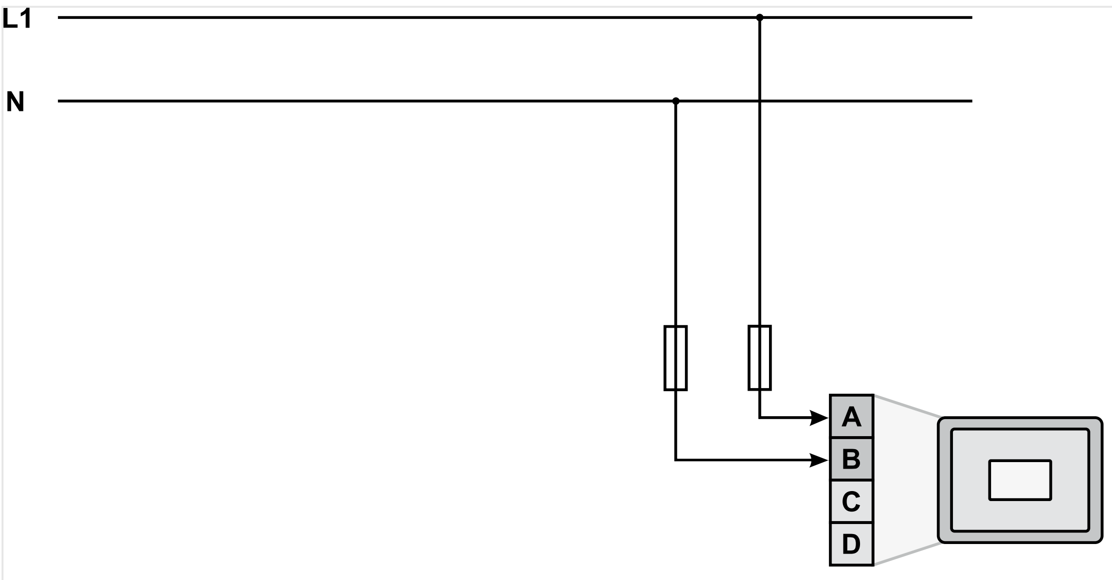


Fig. 36: Measuring inputs - 1Ph 2W (phase neutral)

Terminal assignment

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

Table 17: Auxiliary terminal assignment 1Ph 2W phase neutral

3.2.4.3.1.2 '1Ph 2W' Phase-Phase Measuring

Auxiliary windings

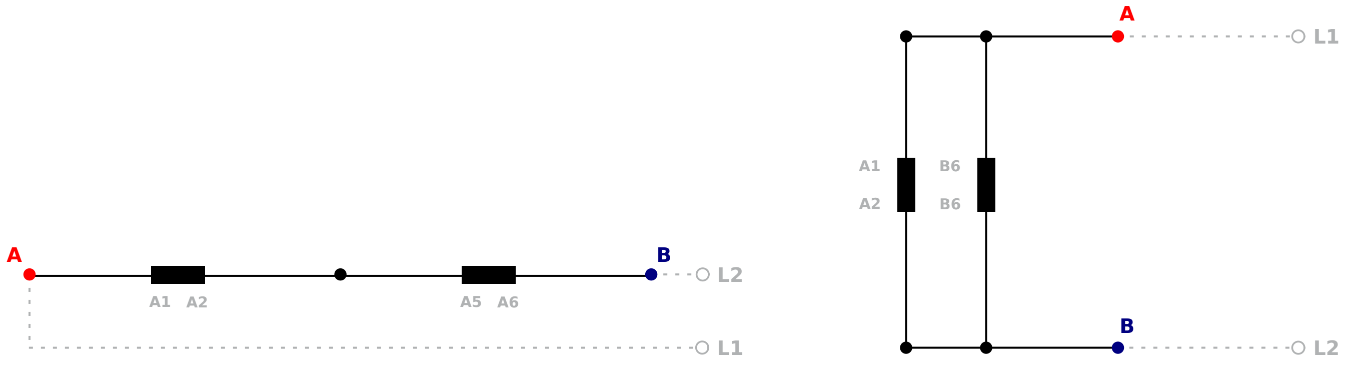


Fig. 37: Auxiliary windings - 1Ph 2W (phase-phase)

Measuring inputs

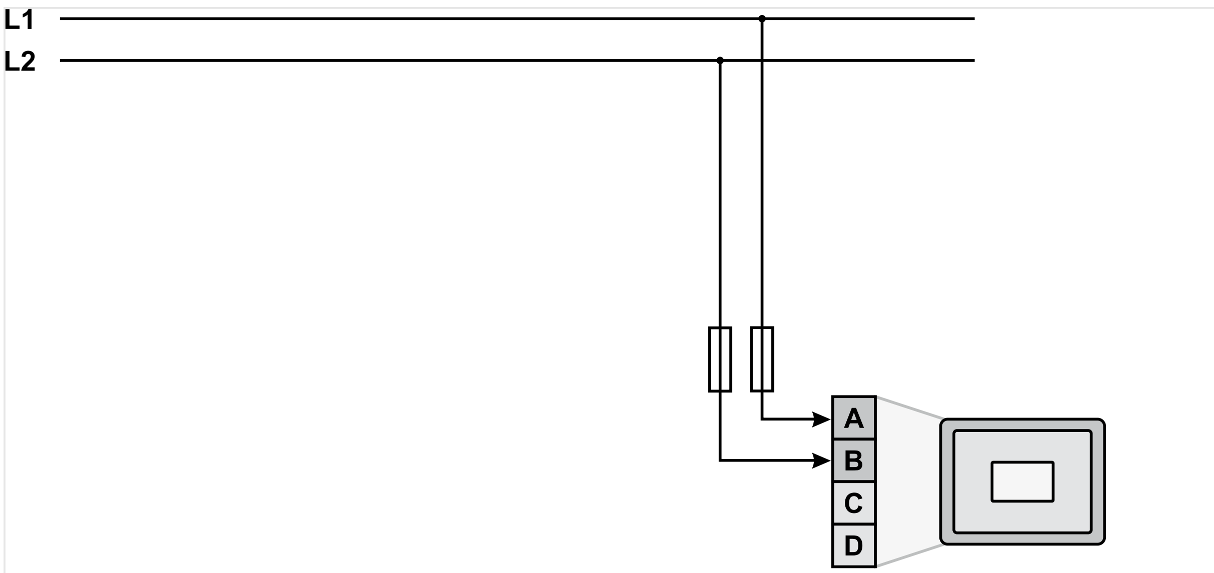


Fig. 38: Measuring inputs - 1Ph 2W (phase-phase)

Terminal assignment

Measuring input / Phase	Terminal	
Auxiliary voltage - phase L1	A	38

Measuring input / Phase	Terminal	
Auxiliary voltage - phase L2	B	40

Table 18: Auxiliary terminal assignment 1Ph 2W phase-phase

3.2.5 Current Measuring

3.2.5.1 System A Current

General notes

WARNING!

Dangerous voltages due to missing load

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

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

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

CAUTION!

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

Schematic and terminals

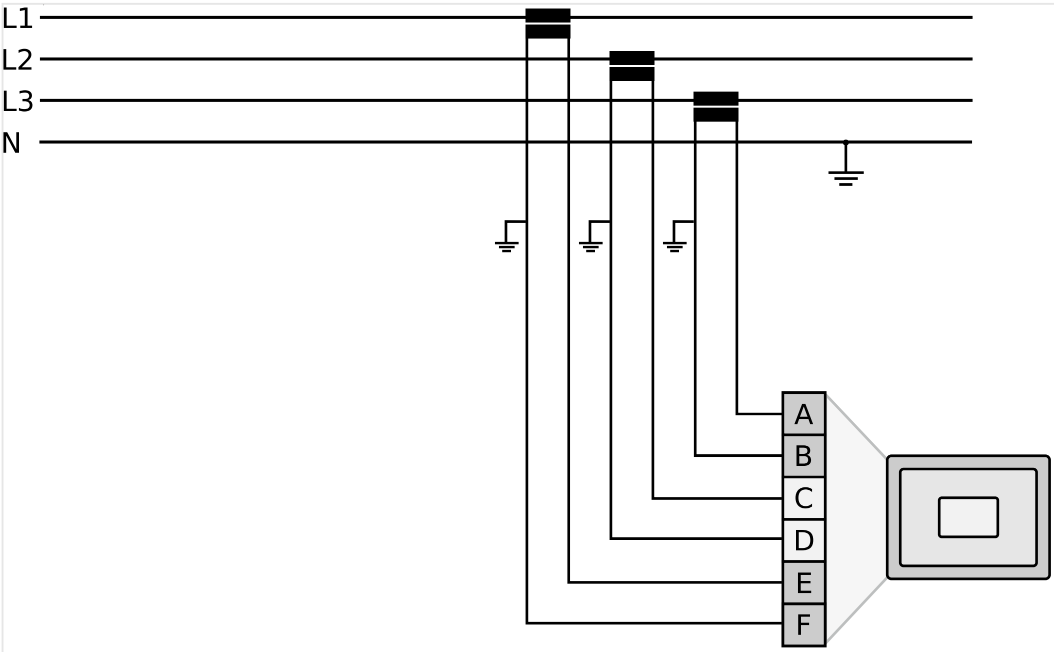


Fig. 39: Current measuring - System A - wiring

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

Table 19: Current measuring - System A - terminal assignment

3.2.5.1.1 Parameter Setting 'L1 L2 L3'

Schematic and terminals

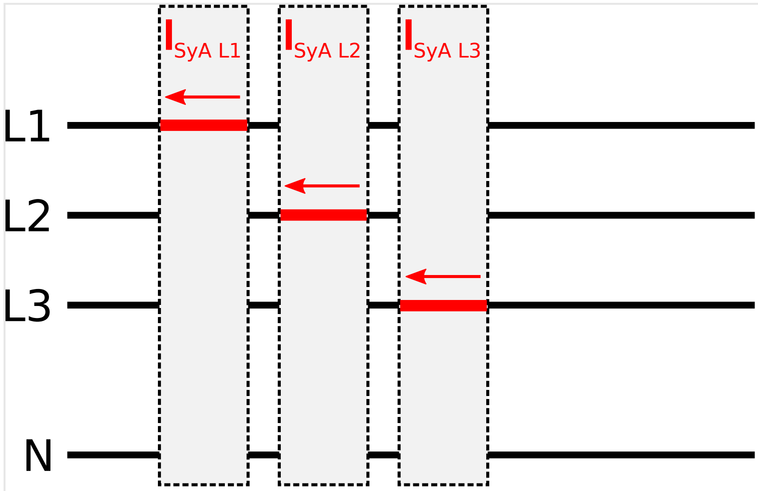


Fig. 40: Current measuring - System A, L1 L2 L3

	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 System A voltage measurement is configured to 1Ph 3W ("3.2.4.1 System A Voltage").

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

Schematic and terminals

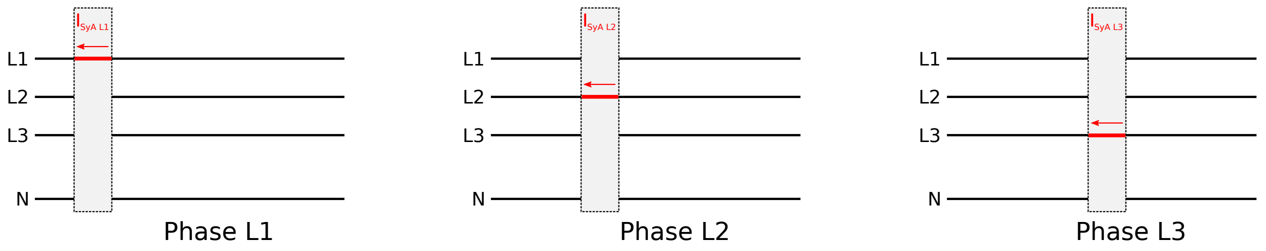


Fig. 41: Current measuring - System A, 'Phase L1' 'Phase L2' 'Phase L3'

	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

3.2.5.2 System B Current

General notes

WARNING!

Dangerous voltages due to missing load

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

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

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

Schematic and terminals

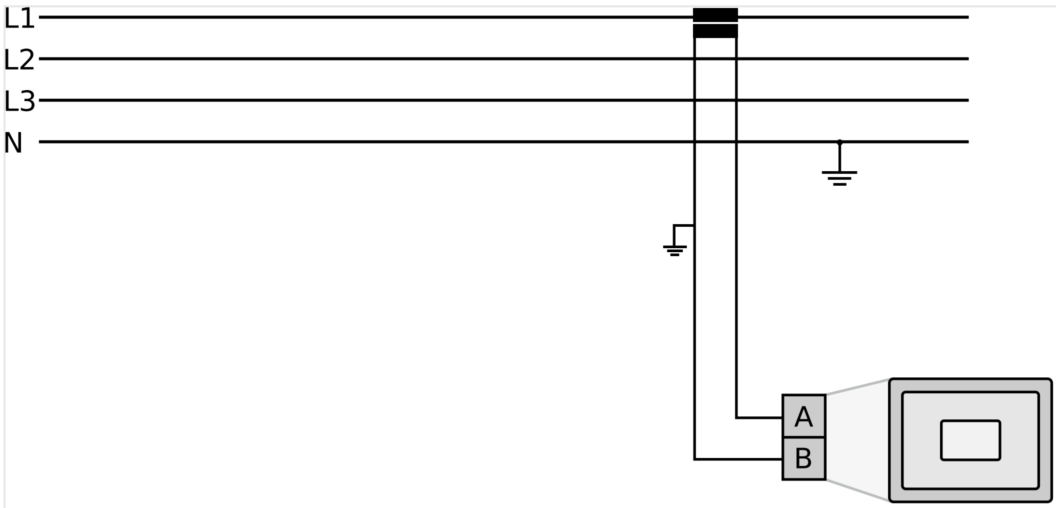


Fig. 42: Current measuring - System B - wiring

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

Table 20: Current measuring - System B - terminal assignment

3.2.5.2.1 Parameter Setting 'Phase L1' 'Phase L2' 'Phase L3'

Schematic and terminals

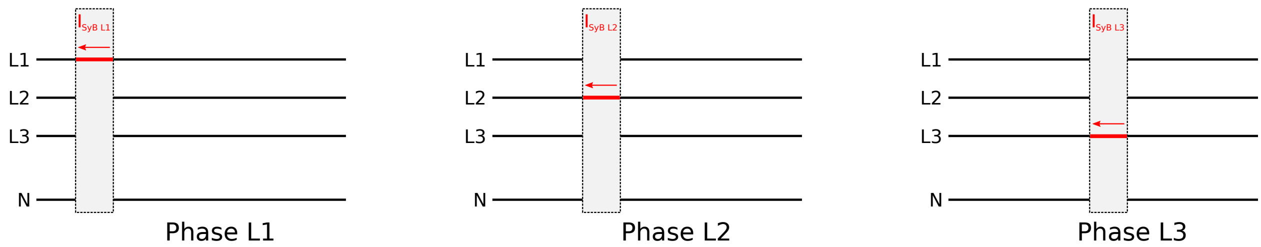


Fig. 43: Current measuring - System B, 'Phase L1' 'Phase L2' 'Phase L3'

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

	Wiring terminals	
Terminal	1	2
Phase	s2 (l) - L3	s1 (k) - L3

3.2.6 Power Measuring

3.2.6.1 Breaker mode CBA

NOTICE!

Software version 2.10-0

The CT mounting direction is located to System A.

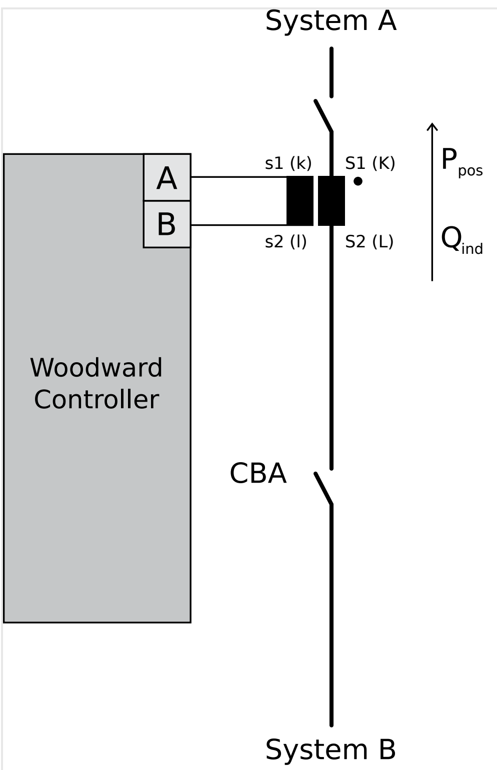


*Fig. 44: Power measuring (breaker mode **CBA**) - wiring*

Terminal				Description
B	3	5	7	System A current
A	4	6	8	

	Description	Sign displayed
Positive real power	Power flow from System B to System A	+ Positive

	Description	Sign displayed
Inductive (lagging) power flow	Inductive power flow from System B to System A	+ Positive

NOTICE!

Software version 2.10-1 or higher

The CT mounting direction is located to System B.

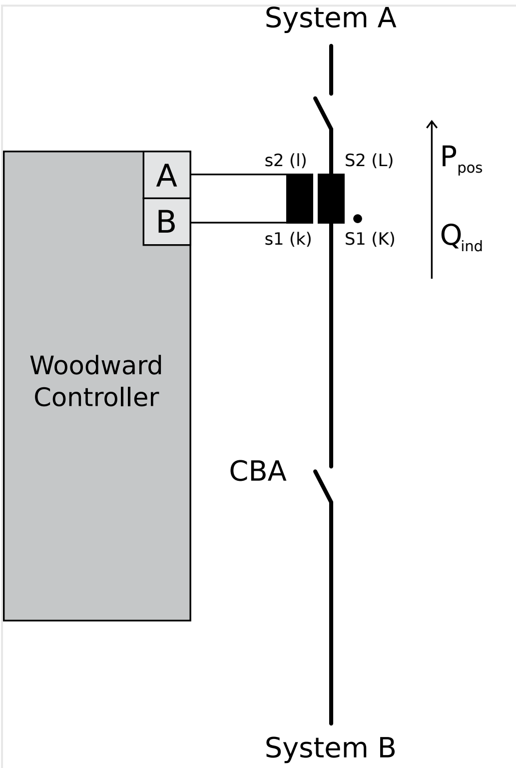


*Fig. 45: Power measuring (breaker mode **CBA**) - wiring*

Terminal				Description
A	3	5	7	System A current
B	4	6	8	

	Description	Sign displayed
Positive real power	Power flow from System B to System A	+ Positive
Inductive (lagging) power flow	Inductive power flow from System B to System A	+ Positive

3.2.6.2 Breaker mode CBA/CBB

NOTICE!

Software version 2.10-0

The CT mounting direction is located to System A.

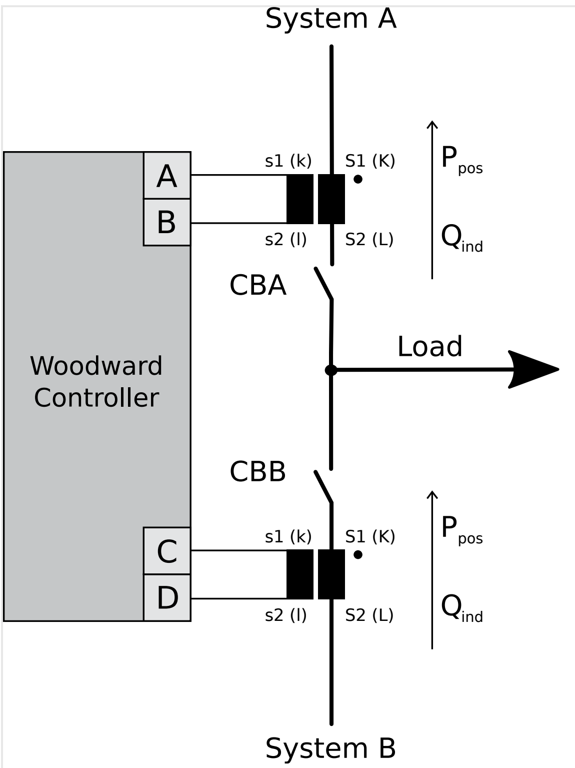


*Fig. 46: Power measuring (breaker mode **CBA/CBB**) - wiring*

Terminal				Description
D	1			System B current
C	2			
B	3	5	7	System A current
A	4	6	8	

	Description	Sign displayed
Positive real power	Power flow from System B to System A	+ Positive
Inductive (lagging) power flow	Inductive power flow from System B to System A	+ Positive

NOTICE!

Software version 2.10-1 or higher

The CT mounting direction is located to System B.

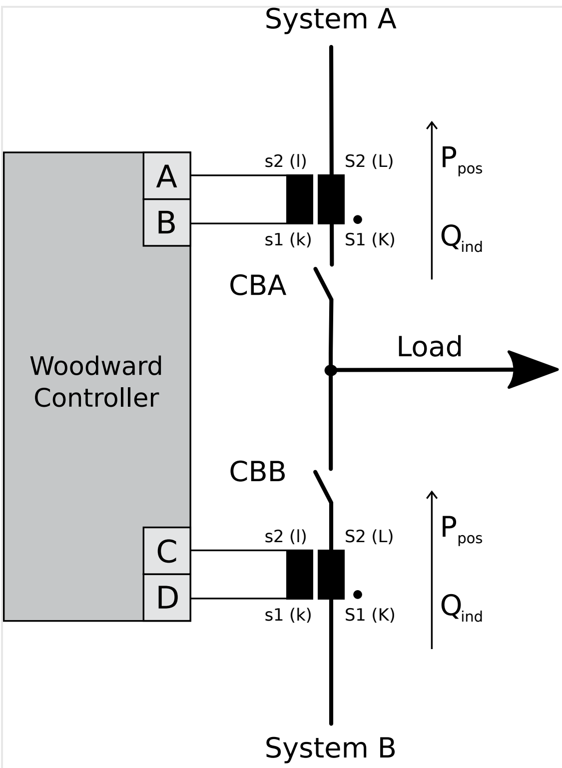


*Fig. 47: Power measuring (breaker mode **CBA/CBB**) - wiring*

Terminal				**Description**
C	1			System B current
D	2			
A	3	5	7	System A current
B	4	6	8	

	Description	**Sign displayed**
Positive real power	Power flow from System B to System A	+ Positive
Inductive (lagging) power flow	Inductive power flow from System B to System A	+ Positive

The load is calculated with the System A and System B active power: $P_L = P_{SyB} - P_{SyA}$

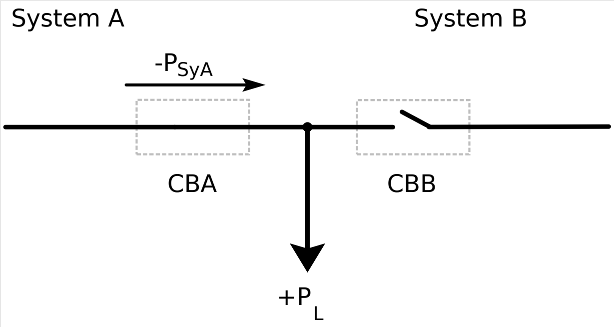


*Fig. 48: LS-6XT (breaker mode **CBA/CBB**) Power measuring CBA closed*

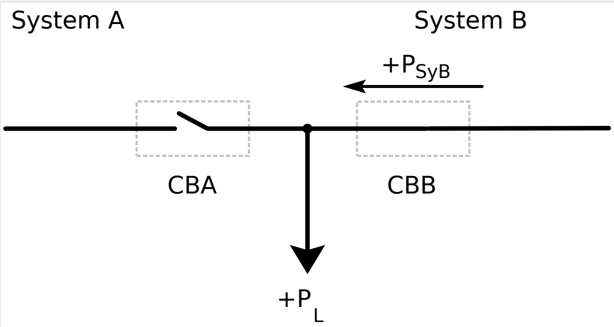


*Fig. 49: LS-6XT (breaker mode **CBA/CBB**) Power measuring CBB closed*

3.2.7 Power Factor Definition

Definition

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

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

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

Properties

	Inductive	**Capacitive**
Load type	Electrical load whose current waveform lags the voltage waveform thus having a lagging power factor. Some inductive loads such as electric motors have a large startup current requirement resulting in lagging power factors.	Electrical load whose current waveform leads the voltage waveform thus having a leading power factor. Some capacitive loads such as capacitor banks or buried cable result in leading power factors.
Different power factor display on the unit	i0.91 (inductive) lg.91 (lagging)	c0.93 (capacitive) ld.93 (leading)

	Inductive	Capacitive
Reactive power display on the unit	70 kvar (positive)	-60 kvar (negative)
Output of the interface	+ (positive)	- (negative)
Current relation to voltage	Lagging	Leading
Generator state	Overexcited	Underexcited
Control signal	If the control unit is equipped with a power factor controller while in parallel with the utility:	
	A voltage lower "-" signal is output as long as the measured value is "more inductive" than the reference setpoint Example: measured = i0.91; setpoint = i0.95	A voltage raise "+" signal is output as long as the measured value is "more capacitive" than the reference setpoint Example: measured = c0.91; setpoint = c0.95

Phasor diagram

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

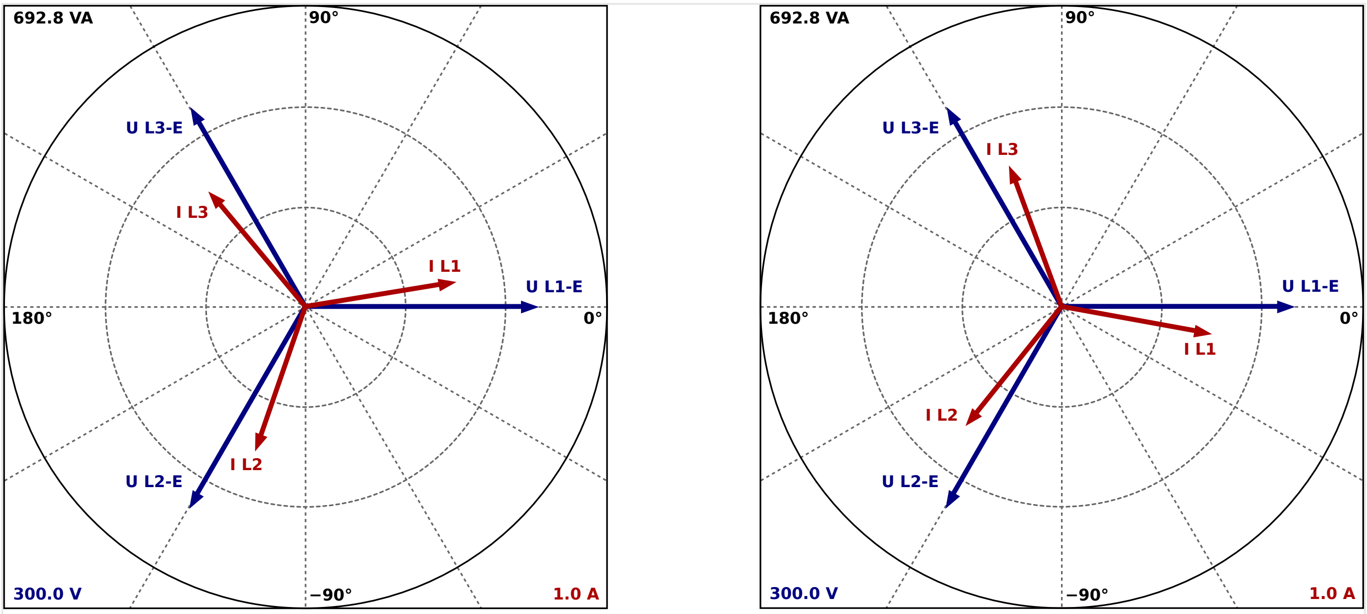


Fig. 50: Phasor diagram: capacitive load (left) and inductive load (right)

3.2.8 Discrete Inputs

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

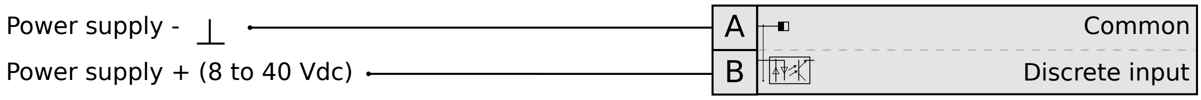


Fig. 51: Discrete input - positive polarity signal

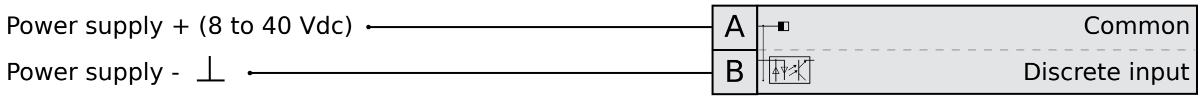


Fig. 52: Discrete input - negative polarity signal

Terminal		Description	Preconfiguration
A	**B**		
66	67	Discrete Input [DI 01]	Preconfigured to "Lock monitoring"
GND	68	Discrete Input [DI 02]	Preconfigured to "External Ackn."
Common ground	69	Discrete Input [DI 03]	Preconfigured to "Open CBB"
	70	Discrete Input [DI 04]	Preconfigured to "En. close CBB"
	71	Discrete Input [DI 05]	Fixed to "Reply: CBB open" (breaker mode "CBA/CBB")
	72	Discrete Input [DI 06]	Preconfigured to "Open CBA"
	73	Discrete Input [DI 07]	Preconfigured to "En. close CBA"
	74	Discrete Input [DI 08]	Fixed to "Reply: CBA open"
	75	Discrete Input [DI 09]	Preconfigured to "Alarm input"
	76	Discrete Input [DI 10]	Preconfigured to "Alarm input"
	77	Discrete Input [DI 11]	Preconfigured to "Alarm input"
	78	Discrete Input [DI 12]	Preconfigured to "Alarm input"

Table 21: DI 01-12

Operation logic

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

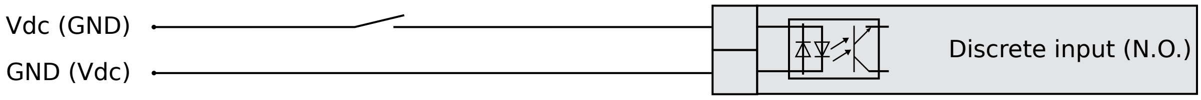


Fig. 53: Discrete inputs - state N.O.

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

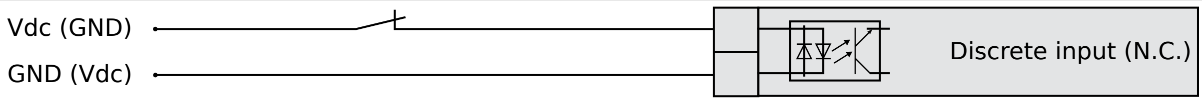


Fig. 54: Discrete inputs - state N.C.

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

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

3.2.9 Relay Outputs (LogicsManager)

General notes

CAUTION!

The relay output "Ready for operation" must be integrated into the alarm chain to make sure that if this relay falls off an appropriate action can be taken.

For information on interference suppressing circuits when connecting 24 V relays, please refer to ⮱ "3.2.9.1 Connecting 24 V Relays".

Schematic and terminals

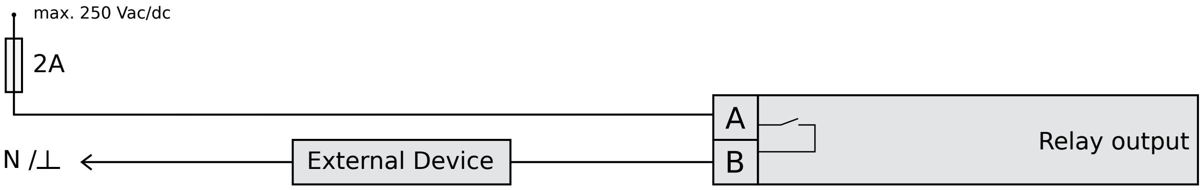


Fig. 55: Relay outputs - schematic

Terminal		Description	Preconfiguration
N.O.	**Common**		
A	**B**	**Form A**	
42	41	Relay output [R 01]	Fixed to "Ready for operation"[1]
43	46	Relay output [R 02]	Preconfigured to "Horn"[1]
44		Relay output [R 03]	Preconfigured to "System B is not OK"[1]
45		Relay output [R 04]	Preconfigured to "System A is not OK"[1]
48	47	Relay output [R 05]	LogicsManager[1]

Terminal		Description	Preconfiguration
N.O.	Common		
A	B	Form A	
			"Command: CBA open relay"
50	49	Relay output [R 06]	Fixed to "CBA close relay"
52	51	Relay output [R 07]	LogicsManager[1] "Command: CBB open relay" (breaker mode "CBA/ CBB")
54	53	Relay output [R 08]	LogicsManager[1] Fixed to "CBB close relay" (breaker mode "CBA/CBB")
56	55	Relay output [R 09]	Preconfigured to "Aux. volt/freq OK "[1]
57	60	Relay output [R 10]	Preconfigured to "Operat. mode MAN"[1]
58		Relay output [R 11]	Preconfigured to "Alarm class A and B"[1]
59		Relay output [R 12]	Preconfigured to "Alarm class C, D, E or F"[1]

[1] configurable via LogicsManager

3.2.9.1 Connecting 24 V Relays

NOTICE!

Damage to adjacent electronic components due to induced voltages

- Implement protection circuits as detailed below.

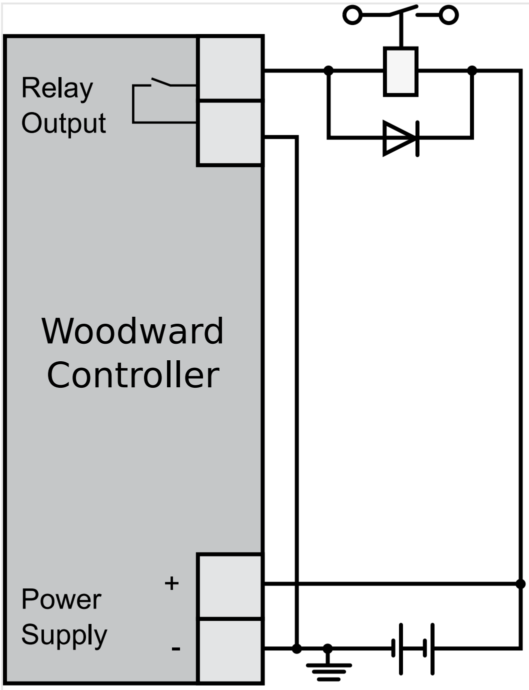


Fig. 56: Protection circuit (example)

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.

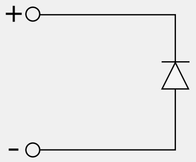
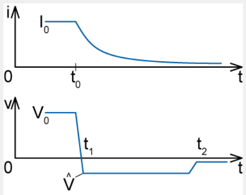
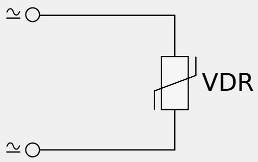
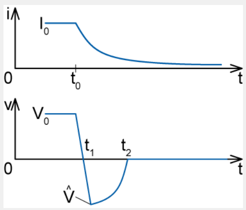
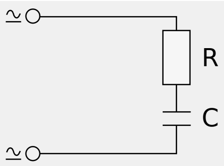
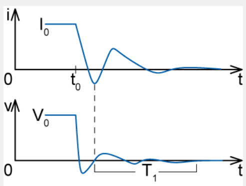
When disabling such a device, high switch-off induced voltages may occur, which might destroy adjacent electronic devices or result interference voltage pulses, which lead to functional faults, by capacitive coupling mechanisms.

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

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

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

3.2.10 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 LS-6XT 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 (⟹ http://www.vdo.com)

Wiring senders

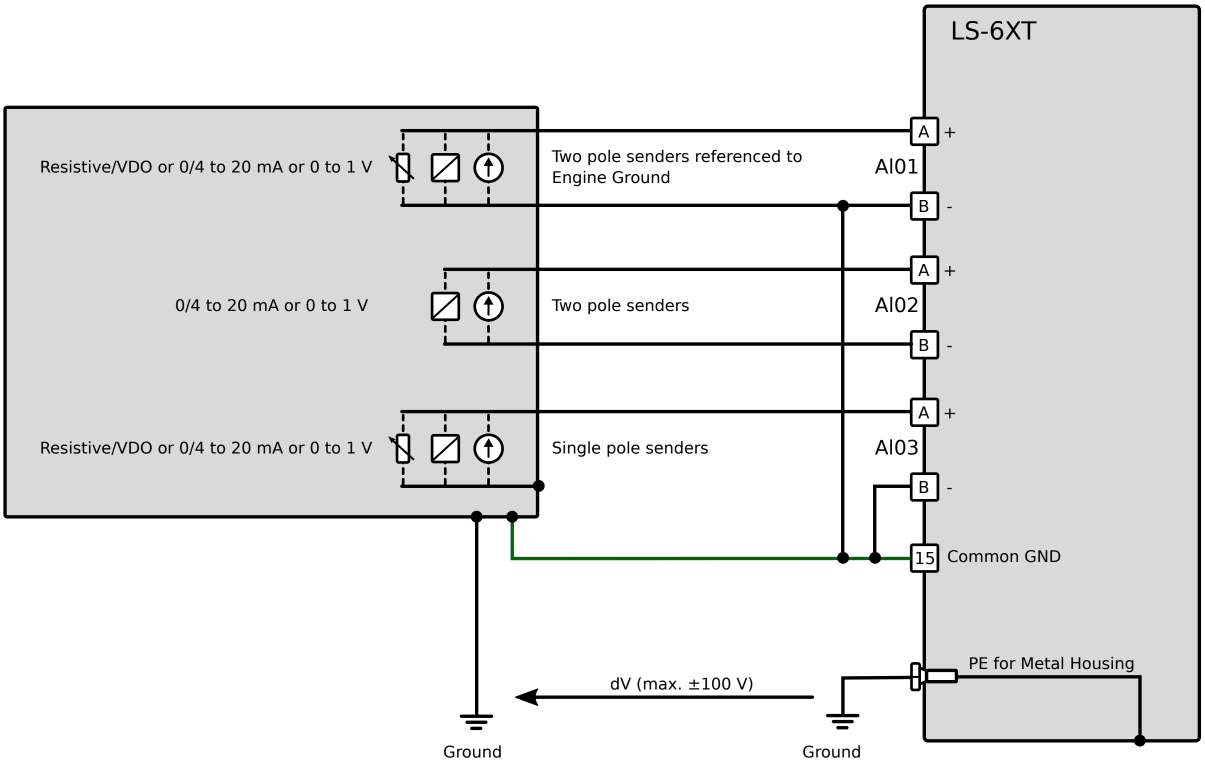


Fig. 57: Analog inputs - wiring senders

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.

3.2.11 Analog Outputs

The LS-6XT offers current, voltage or PWM analog outputs for different applications.

The analog outputs are galvanically isolated.

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

Controller wiring - two wires

Fig. 58: Analog controller output - two wires

CAUTION!

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

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

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

Type	Terminal			Description
I Current **or** V* Voltage	A	19	+	Analog output [AO 02]
	B	20	GND	

*) Internal shunt (resistor) is managed automatically.

3.3 Setup Interfaces

3.3.1 Interfaces overview

Unshielded cable length

For CAN and RS-485:

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

The following drawing shows all available interfaces of the device:

Fig. 59: LS-612XT-P1

1 CAN bus interface connector CAN #1

2 RS-485 interface connector RS-485 #1

3 ETHERNET interface connector (RJ-45) LAN A

4 ETHERNET interface connector (RJ-45) LAN B

5 ETHERNET interface connector (RJ-45) LAN C

6 USB interface connector (2.0, slave) SERVICE port

3.3.2 RS-485 Interface

General notes

The LS-6XT must be configured for half- or full-duplex configuration.

Pin assignment

For location of interface 2 see ⮡ Fig. 59.

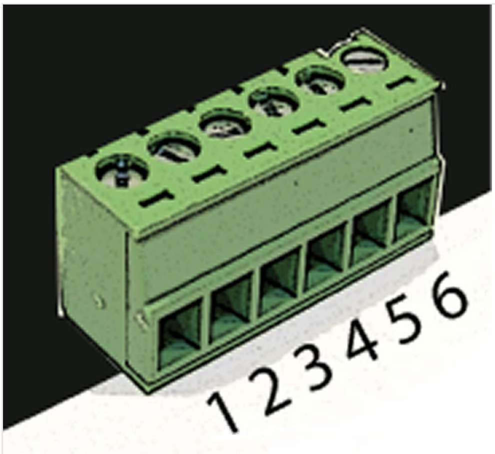


Fig. 60: screwable 6-terminal connector - RS-485

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

Table 22: Pin assignment

RS-485 half-duplex

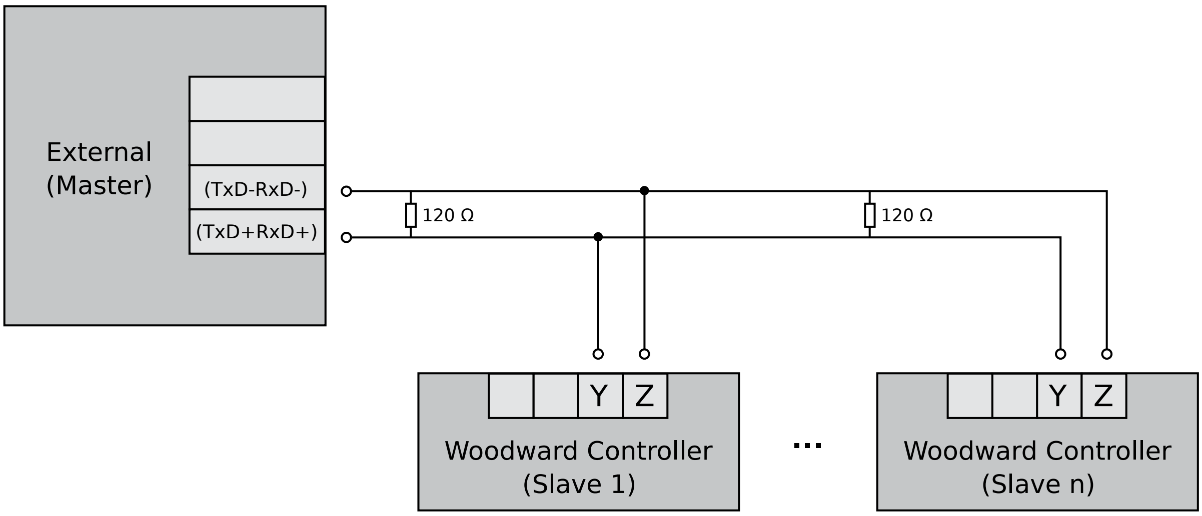


Fig. 61: RS-485 - connection for half-duplex operation (120 Ohms termination resistor at both ends)

RS-485 full-duplex

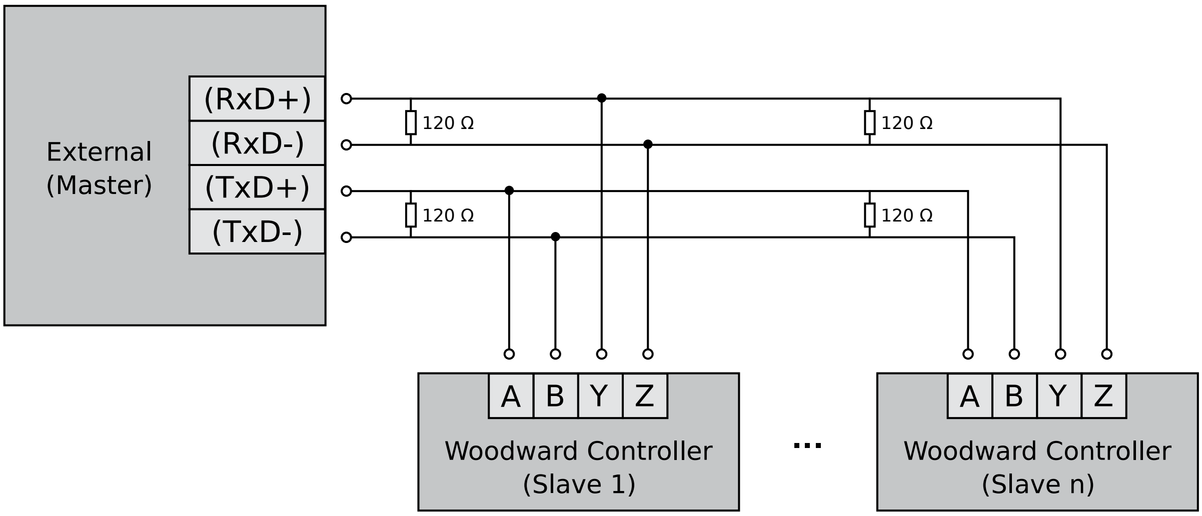


Fig. 62: RS-485 - connection for full-duplex operation

Shielding

The LS-6XT is prepared for shielding: Terminal 4 and the connector housing are internally grounded via an RC element. Therefore, they may either be grounded directly (recommended) or also via an RC element on the opposite connection.

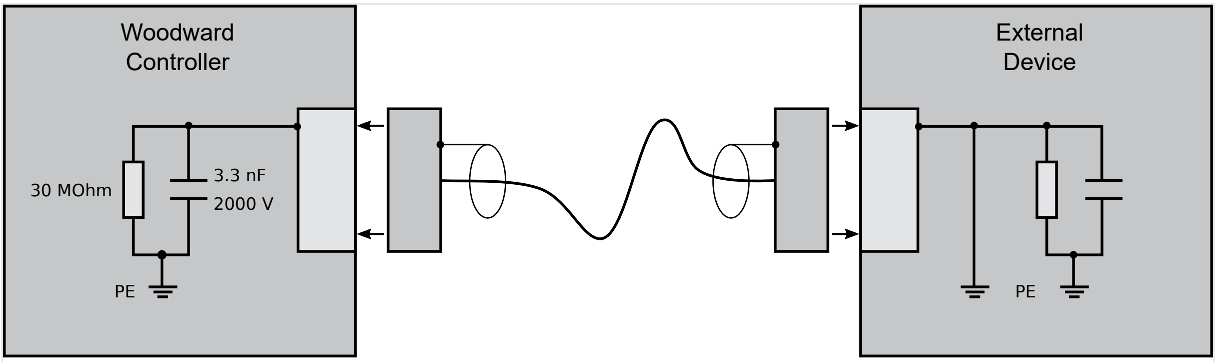


Fig. 63: Shielding preparation (internal RC element)

3.3.3 USB (2.0 slave) interface - Service Port

General notes

Avoid electrostatic discharge!

Avoid electrostatic discharge during USB cable connection to the unit.

To connect this USB 2.0 (slave) device a USB cable with USB Type A (PC/laptop side) and Type B (Woodward device side) connectors is necessary.

USB cable length shall be limited up to 3 m. It is recommended to use professional (high quality) USB cable: 28AWG/1P+24AWG/2C with good shielding.

Use USB service port for ToolKit connection

The USB interface is a service port and the preferred ToolKit connection!

'Read only' USB interface

For location see ⮱ Fig. 59.

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.

3.3.4 CAN Bus Interfaces

Avoid electrostatic discharge!

Avoid electrostatic discharge during cable connection to the unit.

Pin assignment

For location of interface 1 see ⮱ Fig. 59.

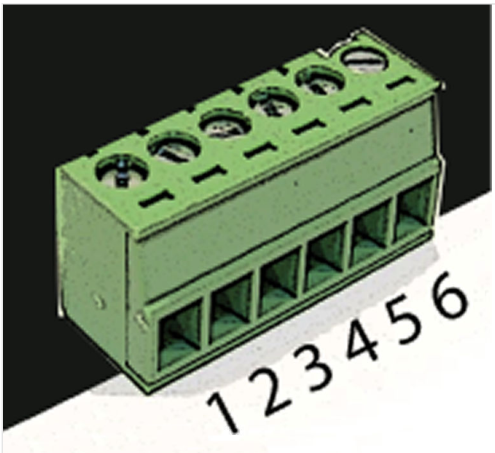


Fig. 64: screwable 6-terminal connector - CAN bus

Terminal	Description	A_{max}
1	GND - local galvanically isolated	1.5 mm^2

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

Table 23: 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.

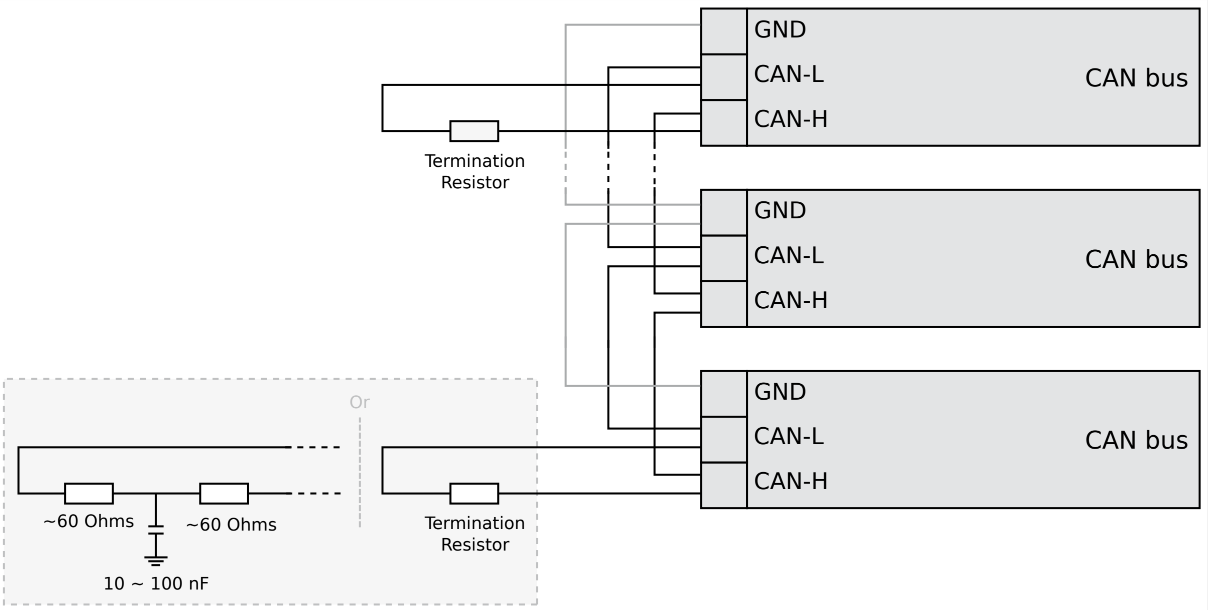


Fig. 65: CAN bus - termination

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

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

Maximum CAN bus length

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

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

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

Bus shielding

All bus connections of the LS-6XT 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.

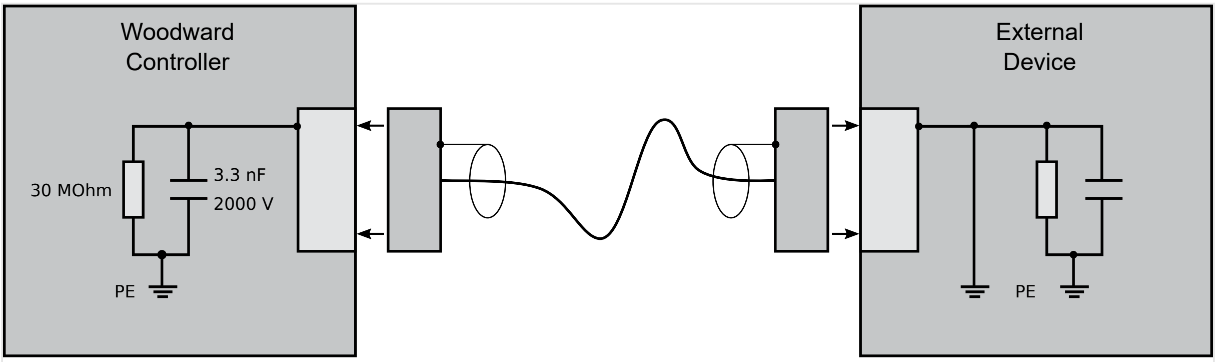


Fig. 66: Bus shielding (internal RC element)

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

3.3.5 Ethernet Interface (incl. Remote Panel)

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

Avoid electrostatic discharge!

Avoid electrostatic discharge during Ethernet cable connection to the unit.

Pin assignment

For location of interfaces 3, 4, and 5 see Fig. 59.

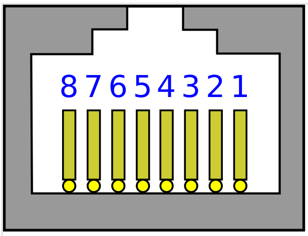


Fig. 67: RJ-45 connector - Ethernet

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 24: Pin assignment

Visualization

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

- The green LED indicates the link activity: blinking during data transmission.

- The yellow LED indicates the link (speed) status:
  - 10MB – LED switched-OFF
  - 100MB – LED switched-ON

General notes

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

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

Cable length / distance

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

Topology

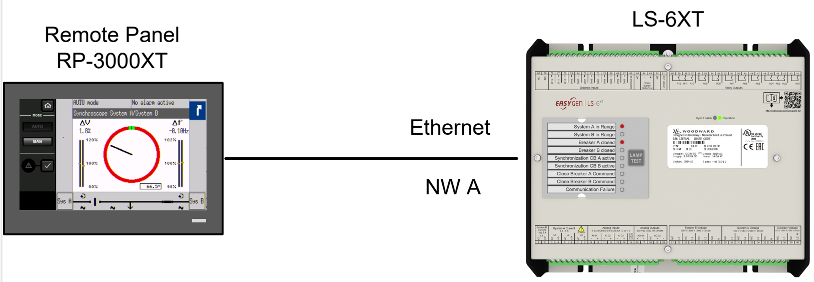


Fig. 68: Application Example: Simple constellation with LS-6XT and RP-3000XT

> ***Remote Control***
>
> The Woodward Remote Control is able to visualize the display of the remotely controlled device and to make front button and soft key related functionality available.
>
> Access via Remote Panel RP-3000XT is described in chapter ⮡ "4.3.8 Configure Remote Panel Mode " and the Technical Manual »37593 RP-3000XT«.

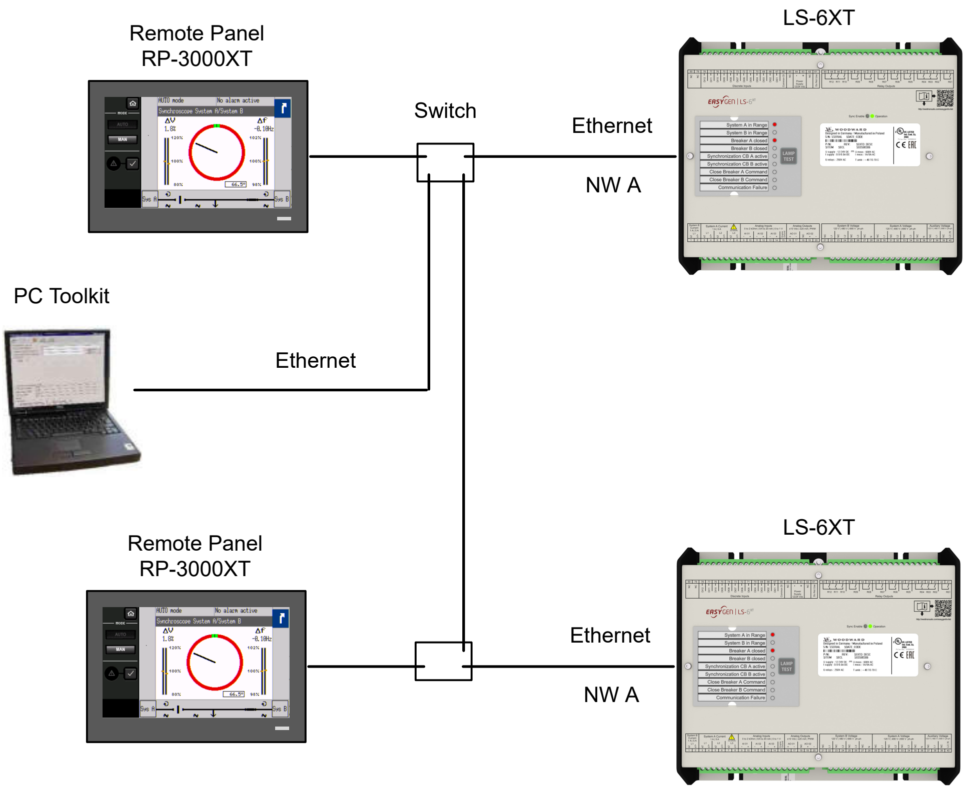


Fig. 69: Application Example: Multiple LS-6XT operation with a ToolKit access point

Troubleshooting

Check first the power supply of the switches.

Check the IP addressed of the single devices. See chapter ⮡ "4.7.5 Ethernet Interfaces" for details.

4 Configuration

Parameter Numbers

All parameters are assigned a unique parameter identification number.

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

This parameter identification number

- is also displayed in the ToolKit configuration screens next to the respective parameter
- can be used with ToolKit "search" functionality
  - to find all ToolKit screens on which this parameter appears
  - to directly jump to the preferred ToolKit screen

Values of variables and parameters

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

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

Rounding error

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

Displayed restrictions sample

Values of user defined tables ([Parameter / Configuration / Configure application / Configure inputs/outputs / Configure analog inputs / General analog inputs / User defined table A (or User defined table B)]) have an input range from -900000.000 to 900000.000.

Type 12345.678 and ...

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

Handle value and unit separately

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

Values and units must fit

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

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

☼ **Values and units**

V, kV, and %

FLOAT, INTEGER

Unit defined and definable

Configuration and Re-Booting

Wait before re-booting

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

Menu structure (menu tree)

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

Exceptions

- The well introduced HMI/display softbutton »Next Page« is continued but in ToolKit named »STATUS MENU«.

  (In ToolKit »Next Page« is used to go to the next page.)

- Some parameters in HMI/display are in ToolKit placed directly with its settings e.g.: find 1692 »Hour« at

  [Next Page / Diagnostic / Miscellaneous / Actual date and time] in HMI/display but

  [Parameter / Configure language / clock / Clock / Actual values] in ToolKit

The following drawing shows the first three (major) levels of the LS-612XT-P1 menu structure:

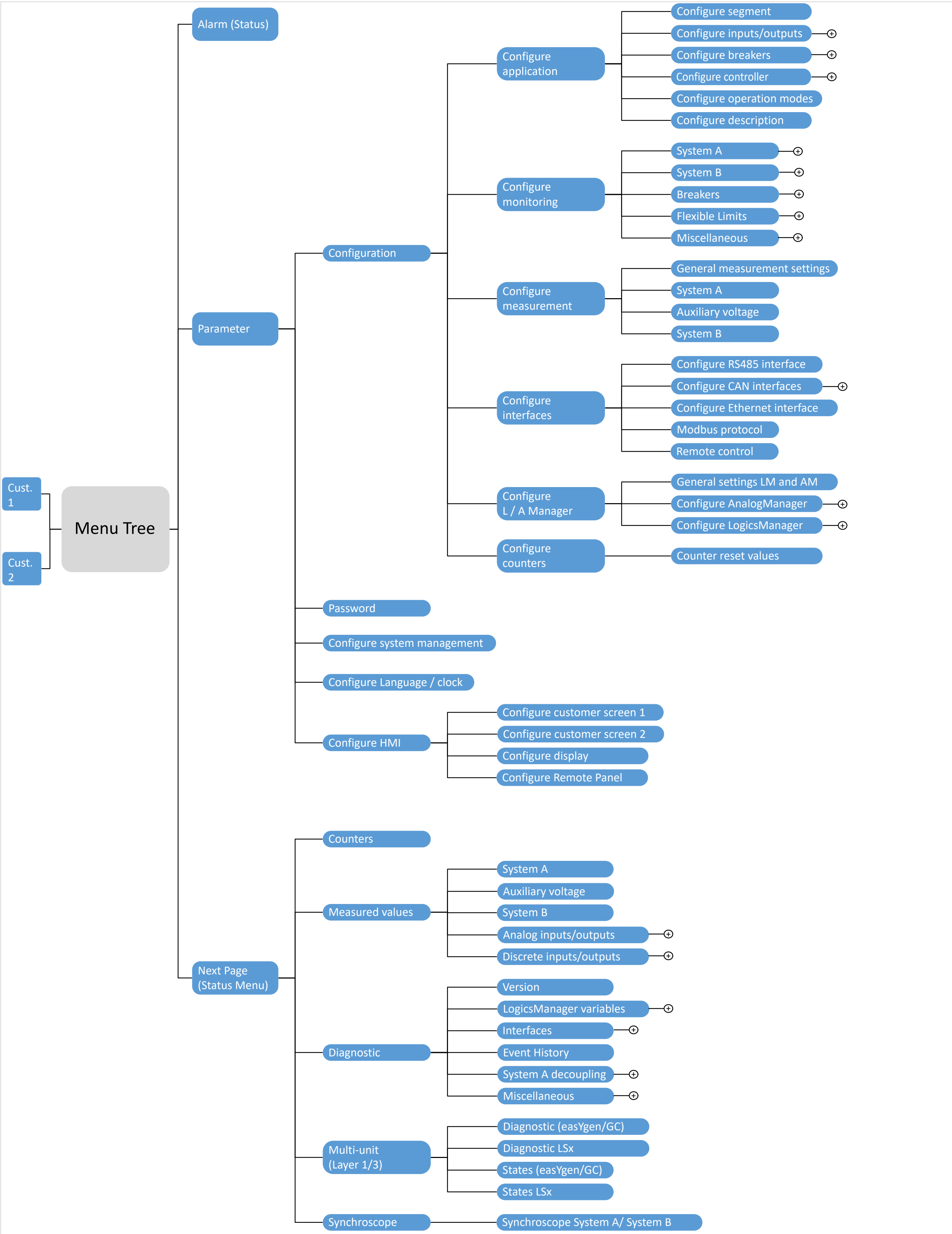


Fig. 70: Menu structure (menu tree)

4.1 Remote Panel Access

> Buttons can be disabled by ToolKit with parameter ⮱▷ 12978 »Lock keypad 1«.

4.1.1 Basic Navigation

Main screen

After power-up the control unit displays the main screen / HOME screen (⮱▷ Fig. 71).

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

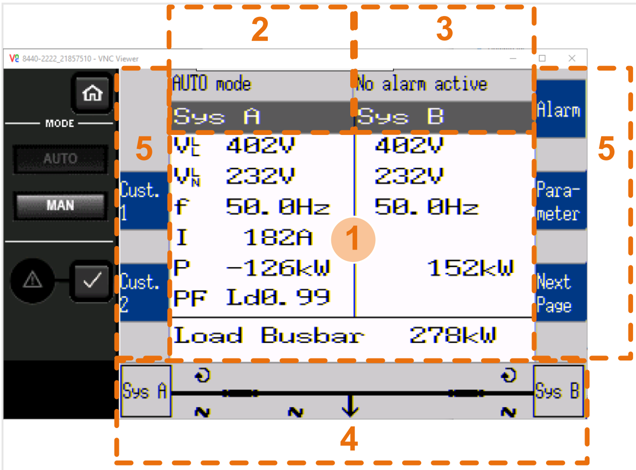


Fig. 71: Main screen (shown with default settings for screen configuration)

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

Values »1«

The "values" section (⮱▷ Fig. 71/1) of the screen illustrates all measured power related information including voltages, currents, frequencies, power, and power factor values.

> The section's content changes based on the selected sub-menu screen.
>
> For information on specialized menu screens refer to ⮱▷ “4.1.5 Specialized Menu Screens”

Status messages »2«

The "status message" section (⮱▷ Fig. 71/2) of the screen shows the actual operating information.

For a list of all operation states refer to “9.6.1 Status messages”.

Alarm messages »3«

The "alarm message" section (Fig. 71/3) of the screen shows the last alarm message that is occurred and not yet acknowledged.

For a list of all alarm messages refer to “9.6.5 Alarm Messages”.

Single line diagram »4«

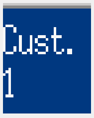
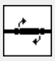
The single line diagram (Fig. 71/4) shows the current status of the power circuit breakers and the detected power at the respective measuring point (System A, Auxiliary voltage or System B).

This section is also used for manual operation.

For additional information refer to “5.2.1 Operating Mode MANUAL”.

Softkeys »5«

The softkeys (Fig. 71/5) permit navigation between screens, levels and functions as well as configuration and operation.

Group	Softkey	Caption	Description
Display		Customer configurable screen 1 (and 2)	Change to "customer specific screen 1 (or 2)" **Notes** The name of this softbuttons is configurable, too.
		Reset Value Display	Reset the maximum value display.
Operation		Increase Value	Increase selected value.
		Decrease Value	Decrease selected value.
		Confirm Input	Confirm and store changed value.
		Acknowledge Message	Acknowledge/Delete message/event.
		Open Breaker	Open mains/generator breaker (MANUAL mode).
		Close Breaker	Close mains/generator breaker (MANUAL mode).
Navigation		Move Up	Select previous value/entry.
		Move Down	Select next value/entry.
		Move Cursor Position	Move cursor position

Group	Softkey	Caption	Description
		Return	Return to previous menu.
	Next Page	Next Page	Go to following page/screen of the current menu (measuring values, status screens and diagnostic screens).
	Para- meter	Parameter Screen	Show parameter screen.
	Alarm	Alarm Screen	Show alarm screen.

Status symbols

Menu screen	Symbol	Caption	Description
Main Screen		Voltage Display Mode	Indicates the actual average delta and average wye voltage from System A and System B.
Single Line Diagram		Rotating Field CW	System A or System B rotating field moves clockwise.
		Rotating Field CCW	System A or System B rotating field moves counter-clockwise.
		Power Detected	Power is detected at the respective measuring point (System A,Auxiliary voltage or System B).
Alarm List		Alarm Condition Present (active)	Indicates that corresponding alarm condition ("yellow" for alarm class A to B, "red" for alarm class C to F) is still present.
		Alarm Condition not present (latched)	Indicates that corresponding alarm condition ("yellow" for alarm class A to B, "red" for alarm class C to F) is not longer present. Acknowledge from the alarm is possible.
	A!	Alarm class A/B/C/D/E/F present	Symbol with "!" indicates that an alarm of class A/B/C/D/E/F is present.
	D	Alarm class A/B/C/D/E/F not present	Symbol without "!" indicates that an alarm of class A/B/C/D/E/F is not present.
LogicsManager		TRUE/enabled	Variable is TRUE (LogicsManager). The bit is enabled (CAN Interface). Relay activated (Discrete Outputs)
		FALSE/disabled	Variable is FALSE (LogicsManager). The bit is disabled (CAN Interface). Relay deactivated (Discrete Outputs)

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

For information on standard softkeys and status symbols refer to “4.1.1 Basic Navigation”.

"Released"

4.1.2 The HOME Screen

General notes

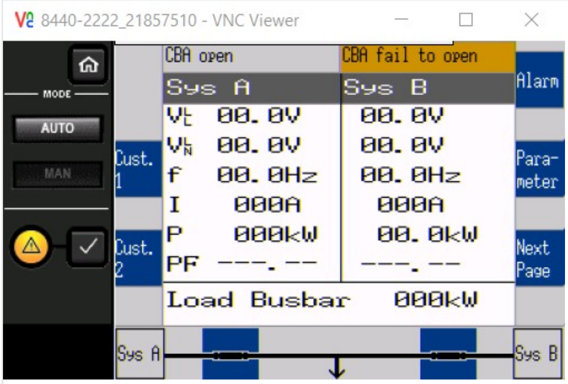


Fig. 72: HOME page/screen

- The “Home” button is a one-click way back to the overview starting point: the HOME page / HOME screen
- **Two customizable buttons** enable selection of indications to display auxiliary values (full access via ToolKit, name/description cannot be changed via HMI)

  Find menu: [Parameter / Configure HMI / Configure customer screen 1 or Configure customer screen 2]
- Lock keypad function is determined by LogicsManager ⮡ 12978. Result is available as logical command variable 86.30.

  Find menu (ToolKit only!): [Parameter / Configure HMI / Configure display]

Display alternatives

The HOME screen display depends from the breaker mode (parameter ⮡ 9018) with indicaton of different values.

- CBA
  - Average Voltage (phase-phase) - System A and B
  - Average Voltage (phase-neutral) - System A and B
  - Frequency - System A and B
  - Currents (L1, L2, L3) - System A
  - Power - System A
  - Power Factor PF - System A
- CBA/CBB
  - Average Voltage (phase-phase) - System A and B
  - Average Voltage (phase-neutral) - System A and B
  - Frequency - System A and B

- Current - System A and B
- Power - System A and B
- Power factor - System A and B
- Power - Load busbar

4.1.3 Customer Screen

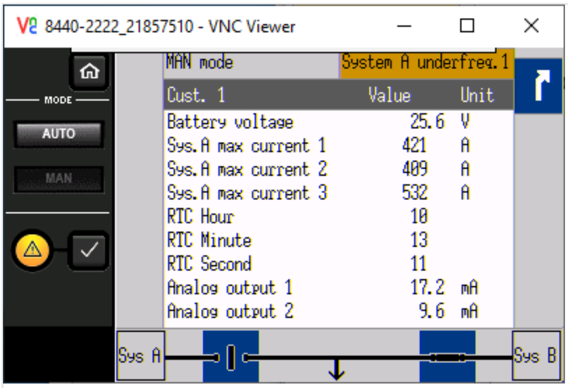


Fig. 73: Customer Screen sample:

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

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

Find menu: [Parameter / Configure HMI / Configure customer screen 1 or Configure customer screen 2 / AM Customer screen x.x]

How to customize screens via ToolKit?

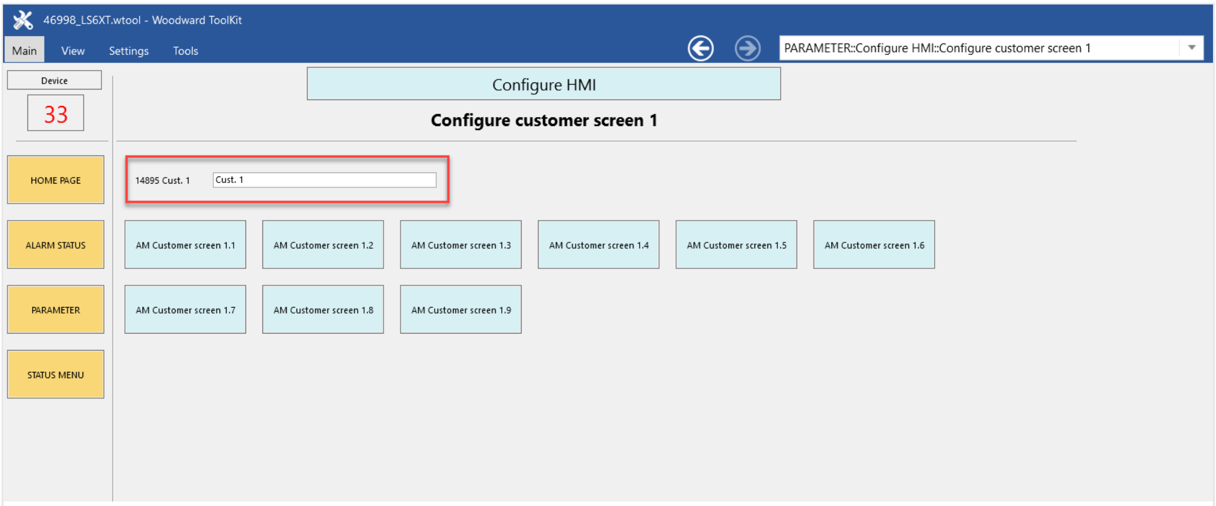


Fig. 74: Customer screen: setting sample

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

Customize via	Parameter	Description
Configure homepage button names for screen 1 and screen 2:		
Screen/button Name	14895, 14897	Button text, displayed at LS-6XT HMI homepage
		Notes The display allows two rows with five letters each. Use <WBR> for row separator because a blank is taken as one letter. If the text is too long it will not be visible and an "empty/clear button" will appear! We propose to check input immediately by refreshing home screen.
Configure each row of the customer screens with:		
Description	7691, 7696, 7701, ..., 7776	Text displayed
Value	AM 7690, 7695, 7700, ..., 7775	AnalogManager to select parameter for display. Additionally available via HMI, too.
Unit	7692, 7697, 7702, ..., 7777	Text displayed

4.1.4 Standard Menu Screens

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

For information on standard softkeys and status symbols refer to ⮡ "4.1.1 Basic Navigation".

For information on all other menu screens refer to ⮡ "4.1.5 Specialized Menu Screens".

4.1.4.1 Navigation Screens

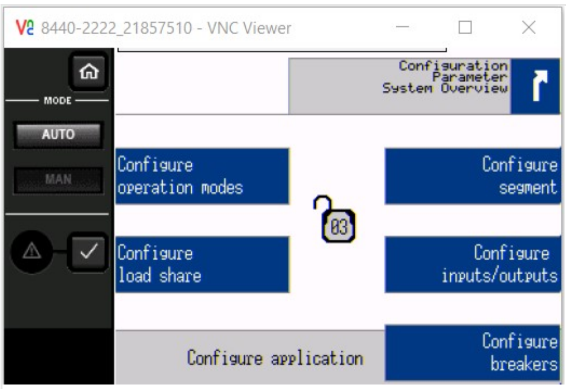


Fig. 75: Navigation screen (example)

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

Navigation screens samples:

Parameter, Configuration, Measured values, Synchroscopes, Diagnostic ...

⚙

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

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

4.1.4.2 Value Setting Screens

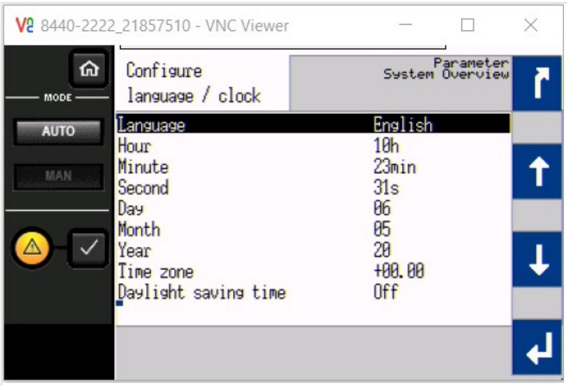


Fig. 76: Value setting screen (example)

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

Value setting screens samples:

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

⚙

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

Softkey	Description
↑	Select previous value/entry.
↓	Select next value/entry.
→	Select cursor postion from selected value
+	Increase selected value.
−	Decrease selected value.

Softkey	Description
	Confirm and store changed value.

4.1.4.3 Status Screens

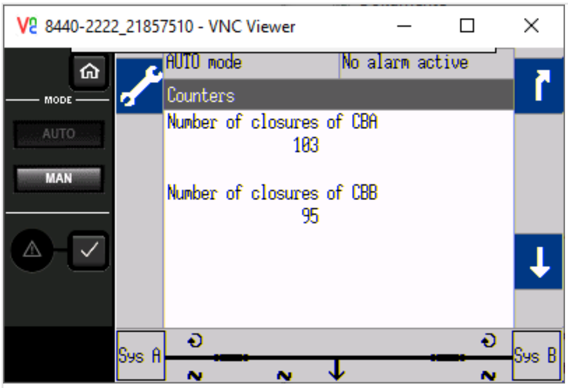


Fig. 77: Status screen (example)

Status screens samples

Status screen	Notes
System A	Which values are shown in the display and whether they are correct depends on the measurement type.
System B	Which values are shown in the display and whether they are correct depends on the measurement type.
Analog inputs/outputs	The analog outputs are displayed as a percentage of the selected hardware range, i.e. 50% of a 0 to 20 mA output refer to 10 mA or alternatively as absolute values (depending on selected parameters).
Discrete inputs/outputs	The configured logic for the discrete input "N.O./N.C." will determine how the LS-6XT reacts to the state of the discrete input. If the respective DI is configured to N.O., the unit reacts on the energized state, if it is configured to N.C., it reacts on the de-energized state.
Counters	For additional information on setting/resetting counters refer to ⮡ "4.10 Configure Counters".
Actual date and time	—
Version	—

Table 25: Status screens samples

4.1.5 Specialized Menu Screens

4.1.5.1 Measured Values

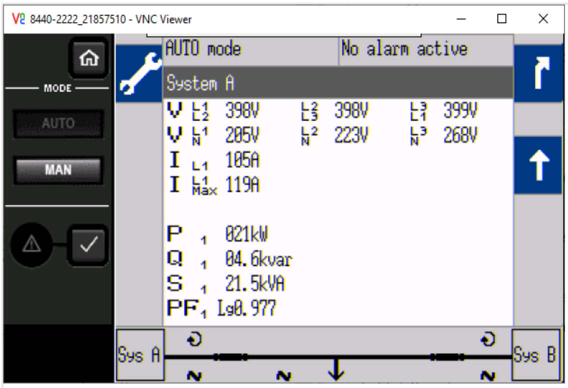
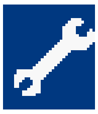


Fig. 78: Measured values System A - 2nd page (example)

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

4.1.5.2 Alarm List

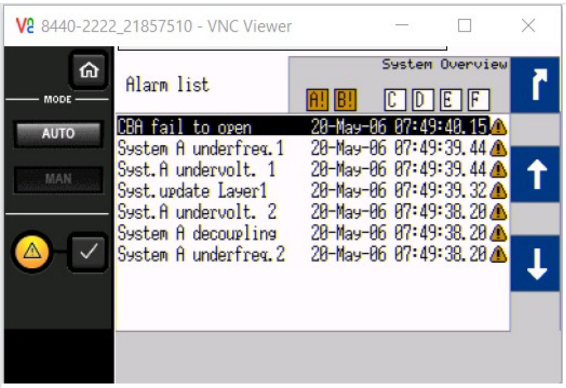


Fig. 79: Alarm List screen

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

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

Symbol/Softkey	Description
⚠	Indicates that corresponding alarm condition (class A/B) is still present.
△	Indicates that corresponding alarm condition (class A/B) is no longer present.

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

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

4.1.5.3 Event History

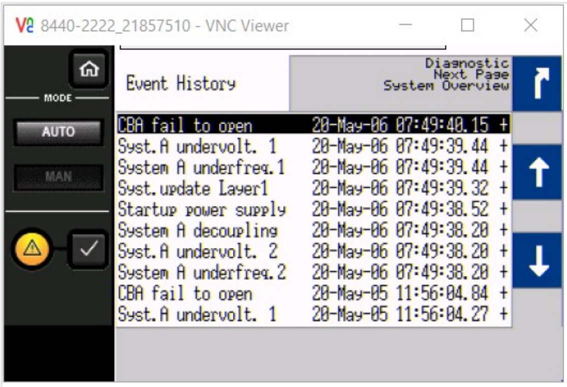


Fig. 80: Event History screen

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

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

4.1.5.4 States easYgen

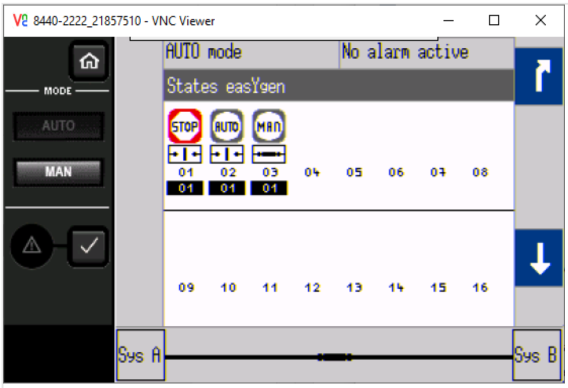


Fig. 81: States easYgen screen

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

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

4.1.5.5 States LSx

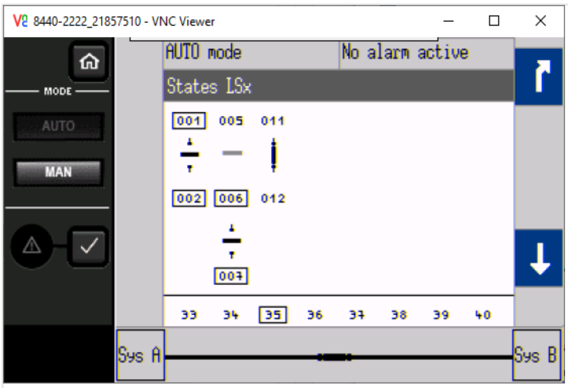


Fig. 82: States LSx screen

The states of the LSx devices are displayed.

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

4.1.5.6 Diagnostic devices

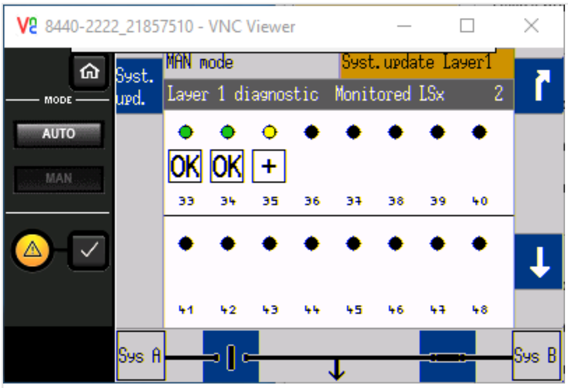


Fig. 83: Diagnostic screen example (HMI)

This screen displays the diagnostic status (the current communication state of the load share and system bus) of the accepted easYgen and/or LS-x devices. Refer to ⮱ Table 59 for details.

4.1.5.7 Synchroscope (System A/System B)

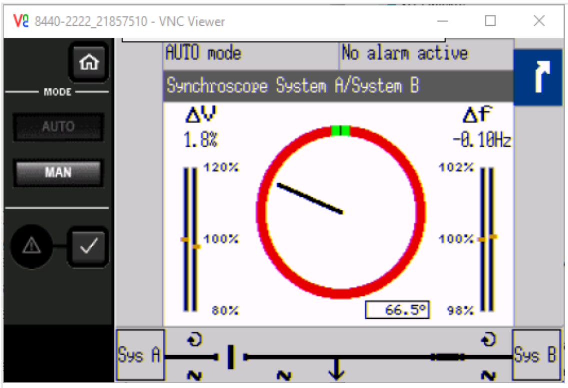


Fig. 84: Synchroscope screen (example)

The needle indicates the actual phase angle between System A and System B.

Please take care for compensation settings with parameters ⮡ 8841 »Phase angle compensation CBA« and ⮡ 8842 »Phase angle CBA«.

If phase angle compensation is active the compensated values are taken for synchroscope display (and synchronization)!

WARNING!

Ensure correct synchronization configuration to avoid generator destructive power!

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

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

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

4.1.5.8 LogicsManager Conditions

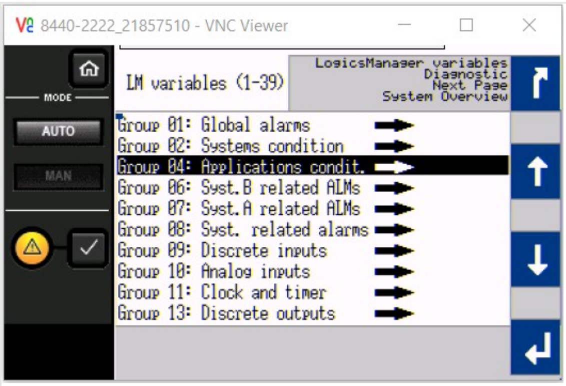


Fig. 85: LogicsManager conditions screen

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

Symbol	Description
↑	Arrow up within a command variable group: navigate page wise
↓	Arrow down within a command variable group: navigate page wise
↵	Select the highlighted command variable group and display the state of the command variables in this group.

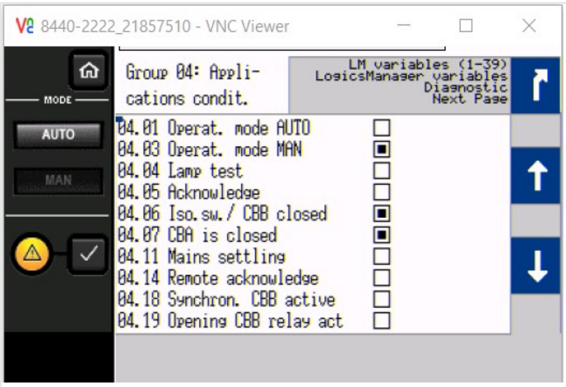


Fig. 86: Command variables screen (example)

Symbol	Description
▣	Variable is TRUE.
☐	Variable is FALSE.

4.1.5.9 LogicsManager

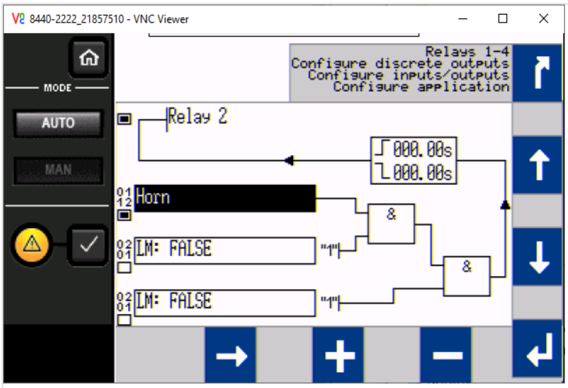


Fig. 87: LogicsManager screen

Some parameters of the LS-6XT are configured via the LogicsManager.

⚙

1. ▷ Configure a logical operation using various command variables, signs, logical operators, and delay times to achieve the desired logical output.
2. ▷ Please refer to ⮡ "9.4.2 Logical Command Variables" for available command variables

Symbol/Softkey	Description
⎾	Delay before output becomes TRUE.
⎿	Delay before output becomes FALSE.
▣	State of the command variable is TRUE.
☐	State of the command variable is FALSE.
↑	Navigate "up" to the next selection fields.
↓	Navigate "down" to the next selection fields.
+	Increase value from the selection field.
−	Decrease value from the selection field.
→	Command variable selection field: Change the command variable group. Time delay configuration field: Change the cursor position.

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

4.1.5.10 Mains Decoupling Threshold

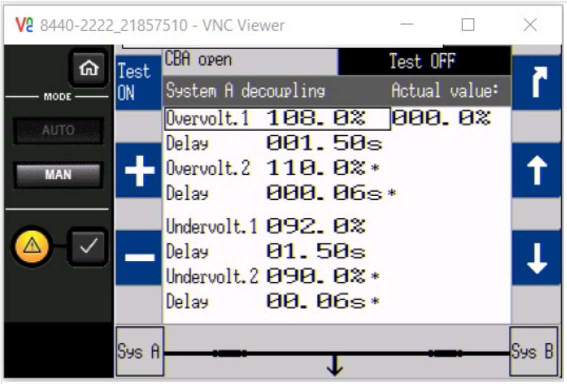


Fig. 88: System A decoupling screen 1

Symbol/Softkey	Description
Test ON	Starts a special TEST mode which allows System A decoupling test independent from the LogicsManager "12942 Enable System A dec." status (even if CBA or CBB is open, no rotation of prime mover/generator).
Test OFF	Stops the TEST mode so System A decoupling is possible if system enabled with the LogicsManager "12942 Enable System A dec." only.
	Notes: TEST mode is deactivated not only by this button but too: • ... automatically after 60 minutes
↑	Navigate "up" to the next parameter or page.
↓	Navigate "down" to the next parameter or page.
+	Increase value from the selected parameter.
−	Decrease value from the selected parameter.
*	Indicates parameters that are part of the System A decoupling configuration.

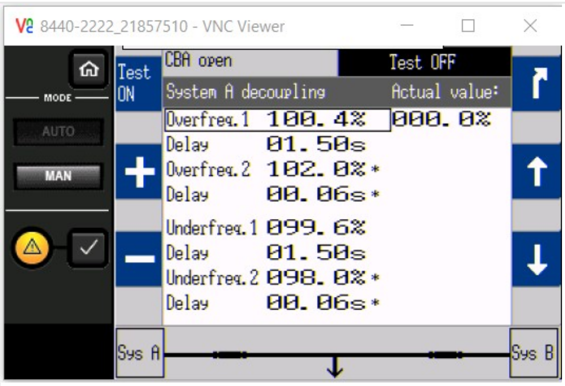


Fig. 89: System A decoupling screen 2

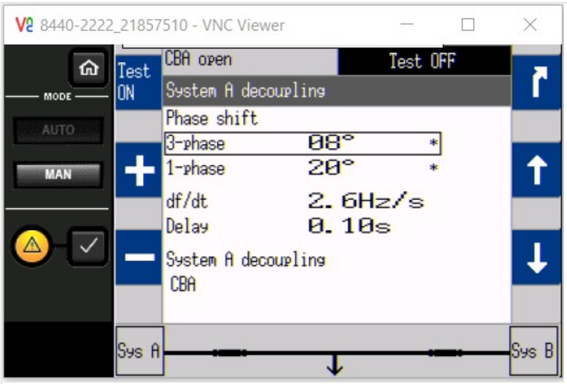


Fig. 90: *System A decoupling screen 3*

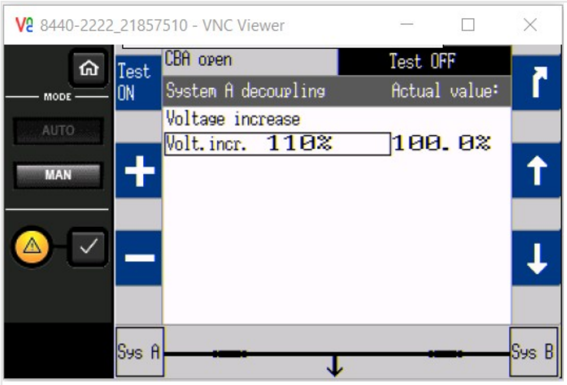


Fig. 91: *System A decoupling screen 4*

4.1.5.11 Test Mains Decoupling

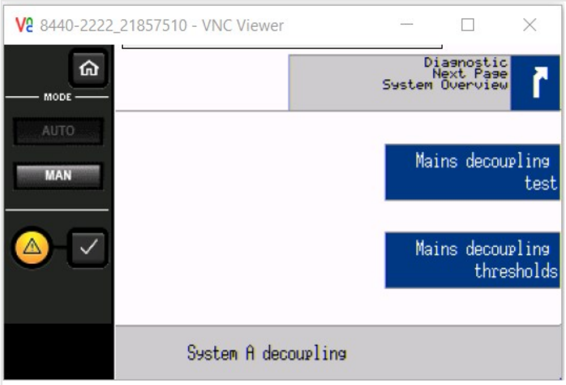


Fig. 92: *Test mains decoupling selection screen*

Restricted Access

The function Mains Decoupling Test is available on Code level CL3. Code levels CL0 to CL2 are intentionally not supported. Refer to ⮑ "4.3.4 Enter Password" for details.

Mains decoupling test is running after the warning is accepted.

The Mains decoupling test opens the selected breaker for mains decoupling (parameter ⮡ 3110).

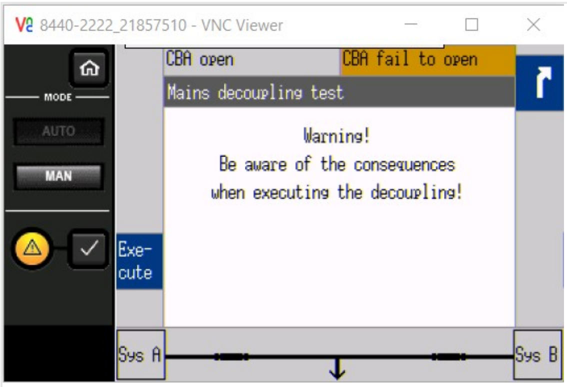


Fig. 93: Security query mains decoupling test

CAUTION!

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

No thresholds are considered.

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

4.1.5.12 CAN Interface 1 State

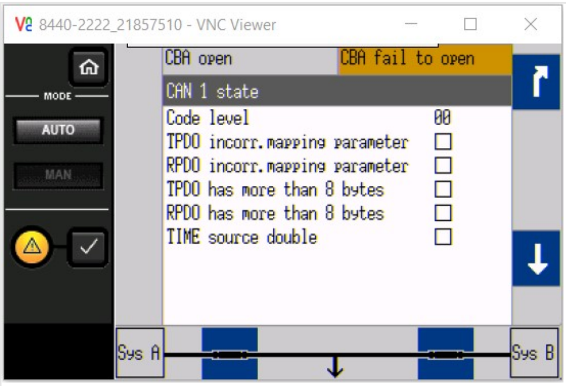


Fig. 94: CAN interface state screen (example)

Symbol	Description
▣	State is TRUE
☐	State is false

Table 26: Graphic assignments

Section		Description
Code level	00	Current code level of CAN1 connection

Section		Description
TPDO has incorrect mapping parameters	▣	State is TRUE/false
RPDO has incorrect mapping parameters	/	
TPDO has more than 8 bytes	☐	
RPDO has more than 8 bytes		
TIME source double		

Table 27: Bit assignments

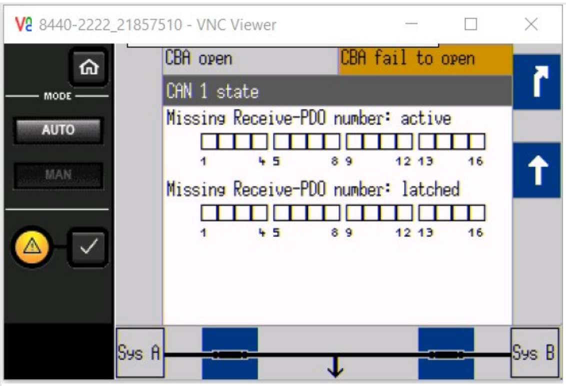


Fig. 95: CAN interface 1 state screen (example)

Symbol	State	Description
▣	State is TRUE	PDO is missing
☐	State is false	PDO is NOT missing

Table 28: Graphic assignments

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

4.1.5.13 Ethernet Network

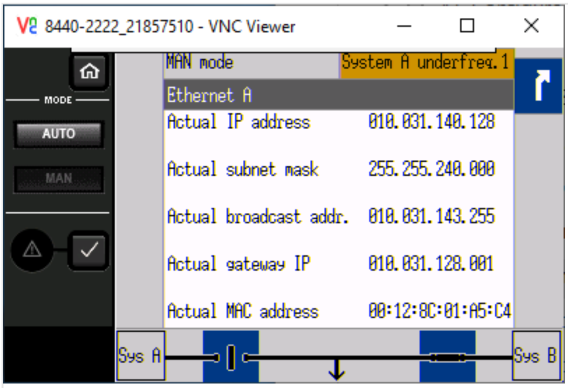


Fig. 96: Ethernet A state screen (example)

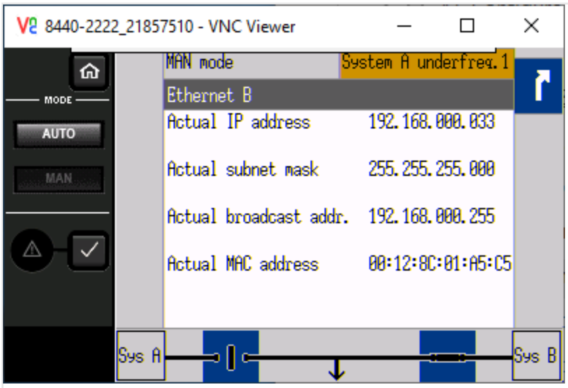


Fig. 97: Ethernet B state screen (example)

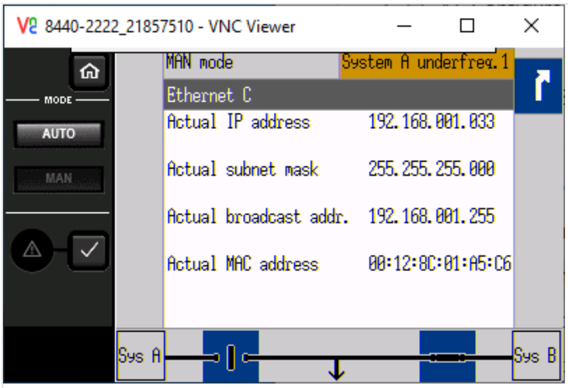


Fig. 98: Ethernet C state screen (example)

Current Ethernet state is displayed. Setting can be found under [Next Page / Diagnostic / Interfaces / Ethernet].

In this menu select:

- »Ethernet A«
- »Ethernet B«

- »Ethernet C«
- »SNTP«
- »Servlink«
- »Modbus TCP/IP«
- »Modbus Master«
- »Interconnectivity«

> See chapter "4.7.5 Ethernet Interfaces" for configuration.

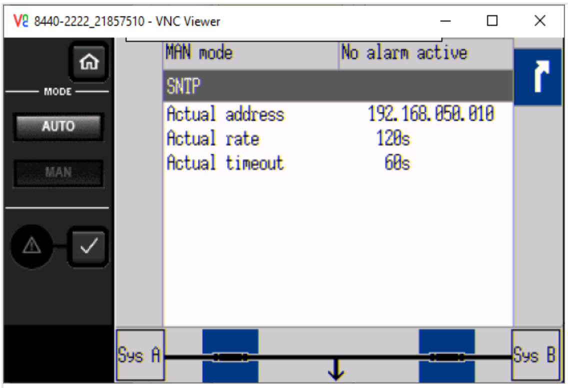


Fig. 99: Ethernet SNTP (example)

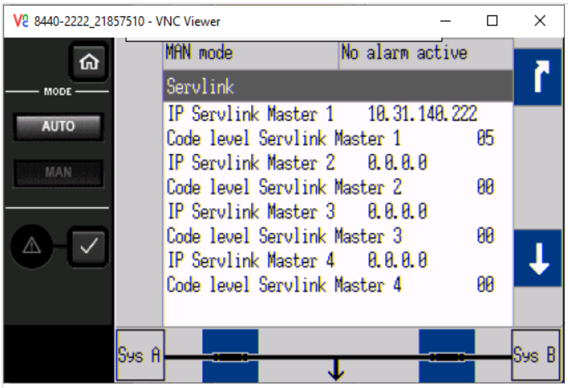


Fig. 100: Ethernet Servlink (example)

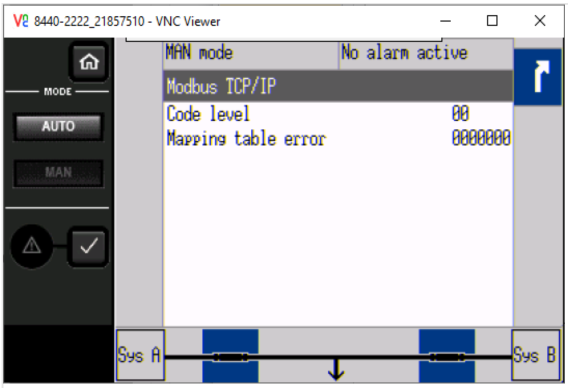


Fig. 101: Ethernet Modbus-TCP-IP

4.1.5.14 USB

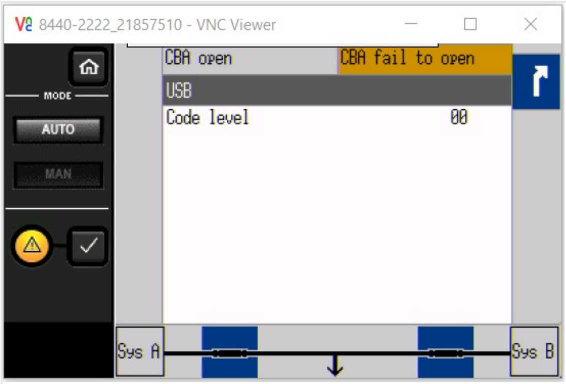


Fig. 102: USB interface

Current USB state is displayed. Setting can be found under [Next Page / Diagnostic / Interfaces / USB].

See chapter ⮡ Chapter 4.7.1 for configuration.

4.1.5.15 RS-485

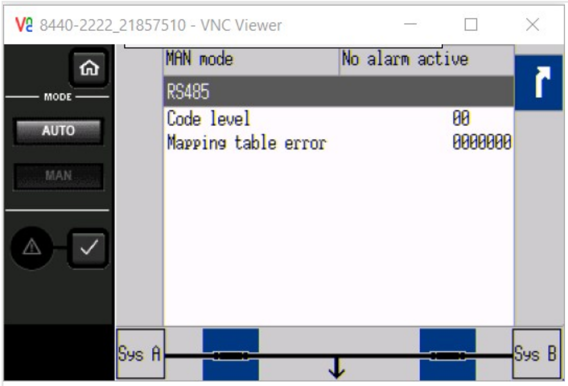


Fig. 103: RS-485 interface

Current RS-485 state is displayed. Setting can be found under [Next Page / Diagnostic / Interfaces / RS485].

> See chapter ⮡ "4.7.2 RS-485 Interface" for configuration.

4.2 Access Via PC (Toolkit)

Version

> Woodward's ToolKit software is required to access the unit via PC
>
> - Required version: 7.0.1 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.

4.3 Basic Setup

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

- Configure language / clock
- Configure system management
- Configure HMI
  - Configure customer screen 1
  - Configure customer screen 2
  - Configure display
  - Configure Remote Panel

(Other configuration is "below" the sub-menu »Configuration«. See following chapters.)

4.3.1 Configure Language/Clock

General notes

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

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

This can easily be checked:

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

If a custom language is configured, the enumeration text in Toolkit displays "Reserve 1". In the LS-6XT HMI, the enumeration text is the name of the current custom language.

If the language is set to "Reserve1" without a loaded custom language, the language of the HMI will be set to English.

Update Clock

HMI/display and ToolKit differ in updating the clock settings

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

Parameters Language/Clock Configuration

ID	Parameter	CL	Setting range **[Default]**	Description
1700	**Language**	0	selectable languages **[English]**	The desired language for the unit display text is configured here.

ID	Parameter	CL	Setting range [Default]	Description
	(Set language)			Available languages are: English, German, Reserve 1.

»Values to be set«

ID	Parameter	CL	Setting range [Default]	Description
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** • 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**	2	Yes **[No]**	Yes transfers the time values to the clock. **Notes** Parameter is only available in Toolkit! 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	The year of the date is set here.

ID	Parameter	CL	Setting range [Default]	Description
			[real-time clock]	**Example** • 0 = Year 2000 • 99 = Year 2099
1699	**Transfer date to clock**	2	Yes **[No]**	Yes transfers the date values to the clock.
				Notes Parameter is only available in Toolkit! ALL values are transferred and overwritten - even if you want to change only one.
4589	**Time zone**	2	-12.00 to 14.00 **[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«

ID	Parameter	CL	Setting range [Default]	Description
4591	**Daylight saving time**	2	On **[Off]**	On enables the Daylight saving time. The daylight saving time feature enables to automatically adjust the real-time clock to local daylight saving time (DST) provisions. If daylight saving time is enabled, the real-time clock will automatically be advanced by one hour when the configured DST begin date and time is reached and falls back again by one hour when the configured DST end date and time is reached. If the unit is used in the southern hemisphere, the DST function will be inverted automatically, if the DST begin month is later in the year than the DST end month.
				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.

ID	Parameter	CL	Setting range [Default]	Description
4594	**DST begin time**	2	0 to 23 h **[0 h]**	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".
4593	**DST begin month**	2	1 to 12 **[1]**	The month for the DST begin date is configured here.
				Example

ID	Parameter	CL	Setting range [Default]	Description
				• 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 h **[0 h]**	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

ID	Parameter	CL	Setting range [Default]	Description
				This parameter is only displayed, if Daylight saving time (parameter ⮡ 4591) is set to "On".
4596	**DST end month**	2	1 to 12 **[1]**	The month for the DST begin date is configured here.
				Example • 1 = 1st month of the year • 12 = 12th month of the year
				Notes This parameter is only displayed, if Daylight saving time (parameter ⮡ 4591) is set to "On".

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 29 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 nth. weekday	1st
4596	DST end month	11

Table 29: 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 30: Daylight saving time - exemplary dates

Localization Tool

☼ **Create a customized localization of a LS-6XT HMI**

The LocalizationTool is a tool which allows the user to create a localization of a LS-6XT HMI in a selected language and create from this a package which can be updated to the device. Creating localized text is done using Excel which has to be installed on the PC. The tool will create a basic Excel sheet. The user will translate in Excel and then from the edited Excel sheet will create a resource file which can be uploaded on the LS-6XT using the Woodward Toolkit tool.

Additionally the tool provides a simulation of the LS-6XT's HMI to check the translation. It also provides a way to re-use previously translated texts.

The Localization tool software is available at the Woodward web site and needs to be installed before use at your PC/laptop. After starting the program, the HELP file can guide through the required settings.

4.3.2 Configure_HMI

4.3.2.1 Configure Customer Screens

The LS-6XT comes with two **fully customizable screens - just one click (one level) from home screen**. Softbutton text and displayed name, values, and units can be defined/selected. The new full-featured AnalogManager 1:1 parameter monitoring but even math. function computing.

There are two configurable customer screens available.

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

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

Customer Screen Configuration

Numbering convention

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

AM Customer screen 1.1

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

ID	Parameter	CL	Setting range [Default]	Description
7692	**Unit**	2	6 characters **[Unit]**	Unit displayed in row 1 **Notes** The max. number of characters is higher but will not be displayed correctly on HMI/display. **Notes** If »°C« or »bar« is assigned the unit will be converted into "°F" or "psi" automatically if the corresponding parameter for conversion ⮡ 3630 and/or ⮡ 3631 is configured to YES.
7690	**AM Customer screen 1.1**	2	Determined by AnalogManager 90.01 **[Pass Through, ...]**	For details see ⮡ Fig. 138.
7934	**Decimal points**	2	0 to 2	Number of decimal points for the value in row 1–9 of the customizeable screen 1.

AM Customer screen #	ID "Description"	ID "Unit"	ID "Decimal points"	AnalogManager
1.1	7691	7692	7932	7690
1.2	7696	7697	7933	7695
1.3	7701	7702	7934	7700
1.4	7706	7707	7935	7705
1.5	7711	7712	7936	7710
1.6	7716	7717	7937	7715
1.7	7721	7722	7938	7720
1.8	7726	7727	7939	7725
1.9	7731	7732	7940	7730
2.1	7736	7737	7941	7735
2.2	7741	7742	7942	7740
2.3	7746	7747	7943	7745
2.4	7751	7752	7944	7750
2.5	7756	7757	7945	7755
2.6	7761	7762	7946	7760
2.7	7766	7767	7947	7765
2.8	7771	7772	7948	7770
2.9	7776	7777	7949	7775

Table 31: Overview Customer Screens/Rows IDs

Customer Screen Configuration

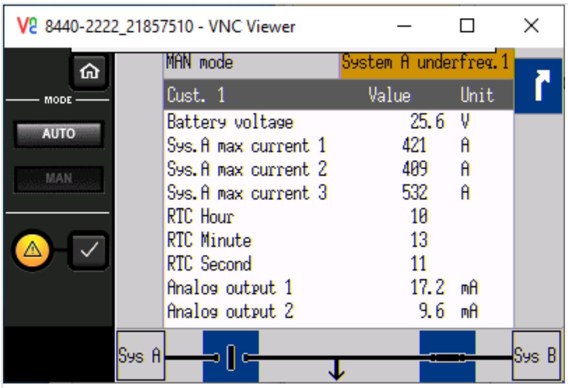


Fig. 104: Customer Screen sample:

ID	Parameter	CL	Setting range [Default]	Description
7701	**Description**	2	Sys.A max current 2	(Defined by customer)
7702	**Unit**	2	A	(Defined by customer)
7700	**AM Customer screen 1.3**	2	Determined by »Pass Through« of »A1= 01.68 Syst.A curr.max L2[A]«	(Defined by customer)
7934	**Decimal points**	2	0	(Defined by customer)

Table 32: Parameters Customer Screen 1.3 Configuration sample

4.3.2.2 Configure Display

Display Configuration

ID	Parameter	CL	Setting range [Default]	Description
4557	**Key activation time**	2	1 to 999 min **[120 min]**	If the soft key "LAMPTEST" has not been pressed for the time configured here, the logical command variable "*04.64 Key activation*" will be enabled.
12978	**Lock keypad 1**	2	Determined by LogicsManager 86.30 **[(0 & 1) & 1]** = 11924	If the remote panel interacts with the LS-6XT the "*Key pad*" can be locked remotely with this LogicManager. If the LogicManager is TRUE following buttons are locked • Operating mode MANUAL/ AUTOMATIC • Breaker open/close in MANUAL mode • Alarm acknowledge For information on the LogicsManager and its default

ID	Parameter	CL	Setting range [Default]	Description
				settings see ⮑ "9.4.1 LogicsManager Overview".

4.3.3 Lamp Test

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

[Button "LAMPTEST"]

Lamp test is available via HMI/display and logical command variable 04.04.

4.3.4 Enter Password

General notes

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

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

Personal security

Configure password security before handing over the device to the customer!

Note your password on a secure location. The next higher password level (2 and 4) allows to reset the password of the level below (1 and 3).

To restore the according User Name Account needs support from Woodward (authorized partner).

Access via channel ...

The following table and drawing provide an overview about the possible access channels to the LS-6XT.

Access to the LS-6XT by a/an ...	# used in drawing ⮑ Fig. 105below
HMI on the control directly	①
PC running ToolKit servlink, connected over USB	②
Remote Panel with the Woodward screen share concept connected over Ethernet (HMI simulation)	③ = ①
3rd party Remote Panel (i.e. Proface, Sütron, ...) running Modbus TCP	④

Access to the LS-6XT by a/an ...	# used in drawing ⮡ Fig. 105below
PLC running Modbus TCP	④
PC running ToolKit servlink, connected over Ethernet	⑤
Netbiter® Easy Connect gateway running Servlink TCP (ToolKit via internet)	⑤
PLC running Modbus RTU via RS-485	⑥
PLC running CANopen	⑦
PLC running CANopen via Profibus DP	⑦

Each channel has its own independent access level.

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

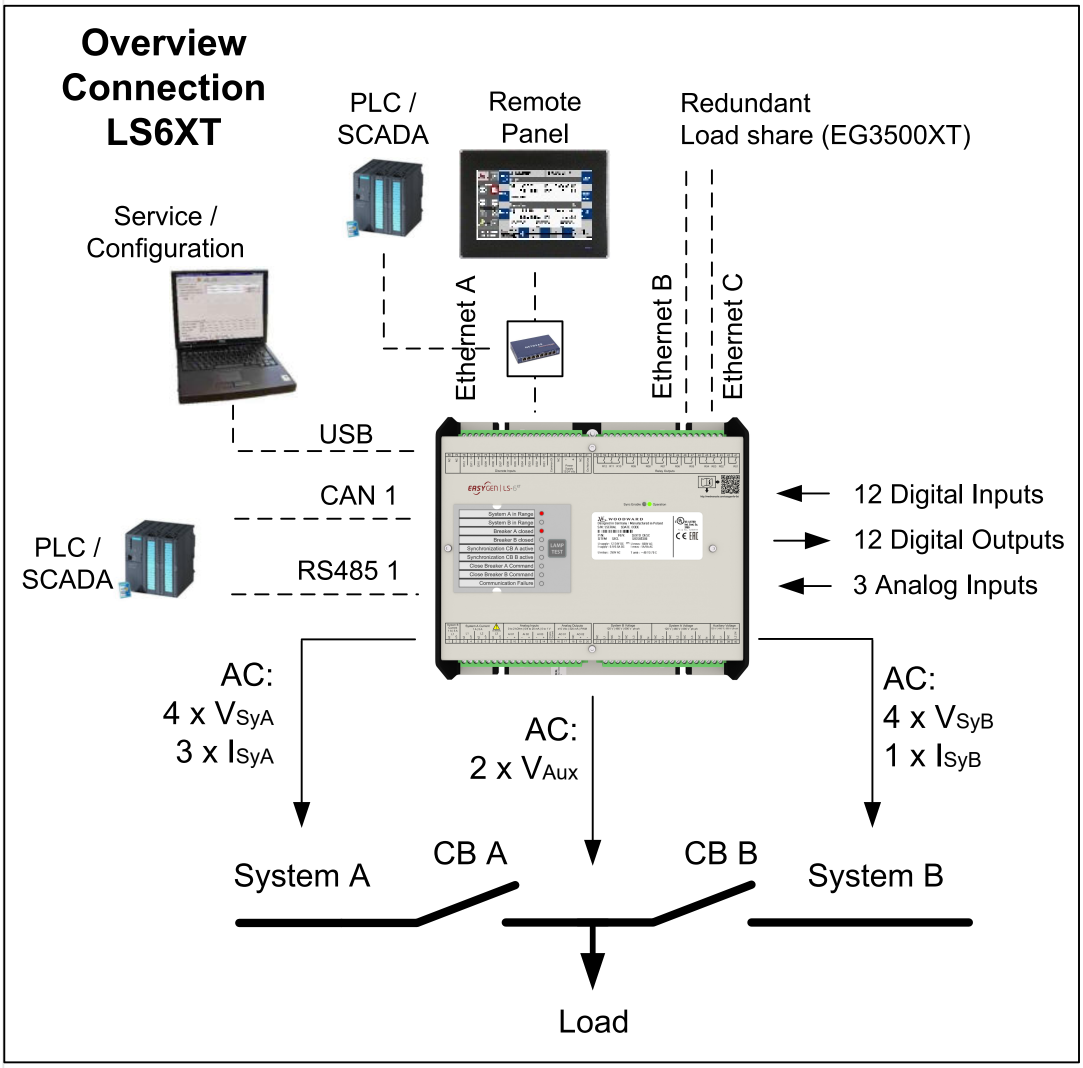


Fig. 105: Access to the LS-6XT device - Overview

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

- Basic Code Entry

- User Account Entry

Hidden entry for more security

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

LOGIN procedure "Basic Code Entry"

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

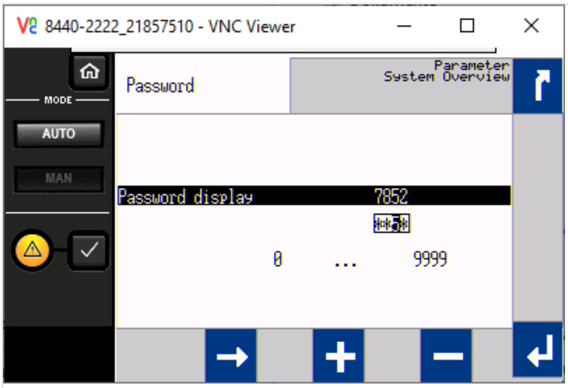


Fig. 106: Password entry: HMI

The Basic Code Entry asks for four numbers to open the related password level. It starts with the default value of parameter ⮡ 10416 »Random number for password«.

LOGIN procedure "User Account Entry"

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

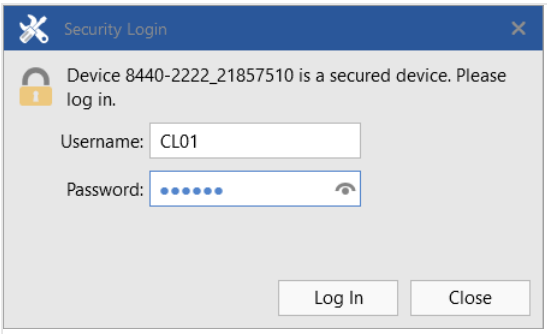


Fig. 107: Password entry: HMI

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.
4	AC04	Algorithm Code	Algorithm Code	**The temporary Super Commissioning Level** The same access rights like in the Super Commissioning Level but with the following exceptions: • The password for this level is not visible. • The access is dismissed afterwards.
3	CL03	CL0003	3	**The Commissioning Level** Access to well defined parameters and configurations, which are usually needed on a commissioning level. The own code level and the levels below can be indicated and configured.
2	AC02	Algorithm Code	Algorithm Code	**The temporary Commissioning Level** The same access rights like in the Commission Level. The Code level is entered in an algorithm code. The access is dismissed afterwards. Only the code levels below can be indicated and configured.
1	CL01	CL0001	1	**The Basic Level** Access to a limited number of parameters and configurations. The own code level can be indicated and configured.
0				No access rights to change, even viewed information is restricted.

Active Code Level

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

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

No direct access as expected?

Please check: LogicsManager 86.30 Parameter ⮡ 12978 "Lock keypad 1" = TRUE?

The Algorithm Code

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

Access Channels

Maximum Security

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

Maximum Flexibility

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

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

The different Password Code Levels

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

Code Level 0

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

Code Level 1 - The Basic Level CL01

- **General:**

  This level releases the access to a limited number of parameters and configurations

- **Basic Code entry:**

  In this and higher levels the password for the Basic Code Level CL01 can be changed

- **User Account Entry:**

  This level is selected with the User Name CL01 and the according password can only be changed being in code level CL01.

  Being in code level AC02 or higher the password of the Basic Level CL01 can be reset to its default by the Yes/No parameter ⮡ 10434.

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

Code Level 2 - The temporary Commissioning Level AC02

- **General:**

  This Level allows temporary access to parameters of the Commission Level.

  The access is dismissed automatically (see ⮡ "Automatic Logout from Password level (Fall into level 0)").

- **Basic Code Entry:**

  In this and higher Levels, the password for the Basic Code Level CL01 can be changed.

- **User Account Entry:**

  This level is selected with the User Name AC02 and the according algorithm for the password can only be changed being in the Commissioning code level CL03.

  Being in code level AC02 or higher the password of the Basic Level CL01 can be reset to its default by the Yes/No parameter ⮡ 10434.

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

Code Level 3 - The Commissioning Level CL03

- **General:**

  In this Level, the operator has access to all parameters and configurations, which are usually needed on a commissioning level

- **Basic Code Entry:**

  In this and higher levels the password for the Commissioning Level CL03 can be changed

- **User Account Entry:**

  This level is selected with the User name CL03 and the according password can only be changed being in the Commissioning Level CL03

  Being in code level AC04 or higher the password of the Commissioning Level CL03 can be reset to its default by the Yes/No parameter ID ⮑ 10435

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

Code Level 4 - The temporary Super Commissioning Level

- **General:**

  This Level allows temporary access to nearly all parameters and configurations, except calibration and super user items.

  The access is dismissed automatically

- **Basic Code Entry:**

  In this and higher levels the passwords for the Commissioning Level CL04 can be changed

- **User Account Entry:**

  This level is selected with the User name AC03 and the according algorithm for the password can only be changed being in the Super Commissioning Level CL05

  Being in code level AC04 or higher the password of the Commissioning Level CL03 can be reset to its default by the Yes/No parameter ID ⮑ 10435

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

Code Level 5 - The Super Commissioning Level CL05

- **General:**

In this Level, the operator has access to nearly all parameters and configurations, except calibration items

The firmware updating is released

- **Basic Code Entry:**

  In this and higher Levels the password of the Super Commissioning Level CL05 can be changed

- **User Account Entry:**

  This level is selected with the User name CL05 and the according password can only be changed being in the Super Commissioning Level CL05

  Being in a higher level as CL05 the password of the Super Commissioning Level CL05 can be reset to its default by the Yes/No parameter ID ⮡ 10436

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

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

Automatic Logout from Password level (Fall into level 0)

All basic code entry channels deny after 2h

The Modbus TCP access channel denies after 2h

Generally with power supply cycling the password level is denied.

The ToolKit Servlink access never logout

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

All basic code entry channels with »0« as password or a wrong password

The ToolKit Servlink access with logout function

The Modbus TCP (in all channels) with wrong password

Definition of the password

Numeric Password of the Basic Code entry

- The range of possible passwords is 1 to 9999

Alpha numeric Password of the User Account entry

- The maximum length of the alpha numeric password is 20 characters

- The maximum length of the alpha numeric prefix (ID ⮡ 10437; ⮡ 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 on the VNC or on RP-3000XT

The LS-6XT supports only the Basic Code entry.

The LS-6XT password level shall be visible in the parameter menu screens.

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

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

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

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

Password handling in ToolKit

The ToolKit supports the User Account entry and in case of 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 LS-6XT must be a member of an Ethernet network and both user name and password have to be transferred (from PLC) to the device.

Set LS-6XT to code level CL05 via Modbus TCP

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

1. Write and transfer »CL05« as hex:
   43-4C-30-35-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
   for "User name" to parameter ⮡ 7490 (40 bytes).
2. Write and transfer »CL0500« as hex:
   43-4C-30-35-30-30-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
   for "Password" to parameter 7491 (40 bytes).

▶ Code level can be read with parameter 10427

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

Password handling via Modbus using RS-485 connection

The LS-6XT must be a member of a RS-485 network and the password has to be transferred (from PLC) to the device.

Set LS-6XT to code level 5 via Modbus RS-485

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

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

Code level state can be read with parameter 10420.
Please find the password level in ToolKit: [STATUS MENU / Diagnostic / Interfaces / RS485].

Password handling via CAN using CANopen connection

The LS-6XT must be a member of a CANopen network and the password has to be transferred (from PLC) to the device.

The LS-6XT provides several CAN ports and therefore each port has its own password level. The password is written by a SDO Communication Channel.

Set LS-6XT to code level 5 via CANopen

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

Procedure for CAN 1

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

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

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

Code level state can be read with parameter 10407.

Please find the password level in ToolKit: [STATUS MENU / Diagnostic / Interfaces / CAN / CAN 1 state].

Code level display (VNC or RP-3000XT)

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

Symbol	Status
	Locked
	Unlocked (Code Level 01)

ID	Parameter	CL	Setting range [Default]	Description
10400	**Password display**	0	0000 to 9999 **[random number]**	The password for configuring the control via the VNC or RP-3000XT 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 VNC or RP-3000XT with screen share mode.

Code level interfaces

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

ID	Parameter	CL	Setting range [Default]	Description
10402	**Password for CAN interface 1**	0	0000 to 9999 **[random number]**	The password for configuring the control via the CAN interface #1 must be entered here. Not visible but can be accessed by interface!

ID	Parameter	CL	Setting range [Default]	Description
10407	**Code level CAN interface 1**	0	**[0]**	This value displays the code level which is currently enabled for access via the CAN interface #1.
7486	**Code level for USB**	0	**[0]**	This value displays the code level, which is currently enabled for access via the USB interface. The password is entered via the ToolKit login window.
10430	**Password for serial interface**	0	0000 to 9999 **[random number]**	The password for configuring the control via the RS485 interface must be entered here. Not visible but can be accessed by interface!
10420	**Code level for RS485**	0	**[0]**	This value displays the code level, which is currently enabled for access via the RS485 interface.
7490	**User name Modbus TCP**	0		The user name for configuring the control via the Modbus TCP/IP interface must be entered here. Not visible but can be accessed by interface!
7491	**Password Modbus TCP**	0	0000 to 9999 **[random number]**	The password for configuring the control via the Modbus TCP/IP interface must be entered here. Not visible but can be accessed by interface!
10427	**Code level Modbus TCP/IP**	0	**[0]**	This value displays the code level, which is currently enabled for access via the Modbus TCP/IP interface.
7816	**IP Servlink Master 1**	0	**[0]**	This is the IP address of the PC that is connected via ToolKit with the device as Servlink Master 1.
7824	**Code level Servlink Master 1**	0	**[0]**	This value displays the code level, which is currently enabled for access as Servlink Master 1.
7817	**IP Servlink Master 2**	0	**[0]**	This is the IP address of the PC that is connected via ToolKit with the device as Servlink Master 2.
7825	**Code level Servlink Master 2**	0	**[0]**	This value displays the code level, which is currently enabled for access as Servlink Master 2.
7818	**IP Servlink Master 3**	0	**[0]**	This is the IP address of the PC that is connected via ToolKit with the device as Servlink Master 3.
7826	**Code level Servlink Master 3**	0	**[0]**	This value displays the code level, which is currently enabled for access as Servlink Master 3.
7819	**IP Servlink Master 4**	0	**[0]**	This is the IP address of the PC that is connected via ToolKit with the device as Servlink Master 4.

ID	Parameter	CL	Setting range [Default]	Description
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.

4.3.4.1 Password System - Parameter Overview

General notes

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

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

ID	Parameter	CL	Setting range [Default]	Description
10415	**Password basic**	1	1 to 9999 **[1]**	The password for the code level "Basic" is defined in this parameter. Refer to "4.3.4 Enter Password" for default values.
10413	**Password commissioning**	3	1 to 9999 **[3]**	The password for the code level "Commissioning" is defined in this parameter. Refer to "4.3.4 Enter Password" for default values.

ID	Parameter	CL	Setting range [Default]	Description
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 ⮡ "4.3.4 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.

4.3.4.1.1 Random Number for Password

ID	Parameter	CL	Setting range [Default]	Description
10416	Random number for password		**[(random four letters number)]**	Random number generated by the LS-6XT device. Needed to get an alphanumeric password by Woodward support.

4.3.4.1.2 Change/Reset Alphanumeric Password

ID	Parameter	CL	Setting range [Default]	Description
Change password basic level				
10439	Old password basic level	1	((empty))	Enter here your old alphanumeric password to release the password change for the basic code level (CL01)
10440	New password basic level	1	((empty))	Enter here your new alphanumeric password string for the basic code level (CL01)

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		Flag: illuminated LED
			[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]	

ID	Parameter	CL	Setting range [Default]	Description
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

ID	Parameter	CL	Setting range [Default]	Description
			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]	

ID	Parameter	CL	Setting range [Default]	Description
Change password super commissioning level				
10449	Old passw. super comm. level	5	((empty))	Enter here your old alphanumeric password to release the password change for the super comm. code level (CL05)
10450	New passw. super comm. level	5	((empty))	Enter here your new alphanumeric password string for the super comm. code level (CL05)
10451	Confirm passw.super comm.level	5	((empty))	Repeat here your new alphanumeric password string for the super comm. code level (CL05)
10452	Change passw.super comm. level	5	**[No]** Yes	With switching this parameter to »Yes«, the control checks the entries for changing the password and executes the password change, if the entries are correct. The visualization 1053 indicates the successful execution.
				Notes If the parameters 10449, 10450, and 1051 are not correct, the password change is not executed.
10453	Change passw. 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.

ID	Parameter	CL	Setting range [Default]	Description
			[No]	

4.3.5 System Management

CAUTION!

Don't initiate »Set factory default settings« during active breaker control! This causes LS-6XT rebooting.

Parameter ⮡ 1701 »Set factory default values« causes a reboot of the control. During this time the breaker and segmenting is not controlled by the LS-6XT! 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	33 to 64 [Layer 1] 33 to 96 [Layer 3] **[33]**	A unique address is assigned to the control though this parameter. This unique address permits the controller to be correctly identified on the CAN bus. The address assigned to the controller may only be used once. All other bus addresses are calculated on the number entered in this parameter. The device number is also important for the device assignment in load sharing and load-dependent start/stop.
				Notes The unit must be rebooted after changing the device number to ensure proper operation. In Application layer **Layer 1** (parameter ⮡ 8990) the device number is internal limited to max. 64.
1889	**Device name preset**	2	**[Device_name]** up to 19 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

ID	Parameter	CL	Setting range [Default]	Description
				special characters will be replaced.
1890	**Device name**	2	**["displayable characters of parameter 1889"]** up to 19 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.
				Note Reboot device to apply changed device name on network!
10455	**Reboot the device**	2	Yes	The following parameter is visible and the reboot from the device is enabled.
			[No]	The following parameter is not invisible.
10419	**REBOOT**	2	Yes	The reboot from the device will be initiated. **Notes** Some parameters requires a reboot to take effect.
			[No]	The device remains in operation. No reboot is performed.
10417	**Factory default settings**	0	Yes	The following three parameters are visible and restoring the configured parameters to factory default values is enabled.
			[No]	The following three parameters are invisible and restoring the configured parameters to factory default values is not enabled.
1701	**Set factory default values**	4	Yes	All parameters, with the exception of customer defined passwords, will be restored to factory default values. If the default setting is initiated the alarm LED starts twinkling with a higher rate (ca. 5 Hz).
				Notes The device is power cycled and rebooting after approx. 20 seconds! In case of ToolKit connected via USB service port: USB connection will be lost!
			[No]	All parameters will remain as currently configured.
				Notes

ID	Parameter	CL	Setting range [Default]	Description
				This parameter is only displayed, if factory default settings (parameter 10417) is set to "Yes".
1896	**Parameter update rate**	4	3 - 7200 s **[3 s]**	This parameter defines the time for cyclical saving of changed parameters in the non voluntary memory. (Only accessible in ToolKit.)
				Notes To ensure that parameter changes are saved, wait at least this time after parameter changes before removing the power supply or reboot. Since memories only allow a limited number of write cycles (about 100000), set this value to a longer time if, for example, you write parameters cyclically via a PLC. **Otherwise, the lifetime of the memory is shortened.**

4.3.6 Reboot Function

The reboot of the device can be initiated with parameter "Reboot the device" ⮡ 10455 and "REBOOT" ⮡ 10419 by operating a Yes/No switch in ToolKit. This is beneficial because some parameters, like

- 1893 Set device name
- 3184 Modbus protocol number

need a reboot procedure to become effective.

> Please be careful with this setting because the device goes off and reboots at new with all its consequences. It's the same like power off/on cycle.

The parameters are located on different ToolKit pages:

- Configure system management
- Modbus protocol

4.3.7 Configure Status/Monitoring (home) screen

Configure HMI

> Configurable via ToolKit only!
>
> PARAMETER/Configure application/Configure description

The description from System A, System B and Load Busbar can be configured. It will be used with Status/Monitoring screen for HMI and home screen of ToolKit. The parameters of system A, system B will still come with "Syst.A / SyA." or "Syst.B / SyB." notification - the customizable text described below is just a heading.

ID	Parameter	CL	Setting range **[Default]**	Description
1891	**Description System A**	2	1 to 9 characters **[Sys A]**	Name is displayed on ... • HMI home screen: as header of measured values of System A on the left hand side at the single line diagram • ToolKit home screen: as single line description at system A side
				Notes The max. possible number of characters is 9. The VNC allows two rows with max. five letters each. Use <WBR> or blank for row separator. If the text is too long it will not be visible! We propose to check input immediately by refreshing home screen.
1892	**Description System B**	2	1 to 9 characters **[Sys B]**	Name displayed on ... • HMI home screen: as header of measured values of System B on the right hand side at the single line diagram • ToolKit home screen: as single line description at system B side
				Notes The max. possible number of characters is 9. The VNC allows two rows with max. five letters each. Use <WBR> or blank for row separator. If the text is too long it will not be visible! We propose to check input immediately by refreshing home screen.
1879	**Description Load Busbar**	2	1 to 12 characters **[Load Busbar]**	Name displayed on ... • HMI home screen:

Released

ID	Parameter	CL	Setting range [Default]	Description
				to the left of the measured load busbar value • ToolKit home screen: as single line description at load busbar
				Notes • Only visible if breaker mode **CBA/CBB** is active. • The max. possible number of characters is 12. If the text is too long it will not be visible completely! We propose to check input immediately by refreshing home screen.

Breaker mode "CBA"

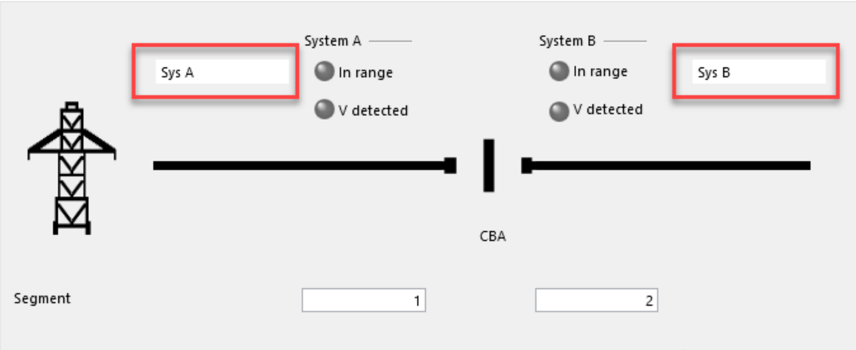


Fig. 108: LS-6XT - Description Breaker mode "CBA"

Breaker mode "CBA/CBB"

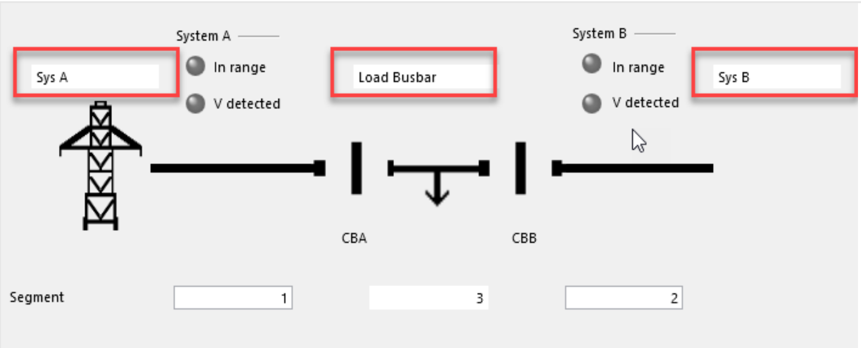


Fig. 109: LS-6XT - Description Breaker mode "CBA/CBB"

4.3.8 Configure Remote Panel Mode

4.3.8.1 Configuration screen Remote Panel Mode

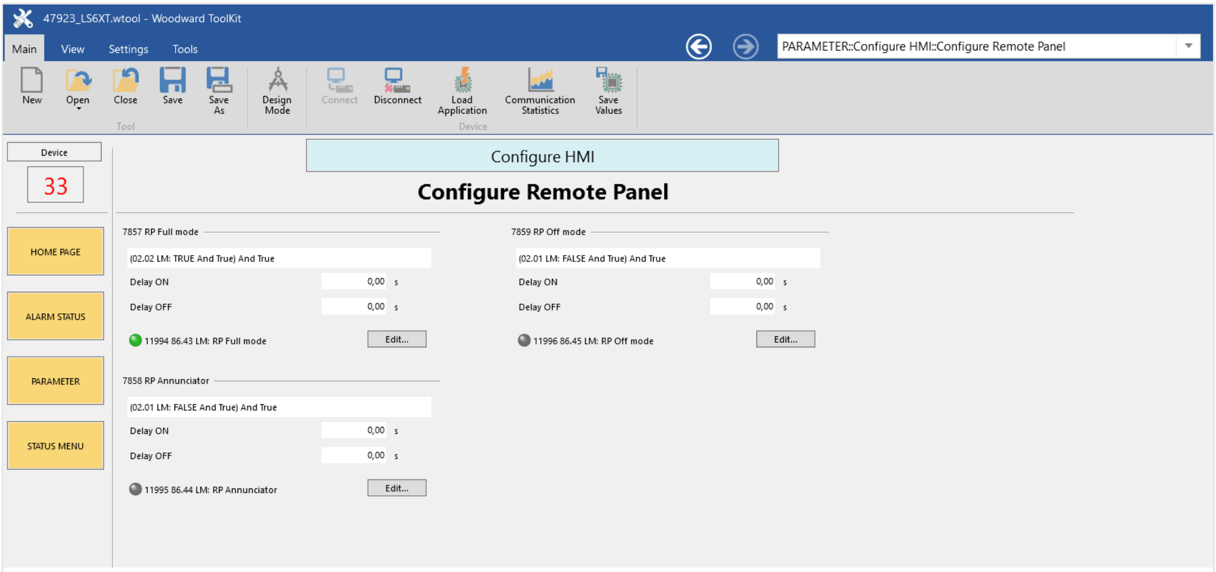


Fig. 110: Configure Remote Panel

4.3.8.2 General notes

General notes

If the remote panel interacts with the LS-6XT, different use cases could be desired. So the remote panel runs usually without any restrictions. This mode is called Full Access Mode.

But it's also possible to restrict the control rights for the remote panel (Annunciator Mode). And finally it will be desired to switch off the remote panel completely (OFF Mode).

To maintain the different operating modes in the remote panel the LS-6XT has to determine with LogicsManagers in which operation mode the Remote Panel RP-3000XT shall run. If no LogicsManager is true, full mode with password suppression is active.

Following operation modes are defined (in order of the LogicsManager priority):

- RP-3000XT Full mode with password suppression (no LM true)

  This mode is currently prepared for a display variant.

- RP-3000XT Full mode
- RP-3000XT Annunciator mode
- RP-3000XT Off mode (highest priority)

4.3.8.3 RP-3000XT in Full Mode

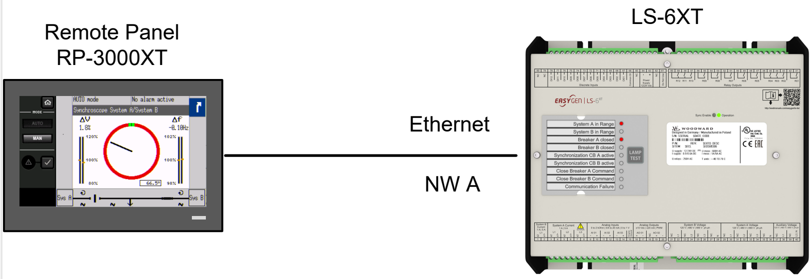


Fig. 111: Remote Panel with the LS-6XT (metal housing)

The RP-3000XT represents full the LS-6XT

- All Operating Mode buttons are indicated and active
- The Acknowledge button is indicated and active
- The Alarm Symbol is indicated and active
- The “Home” button is indicated and active
- The Configuration capability is activated
- No suppress of any screen
- No suppress of Password Screen

The Full Mode becomes active, if the LS-6XT is configured as follows:

- LM "RP-3000XT Full mode" is TRUE

  AND

- LM "RP-3000XT Annunciator mode" is FALSE

  AND

- LM "RP-3000XT Off mode" is FALSE

4.3.8.4 RP-3000XT in Annunciator Mode

The RP-3000XT shows measurement, condition, and alarm data of the LS-6XT. Data in regards to configuration and parameter are faded out and a "disabled" screen (crossed out ⮩ Fig. 114) is displayed instead.

- All Operating Mode buttons are not visible, but the current operation is indicated
- The Acknowledge button is not indicated
- The Alarm Symbol is indicated and active
- The “Home” button is indicated and active
- The Configuration capability is deactivated (according soft key buttons are not indicated or not active)

- All configuration screens of the LS-6XT are suppressed in the RP-3000XT (disabled screen)

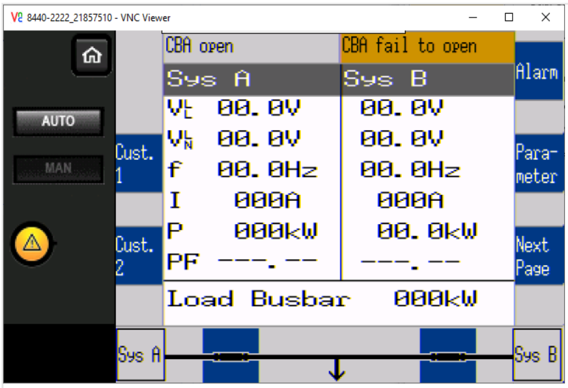


Fig. 112: RP in Annunciator mode - Home screen

The Annunciator mode becomes active, if the LS-6XT is configured as follows:

- LM "RP-3000XT Annunciator mode" is TRUE

  AND

- LM "RP-3000XT Off mode" is FALSE

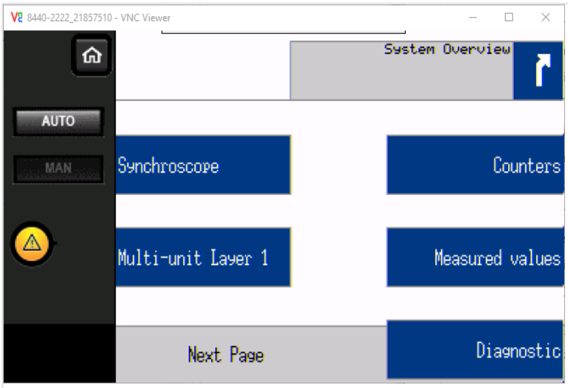


Fig. 113: RP in Annunciator mode - access to menu

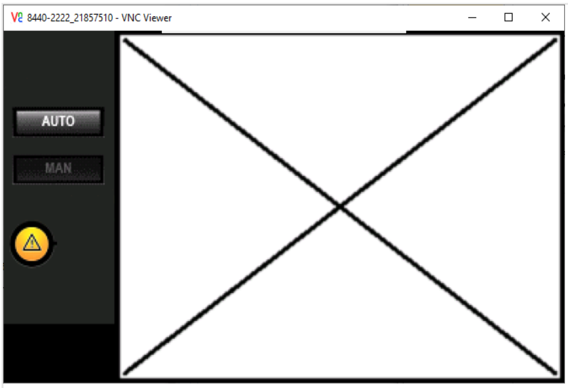


Fig. 114: RP in Annunciator mode - "disabled"screen

4.3.8.5 RP-3000XT in Off Mode

The RP-3000XT supports no screen of the LS-6XT.

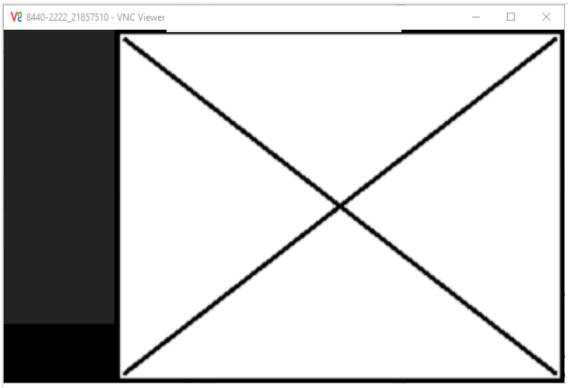


Fig. 115: RP in OFF mode

The Off Mode becomes active, if the LS-6XT is configured as follows

- LM "RP-3000XT Off mode" is TRUE

4.3.8.6 Parameters of RP Modes

Priority of RP Modes

»RP Off mode« higher than »RP Annunciator« higher than »RP Full mode«.

If no mode is selected via LogicsManager »Full mode with Password suppression« is active!

ID	Parameter	CL	Setting range [Default]	Description
7857	**RP Full mode**	2	Determined by LogicsManager 86.43 **[(02.02 LM TRUE & 1) & 1]** = 11994	Once the conditions of the LogicsManager have been fulfilled the unit will empower the RP-3000XT into Full mode described above.
7858	**RP Annunciator**	2	Determined by LogicsManager 86.44 **[(02.01 LM FALSE & 1) & 1]** = 11995	Once the conditions of the LogicsManager have been fulfilled the unit will empower the RP-3000XT into Annunciator mode described above.
7859	**RP Off mode**	2	Determined by LogicsManager 86.45 **[(02.01 LM FALSE & 1) & 1]**	Once the conditions of the LogicsManager have been fulfilled the unit will downgrade the RP-3000XT to Off mode described above.

ID	Parameter	CL	Setting range [Default]	Description
			= 11996	

4.4 Configuration Application

4.4.1 Inputs And Outputs

4.4.1.1 Function Of Inputs And Outputs

4.4.1.1.1 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 "Lock monitoring"	This discrete input is used as lock monitoring. The input "disables" (lock) all monitoring with the "Enable" configuration "Monitoring lock."
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.
Discrete input [DI 03]	Programmable Preconfigured to "Open CBB"	This discrete input is used as Control input for the LM "Open CBB unload".
Discrete input [DI 04]	Programmable Preconfigured to "Enable close CBB"	This discrete input is used as Control input for the LM "Enable close CBB".
Discrete input [DI 05]	Programmable Preconfigured to "Feedback CBB open" (application mode "CBA")	This discrete input is used as Control input for "Feedback CBB open".

Input	Type/Preset	Description
	Fixed to "Reply: CBB open reply" (application mode "CBA/CBB")	Only applicable for application mode "CBA/CBB" The controller utilizes the CB auxiliary (B) contacts into this discrete input to reflect the state of the CBB. **CBB feedback handling** is configured to **CBB open** This input implements negative function logic and must be energized to show when the breaker is open and de-energized to show when the CBB is closed.
Discrete input [DI 06]	Programmable Preconfigured to "Open CBA"	This discrete input is used as Control input for the LM "Open CBA unload".
Discrete input [DI 07]	Programmable Preconfigured to "Enable close CBA"	This discrete input is used as Control input for the LM "Enable close CBA".
Discrete input [DI 08]	Fixed to "Reply: CBA open"	The controller utilizes the CB auxiliary (B) contacts into this discrete input to reflect the state of the CBA. **CBA feedback handling** is configured to **CBA open** This input implements negative function logic and must be energized to show when the breaker is open and de-energized to show when the CBA is closed.
Discrete input [DI 09]	Programmable Preconfigured for "Alarm class B"	This discrete input is always enabled.
Discrete input [DI 10]	Programmable Preconfigured for "Alarm class B"	This discrete input is always enabled.
Discrete input [DI 11]	Programmable Preconfigured for "Alarm class B"	This discrete input is always enabled.
Discrete input [DI 12]	Programmable Preconfigured for "Alarm class B"	This discrete input is always enabled.

Alarm inputs

All discrete inputs, which are not assigned a function, can be used as alarm or control inputs. These discrete inputs can be freely configured as such (⮱ "4.4.1.2 Discrete Inputs").

4.4.1.1.2 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 Preconfigured to "Centralized alarm (horn)"	When a centralized alarm is issued, this discrete output is enabled. A horn or a buzzer maybe activated via this discrete output. Pressing the button next to the "✔" symbol will acknowledge the centralized alarm and disable this discrete output. The discrete output will re-enable if a new fault condition resulting in a centralized alarm occurs. The centralized alarm is initiated by class B alarms or higher.
Relay output [R 03]	Programmable Preconfigured to "System B not OK"	This discrete output will enable if the Frequency and Voltage from the System B is not within the configured operation ranges.

Output	Type/Preset	Description
Relay output [R 04]	Programmable Preconfigured to "System A not OK"	This discrete output will enable if the Frequency and Voltage from the System A is not within the configured operation ranges.
Relay output [R 05]	Fixed Preconfigured to "Command: open CBA"	Only applicable if the function "CBA open relay" is used. The controller enables this discrete output when the CBA is to be opened for switching operations. If the discrete input "Reply CBA" is energized, the discrete output "Command: open CBA" is disabled. The parameter ⮱▷ 3398 defines how this relay functions. If this output is configured as "N.O.", the relay contacts close resulting in the GCB opening circuit energizing. If this output is configured as "N.C.", the relay contacts open resulting in the GCB opening circuit de-energizing. If the controller is configured for the breaker application "None", this relay is freely configurable.
Relay output [R 06]	Fixed "Command: close CBA"	The "Command: close CBA" output issues the signal for the CBA to close. This relay may be configured as an impulse or steady output signal depending on parameter ⮱▷ 3399. **Impulse** If the output is configured as "Impulse", the discrete output will enable for the time configured in parameter ⮱▷ 3417). An external holding coil and sealing contacts must be installed into the CBA closing circuit if this discrete output is configured for an impulse output signal. **Steady** If the relay is configured as "Steady", the relay will energize and remain enabled as long as the discrete input "Reply CBA" remains de-energized and the System A and System B voltages are identical and no open CBA request is active.
Relay output [R 07]	Fixed Preconfigured to "Command: open CBB"	Only applicable if the function "CBB open relay" is used and application mode "CBA/CBB" is active. The controller enables this discrete output when the CBB is to be opened for switching operations. If the discrete input "Reply CBB" is energized, the discrete output "Command: open CBB" is disabled. The parameter ⮱▷ 3403 defines how this relay functions. If this output is configured as "N.O.", the relay contacts close resulting in the GCB opening circuit energizing. If this output is configured as "N.C.", the relay contacts open resulting in the GCB opening circuit de-energizing. If the controller is configured for the breaker application "None", this relay is freely configurable.
Relay output [R 08]	Fixed Preconfigured to "Command: close CBB"	Only applicable for application mode "CBA/CBB" The "Command: close CBB" output issues the signal for the CBB to close. This relay may be configured as an impulse or steady output signal depending on parameter ⮱▷ 3414. **Impulse** If the output is configured as "Impulse", the discrete output will enable for the time configured in parameter ⮱▷ 3416). An external holding coil and sealing contacts must be

Output	Type/Preset	Description
		installed into the CBB closing circuit if this discrete output is configured for an impulse output signal. **Steady** If the relay is configured as "Steady", the relay will energize and remain enabled as long as the discrete input "Reply CBB" remains de-energized and the System A and System B voltages are identical and no open CBB request is active.
Relay output [R 09]	Programmable Preconfigured to "Auxiliary volt./freq. OK"	This discrete output is enabled when the Auxilary Frequency and Voltage is in range.
Relay output [R 10]	Programmable Preconfigured to "Operation mode MAN"	This discrete output is enabled when the operation mode MANUAL is active.
Relay output [R 11]	Programmable Preconfigured to "Alarm class A or B"	This discrete output is enabled when a warning alarm (class A or class B; refer to ⮡ "9.6.4 Alarm Classes" for more information) is issued. After all warning alarms have been acknowledged, this discrete output will disable.
Relay output [R 12]	Programmable Preconfigured to "Alarm class C, D, E or F"	This discrete output is enabled when a shutdown alarm (class C or higher alarm; refer to ⮡ "9.6.4 Alarm Classes" for more information) is issued. After all shutdown alarms have been acknowledged, this discrete output will disable.

4.4.1.1.3 External Discrete Inputs (IKD)

If a Woodward IKD 1 is connected to the LS-6XT via the CAN 1, it is possible to use up to 16 external discrete inputs and assign them as alarms.

- The configuration of these external DIs is performed similarly to the internal DIs (⮡ "4.4.1.2 Discrete Inputs").
- Refer to ⮡ Table 33 for the parameter IDs of the parameters for external DIs 1 through 16.
- For connection to CAN 1 refer to (⮡ "6.5.1 Connecting IKD 1, IKD-IN-16 and IKD-OUT-16 on on CAN Bus 1")

External	DI 1	DI 2	DI 3	DI 4	DI 5	DI 6	DI 7	DI 8
Description	16200	16210	16220	16230	16240	16250	16260	16270
Delay	16000	16010	16020	16030	16040	16050	16060	16070
Operation	16001	16011	16021	16031	16041	16051	16061	16071
Alarm class	16002	16012	16022	16032	16042	16052	16062	16072
Self acknowledge	16004	16014	16024	16034	16044	16054	16064	16074
Enabled	16003	16013	16023	16033	16043	16053	16063	16073

Table 33: External discrete inputs - parameter IDs 1..8

External	DI 9	DI 10	DI 11	DI 12	DI 13	DI 14	DI 15	DI 16
Description	16280	16290	16300	16310	16320	16330	16340	16350
Delay	16080	16090	16100	16110	16120	16130	16140	16150
Operation	16081	16091	16101	16111	16121	16131	16141	16151
Alarm class	16082	16092	16102	16112	16122	16132	16142	16152
Self acknowledge	16084	16094	16104	16114	16124	16134	16144	16154
Enabled	16083	16093	16103	16113	16123	16133	16143	16153

Table 34: External discrete inputs - parameter IDs 9..16

4.4.1.1.4 External Discrete Outputs (IKD)

If Woodward IKDs are connected to the LS-6XT 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 refer to :
>
> - For connection to CAN 1 refer to ("6.5.1 Connecting IKD 1, IKD-IN-16 and IKD-OUT-16 on on CAN Bus 1")

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 35: 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 36: External discrete outputs "2nd IKD": - parameter IDs (9 to 16)

4.4.1.2 Discrete Inputs

General notes

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

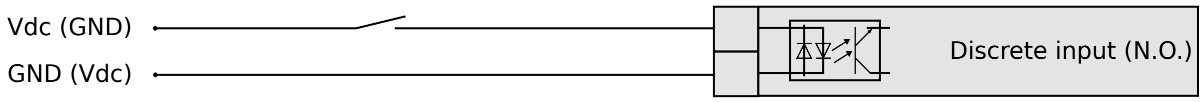


Fig. 116: Discrete inputs - alarm/control inputs - operation logic (state N.O.)

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.

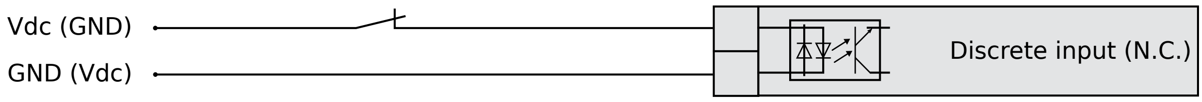


Fig. 117: Discrete inputs - alarm/control inputs - operation logic (state N.C.)

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 7 are pre-configured to various functions and differ in their default values. However, they may still be configured freely.
>
> The discrete input 8 is always used for the circuit breaker reply and cannot be configured.

	DI 1	**DI 2**	**DI 3**	**DI 4**	**DI 5**	**DI 6**	**DI 7**	**DI 8**	**DI 9**	**DI 10**	**DI 11**	**DI 12**
								CBA open only				
Description	1400	1410	1420	1430	1440	1450	1460		1480	1488	1496	1504
Delay	1200	1220	1240	1260	1280	1300	1320		1360	1380	1205	1225
Operation	1201	1221	1241	1261	1281	1301	1321		1361	1381	1206	1226
Alarm class	1202	1222	1242	1262	1282	1302	1322		1362	1382	1207	1227

	DI 1	DI 2	DI 3	DI 4	DI 5	DI 6	DI 7	DI 8 CBA open only	DI 9	DI 10	DI 11	DI 12
Self ack-now-ledg-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 37: Discrete inputs - parameter IDs

ID	Parameter	CL	Setting range [Default]	Description
1400	**Description**	2	user defined (up to 39 characters) for default see ⮡ Table	If the discrete input is enabled with alarm class, this text is displayed on the control unit screen. The event history will store this text message as well.
				Notes This parameter may only be configured using ToolKit. 19 characters are best for HMI readability - text strings with 20 and more characters but without a blank in between are NOT visible as headline on DI {x} detail screen. DI selection screen on HMI/display works fine with up to 30 characters; others are overwritten by mandatory screen symbols. Please verify the length on the display for best view. If the DI is used as control input with the alarm class "Control", you may enter here its function (e.g. external acknowledgment) for a better overview within the configuration.
1200	**Delay**	2	0.02 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.

ID	Parameter	CL	Setting range [Default]	Description
				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.
			A/**[B]**	Warning alarm classes
			C/D/E/F	Shutdown alarm classes
			Control	Signal to issue a control command only. If "control" has been configured, there will be no entry in the event history and a function out of the LogicsManager (⮡ "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).
				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.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮡ 12959.

ID	Parameter	CL	Setting range [Default]	Description
			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

4.4.1.3 Discrete Outputs (LogicsManager)

The discrete outputs are controlled via the LogicsManager.

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

Some outputs are assigned a function according to the application mode (see following table).

Relay		Application mode	
No.	**Termin-al**	**CBA**	**CBA/CBB**
[R 01]	41/42	LogicsManager; pre-assigned with 'Ready for operation OFF' **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.	
[R 02]	43/46	LogicsManager; pre-assigned with 'Centralized alarm (horn)'	
[R 03]	44/46	LogicsManager; pre-assigned with 'System B not OK'	
[R 04]	45/46	LogicsManager; pre-assigned with 'System A not OK'	
[R 05]	47/48	LogicsManager; Command: open CBA	
[R 06]	49/50	Command: close CBA	
[R 07]	51/52	LogicsManager	LogicsManager; Command: open CBB
[R 08]	53/54	LogicsManager	Command: close CBB
[R 09]	55/56	LogicsManager; pre-assigned with 'Auxiliary voltage/frequency OK'	
[R 10]	57/60	LogicsManager; pre-assigned with 'Operation mode MANUAL'	
[R 11]	58/60	LogicsManager; pre-assigned with 'Alarm class A, B active'	
[R 12]	59/60	LogicsManager; pre-assigned with 'Alarm class C, D, E, F active'	

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** (Ready for operation OFF)	2	Determined by LogicsManager 99.01 **[(02.01 LM: 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 Logics-Manager 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 Logics-Manager and its default settings see ⮱ "9.4.1 LogicsManager Overview".
12110 (See ID table below)	**Relay 2** For (pre-defined) function see assignment table above	2	Determined by LogicsManager 99.02 **[(01.12 Horn & 1) & 1]** = 11871	Once the conditions of the Logics-Manager have been fulfilled, the relay will be energized. **Notes** For information on the Logics-Manager and its default settings see ⮱ "9.4.1 LogicsManager Overview".

Parameter IDs

The parameter IDs above refers to relay 2.

- Refer to ⮱ Table 38 for the parameter IDs of the parameters for relay 3 to relay 12.

	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R 10	R 11	R 12
Parameter ID	12580	12110	12310	12320	12130	12140	12150	12160	12170	12180	12560	12590

Table 38: Discrete outputs - relay parameter IDs

4.4.1.4 Analog Inputs

4.4.1.4.1 Analog Inputs (general)

4.4.1.4.1.1 Displayed units

Conversion restricted to ...

The conversions described below are only active for parameters »Unit« of

- analog inputs which units are configured as »°C« or »bar«.

Exact string mandatory

Type in* the »Unit« string carefully!

For example:

- Temperature works with the exact string»°C« only but not with »°c« or »degC« or »° C« ...
- Pressure needs the exact string »bar« only but don't work with »Bar« or »BAR« ... !

*) Parameters »Unit« are:

AI {x} 1034, 1084, ...; customer screens {x.y} 7692, 7697, ...

ID	Parameter	CL	Setting range [Default]	Description
3630	**Convert bar to psi**	1	**[No]**	The pressure value is displayed in bar.
			Yes	The pressure value is converted and then displayed in psi.
3631	**Convert °C to °F**	1	**[No]**	The temperature is displayed in °C (Celsius).
			Yes	The temperature is displayed in °F (Fahrenheit).

4.4.1.4.2 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.

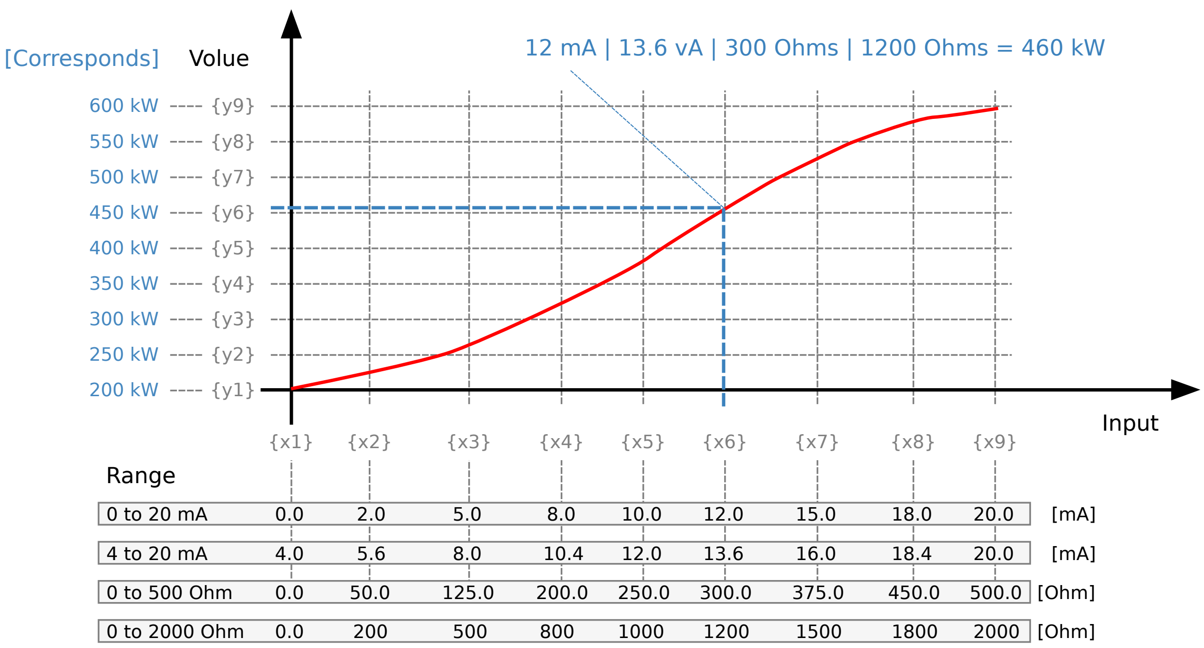


Fig. 118: Characteristic curves (example table)

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]**

4.4.1.4.3 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 (⮡ "4.5.4 Flexible Limits").

ID	Parameter	CL	Setting range **[Default]**	Description
1025 1075 1125	**Analog input {x}: Description**	2	user-defined (up to 39 characters) **[Analog inp. {x}]**	The event history will store this text message and it is also displayed on the visualization screen. If the programmed limit value of the analog input has been reached or exceeded this text is displayed in the control unit screen.
				Notes This parameter may only be configured using ToolKit. 19 characters are best for HMI readability - text strings with 20 and more characters but without a blank in between are NOT visible as headline on AI {x} detail screen. AI selection screen on HMI/display works fine with up to 30 characters; others are overwritten by mandatory screen symbols. The max. number of characters depends on the numbers of Bytes for each character. Please verify the length on the display for best view.
1000 1050 1100	**Analog input {x}: Type**	2		According to the following parameters different measuring ranges are possible at the analog inputs.
			[Off]	The analog input is switched off.
			VDO 5 bar	The value of the analog input is interpreted with the VDO characteristics 0 to 5 bar.
			VDO 10 bar	The value of the analog input is interpreted with the VDO characteristics 0 to 10 bar.
			VDO 150 °C	The value of the analog input is interpreted with the VDO characteristics 50 to 150 °C.
			VDO 120 °C	The value of the analog input is interpreted with the VDO characteristics 40 to 120 °C.
			Pt100	The value of the analog input is interpreted with a Pt100 characteristic.
			Pt1000	The value of the analog input is interpreted with a Pt1000 characteristic.
			AB 94099	The value of the analog input is interpreted with a AB 94099 characteristic.
			Linear	Each analog input may be assigned to a linear characteristic

ID	Parameter	CL	Setting range [Default]	Description
				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 ⮑ "9.2.2 VDO Inputs Characteristics".
1001 1051 1101	**User defined min display value** (User defined minimum 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.

ID	Parameter	CL	Setting range [Default]	Description
				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

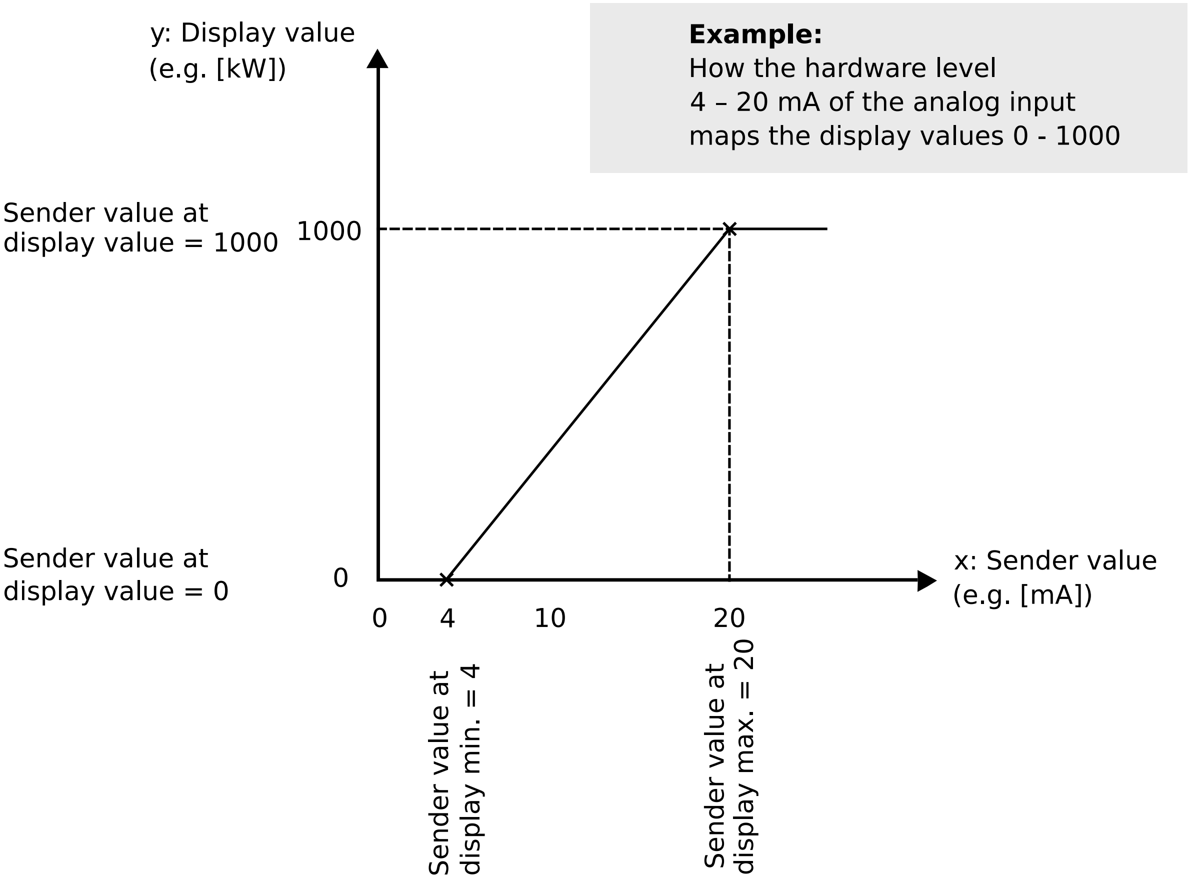


Fig. 119: Analog Input Mapping

ID	Parameter	CL	Setting range [Default]	Description
1020 1070 1120	**Sender type**	2		The software in the control unit may be configured for various types of sensors. The configurable ranges apply to the linear analog input.
			[0 to 2000 Ohm]	The measuring range of the analog input is 0 to 2000 Ohm.
			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" or "Pt100", this parameter must be configured to "0 to 2000 Ohm"!
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. This has the following effect to the measured values (please note tables in ⇨ "9.2.2 VDO Inputs Characteristics"):
				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.
				Example Exponent is 3: value of analog input {½/3} x 10^3 = value of analog input {½/3} x 1000
1033 1083 1133	**Analog input {X}**	(displayed only)		Current scaled value of the AI {X}

Monitoring of the analog inputs (overrun/underrun) must be configured manually to the flexible limits (⮑ "4.5.4 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

ID	Parameter	CL	Setting range [Default]	Description
				(undershoot), this is identified as a wire break.
				Notes A wire break is indicated in ToolKit by displaying an analog input value "Error".
1004 1054 1104	**Wire break alarm class**	2		Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
			A/**[B]**	Warning alarm classes
			C/D/E/F	Shutdown alarm classes
			Control	Signal to issue a control command only
				Notes This parameter is only visible if wire break monitoring (parameter ⮑ 1003/ ⮑ 1053/ ⮑ 1103) is not set to "Off" For additional information refer to ⮑ "9.6.4 Alarm Classes".
1005 1055 1105	**Self acknowledge wire break**	2	Yes	The control automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
				Notes This parameter is only visible wire break monitoring (parameter ⮑ 1003/ ⮑ 1053/ ⮑ 1103) is not set to "Off"
10113 10114 10116	**Filter time constant** for "0/4 to 20 mA" and "0 to 1 V"	2	Off, 1 to 5	A low pass filter may be used to reduce the fluctuation of an analog input reading. The cut-off-frequency is defined as usual with 63% (e^{-1}).
			Off	The analog input is displayed without filtering.
			1	Cut-off-frequency = 7.96 Hz (filter time constant = 0.02 s)
			2	Cut-off-frequency = 3.98 Hz (filter time constant = 0.04 s)

ID	Parameter	CL	Setting range [Default]	Description
			[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)
1034 1084 1134	**Unit**	2	up to 6 characters text **[_ _ _ _ _ _]**	This parameter is assigning a unit text to the displayed analog value.
				Notes This parameter may only be configured using ToolKit. If »°C« or »bar« is assigned the unit will be converted into "F" or "psi" automatically if the corresponding parameter for conversion ⮱ 3630 and/or ⮱ 3631 is configured to YES. The max. number of characters is 39 but depends on numbers of Bytes for each character. The Bytes/character are defined by the font of the currently selected language. Up to six characters are best for display/HMI; more will override screen border/frame. Please verify the length on the display for best view!
3632 3634 3636	**Bargraph minimum**	2	-21000000.00 to 21000000.00 **[0.00]**	The start value for the bar graph display of the analog input is defined here. The value must be entered according to the display format, which refers to the analog input type (parameter ⮱ 1000).
3633	**Bargraph maximum**	2	-21000000.00 to 21000000.00	The end value for the bar graph display of the analog input is

ID	Parameter	CL	Setting range [Default]	Description
3634 3637			**[2000.00]**	defined here. The value must be entered according to the display format, which refers to the analog input type (parameter ⮱ 1000).

4.4.1.5 Analog Outputs

4.4.1.5.1 Analog Outputs 1 and 2

The analog outputs AO 1 and AO 2 may either be configured as analog or PWM outputs.

- The following table shows two configuration examples with parameters and default values for the analog outputs 1 and 2.
- Example 1 at AO 1 is for a System A active power output at AO 1 with a range of -20 kW to 220 kW via a 4 to 20 mA signal (generator rated power = 200 kW).
- Example 2 at AO 2 is for Analog input 1 (0 to 100%) to PWM signal (0 to 100%) with level 6 V.

Configuration examples

Parameter / AnalogManager	Example 1 with AO 1		Example 2 with AO 2	
	ID		ID	Value
Selected hardware type (For details refer to ⮱ Chapter 4.4.1.5.1)	5201	mA	5215	PWM
Minimum hardware level	5208	4	5222	0.00 (%)
Maximum hardware level	5209	20 (mA)	5223	100.00 (%)
PWM output level (visible only if »PWM« selected)	5210	—	5224	6 V
Source value at minimum level	5204	-20 (kW)	5218	0(%)
Source value at maximum level	5206	220 (kW)	5220	100 (%)
Filter time constant	5203	3	5217	Off
AM Data source AO1	5200	Type: Pass through A1 = 01.74 Syst.A act. power [W]	5214	Type: Pass through A1 = 06.01 Analog input 1
Analog output 1	10310	Display of resulting value	10311	Display of resulting value

Settings/setup example

The following drawing shows the relation between the value of the AO signal selected and its corresponding values at the terminal pin. For settings see table below the drawing.

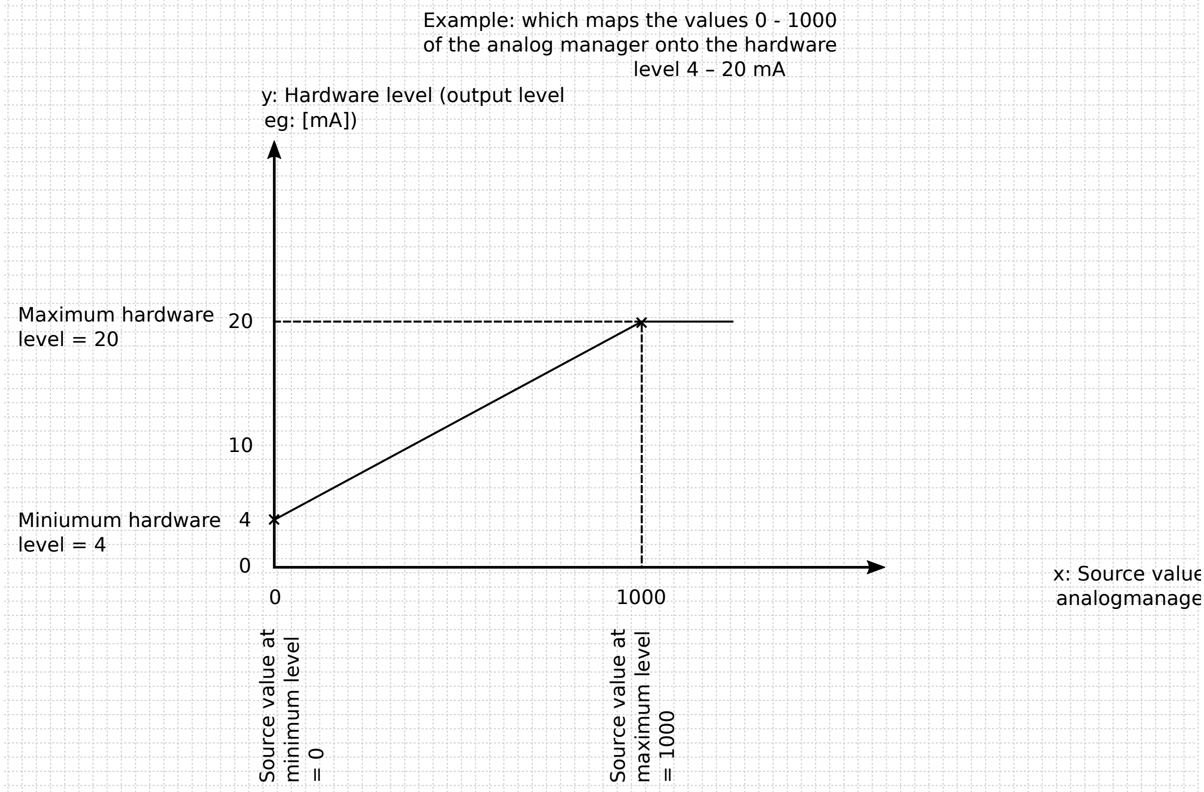


Fig. 120: Example to setup AO for 0 to 1000 IN becomes OUT 4 to 20 mA

Parameter / AnalogManager	Example 3 with AO 1	
	ID	
Selected hardware type (For details refer to ⮑ Chapter 4.4.1.5.1)	5201	mA
Minimum hardware level	5208	4
Maximum hardware level	5209	20 mA
PWM output level (visible only if »PWM« selected)	5210	—
Source value at minimum level	5204	0
Source value at maximum level	5206	1000
Filter time constant	5203	3
AM Data source AO1	5200	Type: Pass through A1 = analog signal with range 0 to 1000
Analog output 1	10310	Display of resulting value

ID	Parameter	CL	Setting range [Default]	Description
5200 5214	**AM Data source ...**	2	Determined by AnalogManager 93.01, 93.02 AO1: **[A1 = 06.01 Analog input 1]** AO2: **[A1 = 06.01 Analog input 1]**	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.
5201 5215	**Selected hardware type**	2		This parameter is used to configure the appropriate type of analog controller signal. The range of the analog output is configured here. PMW value is defined in %.
			Off	No analog output signal will be issued.
			[mA]	**Notes** Because of different isolation purposes the two biasing outputs must be clear labeled with their function.
			V	
			PWM	
5208 5222	**Minimum hardware level** (User defined minimum output value)	2	-20.00 to 100.00 **[0.00]**	The value of the configured hardware range, which shall correspond with the configured minimum source value, must be entered here (y-axis). This specifies the minimum limit of the hardware range.
				Example If the value configured here is 2.5, the maximum output range of +/-20 mA / +/-10 V has a lower limit of 2.5 mA / 2.5 V.
				Notes Value »100« is possible only for PWM.
5209 5223	**Maximum hardware level** (User defined maximum output value)	2	-20.00 to 100.00 **[20.00]**	The value of the configured hardware range, which shall correspond with the configured maximum source value, must be entered here (y-axis). This specifies the maximum limit of the hardware range.
				Example f the value configured here is 7.5, the maximum output range of +/-20 mA / +/-10 V has a upper limit of 7.5 mA / 7.5 V.
				Notes Value »100« is possible only for PWM.

ID	Parameter	CL	Setting range [Default]	Description
5210 5224	**PWM output level**	2	0.00 to 10.00 V **[10.00 V]**	If PWM has been enabled in parameter ⮑ 5201/ ⮑ 5215 the level of the PWM signal (amplitude) may be adjusted here.
5204 5218	**Source value at minimum level**	2	-21000000.00 to 21000000.00 **[0.00]**	The value from the data source must exceed the value configured here to raise the output signal above minimum hardware level. Negative percentage values may be used to change the sign, e.g. for power. The entry format of the value depends on the selected data source.
5206 5220	**Source value at maximum level**	2	-21000000.00 to 21000000.00 **[100.00]**	If the value from the data source reaches the value configured here, the output signal will reach maximum hardware level. Negative percentage values may be used to change the sign, e.g. for power. The entry format of the value depends on the selected data source.
5203 5217	**Filter time constant**	2	Off, 1 to 7	A filter time constant may be used to reduce the fluctuation of an analog output value.
			[Off]	The analog output is displayed without filtering.
			1	Cut-off-frequency = 3.98 Hz (filter time constant = 0.04 s)
			2	Cut-off-frequency = 1.98 Hz (filter time constant = 0.08 s)
			3	Cut-off-frequency = 0.99 Hz (filter time constant = 0.16 s)
			4	Cut-off-frequency = 0.5 Hz (filter time constant = 0.32 s)
			5	Cut-off-frequency = 0.25 Hz (filter time constant = 0.64 s)
			6	Cut-off-frequency = 0.12 Hz (filter time constant = 1.28 s)
			7	Cut-off-frequency = 0.06 Hz (filter time constant = 2.56 s)
				Notes The filter is not applied to the analog output display value, i.e. the end value of the analog output is displayed immediately.

4.4.2 Configure Breakers

4.4.2.1 Good to know: Actions with Breakers

4.4.2.1.1 Dead Bus Closing CBA

The unit closes the CBA without synchronization, if the following conditions are met. The display indicates "CBA dead bus close".

Automatic operation

- The operating mode AUTOMATIC has been selected
- The LM "12945 Enable close CBA" is TRUE
- The LM "12943 Open CBA unload" **and** "12944 Open CBA immed." are FALSE
- The dead bus closure condition is fulfilled
- There is no other device with a smaller device ID willing to close its breaker too (Dead busbar closure negotiation)
- There is no easYgen or GC willing to close its breaker too (Dead busbar closure negotiation)

Application mode **"CBA"** (parameter ⮡ 9018)

- No class C alarm or higher is present

Application mode **"CBA/CBB"** (parameter ⮡ 9018)

- No class C alarm or D alarm is present
- The auxilary voltage is below the dead bus detection limit (parameter ⮡ 5820)

Manual operation

- The operating mode MANUAL has been selected.
- The LM "12975 Close CBA in MAN" is TRUE **or** the "CBA soft-key" is pressed
- The LM "12974 Open CBA in MAN" is FALSE
- The dead bus closure condition is fulfilled
- There is no other device with a smaller device ID willing to close its breaker too (Dead busbar closure negotiation)
- There is no easYgen or GC willing to close its breaker too (Dead busbar closure negotiation)

Application mode **"CBA"** (parameter ⮡ 9018)

- No class C alarm or higher is present

Application mode **"CBA/CBB"** (parameter ⮡ 9018)

- No class C alarm or D alarm is present

- The auxiliary voltage is below the dead bus detection limit (parameter ⮱▷ 5820)

4.4.2.1.2 Dead Bus Closing CBB

> The following applies to application mode **"CBA/CBB"** (parameter ⮱▷ 9018)

The unit closes the CBB, if the following conditions are met simultaneously.

The display indicates "CBB dead bus close".

<u>Automatic operation</u>

- The operating mode AUTOMATIC has been selected
- The LM "12948 Enable close CBB" is TRUE
- The LM "12946 Open CBB unload" **and** "12947 Open CBB immed." are FALSE
- No class E alarm or F alarm is present
- The dead bus closure condition are fulfilled
- The auxilary voltage is below the dead bus detection limit (parameter ⮱▷ 5820)
- There is no other device with a smaller device ID willing to close its breaker too (Dead busbar closure negotiation)
- There is no easYgen or GC willing to close its breaker too (Dead busbar closure negotiation)

<u>Manual operation</u>

- The operating mode MANUAL has been selected.
- The LM "12977 Close CBB in MAN" is TRUE **or** the "CBB soft-key" is pressed
- The LM "12976 Open CBB in MAN" is FALSE
- No class E alarm or F alarm is present
- The dead bus closure condition are fulfilled
- The auxilary voltage is below the dead bus detection limit (parameter ⮱▷ 5820)
- There is no other device with a smaller device ID willing to close its breaker too (Dead busbar closure negotiation)
- There is no easYgen or GC willing to close its breaker too (Dead busbar closure negotiation)

4.4.2.1.3 Dead Busbar Negotiation

Each LS-6XT, who intends to close its breaker on a dead busbar publishes a “Dead busbar closure request” flag over the load share bus and reads back whether there is any other device publishing the same intention:

If not, the unit waits an estimated time for security and then closes its breaker.

If yes, the unit compares its own device number with the smallest device number of all others who also intend to close. If the own device number is smaller than the rest, the unit will close its breaker - otherwise it blocks its own closure.

The LS-6XT removes its wish to close the breaker on a dead busbar, if the breaker closure failure occurs in a multiple application. So the next LS-6XT with the higher device number gets the permission for closure.

The dead busbar negotiation is going over segments.

4.4.2.1.4 Synchronization CBA/CBB

The synchronization is active, if the following conditions are met simultaneously.

The display indicates "Synchronization CBA" or "Synchronization CBB" (application mode **"CBA/CBB"**).

Automatic operation

- The operating mode AUTOMATIC has been selected
- The System A voltage is available and within the configured operating range (⮡ "4.5.1.3 System A Operating Ranges")
- The System B voltage is available and within the configured operating range (⮡ "4.5.2.2 System B Operating Ranges")
- The differential frequency/voltage is within the configured operating range
- Synchronizing the CBA

  The LM "12945 Enable close CBA" is TRUE

  The LM "12943 Open CBA unload" **and** "12944 Open CBA immed." are FALSE

  The CBB is closed (application mode **"CBA/CBB"**)
- Synchronizing the CBB (application mode **"CBA/CBB"**)

  The CBA is closed

  The LM "12948 Enable close CBB" is TRUE

  The LM "12946 Open CBB unload" **and** "12947 Open CBB immed." are FALSE

Manual operation

- Operating mode MANUAL has been selected
- The System A voltage is available and within the configured operating range (⮡ "4.5.1.3 System A Operating Ranges")
- The System B voltage is available and within the configured operating range (⮡ "4.5.2.2 System B Operating Ranges")
- The differential frequency/voltage is within the configured operating range
- Synchronizing the CBA

The LM "12975 Close CBA in MAN" is TRUE **or** the "CBA soft-key" is pressed

The LM "12974 Open CBA in MAN" is FALSE

The CBB is closed (application mode **"CBA/CBB"**)

- Synchronizing the CBB (application mode **"CBA/CBB"**)

  The CBA is closed

  The LM "12977 Close CBB in MAN" is TRUE **or** the "CBB soft-key" is pressed

  The LM "12976 Open CBB in MAN" is FALSE

4.4.2.1.5 Unloading CBA

The unloading CBA is only executed, if two systems are connected and minimum one side contains a variable system. Otherwise the device goes to "Open CBA".

The unloading CBA will be executed under the following conditions:

- In AUTOMATIC operating mode with LM "12943 Open CBA unload".

  It's possible to interrupt the unloading if the LM "12943 Open CBA unload" is FALSE and the LM "12945 Enable close CBA" is TRUE.

- In MANUAL operating mode if parameter "Open CBA in manual" ⮡ 8828 is configured to "With unl."

  - with LM "12974 Open CBA in MAN".

    It's possible to interrupt the unloading if the LM "12974 Open CBA in MAN" is FALSE and the LM "12975 Close CBA in MAN" is TRUE.

  - by pressing the "CBA soft-key".

    With the "CBA soft-key" it's not possible to interrupt the unloading, this forces the CBA open command.

Each LS-6XT, who intends to open the breaker with unloading publishes a “Open wish request” flag over the load share bus and compares its own device number with the smallest device number of all others who also intend to open. If the own device number is smaller than the rest, the unit will send the unloading execution to the easYgen.

> The LS-6XT removes the "Open wish request" flag over the load share bus with "Opening CBA active". Additional the flag is not published during "Command CBA open" request (open the CBA without unloading).

4.4.2.1.6 Unloading CBB

> The following applies to application mode **"CBA/CBB"** (parameter ⮡ 9018)

The unloading CBB is only executed, if two systems are connected and minimum one side contains a variable system. Otherwise the device goes to "Open CBB".

The unloading CBB will be executed under the following conditions:

- In AUTOMATIC operating mode with LM "12946 Open CBB unload".

  It's possible to interrupt the unloading if the LM "12946 Open CBB unload" is FALSE and the LM "12948 Enable close CBB" is TRUE.

- In MANUAL operating mode if parameter "Open CBB in manual" ⮱▷ 8829 is configured to "With unl."

  - with LM "12976 Open CBB in MAN".

    It's possible to interrupt the unloading if the LM "12976 Open CBB in MAN" is FALSE and the LM "12977 Close CBB in MAN" is TRUE.

  - by pressing the "CBB soft-key".

    With the "CBB soft-key" it's not possible to interrupt the unloading, this forces the CBB open command.

Each LS-6XT, who intends to open the breaker with unloading publishes a “Open wish request” flag over the load share bus and compares its own device number with the smallest device number of all others who also intend to open. If the own device number is smaller than the rest, the unit will send the unloading execution to the easYgen.

> The LS-6XT removes the "Open wish request" flag over the load share bus with "Opening CBB active". Additional the flag is not published during "Command CBB open" request (open the CBB without unloading).

4.4.2.1.7 Open CBA

The CBA will be opened when the "Command CBA open" is issued. The behavior of the CBA open relay depends on the setting of parameter "CBA open relay" ⮱▷ 3398.

If this parameter is configured as "N.O.", the relay energizes to open the CBA, if it is configured as "N.C.", the relay de-energizes to open the CBA.

The CBA will be opened under the following conditions:

- In AUTOMATIC operating mode with LM "12943 Open CBA unload" after unloading **or** with LM "12944 Open CBA immed."
- In MANUAL operating mode by pressing the "CBA soft-key"

Application mode **"CBA"** (parameter ⮱▷ 9018)

- Alarm class C or higher is present

Application mode **"CBA/CBB"** (parameter ⮱▷ 9018)

- Alarm class C or D is present
- By pressing the "CBB soft-key" (Application mode **"CBA/CBB"** depending on the CB logic which has been set) in MANUAL operating mode

The opening from the CBA is finished if the breaker is recognized as open (reply CBA is open, Discrete input 8).

Software version 2.10-2 or higher offers additional possibilities to leave the CBA open state

The opening from the CBA is additional finished if the following conditions are met simultaneously.

Automatic operation

- LM "Enable close CBA" is active ⮡ 12945
- LM "Open CBA unload" is not active ⮡ 12943
- LM "Open CBA immed." is not active ⮡ 12944
- System A is in range
- Alarm class C or D is not active

Manual operation

- LM "Close CBA in MAN" is active ⮡ 12975 **or** the "CBA soft-key" is pressed
- LM "Open CBA in MAN" is not active ⮡ 12974
- System A is in range
- Alarm class C or D is not active

4.4.2.1.8 Open CBB

The following applies to application mode **"CBA/CBB"** (parameter ⮡ 9018)

The CBB will be opened when the "Command CBB open" is issued. The behavior of the CBB open relay depends on the setting of parameter "CBB open relay" ⮡ 3403.

If this parameter is configured as "N.O.", the relay energizes to open the CBB, if it is configured as "N.C.", the relay de-energizes to open the CBB.

The CBB will be opened under the following conditions:

- In AUTOMATIC operating mode with LM "12946 Open CBB unload" after unloading **or** with LM "12947 Open CBB immed."
- In MANUAL operating mode by pressing the "CBB" soft-key
- Alarm class E or F is present
- By pressing the "CBA soft-key" (depending on the CB logic which has been set) in MANUAL operating mode

The opening from the CBB is finished if the breaker is recognized as open (reply CBB is open, Discrete input 5).

Software version 2.10-2 or higher offers additional possibilities to leave the CBB open state

The opening from the CBB is additional finished if the following conditions are met simultaneously.

Automatic operation

- LM "Enable close CBB" is active ⮡ 12948
- LM "Open CBB unload" is not active ⮡ 12946
- LM "Open CBB immed." is not active ⮡ 12947
- System B is in range
- Alarm class E or F is not active

Manual operation

- LM "Close CBB in MAN" is active ⮡ 12977 **or** the "CBB soft-key" is pressed
- LM "Open CBB in MAN" is not active ⮡ 12976
- System B is in range
- Alarm class E or F is not active

4.4.2.2 General Breaker Settings

General notes

These parameters determine in which breaker mode the LS-6XT operates the breaker. The device can be configured to a 1- or 2-breaker control by these parameters. These parameters have to be adjusted as early as possible, because they pre-configure other parameters.

ID	Parameter	CL	Setting range [Default]	Description
9018	**Breaker mode LS6**	2	CBA	The device supports **one circuit breaker**, signed as CBA and **one isolation switch**.
			[CBA/CBB]	The device supports **two circuit breakers** signed as CBA and CBB with a load path in-between.
8990	**Application layer**	2	**[Layer 1]**	The device is used either in a none GC systems or in GC system Layer 1. For more details see ⮡ "6.1 Application Layers"
			Layer 3	The device is used in a GC systems in Layer 3. For more details see ⮡ "6.1 Application Layers"

4.4.2.2.1 Breaker Mode CBA

General notes

The following parameters are **only** applicable for breaker mode **"CBA"** (parameter ⮡ 9018)

ID	Parameter	CL	Setting range [Default]	Description
8840	**Application mode CBA**	1	Single LSx	**Application mode A01** In this application mode, there is only one single LS-6XT unit.
			[LSx]	**Application mode A02** This is the application mode for multiple LS-6XT units operation. In this mode a PLC can control the LS-6XT units.
			L-MCB	**Application mode A03** In this application mode, the easYgen is controlling the MCB via the LS-6XT. The operation mode is fixed to automatic. **Notes** This application mode is currently only possible in application **Layer 1** ⮡ 8990
			L-GGB	**Application mode A04** In this application mode, the easYgen is controlling the GGB via the LS-6XT. The operation mode is fixed to automatic. **Notes** This application mode is currently only possible in application **Layer 1** ⮡ 8990
12950	**Isol.sw open**	2	Determined by LogicsManager **[(87.39 & 1) &1]**	As long as the conditions of the LogicsManager have been fulfilled, the LS-6XT assumes an open isolation switch (else a closed isolation switch).

Fixed parameters

In the application modes A03 and A04 some parameters are preconfigured to fixed values. In these modes these parameters cannot be accessed via front panel or ToolKit.

- Check the following parameters if you change the application mode from A03 or A04 to A02 or A01.

Device number (parameter ⮑ 1702)	Variable system (parameter ⮑ 8816)
Node-ID CAN bus 1 (parameter ⮑ 8950)	Synchronization mode (parameter ⮑ 5728)
Startup in mode (parameter ⮑ 8827)	Mains power measurement (parameter ⮑ 8813)
Isol. switch (parameter ⮑ 8815)	Dead bus closure CBA (parameter ⮑ 3431)
Segment number System A (parameter ⮑ 8810)	Connect A dead to B dead (parameter ⮑ 8802)
Segment number System B (parameter ⮑ 8811)	Connect A dead to B alive (parameter ⮑ 8803)
Mains connection (parameter ⮑ 8814)	Connect A alive to B dead (parameter ⮑ 8804)
Open CBA in manual (parameter ⮑ 8828)	Connect synchronous mains (parameter ⮑ 8820)
Max. phase angle (parameter ⮑ 8821)	Delay time phi max. (parameter ⮑ 8822)

Hidden parameters

The following parameters (LogicsManager) are hidden and have no impact in the application modes A03 and A04.

LogicsManager	Command Variable
Enable close CBA (parameter ⮑ 12945)	87.34 LM: Enable close CBA
Open CBA immed. (parameter ⮑ 12944)	87.33 LM: Open CBA immed.
Open CBA unload (parameter ⮑ 12943)	87.32 LM: Open CBA unload
Operat. mode AUTO (parameter ⮑ 12510)	86.16 LM: Operat. mode AUTO
Operat. mode MAN (parameter ⮑ 12520)	86.17 LM: Operat. mode MAN
Open CBA in MAN (parameter ⮑ 12974)	87.48 LM: Open CBA in MAN
Close CBA in MAN (parameter ⮑ 12975)	87.49 LM: Close CBA in MAN

4.4.2.2.2 Breaker Mode CBA/CBB

General notes

The following parameters are **only** applicable for breaker mode **"CBA/CBB"** (parameter ⮑ 9018)

ID	Parameter	CL	Setting range [Default]	Description
8992	**Application mode CBA/CBB**	2	Single LSx	**Application mode A01** In this application mode there is only one single LS-6XT unit installed.
			L-GGBMCB	**Application mode A05** In this application mode the easYgen controls the GGB and the MCB via

ID	Parameter	CL	Setting range [Default]	Description
				the LS-6XT. The operation mode is fixed to automatic. **Notes** This application mode is currently only possible in application **Layer 1** ⮡ 8990
			[LSx]	**Application mode** A02 In this application mode the device expects to see minimum one other device (LSx or easYgen/GC). This also is the application mode for multiple LS-6XT units operation. The commands to close and open the breakers come from outside. In this mode a PLC can control the LS-6XT units.
				Notes This parameter is only valid if the 'Breaker mode LS6' (parameter ⮡ 9018) is configured to 'CBA/CBB'.

The LS-6XT configured as 2-breaker control can be configured to three different application modes:

Application mode	Symbol
Single LSx	A01
LSx	A02
L-GGBMCB	A05

For additional information refer to ⮡ "6 Application Field".

Fixed parameters

In the application mode A05 some parameters are preconfigured to fixed values. In this mode these parameters cannot be accessed via front panel or ToolKit.

Check the following parameters if you change the application mode from A05 to A02 or A01.

Device number (parameter ⮡ 1702)	Variable system (parameter ⮡ 8816)
Node-ID CAN bus 1 (parameter ⮡ 8950)	Synchronization mode (parameter ⮡ 5728)
Startup in mode (parameter ⮡ 8827)	Mains power measurement (parameter ⮡ 8813)
Segment number System A (parameter ⮡ 8810)	Dead bus closure CB (parameter ⮡ 3432)
Segment number System B (parameter ⮡ 8811)	Connect A dead to B dead (parameter ⮡ 8802)
Mains connection (parameter ⮡ 8814)	Connect A dead to B alive (parameter ⮡ 8803)
Max. phase angle (parameter ⮡ 8821)	Connect A alive to B dead (parameter ⮡ 8804)

Connect open load to A dead (parameter ⮡ 9013)	Connect synchronous mains (parameter ⮡ 8820)
Connect open load to A alive (parameter ⮡ 9014)	Delay time phi max. (parameter ⮡ 8822)
Connect open load to B dead (parameter ⮡ 9015)	Transfer time CBA<->CBB (parameter ⮡ 3400)
Connect open load to B alive (parameter ⮡ 9016)	Open CBA in manual (parameter ⮡ 8828)

4.4.2.2.3 Dead Bus Closure

General notes

NOTICE!

A dead bus closure can also be performed in the case of a mains failure. If the dead bus closure should not be performed, the corresponding parameters must be switched "Off" (parameter ⮡ 8802, ⮡ 8803 or ⮡ 8804)

The following parameter is **only** applicable for breaker mode **"CBA"** (parameter ⮡ 9018)

ID	Parameter	CL	Setting range [Default]	Description
3431	**Dead bus closure CBA**	2	On	Dead bus closure possible according to the conditions defined by parameters • Connect A dead to B dead ⮡ 8802, • Connect A dead to B alive ⮡ 8803, • Connect A alive to B dead ⮡ 8804 and • Dead bus detection max. volt. ⮡ 5820.
			[Off]	No dead bus closure possible.
				Notes No access in application modes A03 and A04.

The following parameter is **only** applicable for breaker mode **"CBA/CBB"** (parameter ⮡ 9018)

ID	Parameter	CL	Setting range [Default]	Description
3432	**Dead bus closure CB**	2	On	Dead bus closure possible according to the conditions defined by parameters • Connect A dead to B dead 8802, • Connect A dead to B alive 8803, • Connect A alive to B dead 8804 and • Dead bus detection max. volt. 5820.
			[Off]	No dead bus closure possible.
				Notes No access in application mode A05.
5820	**Dead bus detection max. volt.**	2	0 to 30 % **[10 %]**	If system A/B voltage falls below this percentage of system A/B rated voltage for the time configured by parameter 8805, a dead bus condition is detected.
8805	**Dead bus closure delay time**	2	0.0 to 20.0 s **[5.0 s]**	The system voltage must be below the value configured in parameter 5820 for at least the time defined here to detect a dead bus condition of a system.
				Notes The delay time starts as soon as the measured voltage is below the value configured in parameter 5820. The delay time is independent of LogicsManager "Enable close CBA" (parameter 12945).
8802	**Connect A dead to B dead**	2	On	Dead bus closure of system A dead to system B dead is allowed.
			[Off]	Dead bus closure of system A dead to system B dead is not allowed.
				Notes No access in application modes A03 , A04 , A05.
8804	**Connect A alive to B dead**	2	On	Dead bus closure of system A alive to system B dead is allowed.
			[Off]	Dead bus closure of system A alive to system B dead is not allowed.
				Notes No access in application modes A03 , A04 , A05.
8803	**Connect A dead to B alive**	2	On	Dead bus closure of system A dead to system B alive is allowed.
			[Off]	Dead bus closure of system A dead to system B alive is not allowed.

ID	Parameter	CL	Setting range [Default]	Description
				Notes No access in application modes A03 , A04 , A05.

General notes

The following cases and parameters are **only** applicable for breaker mode **"CBA/CBB"** (parameter ⮡ 9018)

Case 1: Open Load Segment Closure

The load can be supplied either from the System A (CBA closed) or System B (CBB closed). In general the CBA has a higher closing priority than CBB.

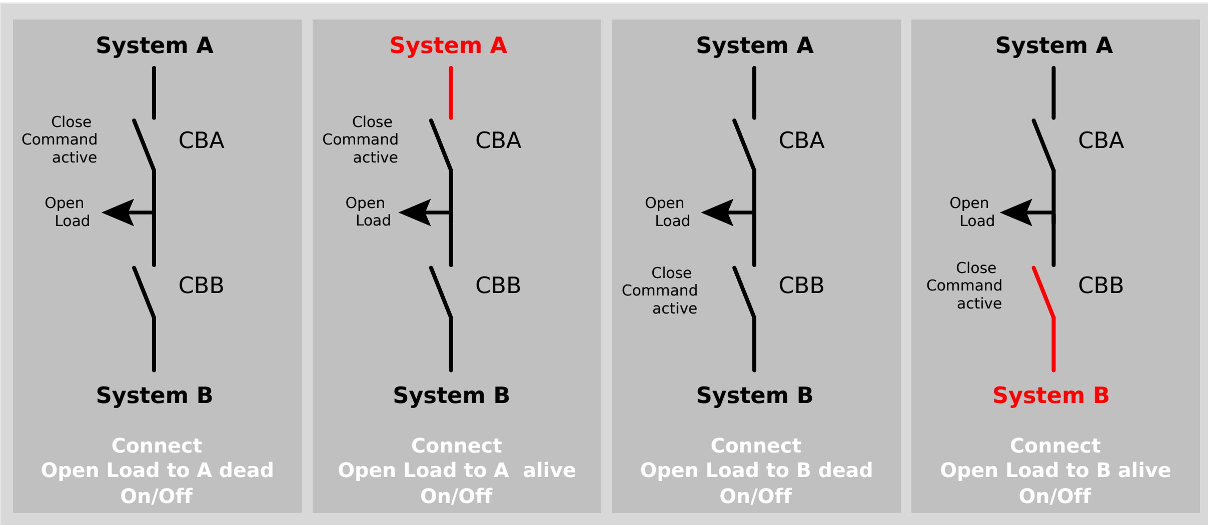


Fig. 121: Dead busbar: Open load segment closure

ID	Parameter	CL	Setting range [Default]	Description
9013	**Connect open load to A dead**	2	On	The CBA closure of an open load onto a dead busbar system A is enabled.
			[Off]	The CBA closure of an open load onto a dead busbar system A is disabled.
				This parameter determines an open load closure in a situation when busbar system A is dead. **Notes** No access in application mode A05.

ID	Parameter	CL	Setting range [Default]	Description
9014	**Connect open load to A alive**	2	**[On]**	The CBA closure of an open load onto an alive busbar system A is enabled.
			Off	The CBA closure of an open load onto an alive busbar system A is disabled.
				This parameter determines an open load closure in a situation when busbar system A is alive. **Notes** No access in application mode A05.
9015	**Connect open load to B dead**	2	On	The CBB closure of an open load onto a dead busbar system B is enabled.
			[Off]	The CBB closure of an open load onto a dead busbar system B is disabled.
				This parameter determines an open load closure in a situation when busbar system B is dead. **Notes** No access in application mode A05 .
9016	**Connect open load to B alive**	2	**[On]**	The CBB closure of an open load onto an alive busbar system B is enabled.
			Off	The CBB closure of an open load onto an alive busbar system B is disabled.
				This parameter determines an open load closure in a situation when busbar system B is alive. **Notes** No access in application mode A05.

Case 2: System A / System B Closure

This logic works in breaker mode "PARALLEL" only.

This case describes the coupling from System A and System B (both breakers will be closed). The closing of CBA has a higher priority than the closing of CBB.

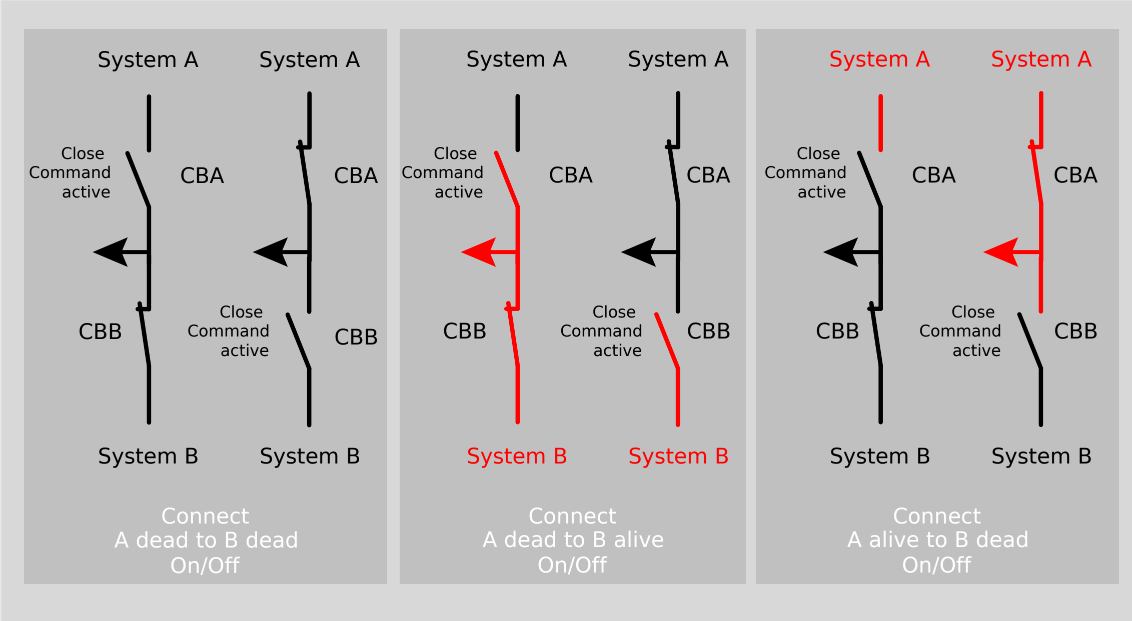


Fig. 122: Dead busbar: System A/B closur

Function

A close CBB command without synchronization is issued, if the following conditions are fulfilled simultaneously:

- Dead bus closure CBB function is configured to ON
- LM "Enable to Close CBB" is TRUE
- LM "Enable to Close CBA" is FALSE
- Discrete input "Reply CBB is open" is set
- No CB blocking alarm is triggered
- No easYgen is trying to carry out a dead busbar closure
- No higher prioritized LSx is trying to close its breaker
- The configured dead busbar closure mode matches the real conditions

Priority during Breaker Closure

The simultaneous dead busbar closure of CBA and CBB is not allowed!

In an emergency application the simultaneous closing of two circuit breakers is blocked via communication between the LS-6 and the easYgen(s). Once an easYgen is enabled to for a dead bus closure connection it has priority over all LS-6 (any CB controlled by an LSx cannot be closed). If multiple LS-6 are enabled to close a circuit breaker at the same time the LS-6 with the lowest Device number receives the master status and transmits the set point signals to the genset control (all other LSx then are inactive)

4.4.2.2.4 Breaker transition mode

Transition Command Logic

Breaker Transition Mode	Action	Command	State X=Don't Care
Open Transition Closed Transit. Interchange	Make a transition from **CBB to CBA**	LM "Enable CBA to close"	**TRUE**
		LM "Open CBA Unload"	FALSE
		LM "Open CBA Immediately”	FALSE
		DI “CBA is open”	TRUE
		System A is OK	TRUE
		LM "Enable CBB to close"	X
		LM "Open CBB Unload"	FALSE
		LM "Open CBB Immediately”	FALSE
		DI “CBB is open”	X
		System B is OK	X

Breaker Transition Mode	Action	Command	State X=Don't Care
Open Transition Closed Transit. Interchange	Make a transition from **CBA to CBB**	LM "Enable CBA to close"	FALSE
		LM "Open CBA Unload"	FALSE
		LM "Open CBA Immediately”	FALSE
		DI “CBA is open”	X
		System A is OK	X
		LM "Enable CBB to close"	**TRUE**
		LM "Open CBB Unload"	FALSE
		LM "Open CBB Immediately”	FALSE
		DI “CBB is open”	TRUE
		System B is OK	TRUE

If both transfer commands are enabled, the transition from CBB to CBA has higher priority.

Close Commands (Parallel) Logic

Breaker Transition Mode	Action	Command	State **X=Don't Care**
Parallel	Close the **CBA**	LM "Enable CBA to close"	**TRUE**
		LM "Open CBA Unload"	FALSE
		LM "Open CBA Immediately"	FALSE
		DI "CBA is open"	TRUE
		System A is OK	TRUE
		LM "Enable CBB to close"	X
		LM "Open CBB Unload"	X
		LM "Open CBB Immediately"	X
		DI "CBB is open"	X
		System B is OK	X

Breaker Transition Mode	Action	Command	State **X=Don't Care**
Parallel	Close the **CBB**	LM "Enable CBA to close"	FALSE
		LM "Open CBA Unload"	X
		LM "Open CBA Immediately"	X
		DI "CBA is open"	X
		System A is OK	X
		LM "Enable CBB to close"	**TRUE**
		LM "Open CBB Unload"	FALSE
		LM "Open CBB Immediately"	FALSE
		DI "CBB is open"	TRUE
		System B is OK	TRUE

If both close commands are enabled and both CBs are open, the close command CBA has higher priority.

Opening Commands Logic

Breaker Transition Mode	**Action**	**Command**	**State** **X=Don't Care**
Parallel	Open **CBA** with unloading	LM "Enable CBA to close"	X
		LM "Open CBA Unload"	**TRUE**
		LM "Open CBA Immediately”	FALSE
		DI “CBA is open”	FALSE
		System A is OK	X
		LM "Enable CBB to close"	X
		LM "Open CBB Unload"	X
		LM "Open CBB Immediately”	X
		DI “CBB is open”	X
		System B is OK	X

The unloading command »CBA with unloading« leads to an immediate open command, in all other breaker modes than “Parallel” or the CBB is open.

Breaker Transition Mode	**Action**	**Command**	**State** **X=Don't Care**
Open Transition Closed Transit. Interchange Parallel	Open **CBA** immediately	LM "Enable CBA to close"	X
		LM "Open CBA Unload"	X
		LM "Open CBA Immediately”	**TRUE**
		DI “CBA is open”	FALSE
		System A is OK	X
		LM "Enable CBB to close"	X
		LM "Open CBB Unload"	X
		LM "Open CBB Immediately”	X
		DI “CBB is open”	X
		System B is OK	X

If both open commands for the CBA are enabled, the immediate one has higher priority.

Breaker Transition Mode	Action	Command	State **X=Don't Care**
Parallel	Open **CBB** with unloading	LM "Enable CBA to close"	X
		LM "Open CBA Unload"	FALSE
		LM "Open CBA Immediately"	FALSE
		DI "CBA is open"	X
		System A is OK	X
		LM "Enable CBB to close"	X
		LM "Open CBB Unload"	TRUE
		LM "Open CBB Immediately"	FALSE
		DI "CBB is open"	FALSE
		System B is OK	X

The unloading command »CBB with unloading« leads to an immediate open command, in all other breaker modes than "Parallel" or the CBA is open.

Breaker Transition Mode	Action	Command	State **X=Don't Care**
Open Transition Closed Transit. Interchange Parallel	Open **CBB** immediately	LM "Enable CBA to close"	X
		LM "Open CBA Unload"	X
		LM "Open CBA Immediately"	X
		DI "CBA is open"	X
		System A is OK	X
		LM "Enable CBB to close"	X
		LM "Open CBB Unload"	X
		LM "Open CBB Immediately"	TRUE
		DI "CBB is open"	FALSE
		System B is OK	X

If both open commands for the CBB are enabled, the immediate one has higher priority.

Opening commands have higher priority then close commands.

If both breakers are closed during parallel mode and there is no active close or open command present, and the transition mode will be changed to »Open«, »Closed« or »Interchange« mode, CBB is opened first.

ID	Parameter	CL	Setting range [Default]	Description
3473	**Open trans.with missing EG**	2		If a communication issue between the LS-6XT and easYgen occurs (no easYgens detected) the transfer with open transition can be released.
			[No]	The LS-6XT does not make any breaker action.
			Yes	Transfer with "Open transition" is released.
				Notes Only in application mode **A02**.
3400	**Transfer time CBA<->CBB**	2	0.50 to 99.99 s **[1.00 s]**	This is the break time for the open transition transfer mode.
				Notes No access in application mode **A05**.
3411	**Breaker transition mode**	2		This parameter determines how the load is transferred from System A to System B and vice versa.
			[Parallel]	Parallel: The load is connected to both systems.
			Interchange	Interchange: The target connection is synchronized first. Then the load is ramped before the other breaker will be opened.
			Closed Transit.	Closed transition: The target connection is synchronized first, then the other breaker will be opened immediately.
				Notes The maximum paralleling time (CBA and CBB closed) is < 100 ms
			Open Transition	Open transition: The current connection is opened before the target connection is closed.

ID	Parameter	CL	Setting range [Default]	Description
				Notes No access in application mode A05.
3412	**Breaker transition mode 1**	2		This parameter determines how the load is transferred from System A to System B and vice versa. As option 1
			[Parallel]	Parallel: The load is connected to both systems.
			Interchange	Interchange: The target connection is synchronized first. Then the load is ramped before the other breaker will be opened.
			Closed Transit.	Closed transition: The target connection is synchronized first, then the other breaker will be opened immediately.
			Open Transition	Open transition: The current connection is opened before the target connection is closed.
				Notes No access in application mode A05.
12931	**Transition mode 1**	2	Determined by LogicsManager **[(0&1)&1]**	This LogicsManager enables the breaker transition mode 1.
				Notes Transition mode 1 has a higher priority than transition mode 2. If LogicsManagers "Transition mode 1" (parameter 12931) and "Transition mode 2" (parameter 12932) are TRUE, the transition mode 1 will be active.
3413	**Breaker transition mode 2**	2		This parameter determines how the load is transferred from System A to System B and vice versa. As option 2
			[Parallel]	Parallel: The load is connected to both systems.
			Interchange	Interchange: The target connection is synchronized first. Then the load is ramped before the other breaker will be opened.
			Closed Transit.	Closed transition:

ID	Parameter	CL	Setting range [Default]	Description
				The target connection is synchronized first, then the other breaker will be opened immediately.
			Open Transition	Open transition: The current connection is opened before the target connection is closed.
				Notes No access in application mode A05.
12932	**Transition mode 2**	2	Determined by LogicsManager **[(0&1)&1]**	This LogicsManager enables the breaker transition mode 2.

4.4.2.3 Configure CBA

ID	Parameter	CL	Setting range [Default]	Description
3476	**CBA feedback handling**	2	**[CBA open]**	CBA open: Energized DI 8 indicates that the CBA is open.
			CBA closed	CBA closed: Energized DI 8 indicates that the CBA is closed.
3399	**CBA close command**	2	**[Steady]**	The relay output is energized as long as the breaker should be closed.
			Impulse	The relay output is energized for the closing time pulse.
3398	**CBA open relay**	2	**[N.O.]**	Normally open.
			N.C.	Normally closed.
			Not used	The relay is not used for opening the CBA.
3417	**CBA time pulse**	2	0.10 to 0.50 s **[0.50 s]**	Breaker pulse duration to close the CBA.. The time of the pulse output may be adjusted to the breaker being utilized.
5715	**Closing time CBA**	2	40 to 300 ms **[80 ms]**	The inherent closing time of the CBA corresponds to the lead-time of the close command. The close command will be issued independent of the differential

ID	Parameter	CL	Setting range [Default]	Description
				frequency at the entered time before the synchronous point.
3407	**CBA auto unlock**	2		This is used for special circuit breakers to put the CBA into a defined initial state or to enable closing at all.
			Yes	Before every close-pulse, an open-pulse is issued for defined duration (parameter 5718). A CB close pulse is enabled only after the open pulse is issued.
			[No]	The CB close pulse is enabled without being preceded by a CB open pulse.
5718	**CBA open time pulse**	2	0.10 to 9.90 s **[1.00 s]**	This time defines the length of the CBA open time pulse, if the automatic switch unblocking CBA (parameter 3407) is activated.
8828	**Open CBA in manual**	2	**[Immediate]**	If there is an open command in manual mode, the CBA will open immediately.
			With unl.	If there is an open command in manual mode, the CBA will open with unloading. If there is a further open command while unloading (via LM or button) the CBA opens immediately.
				Notes With the exception of application mode **A01**, unloading is skipped, if no closed GCB in the relevant segments is detected. No access in application modes **A03**, **A04** or **A05**.
12974	**Open CBA in MAN**	2	Determined by LogicsManager **[(0&1)&1]**	Once the conditions of the LogicsManager have been fulfilled the LS-6XT opens the CBA immediately or with unloading (according to parameter 8828), if no other LS-6XT with higher priority likes to do the same.
				Notes If a close or open command is active but is blocked by another device with higher priority the display shows "CBA request". Only in operation mode MANUAL. No access in application modes **A03**, **A04** or **A05**.
12975	**Close CBA in MAN**	2	Determined by LogicsManager **[(0&1)&1]**	Once the conditions of the LogicsManager have been fulfilled the LS-6XT closes the CBA, if no other LS-6XT with higher priority likes to do the same. (Provided the

ID	Parameter	CL	Setting range [Default]	Description
				conditions for dead bus closure or synchronization are true.)
				Notes If a close or open command is active but is blocked by another device with higher priority the display shows "CBA request". Only in operation mode MANUAL. No access in application modes A03, A04 or A05.
12943	**Open CBA unload**	2	Determined by LogicsManager **[(09.06& 1)&1]**	Once the conditions of the LogicsManager have been fulfilled the LS-6XT opens the CBA with unloading, if no other LS-6XT with higher priority likes to do the same.
				Notes If a close or open command is active but is blocked by another device with higher priority the display shows "CBA request". Only in operation mode AUTOMATIC. No access in application modes A03, A04 or A05.
12944	**Open CBA immed.**	2	Determined by LogicsManager **[(0&1)&1]**	Once the conditions of the LogicsManager have been fulfilled the LS-6XT opens the CBA immediately.
				Notes Only in operation mode AUTOMATIC. No access in application modes A03, A04 or A05.
12945	**Enable close CBA**	2	Determined by LogicsManager **[(09.07&!08.07)&!07.05]**	Once the conditions of the LogicsManager have been fulfilled the LS-6XT closes the CBA, if no other LS-6XT with higher priority likes to do the same. (Provided the conditions for dead bus closure or synchronization are true.)
				Notes If a close or open command is active but is blocked by another device with higher priority the display shows "CBA request". Only in operation mode AUTOMATIC. No access in application modes A03, A04 or A05.

4.4.2.3.1 Synchronization CBA

ID	Parameter	CL	Setting range [Default]	Description
5730	**Synchronization CBA**	2	**[Slip frequency]**	The LS-6XT instructs the frequency controller (e.g. easYgen) to adjust the frequency in a way, that the frequency of the variable system is marginally greater than the target. When the synchronizing conditions are reached, a close command will be issued. The slipping frequency is positive to avoid reverse power.
			Phase matching	The LS-6XT instructs the frequency controller (e.g. easYgen) to adjust the phase angle of the variable system to that of the target, in view of turning the phase difference to zero.
				Notes This parameter has no impact on Command Variables 02.28 Sync. Check Relay and 02.29 Sync. Condition.
5709	**CBA sync. with sep. slip**	2	On	The easYgen(s) take the LS-6XT slip frequency separate offset (easYgen-3400XT/3500XT version 1.13 and higher, parameter 6676).
			[Off]	The easYgen(s) take the slip frequency offset (easYgen parameter 5502) of the GCBs.
				Notes This parameter is only visible if the LS-6XT 'Synchronization CBA' (parameter 5730) is set to 'Slip frequency'. This parameter is only valid if the easYgen is in application mode GCB/LSx and if the LS-6XT 'Synchronization CBA' (parameter 5730) is set to 'Slip frequency'.
5711	**Pos. freq. differential CBA** (Positive frequency differential CBA)	2	0.00 to 0.49 Hz **[+0.18 Hz]**	The prerequisite for a connect command being issued for the CBA is that the differential frequency is below the configured differential frequency. This setting is always in regards of system A: • If the system B is the variable system (i.e. generator), this configuration is the maximum allowed slip frequency then generator(s) can run slower than system A. • If the system A is the variable system (i.e. generator), this configuration is the maximum allowed slip frequency then

ID	Parameter	CL	Setting range [Default]	Description
				generator(s) can run faster than system B.
5712	**Neg. freq. differential CBA** (Negative frequency differential CBA)	2	-0.49 to 0.00 Hz **[-0.18 Hz]**	The prerequisite for a connect command being issued for the CBA is that the differential frequency is above the configured differential frequency. This setting is always in regards of system A: • If the system B is the variable system (i.e. generator), this configuration is the maximum allowed slip frequency then generator(s) can run faster than system A. • If the system A is the variable system (i.e. generator), this configuration is the maximum allowed slip frequency then generator(s) can run slower than system B.
5710	**Voltage differential CBA**	2	0.50 to 20.00% **[5.00%]**	The maximum permissible voltage differential for closing CBA is configured here.
				Notes If the difference between system A and system B voltage does not exceed the value configured here and the system voltages are within the operating voltage windows (parameters ⮡ 5800, ⮡ 5801, ⮡ 5810, ⮡ 5811) the command: "CBA close" may be issued.

4.4.2.3.2 Phase Matching CBA

The following parameters are only valid if 'Synchronization CBA' (parameter ⮡ 5730) is configured to 'Phase matching'.

ID	Parameter	CL	Setting range [Default]	Description
5713	**Max. positive phase angle CBA**	2	0.0 to 60.0 ° **[7.0 °]**	The prerequisite for a connect command being issued for the CBA is that the leading phase angle between system B and system A is below the configured maximum permissible angle.
5714	**Max. negative phase angle CBA**	2	-60.0 to 0.0 ° **[-7.0 °]**	The prerequisite for a connect command being issued for the CBA is that the lagging phase angle between system B and system A is

ID	Parameter	CL	Setting range [Default]	Description
				above the configured minimum permissible angle.
5717	**Phase matching CBA dwell time**	2	0.0 to 60.0 s **[3.0 s]**	This is the minimum time that the system A/B voltage, frequency, and phase angle must be within the configured limits before the breaker will be closed.

4.4.2.4 Configure CBB

General notes

The following parameters are **only** applicable for breaker mode **"CBA/CBB"** (parameter ⮡ 9018)

ID	Parameter	CL	Setting range [Default]	Description
3474	**CBB feedback handling**	2	**[CBB open]**	CBB open: Energized DI 5 indicates that the CBB is open.
			CBB closed	CBB closed: Energized DI 5 indicates that the CBB is closed.
3414	**CBB close command**	2	**[Steady]**	The relay output is energized as long as the breaker should be closed.
			Impulse	The relay output is energized for the closing time pulse.
3403	**CBB open relay**	2	**[N.O.]**	Normally open.
			N.C.	Normally closed.
			Not used	The relay is not used for opening the CBB.
3416	**CBB time pulse**	2	0.10 to 0.50 s **[0.50 s]**	Breaker pulse duration to close the CBB. The time of the pulse output may be adjusted to the breaker being utilized.
5705	**Closing time CBB**	2	40 to 300 ms **[80 ms]**	The inherent closing time of the CBB 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
3405	**CBB auto unlock**	2		This is used for special circuit breakers to put the CBB into a defined initial state or to enable closing at all.
			Yes	Before every close-pulse, an open-pulse is issued for defined duration (parameter 5708). A CB close pulse is enabled only after the open pulse is issued.
			[No]	The CB close pulse is enabled without being preceded by a CB open pulse.
5708	**CBB open time pulse**	2	0.10 to 9.90 s **[1.00 s]**	This time defines the length of the CBB open time pulse, if the automatic switch unblocking CBB (parameter 3405) is activated.
8829	**Open CBB in manual**	2	**[Immediate]**	If there is an open command in manual mode, the CBB will open immediately.
			With unl.	If there is an open command in manual mode, the CBB will open with unloading. If there is a further open command while unloading (via LM or button) the CBB opens immediately.
				Notes With the exception of application mode A01, unloading is skipped, if no closed GCB in the relevant segments is detected. No access in application mode A05.
12976	**Open CBB in MAN**	2	Determined by LogicsManager **[(0&1)&1]**	Once the conditions of the LogicsManager have been fulfilled the LS-6XT opens the CBB immediately or with unloading (according to parameter 8829), if no other LS-6XT with higher priority likes to do the same.
				Notes If a close or open command is active but is blocked by another device with higher priority the display shows "CBB request". Only in operation mode MANUAL. No access in application mode A05.
12977	**Close CBB in MAN**	2	Determined by LogicsManager **[(0&1)&1]**	Once the conditions of the LogicsManager have been fulfilled the LS-6XT closes the CBB, if no other LS-6XT with higher priority likes to do the same. (Provided the conditions for dead bus closure or synchronization are true.)
				Notes

ID	Parameter	CL	Setting range [Default]	Description
				If a close or open command is active but is blocked by another device with higher priority the display shows "CBB request". Only in operation mode MANUAL. No access in application mode A05.
12946	**Open CBB unload**	2	Determined by LogicsManager **[(09.03& 1)&1]**	Once the conditions of the LogicsManager have been fulfilled the LS-6XT opens the CBB with unloading, if no other LS-6XT with higher priority likes to do the same.
				Notes If a close or open command is active but is blocked by another device with higher priority the display shows "CBB request". Only in operation mode AUTOMATIC. No access in application mode A05.
12947	**Open CBB immed.**	2	Determined by LogicsManager **[(0&1)&1]**	Once the conditions of the LogicsManager have been fulfilled the LS-6XT opens the CBB immediately.
				Notes Only in operation mode AUTOMATIC. No access in application mode A05.
12948	**Enable close CBB**	2	Determined by LogicsManager **[(09.04&!08.05)&! 06.21]**	Once the conditions of the LogicsManager have been fulfilled the LS-6XT closes the CBB, if no other LS-6XT with higher priority likes to do the same. (Provided the conditions for dead bus closure or synchronization are true.)
				Notes If a close or open command is active but is blocked by another device with higher priority the display shows "CBB request". Only in operation mode AUTOMATIC. No access in application mode A05.

4.4.2.4.1 Synchronization CBB

ID	Parameter	CL	Setting range [Default]	Description
5729	**Synchronization CBB**	2	**[Slip frequency]**	The LS-6XT instructs the frequency controller (e.g. easYgen) to adjust the frequency in a way, that the frequency of the variable system is marginally greater than the target.

ID	Parameter	CL	Setting range [Default]	Description
				When the synchronizing conditions are reached, a close command will be issued. The slipping frequency is positive to avoid reverse power.
			Phase matching	The LS-6XT instructs the frequency controller (e.g. easYgen) to adjust the phase angle of the variable system to that of the target, in view of turning the phase difference to zero.
				Notes This parameter has no impact on Command Variables 02.28 Sync. Check Relay and 02.29 Sync. Condition.
5749	**CBB sync. with sep. slip**	2	On	The easYgen(s) take the LS-6XT slip frequency separate offset (easYgen-3400XT/3500XT version 1.13 and higher, parameter 6676).
			[Off]	The easYgen(s) take the slip frequency offset (easYgen parameter 5502) of the GCBs.
				Notes This parameter is only visible if the LS-6XT 'Synchronization CBB' (parameter 5729) is set to 'Slip frequency'. This parameter is only valid if the easYgen is in application mode GCB/LSx A02 and if the LS-6XT 'Synchronization CBB' (parameter 5729) is set to 'Slip frequency'. The parameter 6676 is only implemented in easYgen-3400XT/ 3500XT version 1.13 and higher. In combination with other devices the parameter described here has no impact.
5701	**Pos. freq. differential CBB** (Positive frequency differential CBB)	2	0.00 to 0.49 Hz **[+0.18 Hz]**	The prerequisite for a connect command being issued for the CBB is that the differential frequency is below the configured differential frequency. This setting is always in regards of system A: • If the system B is the variable system (i.e. generator), this configuration is the maximum allowed slip frequency then generator(s) can run slower than system A. • If the system A is the variable system (i.e. generator), this configuration is the maximum allowed slip frequency then generator(s) can run faster than system B.

ID	Parameter	CL	Setting range [Default]	Description
5702	**Neg. freq. differential CBB** (Negative frequency differential CBB)	2	-0.49 to 0.00 Hz **[-0.18 Hz]**	The prerequisite for a connect command being issued for the CBB is that the differential frequency is above the configured differential frequency. This setting is always in regards of system A: • If the system B is the variable system (i.e. generator), this configuration is the maximum allowed slip frequency then generator(s) can run faster than system A. • If the system A is the variable system (i.e. generator), this configuration is the maximum allowed slip frequency then generator(s) can run slower than system B.
5700	**Voltage differential CBB**	2	0.50 to 20.00 % **[5.00 %]**	The maximum permissible voltage differential for closing CBB is configured here.
				Notes If the difference between system A and system B voltage does not exceed the value configured here and the system voltages are within the operating voltage windows (parameters ⮱▷ 5800, ⮱▷ 5801, ⮱▷ 5810, ⮱▷ 5811) the command: "CBB close" may be issued.

4.4.2.4.2 Phase Matching CBB

The following parameters are only valid if 'Synchronization CBB' (parameter ⮱▷ 5729) is configured to 'Phase matching'.

ID	Parameter	CL	Setting range [Default]	Description
5703	**Max. positive phase angle CBB**	2	0.0 to 60.0 ° **[7.0 °]**	The prerequisite for a connect command being issued for the CBB is that the leading phase angle between system B and system A is below the configured maximum permissible angle.
5704	**Max. negative phase angle CBB**	2	-60.0 to 0.0 ° **[-7.0 °]**	The prerequisite for a connect command being issued for the CBB is that the lagging phase angle between system B and system A is above the configured minimum permissible angle.
5707	**Phase matching CBB dwell time**	2	0.0 to 60.0 s	This is the minimum time that the system A/B voltage, frequency, and

ID	Parameter	CL	Setting range [Default]	Description
			[3.0 s]	phase angle must be within the configured limits before the breaker will be closed.

4.4.2.5 Configure Synchronization

For synchronization with two systems please see additionally ⮱ "9.7.1 Synchronization Of System A and System B".

General

In some applications it can be beneficial to switch on 1-phase synchronization even a three phase measurement is maintained and configured. In some application it can come can come to slightly different phase angles due to different voltage amplitudes. This can lead in the slipping frequency mode to difficult conditions.

The synchronization can be executed in single phase or three phase manner:

Single phase

The single phase synchronization is used if one of the following conditions are active

- System A voltage measurement if configured to 1PH2W or 1PH3W (Parameter ⮱ 1851)
- System B voltage measurement if configured to 1PH2W or 1PH3W (Parameter ⮱ 1853)
- Synchronization is configured as 1-phase (Parameter ⮱ 8817)

Three phase

The three phase synchronization is used if following conditions are active

- System A voltage measurement is configured to a three phase system (Parameter ⮱ 1851)
- System B voltage measurement is configured to a three phase system (Parameter ⮱ 1853)
- Synchronization is configured as 3-phase (Parameter ⮱ 8817)

The synchroscope (HMI and Toolkit) visualize the highest Delta voltage and highest Phase angle.

The synchronization type can be set on single or three phase matching.

If the measurement system is configured on three phase and the 1-phase synchronization is selected the operating ranges are still three phase considered

ID	Parameter	CL	Setting range [Default]	Description
8817	**Synchronization**	2	This parameter selects the single phase or three phase synchronization.	
			[1-phase]	The synchronization function compares the L1-L2 measurement system A to system B.
			3-phase	The synchronization function compares the L1-L2, L2-L3, L3-L1 measurement system A to system B.
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(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.
			Controlled by LM	The synchronization mode is controlled by LogicsManager ⮱▷ 12907, ⮱▷ 12906 and ⮱▷ 12908). If none of these parameters is enabled, the synchronization is disabled. If more than one of these parameters is enabled, the following priority is valid: • 1. PERMISSIVE • 2. CHECK • 3. RUN
				Notes The device will still perform a dead busbar closure if the conditions are valid.

ID	Parameter	CL	Setting range [Default]	Description
				No access in the application modes A03, A04, A05.
12906	**Syn. mode CHECK** (Synchronization mode CHECK)	2	Determined by LogicsManager **[(0&1)&1]**	Once the conditions of the LogicsManager have been fulfilled the CHECK synchronization mode will be enabled.
				Notes For information on the LogicsManager and its default settings see ⮡ "9.4.1 LogicsManager Overview".
12907	**Syn. mode PERMIS.** (Synchronization mode PERMISSIVE)	2	Determined by LogicsManager **[(0&1)&1]**	Once the conditions of the LogicsManager have been fulfilled the PERMISSIVE synchronization mode will be enabled.
				Notes For information on the LogicsManager and its default settings see ⮡ "9.4.1 LogicsManager Overview".
12908	**Syn. mode RUN** (Synchronization mode RUN)	2	Determined by LogicsManager **[(0&1)&1]**	Once the conditions of the LogicsManager have been fulfilled the RUN synchronization mode will be enabled.
				Notes For information on the LogicsManager and its default settings see ⮡ "9.4.1 LogicsManager Overview".
15157	**Synchroscope autom. to front** (Synchroscope automatic to front)	2	On	The synchroscope screen automatically appears on the main screen, when the synchronization becomes active.
			[Off]	Functionality deactivated.

4.4.2.6 Phase angle compensation

To determine the phase angle deviation (to be configured with the parameters listed below) do either of the following:

- When mains voltage can be connected follow the steps in Procedure.
- When mains voltage cannot be connected but the vector group of the transformer is known, follow the steps in Procedure

⚙ **Determining the phase angle deviation (connected mains voltage)**

> The mains voltage is connected:

1. ▷ With a phase angle deviation of 0 ° and system B not energized and system A energized, close the CBA.

▶ This will result in system A and system B being at the same voltage potential.
The phase angle deviation will now be displayed on the LS-6XT screen (synchronization angle phi).

2. ▷ Enter the displayed value into parameter ⮱ 8842.

NOTICE!

Damaged components due to incorrect settings

- Validate the setting in every control unit with a differential voltage measurement.

⚙ Calculating the phase angle deviation (known transformer vector group)

> The vector group states the phase angle deviation in multiples of 30°. From the vector group the phase angle deviation can be calculated as an angle between 0° and 360°:

1. ▷ To calculate the resulting value, assume the low voltage side of the transformer always lags behind the high voltage side (phase angle deviation α).

Calculate the phase angle deviation as follows:

	High voltage side = System [A]	High voltage side = System [B]
α < 180°	α	-α
α > 180°	-360° + α	360° -α

ID	Parameter	CL	Setting range [Default]	Description
8841	**Phase angle compensation CBA**	2		This parameter defines if the parameter ⮱ 8842 is valid or not.
			On	If a transformer is located between systems A and B and if the transformer has a vector group with a phase angle deviation, then "On" should be configured in this parameter.
			[Off]	If a transformer is not located between systems A and B or if the transformer has a vector group without a phase angle deviation, then "Off" should be configured in this parameter.
				Notes WARNING: Ensure the following parameters are configured

ID	Parameter	CL	Setting range [Default]	Description
				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 LS-6XT with a label showing the configured phase angle compensation.
8842	**Phase angle CBA**	2	-180 to 180° **[0°]**	This parameter compensates phase angle deviations, which can be caused by transformers (e.g. a delta to wye transformer) located within the electrical system.
				Notes If a transformer is not located between systems A and B or if the transformer has a vector group without a phase angle deviation, then a phase angle deviation of 0° should be configured in this parameter. For information on how to determine the phase angle deviation refer to ⮡ Chapter 4.4.2.6. WARNING: Ensure this parameter is configured correctly to prevent erroneous synchronization settings. Incorrect wiring of the system cannot be compensated for with this parameter!

4.4.2.7 Configure Synchronous network

ID	Parameter	CL	Setting range [Default]	Description
8820	**Connect synchronous mains**	2	Yes	Closing the CBA in case of synchronous mains is possible if • System A and System B are detected as mains connected and • The angle is in the configuration window of parameter ⮡ 8821 for at least the time configured in parameter ⮡ 8822 and • The voltage difference between System A and System B is is in the

ID	Parameter	CL	Setting range [Default]	Description
				configuration window of parameter 8823. ↳ 8823.
			[No]	Closing the CBA in case of synchronous mains (System A and System B are mains connected) is not allowed.
				Notes If no closed GCB in the relevant segment is detected, unloading will be canceled and the breaker will be opened immediately (even if the command “Open CBA with unloading” is active). No access in the application modes **A03**, **A04**, **A05**.
8852	**Connect synchronous segments**	2	Yes	Closing the CBA in case of synchronous segments is possible if • System A and System B are detected as already connected and • The angle is in the configuration window of parameter ↳ 8821 for at least the time configured in parameter ↳ 8822 • The voltage difference between System A and System B is is in the configuration window of parameter ↳ 8823 The closing of the CBA is executed without synchronization.
			[No]	In case of synchronous segments are detected, the CBA will not be closed. Synchronization is not executed.
				Notes No access in the application modes **A03**, **A04**, **A05**.
8821	**Max. phase angle**	2	0 to 20° **[20°]**	Maximum admissible angle between both voltage systems in case of connecting synchronous mains or segments.
				Notes No access in the application modes **A03**, **A04**, **A05**.
8823	**Max. voltage differential**	2	0.50 to 20.00% **[5.00%]**	Maximum admissible voltage difference between both voltage systems in case of connecting synchronous mains or segments.
				Notes

ID	Parameter	CL	Setting range [Default]	Description
				No access in the application modes A03, A04, A05.
8822	**Delay time phi max.**	2	0 to 99 s **[1 s]**	Defines the time how long the phase angle (parameter ⮡ 8821) between both voltage systems needs to be below the configured maximum permissible angle before connecting synchronous mains.
				Notes No access in the application modes A03, A04, A05.

4.4.2.8 Configure Logic commands

General notes

In breaker mode **"CBA/CBB"** the LS-6XT provides logic commands to handle the breaker control (CBA/CBB requests) without an external PLC logic. This requires the mains connection at System A and variable source (generators) at System B.

The intention from the logic commands is to use these flags for the LogicManager configuration.

Command variable	Usable for LogicsManager
04.88 Logic cmd CBA close	Enable close CBA (Parameter ⮡ 12945)
04.89 Logic cmd CBA open	Open CBA immed. (Parameter ⮡ 12944)
04.90 Logic cmd CBB close	Enable close CBB (Parameter ⮡ 12948)
04.91 Logic cmd CBB open	Open CBB immed. (Parameter ⮡ 12947)

This logic commands includes the emergency mode (AMF mode) and the remote start as well. The command variable ("04.92 Logic cmd Gen. start") is usable for the start from the generators.

Emergency run

If the LogicsManager outputs 'Inhibit emergency run' is TRUE, an emergency power operation may be prevented or interrupted from an external source.

The display indicates "Emergency run" during emergency power operation.

If the mains return during an emergency power operation, the mains settling time (parameter ⮡ 2801) must expire before the load is transferred from the generator to mains operation.

Activation of emergency power

If the mains (System A) is not within the configured frequency and voltage operating limits (⮡ "4.5.1.3 System A Operating Ranges") for at least the time configured in the parameter "Mains fail delay time" (parameter ⮡ 2800), an emergency power operation is activated.

CBA malfunction

An emergency power operation will be performed, if the control is not able to close or recluse the CBA and the alarm "Fail to close CBA" occurs.

System A rotation field alarm

If the mains returns after a mains failure with a reversed rotation direction the LS-6XT remains in emergency power operation until the mains rotation (System A) matches the rotation of the generator (System B).

The emergency mode will not start upon a mains rotation field alarm, but it will keep on running if it has already started.

ID	Parameter	CL	Setting range [Default]	Description
2802	**Emergency run**	2	On	If the mains fault occurs according to the following parameters, the automatic emergency operation is carried out.
			[Off]	No emergency operation is carried out.
2800	**Mains fail delay time**	2	0.00 to 655.00 s **[3.00 s]**	To start the emergency operation the monitored mains must be failed continuously for the minimum period of time set with this parameter.
				Notes This delay time starts only if the emergency power is activated.
3408	**Emerg. start with CBA failure**	2	Yes **[No]**	Emergency power operations may be configured with the failure of the CBA in addition to a loss of power on the mains supply.
				Notes An CBA breaker alarm is indicated if parameter "CBA monitoring" (parameter ⮡ 2620) is configured "On".
12200	**Inhibit emerg.run**	2	Determined by LogicsManager 86.11 **[(0 & 1) & 1]** = 10710	Once the conditions of the LogicsManager have been fulfilled the emergency power operation will be terminated or blocked.
				Notes

ID	Parameter	CL	Setting range [Default]	Description
				It is possible to interrupt an already activated emergency run. For information on the LogicsManager and its default settings see ⮱▷ "9.4.1 LogicsManager Overview".
12882	**Emerg. back to mains**	2	Determined by LogicsManager 86.52 **[(02.02 & 1) & 1]** = 11084	Once the conditions of the LogicsManager have been fulfilled the load will be transferred back to mains and after successful CBA closing the emergency mode stops.
				Notes It is possible to extend the emergency run after the mains settling time and continue with generator supply. For information on the LogicsManager and its default settings see ⮱▷ "9.4.1 LogicsManager Overview".

Generator power

The closing from the CBB depends on the available generator power and the total power of all running easYgen with closed GCB.

ID	Parameter	CL	Setting range [Default]	Description
3440	**Min.Generator power**	2	0.00 to 327.67 MW **[0.10 MW]**	CBB operation - the CBB shall be closed when a minimum generator rated power is available. The nominal power of all active running generators with closed breaker determine the closing of the CBB.
				Notes This minimum power is used for emergency mode and remote start.
12936	**Bypass min. Pgen.**	2	Determined by LogicsManager 87.29 **[(0 & 1) & 1]** = 11418	This LogicsManager equation can bypass the considered minimal nominal generator power for closing the CBB. If the LogicsManager becomes TRUE the CBB will be closed independent of the current nominal generator power. According to the breaker transfer mode.
				Notes For information on the LogicsManager and its default settings see ⮱▷ "9.4.1 LogicsManager Overview".

Remote start

The remote start activates the load test from the generator group and the breaker action from the LS-6XT is in relation to selected breaker transition mode.

- "Breaker transition mode" (Parameter ⮡ 3411) or
- "Breaker transition mode 1" (Parameter ⮡ 3412) or
- "Breaker transition mode 2" (Parameter ⮡ 3413)

ID	Parameter	CL	Setting range [Default]	Description
12883	**Generator remote start**	2	Determined by LogicsManager 87.99 **[(0 & 1) & 1]** = 10979	Once the conditions of the LogicsManager have been fulfilled the remote start (generator load test) is active.
				Notes For information on the LogicsManager and its default settings see ⮡ "9.4.1 LogicsManager Overview".

For more details see Application Field ⮡ "6.4.6.2 Setup easYgen & LS-6 Application with Logic Commands".

4.4.3 Configure Segment

General notes

The LS-6XT can be used in different applications. The following examples show typical ones.

The following examples are **only** applicable for breaker mode **"CBA"** (parameter ⮡ 9018)

No isolation switch

No isolation switch is installed. At the following example

- Segment no. System A is 10 (parameter ⮡ 8810)
- Segment no. System B is 11 (parameter ⮡ 8811)
- Isolation switch is set to None (parameter ⮡ 8815)

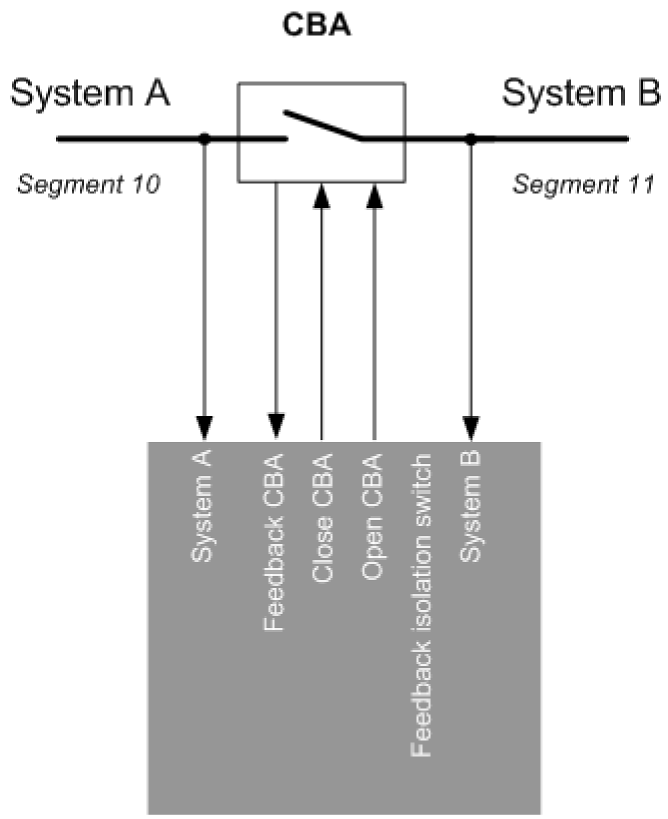


Fig. 123: LS-6XT - No isolation switch (example)

Isolation switch on System A side

The isolation switch is installed on System A side. At the following example

- Segment no. System A is 11 (parameter ⮡ 8810)
- Segment no. System B is 12 (parameter ⮡ 8811)
- Segment no. Isolation switch is 10 (parameter ⮡ 8812)
- Isolation switch is set to System A (parameter ⮡ 8815)

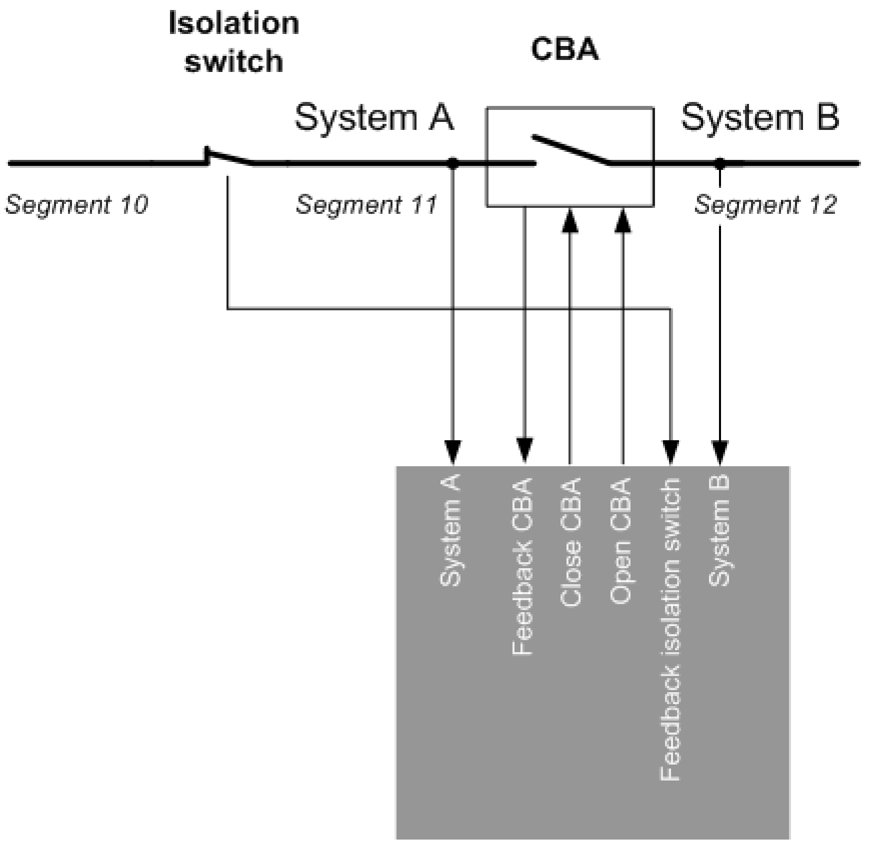


Fig. 124: LS-6XT - Isolation switch on System A side (example)

Isolation switch on System B side

The isolation switch is installed on System B side. At the following example

- Segment no. System A is 10 (parameter ⮡ 8810)
- Segment no. System B is 11 (parameter ⮡ 8811)
- Segment no. Isolation switch is 12 (parameter ⮡ 8812)
- Isolation switch is set to System B (parameter ⮡ 8815)

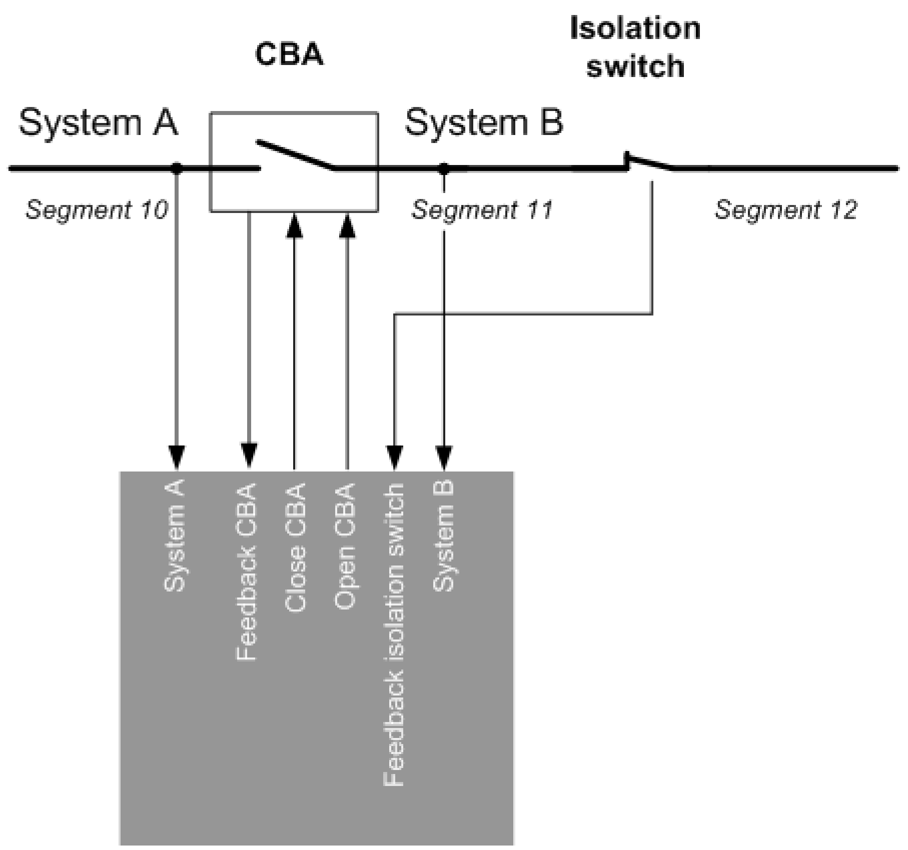


Fig. 125: LS-6XT - Isolation switch on System B side (example)

> The following example are **only** applicable for breaker mode **"CBA/CBB"** (parameter ⮱ 9018)

Example for LS-6XT

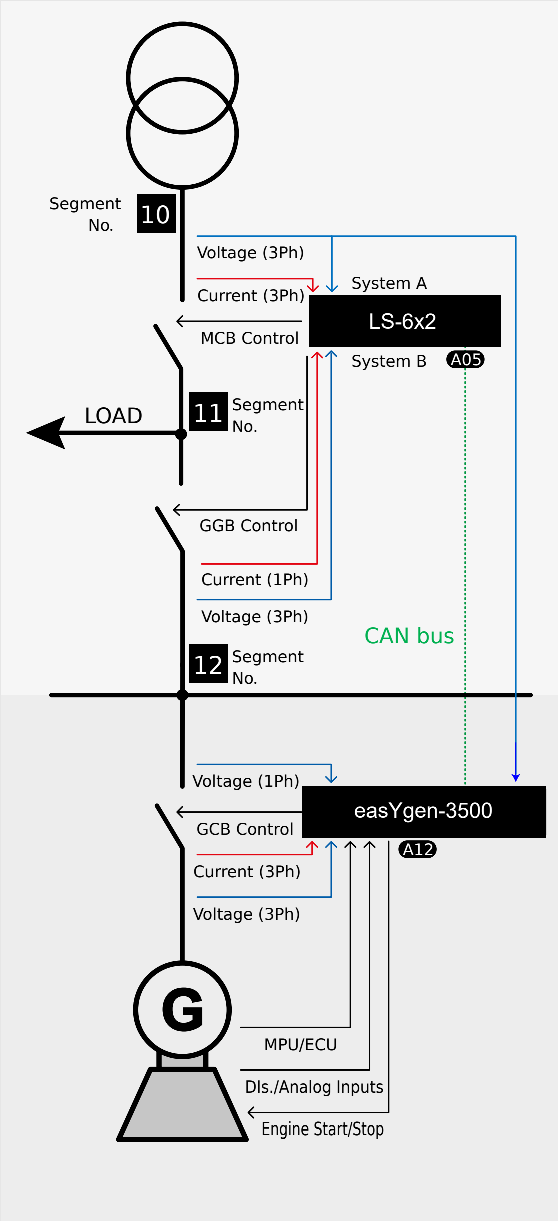


Fig. 126: LS-6XT Application example

ID	Parameter	CL	Setting range [Default]	Description
8810	**Segment number System A**	2	1 to 128 **[1]**	Segment number for system A.
				Notes In Layer 1 (parameter 8990) the max. value is limited to **64**. No access in the application modes **A03**, **A04**, **A05**.
8811	**Segment number System B**	2	1 to 128	Segment number for system B.

ID	Parameter	CL	Setting range [Default]	Description
			[2]	
				Notes In Layer 1 (parameter ⮱▷ 8990) the max. value is limited to **64**. No access in the application modes A03, A04, A05.

The following parameter is **only** applicable for breaker mode **"CBA"** (parameter ⮱▷ 9018)

ID	Parameter	CL	Setting range [Default]	Description
8812	**Segment number isol. switch**	2	1 to 128 **[1]**	Segment number isolation switch (if available). **Notes** In Layer 1 (parameter ⮱▷ 8990) the max. value is limited to **64**. No access in the application modes A03, A04.

The following parameter is **only** applicable for breaker mode **"CBA/CBB"** (parameter ⮱▷ 9018)

ID	Parameter	CL	Setting range [Default]	Description
8799	**Segment number load**	2	1 to 128 **[3]**	Segment number for the load path.
				Notes In Layer 1 (parameter ⮱▷ 8990) the max. value is limited to **64**. In example: Segment no. 11 No access in the application mode A05.

ID	Parameter	CL	Setting range [Default]	Description
8813	**Mains power measurement**	2	**[Valid]**	The measured power is used for mains real power control.
			Invalid	The measured power is not used for power control.
				Notes No access in the application modes **A03**, **A04**, **A05**.
8814	**Mains connection**	2	None	No system is wired to mains directly. It can not be used for mains failure detection.
			[System A]	System A is wired to mains directly.
			System B	System B is wired to mains directly.
			Isol.swi.	The system of the isolation switch is wired to mains.
				Notes No access in the application modes **A03**, **A04**, **A05**.

The following parameter is **only** applicable for breaker mode **"CBA"** (parameter ⮡ 9018)

ID	Parameter	CL	Setting range [Default]	Description
8815	**Isol. switch**	2	**[None]**	No isolation switch at system A or system B.
			System A	Isolation switch is at system A.
			System B	Isolation switch is at system B.
				Notes No access in the application modes **A03** and **A04**.
8816	**Variable system**	2		One of the systems must be defined as a variable system. A variable system is defined as a system that can change in frequency and voltage due to the easYgen control unit. In normal applications this is the frequency/voltage that is situated opposite the mains voltage of the MCB. The opposite side of the CB is therefore either constant (mains voltage) or a controlled stable (bus coupler) system.
			System A	Variable system is system A.
			[System B]	Variable system is system B.

ID	Parameter	CL	Setting range [Default]	Description
			By LM	A LogicsManager equation determines whether variable system is system A or system B (parameter 12949).
				Notes No access in the application modes **A03**, **A04**, **A05**.
12949	**Variab. system A** (Variable system A)	2	Determined by LogicsManager **[(0 & 1) & 1]**	Once the conditions of the LogicsManager have been fulfilled the system A will be the variable one. If the conditions of the LogicsManager have not been fulfilled the system B will be the variable one.
				This configuration is only valid, if the variable system is configured as 'By LM'. **Notes** No access in the application modes **A03**, **A04**, **A05**. For information on the LogicsManager and its default settings see ⮱ "9.4.1 LogicsManager Overview".

4.4.4 Configure Operation Modes

4.4.4.1 Operation Modes: General

Priority of operation modes

The priority of operation modes is well defined from highest to lowest priority:

- »MANUAL«
- »AUTOMATIC«

ID	Parameter	CL	Setting range [Default]	Description
8827	**Startup in mode** (Operating mode after applying the power supply)	2		If the controller is powered down, the unit will start in the following configured mode when it is powered up again.
			AUTO	The unit starts in the AUTOMATIC operating mode.
			[MAN]	The unit starts in the MANUAL operating mode.

ID	Parameter	CL	Setting range [Default]	Description
			Last	The unit starts in the last operating mode the control was in prior to being de-energized.
				Notes For the selection of the operating mode via the LogicsManager (if two different operating modes have been selected simultaneously) the control unit will prioritize the modes as follows: • 1. MANUAL • 2. AUTOMATIC
12510	**Operat. mode AUTO** (Activate operating mode AUTOMATIC)	2	Determined by LogicsManager 86.16 **[(0 & 1) & 1]** = 10715	Once the conditions of the LogicsManager have been fulfilled the unit will change into operating mode AUTOMATIC. If MANUAL mode is selected via the LogicsManager it is not possible to change operating modes via the front panel.
				Notes For information on the LogicsManager and its default settings see ⮡ "9.4.1 LogicsManager Overview".
12520	**Operat. mode MAN** (Activate operating mode MANUAL)	2	Determined by LogicsManager 86.17 **[(0 & 1) & 1]** = 10716	Once the conditions of the LogicsManager have been fulfilled the unit will change into operating mode MANUAL. If MANUAL mode is selected via the LogicsManager it is not possible to change operating modes via the front panel.
				Notes For information on the LogicsManager and its default settings see ⮡ "9.4.1 LogicsManager Overview".

4.4.5 Configure Load Share

ID	Parameter	CL	Setting range [Default]	Description
9924	**Load share Interface**	2		The interface, which is used for transmitting the load share data is configured here.
			Off	Deactivate load share interface.

ID	Parameter	CL	Setting range [Default]	Description
			[CAN]	Use CAN1 interface. **Notes** This mode works only properly in application **Layer 1** (parameter 8990 ⮑ 8990).
			Ethernet A	Use Ethernet A interface.
			Ethernet B/C	Use Ethernet B or C interface. **Notes** Redundant load sharing.
			CAN1/Ethernet A	Use CAN1 or Ethernet A interface. **Notes** Redundant load sharing. This mode works only properly in application **Layer 1** (parameter ⮑ 8990).
			Ethernet B	Use Ethernet B interface.
2442	**Load share timeout event**	2	**[Off]**	Loadshare timeout events are disabled.
			On	Loadshare timeout events are enabled. If a loadshare message was not received within a defined time, a loadshare timeout event will be shown in the Event History.

4.5 Configure Monitoring

4.5.1 System A

4.5.1.1 General System A Monitoring

ID	Parameter	CL	Setting range [Default]	Description
1771	**System A voltage monitoring**	2		The unit can either monitor the wye voltages (phase-neutral) or the delta voltages (phase-phase). The monitoring of the wye voltage is above all necessary to avoid earth-faults in a compensated or isolated network resulting in the tripping of the voltage protection.
			[Phase - phase]	The phase-phase voltage will be monitored and all subsequent parameters concerning voltage monitoring "System A" are referred to this value (VL-L).

ID	Parameter	CL	Setting range [Default]	Description
			Phase - neutral	The phase-neutral voltage will be monitored and all subsequent parameters concerning voltage monitoring "System A" are referred to this value (VL-N).
			All	The phase-phase **and** phase-neutral voltage will be monitored and all subsequent parameters concerning voltage monitoring "System A" are referred to this value (VL-L & VL-N). This setting is only effective if "System A voltage measuring" (parameter ⮑ 1853) is configured to "3Ph 4W".
2801	**Mains settling time**	2	0 to 9999 s **[20 s]**	To end the emergency operation, the monitored mains must be within the configured operating parameters without interruption for the minimum period of time set with this parameter without interruption. This parameter permits delaying the switching of the load from the generator to the mains. The display indicates "Mains settling" during this time.

General notes

A drop-off ratio (Hysteresis) is configurable for the System A frequency and voltage monitoring.

ID	Parameter	CL	Setting range [Default]	Description
2964	**Hysteresis overvolt. monit.**	2	0.0 to 10.0 % **[1.5 %]**	If the System A voltage has exceeded the configured limit, the voltage must fall below the limit and the value configured here, to reset the alarm.
				Notes This value refers to the System A rated voltage (parameter ⮑ 1766).
2997	**Hysteresis undervolt. monit.**	2	0.0 to 10.0 % **[1.5 %]**	If the System A voltage has fallen below the configured limit, the voltage must exceed the limit and the value configured here, to reset the alarm.
				Notes

ID	Parameter	CL	Setting range [Default]	Description
				This value refers to the "System A rated voltage" (parameter ⮱ 1766).
2965	**Hysteresis overfreq. monit.**	2	0.0 to 2.0% **[0.1%]**	If the System A frequency has exceeded the configured limit, the frequency must fall below the limit and the value configured here, to reset the alarm.
				Notes This value refers to the System rated frequency (parameter ⮱ 1750).
2998	**Hysteresis underfreq. monit.**	2	0.0 to 2.0% **[0.1%]**	If the System A frequency has fallen below the configured limit, the frequency must exceed the limit and the value configured here, to reset the alarm.
				Notes This value refers to the System rated frequency (parameter ⮱ 1750).

4.5.1.2 Blocking of System A Protection

General notes

The operator can deactivate the System A monitoring features and the decoupling function. A dedicated LogicsManager is installed to disable all System A monitoring and the decoupling function.

> Already latched alarms (self acknowledge = No) are not removed from the alarm list by this function.

Following functions are blocked:

- System A decoupling
- System A over frequency 1&2
- System A under frequency 1&2
- System A over voltage 1&2
- System A under voltage 1&2
- System A voltage asymmetry
- System A voltage increase (10 minutes average value)
- System A Time-dependent Voltage (FRT)
- System A Q(V) Monitoring

- System A phase shift
- System A df/dt

ID	Parameter	CL	Setting range [Default]	Description
15159	**Disab.Syst.A mon.**	2	Determined by LogicsManager 87.72 **[(0 & 1) & 1]** **t_{ON} = 0.00; t_{OFF} = 0.00]** = 11461	Switch to disable • all System A monitoring functions and • the System A decoupling function.

4.5.1.3 System A Operating Ranges

4.5.1.3.1 General System A Operating Range

General notes

> The System A operating voltage/frequency parameters are used to trigger System A failure conditions in order to activate an emergency run.
>
> The System A values must be within this ranges to synchronize the System A circuit breaker. It is recommended to configure the operating limits within the monitoring limits.

Example

If the System A rated voltage is 400 V, the upper voltage limit is 110 % (of the System A rated voltage, i.e. 440 V), and the hysteresis for the upper voltage limit is 5 % (of the System A rated voltage, i.e. 20 V), the System A voltage will be considered as being out of the operating limits as soon as it exceeds 440 V and will be considered as being within the operating limits again as soon as it falls below 420 V (440 V – 20 V).

If the rated system frequency is 50 Hz, the lower frequency limit is 90 % (of the rated system frequency, i.e. 45 Hz), and the hysteresis for the lower frequency limit is 5 % (of the rated system frequency, i.e. 2.5 Hz), the System A frequency will be considered as being out of the operating limits as soon as it falls below 45 Hz and will be considered as being within the operating limits again as soon as it exceeds 47.5 Hz (45 Hz + 2.5 Hz).

ID	Parameter	CL	Setting range [Default]	Description
5810	**Upper voltage limit**	2	100 to 150% **[110%]**	The maximum permissible positive deviation of the System A voltage from the System A rated voltage (parameter ⮡ 1766) is configured here. This value may be used as a voltage limit switch. The conditional state of this switch may be used as a command variable for the LogicsManager (02.09).

ID	Parameter	CL	Setting range [Default]	Description
5814	**Hysteresis upper voltage limit**	2	0 to 50% **[2%]**	If the System A 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 System A voltage from the System A rated voltage (parameter ⮡ 1766) is configured here. This value may be used as a voltage limit switch. The conditional state of this switch may be used as a command variable for the LogicsManager (02.09).
5815	**Hysteresis lower voltage limit**	2	0 to 50% **[2%]**	If the System A 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 System A frequency from the rated system frequency (parameter ⮡ 1750) is configured here. This value may be used as a frequency limit switch. The conditional state of this switch may be used as a command variable for the LogicsManager (02.10). **Notes** [1] The lowest measurable frequency is 40 Hz. 66.7 % of 60 Hz is 40 Hz. Equivalent for 50 Hz don't go below 80 %.
5816	**Hyst. upper frequency limit**	2	0.0 to 50.0% **[0.5%]**	If the System A 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 System A frequency from the rated system frequency (parameter ⮡ 1750) is configured here. This value may be used as a frequency limit switch. The conditional state of this switch may be used as a command variable for the LogicsManager (02.10).

ID	Parameter	CL	Setting range [Default]	Description
				Notes [1] The lowest measurable frequency is 40 Hz. 66.7 % of 60 Hz is 40 Hz. Equivalent for 50 Hz don't go below 80 %.
5817	**Hyst. lower frequency limit**	2	0.0 to 50.0% **[0.5%]**	If the System A 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.

4.5.1.3.2 Reconnecting System A Operating Range

Introduction

After System A decoupling from the power generation device, with under-/over frequency or under-/over voltage, the automatic reconnection to the grid after the System A settling time is only possible, if the System A is within the following operation ranges.

The operation ranges for System A reconnecting uses the voltages according to the configured System A voltage monitoring ⮡ 1771, phase-phase/phase-neutral/All). Only if all considered voltages are back in band the synchronization to System A will be executed.

ID	Parameter	CL	Setting range [Default]	Description
5818	**Upper voltage limit**	2	100 to 150% **[105%]**	The maximum permissible positive deviation of the System A voltage from the System A rated voltage after System A decoupling.
5819	**Lower voltage limit**	2	50 to 100% **[95%]**	The maximum permissible negative deviation of the System A voltage from the System A rated voltage after System A decoupling.
5821	**Upper frequency limit**	2	66,7 to 150% **[100.2%]**	The maximum permissible positive deviation of the System A voltage from the System A rated voltage after System A decoupling.
5822	**Lower frequency limit**	2	66.7 to 100% **[99.8%]**	The maximum permissible negative deviation of the System A voltage from the System A rated voltage after System A decoupling.

4.5.1.4 System A Decoupling

General notes

The System A decoupling function is intended for use in a mains parallel operation and monitors a series of subordinate System A protection thresholds. If a threshold is exceeded, the breaker control initiates a breaker opening and separates the system from the mains at the defined breaker.

The following thresholds are monitored anyway:

- Overfrequency level 2 (⮡ "4.5.1.5 System A Overfrequency (Level 1 & 2) ANSI# 81O")
- Underfrequency level 2 (⮡ "4.5.1.6 System A Underfrequency (Level 1 & 2) ANSI# 81U")
- Overvoltage level 2 (⮡ "4.5.1.7 System A Overvoltage (Level 1 & 2) ANSI# 59")
- Undervoltage level 2 (⮡ "4.5.1.8 System A Undervoltage (Level 1 & 2) ANSI# 27")
- System A phase shift / df/dt (ROCOF) (⮡ "4.5.1.4.2 Change Of Frequency")

Depending on the parameter settting, the following thresholds can additionally be taken into account:

- Overfrequency level 1 (⮡ 8848)
- Underfrequency level 1 (⮡ 8847)
- Overvoltage level 1 (⮡ 8845)
- Undervoltage level 1 (⮡ 8844)
- Voltage increase (⮡ 8808)
- Time-dependent voltage (⮡ 4989)
- QV monitoring (⮡ 3295)
- Ext. Syst.A decoupl. (⮡ 12922)

If one of these protective functions is triggered, the display indicates "System A decoupling" (the logical command variable "07.25" will be enabled) and the active alarm.

4.5.1.4.1 General System A Decoupling

> The System A decoupling function is optimized on the both relay outputs "CBA open" and "CBB open". In case of using a free relay output in conjunction with the command variable 07.25 an additional delay time of up to 20 ms is to consider.

Managing Breaker Open alarm

When the System A decoupling function detects a breaker open failure, the according breaker alarm will be triggered as long the monitoring function is activated. Additionally in cases where the decoupling mode has to change over to the other breaker, (CBA->CBB, CBB->CBA), the alarm text "Decoupling CBA<->CBB" is indicated. The breaker open alarm already occurs after the System A decoupling feedback delay (refer to parameter ⮡ 3113).

ID	Parameter	CL	Setting range [Default]	Description
12942	**Enable System A dec.**	2	Determined by LogicsManager 87.31 **[(04.07 & 04.06) & 1]**	Once the conditions of the LogicsManager have been fulfilled, the System A decoupling function is enabled.
				Notes For information on the LogicsManager and its default settings see ⮡ "9.4.1 LogicsManager Overview".
12922	**Ext.Syst.A decoupl.**	2	Determined by LogicsManager 86.27 **[(0 & 1) & 1]**	The unit may be configured to decouple when commanded by an external device. Once the conditions of the LogicsManager have been fulfilled, an external System A failure is issued.
				Notes For information on the LogicsManager and its default settings see ⮡ "9.4.1 LogicsManager Overview".
3110	**System A decoupling**	2	Off	System A decoupling monitoring is disabled.
			[CBA]	System A decoupling is carried out according to the following parameters. If one of the subordinate monitoring functions is triggered, the CBA will be opened. If the unit is operated in parallel with the System A and the CBB opens, the CBA will be closed again.
			CBA->CBB	Application mode "CBA/CBB" System A decoupling is carried out according to the following parameters. If one of the subordinate monitoring functions is triggered, the CBA will be opened. If the reply "CBA open" is not present within the delay configured in parameter ⮡ 3113, the CBB will be opened as well.
			CBB	Application mode "CBA/CBB" System A decoupling is carried out according to the following parameters. If one of the subordinate monitoring functions is triggered, the CBB will be opened.
			CBB->CBA	Application mode "CBA/CBB" System A decoupling is carried out according to the following parameters. If one of the

ID	Parameter	CL	Setting range [Default]	Description
				subordinate monitoring functions is triggered, the CBB will be opened. If the reply "CBB open" is not present within the delay configured in parameter ⮡ 3113, the CBA will be opened as well.
			CB by LM	Application mode "CBA/CBB" System A decoupling is carried out. If one of the subordinate monitoring functions is triggered, a breaker will be opened, which is determined by the LogicsManager equation "15160 LM System A decoupling CBB" ⮡ 15160. If it's status is TRUE, the CBB will be opened. If it's status is FALSE, the CBA will be opened.
3113	**Syst.A decoupl.feedback delay**	2	0.2 to 99.9 s **[0.4 s]**	Application mode "CBA/CBB" If the open signal from the respective circuit breaker cannot be detected within the time configured here, the System A decoupling function performs the action as configured in parameter ⮡ 3110.
15160	**System A decoupl.CBB**	2	Determined by LogicsManager **[(0 & 1) & 1]**	LogicsManager determines which breaker will be opened for decoupling. If 87.73 "LM: Syst. A decoupl. CBB" is true the CBB will be opened, else the CBA.
				Notes Only vaild if "SyA. decoupling (parameter ⮡ 3110) is set to "CB by LM". For additional information on the LogicsManager and its default settings see ⮡ "9.4.1 LogicsManager Overview".
3111	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ⮡ "9.6.4 Alarm Classes".
3112	**Self acknowledge**	2	Yes	The control automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by

ID	Parameter	CL	Setting range [Default]	Description
				activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
8848	**Syst.A decoupl.by overfreq.1**	2		The System A overfrequency 1 alarm can be linked to the System A decoupling function, if required.
			On	The System A overfrequency 1 trip is linked to the System A decoupling function with all its consequences.
			[Off]	The System A overfrequency 1 trip is ignored in the System A decoupling function.
				Notes It is recommended to configure the operating limits (parameter ⮡ 5810 to ⮡ 5817) within the monitoring limits.
8845	**Syst.A decoupl.by overvolt.1**	2		The System A overvoltage 1 alarm can be linked to the System A decoupling function, if required.
			On	The System A overvoltage 1 trip is linked to the System A decoupling function with all its consequences.
			[Off]	The System A overvoltage 1 trip is ignored in the System A decoupling function.
				Notes It is recommended to configure the operating limits (parameter ⮡ 5810 to ⮡ 5817) within the monitoring limits.
3295	**Syst.A decoupling by QV**	2	On	The QV monitoring function is linked to the System A decoupling function with all its consequences and is assigned to "Delay step 1" (parameter ⮡ 3283).
			[Off]	The QV monitoring function is ignored in the System A decoupling function.
4989	**Syst.A decoupl.time-dep.volt.**	2	On	Time-dependent voltage monitoring 1,2, or 3 does cause a decoupling.
			[Off]	Time-dependent voltage monitoring does not cause a decoupling.
8847	**Syst.A decoupl.by underfreq.1**	2		The System A underfrequency 1 alarm can be linked to the System A decoupling function, if required.
			On	The System A underfrequency 1 trip is linked to the System A decoupling function with all its consequences.

ID	Parameter	CL	Setting range [Default]	Description
			[Off]	The System A underfrequency 1 trip is ignored in the System A decoupling function.
				Notes It is recommended to configure the operating limits (parameter ⮱▷ 5810 to ⮱▷ 5817) within the monitoring limits.
8844	**Syst.A decoupl.by undervolt.1**	2		The System A undervoltage 1 alarm can be linked to the System A decoupling function, if required.
			On	The System A undervoltage 1 trip is linked to the System A decoupling function with all its consequences.
			[Off]	The System A undervoltage 1 trip is ignored in the System A decoupling function.
				Notes It is recommended to configure the operating limits (parameter ⮱▷ 5810 to ⮱▷ 5817) within the monitoring limits.
8808	**Syst.A decoupl.volt.increase**	2	On	Voltage increase monitoring does cause a decoupling.
			[Off]	Voltage increase monitoring does not cause a decoupling.

4.5.1.4.2 Change Of Frequency

Phase shift

A vector/phase shift is defined as the sudden variation of the voltage curve which may be caused by a major generator load change. It usually occurs, if the utility opens the MCB, which causes a load change for the genset.

The LS-6XT control measures the duration of a cycle, where a new measurement is started with each voltage passing through zero. The measured cycle duration will be compared with an internal quartz-calibrated reference time to determine the cycle duration difference of the voltage signal.

> The phase shift monitoring is a very sensitive functionality and reacts according to the settings on each sine wave constellation.
>
> Please be aware that under special circumstances it may come to a phase shift trip, when switching elements are taken into the System A measurement lines because System A voltage sensing lines are switched nearby the genset control.

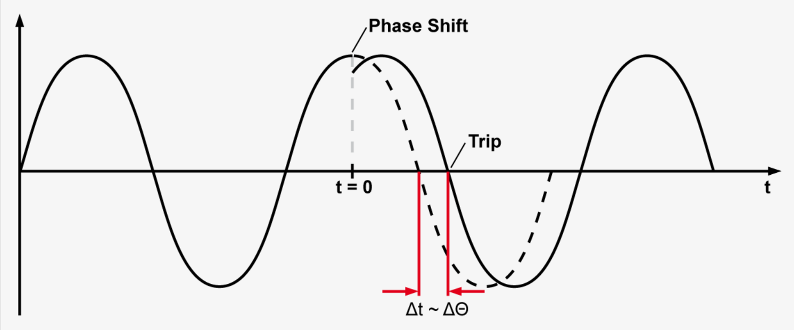


Fig. 127: Phase shift

A vector/phase shift as shown in ⮱ Fig. 127 causes a premature or delayed zero passage. The determined cycle duration difference corresponds with the occurring phase shift angle.

The monitoring may be carried out three-phased or one/three-phased. Different limits may be configured for one-phase and three-phase monitoring. The vector/phase shift monitor can also be used as an additional method to decouple from the System A. Vector/ phase shift monitoring is only enabled after the monitored voltage exceeds 50% of the PT secondary rated voltage.

Function "Voltage cycle duration not within the permissible range"

The voltage cycle duration exceeds the configured limit value for the phase/vector shift. The result is, that the power circuit breaker that disconnects from the System A, is opened, the message "System A phase shift" is displayed, and the logical command variable "07.14" is enabled.

df/dt (ROCOF)

df/dt (rate of change of frequency) monitoring measures the stability of the frequency. The frequency of a source will vary due to changing loads and other effects. The rate of these frequency changes due to the load variances is relatively high compared to those of a large network.

Function "Rate of change of frequency not within permissible limits"

The control unit calculates the unit of measure per unit of time. The df/dt is measured over 4 sine waves to ensure that it is differentiated from a phase shift. This results in a minimum response time of approximately 100 ms (at 50 Hz).

ID	Parameter	CL	Setting range [Default]	Description
3058	**Change of frequency**	2	Off	Monitoring is disabled.
			[Phase shift]	Phase shift monitoring is carried out according to the parameters described in ⮱ Fig. 127.
			df/dt	df/dt monitoring is carried out according to the parameters described in ⮱ “df/dt (ROCOF)”.
			Ph-shift,df/dt	Phase shift monitoring and df/dt monitoring is carried out. Tripping

ID	Parameter	CL	Setting range [Default]	Description
				occurs if phase shift **or** df/dt is triggered.
3053	**Phase shift: Monitoring**	2	**[1- and 3-phase]**	During single-phase voltage phase/vector shift monitoring, tripping occurs if the phase/vector shift exceeds the configured threshold value (parameter ⮱▷ 3054) in at least one of the three phases.
			3-phase	During three-phase voltage phase/ vector shift monitoring, tripping occurs only if the phase/vector shift exceeds the specified threshold value (parameter ⮱▷ 3055) in all three phases within 2 cycles.
				Notes If a phase/vector shift occurs in one or two phases, the single-phase threshold value (parameter ⮱▷ 3054) is taken into consideration; if a phase/ vector shift occurs in all three phases, the three-phase threshold value (parameter ⮱▷ 3055) is taken into consideration. Single phase monitoring is very sensitive and may lead to nuisance tripping if the selected phase angle settings are too small. 3 phase System A phase shift monitoring is only enabled if System A voltage measuring (parameter ⮱▷ 1853) is configured to "3Ph 4W" or "3Ph 3W".
3054	**Phase shift: Limit 1-phase**	2	3 to 30° **[20°]**	If the electrical angle of the System A voltage shifts more than this configured value in any single phase, an alarm with the class configured in parameter ⮱▷ 3051 is initiated. Depending on the configured System A decoupling procedure (parameter ⮱▷ 3110), the CBA, CBB, or an external CB will be opened.
3055	**Phase shift: Limit 3-phase**	2	3 to 30° **[8°]**	If the electrical angle of the System A voltage shifts more than this configured value in all three phases, an alarm with the class configured in parameter ⮱▷ 3051 is initiated. Depending on the configured System A decoupling procedure (parameter ⮱▷ 3110), the CBA, CBB, or an external CB will be opened.
3051	**Phase shift: Alarm class**	2	Class A/B/C/D/E/F, Control	Each limit may be assigned an independent alarm class that

ID	Parameter	CL	Setting range [Default]	Description
			[B]	specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ⮡ "9.6.4 Alarm Classes".
3052	**Phase shift: Self acknowledge**	2	**[Yes]**	The control automatically clears the alarm if the fault condition is no longer detected.
			No	The control does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
3056	**Phase shift: Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮡ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	Defining of an own release flag through LogicsManager equations.
			FRT ROCOF enable	The dynamic System A stabilization according to VDE-AR-N 4110/4105 requires a temporary blocking of the ROCOF monitor. Please refer to the according VDE-AR-N rule.
3104	**df/dt: Limit**	2	0.1 to 9.9 Hz/s **[2.6 Hz/s]** (Hysteresis: 0.1 Hz/s) (Reset Delay: 80 ms)	The df/dt threshold is defined here. If this value is reached or exceeded for at least the delay time without interruption, an alarm with the class configured in parameter ⮡ 3101 is initiated. Depending on the configured System A decoupling procedure (parameter ⮡ 3110), the CBA, CBB, or an external CB will be opened.
3105	**df/dt: Delay**	2	0.10 to 2.00 s **[0.10 s]**	If the monitored rate of df/dt exceeds the threshold value for the delay time configured here, an alarm will be issued. If the monitored df/dt exceeds the threshold (plus the hysteresis) again before the delay expires the time will be reset.

ID	Parameter	CL	Setting range [Default]	Description
3101	**df/dt: Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ⮡ "9.6.4 Alarm Classes".
3102	**df/dt: Self acknowledge**	2	Yes	The control automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
3103	**df/dt: Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮡ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	Defining of an own release flag through LogicsManager equations.
			FRT ROCOF enable	The dynamic System A stabilization according to VDE-AR-N 4110/4105 requires a temporary blocking of the ROCOF monitor. Please refer to the according VDE-AR-N rule.

4.5.1.5 System A Overfrequency (Level 1 & 2) ANSI# 81O

General notes

There are two overfrequency alarm levels available in the control.

> If this protective function is triggered, the display indicates "System A overfreq. 1" or "System A overfreq. 2" and the logical command variable "07.06" or "07.07" will be enabled.

Refer to ⮡ Fig. 211 for the triggering characteristic of this monitoring function.

Both alarms are definite time alarms and are illustrated in the figure. The figure diagrams a frequency trend and the associated pickup times and length of the alarms. Monitoring of the frequency is accomplished in two steps.

ID	Parameter	CL	Setting range [Default]	Description
2850 2856	**Monitoring**	2	**[On]**	Overfrequency monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: limit 1 < Level 2 limit).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
2854 2860	**Limit**	2	100.0 to 140.0% 2854: **[100.4%]** 2860: **[102.0%]** (Reset Delay: 80 ms)	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or exceeded for at least the delay time without interruption, the action specified by the alarm class is initiated.
				Notes This value refers to the System rated frequency (parameter ⮡ 1750).
2855 2861	**Delay**	2	0.00 to 99.99 s 2855: **[1.50 s]** 2861: **[0.06 s]**	If the monitored System A frequency value exceeds the threshold value for the delay time configured here, an alarm will be issued.
				Notes If the monitored System A frequency falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.
2851 2857	**Alarm class**	2	Class A/B/C/D/E/F, Control 2851: **[A]** 2857: **[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 ⮡ "9.6.4 Alarm Classes"
2852 2858	**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

ID	Parameter	CL	Setting range [Default]	Description
				activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
2853 2859	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮡ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.1.6 System A Underfrequency (Level 1 & 2) ANSI# 81U

General notes

There are two underfrequency alarm levels available in the control.

If this protective function is triggered, the display indicates "System A underfreq. 1" or "System A underfreq. 2" and the logical command variable "07.08" or "07.09" will be enabled.

Refer to ⮡ Fig. 212 for the triggering characteristic of this monitoring function.

Both alarms are definite time alarms and are illustrated in the figure. The figure diagrams a frequency trend and the associated pickup times and length of the alarms. Monitoring of the frequency is performed in two steps.

ID	Parameter	CL	Setting range [Default]	Description
2900 2906	**Monitoring**	2	**[On]**	Underfrequency monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: Level 1 > Level 2).
			Off	Monitoring is disabled for limit 1 and/or Level 2 limit.
2904 2910	**Limit**	2	66.7 to 140.0% 2904: **[99.6%]**	The percentage values that are to be monitored for each threshold limit are defined here.

ID	Parameter	CL	Setting range [Default]	Description
			2910: **[98.0%]** (Reset Delay: 80 ms)	If this value is reached or fallen below for at least the delay time without interruption, the action specified by the alarm class is initiated.
				Notes This value refers to the System rated frequency (parameter ⮱▷ 1750).
2905 2911	**Delay**	2	0.00 to 99.99 s 2905: **[1.50 s]** 2911: **[0.06 s]**	If the monitored System A frequency value falls below the threshold value for the delay time configured here, an alarm will be issued.
				Notes If the monitored System A frequency exceeds the threshold (plus the hysteresis) again before the delay expires the time will be reset.
2901 2907	**Alarm class**	2	Class A/B/C/D/E/F, Control 2901: **[A]** 2907: **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ⮱▷ "9.6.4 Alarm Classes"
2902 2908	**Self acknowledge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
2903 2909	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮱▷ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:**

ID	Parameter	CL	Setting range [Default]	Description
				96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.1.7 System A Overvoltage (Level 1 & 2) ANSI# 59

General notes

There are two overvoltage alarm levels available in the control. Voltage is monitored depending on parameter "System A voltage measuring" (parameter ⮡ 1851).

If this protective function is triggered, the display indicates "System A overvoltage 1" or "System A overvoltage 2" and the logical command variable "07.10" or "07.11" will be enabled.

Refer to ⮡ Fig. 211 for the triggering characteristic of this monitoring function.

Both alarms are definite time alarms and are illustrated in the figure. The figure diagrams a frequency trend and the associated pickup times and length of the alarms. Monitoring of the voltage is done in two steps.

The System A overvoltage Level 2 limit configuration parameters are located below the System A decoupling function menu on the display.

ID	Parameter	CL	Setting range [Default]	Description
2950 2956	**Monitoring**	2	**[On]**	Overvoltage monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: limit 1 < Level 2 limit).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
2954 2960	**Limit**	2	50.0 to 150.0% 2954: **[108.0%]** 2960: **[110.0%]** (Reset Delay: 80 ms)	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or exceeded for at least the delay time without interruption, the action specified by the alarm class is initiated.
				Notes This value refers to the System A rated voltage (parameter ⮡ 1766).
2955	**Delay**	2	0.00 to 999.00 s	If the monitored System A voltage exceeds the threshold value for

ID	Parameter	CL	Setting range [Default]	Description
2961			2955: **[1.50 s]** 2961: **[0.06 s]**	the delay time configured here, an alarm will be issued.
				Notes If the monitored System A voltage falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.
2951 2957	**Alarm class**	2	Class A/B/C/D/E/F, Control 2951: **[A]** 2957: **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ⮡ "9.6.4 Alarm Classes"
2952 2958	**Self acknowledge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
2953 2959	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮡ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.1.8 System A Undervoltage (Level 1 & 2) ANSI# 27

General notes

There are two undervoltage alarm levels available in the control. Voltage is monitored depending on parameter "System A voltage measuring" (parameter ⮡ 1851).

If this protective function is triggered, the display indicates "System A undervoltage 1" or "System A undervoltage 2" and the logical command variable "07.12" or "07.13" will be enabled.

Refer ⮡ Fig. 212 for the triggering characteristic of this monitoring function.

Both alarms are definite time alarms and are illustrated in the figure. The figure diagrams a frequency trend and the associated pickup times and length of the alarms. Monitoring of the voltage is done in two steps.

ID	Parameter	CL	Setting range [Default]	Description
3000 3006	**Monitoring**	2	**[On]**	Undervoltage monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: Level 1 limit < Level 2 limit).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
3004 3010	**Limit**	2	10.0 to 150.0% 3004: **[92.0%]** 3010: **[90.0%]** (Reset Delay: 80 ms)	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or exceeded for at least the delay time without interruption, the action specified by the alarm class is initiated.
				Notes This value refers to the "System A rated voltage" (parameter ⮡ 1766). Minimum value follows BDEW requirement.
3005 3011	**Delay**	2	0.00 to 99.99 s 3005: **[1.50 s]** 3011: **[0.06 s]**	If the monitored System A voltage falls below the threshold value for the delay time configured here, an alarm will be issued.
				Notes If the monitored System A voltage exceeds the threshold (plus the hysteresis) again before the delay expires the time will be reset.
3001 3007	**Alarm class**	2	Class A/B/C/D/E/F, Control 3001: **[A]** 3007: **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ⮡ "9.6.4 Alarm Classes"

ID	Parameter	CL	Setting range [Default]	Description
3002 3008	**Self acknowledge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
3003 3009	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮱ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.1.9 System A Voltage Asymmetry

General notes

Voltage asymmetry is determined by calculating the negative sequence component of a three-phase system. This value is derived from the three delta voltages (phase-phase) and considers the voltage phase rotation.

The protective function is triggered if the negative sequence value exceeds a configured permissible limit refers to the System A rated voltage.

> If this protective function is triggered, the display indicates "SyA. volt. asymmetry" and the logical command variable "07.26" will be enabled.

Refer to ⮱ Fig. 213 for the triggering characteristic of this monitoring function.

> This monitoring function is only enabled if system A voltage measuring (parameter ⮱ 1851) is configured to "3Ph 4W" or "3Ph 3W".

ID	Parameter	CL	Setting range [Default]	Description
3921	**Monitoring**	2	**[On]**	Voltage asymmetry monitoring is carried out according to the following parameters.
			Off	No monitoring is carried out.
3924	**Limit**	2	1.0 to 99.9 % **[10.0 %]**	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or exceeded for at least the delay time without interruption, the action specified by the alarm class is initiated.
				Notes This value refers to the 'System A rated voltage' (parameter ⮡ 1766).
3925	**Delay**	2	0.02 to 99.99 s **[5.00 s]**	If the monitored voltage asymmetry exceeds the threshold value for the delay time configured here, an alarm will be issued.
				Notes If the monitored voltage asymmetry falls below the threshold (minus the hysteresis) before the delay expires the time will be reset
3922	**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 ⮡ "9.6.4 Alarm Classes"
3923	**Self acknowledge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgement" (via a discrete input or via an interface).
3926	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined

ID	Parameter	CL	Setting range [Default]	Description
				through the LogicsManager equation "12959 Lock Monitoring" ⮑ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.1.10 System A Voltage Increase

General notes

Voltage is monitored depending on parameter "Monitoring" (parameter ⮑ 8806). This function allows the monitoring of the voltage quality over a longer time period. It is realized as a 10 minute moving average[1]. The function is only active, if System A is within the operating range. If "System A voltage measuring" (parameter ⮑ 1851) is configured to a three-phase measurement, the slow voltage increase alarm is monitoring the individual three-phase voltages of the System A according to parameter “AND characteristics” (parameter ⮑ 8849). The parameter "System A decoupling volt. incr." (parameter ⮑ 8808) determines if a voltage increase shall trigger a System A decoupling or not.

If this protective function is triggered, the display indicates "System A volt. increase". The alarm can be incorporated into the System A decoupling function.

The average is set to "System A rated voltage" (parameter ⮑ 1766) if:

- Frequency is not in the operating range OR
- Monitoring (parameter ⮑ 8806) is "Off" OR
- Monitoring is "Disabled" (parameter ⮑ 8833) OR
- Monitoring is tripped AND the measured voltage is again in the operating range

Back synchronization is only possible, if:

- The 10 minute average value is smaller than the defined limit AND
- The actual measured value is inside the operating range AND
- The System A settling time is over

Please be aware that if "System A voltage monitoring" (parameter ⮑ 1771) is configured to "All" and the System A voltage increase monitoring (parameter ⮑ 8806) is used, that this function only monitors "Phase - neutral".

ID	Parameter	CL	Setting range [Default]	Description
8806	**Monitoring**	2	On	Voltage increase monitoring is carried out according to the following parameters.
			[Off]	No monitoring is carried out.
8807	**Limit**	2	100 to 150% **[110%]**	The percentage voltage value that is to be monitored is defined here. If the average voltage over 10 minutes is higher, the action specified by the alarm class is initiated.
				Notes This value refers to the "System A rated voltage" (parameter ⮩ 1766).
8849	**AND characteristics**	2	On	If the 10 minute voltage averages of **all** phases exceed the limit, the monitoring is tripping.
			[Off]	If the 10 minute voltage average of **at least one** phase exceeds the limit, the monitoring is tripping.
8831	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ⮩ "9.6.4 Alarm Classes"
8832	**Self acknowledge**	4	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
8833	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮩ 12959.
			For xx = 1 to 32: 96.{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE.

ID	Parameter	CL	Setting range [Default]	Description
			LM: Flag{xx}	**Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32
8850	**Volt.incr.average**	0	—	This visualization value shows the current 10 minute average voltage.

4.5.1.11 System A Time-Dependent Voltage

General notes

> ***Three Time Dependent System A Voltage Monitors Available***
>
> The three monitors behave similar but each with a separate Fault-Ride-Through (FRT) curve.

Example of a Time Dependent System A Voltage Curve

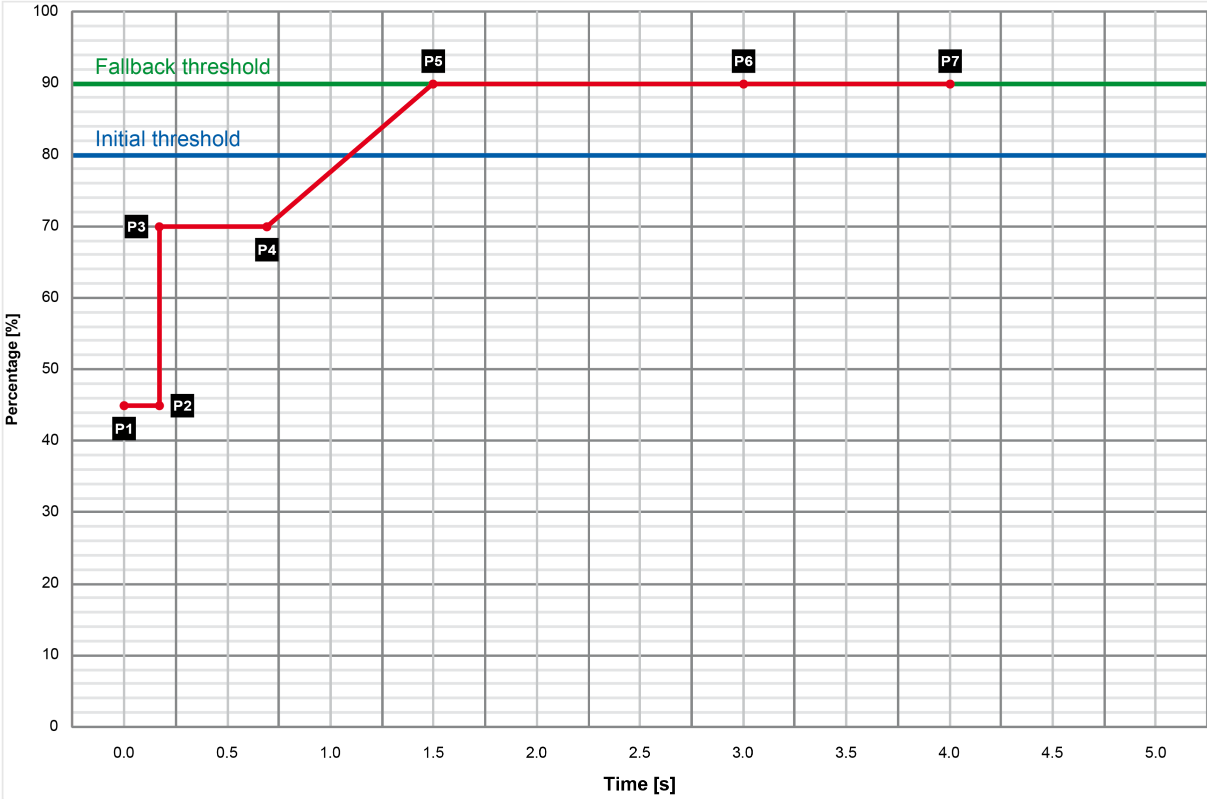


Fig. 128: Time-dependent voltage monitoring curve

P1	0.00 s → 45.0%
P2	0.15 s → 45.0%
P3	0.15 s → 70.0%
P4	0.70 s → 70.0%
P5	1.50 s → 90.0%
P6	3.00 s → 90.0%
P7	4.00 s → 90.0%
Fallback threshold	90.0%
Initial threshold	80.0%
Fallback time	1.00 s

General settings for System A decoupling and Monitoring Voltage 1 - 3

Find parameters ...

Find parameters in two menus:

- [Configuration / Configure monitoring / System A / System A decoupling / General System A decoupling]
- [Configuration / Configure monitoring / System A / Frequency / Voltage / Time-dependent voltage]

ID	Parameter	CL	Setting range [Default]	Description
4951	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ⮱ "9.6.4 Alarm Classes"
4959	**Self acknowledge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
4999	**Monitoring enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮱ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.1.11.1 Time Dependent System A Voltage Monitor 1

This monitoring function is supporting a dynamic stabilization of System A. To maintain the VDE-AR-N 4105 and VDE-AR-N 4110 grid code (2019) up to 3 FRT (Fault-Ride-Through) curves can be defined.

The voltage is monitored depending on parameter "System A voltage measuring" (parameter ⮱ 1851).

Furthermore it can be configured either as undervoltage or overvoltage monitoring (»underrun« or »overrun« selected with parameter "Monitoring at ⮱ 4953). If the measured voltage of at least N phase (N is defined with parameter 4960) falls below/ exceeds the configured "Initial threshold" (parameter ⮱ 4970), the time-dependent voltage monitoring sequence starts and the voltage threshold will change in time according to the configured threshold curve points (see ⮱ Fig. 128).

If the measured voltage falls below/exceeds this curve, the monitoring function triggers and LogicsManager 07.28 becomes TRUE. The System A decoupling function is incorporated, if configured. If the measured voltage falls below/exceeds the configured "Fallback threshold" (parameter ↳ 4978) for at least the configured "Fallback time" (parameter ↳ 4968), the time-dependent voltage monitoring sequence will be reset.

The threshold curve results from seven configurable points and a linear interpolation between these points. ↳ Fig. 128 shows an example of a Low-Voltage-Ride-Through (LVRT) curve for time-dependent voltage monitoring. The curve is configured by default according to a typical grid code requirement.

Rules for configuration

The time points should always have an ascending order. The fallback threshold (parameter ↳ 4978) should always be configured to a value higher/lower than the initial threshold (parameter ↳ 4970).

The monitoring on undervoltage over the undervoltage curve (or overvoltage or overvoltage curve) is always active, if the »Monitoring« (parameter ↳ 4950) is enabled. A System A decoupling is only executed, if the generator runs parallel to System A.

The monitor behaves according to the configured »Characteristic« (parameter ↳ 4960).

- "3-phase": all 3 phases are taken into account. Only if **all** phases are below/above the configurable curve, the monitor will trip.
- "2-phase": the two lowest/highest phases are taken into account. Even if only two phases run below/above the configurable curve, the monitor will trip.
- "1-phase": the single phases are taken into account. Even if only one phase runs below/above the configurable curve, the monitor will trip.

The monitoring starts with passing the initial threshold. The tripping time is determined by the voltage deviation and its according curve location. The monitoring is disabled, if the voltage value (values) have crossed the fallback threshold. The monitor trips the LogicsManager 07.28 command variable 10877.

For additional information refer to ↳ “9.4.2 Logical Command Variables”

FRT Monitoring Characteristic

The monitoring type influences the FRT:

Parameter "System A voltage monitoring" ↳ 1771 determines, if the Ph-Ph, Ph-N, or all measurements are used.

If type "**All**" is available and configured, and **3Ph4W** is configured, "Time dependent Voltage Monitoring" is calculated with phase-phase and phase-neutral voltages. If **All and 1Ph3W** is configured, only Ph-N values are used.

The System A time-dependent monitoring works with configurable FRT characteristics. In conjunction with System A voltage measuring (Parameter ↳ 1851) and System A voltage monitoring (see section before) different monitoring procedures take place.

Bloking ROCOF Monitor During Dynamic System A Stabilization

Due the higher prioritization of the Dynamic System A Stabilization (FRT) as the ROCOF monitor, the ROCOF monitor must be disabled for longest 5 seconds when any FRT curve was initiated. Therefore each FRT (=Time-dependent voltage monitoring) function provides a flag. The flag is set, if the particular initiation threshold is passed. The flag is reset if all monitored voltages are back in band (parameter ↳ 4978).

The 3 flags are OR'ed and results in one "FRT initiated" flag. This flag will be kept TRUE for maximal 5 seconds. Finally this ROCOF blocking flag will be inverted and entered as LM Command Variable "07.34 FRT ROCOF enable".

Time-dep. voltage 1

ID	Parameter	CL	Setting range [Default]	Description
4950	**Monitoring**	2	On	Time-dependent voltage monitoring is carried out according to the following parameters.
			[Off]	No monitoring is carried out.
4960	**Characteristic**	2		The System A time-dependent monitoring works with different characteristics.
			[1-phase]	Uses the lowest/highest phase for triggering the alarm. If "1771 System A voltage monitoring" ⮱▷ 1771 is configured to "All", the alarm will be triggered if at least one phase L-L or at least one phases L-N is out of range and will be reset if all phases of L-L and all phases of L-N are in range.
			2-phase	Uses the two lowest/highest phases for triggering the alarm. If "1771 System A voltage monitoring" ⮱▷ 1771 is configured to "All", the alarm will be triggered if at least two phases L-L or at least two phases L-N are out of range and will be reset if at least two phases of L-L and at least two phases of L-N are in range.
			3-phase	Uses all three phases (symmetric condition) for triggering the alarm. If "1771 System A voltage monitoring" ⮱▷ 1771 is configured to "All", the alarm will be triggered if all phases L-L or all phases L-N are out of range and will be reset if at least one phase of L-L and at least one phase of L-N is in range.
4953	**Monitoring at**	2		Selects whether the system shall do over- or undervoltage monitoring.
			[Underrun]	The undervoltage monitoring is carried out (The monitoring function triggers if the measured voltage is below the curve).
			Overrun	The overvoltage monitoring is carried out (The monitoring function triggers if the measured voltage exceeds the curve).
4970	**Init threshold**	2	0.0 to 150.0% **[80.0%]**	The time-dependent voltage monitoring initial threshold is configured here. If the measured voltage falls below/exceeds this threshold, the monitoring

ID	Parameter	CL	Setting range [Default]	Description
				sequence starts and the voltage threshold will change in time according to the configured threshold curve points. If the measured voltage falls below/exceeds this curve, the monitoring function triggers and the configured relay will energize.
4978	**Fallback threshold**	2	0.0 to 150.0% **[90.0%]**	The time-dependent voltage monitoring fallback voltage is configured here. If the measured voltage falls below/exceeds the voltage configured here for at least the configured "Fallback time", the monitoring sequence will be reset.
				Notes This parameter should always be configured to a value higher/lower than the "Init threshold" (parameter ⮱▷ 4970) for proper operation. The parameter "Point 7 voltage" (parameter ⮱▷ 4977) is used as fallback threshold if it is configured to a value higher/lower than the parameter "Fallback threshold" (parameter ⮱▷ 4978).
4968	**Fallback time**	2	0.00 to 320.00 s **[1.00 s]**	The time-dependent voltage monitoring fallback time is configured here. If the measured voltage falls below/exceeds the configured "Fallback threshold" (parameter ⮱▷ 4978) for at least the time configured here, the monitoring sequence will be reset.
4971 4972 4973 4974 4975 4976 4977	**Point {x} voltage** [x = 1 to 7]	2	0.0 to 150.0% 4971: **[45.0%]** 4972: **[45.0%]** 4973: **[70.0%]** 4974: **[70.0%]** 4975: **[90.0%]** 4976: **[90.0%]** 4977: **[90.0%]**	The voltage values of time-dependent voltage monitoring voltage points are configured here.
				Notes Please avoid a setting between 0.1% and 5.0%.
4961 4962 4963	**Point {x} time** [x = 1 to 7]	2	0.00 to 320.00 s 4961: **[0.00 s]** 4962: **[0.15 s]**	The time values of time-dependent voltage monitoring time points are configured here.

ID	Parameter	CL	Setting range [Default]	Description
4964 4965 4966 4967			4963: **[0.15 s]** 4964: **[0.70 s]** 4965: **[1.50 s]** 4966: **[3.00 s]** 4967: **[4.00 s]**	

4.5.1.11.2 Time Dependent System A Voltage Monitor 2

The Time dependent voltage monitoring 2 is an additional independent FRT monitoring, which behaves like the Time dependent voltage monitoring 1 described in the previous chapter.

It serves a LogicsManager 07.31 command variable "Time-dep. voltage 2" 11750 to trip a relay or to incorporate the monitoring into the System A decoupling feature of the device.

The alarm class and the self-acknowledge feature is taken from the original time dependent voltage monitoring (see ⮡ "General settings for System A decoupling and Monitoring Voltage 1 - 3".

Time-dep. voltage 2

ID	Parameter	CL	Setting range [Default]	Description
4954	**Monitoring**	2	On	Time-dependent voltage 2 monitoring is carried out according to the following parameters.
			[Off]	No monitoring is carried out.
				Notes. It is an additional independent FRT monitoring. It serves a LogicsManager command variable to trip a relay or to incorporate the monitoring into the System A decoupling function of the device. The alarm class ⮡ 4951 and the self-acknowledge ⮡ 4959 setting is shared with the other time dependent voltage monitoring.
4969	**Characteristic**	2		The System A time-dependent monitoring works with different characteristics.
			[1-phase]	Uses the lowest/highest phase for triggering the alarm. If "1771 System A voltage monitoring" ⮡ 1771 is configured to "All", the alarm will be triggered if at least one phase L-L or at least one phases L-N is out of range and will be reset if all phases of L-L and all phases of L-N are in range.
			2-phase	Uses the two lowest/highest phases for triggering the alarm. If

ID	Parameter	CL	Setting range [Default]	Description
				"1771 System A voltage monitoring" ⮱▷ 1771 is configured to “All”, the alarm will be triggered if at least two phases L-L or at least two phases L-N are out of range and will be reset if at least two phases of L-L and at least two phases of L-N are in range.
			3-phase	Uses all three phases (symmetric condition) for triggering the alarm. If "1771 System A voltage monitoring" ⮱▷ 1771 is configured to “All”, the alarm will be triggered if all phases L-L or all phases L-N are out of range and will be reset if at least one phase of L-L and at least one phase of L-N is in range.
4957	**Monitoring at**	2		Selects whether the system shall do over- or undervoltage monitoring.
			[Underrun]	The undervoltage monitoring is carried out (The monitoring function triggers if the measured voltage is below the curve).
			Overrun	The overvoltage monitoring is carried out (The monitoring function triggers if the measured voltage exceeds the curve).
4990	**Init threshold**	2	0.0 to 200.0% **[80.0%]**	The time-dependent voltage 2 monitoring initial threshold is configured here. If the measured voltage falls below/exceeds this threshold, the monitoring sequence starts and the voltage threshold will change in time according to the configured threshold curve points. If the measured voltage 2 falls below/exceeds this curve, the monitoring function triggers and the configured relay will energize.
4998	**Fallback threshold**	2	0.0 to 200.0% **[90.0%]**	The time-dependent voltage 2 monitoring fallback voltage is configured here. If the measured voltage falls below/exceeds the voltage configured here for at least the configured "Fallback time" (parameter ⮱▷ 4988), the monitoring sequence will be reset.
				Notes This parameter should always be configured to a value higher/lower than the "Init threshold" (parameter ⮱▷ 4990) for proper operation. The parameter "Point 7 voltage" (parameter ⮱▷ 4997) is used as fallback threshold if it is configured to a value higher/lower

ID	Parameter	CL	Setting range [Default]	Description
				than the parameter "Fallback threshold" (parameter ⮱▷ 4998).
4988	**Fallback time**	2	0.00 to 320.00 s **[1.00 s]**	The time-dependent voltage 2 monitoring fallback time is configured here. If the measured voltage falls below/exceeds the configured "Fallback threshold" (parameter ⮱▷ 4998) for at least the time configured here, the monitoring sequence will be reset.
4991 4992 4993 4994 4995 4996 4997	**Point {x} voltage (2)** [x = 1 to 7]	2	0.0 to 200.0% 4991: **[10.0%]** 4992: **[10.0%]** 4993: **[90.0%]** 4994: **[90.0%]** 4995: **[90.0%]** 4996: **[90.0%]** 4997: **[90.0%]**	The voltage values of time-dependent voltage 2 monitoring voltage points are configured here.
				Notes Please avoid a setting between 0.1% and 5.0%.
4981 4982 4983 4984 4985 4986 4987	**Point {x} time** [x = 1 to 7]	2	0.00 to 320.00 s 4981: **[0.00 s]** 4982: **[0.15 s]** 4983: **[1.50 s]** 4984: **[10.00 s]** 4985: **[20.00 s]** 4986: **[30.00 s]** 4987: **[40.00 s]**	The time values of time-dependent voltage 2 monitoring time points are configured here.

4.5.1.11.3 Time Dependent System A Voltage Monitor 3

The Time dependent voltage monitoring 3 is an additional independent FRT monitoring, which behaves like the Time dependent voltage monitoring 1 described in the previous chapter.

It serves a LogicsManager 07.33 command variable "Time-dep. voltage 3" 11750 to trip a relay or to incorporate the monitoring into the System A decoupling feature of the device.

The alarm class and the self-acknowledge feature is taken from the original time dependent voltage monitoring (see ⮱▷ “General settings for System A decoupling and Monitoring Voltage 1 - 3”.

Time-dep. voltage 3

ID	Parameter	CL	Setting range [Default]	Description
9130	**Monitoring**	2	On	Time-dependent voltage 3 monitoring is carried out according to the following parameters.
			[Off]	No monitoring is carried out.
				Notes. It is an additional independent FRT monitoring. It serves a LogicsManager command variable to trip a relay or to incorporate the monitoring into the System A decoupling function of the device. The alarm class ⮱▷ 4951 and the self-acknowledge ⮱▷ 4959 setting is shared with the other time dependent voltage monitoring.
4979	**Characteristic**	2		The System A time-dependent monitoring works with different characteristics.
			[1-phase]	Uses the lowest/highest phase for triggering the alarm. If "1771 System A voltage monitoring" ⮱▷ 1771 is configured to “All”, the alarm will be triggered if at least one phase L-L or at least one phases L-N is out of range and will be reset if all phases of L-L and all phases of L-N are in range.
			2-phase	Uses the two lowest/highest phases for triggering the alarm. If "1771 System A voltage monitoring" ⮱▷ 1771 is configured to “All”, the alarm will be triggered if at least two phases L-L or at least two phases L-N are out of range and will be reset if at least two phases of L-L and at least two phases of L-N are in range.
			3-phase	Uses all three phases (symmetric condition) for triggering the alarm. If "1771 System A voltage monitoring" ⮱▷ 1771 is configured to “All”, the alarm will be triggered if all phases L-L or all phases L-N are out of range and will be reset if at least one phase of L-L and at least one phase of L-N is in range.
9133	**Monitoring at**	2		Selects whether the system shall do over- or undervoltage monitoring.
			Underrun	The undervoltage monitoring is carried out (The monitoring function triggers if the measured voltage is below the curve).
			[Overrun]	The overvoltage monitoring is carried out (The monitoring

ID	Parameter	CL	Setting range [Default]	Description
				function triggers if the measured voltage exceeds the curve).
9148	**Init threshold**	2	0.0 to 200.0% **[115.0%]**	The time-dependent voltage monitoring initial threshold is configured here. If the measured voltage falls below/exceeds this threshold, the monitoring sequence starts and the voltage threshold will change in time according to the configured threshold curve points. If the measured voltage falls below/ exceeds this curve, the monitoring function triggers and the configured alarm / decoupling will be initiated.
9156	**Fallback threshold**	2	0.0 to 200.0% **[110.0%]**	The time-dependent voltage monitoring fallback voltage is configured here. If the measured voltage falls below/exceeds the voltage configured here for at least the configured "Fallback time" (parameter ⮱▷ 9147), the monitoring sequence will be reset.
				Notes This parameter should always be configured to a value higher/lower than the "Init threshold" (parameter ⮱▷ 9148) for proper operation. The parameter "Point 7 voltage" (parameter ⮱▷ 9155) is used as fallback threshold if it is configured to a value higher/lower than the parameter "Fallback threshold" (parameter ⮱▷ 9156).
9147	**Fallback time**	2	0.00 to 320.00 s **[1.00 s]**	The time-dependent voltage monitoring fallback time is configured here. If the measured voltage falls below/exceeds the configured "Fallback threshold" (parameter ⮱▷ 9156) for at least the time configured here, the monitoring sequence will be reset.
9149 9150 9151 9152 9153 9154 9155	**Point {x} voltage (2)** [x = 1 to 7]	2	0.0 to 150.0% 9149: **[125.0%]** 9150: **[125.0%]** 9151: **[120.0%]** 9152: **[120.0%]** 9153: **[115.0%]** 9154: **[115.0%]** 9155: **[110.0%]**	The voltage values of time-dependent voltage 3 monitoring voltage points are configured here.
				Notes

ID	Parameter	CL	Setting range [Default]	Description
				Avoid a setting between 0.1% and 5.0%.
9140 9141 9142 9143 9144 9145 9146	**Point {x} time** [x = 1 to 7]	2	0.00 to 320.00 s 9140: **[0.00 s]** 9141: **[0.10 s]** 9142: **[0.10 s]** 9143: **[5.00 s]** 9144: **[5.00 s]** 9145: **[60.00 s]** 9146: **[60.00 s]**	The time values of time-dependent voltage 3 monitoring time points are configured here.

4.5.1.11.4 Time dependent voltage monitoring – Decoupling Function

The 3 Time dependent voltage monitorings can be allocated to the System A decoupling function. With a configuration general all 3 FRT monitors are included.

Alarm flags (latched)

Time dependent voltage 1 (FRT1) is LM flag 07.28, ID10877

Time dependent voltage 2 (FRT2) is LM flag 07.31, ID11750

Time dependent voltage 3 (FRT3) is LM flag 07.33, ID11751

4.5.1.12 QV Monitoring

General notes

In case of mains undervoltage some grid codes require a special monitoring function to avoid the import of inductive reactive power at the mains interchange point. The monitoring function measures close to System A. For this reason the QV monitoring is a function of system A voltage and system A reactive power.

QV monitoring is triggered if the following conditions are fulfilled.

- QV monitoring is configured to "On" (parameter ⮡ 3292)
- Measured reactive power is higher than the configured “Reactive power threshold” (parameter ⮡ 3291)
- Measured voltages are below the configured “Limit undervoltage” (parameter ⮡ 3285)

As a result Timer 1 and Timer 2 are starting. If the delay time "Delay step 1" (parameter ⮡ 3283) has exceeded, LogicsManager 07.29 becomes TRUE and the corresponding alarm message "QV monitoring 1" is indicated. If the delay time "Delay step 2" (parameter ⮡ 3284) has exceeded, LogicsManager 07.30 becomes TRUE and the corresponding alarm message "QV monitoring 2" is indicated.

If parameter “System A decoupling by QV” (parameter ⮡ 3295) is configured to "On" the decoupling function is assigned to “Delay step 1” (parameter ⮡ 3283).

- The LogicsManager command flags 07.29 and 07.30 can be additionally used to cause other actions according to the corresponding regulations of the grid.
- The QV Monitoring function according the German grid code VDE-AR-N 4105 depends on parameter "1771 System A voltage monitoring" ⮡ 1771 "phase-phase/phase-neutral monitoring".

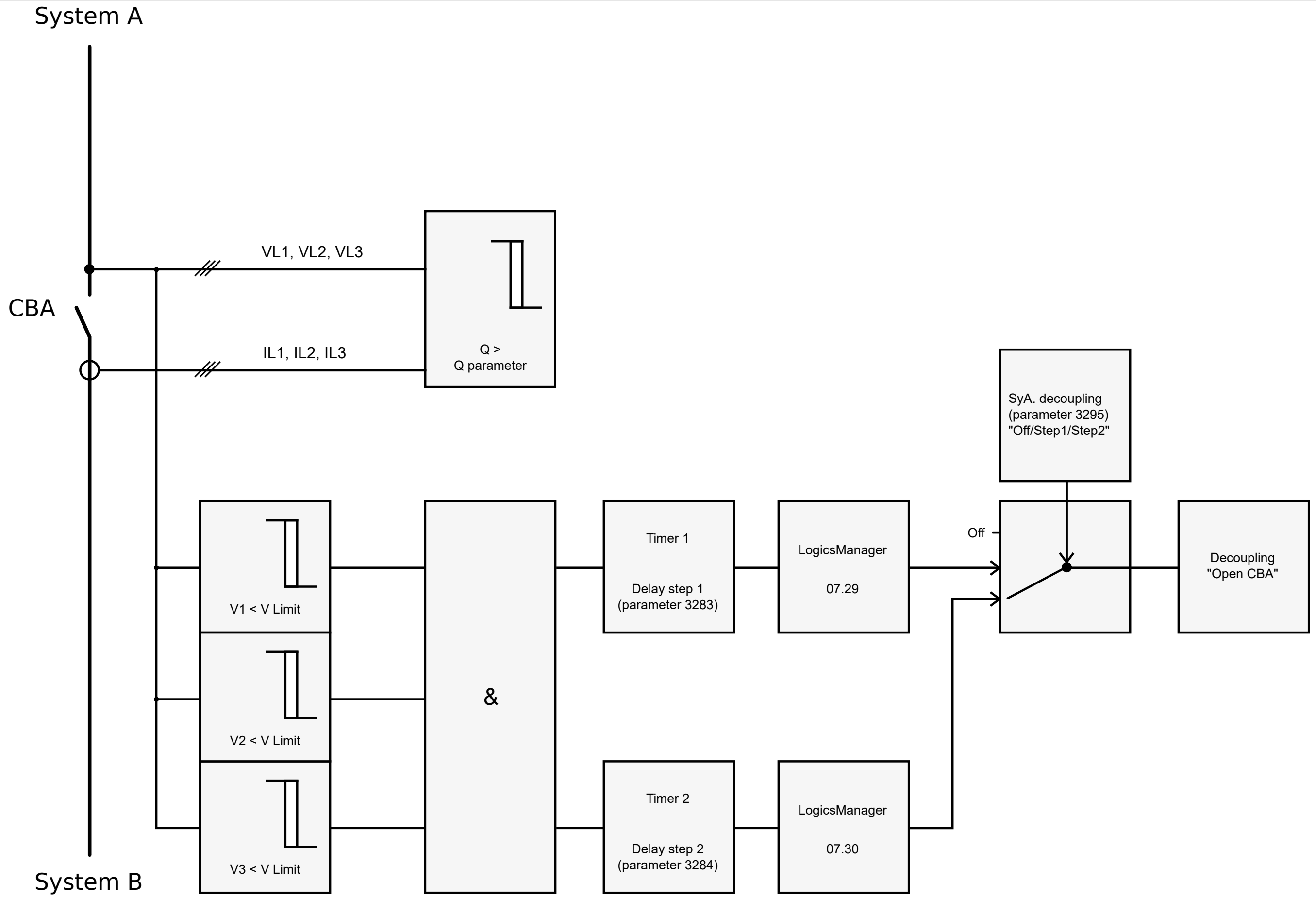


Fig. 129: QV monitoring - schematic

ID	Parameter	CL	Setting range [Default]	Description
3292	**Monitoring**	2	On	QV monitoring is carried out according to the following parameters.
			[Off]	No monitoring is carried out.
3285	**Limit undervoltage**	2	45 to 150% **[85%]**	The percentage voltage value that is to be monitored is defined here. If the voltages of all phases (one phase in 1Ph 2W system) are below this limit, the voltage

ID	Parameter	CL	Setting range [Default]	Description
				condition for tripping the monitoring function is TRUE.
				Notes This value refers to the "System A rated voltage" (parameter ⮡ 1766).
3291	**Reactive power threshold**	2	2 to 100% **[5%]**	The percentage reactive value that is to be monitored is defined here. If the absolute value of reactive power Q is higher than this threshold, the reactive power condition for tripping the monitoring function is TRUE.
				Notes This value refers to the "Syst.A rated react. power [kvar]" (parameter ⮡ 1758).
3283	**Delay step 1**	2	0.10 to 99.99 s **[0.50 s]**	If the QV monitoring conditions are met, for the delay time configured here, an alarm "QV monitoring 1" will be issued and LogicsManager 07.29 becomes TRUE.
				Notes The decoupling function is only activated if "System A decoupling by QV" (parameter ⮡ 3295) is configured to "On".
3284	**Delay step 2**	2	0.10 to 99.99 s **[1.50 s]**	If the QV monitoring conditions are met, for the delay time configured here, an alarm "QV monitoring 2" will be issued and LogicsManager 07.30 becomes TRUE.
3280	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	The alarm class specifies what action should be taken when at least one delay has been exceeded.
				Notes The alarm class is valid for parameter ⮡ 3283 and ⮡ 3284. For additional information refer to ⮡ "9.6.4 Alarm Classes"
3293	**Self acknowledge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected.

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).
				Notes The self acknowledge is valid for parameter ⮱ 3283 and ⮱ 3284.
3294	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮱ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.1.13 System A Voltage Phase Rotation

General notes

NOTICE!

Damage to the control unit and/or generation equipment

- Please ensure during installation that all voltages applied to this unit are wired correctly to both sides of the circuit breaker.

Failure to do so may result in damage to the control unit and/or generation equipment due to closing the breaker asynchronous or with mismatched phase rotations and phase rotation monitoring enabled at all connected components (engine, generator, breakers, cable, busbars, etc.).

This function will block a connection of systems with mismatched phases only under the following conditions:

- The voltages being measured are wired correctly with respect to the phase rotation at the measuring points (i.e. the voltage transformer in front and behind the circuit breaker)
- The measuring voltages are wired without angular phase shift or interruption from the measuring point to the control unit
- The measuring voltages are wired to the correct terminals of the control unit (i.e. L1 of the System A is connected with the terminal of the control unit which is intended for the L1 of the System A)
- The LogicsManager function "Enable close CBA" (refer to parameter 12945) is false in case of a incorrect rotation field
- Application mode **"CBA"**

  The configured alarm class is class C to class F (breaker relevant alarm)

- Application mode **"CBA/CBB"**

  The configured alarm class is class C or class D (breaker relevant alarm)

Correct phase rotation of the phase voltages ensures that damage will not occur during a breaker closure. 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 voltages into the unit are calculated as counterclockwise the alarm will be initiated. The direction of configured rotation being monitored by the control unit is displayed on the screen.

If this protective function is triggered, the display indicates "Sys.A ph.rot. mismatch" and the logical command variable "07.05" will be enabled.

This monitoring function is only enabled if System A voltage measuring (parameter ⮱▷ 1851) is configured to "3Ph 4W" or "3Ph 3W" and the measured voltage exceeds 50 % of the rated voltage (parameter ⮱▷ 1766) or if System A voltage measuring (parameter ⮱▷ 1851) is configured to "1Ph 2W" (in this case, the phase rotation is not evaluated, but defined by the 1Ph2W phase rotation (parameter ⮱▷ 1859)).

ID	Parameter	CL	Setting range [Default]	Description
3970	**Monitoring**	2	**[On]**	Phase rotation monitoring is carried out according to the following parameters.
			Off	No monitoring is carried out.
3974	**System A phase rotation**	2	**[CW]**	The three-phase measured System A voltage is rotating CW (clock-wise; that means the voltage rotates in L1-L2-L3 direction; standard setting).
			CCW	The three-phase measured System A voltage is rotating CCW (counter clock-wise; that means the voltage rotates in L1-L3-L2 direction).
3971	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ⮱▷ "9.6.4 Alarm Classes"
3972	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
3973	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮱▷ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:**

ID	Parameter	CL	Setting range [Default]	Description
				96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.2 System B

4.5.2.1 General System B Monitoring

ID	Parameter	CL	Setting range [Default]	Description
1770	**System B 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 will be monitored and all subsequent parameters concerning voltage monitoring "System B" are referred to this value (V_{L-L}).
			Phase - neutral	The phase-neutral voltage will be monitored and all subsequent parameters concerning voltage monitoring "System B" are referred to this value (V_{L-N}).
				Notes WARNING: This parameter defines how the protective functions operate.

4.5.2.2 System B Operating Ranges

The operating voltage/frequency parameters are used to check if the values are in range when performing a dead bus closure and synchronization of the System B.

ID	Parameter	CL	Setting range [Default]	Description
5800	**Upper voltage limit**	2	100 to 150% **[110%]** (Hysteresis: 1%)	The maximum permissible positive deviation of the System B voltage from the System B rated

ID	Parameter	CL	Setting range [Default]	Description
	(System B maximum operating voltage limit)			voltage (parameter ⮱▷ 1768) is configured here. This value may be used as a voltage limit switch. The conditional state of this switch may be used as a command variable for the LogicsManager (02.03).
5801	**Lower voltage limit** (System B minimum operating voltage limit)	2	50 to 100% **[90%]** (Hysteresis: 1%)	The maximum permissible negative deviation of the System B voltage from the System B rated voltage (parameter ⮱▷ 1768) is configured here. This value may be used as a voltage limit switch. The conditional state of this switch may be used as a command variable for the LogicsManager (02.03).
5802	**Upper frequency limit** (System B maximum operating frequency limit)	2	66.7 to 150.0% **[110.0%]** (Hysteresis: 0.05%)	The maximum permissible positive deviation of the System B frequency from the rated system frequency (parameter ⮱▷ 1750) is configured here. This value may be used as a frequency limit switch. The conditional state of this switch may be used as a command variable for the LogicsManager (02.04).
5803	**Lower frequency limit** (System B minimum operating frequency limit)	2	66.7 to 100.0% **[90.0%]** (Hysteresis: 0.05%)	The maximum permissible negative deviation of the System B frequency from the rated system frequency (parameter ⮱▷ 1750) is configured here. This value may be used as a frequency limit switch. The conditional state of this switch may be used as a command variable for the LogicsManager (02.04).

4.5.2.3 System B Voltage Phase Rotation

General notes

NOTICE!

Damage to the control unit and/or generation equipment

- Ensure that the control unit is properly connected to phase voltages on both sides of the circuit breaker(s) during installation.

Failure to do so may result in damage to the control unit and/or generation equipment due to the breaker closing asynchronously or with mismatched phase rotations. Also ensure that phase rotation monitoring is enabled at all connected components (engine, System B, 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 System B is connected with the terminal of the control unit which is intended for the System B L1 phase)
- The LogicsManager function "Enable close CBB" (refer to parameter ⮱▷ 12948) is false in case of a incorrect rotation field
- The configured alarm class is class E or class F (breaker relevant alarm)

Correct phase rotation of the phase voltages ensures that damage will not occur during a breaker closure to either the mains or the System B. 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.

If this protective function is triggered, the display indicates "Syst.B ph.rot. mismatch" and the logical command variable "06.21" will be enabled.

This monitoring function is only enabled if System B voltage measuring (parameter ⮱▷ 1853) is configured to "3Ph 4W" or "3Ph 3W" and the measured voltage exceeds 50 % of the rated voltage (parameter ⮱▷ 1768) or if System B voltage measuring (parameter ⮱▷ 1853) is configured to "1Ph 2W" (in this case, the phase rotation is not evaluated, but defined by the 1Ph2W phase rotation (parameter ⮱▷ 1859)).

ID	Parameter	CL	Setting range [Default]	Description
3950	**Monitoring**	2	**[On]**	Phase rotation monitoring is carried out according to the following parameters.
				Notes The phase rotation monitor is internally configured with a two seconds delay, so that the expected response time is less than three seconds.
			Off	No monitoring is carried out.
3954	**System B phase rotation**	2	**[CW]**	The three-phase measured System B voltage is rotating CW (clock-wise; that means the voltage rotates in L1-L2-L3 direction; standard setting).
			CCW	The three-phase measured System B voltage is rotating CCW (counter clock-wise; that means the voltage rotates in L1-L3-L2 direction).
3951	**Alarm class**	2	Class A/B/C/D/E/F, Control **[F]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ⮡ "9.6.4 Alarm Classes"
3952	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
3953	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮡ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:**

ID	Parameter	CL	Setting range [Default]	Description
				96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.3 Breaker

4.5.3.1 CBA

General notes

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

"Breaker 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 CBA alarm will be initiated (refer to parameter "CBA maximum attempts of closure", parameter ⮡ 3419).

If this protective function is triggered, the display indicates "CBA fail to close" and the logical command variable "08.07" will be enabled.

"Breaker open alarm"

If the control is attempting to open the circuit breaker and it fails to see that the CBA is open within the configured time in seconds after issuing the breaker open command then the monitoring CBA alarm will be initiated (refer to parameter "CBA open monitoring", parameter ⮡ 3421).

If this protective function is triggered, the display indicates "CBA fail to open" and the logical command variable "08.08" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
2620	**CBA monitoring**	2	**[On]**	Monitoring of the CBA is carried out according to the following parameters.
			Off	Monitoring is disabled.
2621	**CBA alarm class**	2	Class A/B/C/D/E/F **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ⮡ "9.6.4 Alarm Classes"

ID	Parameter	CL	Setting range [Default]	Description
3419	**CBA max.attempts of closure**	2	1 to 10 **[5]**	The maximum number of breaker closing attempts is configured in this parameter (relay output "Command: close CBA"). When the breaker reaches the configured number of attempts, a "CBA fail to close" alarm is issued. The counter for the closure attempts will be reset as soon as the "Reply CBA" is de-energized for at least 5 seconds to signal a closed CBA.
3421	**CBA open monitoring**	2	0.10 to 5.00 s **[2.00 s]**	If the "Reply CBA" is not detected as energized once this timer expires, a "CBA fail to open" alarm is issued. This timer initiates as soon as the "open breaker" sequence begins. The alarm configured in (parameter ⮡▷ 2621) is issued.
2622	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮡▷ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.3.2 Synchronization CBA

> For synchronization with two systems please see additionally ⮡▷ "9.7.1 Synchronization Of System A and System B".

ID	Parameter	CL	Setting range [Default]	Description
3070	**Monitoring**	2	**[On]**	Monitoring of the CBA synchronization is carried out according to the following parameters.
			Off	Monitoring is disabled.
3073	**Delay**	2	3 to 999 s	If it was not possible to synchronize the CBA within the

ID	Parameter	CL	Setting range [Default]	Description
			[60 s]	time configured here, an alarm will be issued. The message "CBA syn. timeout" is issued and the logical command variable "08.31" will be enabled.
3071	**Alarm class**	2	Class A/B/C/D/E/F/Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ⮡ "9.6.4 Alarm Classes"
3072	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgement" (via a discrete input or via an interface).
3075	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮡ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.3.3 CBA Unload Mismatch

ID	Parameter	CL	Setting range [Default]	Description
8819	**Unload trip level CBA**	2	0.5 to 99.9 % **[3.0 %]**	If the monitored power of system A falls below this value, a "CBA open" command will be issued.
				Notes

ID	Parameter	CL	Setting range **[Default]**	Description
				This value refers to the "System A rated active pwr.[kW]" (parameter ⮡ 1752).
8835	**Delay**	2	1 to 999 s **[30 s]**	If the monitored system A power does not fall below the limit configured in parameter ⮡ 8819 before the time configured here expires, a "CBA open" command will be issued together with an alarm "CBA unload mismatch" and the logical command variable "08.36" will be enabled.
8836	**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 ⮡ "9.6.4 Alarm Classes"
8837	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgement" (via a discrete input or via an interface).
8846	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮡ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.3.4 CBB

General notes

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

"Breaker 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 CBB alarm will be initiated (refer to parameter "CBB maximum attempts of closure", parameter ⮡ 3418).

If this protective function is triggered, the display indicates "CBB fail to close" and the logical command variable "08.05" will be enabled.

"Breaker open alarm"

If the control is attempting to open the circuit breaker and it fails to see that the CBB is open within the configured time in seconds after issuing the breaker open command then the monitoring CBB alarm will be initiated (refer to parameter "CBB open monitoring", parameter ⮡ 3420).

If this protective function is triggered, the display indicates "CBB fail to open" and the logical command variable "08.06" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
2600	**CBB monitoring**	2	**[On]**	Monitoring of the CBB is carried out according to the following parameters.
			Off	Monitoring is disabled.
2601	**CBB alarm class**	2	Class A/B/C/D/E/F **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ⮡ "9.6.4 Alarm Classes"
3418	**CBB max.attempts of closure**	2	1 to 10 **[5]**	The maximum number of breaker closing attempts is configured in this parameter (relay output "Command: close CBB"). When the breaker reaches the configured number of attempts, a "CBB fail to close" alarm is issued. The counter for the closure attempts will be reset as soon as the "Reply CBB" is de-energized for at least 5 seconds to signal a closed CBB.
3420	**CBB open monitoring**	2	0.10 to 5.00 s **[2.00 s]**	If the "Reply CBB" is not detected as energized once this timer expires, a "CBB fail to open" alarm is issued. This timer initiates as soon as the "open breaker" sequence begins. The alarm configured in (parameter ⮡ 2601) is issued.

ID	Parameter	CL	Setting range [Default]	Description
2602	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮡ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.3.5 Synchronization CBB

For synchronization with two systems please see additionally ⮡ "9.7.1 Synchronization Of System A and System B".

ID	Parameter	CL	Setting range [Default]	Description
3060	**Monitoring**	2	**[On]**	Monitoring of the CBB synchronization is carried out according to the following parameters.
			Off	Monitoring is disabled.
3063	**Delay**	2	3 to 999 s **[60 s]**	If it was not possible to synchronize the CBB within the time configured here, an alarm will be issued. The message "CBB syn. timeout" is issued and the logical command variable "08.30" will be enabled.
3061	**Alarm class**	2	Class A/B/C/D/E/F/Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ⮡ "9.6.4 Alarm Classes"
3062	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm

ID	Parameter	CL	Setting range [Default]	Description
				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 acknowledgement" (via a discrete input or via an interface).
3065	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮱▷ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.3.6 CBB Unload Mismatch

ID	Parameter	CL	Setting range [Default]	Description
3125	**Unload trip level CBB**	2	0.5 to 99.9 % **[3.0 %]**	If the monitored power flow of system B falls below this value, a "CBB open" command will be issued.
				Notes This value refers to the "SyB. rated active power" (parameter ⮱▷ 1748).
3123	**Delay**	2	1 to 999 s **[30 s]**	If the monitored system B power does not fall below the limit configured in (parameter ⮱▷ 3125) before the time configured here expires, a "CBB open" command will be issued together with an alarm "CBB unload mismatch" and the logical command variable "08.46" 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

ID	Parameter	CL	Setting range [Default]	Description
				For additional information refer to ⮡ "9.6.4 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 output "External acknowledgement" (via a discrete input or via an interface).
3126	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮡ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.3.7 System A / System B Phase Rotation

General notes

Correct phase rotation of the phase voltages ensures that damage will not occur during a breaker closure. The voltage phase rotation alarm checks, if the phase rotation of the measured voltage systems are identical.

If the control unit detects different phase rotations of system A and system B, the alarm will be initiated and a breaker synchronization is inhibited. However, this alarm will not prevent a dead busbar closure, i.e. a dead bus start.

> If this protective function is triggered, the display indicates "Ph.rotation mismatch" and the logical command variable "08.33" will be enabled.

This monitoring function is only enabled if system A voltage measuring (parameter ⮱ 1851) and system B voltage measuring (parameter ⮱ 1853) are configured to "3Ph 4W" or "3Ph 3W" and the measured voltage exceeds 50 % of the rated voltage (parameter ⮱ 1766) or if system A voltage measuring (parameter ⮱ 1851) and system B voltage measuring (parameter ⮱ 1853) are configured to "1Ph 2W". In this case, the phase rotation is not evaluated, but defined by the 1Ph2W phase rotation (parameter ⮱ 1859).

ID	Parameter	CL	Setting range [Default]	Description
2940	**Monitoring**	2	**[On]**	Phase rotation monitoring is carried out according to the following parameters
			Off	Monitoring is disabled.
2941	**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 ⮱ "9.6.4 Alarm Classes"
2942	**Self acknowledge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgement" (via a discrete input or via an interface).
2945	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮱ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.3.8 CB closed transition monitoring

General notes

> The close transition monitoring is **only** applicable for breaker mode **"CBA/CBB"** (parameter ⮡ 9018)

The breaker transition mode "Closed Transition" usually implies that the transition from System A to System B is maintained within 100ms. So during the close process the control has to recognize as fast as possible the moment when both breakers are closed and has to give out the according breaker open command.

The operator can enable this monitor that in situations in which both breakers remain closed for more than 100 milliseconds, the last closed breaker is re-opened and the re-synchronization is locked.

> The utility providers usually demand to be no longer parallel than 210ms in failure situations. The configurable response time must be selected so that under 100ms no trip occurs and the final opening is completed within longest 210ms.

> The close transition monitoring is activated, if the monitoring is enabled and the breaker transition mode "Close transition" is activated.

When the monitor trips it indicates a general alarm "CL transition fault" and blocks the re-synchronization. With acknowledge the alarm "CL transition fault" the synchronization will be released again. The tripped close transition fault is available as LM command variable "08.69 CL transition fault". The breaker which does not open is reported to the according breaker open monitoring if the breaker monitoring is enabled.

Transfer from CBA to CBB

When the CBB is synchronized and the CBA and CBB are closed, a timer is started. If the feedback of a successful CBA open signal does not come within the adjustable response time, the CBB will be opened immediately. The alarm "CL transition fault" is triggered and stays active as long as both breaker are closed. Additional if this fault happens and the CBA monitoring is enabled, the LS-6XT will indicate "CBA fail to open".

Transfer from CBB to CBA

When the CBA is synchronized and the CBA and CBB are closed, a timer is started. If the feedback of a successful CBB open signal does not come within the adjustable response time, the CBA will be opened immediately. The alarm "CL transition fault" is triggered and stays active as long as both breaker are closed. Additional if this fault happens and the CBB monitoring is enabled, the LS-6XT will indicate "CBB fail to open.

ID	Parameter	CL	Setting range [Default]	Description
3469	**CL trans. monitoring**	2	On	Closed transition monitoring is carried out according to the following parameter.
			[Off]	Monitoring is disabled.

ID	Parameter	CL	Setting range [Default]	Description
3470	**Response time**	2	0.05 to 9.99 s **[0.12 s]**	This is the maximal time both breakers are being allowed to be closed simultaneously.
				Notes The utility providers usually demand to be no longer parallel than 210ms. The configurable response time must be selected so that under 100ms no trip occurs and the final opening is completed within longest 210ms.

4.5.4 Flexible Limits

General notes

CAUTION!

Hazards due to improper configuration of protective functions

Flexible Limits must not be used for protective functions, because the monitoring function is not guaranteed beyond an exceeding of 320 %.

It is not possible to monitor temperature values in Degree Fahrenheit and pressure values in psi. Although parameters ⮡ 3630 or ⮡ 3631 are configured to a value display in °F or psi, flexible limit monitoring always refers to the value in Degree Celsius or bar.

This control unit offers 40 flexible limits. They may be used for "Limit Switch" functions of all measured analog values. It is possible to choose between alarm (warning and shutdown) and control operation via the LogicsManager.

If an alarm class is triggered, the display indicates "Flexible limit {x}", where {x} indicates the flexible limit 1 to 40, or the text configured using ToolKit and the logical command variable "15.{x}" will be enabled.

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

The 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)	A description for the respective flexible limit may be entered here.

ID	Parameter	CL	Setting range [Default]	Description
			[Flex. limit {x}]	The description is displayed instead of the default text if this limit is exceeded.
				Notes This parameter may only be configured using ToolKit. 19 characters are best for VNC or RP-3000XT readability - text strings with 20 and more characters but without a blank in between are NOT visible as headline on detail screen. Selection screen on VNC or RP-3000XT works fine with up to 30 characters; others are overwritten by mandatory screen symbols. The max. number of characters depends on the numbers of Bytes for each character. Please verify the length on the display for best view.
4200	**Monitoring**	2	On	Monitoring of the limit {x} is carried out according to the following parameters.
			[Off]	Monitoring is disabled.
4204	**Monitoring at**	2	**[Overrun]**	The monitored value must exceed the threshold limit for a fault to be recognized.
			Underrun	The monitored value must fall below the threshold limit for a fault to be recognized.
4205	**Limit**	2	-21000000.00 to 21000000.00 **[100.00]**	The threshold limit of the value to be monitored is defined by this parameter. If this value is reached or exceeded / fallen below (dependent on parameter ⮡ 4207) 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. If the monitored analog value has a reference value, the threshold is expressed as a percentage of this reference value (-320.00 % to 320.00 %). If an analog input is monitored, the threshold refers to the display value format (refer to ⮡ "9.5.3.11 Display Value Format").
				Notes

ID	Parameter	CL	Setting range [Default]	Description
				Refer to ⮑ "Examples" for examples on how to configure the limit.
4216	**Hysteresis**	2	0 to 21000000.00 **[1.00]**	During monitoring, the actual value must exceed or fall below one of the limits defined in parameter ⮑ 4205 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 ⮑ "9.6.4 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 output "External

ID	Parameter	CL	Setting range [Default]	Description
				acknowledgment" (via a discrete input or via an interface).
4203	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮡ 12959.
			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

Flexible limit #	Descrip-tion	Monitor-ing	Monitor-ed analog value	Monitor-ing at	Limit	Hyster-esis	Delay Fallback	Alarm class	Self acknow-ledge	Enabled
16	7196	6080	6086	6084	6085	6088	6087	6081	6082	6083
17	7204	6090	6096	6094	6095	6098	6097	6091	6092	6093
18	7212	6100	6106	6104	6105	6108	6107	6101	6102	6103
19	7220	6110	6116	6114	6115	6118	6117	6111	6112	6113
20	7228	6120	6126	6124	6125	6128	6127	6121	6122	6123
21	7236	6130	6136	6134	6135	6138	6137	6131	6132	6133
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 39: Flexible limits - parameter IDs

Examples

Example value	Desired limit	Reference value / display value	Limit entry format
01.24 Syst.A act.power [%]	160 kW	System A rated active pwr. [kW] (parameter ⮡ 1752) = 200 kW	8000 (= 80.00%)
01.09 Syst.A frequency [%]	51.5 Hz	System rated frequency (parameter ⮡ 1750) = 50 Hz	10300 (= 103.00%)
06.03 Analog input 3 (configured to VDO 5 bar)	4.25 bar	Display in 0.01 bar	00425 (= 4.25 bar)
06.02 Analog input 2 (configured to VDO 150 °C)	123 °C	Display in °C	00123 (= 123 °C)
06.03 Analog input 3 (configured to Linear, Value at 0% = 0, Value at 100% = 1000)	10 mm	Display in 0.000 m (parameter ⮡ 1035 configured to 0.000 m)	00010 (= 0.010 m)

Table 40: Flexible limits - analog value examples

The flexible limits must be used to monitor analog inputs like oil pressure or coolant temperature for example. We recommend to change the flexible limit description accordingly.

The table below gives some configuration examples. The analog inputs must be configured accordingly.

Parameter	Example for low oil pressure monitoring	Example for high coolant temperature monitoring
Description	Oil pressure	Coolant temp.
Monitoring	On	On
Monitored data source	06.01 Analog input 1	06.02 Analog input 2
Monitoring at	Underrun	Overrun
Limit	200 (2.00 bar)	80 (80 °C)
Hysteresis	10	2
Delay	0.50 s	3 s
Alarm class	F	B
Self acknowledge	No	No
Enabled	Always	96.01 LM:Flag 1

Table 41: Flexible limits - configuration examples

4.5.5 Miscellaneous

4.5.5.1 General monitoring settings

ID	Parameter	CL	Setting range [Default]	Description
1756	**Time until horn reset**	0	0 to 1000 s **[180 s]**	After each alarm of alarm class B through F occurs, the alarm LED flashes and the horn (command variable 03.05) is enabled. After the delay time "Time until horn reset" has expired, the horn (command variable 03.05) is disabled. The alarm LED flashes until the alarm has been acknowledged either via the push button, the LogicsManager, or the interface. **Notes** If this parameter is configured to 0, the horn will remain active until it will be acknowledged.
12490	**Ext. acknowledge** (External acknowledgment of alarms)	2	Determined by LogicsManager 86.15 **[(09.02 Discrete input 2 & 1) & 1]** = 10714	It is possible to acknowledge all alarms simultaneously from remote, e.g. with a discrete input. The logical output of the LogicsManager has to become TRUE twice. The first time is for acknowledging the horn, the second for all alarm 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. **Notes** For information on the LogicsManager and its default settings see ⮡ "9.4.1 LogicsManager Overview".
12959	**Lock Monitoring** (Locking alarm monitoring)	2	Determined by LogicsManager 87.40 **[(09.01 Discrete input 1 & 1) & 1]**	As long as the conditions of the LogicsManager have been fulfilled all monitoring functions which are configured to "Monitoring lockable" are locked.

ID	Parameter	CL	Setting range [Default]	Description
			= 11429	

4.5.5.2 Free Configurable Alarms

General Notes

The LS-6XT provides 16 freely configurable alarms.

Each alarm is configurable by:

- A LogicsManager equation
- Alarm text/description (configurable with ToolKit only)
- Delay time
- Alarm class
- Self acknowledgment
- Being enabled depending on Monitoring lock. LM 87.40 (selectable)

Free Alarm 1 for example

ID	Parameter	CL	Setting range [Default]	Description
8120	**Free alarm 1**	2	Determined by LogicsManager 88.01	This LogicsManager is used to select the source of monitoring.
			[02.01 FALSE & 1 & 1] = 11550	**Notes** For information on the LogicsManager and its default settings see “9.4.1 LogicsManager Overview”.
8121	**Alarm class**	2	Class A/B/C/D/E/F, Control **[Class B]**	The assigned independent alarm class specifies what action should be taken when the alarm becomes TRUE.
8122	**Self acknowledge**	2	Yes/No	The control automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control does not automatically clears the alarm if the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
8123	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.

ID	Parameter	CL	Setting range [Default]	Description
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮡▷ 12959
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32
8236	**Delay**	2	0.02 to 99999.99 s **[1.00 s]**	Period before alarm becomes TRUE.
6680	**Description**	2	**[Free alarm 1]** ...((30 characters))*	Text is configurable by ToolKit. **Notes** *) The max. number of characters depends also on the numbers of bytes for each character and is 48 but 30 characters can be read on VNC or RP-3000XT without restrictions.

Parameter IDs

Free alarm #	Description	LogicsManager	Alarm class	Self acknowledge	Enabled	Delay
1	6680	8120	8121	8122	8123	8236
2	6681	8124	8125	8126	8127	8237
3	6682	8128	8129	8130	8131	8238
4	6683	8132	8133	8134	8135	8239
5	6688	8136	8137	8138	8139	8240
6	6689	8140	8141	8142	8143	8241
7	6690	8144	8145	8146	8147	8242
8	6691	8148	8149	8152	8153	8243
9	6692	8154	8155	8156	8157	8244
10	6693	8158	8159	8161	8163	8245
11	6694	8165	8167	8168	8169	8246
12	6695	8170	8171	8172	8173	8247
13	6696	8174	8175	8176	8177	8248
14	6697	8178	8179	8180	8181	8249
15	6698	8182	8183	8184	8185	8250

Free alarm #	Description	LogicsManager	Alarm class	Self acknowledge	Enabled	Delay
16	6699	8186	8187	8188	8189	8251

Table 42: Free alarms - parameter IDs

4.5.5.3 CAN Interfaces

4.5.5.4 CAN Interface 1

General notes

The CANopen interface 1 is monitored. If the interface does not receive a Receive Process Data Object (RPDO) before the delay expires, an alarm will be initiated.

If this protective function is triggered, the display indicates "CANopen Interface 1" and the logical command variable "08.18" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
3150	**Monitoring**	2	On	CANopen Interface 1 monitoring is carried out according to the following parameters.
			[Off]	Monitoring is disabled.
3154	**Delay**	2	0.01 to 650.00 s **[0.20 s]**	The maximum receiving break is configured with this parameter. If the interface does not receive an RPDO within this time, the action specified by the alarm class is initiated. The delay timer is re-initialized after every message is received.
3151	**Alarm class**	2	Class A/B/C/D/E/F/Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to “9.6.4 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. 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 "Ext. acknowledge" (via a discrete input or via an interface).
3153	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮡ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.5.5 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.
			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 ⮡ “9.6.4 Alarm Classes”

ID	Parameter	CL	Setting range [Default]	Description
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 by manually pressing the appropriate buttons or by activating the LogicsManager output "Ext. acknowledge" (via a discrete input or via an interface).
3178	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮱▷ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.5.6 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 ⮱▷ "9.2.1 Triggering Characteristics" for the triggering characteristic of this monitoring function.

ID	Parameter	CL	Setting range [Default]	Description
3450 3456	**Monitoring**	2	3450: **[On]** 3456: **[On]**	Overvoltage monitoring of the battery voltage is carried out according to the following parameters. Both values may be configured independent from each other (prerequisite: Level 1 < Level 2).

ID	Parameter	CL	Setting range [Default]	Description
			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 ⮡ "9.6.4 Alarm Classes"
3452 3458	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "Ext. acknowledge" (via a discrete input or via an interface).
3453 3459	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Monitoring lock." is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮡ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:**

ID	Parameter	CL	Setting range [Default]	Description
				96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.5.7 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 "9.2.1 Triggering Characteristics" 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)

ID	Parameter	CL	Setting range [Default]	Description
				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 ⮡ "9.6.4 Alarm Classes"
3502 3508	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgment" (via a discrete input or via an interface).
3503 3509	**Enabled**	4	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Monitoring lock." is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮡ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.5.8 Voltage plausibility

General notes

If there is a connection between the systems based on the breaker feedbacks, the monitoring function compares the voltage status flags (voltage okay/dead) on same condition. Additionally, if System A and B are okay, the monitor expects to see a phase angle between both systems less than +/- 10°. The intension of this monitor is to detect wiring failures or blown fuses.

An alarm will be initiated if

Application mode **"CBA"** (parameter ⮡ 9018).

<u>Breaker CBA is closed</u> (connection between System A and B)

- the status flags of System A (02.09) and System B (02.03) do not have the same condition
- the status flags of System A (02.09) and System B (02.03) have the same condition but the phase angle between both systems is too big

Application mode **"CBA/CBB"** (parameter 9018).

<u>Breaker CBA is closed</u> (connection between System A and Auxiliary voltage)

- the status flags of System A (02.09) and Auxiliary voltage (02.06) do not have the same condition

<u>Breaker CBB is closed</u> (connection between System B and Auxiliary voltage)

- the status flags of System B (02.03) and Auxiliary voltage (02.06) do not have the same condition

<u>Breaker CBA and CBB are closed</u> (connection between System A, System B and Auxiliary voltage)

- the status flags of System A (02.09), System B (02.03) and Auxiliary voltage (02.06) do not have the same condition
- the status flags of System A (02.09) and System B (02.03) have the same condition but the phase angle between both systems is too big

If this protective function is triggered, the display indicates "Voltage mismatch" and the logical command variable "08.47" will be enabled.

ID	Parameter	CL	Setting range **[Default]**	Description
2991	**Monitoring**	2	On	Voltage plausibility monitoring is carried out according to the following parameters.
			[Off]	Monitoring is disabled.
2995	**Delay**	2	1 to 999 s **[30 s]**	If the monitored conditions are met for the delay time configured here, an alarm will be issued.
2992	**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 “9.6.4 Alarm Classes”
2993	**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

ID	Parameter	CL	Setting range [Default]	Description
				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 "Ext. acknowledge" (via a discrete input or via an interface).
2994	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Monitoring lock." is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮡ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.5.9 Operating range failure

General notes

The operating range monitoring signalizes a wrong behavior of the system. The device is blocked to continue. The reason for this often is a not reached operating range or a missing breaker feedback or release. The device indicates the root cause by issuing an additional error number. Each error number represents a different root cause. This shall provide assistance in troubleshooting.

If this protective function is triggered, the display indicates "Operating range {x}" and the following logical command variable will be enabled:

If there is more than one failure at the same time following operating range priority is used:

1 - 2 - 4 - 3 - 6 - 5

Command variable	Function	Conditions to trigger the alarm
08.55 Operating range 1	**CAN interface** The LS-6XT needs at least one other member. The alarm indicates that the LS-6XT is blocked, because there is no other member on the CAN bus recognized. **Notes**	• The command LM "Enable close CBA" is TRUE • AND The CBA feedback is open • AND No CAN member is recognized OR • The command LM "Enable close CBB" is TRUE • AND The CBB feedback is open

Command variable	Function	Conditions to trigger the alarm
	Application mode **"CBA"** This alarm is only active if the application mode CBA (parameter ⮱▷ 8840) is configured to "LSx". Application mode **"CBA/CBB"** This alarm is only active if the application mode CBA/CBB (parameter ⮱▷ 8992) is configured to "LSx".	• AND No CAN member is recognized
08.56 Operating range 2	**Synchronous networks** The alarm indicates that the LS-6XT is blocked, because there are synchronous networks or synchronous segment numbers on system A and system B side recognized. But the according configurations "Connect synchronous mains" (parameter ⮱▷ 8820) and "Connect synchronous segments" (parameter ⮱▷ 8852) do not allow that. **Notes** Application mode **"CBA"** This alarm is only active if the application mode CBA (parameter ⮱▷ 8840) is configured to "LSx". Application mode **"CBA/CBB"** This alarm is only active if the application mode CBA/CBB (parameter ⮱▷ 8992) is configured to "LSx".	• The command LM "Enable close CBA" is TRUE • AND The CBA feedback is open • AND Synchronous mains or synchronous segments are detected but not allowed to connect. OR • The command LM "Enable close CBB is TRUE • AND The CBB feedback is open • AND Synchronous mains or synchronous segments are detected but not allowed to connect.
08.57 Operating range 3	**CBA dead bus closure condition** The alarm indicates that the LS-6XT is blocked, because there is a dead busbar closure CBA situation recognized but the according configurations (parameter ⮱▷ 3431, ⮱▷ 8802, ⮱▷ 8803 and ⮱▷ 8804) do not allow a dead busbar closure CBA. The alarm indicates that the LS-6XT is blocked, because there is a dead busbar closure CBA situation recognized but the according configurations (parameter ⮱▷ 9013 and ⮱▷ 9014) do not allow a dead busbar closure CBA.	• The command LM "Enable close CBA" is TRUE • AND The CBA feedback is open • AND A CBA dead busbar closure is detected but not allowed to execute • AND The alarm class for opening the breaker is not active • AND The mains settling time is not running
08.58 Operating range 4	**CBA synchronization** The alarm indicates that the LS-6XT is blocked, because there is a CBA synchronization	• The command LM "Enable close CBA" is TRUE • AND The CBB feedback is closed

Command variable	Function	Conditions to trigger the alarm
	situation recognized but the System A or System B does not match the operating ranges.	• AND The CBA feedback is open • AND The System A or B is not in range for synchronization • AND The alarm class for opening the breaker CBA is not active
08.59 Operating range 5	**CBB dead bus closure condition** The alarm indicates that the LS-6XT is blocked, because there is a dead busbar closure CBB situation recognized but the according configurations (parameter ⮡ 9015 and ⮡ 9016) do not allow a dead busbar closure CBB. **Notes** Application mode **"CBA/CBB"**	• The command LM "Enable close CBB" is TRUE • AND The CBB feedback is open • AND A CBB dead busbar closure is detected but not allowed to execute • AND The alarm class for opening the breaker CBB is not active • AND The mains settling time is not running
08.60 Operating range 6	**CBB synchronization** The alarm indicates that the LS-6XT is blocked, because there is a CBB synchronization situation recognized but the System A or System B does not match the operating ranges. **Notes** Application mode **"CBA/CBB"**	• The command LM "Enable close CBB" is TRUE • AND The CBB feedback is open • AND The CBA feedback is closed • AND The System A or B is not in range for synchronization • AND The alarm class for opening the breaker CBB is not active

ID	Parameter	CL	Setting range [Default]	Description
2660	**Monitoring**	2	**[On]**	Operating range monitoring is carried out according to the following parameters.
			Off	Monitoring is disabled.
2663	**Delay**	2	1 to 999 s **[30 s]**	If one of the above mentioned conditions for an operating range failure is fulfilled for the delay time configured here, the appropriate alarm will be issued.
2661	**Alarm class**	2	Class A/B/C/D/E/F/Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ⮡ "9.6.4 Alarm Classes"
2662	**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

ID	Parameter	CL	Setting range [Default]	Description
				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 acknowledgement" (via a discrete input or via an interface).
2678	**Enabled**	4	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock..	Monitoring for fault conditions is performed until "Monitoring lock." is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮡ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.5.10 Plausibility Check of Voltages "AC Wiring"

General Notes

The LS-6XT detects the frequency out of up to six voltages (L1-N, L2-N, L3-N, L1-L2, L2-L3 and L3-L1). The frequency measurement (of all three systems) additionally checks the values on plausibility. With this monitoring the LS-6XT can detect wrong wiring issues.

Wrong Wiring Issue

It might occur that for example a System A frequency is measured even if the System A is not running. This can happen e.g. if PE (terminal 61) is not connected, the System A neutral connection is broken, and System B is energized with 1Ph2W connection. In this case a potential shift occurs which could lead to "ghostly" voltages at the System A (or busbar, or System B) phase-neutral system. This voltages lead to a frequency measurement even if no voltage is detected in the System A phase-phase system.

The »Plausibility AC wiring« monitoring is introduced to indicate such situations at System A, and System B measurement. These alarms are tripping if only "Phase-Phase" or only "Phase-Neutral" frequency is detected. If such an alarm ("System A AC wiring" or "System B AC wiring" has tripped please check all "Phase-Phase" and "Phase-Neutral" voltages via HMI or Toolkit to get more information and check the AC wiring.

This »Plausibility AC wiring« monitoring function is only active if the wiring can provide "Phase-Phase" and "Phase-Neutral" values.

The plausibility monitoring offers one setting for all three measurement systems. The Monitor is placed under: [PARAMETER / Configure monitoring / Miscellaneous: Other monitoring].The alarm indications are called System A. .../System B AC wiring (see ⮡ "9.6.5 Alarm Messages").

ID	Parameter	CL	Setting range [Default]	Description
1964	**Monitoring**	2	**[On]**	Enabling Plausibility AC Wiring monitoring.
			Off	Monitoring is disabled
1965	**Delay**	2	00.2 to 99.99 s **[00.30 s]**	If the monitored value undershoots the threshold value for the delay time configured here, an alarm will be issued.
1966	**Alarm class**	2	Class A, B, C, D, E, F, Control **[Class B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
1967	**Self acknowledge**	2	**[Yes]**	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected.
1968	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Monitoring lock." is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮡ 12959.
			For xx = 1 to 32: 96.{xx} LM: Flag{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:** 96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

4.5.5.11 System plausibility

General notes

The LS-6 checks the overall system condition and compares the own status from System A and System B with other devices in the system with have the same segment number. If there is a difference between the own status and the status from the other LS-6 the "System plausibility" monitoring is active.

The intention of this monitor is to detect wiring failures or blown fuses independent from the breaker status or incorrect parametrization during commissioning.

An alarm will be initiated if

- another LS-6 or more have the same segment number as System A with another status (System in range, System is black)
- another LS-6 or more have the same segment number as System B with another status (System in range, System is black)

If this protective function is triggered, the display indicates "System plausibility" and the logical command variable "08.88 System plausibility" will be enabled.

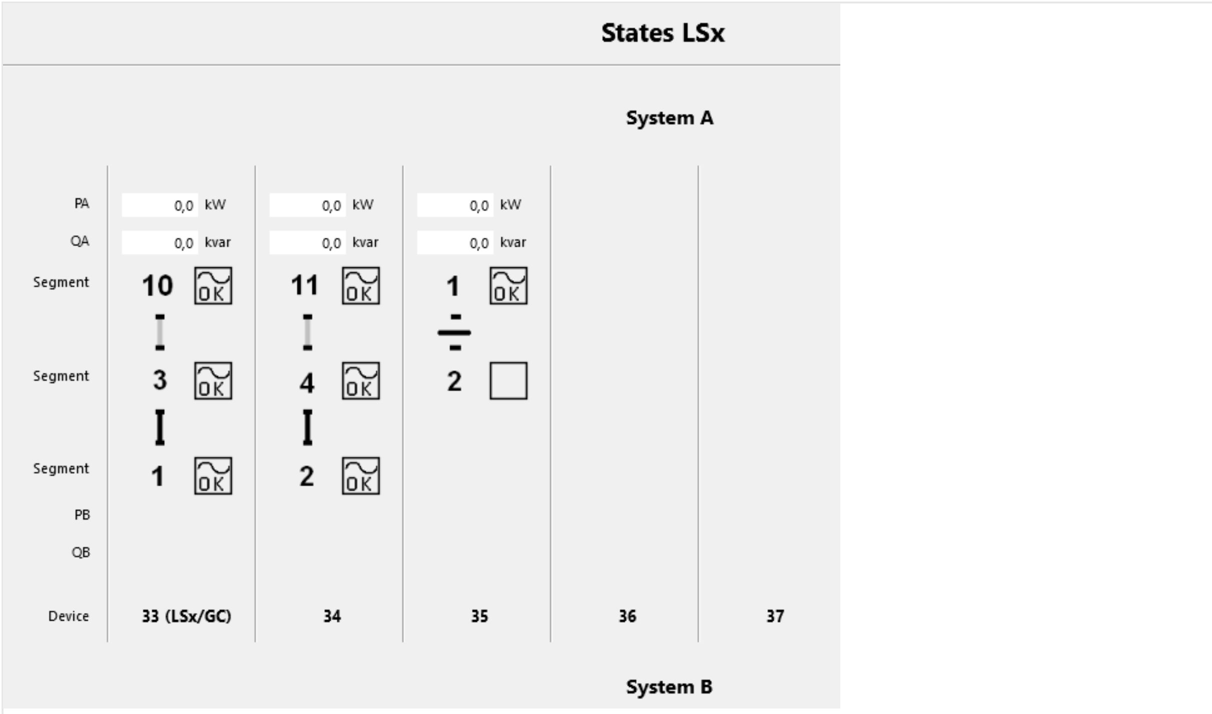
ID	Parameter	CL	Setting range [Default]	Description
18478	**Monitoring**	2	On	System plausibility monitoring is carried out according to the following parameters.
			[Off]	Monitoring is disabled.
18479	**Delay**	2	1 to 99 s **[3 s]**	If the monitored conditions are met for the delay time configured here, an alarm will be issued.
18480	**Alarm class**	2	Class A, Class B, Class C, Class D, Class E, Class F , Control **[Class B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				Notes For additional information refer to ⮡ "9.6.4 Alarm Classes"
18481	**Self acknowledge**	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "Ext. acknowledge" (via a discrete input or via an interface).
18482	**Enabled**	2	**[Always]**	Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Monitoring lock." is enabled. This is determined through the LogicsManager equation "12959 Lock MonitoringLogman_BlockMonitoring" ⮡ 12959.
			For xx = 1 to 32: 96.{xx}	The monitoring is executed, if the LogicsManager "Flag {xx}" is TRUE. **Example:**

ID	Parameter	CL	Setting range [Default]	Description
			LM: Flag{xx}	96.01 LM: Flag1, 96.02 LM: Flag2, ..., 96.32 LM: Flag32

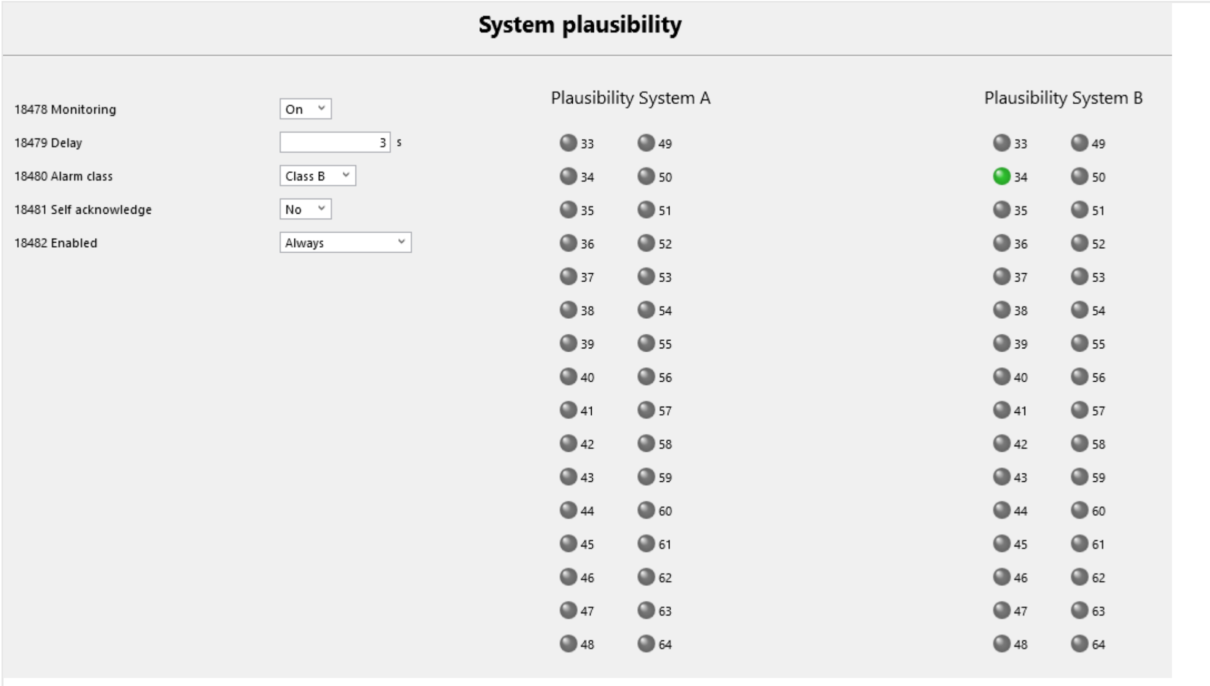
Example

In a "H-Configuration" both LS-6 at the incoming mains side have the breaker closed and System A/B are within the operation range, but the LS-6 located at the tie breaker (device 35) has a blown fuse at System B and an open breaker condition.

The system plausibility monitoring is active and detects a mismatch with device 34 at System B side.



The system plausibility from device 35 detects a mismatch with device 34 at segment B.



4.5.5.12 Multi-Unit Missing member

General notes

The multi-unit missing member monitoring function checks whether all participating units are available (sending data on the load share line).

The timeout depends on the configured "Load share Interface" 9924 and the related parameters, as follow:

- **CAN:**

  Missing Member Timeout = (9921 * 9999) + (9921 * 9990)

  Default Setting: Missing Member Timeout = (0.1s * 2) + (0.1s * 12) = 1.4s

- **ETHERNET A, B or B/C:**

  Missing Member Timeout = (7488 * 7489) + (7488 * 7497)

  Default Setting: Missing Member Timeout = (0.08s * 5) + (0.08s * 12) = 1.36s

- **CAN/ETHERNET A:**

  With the assumption that both interfaces get lost to the same time, the longer timeout of both is taken.

  Default Setting: CAN Missing Member Timeout = 1.4s and ETHERNET Missing Member Timeout = 1.36s. The CAN Missing Member Timeout with 1.4s will take place.

After energizing the device, a delay is started, which allows a possible "Missing member" 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 device, the timeout delay will be active.

For Ethernet connections, this delay time is 12 seconds. Approximately 12 seconds after energizing the device, the timeout delay will be active.

During »System update« the alarm is disabled.

For more information see ⮡ “6.6 Communication Management”

4.5.5.12.1 Multi-Unit Missing easYgen

General notes (Multi-unit Layer 1)

The parameters are only visible if the application **Layer 1** is active (parameter ⮡ 8990).

The multi-unit missing easYgen monitoring function checks whether all participating units are available (sending data on the load share line).

If the number of available units is less than the number of displayed "Monitored easYgen" ⮡ 9925 (initiated by parameter ⮡ 13356 System update) for at least the delay time, the display indicates "Missing easYgen" and the logical command variables "08.17" and "08.27" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
4060	**Monitoring**	2	On	Multi-unit missing members monitoring is carried out.
			[Off]	Monitoring is disabled.
4061	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	This function may be assigned an independent alarm class that specifies what action should be taken when this function triggers an alarm.
				Notes For additional information refer to ⮡ “9.6.4 Alarm Classes”.
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 by manually pressing the appropriate buttons or by activating the LogicsManager

ID	Parameter	CL	Setting range [Default]	Description
				output "Ext. acknowledge" (via a discrete input or via an interface).

4.5.5.12.2 Multi-Unit Missing GC

General notes (Multi-unit Layer 3)

The parameters are only visible if the application **Layer 3** is active (parameter ⮡ 8990).

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 displayed "Monitored GC" ⮡ 9928 (initiated by parameter ⮡ 13349 System update) for at least the delay time, the display indicates "Missing GC" and the logical command variables "08.17" and "08.63" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
4136	**Monitoring**	2	On	Multi-unit missing GC monitoring is carried out.
			[Off]	Monitoring is disabled.
4041	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	This function may be assigned an independent alarm class that specifies what action should be taken when this function triggers an alarm.
				Notes For additional information refer to ⮡ "9.6.4 Alarm Classes".
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 by manually pressing the appropriate buttons or by activating the LogicsManager output "Ext. acknowledgeExternal acknowledgment" (via a discrete input or via an interface).

4.5.5.12.3 Multi-unit missing LSx

General notes (Mult-unit Layer 1)

The parameters are only visible if the application **Layer 1** is active (parameter ⮡ 8990).

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 displayed "Monitored LSx" ⮱ 9926 (initiated by parameter ⮱ 13356 System update) for at least the delay time, the display indicates "Missing LSx Layer 1" and the logical command variables "08.17" and "08.28" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
4066	**Monitoring**	2	On	Multi-unit missing members monitoring is carried out.
			[Off]	Monitoring is disabled.
4067	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	This function may be assigned an independent alarm class that specifies what action should be taken when this function triggers an alarm.
				Notes For additional information refer to ⮱ "9.6.4 Alarm Classes".
4068	**Self acknowledge**	2	Yes	The control automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control does not automatically reset the alarm when the fault condition is no longer detected. The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "Ext. acknowledge" (via a discrete input or via an interface).

General notes (Mult-unit Layer 3)

The parameters are only visible if the application **Layer 3** is active (parameter ⮱ 8990).

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 displayed "Monitored LSx" ⮱ 7877 (initiated by parameter ⮱ 13349 System update) for at least the delay time, the display indicates "Missing LSx Layer 3" and the logical command variables "08.17" and "08.64" will be enabled.

ID	Parameter	CL	Setting range [Default]	Description
4040	**Monitoring**	2	On	Multi-unit missing members monitoring is carried out.
			[Off]	Monitoring is disabled.
4044	**Alarm class**	2	Class A/B/C/D/E/F, Control	This function may be assigned an independent alarm class that specifies what action should be

ID	Parameter	CL	Setting range [Default]	Description
			[B]	taken when this function triggers an alarm.
				Notes For additional information refer to ⮩ "9.6.4 Alarm Classes".
4045	**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 "Ext. acknowledge" (via a discrete input or via an interface).

4.5.5.13 Multi-Unit System update

General notes (Multi-Unit Layer 1)

The parameters are only visible if the application **Layer 1** is active (parameter ⮩ 8990).

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) the display indicates "Syst.update Layer1" and the logical command variables "08.65" will be enabled.

For more information see ⮩ "6.6 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.

ID	Parameter	CL	Setting range [Default]	Description
7833	**Alarm class**	2	Class A/B/C/D/E/F, Control **[B]**	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. **Notes** For additional information refer to ⮡ "9.6.4 Alarm Classes"
7834	**Self acknowledge**	-/-	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 "Ext. acknowledge" (via a discrete input or via an interface).

General notes (Multi-Unit Layer 3)

The parameters are only visible if the application **Layer 3** is active (parameter ⮡ 8990).

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 (GC or LSx) is more than the number of displayed units (GC or LSx) the display indicates "Syst.update Layer3" and the logical command variables "08.66" will be enabled.

For more information see ⮡ "6.6 Communication Management"

ID	Parameter	CL	Setting range [Default]	Description
7866	**MonitoringMonitoring**	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.

ID	Parameter	CL	Setting range [Default]	Description
7867	**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 ⮱▷ "9.6.4 Alarm Classes"
7868	**Self acknowledge**	-/-	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 "Ext. acknowledge" (via a discrete input or via an interface).

4.5.5.14 Load Share Interface Redundancy is Lost

General

Beside the automatic handling of redundant load share line messages the LS-6XT can inform the operator if a redundant load share communication line get lost. Preassumption for that is an enabled redundant load share line like "CAN1/Ethernet A" or "Ethernet B/C" in conjunction with a successful system update procedure.

If the according alarm has occurred the operator usually checks the "Diagnostic devices" screen. Available on device display or over ToolKit. There he will be informed which channel is affected. Refer to system update for more information.

Function

If the parameter "9924 Load share Interface" is configured to "Ethernet B/C" or "CAN1/ Ethernet A" and the system update was executed, the monitoring becomes active.

The devices observes if the both load share messages are correctly receipt. If a channel fails the alarm "Redund. LS timeout" is triggered.

ID	Parameter	CL	Setting range [Default]	Description
5017	**MonitoringMonitoring**	2		The monitoring of the load share communication line redundancy can be enabled here.
			On	On: Monitoring is enabled
			[Off]	Off: Monitoring is disabled
5018	**Alarm class**	2	A/B/C/D/E/F, Control	Each limit may be assigned an independent alarm class that

ID	Parameter	CL	Setting range [Default]	Description
			[Class B]	specifies what action should be taken when the limit is surpassed.
5019	**Delay**	2	0.2 to 999.9s **[3.0s]**	The redundancy lost error can be delayed according to the application.
5020	**Self acknowledge**	2	No	No: The control unit does not automatically reset the alarm when the fault condition is no longer detected.
			[Yes]	Yes: The control unit automatically clears the alarm if the fault condition is no longer detected.
5021	**Enabled**	2	**[Always]**	Always: Monitoring for this fault condition is continuously enabled.
			Monitoring lock.	Monitoring for fault conditions is performed until "Lock Monitoring" is enabled. This is determined through the LogicsManager equation "12959 Lock Monitoring" ⮡ 12959.
			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

4.6 Configure Measurement

Dependencies

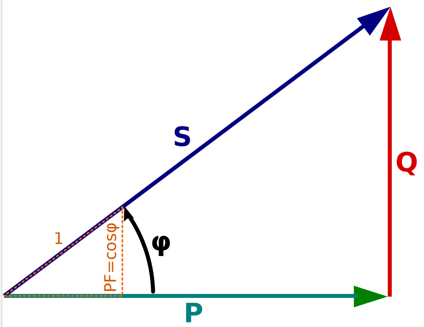


Fig. 130: AC power triangle

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

4.6.1 General measurement settings

ID	Parameter	CL	Setting range [Default]	Description
1750	**System rated frequency**	2	50Hz / 60Hz **[50Hz]**	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

ID	Parameter	CL	Setting range [Default]	Description
				For information on measuring principles refer to ⮱ "3.2.4 Voltage Measuring". Never configure the auxiliary voltage measurement for phase-neutral, if the other systems like system A and system B are configured as 3Ph 3W or 3Ph 4W. The phase angle for synchronization would be not correct.
1859	**1Ph2W phase rotation**	3	**[CW]**	A clockwise rotation field is considered for 1Ph 2W measuring.
			CCW	A counter-clockwise rotation field is considered for 1Ph 2W measuring.
				Notes For information on measuring principles refer to ⮱ "3.2.4 Voltage Measuring".

4.6.2 System A

ID	Parameter	CL	Setting range [Default]	Description
1766	**System A rated voltage**	2	50 to 650000 V **[400 V]**	This value refers to the rated voltage of the System A (System A voltage on data plate) and is the voltage measured on the potential transformer primary. The System A rated voltage is used as a reference figure for all System A voltage related functions, which use a percentage value, like System A voltage monitoring, breaker operation windows or the AnalogManager.
1752	**System A rated active pwr.[kW]**	2	0.5 to 99999.9 kW **[200.0 kW]**	This value specifies the System A real power rating, which is used as a reference figure for related functions. The System A rated active power is the System A apparent power multiplied by the System A power factor (typically ~0.8). These values are indicated in the System A data plate (⮱ "4.6.1 General measurement settings").
1758	**Syst.A rated react.pwr.[kvar]**	2	0.5 to 99999.9 kvar **[200.0 kvar]**	This value specifies the System A reactive power rating, which is used as a reference figure for related functions. The System A rated reactive power also depends on the System A values (⮱

ID	Parameter	CL	Setting range [Default]	Description
				"4.6.1 General measurement settings").
1754	**System A rated current**	2	1 to 32000 A **[500 A]**	This value specifies the System A rated current, which is used as a reference figure for related functions.
1851	**System A voltage measuring**	2	3Ph 4W OD	Measurement is performed Line-Neutral (Open Delta connected system). The voltage is connected via transformer with 3 Wire. Phase voltages and the neutral must be connected for proper calculation. Measurement, display and protection are adjusted according to the rules for Open Delta connected systems. Monitoring refers to the following voltages: • VL12, VL23 and VL31
			1Ph 3W	Measurement is performed Line-Neutral (WYE connected system) and Line-Line (Delta connected system). The protection depends on the setting of parameter ⮱ 1771. Measurement, display, and protection are adjusted according to the rules for single-phase systems. Monitoring refers to the following voltages: • VL13 (parameter ⮱ 1771 configured to "Phase-phase") • VL1N, VL3N (parameter ⮱ 1771 configured to "Phase-neutral")
			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 systems. Monitoring refers to the following voltages: • VL1N, VL12
			3Ph 3W	Measurement is performed Line-Line (Delta connected system). Phase voltages must be connected for proper calculation.

ID	Parameter	CL	Setting range [Default]	Description
				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 ⮱ 1771. Phase voltages and the neutral must be connected for proper calculation. Measurement, display and protection are adjusted according to the rules for WYE connected systems. Monitoring refers to the following voltages: • VL12, VL23 and VL31 (parameter ⮱ 1771 configured to "Phase-phase") • VL1N, VL2N and VL3N (parameter ⮱ 1771 configured to "Phase-neutral")
				Notes If this parameter is configured to 1Ph 3W, the System A and System B rated voltages (parameters ⮱ 1766and ⮱ 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 Voltage Measuring".
1850	**System A 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

ID	Parameter	CL	Setting range [Default]	Description
				This parameter is only effective if System A voltage measuring (parameter ⮡ 1851) is configured to "3Ph 4W" or "3Ph 3W". For information on measuring principles refer to ⮡ "3.2.5 Current Measuring".

4.6.2.1 Configure transformer

General notes

The setpoints for specific parameters will differ depending upon the setting of parameter »System A 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	**System A PT prim.rated voltage** (System A potential transformer primary voltage rating)	2	50 to 650000 V **[400 V]**	Some System A applications may require the use of potential transformers to facilitate measuring the voltages produced by the System A. The rating of the primary side of the potential transformer must be entered into this parameter. If the application does not require potential transformers (i.e. the measured voltage is 690 V or less), then the measured voltage will be entered into this parameter.
1800	**System A PT sec.rated voltage** (System A potential transformer secondary voltage rating)	2	50 to 690 V **[400 V]**	Some System A applications may require the use of potential transformers to facilitate measuring the voltages produced by the System A. 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	**System A CT prim.rated current** (System A 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**

ID	Parameter	CL	Setting range [Default]	Description
				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	**System A current range**	2	1A **[5A]**	The input range of the current transformer must be selected/ defined.

4.6.2.2 External active power

ID	Parameter	CL	Setting range [Default]	Description
2972	**Ext.System A active power**	2	Yes	The System A active power is coming from an external source. The following measurement values of the external System A active power depend on the external System A **re**active power measurement. So there is to differentiate between two cases: **Case 1:** External System A **reactive** power measurement (parameter ⮱▷ 3018) is disabled: • The System A power factor is assumed as "1". • The System A power factor is not displayed. • The System A total reactive power is not displayed. **Case 2:** External System A **reactive** power measurement (parameter ⮱▷ 3018) is enabled: • The System A power factor is calculated and displayed. • The System A total reactive power is calculated and displayed. • The System A total apparent power is calculated and displayed.

ID	Parameter	CL	Setting range [Default]	Description
			[No]	The System A active power is internally measured.
2973	**Power measurement resolution** (System A power measurement resolution)	2		This parameter controls the resolution and the format.
			Selected resolution	Measured active power
			0.01kW	0.01kW * analog value (AnalogManager output)
			0.1kW	0.1kW * analog value (AnalogManager output)
			[1kW]	1kW * analog value (AnalogManager output)
			0.01MW	0.01MW * analog value (AnalogManager output)
			0.1MW	0.1MW * analog value (AnalogManager output)
6009	**AM Ext.System A act.pwr**	2	Determined by AnalogManager 81.33: **[A1 = 06.01 Analog input 1]**	Typically an analog input is selected as data source which is connected to an external transducer.

4.6.2.3 External reactive power

ID	Parameter	CL	Setting range [Default]	Description
3018	**Ext.System A reactive power**	2	Yes	The System A reactive power is coming from an external source. The following measurement values depend on the external System A active power measurement. So there is to differentiate between two cases: **Case 1:** External System A **active** power measurement (parameter ⮱▷ 2972) is disabled: • The System A power factor is assumed as "1". • The System A power factor is not displayed. • The System A total active power is not displayed. **Case 2:** External System A **active** power measurement (parameter ⮱▷ 2972) is enabled: • The System A power factor is calculated and displayed. • The System A total reactive power is calculated and displayed.

ID	Parameter	CL	Setting range [Default]	Description
				• The System A total apparent power is calculated and displayed.
			[No]	The System A reactive power is internally measured.
3019	**React.pwr meas.resolution** (System A reactive power measurement resolution)	2		This parameter controls the resolution and the format.
			Selected resolution	Measured reactive power
			0.01kvar	0.01kvar * analog value (AnalogManager output)
			0.1kvar	0.1kvar * analog value (AnalogManager output)
			[1kvar]	1kvar * analog value (AnalogManager output)
			0.01Mvar	0.01Mvar * analog value (AnalogManager output)
			0.1Mvar	0.1Mvar * analog value (AnalogManager output)
6029	**AM Ext.Syst.A react.pwr**	2	Determined by AnalogManager 81.43: **[A1 = 10.01 ZERO]**	Typically an analog input is selected as data source which is connected to an external transducer.

4.6.3 System B

ID	Parameter	CL	Setting range [Default]	Description
1768	**System B rated voltage**	2	50 to 650000 V **[400 V]**	This value refers to the rated voltage of the System B and is the voltage measured on the potential transformer primary. The System B potential transformer primary voltage is entered in this parameter. The System B rated voltage is used as a reference figure for all System B voltage related functions, which use a percentage value, like System B voltage monitoring, breaker operation windows or the AnalogManager.
1748	**System B rated active pwr.[kW]**	2	0.5 to 99999.9 kW **[200.0 kW]**	This value specifies the System B real power rating, which is used as a reference figure for related functions. The System B rated active power is a reference value used by several monitoring and control functions (⮱▷ "4.6.1 General measurement settings").
1746	**Syst.B rated react.pwr.[kvar]**	2	0.5 to 99999.9 kvar	This value specifies the System B reactive power rating, which is

ID	Parameter	CL	Setting range [Default]	Description
			[200.0 kvar]	used as a reference figure for related functions. The System B rated reactive power is a reference value used by several monitoring and control functions(⮡ "4.6.1 General measurement settings").
1785	**System B rated current**	2	1 to 32000 A **[300 A]**	This value specifies the System B rated current, which is used as a reference figure for related functions.
1853	**System B voltage measuring**	2	**[3Ph 4W]**	Measurement is performed Line-Neutral (WYE connected system) and Line-Line (Delta connected system). The protection depends on the setting of parameter ⮡ 1770. Phase voltages and the neutral must be connected for proper calculation. Measurement, display and protection are adjusted according to the rules for WYE connected systems. Monitoring refers to the following voltages: • VL12, VL23 and VL31 (parameter ⮡ 1770 configured to "Phase-phase") • VL1N, VL2N and VL3N (parameter ⮡ 1770 configured to "Phase-neutral") • VL12, VL23, VL31, VL1N, VL2N and VL3N (parameter ⮡ 1770 configured to "All")
			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

ID	Parameter	CL	Setting range [Default]	Description
				to the rules for phase-phase systems. Monitoring refers to the following voltages: • VL1N, VL12
			1Ph 3W	Measurement is performed Line-Neutral (WYE connected system) and Line-Line (Delta connected system). The protection depends on the setting of parameter ⮱▷ 1770. Measurement, display, and protection are adjusted according to the rules for single-phase systems. Monitoring refers to the following voltages: • VL13 (parameter ⮱▷ 1770 configured to "Phase-phase") • VL1N, VL3N (parameter ⮱▷ 1770 configured to "Phase-neutral") • VL1N, VL3N (parameter ⮱▷ 1770 configured to "All")
				Notes If this parameter is configured to 1Ph 3W, the System A and System B 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).
1852	**System B current measuring**	2	**[Phase L1]** Phase L2 Phase L3	Phase L{1/2/3} Measurement is performed for the selected phase only. The measurement and display refer to the selected phase. The configured phase CT must be connected to perform current measurement.
				Notes For information on measuring principles refer to ⮱▷ "3.2.5 Current Measuring". This parameter is only effective if System B voltage measuring (parameter ⮱▷ 1853) is configured to "3Ph 4W" or "3Ph 3W".

4.6.3.1 Configure transformer

General notes

The setpoints for specific parameters will differ depending upon the setting of parameter »System B current range« ⮡ 1832.

- 1832 = "1A": Current transformer with ../1 A rated current
- 1832 = "5A": Current transformer with ../5 A rated current

ID	Parameter	CL	Setting range [Default]	Description
1804	**System B PT prim.rated voltage** (System B potential transformer primary voltage rating	2	50 to 650000 V **[400 V]**	Some applications may require the use of potential transformers to facilitate measuring the voltages to be monitored. The rating of the primary side of the potential transformer must be entered into this parameter.
				Notes If the application does not require potential transformers (i.e. the measured voltage is 690 V or less), then the measured voltage will be entered into this parameter.
1803	**System B PT sec.rated voltage** (System B 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 System B voltages. The rating of the secondary side of the potential transformer must be entered into this parameter. If the application does not require potential transformers (i.e. the measured voltage is 690 V or less), then the measured voltage will be entered into this parameter.
1807	**System B CT prim.rated current** (System B current transformer primary rating)	2	1 to 32000 A/x **[500 A/x]**	The input of the current transformer ratio is necessary for the indication and control of the actual monitored value. The current transformers ratio should be selected so that at least 60% of the secondary current rating can be measured when the monitored system is at 100% of operating capacity (i.e. at 100% of system capacity a 5 A CT should output 3 A). If the current transformers are sized so that the percentage of the output is lower, the loss of resolution may cause inaccuracies in the monitoring and control functions and affect the functionality of the control.

ID	Parameter	CL	Setting range [Default]	Description
1832	**System B current range**	2	1A	The input range of the current transformer must be selected/ defined.
			[5A]	

4.6.3.2 External active power

ID	Parameter	CL	Setting range [Default]	Description
2966	**Ext.System B active power**	2	Yes	The System B active power is coming from an external source. The following measurement values of the external System B active power depend on the external System B **re**active power measurement. So there is to differentiate between two cases: **Case 1:** External System B **reactive** power measurement (parameter ⊑▷ 2969) is disabled: • The System B power factor is assumed as "1". • The System B power factor is not displayed. • The System B total reactive power is not displayed. **Case 2:** External System B **reactive** power measurement (parameter ⊑▷ 2969) is enabled: • The System B power factor is calculated and displayed. • The System B total reactive power is calculated and displayed. • The System B total apparent power is calculated and displayed.
			[No]	The System B active power is internally measured.
2967	**Power measurement resolution** (System B power measurement resolution)	2		This parameter controls the resolution and the format.
			Selected resolution	Measured active power
			0.01kW	0.01kW * analog value (AnalogManager output)
			0.1kW	0.1kW * analog value (AnalogManager output)
			[1kW]	1kW * analog value (AnalogManager output)
			0.01MW	0.01MW * analog value (AnalogManager output)

ID	Parameter	CL	Setting range [Default]	Description
			0.1MW	0.1MW * analog value (AnalogManager output)
5780	**AM Ext.System B act.pwr**	2	Determined by AnalogManager 81.19: **[A1 = 06.02 Analog input 2]**	Typically an analog input is selected as data source which is connected to an external transducer.

4.6.3.3 External reactive power

ID	Parameter	CL	Setting range [Default]	Description
2969	**Ext.System B reactive power**	2	Yes	The System B reactive power is coming from an external source. The following measurement values depend on the external System B active power measurement. So there is to differentiate between two cases: **Case 1:** External System B **active** power measurement (parameter ⮡ 2966) is disabled: • The System B power factor is assumed as "1". • The System B power factor is not displayed. • The System B total active power is not displayed. **Case 2:** External System B **active** power measurement (parameter ⮡ 2966) is enabled: • The System B power factor is calculated and displayed. • The System B total reactive power is calculated and displayed. • The System B total apparent power is calculated and displayed.
			[No]	The System A reactive power is internally measured.
2970	**React.pwr meas.resolution** (System B reactive power measurement resolution)	2		This parameter controls the resolution and the format.
			Selected resolution	Measured reactive power
			0.01kvar	0.01kvar * analog value (AnalogManager output)
			0.1kvar	0.1kvar * analog value (AnalogManager output)
			[1kvar]	1kvar * analog value (AnalogManager output)

ID	Parameter	CL	Setting range [Default]	Description
			0.01Mvar	0.01Mvar * analog value (AnalogManager output)
			0.1Mvar	0.1Mvar * analog value (AnalogManager output)
5794	**AM Ext.Syst.B react.pwr**	2	Determined by AnalogManager 81.20: **[A1 = 10.01 ZERO]**	Typically an analog input is selected as data source which is connected to an external transducer.

4.6.4 Auxiliary voltage

The auxiliary voltage parameters are used in application mode **"CBA/CBB"** (parameter ⮡ 9018) for the dead bus closure detection.

ID	Parameter	CL	Setting range [Default]	Description
1781	**Aux.volt. rated voltage**	2	50 to 650000 V **[400 V]**	This value refers to the rated voltage of auxiliary voltage and is the voltage measured on the potential transformer primary. The auxiliary voltage potential transformer primary voltage is entered in this parameter. The auxiliary voltage rated voltage is used as a reference figure for all auxiliary voltage related functions, which use a percentage value.

4.6.4.1 Configure transformer

ID	Parameter	CL	Setting range [Default]	Description
1813	**Aux.volt.PT prim.rated volt.** (Auxiliary voltage 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
1812	**Aux.volt.PT sec.rated volt.** (Auxiliary voltage 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.

4.7 Configure Interfaces

4.7.1 USB Service Port

If the LS6 is connected to a PC via USB port, the device appears as an USB drive. The drive contains e.g. the technical manual, appropriate configuration files and the virtual COM port driver to connect to the LS6 using ToolKit. If the PC does not install the COM port automatically, then the installer in folder "Driver" must be executed before starting ToolKit

There is no configuration to do for the USB Service Port.

USB Service Port

The USB service port is restricted for ToolKit communication, Woodward service communication, and - if provided by factory side - read only files.

The »Automatic Reconnection« over USB is not possible.

If connection over USB is lost, please reconnect manually:

- 1. Wait until the LS-6XT is recognized again through the PC (as an external hard drive)
- 2. Start via ToolKit at new by "Disconnect" and then "Connect" again

4.7.2 RS-485 Interface

ID	Parameter	CL	Setting range [Default]	Description
3170	**Baudrate**	2	2.4 / 4.8 / 9.6 / **[19.2]** / 38.4 / 56 / 115 kBaud	This parameter defines the baud rate for communications. Please note, that all participants on the bus must use the same baud rate.

ID	Parameter	CL	Setting range [Default]	Description
3171	**Parity**	2	**[No]** / Even / Odd	The used parity of the interface is set here.
3172	**Stop bits**	2	**[One]** / Two	The number of stop bits is set here.
3173	**Full-, halfduplex mode**	2	**[Fullduplex]**	Fullduplex mode is enabled.
			Halfduplex	Halfduplex mode is enabled.
3188	**Modbus slave ID**	2	0 to 255 **[33]**	The Modbus device address, which is used to identify the device via Modbus, is entered here. If "0" is configured here, the Modbus is disabled.
3189	**Reply delay time**	2	0.00 to 2.55 s **[0.00 s]**	This is the minimum delay time between a request from the Modbus master and the sent response of the slave. This time is required in half-duplex mode.
9128	**Password protection**	5	Off	Password protection for Modbus RS 485 is **not active**.
				Notes Take care for a protected access!
			[On]	Password protection for Modbus RS 485 is active.

4.7.3 Modbus protocol

Data Format(s)

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

Composite data types like LOGMAN, ANALOGMANAGER, and TEXT use separate descriptions.

ID	Parameter	CL	Setting range [Default]	Description
3184	**Modbus protocol number**	2	0 to 65535	A Modbus protocol may be selected by entering the data protocol ID here. If an unknown data protocol ID is configured here, nothing will be transmitted. Possible data protocol IDs (existing protocols) are listed in this Technical Manual. Instead of a Woodward protocol, a customer specific data protocol can be selected. Such a protocol must have been uploaded onto the device and its file name must fit the reserved range from protocol number 65100 to 65199.

ID	Parameter	CL	Setting range [Default]	Description
				Use Woodward "TelegramMapper" PC software to create your own Data Telegrams (refer to ⮡ "6.10.4 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!
			[5300]	Number of the Data Telegram to be used for communication (corresponds to the file name [xxxx].scp).
				Notes All Date Telegrams described in this Technical Manual are device implemented: no separate scp-file (e.g. "5010.scp") needed.
	Reboot the device	2		If a customer specific data protocol is selected the reboot from the device can be initiated. After device reboot the protocol becomes effective. Refer to ⮡ 10455.
3179	**Detect a gap in a Modbus frame**	2	**[On]**	If a received Modbus command has a gap between its byte of more than 5 ms, this command is ignored.
			Off	The Modbus message is not checked.
3181	**Power [W] exponent 10^x**	2	2 to 5 **[3]**	This setting adjusts the format of the 16 bit power values in the data telegram.
				Notes Valid for data telegram 5300 ⮡ "9.3.1 Protocol 5300 (Basic Visualization)" only! 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.
				Notes Valid for data telegram 5300 ⮡ "9.3.1 Protocol 5300 (Basic Visualization)" only!

ID	Parameter	CL	Setting range [Default]	Description
				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 Valid for data telegram 5300 ⮡ "9.3.1 Protocol 5300 (Basic Visualization)" only! Refer to ⮡ "Current measurement example" for examples.
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 ⮡ "6.10.5 Modbus master").

Power measurement example

☼

How to use "Power [W] exponent 10^x" 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 43: Power measurement example

Voltage measurement example

How to use "Voltage [V] exponent 10^x" 3182

Voltage measurement:

- The measurement range is 0...480 V
- Momentary measurement value = 477.8 V

Setting	Meaning	Calculation	Transfer value (16 Bit, max. 32767)	Possible display format
-1	10^{-1}	477.8 V / 10^{-1} W	4778	477.8 V
0	10^{0}	477.8 V / 10^{0} V	477	477 V
1	10^{1}	477.8 V / 10^{1} V	47	N/A
2	10^{2}	477.8 V / 10^{2} V	4	N/A

Table 44: Voltage measurement example

Current measurement example

How to use "Current [A] exponent 10^x" 3183

Current measurement:

- The measurement range is 0...500 A
- Momentary measurement value = 345.4 A

Setting	Meaning	Calculation	Transfer value (16 Bit, max. 32767)	Possible display format
-1	10^{-1}	345.4 A / 10^{-1} A	3454	345.4 A
0	10^{0}	345.4 A / 10^{0} A	345	345 A

Table 45: Current measurement example

4.7.4 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 ⮑ 9100and ⮑ 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
	Bit 30 = 0; Bit 31 = 1	Yes	No
	Bit 30 = 1; Bit 31 = 1	Yes	Yes
Default	Bit 30 = 0; Bit 31 = 0	No	No
	Bit 30 = 1; Bit 31 = 0	No	Yes
	Bit 30 = 0; Bit 31 = 1	Yes	No[1]
	Bit 30 = 1; Bit 31 = 1	Yes	Yes[1]
On	Bit 30 = 0; Bit 31 = 0	No	No
	Bit 30 = 1; Bit 31 = 0	No	Yes
	Bit 30 = 0; Bit 31 = 1	Yes	No
	Bit 30 = 1; Bit 31 = 1	Yes	Yes

[1] If CANopen master (lowest Node-ID).

ID	Parameter	CL	Setting range [Default]	Description
3156	**Baudrate**	2	20 / 50 / 100 / 125 / 250 / 500 / 800 / 1000 kBaud **[250 kBd]**	This parameter defines the used baud rate. Please note, that all participants on the CAN bus must use the same baud rate.
1894	**Align device no. with Node-ID**	2	No **[Yes]**	If this parameter is configured to "Yes" the parameter »Node-ID CAN bus 1« ⮡ 8950 will be overwritten with the value of the »Device number« ⮡ 1702 and is not visible. If configured to "No", parameter »Device number« ⮡

ID	Parameter	CL	Setting range [Default]	Description
				1702 is visible and will not be overwritten.
				Notes This is to avoid CAN ID conflict in multi unit systems if using the same ID more than one time. This can cause CAN "Bus-Off" failure.
8950	**Node-ID CAN bus 1**	2	1 to 127 (dec) **[33]**	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 LS-6XT 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 device is configured to Default Master, the unit with the lower Node-ID will take over control. Therefore, the CAN bus devices, which are intended to act as Default Master should be assigned a low Node-ID. No other device on the CAN bus (except the LS-6XT) 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

ID	Parameter	CL	Setting range [Default]	Description
				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 LS-6XT. 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 Message**	2	1 to FFFFFFFF hex **[100 hex]**	This parameter defines whether the unit generates the TIME message or not. Complies with CANopen specification: object 1012 hex, subindex 0; defines the COB-ID of the time object (TIME).
				Notes The structure of this object is shown in ⮑ "COB-ID of SYNC/ TIME messages"
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 ⮑

ID	Parameter	CL	Setting range [Default]	Description
				9101) it will send the TIME message with this interval.
				Notes The structure of this object is shown in ⮑ "TIME synchronization message"
9126	**Password protection**	5	Off	Password protection for CAN 1 is **not active**.
				Notes Take care for a protected access!
			[On]	Password protection for CAN 1 is active.

4.7.4.1 Additional Server SDOs (Service Data Objects)

General notes

> The CAN bus is a field bus and subject to various disturbances. Therefore, it cannot be guaranteed that every request will be answered. We recommend to repeat a request, which is not answered within reasonable time.

The first Node-ID is the standard Node-ID of CAN interface 1 (parameter ⮑ 8950).

ID	Parameter	CL	Setting range [Default]	Description
12801	**2. Node ID**	2	0 to 127 (dec) **[0]**	In a multi-master application, each Master needs its own identifier (Node-ID) from the unit. in order to send remote signals (i.e. remote start, stop, shutdown, or acknowledge) to the unit. The additional SDO channel will be made available by configuring this Node-ID to a value different than zero. This is the additional CAN ID for the PLC.
12802	**3. Node ID**	2	0 to 127 (dec) **[0]**	In a multi-master application, each Master needs its own identifier (Node-ID) from the unit. in order to send remote signals (i.e. remote start, stop, shutdown, or acknowledge) to the unit. The additional SDO channel will be made available by configuring this Node-ID to a value different than zero. This is the additional CAN ID for the PLC.
12803	**4. Node ID**	2	0 to 127 (dec)	In a multi-master application, each Master needs its own identifier (Node-ID) from the unit.

ID	Parameter	CL	Setting range [Default]	Description
			[0]	in order to send remote signals (i.e. remote start, stop, shutdown, or acknowledge) to the unit. The additional SDO channel will be made available by configuring this Node-ID to a value different than zero. This is the additional CAN ID for the PLC.
12804	**5. Node ID**	2	0 to 127 (dec) **[0]**	In a multi-master application, each Master needs its own identifier (Node-ID) from the unit. in order to send remote signals (i.e. remote start, stop, shutdown, or acknowledge) to the unit. The additional SDO channel will be made available by configuring this Node-ID to a value different than zero. This is the additional CAN ID for the PLC.

4.7.4.2 Receive PDO {x} (Process Data Object)

General notes

RPDO mapping is carried out as shown in (Fig. 131).

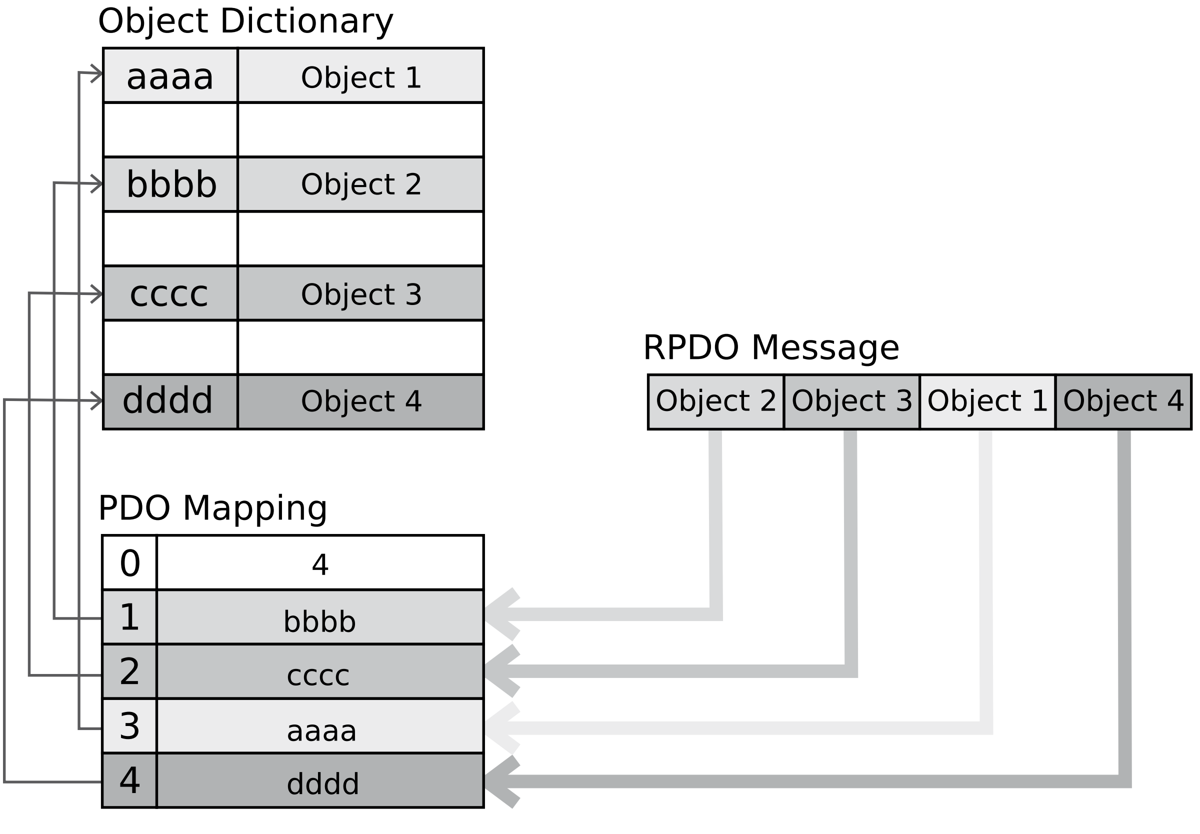


Fig. 131: RPDO mapping principle

Parameters ⮡ 9300/ ⮡ 9310/ ⮡ 9320/ ⮡ 12805/ ⮡ 12806 use communication parameters that adhere to the following structure.

RPDO Objects can be remote signals (parameter 503; please refer to ⮡ "Remote control word 1" for details), DI states and AI measured values.

Bit number	Value	Meaning
31 (MSB)	0	PDO exists / is valid
	1	PDO does not exist / is not valid
30	X	N/A
29	X	N/A
28-11	0	Always
10-0 (LSB)	X	Bits 10-0 of COB-ID

PDO valid / not valid allows to select, which PDOs are used in the operational state.

ID	Parameter	CL	Setting range **[Default]**	Description
9300 9310 9320 12805 12806	**COB-ID**	2	1 to FFFFFFFF hex **[80000000 hex]**	This parameter contains the communication parameters for the PDOs, the device is able to receive. Complies with CANopen specification: object 1400 hex (for RPDO 1, 1401 hex for RPDO 2, 1402 hex for RPDO 3, 1403 hex for RPDO 4, and 1404 hex for RPDO 5), subindex 1.
				Notes The structure of this object is shown in ⮡ Chapter 4.7.4.2. 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.
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

ID	Parameter	CL	Setting range [Default]	Description
				Complies with CANopen specification: object 1400 hex (for RPDO 1, 1401 hex for RPDO 2, 1402 hex for RPDO 3, 1403 hex for RPDO 4, and 1404 for RPDO 5), subindex 5
8970 8971 8972 8973 8974	**Selected Data Protocol**	2	0 to 65535 **[0]**	A data protocol may be selected by entering the data protocol ID here. If 0 is configured here, the message assembled by the mapping parameters is used. If an unknown data protocol ID is configured here, a failure is indicated by the CAN status bits.
			65000	IKD 1 - external DIs/DOs 1 through 8
			65001	IKD 1 - external DIs/DOs 9 through 16
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

ID	Parameter	CL	Setting range [Default]	Description
				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.

4.7.4.3 Transmit PDO {x} (Process Data Object)

General notes

TPDO mapping is carried out as shown in (⮡ Fig. 132).

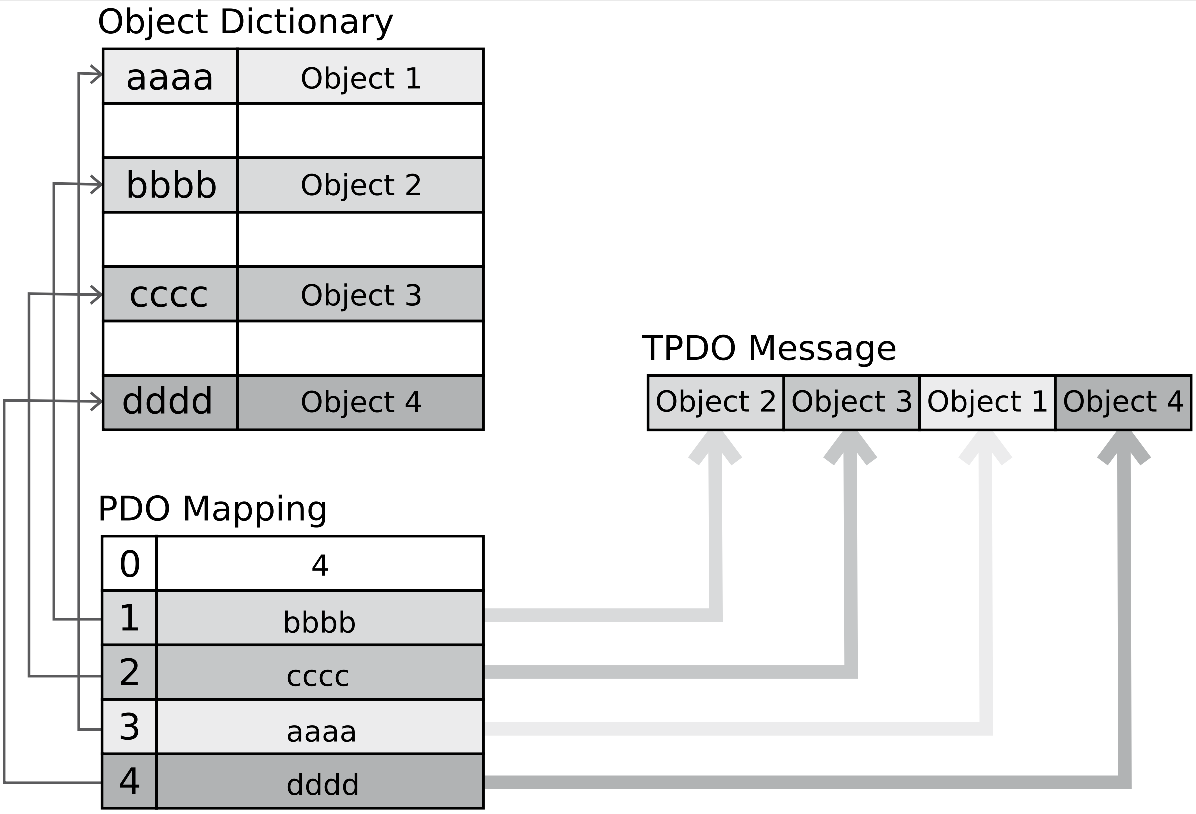


Fig. 132: TPDO mapping

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 ⮑ "9.3 Data Protocols"):

- 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	Value	Meaning
31 (MSB)	0	PDO exists / is valid

Bit number	Value	Meaning
	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	**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.

ID	Parameter	CL	Setting range [Default]	Description
12792				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 4.7.4.3 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	**Selected Data Protocol**	2	0 to 65535 8962: **[5301]**	A data protocol may be selected by entering the data protocol ID here. If 0 is configured here, the message assembled by the

ID	Parameter	CL	Setting range [Default]	Description
8964 8965 8966			8963: **[0]** 8964: **[0]** 8965: **[0]** 8966: **[0]**	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:
			5301	Data telegram (CAN)
			5302	Data telegram (CAN)
			65000	IKD 1 - external DIs/DOs 1 through 8
			65001	IKD 1 - external DIs/DOs 9 through 16
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

ID	Parameter	CL	Setting range [Default]	Description
9607 9617 9627 9637 12797	**3. Mapped Object**	2	0 to 65535 **[0]**	This parameter contains the information about the mapped application variables. These entries describe the PDO contents by their index. The sub-index is always 1. The length is determined automatically.
				Notes Complies with CANopen specification: object 1A00 hex (for TPDO 1, 1A01 hex for TPDO 2, 1A02 hex for TPDO 3, 1A03 hex for TPDO 4, and 1A04 hex for TPDO 5), subindex 3
9608 9618 9628 9638 12798	**4. Mapped Object**	2	0 to 65535 **[0]**	This parameter contains the information about the mapped application variables. These entries describe the PDO contents by their index. The sub-index is always 1. The length is determined automatically.
				Notes Complies with CANopen specification: object 1A00 hex (for TPDO 1, 1A01 hex for TPDO 2, 1A02 hex for TPDO 3, 1A03 hex for TPDO 4, and 1A04 hex for TPDO 5), subindex 4

4.7.5 Ethernet Interfaces

General notes

The Ethernet network provides a fast communication capability to different devices, like remote panel, PLC or SCADA systems. The common protocol Modbus TCP is there for the preferred communication protocol. Additionally the Ethernet connection supports the Woodward protocol Servlink for ToolKit and other Woodward own monitoring tools (like remote panel and SCADA visualization tool). At least the LS-6XT provides a UDP protocol for system relevant and time discrete information exchange.

Do not connect the LS-6XT with the internet as long the security aspects are not considered. Consider an IP responsible person to discuss proper security procedures like placing routers and fire walls.

If the LS-6XT (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

ID	Parameter	CL	Setting range [Default]	Description
				entry is done in 80ms steps (80, 160, 240, 320, 400). **Note:** This setting must be the same for all members. Refer to ⮡ "7.6 Load Sharing" for more information.
7489	**Timeout cycles**	2	**[5]** 2 to 30	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 ⮡ "7.6 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"(ID 7497)] multiplied with "Transmission rate"(ID 7488). **Note:** This setting must be the same in all members. Refer to ⮡ "7.6 Load Sharing" for more information.
7485	**Modbus/TCP Slave ID**	2	**[33]** 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!

ID	Parameter	CL	Setting range [Default]	Description
			[On]	Password protection for Ethernet is active.

4.7.5.1 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" and the LM flag "08.54 Eth. configuration" are active.

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.

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

4.7.5.2 Ethernet Network A

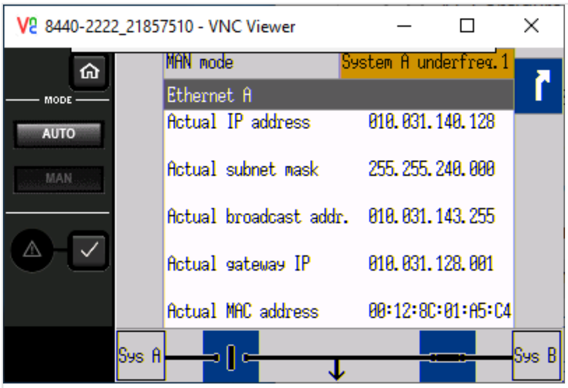


Fig. 133: Ethernet Network A screen

The actual IP address, subnet mask, gateway IP address (all hex values) can be viewed under Next Page (Status Menu) / Diagnostic / Interfaces / Ethernet / Ethernet A.

IP address

Each port within the Ethernet network must have its own network address. As long the Ethernet network is only used by the LS-6XT system, the address range is free configurable. For better troubleshooting use the default Ethernet address range and configure the single IP addresses according to their device numbers.

Device part: Restrictions

The "device part" is the logical result of »IP address« AND NOT »Network Mask«. The bits (dual system 0_2/1_2) of the device part must be different from being all the same - neither all zero 0_2 nor all 1_2 (broadcast).

Please select your IP address accordingly.

Gateway IP address

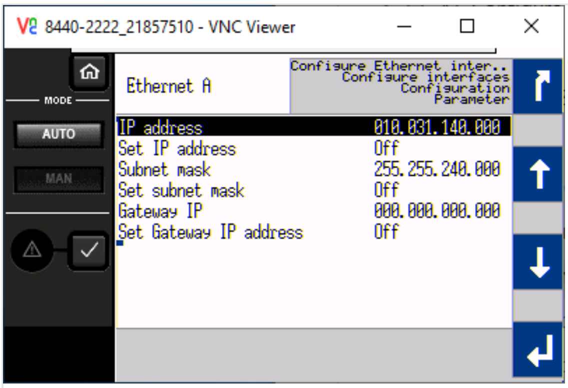


Fig. 134: Ethernet IP and gateway addresses

The gateway IP address defines a node within a local area network (LAN), which is directed to external networks. It is usually not needed in a LS-6XT Ethernet network. Refer to your network responsible contact person, if a gateway capability is required.

HEX values

The addresses and subnet masks are known as hex values but are displayed in HMI and ToolKit as decimal values.

ID	Parameter	CL	Setting range [Default]	Description
5330 5331 5332 5333	**IP address**	2	[10, 31, 140, 0]	Field 1,2,3,4 for IP address Ethernet port A. This setting will be not valid automatically. The »Set IP address« parameter must be set to »ON« for enabling. **Notes** Device part bits are not allowed to be either **all** *00...$_2$* or **all** *11...$_2$* (broadcast).
7412	**Set IP address**	2	Off	Set IP-Address Ethernet port A.
5334 5335 5336 5337	**Subnet mask**	2	[255, 255, 240, 0]	Set byte 1,2,3,4 of the subnet mask Ethernet port A. This setting will be not valid automatically. The »Set subnet mask« parameter must be set to »ON« for enabling.
7413	**Set subnet mask**	2	Off	Set subnet mask Ethernet port A.
5338 5339 5340 5341	**Gateway IP**	2	[0, 0, 0, 0]	Field 1,2,3,4 for gateway IP-Address for Ethernet port A. This setting will be not valid automatically. The »Set IP address« parameter must be set to »ON« for enabling. If 0.0.0.0 is set, the gateway's functionality is switched off.
5342	**Set Gateway IP address**	2	Off	Set Gateway IP Address for Ethernet port A

4.7.5.3 Ethernet Network B

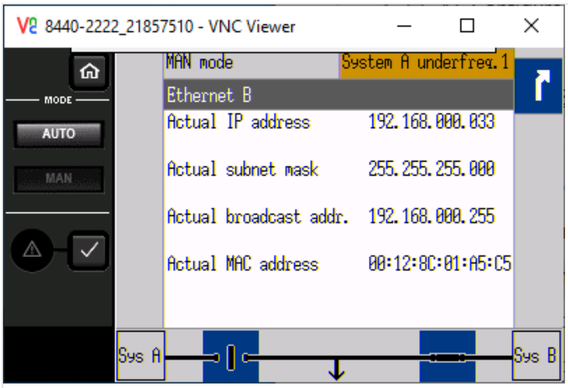


Fig. 135: Ethernet Network B screen

The actual IP address and subnet mask (all hex values) can be viewed under Next Page (Status Menu) / Diagnostic / Interfaces / Ethernet / Ethernet B.

IP address

Each port within the Ethernet network must have its own network address. As long the Ethernet network is only used by the LS-6XT system, the address range is free configurable. For better troubleshooting use the default Ethernet address range and configure the single IP addresses according to their device numbers.

Device part: Restrictions

The "device part" is the logical result of »IP address« AND NOT »Network Mask«. The bits (dual system $0_2/1_2$) of the device part must be different from being all the same - neither all zero 0_2 nor all 1_2 (broadcast).

Please select your IP address accordingly.

HEX values

The addresses and subnet masks are known as hex values but are displayed in HMI and ToolKit as decimal values.

ID	Parameter	CL	Setting range [Default]	Description
5430 5431 5432 5433	**IP address**	2	[192, 168, 0, 33]	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.

4.7.5.4 Ethernet Network C

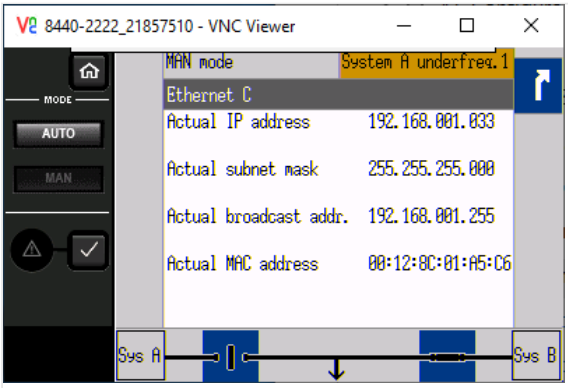


Fig. 136: Ethernet Network C screen

The actual IP address and subnet mask (all hex values) can be viewed under Next Page (Status Menu) / Diagnostic / Interfaces / Ethernet / Ethernet C.

IP address

Each port within the Ethernet network must have its own network address. As long the Ethernet network is only used by the LS-6XT system, the address range is free configurable. For better troubleshooting use the default Ethernet address range and configure the single IP addresses according to their device numbers.

Device part: Restrictions

The "device part" is the logical result of »IP address« AND NOT »Network Mask«. The bits (dual system $0_2/1_2$) of the device part must be different from being all the same - neither all zero 0_2 nor all 1_2 (broadcast).

Please select your IP address accordingly.

HEX values

The addresses and subnet masks are known as hex values but are displayed in HMI and ToolKit as decimal values.

ID	Parameter	CL	Setting range [Default]	Description
7418 7419 7420 7421	**IP address**	2	[192, 168, 1, 33]	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	**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.

ID	Parameter	CL	Setting range [Default]	Description
7423 7424 7425				The »Set subnet mask« parameter must be set to »ON« for enabling.
7417	**Set subnet mask**	2	Off	Set subnet mask Ethernet port C.

4.7.5.5 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 LS-6XT can be configured as a SNTP client. The LS-6XT 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 LS-6XT requests time and date information from an external SNTP server, marked with an own IP address.

- **Load sharing mode**

  The LS-6XT requests time and date information from the easYgen with the smallest device number, if the load sharing over Ethernet is enabled.

- **Internal clock mode**

  The SNTP client mechanism is disabled. The own real time clock determines clock and date.

HEX values

The addresses and subnet masks are known as hex values but are displayed in HMI and ToolKit as decimal values.

ID	Parameter	CL	Setting range [Default]	Description
7780 7781 7782 7783	**SNTP address**	2	**[10, 14, 128, 128]** 0 to 255 (4x)	Set byte 1,2,3,4 of the IP address of the external SNTP-Server.
7784	**Rate**	2	**[1200s]** 60 to 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]**	The device provides different SNTP modes.

ID	Parameter	CL	Setting range [Default]	Description
			External SNTP Load sharing	**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 LS-6XT system. A master (usually the device with the smallest device number) serves all easYgens with time and date information according to their request rate.

4.7.6 Load Share Parameters

ID	Parameter	CL	Setting range [Default]	Description
9921	**Transfer rate LS fast message** (CAN)	2	0.10 to 0.30 s **[0.10 s]**	The transfer rate defines the time delay between two fast CAN messages. In case of CAN systems with a high bus load (e.g. long distance between the units with low baud rate), a shorter transfer rate (higher time setting) helps to reduce the bus load. **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. Refer to ⮡ "7.6 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, you can set here how many more CAN fast messages may be lost consecutively from this partner before his data is declared invalid. **Note:**

ID	Parameter	CL	Setting range [Default]	Description
				This setting must be the same for all members. Refer to ⮱ "7.6 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).

4.7.7 Remote Control

To remotely control individually functions in the LS6 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 3".

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

ID	Parameter	CL	Setting range [Default]	Description
				the remote control (LogicsManager command variables 9-16).

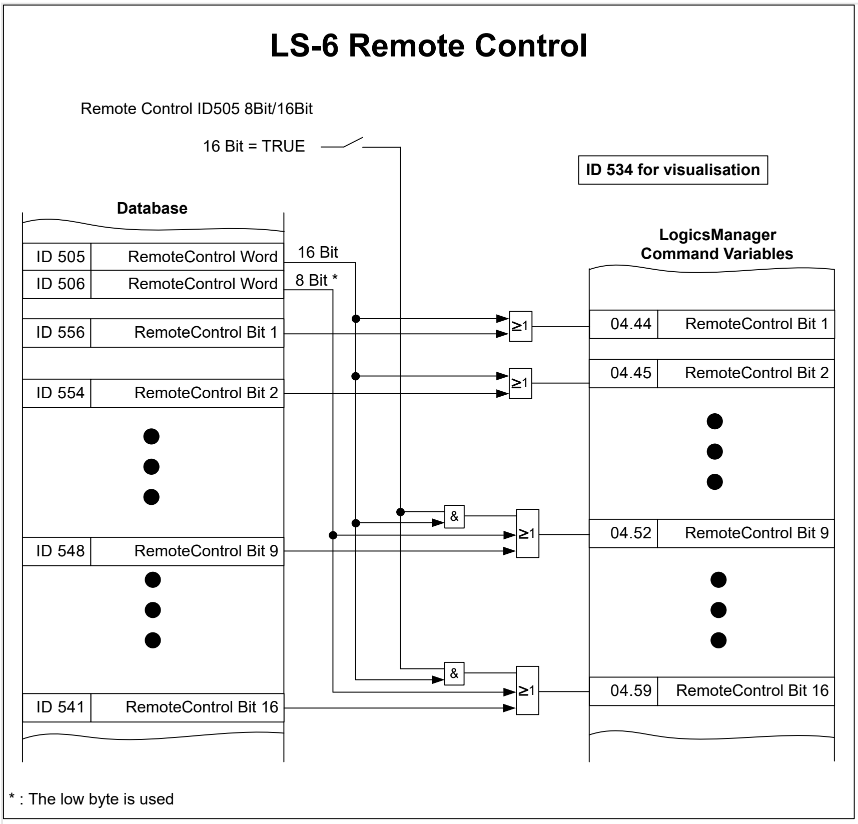


Fig. 137: Remote Control

4.8 Configure LogicsManager

Logical symbols

The LS-6XT LogicsManager screens show logical symbols according to the IEC standard.

ID	Parameter	CL	Setting range [Default]	Description
4117	**Use ASA symbols**	2	Yes	Symbols according to the ASA standard are used in LogicsManager screens.
			[No]	Symbols according to the IEC standard are used in LogicsManager screens.

Refer to "9.4.3 Logical Symbols" for a table of symbols according to the different standards.

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

4.8.1 Configure Internal Flags

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

Flag {x}	Flag 1	Flag 2	Flag 3	Flag 4	Flag 5	Flag 6	Flag 7	Flag 8
Parameter ID	12230	12240	12250	12260	12270	12280	12290	12300
Result ID	10700	10701	10702	10702	10704	10705	10706	10707
Description ID	12053	12054	12055	12056	12057	12058	12059	12060

Table 46: Flag parameter IDs (1 to 8)

Flag {x}	Flag 9	Flag 10	Flag 11	Flag 12	Flag 13	Flag 14	Flag 15	Flag 16
Parameter ID	12910	12911	12912	12913	12914	12915	12916	12917
Result ID	11609	11610	11611	11612	11613	11614	11615	11616
Description ID	12061	12062	12063	12064	12065	12066	12067	12068

Table 47: Flag parameter IDs (9 to 16)

Flag {x}	Flag 17	Flag 18	Flag 19	Flag 20	Flag 21	Flag 22	Flag 23	Flag 24
Parameter ID	12231	12233	12235	12237	12241	12243	12245	12247
Result ID	12232	12234	12236	12238	12242	12244	12246	12248
Description ID	12069	12070	12071	12072	12073	12074	12075	12076

Table 48: Flag parameter IDs (17 to 24)

Flag {x}	Flag 25	Flag 26	Flag 27	Flag 28	Flag 29	Flag 30	Flag 31	Flag 32
Parameter ID	12251	12253	12255	12257	12261	12263	12265	12267
Result ID	12252	12254	12256	12258	12262	12264	12266	12268
Description ID	12077	12078	12079	12080	12081	12082	12083	12084

Table 49: Flag parameter IDs (25 to 32)

ID	Parameter	CL	Setting range **[Default]**	Description
Parameter ID	**Flag {x}**	2	Determined by LogicsManager {XX.XX} **[(0 & 1) & 1]** = {nnnnn}	The flags may be used as auxiliary flags for complex combinations by using the logical output of these flags as command variable for other logical outputs. **Notes**

ID	Parameter	CL	Setting range [Default]	Description
				Flag 1 is also used as placeholder in other logical combinations. Flag 8 is preset with a timer start and shows different default values. {XX.XX} is a placeholder for the LogicsManager number {nnnnn} is a placeholder for the parameter ID of the logical output of the LogicsManager equation
Description ID	**Description {1 - 32}**	2	user-defined (up 22 to characters) **[LM Internal Value {1 - 32}]**	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.

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

4.8.2 Configure LSx Flags

Each LS-6XT has five special flags ("Flag 1 LSx" to "Flag 5 LSx") which can be defined via LogicsManager. They are transmitted via the load share interface. These flags **Layer 1** (26.01 to 27.80) or **Layer 3** (47.01 to 50.80) are received by the other LS-6XT and easYgen devices and 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}	**Flag {x} LSx**	2	Determined by LogicsManager **[(0 & 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 50.

Flag {x} LSx	Flag 1 LSx	Flag 2 LSx	Flag 3 LSx	Flag 4 LSx	Flag 5 LSx
Parameter ID {yyyyy}	12952	12953	12954	12955	12956

Table 50: LS-6XT flag parameter IDs

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

4.8.3 Configure LEDs

Each LS-6XT 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 LS-6XT to control the LEDs.

The LED {x} LogicsManagers are available via HMI and ToolKit even if the menu tree (location) is different.

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 51.

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 51: LED flag parameter IDs

4.8.4 Set Timers

Utilizing the LogicsManager it is possible to establish specific times of the day, days, hours, minutes or seconds that functions can be enabled.

Logic command variables	Function
11.01 Timer 1	TRUE if Timer 1 overrun.
11.02 Timer 2	TRUE if Timer 2 overrun.
11.03 Active weekday	TRUE if configured weekday is active.
11.04 Active day	TRUE if configured day in month is active.
11.05 Active hour	TRUE if configured hour is active.
11.06 Active minute	TRUE if configured minute is active.
11.07 Active second	TRUE if configured second is active.

Daily time setpoints - Timer 1/2

Utilizing the LogicsManager it is possible to establish specific times of the day that functions (i.e. generator exerciser) can be enabled.

The two daily time setpoints are activated each day at the configured time and last until the end of the day. Using the LogicsManager these setpoints may be configured individually or combined to create a time range.

Active time setpoints

Utilizing the LogicsManager it is possible to establish specific days (or hours, minutes, seconds) that functions (i.e. generator exerciser) can be enabled. The active switching point is activated only on a specified day (or hour, minute, second).

The setpoints may be configured individually or combined via the LogicsManager. You may configure monthly, daily, hourly, minutely, or even secondly time setpoints depending on how you combine the setpoints in the LogicsManager.

Weekly time setpoint

Utilizing the LogicsManager it is possible to establish specific days of the week that functions (i.e. generator exerciser) can be enabled.

The weekly time setpoint is enabled during the indicated day from 0:00:00 hours to 23:59:59 hours.

Daily time setpoints - Timer 1/2

ID	Parameter	CL	Setting range [Default]	Description
1652 1657	**Timer {x}: Hour**	2	0 to 23 h 1652: **[8 h]** 1657: **[17 h]**	Enter the hour of the daily time setpoint here. **Example** • 0 = 0th hour of the day (midnight). • 23 = 23rd hour of the day (11pm).

ID	Parameter	CL	Setting range [Default]	Description
1651 1656	**Timer {x}: Minute**	2	0 to 59 min **[0 min]**	Enter the minute of the daily time setpoint here. **Example** • 0 = 0th minute of the hour. • 59 = 59th minute of the hour.
1650 1655	**Timer {x}: Second**	2	0 to 59 s **[0 s]**	Enter the second of the daily time setpoint here. **Example** • 0 = 0th second of the minute. • 59 = 59th second of the minute.

Active time setpoints

ID	Parameter	CL	Setting range [Default]	Description
1663	**Active day**	2	Day 1 to 31 **[1]**	Enter the day of the active switch point here. The active time setpoint is enabled during the indicated day from 0:00:00 hours to 23:59:59 hours. **Example** • 01 = 1st day of the month. • 31 = 31st day of the month.
1662	**Active hour**	2	0 to 23 h **[12 h]**	Enter the hour of the active switch point here. The active time setpoint is enabled every day during the indicated hour from minute 0 to minute 59. **Example** • 0 = 0th hour of the day. • 23 = 23rd hour of the day.
1661	**Active minute**	2	0 to 59 min **[0 min]**	Enter the minute of the active switch point here. The active time setpoint is enabled every hour during the indicated minute from second 0 to second 59. **Example** • 0 = 0th minute of the hour. • 59 = 59th minute of the hour.
1660	**Active second**	2	0 to 59 s	Enter the second of the active switch point here.

ID	Parameter	CL	Setting range [Default]	Description
			[0 s]	The active time setpoint is enabled every minute during the indicated second. **Example** • 0 = 0th second of the minute. • 59 = 59th second of the minute.

Weekly time setpoint - active week days

Please select each of the active weekdays.

ID	Parameter	CL	Setting range [Default]	Description
1670	**Monday active**	2	**[Yes]**	The switch point is enabled every Monday.
			No	The switch point is disabled every Monday.
1671	**Tuesday active**	2	**[Yes]**	The switch point is enabled every Tuesday.
			No	The switch point is disabled every Tuesday.
1672	**Wednesday active**	2	**[Yes]**	The switch point is enabled every Wednesday.
			No	The switch point is disabled every Wednesday.
1673	**Thursday active**	2	**[Yes]**	The switch point is enabled every Thursday.
			No	The switch point is disabled every Thursday.
1674	**Friday active**	2	**[Yes]**	The switch point is enabled every Friday.
			No	The switch point is disabled every Friday.
1675	**Saturday active**	2	Yes	The switch point is enabled every Saturday.
			[No]	The switch point is disabled every Saturday.
1676	**Sunday active**	2	Yes	The switch point is enabled every Sunday.

ID	Parameter	CL	Setting range [Default]	Description
			[No]	The switch point is disabled every Sunday.

4.9 Configure AnalogManager

4.9.1 Operations

An AnalogManager (AM) is a flexible 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 Type the AM takes up to two analog inputs and eventually one analog constant to calculate the result. Additionally up to two digital inputs are considered to control the process. The internal logic of the selected Type defines the boolean output 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 “4.9.2 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.

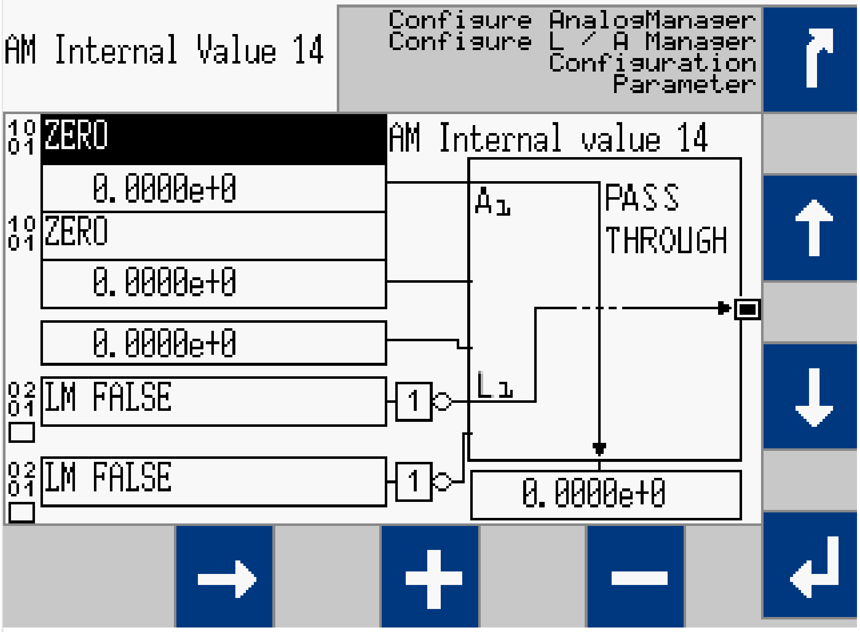


Fig. 138: Display (HMI) AM14

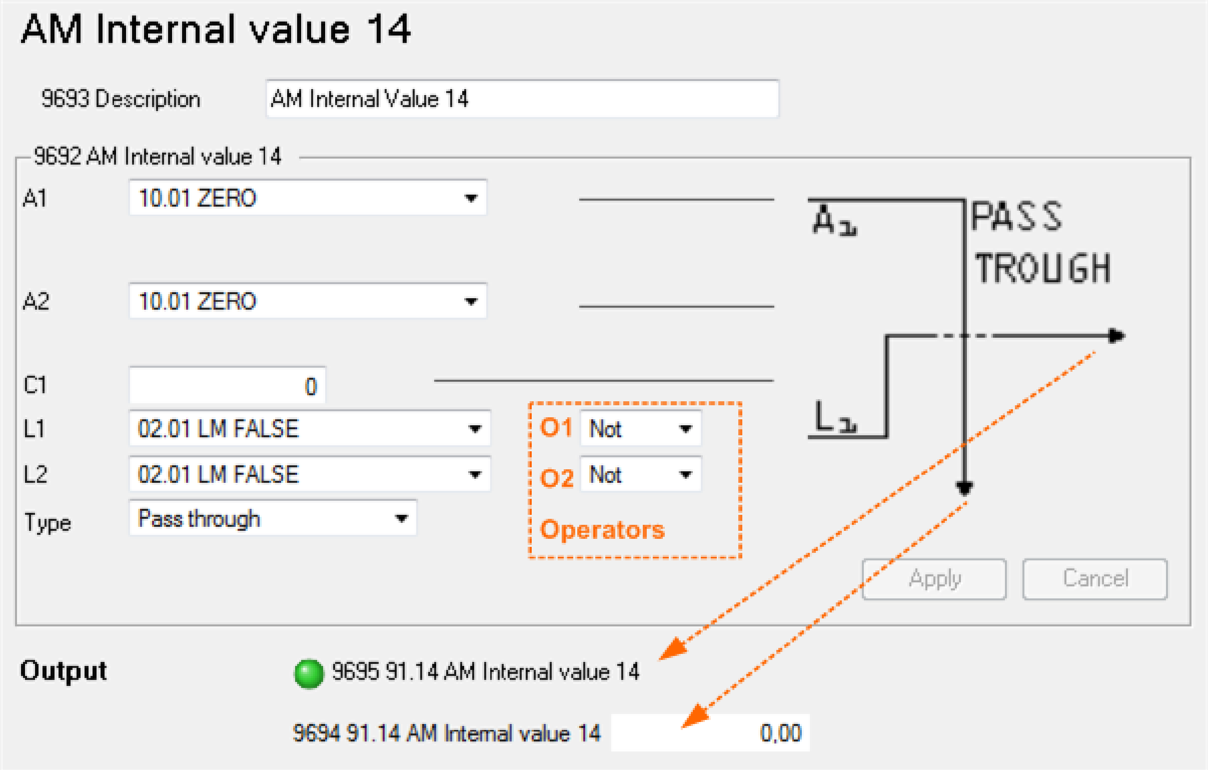


Fig. 139: ToolKit AM14

*) 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 HMI, 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 HMI, ToolKit, or other (remote) interface
O2	Operator 2 (Operators-Unary 2)	selected via HMI, ToolKit, or other (remote) interface
Type	AnalogManager type (operation)	selected via HMI, ToolKit, or other (remote) interface
BR	Boolean result	result/output of the boolean operation **Notes**

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	Value 1	Value 2	Value 3	Value 4	Value 5	Value 6	Value 7	Value 8
Parameter ID	9640	9644	9648	9652	9656	9660	9664	9668
Description ID	9641	9645	9649	9653	9657	9661	9665	9669
Analog Result ID	9642	9646	9650	9654	9658	9662	9666	9670
Logical Result ID	9643	9647	9651	9655	9659	9663	9667	9671

Table 52: Internal Values parameter IDs (1 to 8)

Value	Value 9	Value 10	Value 11	Value 12	Value 13	Value 14	Value 15	Value 16
Parameter ID	9672	9676	9680	9684	9688	9692	9696	9700
Description ID	9673	9677	9681	9685	9689	9683	9697	9701
Analog Result ID	9674	9678	9682	9686	9690	9684	9698	9702
Logical Result ID	9675	9679	9683	9687	9691	9685	9699	9703

Table 53: 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
Parameter ID	**AM Internal value 1 {1 - 16}**	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.
Description ID	**Description {1 - 16}**	2	user-defined (up 22 to characters) **[AM Internal value 1 {1 - 16}]**	The text may have 0 through 22 characters. **Notes**

ID	Parameter	CL	Setting range [Default]	Description
				This parameter may only be configured using ToolKit. The max. number of characters depends on the numbers of bytes for each character. Please verify the length on the display for best view.

The analog and logic results can be used via analog variables “91.01 AM Internal value 1” - “91.16 AM Internal value 16” and via command “91.01 AM Internal value 1” - “91.16 AM Internal value 16”.

Examples

Calculating with an AnalogManager

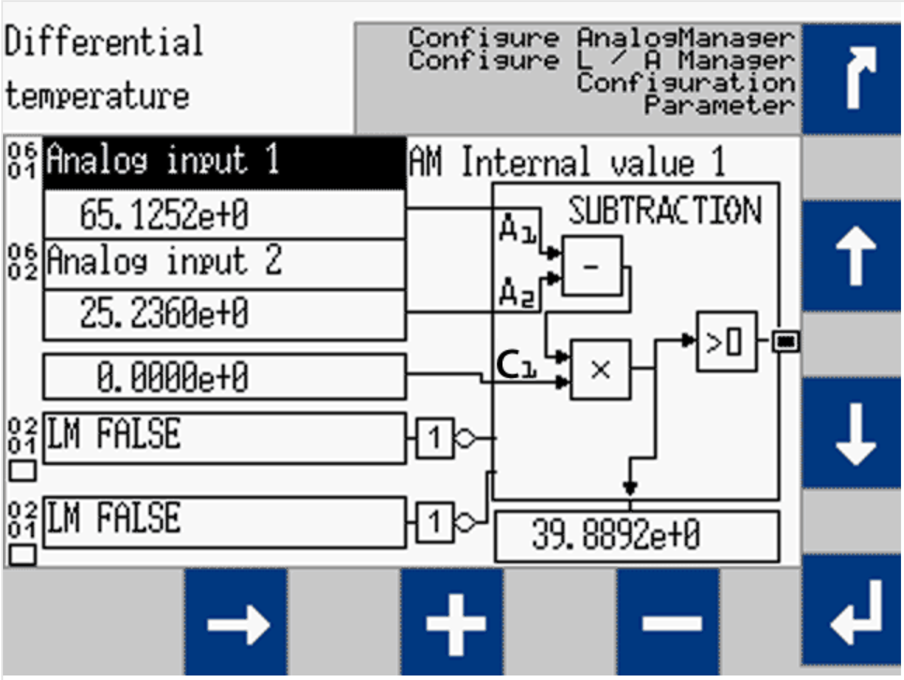


Fig. 140: screen shot HMI: AM subtraction sample

Acronym	Name	Value	
A1	Analog input 1	Number:	06.01
		Name:	Analog Input 1
		Value:	65.1252
A2	Analog input 2	Number:	06.02
		Name:	Analog Input 2
		Value:	25.2360
C1	Analog constant input	Value:	0
L1	Boolean input 1	Number:	02.01
		Name:	LM FALSE
		Value:	0
L2	Boolean input 2	Number:	02.01
		Name:	LM FALSE
		Value:	0
O1	Operator 1	NOT [input will be inverted]	
O2	Operator 2	NOT [input will be inverted]	
Type	Operation type	SUBTRACTION	
BR	Boolean result	(A1 - A2) x C1 > 0 (available as boolean result »91.01 AM Internal value 1«)	
AR	Analog result	(A1 - A2) x C1 (available as analog result »91.01 AM Internal value 1«)	

Incrementing and comparing with an AnalogManager

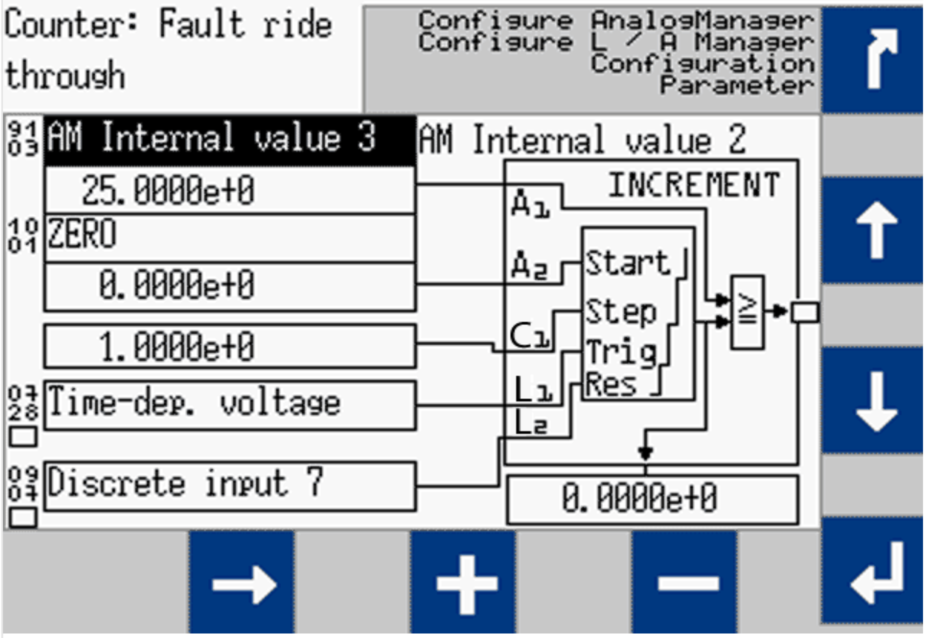
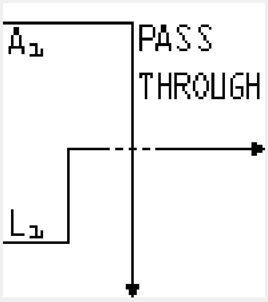
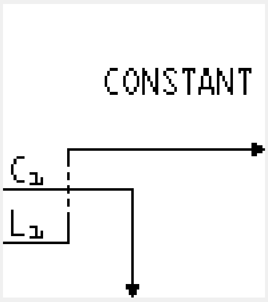
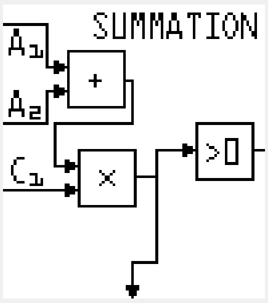
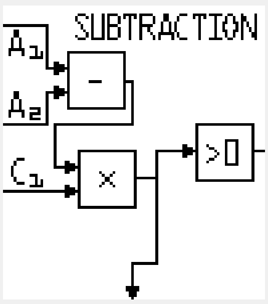


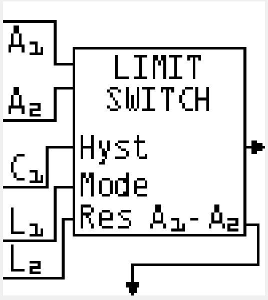
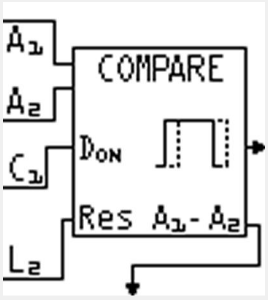
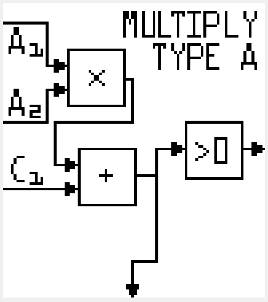
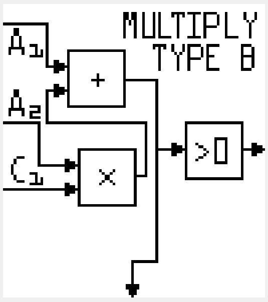
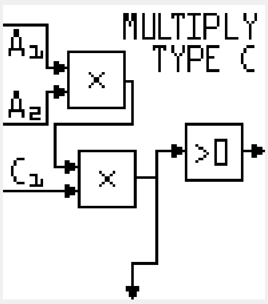
Fig. 141: screen shot HMI: AM increment sample

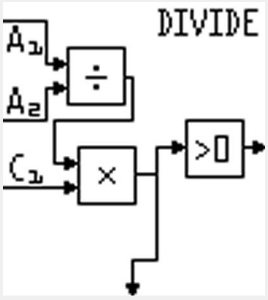
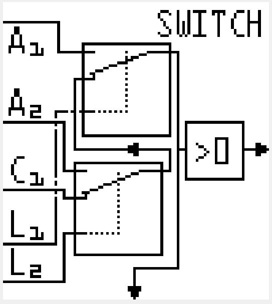
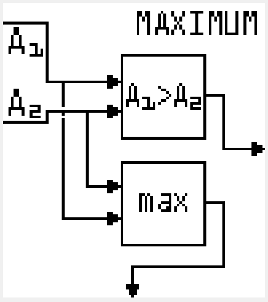
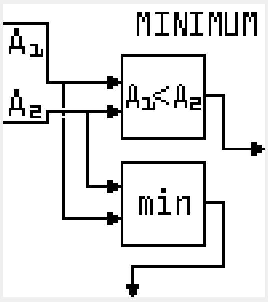
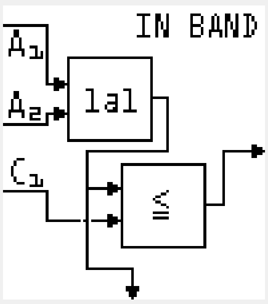
Acronym	Name	Value	
A1	Analog input 1	Number:	91.03
		Name:	Internal value 3
		Value:	25.0000
A2	Analog input 2	Number:	10.01
		Name:	ZERO
		Value:	0
C1	Analog constant input	Value:	1.000
L1	Boolean input 1	Number:	07.28
		Name:	Time dependent voltage
		Value:	Result of LM 07.28
L2	Boolean input 2	Number:	09.07
		Name:	Discrete input 7
		Value:	Result of LM 09.07
O1	Operator 1	L1 [passed]	
O2	Operator 2	L2 [passed]	
Type	Operation type	INCREMENT	
BR	Boolean result	A1≧ A2 + (n[L1] x C1)* *) Reset if L2 = TRUE (available as boolean result »91.02 AM Internal value 2«)	
AR	Analog result	A2 + (n[L1] x C1)* *) Reset if L2 = TRUE (available as analog result »91.02 AM Internal value 2«)	

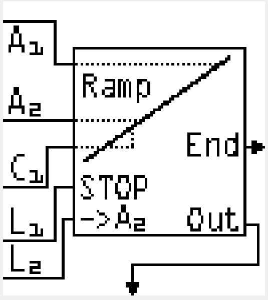
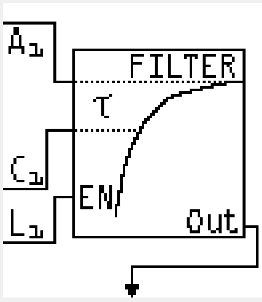
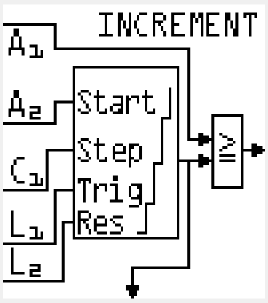
The following AnalogManager operations are available:

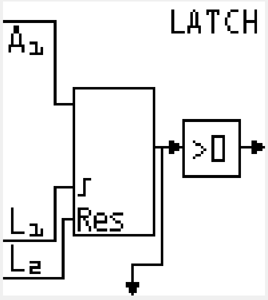
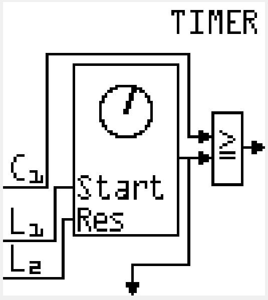
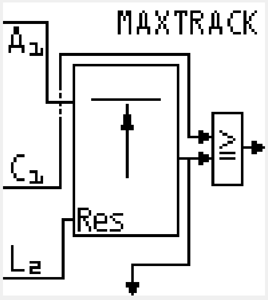
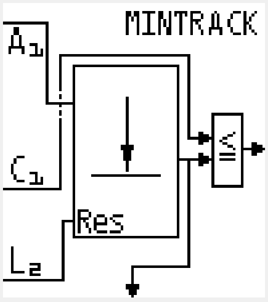
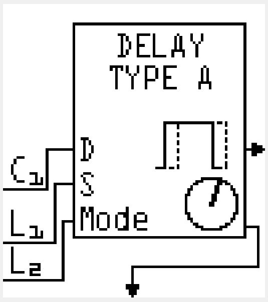
> ***New AnalogManager "Type" selected? Then: ...***
>
> Please be aware that the input values stay "as is" (are NOT changed) if a new Type is selected. Check all input settings A1, A2, C1, L1, L2, O1, O2 before applying!
>
> **Example:**
>
> If A2 = 0 and you select Type "Divide", you would ask the AnalogManager to divide by zero!

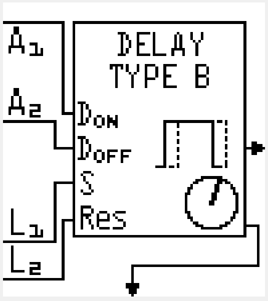
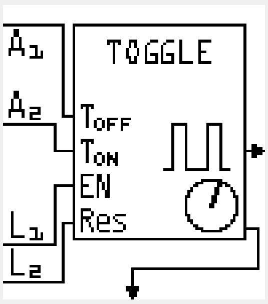
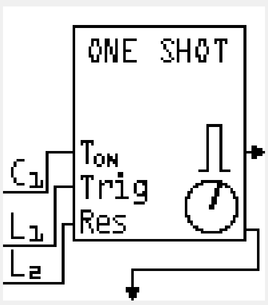
AnalogManager Operation (Type)	Bitmap	Function (Output)
Pass through		Analog Result = A1 Boolean Result = L1
Constant		Analog Result = C1 Boolean Result = L1
Summation		Analog Result = (A1 + A2) * C1 Boolean Result goes TRUE, if Analog Result > 0
Subtraction		Analog Result = (A1 - A2) * C1 Boolean Result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

AnalogManager Operation (Type)	Bitmap	Function (Output)
Limit Switch		Analog Result = (A1 - A2) **L1 = FALSE -> Overrun mode**: Boolean Result goes TRUE, if A1 > A2 Boolean Result goes FALSE, if A1 <= (A2 - C1) **L1 = TRUE -> Underrun mode**: Boolean Result goes TRUE, if A1 < A2 Boolean Result goes FALSE, if A1 >= (A2 + C1) C1 = Hysteresis L1 = TRUE = Underrun mode, otherwise Overrun mode L2 = Resets Hysteresis.
Compare with Delay On		Analog Result = (A1 - A2) Boolean Result goes TRUE, if A1 > A2 for the duration of C1 time [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
Multiply type C		Analog Result = A1 * A2 * C1 Boolean Result goes TRUE, if Analog Result > 0

AnalogManager Operation (Type)	Bitmap	Function (Output)
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
In Band		Analog Result = ABS(A1 - A2) Boolean Result goes TRUE, if (ABS(A1 - A2) <= C1) C1 = maximum tolerance for being "in band"

AnalogManager Operation (Type)	Bitmap	Function (Output)
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)
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

AnalogManager Operation (Type)	Bitmap	Function (Output)
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.
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)

AnalogManager Operation (Type)	Bitmap	Function (Output)
		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.
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.

4.9.2 AnalogManager Constants

General note

For even more flexibility and use of "self explaining" parameters 16 constants can be defined. These constants are available as AnalogManager input AM 13.01 to AM 13.16. Each parameter can be named individually and its value can be defined in a wide range:

AnalogManager Constants 1 to 16

AnalogManager values may be used for multiple functions.

AM Constant #	1	2	3	4	5	6	7	8
Description	15567	15568	15569	15570	15571	15572	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 54: 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 55: 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	Preset value to be used as AM 13.yy.

ID	Parameter	CL	Setting range [Default]	Description
			[1]	

4.10 Configure Counters

ID	Parameter	CL	Setting range [Default]	Description
2521	**Syst.A pos.act.energy preset**	2	0 to 999,999.00 MWh **[0.00 MWh]**	This value is utilized to set the following counters: • MWh counter The number entered into this parameter is the number that will be set to the parameter listed below when enabled.
2510	**Set Syst.A act.energy 0.00MWh**	2	Yes	The current value of this counter is overwritten with the value configured in "Syst.A pos.act.energy preset" (parameter 2521). After the counter has been (re)set, this parameter changes back to "No" automatically.
			[No]	The value of this counter is not changed.
				Example • The counter value preset (parameter 2521) is configured to "3456". • If this parameter is set to "Yes", the "System A positive active energy" counter will be set to 34.56 MWh.
2525	**Syst.A neg.act.energy preset**	2	0 to 999,999.00 MWh **[0.00 MWh]**	This value is utilized to set the following counters: • MWh counter The number entered into this parameter is the number that will be set to the parameter listed below when enabled.
2512	**Set Syst.A -act.en. 0.00MWh**	2	Yes	The current value of this counter is overwritten with the value configured in "Syst.A neg.act.energy preset" (parameter 2525). After the counter has been (re)set, this parameter changes back to "No" automatically.
			[No]	The value of this counter is not changed.
				Example

ID	Parameter	CL	Setting range [Default]	Description
				• The counter value preset (parameter ⮩ 2525) is configured to "3456". • If this parameter is set to "Yes", the "System A negative active energy" counter will be set to 34.56 MWh.
2523	**Syst.A pos.react.energy preset**	2	0 to 999,999.00 Mvarh **[0.00 Mvarh]**	This value is utilized to set the following counters: • Mvarh counter The number entered into this parameter is the number that will be set to the parameter listed below when enabled.
2511	**Set Syst.A react.en. 0.00Mvarh**	2	Yes	The current value of this counter is overwritten with the value configured in "SyA. reactive energy preset" (parameter ⮩ 2523). After the counter has been (re)set, this parameter changes back to "No" automatically.
			[No]	The value of this counter is not changed.
				Example • The counter value preset (parameter ⮩ 2523) is configured to "3456". • If this parameter is set to "Yes", the "System A positive reactive energy" counter will be set to 34.56 Mvarh.
2527	**Syst.A neg.react.energy preset**	2	0 to 999,999.00 Mvarh **[0.00 Mvarh]**	This value is utilized to set the following counters: • Mvarh counter The number entered into this parameter is the number that will be set to the parameters listed below when enabled.
2513	**Set Syst.A -react.en.0.00Mvarh**	2	Yes	The current value of this counter is overwritten with the value configured in "SyA. -reactive energy preset" (parameter ⮩ 2527). After the counter has been (re)set, this parameter changes back to "No" automatically.
			[No]	The value of this counter is not changed.
				Example • The counter value preset (parameter ⮩ 2527) is configured to "3456". • If this parameter is set to "Yes", the "System A negative reactive

ID	Parameter	CL	Setting range [Default]	Description
				energy" counter will be set to 34.56 Mvarh.
2541	**CBA number of closures preset**	2	0 to 65535 **[0]**	This parameter defines the number of times the control unit registers a CBA closure. The number entered here will overwrite the current displayed value after confirming with parameter ⮑ 2542.
2542	**CBA Set number of closures**	2	Yes	The current value of the CBA close counter is overwritten with the value configured in "CBA number of closures preset". After the counter has been (re)set, this parameter changes back to "No" automatically.
			[No]	The value of this counter is not changed.

The following parameter are **only** applicable for breaker mode **"CBA/CBB"** (parameter ⮑ 9018)

ID	Parameter	CL	Setting range [Default]	Description
2548	**CBB number of closures preset**	2	0 to 65535 **[0]**	This parameter defines the number of times the control unit registers a CBB closure. The number entered here will overwrite the current displayed value after confirming with parameter ⮑ 2549.
2549	**CBB Set number of closures**	2	Yes	The current value of the CBB close counter is overwritten with the value configured in "CBB number of closures preset". After the counter has been (re)set, this parameter changes back to "No" automatically.
			[No]	The value of this counter is not changed.

5 Operation

5.1 Power ON

Behavior during starting LS-6XT

The start-up procedure of the LS-6XT 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« ⮡ Fig. 2 .

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 LS-6XT 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 LS-6XT finished starting.

With power cycle or reboot of the LS-6XT the USB connection is lost: Please unplug/plug and/or start USB connection again after the LS-6XT 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

5.2 Change Operating Modes

Startup

The LS-6XT starts in the operating mode defined by parameter ⮡ 8827 »Startup in mode«. Refer to ⮡ "4.4.4 Configure Operation Modes" for details.

Select Operation Mode

Operation modes can be selected via

- front panel buttons (Remote Panel RP-3000XT or VNC client),
- HMI configuration (Remote Panel RP-3000XT or VNC client),

- remote settings via interfaces, or
- ToolKit

5.2.1 Operating Mode MANUAL

General usage

In the MANUAL operating mode (mode button »MAN«) the power circuit breaker can be operated via the push buttons along the bottom of the display (softkeys) ⮡ Fig. 142.

NOTICE!

The MANUAL mode is not possilbe in application mode "L-MCB" **A03**, "L-GGB" **A04** and "L-GGBMCB" **A05**

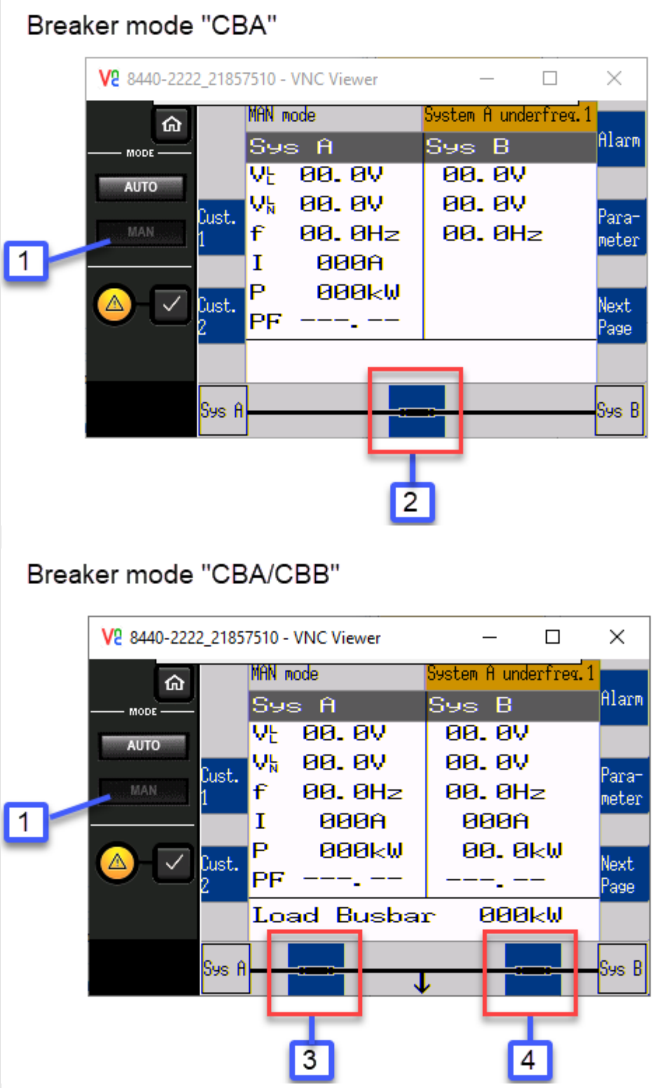


Fig. 142: LS-6XT_MAN-buttons

1	Mode button: MAN
2, 3 and 4	Soft buttons: Breaker OPEN/CLOSE

NOTICE!

The breakers will open immediately without power reduction.

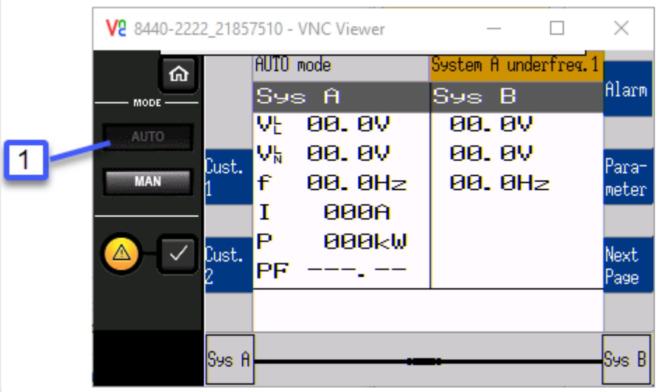
Use the mode button »MAN« to activate operating mode MANUAL.

5.2.2 Operating Mode AUTOMATIC

General usage

In the AUTOMATIC operating mode (»AUTO«), all CBA, and/or CBB functions are operated via an interface, or automatically by the control unit.

Breaker mode "CBA"



Breaker mode "CBA/CBB"

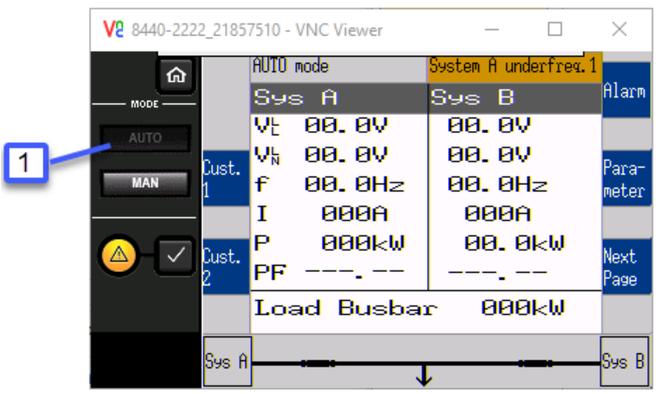


Fig. 143: LS-6XT_AUTO mode

1 Mode button: AUTO

The function of the LS-6XT depends on the configuration of the unit and how the external signals are used.

Use the mode button »AUTO« to activate operating mode AUTOMATIC.

5.3 Restore Language Setting via HMI, Buttons and Softkeys

> In order to change the language setting via HMI, press the (soft)keys in the following order:

Language parameter is on code level "0", so the instruction will work with each code level.

1. Press button »HOME« once to return to the start screen
2. Press softkey »Parameter«
3. Press softkey »Configure language / clock«
4. Press softkey »Confirm Input« ↲ to edit the language setting
5. Press softkeys »Increase Value« + or »Decrease Value« − to select the desired language.
6. Press softkey »Confirm Input« ↲ to commit the language setting.

▶ The desired display language is restored.

6 Application Field

6.1 Application Layers

6.1.1 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 handles this group as a big generator to the load bus bar and shares load across all other groups. Maximum 16 GC 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. 144.

For applications without GC there is only one Layer (Layer 1) in the system.

A LS-6XT device can operate in Layer 1 and Layer 3 but needs to be configured accordingly, see application layer parameter ⮱▷ 8990.

LS-6XT devices configured to Layer 1 does not communicate with LS-6XT devices configured to Layer 3

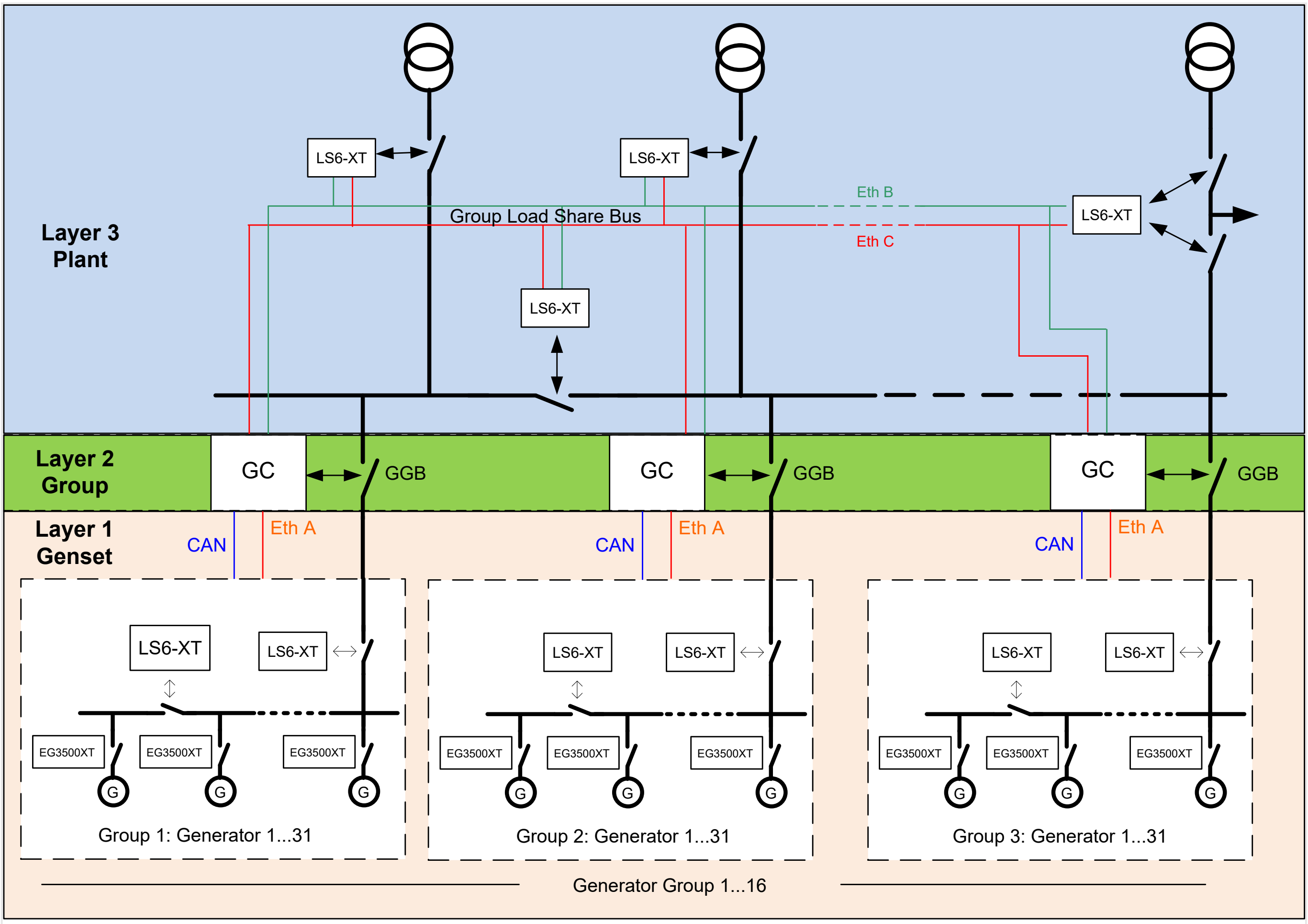


Fig. 144: Example overview layers in an application with GC

Figure ⮱▷ Fig. 144 shows an example of the three different Layers:

- Layer 1 with the generators, easYgens, GCBs and LS-6XT Layer 1
- Layer 2 with the Group Controllers
- Layer 3 with the load bus bar with GC and LS-6XT Layer 3

A GC 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 1

In a system without Group Controller:

A LS-6XT device configured for Layer 1 communicates with all other LS-6XT devices configured to Layer 1 and to all easYgens, according to the Load Share Interface ⮱▷ 9924.

For a none GC application a LS-6XT needs to be configured always to Layer 1

In a system with Group Controller:

A LS-6XT device configured for Layer 1 communicates with all other LS-6XT devices configured to Layer 1 and to all easYgens in the same group, according to the Load Share Interface parameter ⮱▷ 9924. Additional to that it communicates with the GC because Layer 1 devices see the GC as easYgens with number 32 and LS-6XT with number 33. The Group Controller also appears in the ⮱▷ “6.6.2 Diagnostic Screens” for the easYgen as 'GC (32)' and for the LSx as 'GC (33).

In a GC system there is no communication between LS-6XT Layer 1 devices of different groups and no communication between LS-6XT Layer 1 and Layer 3 devices

In Layer 1 (with GC) the Load Share Interface parameter ⮱▷ 9924 supports only CAN, Ethernet A or CAN/Ethernet A.

Communication in Layer 3

A Layer 3 is only available if there is a GC in the system.

The LS-6XT device configured to Layer 3 communicates with all other LS-6XT devices configured to Layer 3 and to all Group Controllers, according to the Load Share Interface parameter ⮱▷ 9924.

In Layer 3 the Load Share Interface ⮱ 9924 supports only Ethernet B or Ethernet B/C.

6.2 Application Modes Overview

General notes

The LS-6XT circuit breaker control unit is designed to enable complex power management applications with multiple incoming mains and bus breakers in combination with easYgen-3400XT/3500XT equipped genset controllers.

As long only the CAN bus communication is used (with its restrictions) the LS-6XT can also interact with the easYgen-3400/3500 series in a manner like the LS-5 device does it. This Application chapter handles mainly the combination of easYgen-3400XT/3500XT with the LS-6XT.

This device combination allows to establish various applications. To make the handling for that wide range of applications easier, different preconfigured application modes in the LS-6XT as well in the easYgen-3400XT/3500XT are provided. These application modes are created because some pre-configurations are automatically fixed through the according application modes. The following chapter explains the differentiation of the application modes and there settings.

Not all possible configurations can be explained in detail, but the chapter shall help to guide through the settings according to the mode.

Through the introduction of the alternative breaker control LS-6XT the easYgen configuration and visualization takes the expression LSx instead of LS5 respectively LS-6XT.

This chapter handles the LS-6XT located in layer 1. If the LS-6XT shall be placed in a system with the Woodward Group Controller GC3400XT please refer to the manual of the GC or to probably provided application notes describing Layer 1 / Layer 3 systems.

Breaker mode "CBA" OR “CBA/CBB”

The LS6XT can be configured as one or two breaker device. Refer to ⮱ 9018

Breaker mode “CBA”

The breaker mode “CBA” is required if there is one breaker to open and to close. This allows also to handle optionally the feedback of a nearby located isolation switch for segment handling. In this setting the auxiliary voltage measurement of the LS-6XT is free usable for own purposes.

Breaker mode "CBA/CBB"

The breaker mode “CBA/CBB” is required if there are two breakers with a load output in-between is used. Through the CBA and CBB open and close operation the load can be switched or ramped between two sides respectively two sources. The isolation switch function is not usable in this mode. The measured auxiliary voltage is taken into account, if the Voltage Plausibility Monitor is switched on. Refer to Plausibility Monitor description for more information.

This chapter handles the LS-6XT located in layer 1. If the LS-6XT shall be placed in a system with the Woodward Group Controller GC3400XT please refer to the manual of the GC or to probably provided application notes describing Layer 1 / Layer 3 systems.

6.3 Breaker Mode CBA

For detailed information on the application modes, notes on safety and examples of special applications refer to the following chapters:

The CBA Modes

- Setup Stand-Alone Applications (Mode A01)
- Setup easYgen and slave LSx applications (Mode A03 and A04)
- Setup easYgen and independent Lx applications (Mode A02)

6.3.1 CBA-Mode: Correlating application modes

	LS-6XT (CBA Mode)		**easYgen-3400XT/3500XT**	
	Mode	**Symbol**	**Mode**	**Symbol**
LSx	Single LSx	A01	N/A	N/A
LSx & easYgenXT	LSx with CAN (up to 16 unit) with Ethernet only (up to 32 units)	A02	GCB/LSx	A07
	L-MCB (max. 1 unit)	A03	GCB/L-MCB	A08
			GCB/GGB/L-MCB	A09
	L-GGB (max. 1 unit)	A04	GCB/L-GGB	A10
			GCB/L-GGB/L-MCB	A11

6.3.2 CBA-Mode: Stand-Alone Application Mode

LS-6XT (CBA-Mode)		**easYgen-3400XT/ 3500XT**		
Mode	**Symbol**	**Mode**	**Symbol**	**Function**
Single LSx	A01	None	None	Independent synch check relay mode.

LS-6XT (CBA-Mode)		easYgen-3400XT/ 3500XT		
Mode	**Symbol**	**Mode**	**Symbol**	**Function**
				This application mode provides the following functions: • Handling of CBA (dead bus closure, synchronization, open) initiated by the corresponding command variables or by manual commands. • Measuring and monitoring of system A values (voltage, frequency, phase rotation, current). • Measuring of system B values (voltage, frequency, phase rotation). • Measuring of active and reactive power on system A. • Measuring of phase angle system A to system B. • Interacting as an independent synchronizer for a PLC by communication interface (CANopen, Modbus RTU slave). • Measuring of an auxiliary AC voltage for own purposes.

6.3.3 CBA-Mode: LS-6XT & easYgen-3400XT/3500XT - Common Application Modes

For information on the easYgen genset control unit's application modes refer to the easYgen manual.

6.3.3.1 LSx View

LS-6XT (CBA Mode)		easYgen-3400XT/ 3500XT		
Mode	**Symbol**	**Mode**	**Symbol**	**Function**
LSx	A02	GCB/LSx	A07	Open LSx system, in combination with easYgen-3400XT/3500XT, individually configurable. This application mode provides the following functions: • Handling of CBA (dead bus closure, synchronization, open) initiated by the corresponding command variables or by manual commands. • Measuring and monitoring of system A values (voltage, frequency, phase rotation, current). • Measuring of system B values (voltage, frequency, phase rotation). • Measuring of active and reactive power on system A. • Measuring of phase angle system A to system B. • Recognition of segments within the easYgen / LSx system. • Dead bus arbitration with other easYgen and LSx. • Mains decoupling function in the LSx configurable, for LSx connected with system A at mains.
L-MCB	A03	GCB/L-MCB	A08	LSx as MCB control in combination with easYgen-3400XT/3500XT in a fixed application. This application mode provides the following functions: • Handling of a MCB (dead bus closure, synchronization, open) initiated by the easYgen.
		GCB/GGB/L-MCB	A09	

LS-6XT (CBA Mode)		easYgen-3400XT/ 3500XT		
Mode	**Symbol**	**Mode**	**Symbol**	**Function**
				• Measuring and monitoring of system A values, (mains voltage, mains frequency, mains phase rotation, mains current), transferred to easYgen. • Measuring of system B values, (voltage, frequency, phase rotation), transferred to easYgen. • Measuring of mains active and mains reactive power on system A. • Automatic configuration of the relevant parameters. • Mains decoupling function in the LSx configurable.
L-GGB	A04	GCB/L-GGB	A10	LSx as GGB control in combination with easYgen-3400XT/3500XT in a fixed application. This application mode provides the following functions: • Handling of a GGB (dead bus closure, synchronization, open) initiated by the easYgen. • Measuring and monitoring of system A values (load voltage, load frequency, load phase rotation). • Measuring of system B values (generator busbar voltage, -frequency, -phase rotation). • Automatic configuration of the relevant parameters.

6.3.3.2 easYgen-3400XT/3500XT View

easYgen-3400XT/ 3500XT		LS-6XT (CBA Mode)		
Mode	**Symbol**	**Mode**	**Symbol**	**Function**
GCB/LSx	A07	LSx	A02	One or more easYgen in combination with an open LSx system, individually configurable for different application. Multiple isolated and/or mains parallel operation. (for max. possible number of easYgen and LSx see **Notes** below). This application mode provides the following functions: • Handling of the GCB (dead bus closure, synchronization, open) initiated by start command in AUTO or individually in MAN mode. • Measuring and monitoring of generator values (voltage, frequency, phase rotation, current and power). • Measuring of generator busbar values (voltage, frequency). • Indicating of mains values (voltage, frequency) sent from 'Mains'-LSx with the smallest ID in the own segment. • Indicating the sum of active and reactive power sent from all 'Mains'-LSx in the own segment. • Regulating Import/Export power with the sum of active and reactive power sent from all 'Mains'-LSx in the own segment. • The easYgen recognizes through the LSx system the active segment number. • Connection to mains (MCB is closed) is recognized via the LSx system, if one or more “Mains”-LSx are available. • The close and open commands for the single LSx breakers are usually not generated in the easYgen. • Mains voltage and current is usually not connected at the easYgen. • Run-up synchronization, acting on the GCB, is possible.

easYgen-3400XT/ 3500XT		LS-6XT (CBA Mode)		
Mode	Symbol	Mode	Symbol	Function
				Notes The band width of the CAN bus allows to connect up to 32 easYgens in conjunction with up to 16 LSx devices. Theoretically up to 32 LSx are possible, but it requires a reduced number of easYgen devices. The amount of easYgen and LSx together should not exceed 48 devices, but to go sure please discuss the possible risks with your Woodward Sales Support. The band width of the Ethernet bus allows to connect up to 32 easYgens in conjunction with up to 32 LSx devices. If a CAN bus is involved e.g. through using the CAN1/Ethernet A redundancy communication the rules of the CAN communication take place.
GCB/L-MCB	A08	L-MCB	A03	One or more easYgen in combination with one LSx unit, acting on the MCB in a fixed application. Multiple isolated and/or mains parallel operation. The same handling as in the GCB/MCB mode, but the MCB is operated through the LSx. This application mode provides the following functions: • Handling of the GCB (dead bus closure, synchronization, open) initiated by start command in AUTO or individually in MAN mode. • Handling of the MCB (dead bus closure, synchronization, open) in AUTO and MANUAL according to the rules of the GCB/MCB mode. • Measuring and monitoring of generator values (voltage, frequency, phase rotation, current and power) • Measuring of generator busbar values (voltage, frequency) • Indicating of mains values (voltage, frequency, phase angle) sent from the LSx. • Indicating of active and reactive power at the interchange point sent from LSx. • Regulating Import/Export power with active and reactive power sent from LSx. • Mains voltage and current is usually not connected at the easYgen. • The breaker transition mode is considered. • Connection to mains (MCB is closed) is recognized via the LSx. • Run-up synchronization, acting on the GCB, is possible.
GCB/GGB/L-MCB	A09	L-MCB	A03	One or more easYgen, one generator group breaker (GGB) in combination with one LSx unit, acting on the MCB in a fixed application. Multiple isolated and/or mains parallel operation. The same handling as in the GCB/GGB/MCB mode, but the MCB is operated through the LSx. This application mode provides the following functions: • Handling of the GCB (dead bus closure, synchronization, open) initiated by start command in AUTO or individually in MAN mode. • Handling of the GGB (dead bus closure, synchronization, open) initiated by start command in AUTO or individually in MAN mode. • Handling of the MCB (dead bus closure, synchronization, open) in AUTO and MANUAL according to the rules of the GCB/GGB/MCB mode. • Measuring and monitoring of generator values (voltage, frequency, phase rotation, current and power). • Measuring of generator busbar values (voltage, frequency).

easYgen-3400XT/ 3500XT		LS-6XT (CBA Mode)		
Mode	**Symbol**	**Mode**	**Symbol**	**Function**
				• Measuring and monitoring of load busbar values (voltage, frequency, phase rotation, current and power) • Indicating of mains values (voltage, frequency, phase angle) sent from the LSx. • Indicating of active and reactive power at the interchange point sent from LSx. • Regulating Import/Export power with active and reactive power sent from LSx. • Run-up synchronization, acting on the GCB or GCB/GGB, is possible. • The breaker transition mode is considered. • Connection to mains (MCB is closed) is recognized via the LSx.
GCB/L-GGB	A10	L-GGB	A04	One or more easYgen with one LSx unit, acting on the GGB in a fixed application. Only isolated operation. The same handling as in the GCB/GGB mode without mains parallel operation, but the GGB is operated through the LSx. This application mode provides the following functions: • Handling of the GCB (dead bus closure, synchronization, open) initiated by start command in AUTO or individually in MAN mode. • Handling of the GGB (dead bus closure, synchronization, open) initiated by start command in AUTO or individually in MAN mode according to the rules of the GCB/GGB mode. • Measuring and monitoring of generator values (voltage, frequency, phase rotation, current and power). • Measuring of generator busbar values (voltage, frequency). • Run-up synchronization, acting on the GCB or GCB/GGB, is possible.
GCB/L-GGB/L-MCB	A11	L-MCB L-GGB	A03 A04	One or more easYgen with one LSx unit, acting on the GGB and another LSx unit, acting on the MCB in a fixed application. Multiple isolated and/or mains parallel operation. The same handling as in the GCB/GGB/MCB mode, but the GGB and MCB are operated by the LSx. This application mode provides the following functions: • Handling of the GCB (dead bus closure, synchronization, open) initiated by start command in AUTO or individually in MAN mode. • Handling of the GGB (dead bus closure, synchronization, open) initiated by start command in AUTO or individually in MAN mode according to the rule of the GCB/GGB/MCB mode. • Handling of the MCB (dead bus closure, synchronization, open) in AUTO and MANUAL according to the rules of the GCB/GGB/MCB mode. • Measuring and monitoring of generator values (voltage, frequency, phase rotation, current and power). • Measuring of generator busbar values (voltage, frequency) • Indicating of mains values (voltage, frequency, phase angle) sent from the LSx. • Indicating of active and reactive power at the interchange point sent from LSx. • Regulating Import/Export power with active and reactive power sent from LSx.

easYgen-3400XT/ 3500XT		LS-6XT (CBA Mode)		
Mode	**Symbol**	**Mode**	**Symbol**	**Function**
				• Run-up synchronization, acting on the GCB or GCB/GGB, is possible.

6.3.4 CBA-Mode: Setup Stand-Alone Applications (Mode A01)

Overview

The LS-6, configured to application mode A01 'Single LSx', runs as an independent unit and does not expect any other unit on the CAN bus or Ethernet bus.

The idea of this mode is to use the LS-6 as a simple sync check relay controlled by discrete inputs or to run it together with a PLC as a synchronizer. The PLC receives all measurement values (voltages, current, power, phase angle) via communication interface to run closed loop synchronization.

Additionally the LS-6 can be used as a measurement transformer for displaying and monitoring values. The mains decoupling functions (voltage, frequency, change of frequency) can also be used when a parallel mains setup exists.

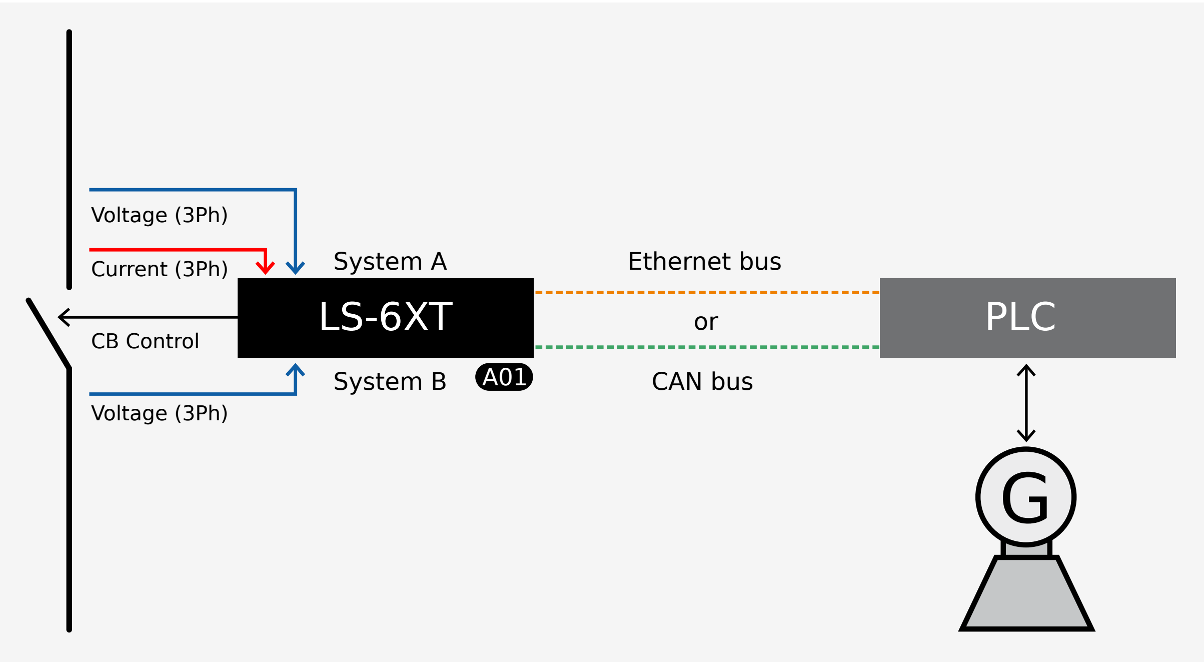


Fig. 145: Application mode A01 'Single LSx'

General notes

NOTICE!

Dead bus interlocking due to incorrect setup

No other LSx or easYgen device is expected on the CAN or Ethernet bus. After power-up the LS-6 can carry out a dead bus closure regardless if other devices are connected to the bus (arbitration time is ignored).

Nevertheless, dead bus interlocking occurs, if the LS-6 detects another device (with higher priority) within 40 seconds after power-up on the CAN or Ethernet bus, which wants to carry out a dead bus closure.

The LS-6 acts as if there is no other LSx in the system.

Prerequisites

- Personnel: Qualified electrician

1. For a mains decoupling function, connect the system A measurement on the mains busbar.
2. Setup the PLC to act as master and to monitor the functionality of the communication interface.

Configure LS-6

- Personnel: User

The following paths a valid for the configuration via HMI. At the configuration via ToolKit the path hierarchy might be different.

1. Configure the application mode ⮡ 9018 of the LS-6 device to CBA mode.
   Set the application mode ⮡ 8840 of the LS-6 to A01 'Single LSx'.
2. To configure measurement navigate to [Configuration / Configure measurement] and enter the desired settings.
3. When tapping voltages over power transformer, phase angle compensation may be required.

   If a phase angle compensation is required, navigate to [Configuration / Configure application / Configure breakers / Configure CBA / Phase angle compensation]

NOTICE!

Component damage

Incorrect settings may cause erratic system behavior and damage to the involved components .

- Set the values carefully and double check with a voltmeter at the according breaker.

4. ▷ If control to open and close the breaker should be handled by discrete inputs, use the default setting according to the wiring diagram (⮱ "3.2.2 Wiring Diagram").

5. ▷ If control to open and close the breaker should be handled by communication interface, the register with the remote control bits is used (LM Command variables 04.44 to 04.59, Bit 1 to Bit 16).
For more information on how to address the according data register refer to ⮱ "7 Interfaces And Protocols".

6. ▷ Configure the breaker close command
   - To configure the close command CBA, the LogicsManager equation "Enable close CBA" can be modified.
     Navigate to [Parameter / Configure application / Configure breakers / Configure CBA / Enable close CBA] and enter the desired arguments.

7. ▷ Configure the breaker open command
   - To configure the open command CBA, the LogicsManager equation "Open CBA immed." can be modified.
     Navigate to [Parameter / Configure application / Configure breakers / Configure CBA / Open CBA immed.] and enter the desired arguments.

   The open command with unloading can only be executed through the LogicsManager equation "Open CBA unload", if the PLC can influence the unloading of the breaker.

8. ▷ If manual operation via push buttons acting on DI is required
   - For the CBA the two LogicsManager equations "Open CBA in manual" and "Close CBA in manual" can be used.
     Set the parameter "Open CBA in manual" to "Immediate".

9. ▷ The LS-6 can be adjusted for different kinds of breaker closure.
Navigate to [Parameter / Configure application / General breakers settings] to configure specific kinds of breaker closure.
Configure "Dead bus closure CBA" to generally handle any kind of dead busbar closure.

10. ▷ The LS-6 can be adjusted for different kinds of breaker closure.
Navigate to [Configuration / Configure application / General breakers settings] to configure specific kinds of breaker closure.
Configure "Dead bus closure CBA" to generally handle any kind of dead busbar closure.

6.3.5 CBA-Mode: Setup easYgen & Slave LSx Applications (Mode A03 & A04)

Introduction

In application modes A03 'L-MCB' and A04 'L-GGB' the LS-6 runs as a slave unit. In these modes the LS-6 is guided by the easYgen and takes over directly the close and open commands coming from the easYgen(s).

No external logic is needed to decide, when the breaker is to open or to close. The operating mode MANUAL in the LS-6 is not supported.

Manual control is provided by the easYgen(s). The isolation switch input of the LS-6 is ignored. The LS-6 sends measuring values and flags to the CAN OR Ethernet bus connected easYgen(s), which are needed for the according application mode.

The application mode determines the fixed segment numbers for system A and B. The LogicsManager for close and open commands are faded out.

General notes

The applications where the LS-6 is configured to A03 and A04 are fixed and can not be varied except for the number of generators, feeding on the generator busbar (max. 32). Other tie-breakers are not allowed.

The LS-6 is expecting at least one easYgen device in the system.

Complex applications may require external close and open logic (via PLC). For these cases the free LSx mode A02 is required.

In application mode A03 and A04 the operating mode MANUAL is not supported in the LS-6.

Predefined applications

The following chapters provide step by step instructions on how to set up the following predefined applications:

- “6.3.5.1 Single or multiple easYgen with one externally operated MCB”
- “6.3.5.2 Multiple easYgen with one GGB and one externally operated MCB”
- “6.3.5.3 Multiple easYgen with one externally operated GGB in isolated operation”
- “6.3.5.4 Multiple easYgen with one externally operated GGB and one externally operated MCB”

6.3.5.1 Single or multiple easYgen with one externally operated MCB

Overview

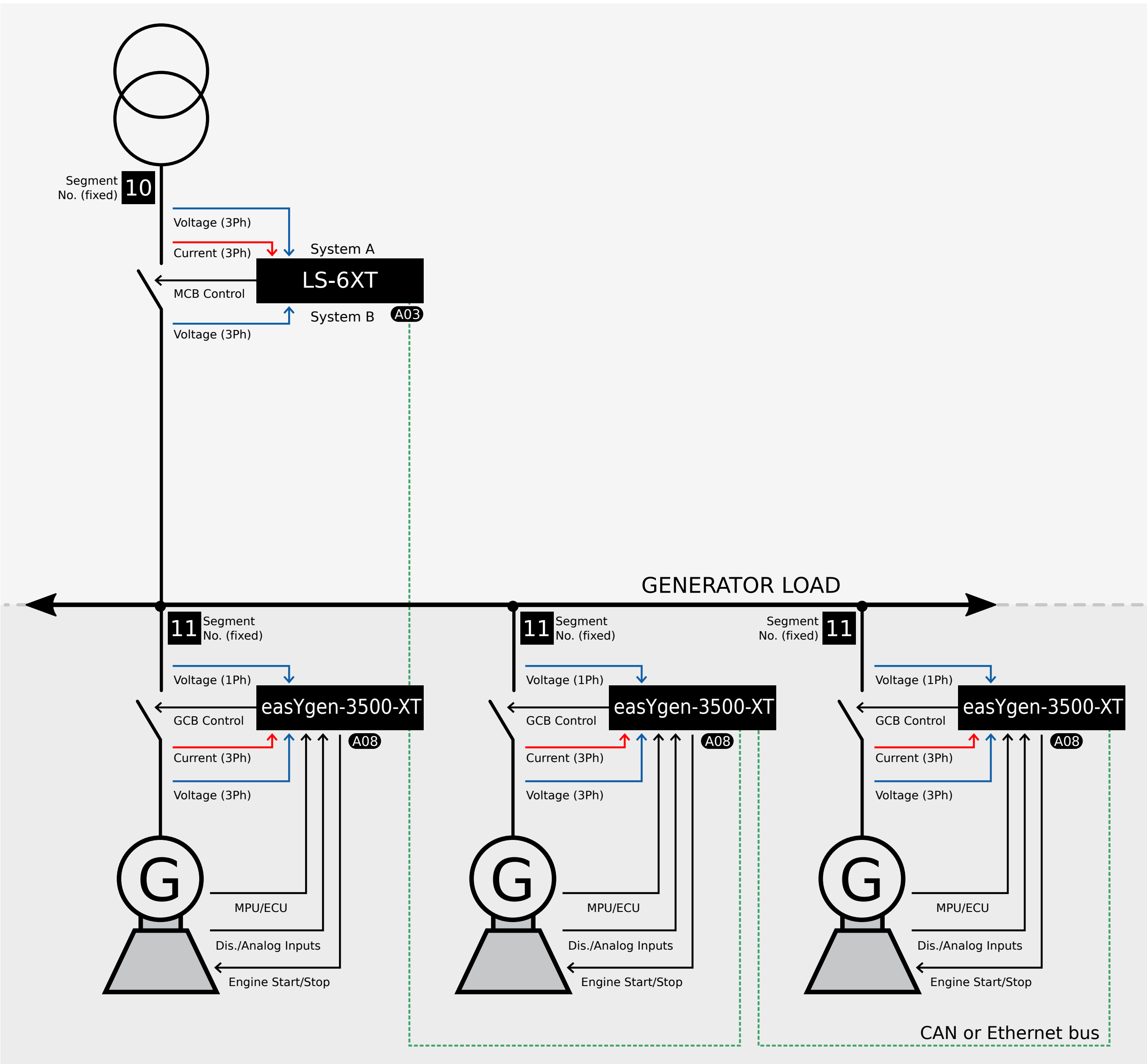


Fig. 146: Single or multiple easYgen with one externally operated MCB

One or more gensets feed on a load busbar. The easYgen(s) close and open their own generator breaker. The LS-6 at the interchange point closes and opens the MCB. All breakers are connected to the same segment; the generator busbar is equal to the load busbar. The easYgen(s) are running the same tasks as in the application mode GCB/MCB with the differentiation, that instead of a direct MCB handling now the LS-6 is taking over that part.

The decision when to close or open the MCB is coming from the easYgen(s) via CAN or Ethernet bus. The manual control on the MCB is restricted on the easYgen(s). If a run-up synchronization is desired, only the mode "with GCB" is supported.

In this setup the mains decoupling is provided by the LS-6.

Required application modes:

- easYgen-3400XT/3500XT: A08 'GCB/L-MCB'
- LS-6: A03 'L-MCB'

General notes

To provide mains decoupling, acting on the GCB, the mains decoupling function of the easYgen must be used.

- Refer to the corresponding chapter of the easYgen manual.

This application setup is predefined and allows for no variations, except the amount of easYgen-3000XT driven generators (up to 32).

- Check whether your application is compatible with the prerequisites listed below.

Prerequisites LS-6

- Personnel: Qualified electrician

1. The system A voltage and current measurement is connected to the mains.
2. The system B voltage measurement is connected to the busbar.
3. The MCB breaker feedback is connected to the LS-6 only.
4. The MCB breaker command(s) are connected to the LS-6 only.
5. Set up the Communication Interface between the devices. Refer to Communication Management “6.6 Communication Management”for more information.

Prerequisites easYgen

- Personnel: Qualified electrician

1. The generator voltage and current measurement is connected to the generator.
2. The busbar voltage measurement is connected to the busbar.
3. The mains voltage measurement is not used.
4. The GCB breaker feedback is connected to the according easYgen.
5. The GCB breaker command(s) are connected to the according easYgen.
6. Set up the Communication Interface between the devices. Refer to Communication Management “6.6 Communication Management”for more information..

Configure LS-6

>

- Personnel: User

1. ▷ Configure the application mode ⮑▷ 9018 of the LS-6 on CBA mode.
2. ▷ Configure the application mode ⮑▷ 8840 of the LS-6 on A03 'L-MCB' .
To configure measurement navigate to [Configuration / Configure measurement] and enter the desired settings.
3. ▷ When tapping voltages over power transformer, phase angle compensation may be required.

If a phase angle compensation is required, navigate to [Configuration / Configure application / Configure breakers / Configure CBA / Phase angle compensation]

NOTICE!

Component damage

Incorrect settings may cause erratic system behavior and damage to the involved components .

- Set the values carefully and double check with a voltmeter at the according breaker.

4. ▷ Configure the breaker close and/or open relay(s) according to your MCB.
5. ▷ Check the synchronization setting, like phase angle, frequency window and voltage.

⚙ **Configure easYgen**

>

- Personnel: User

1. ▷ Configure the application mode (parameter 3444) of each easYgen device to A08 'GCB/L-MCB' .
2. ▷ Configure the measurement for generator and busbar according to the easYgen manual.
3. ▷ The mains measurement is not used in this application mode. Therefore:
   - You should switch off the single mains monitoring functions or you disable mains monitoring generally by the LogicsManager “Disable mains monitoring” (parameter 15159).
   - You should switch off the mains decoupling function by the parameter “Mains decoupling” (parameter 3110).
4. ▷ When tapping voltages over power transformer, phase angle compensation may be required.

If a phase angle compensation is required, navigate to [Parameter / Configuration / Configure Application / Configure Breakers / Configure GCB / Phase angle compensation GCB].

NOTICE!

Component damage

Incorrect settings may cause erratic system behavior and damage to the involved components .

- Set the values carefully and double check with a voltmeter at the according breaker.

5. ▷ For displaying the mains values coming from LS-6 on the Home Page, navigate to parameter "Show mains data" (parameter 4103) and switch to "LSx".

6. ▷ In this setup each easYgen device provides four free usable control bits for sending information to the whole device system in layer 1. These bits can be used as command variables in the LS-6.

One of the bits could for example be used to initiate alarms acknowledgement in the LS-6 or to release the mains decoupling.

Navigate to [Parameter / Configuration / Configure LogicsManager / Configure LSx] to configure the command variables.

6.3.5.2 Multiple easYgen with one GGB and one externally operated MCB

Overview

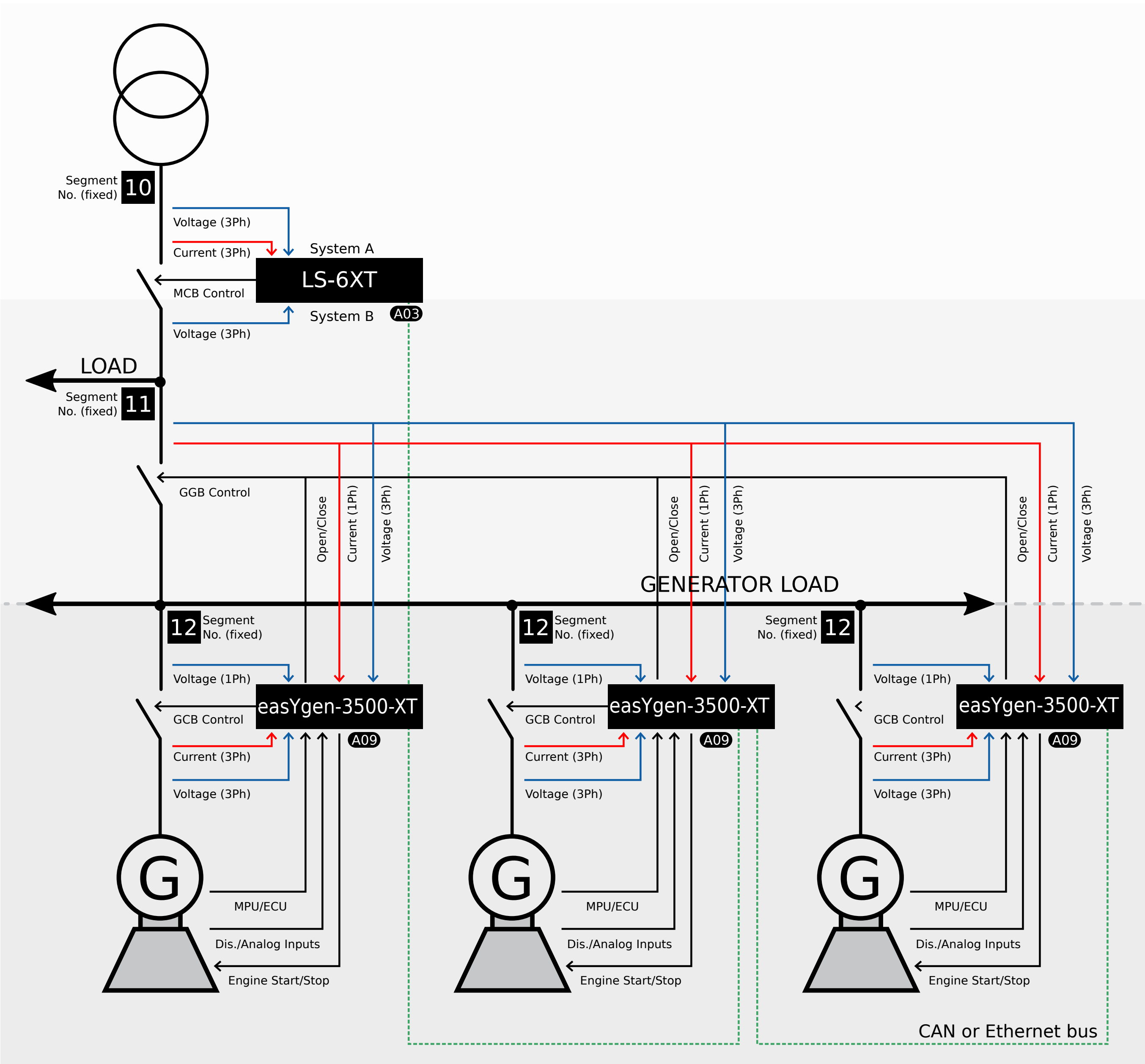


Fig. 147: Multiple easYgen with one GGB and one externally operated MCB

One or more gensets feed on a generator busbar. The easYgen(s) close and open their own generator breaker. The easYgen(s) close and open the common generator group breaker (GGB). The LS-6 at the interchange point closes and opens the MCB.

This application includes a generator busbar and a load busbar and one mains income. The easYgen(s) running the same tasks as in the application mode GCB/GGB/MCB with the differentiation, that instead of a direct MCB handling through the easYgen, the LS-6 controls the MCB.

The decision when to close or open the MCB is coming from the easYgen(s) over the CAN or Ethernet bus. The manual control on the MCB is restricted on the easYgen(s).

If a run-up synchronization is desired, the modes "with GCB" and "with GCB/GGB" are supported. In this setup the mains decoupling is provided by the LS-6.

Required application modes:

- easYgen-3400XT/3500XT: A09 'GCB/GGB/L-MCB'
- LS-6: A03 'L-MCB'

General notes

For information on mains decoupling over GCB refer to the corresponding chapter of the easYgen manual.

The mains measurement of the easYgen(s) are used for the load busbar measurement.

This application setup is predefined and allows for no variations, except the amount of easYgen-3000 or easYgen-3000XT driven generators (up to 32).

- Check whether your application is compatible with the prerequisites listed below.

Prerequisites LS-6

- Personnel: Qualified electrician

1. The system A voltage and current measurement is connected to the mains.
2. The system B voltage measurement is connected to the load busbar.
3. The MCB breaker feedback is connected to the LS-6 only.
4. The MCB breaker command(s) are connected to the LS-6 only.
5. Set up the Communication Interface between the devices. Refer to Communication Management "6.6 Communication Management"for more information.

Prerequisites easYgen

- Personnel: Qualified electrician

1. The generator voltage and current measurement is connected to the generator.
2. The busbar voltage measurement is connected to the generator busbar.
3. The mains voltage measurement is connected to the load busbar.
4. The GGB breaker feedback is connected to all easYgens.
5. The GGB breaker command(s) are connected to all easYgens.

6. ▷ The GCB breaker feedback is connected to the according easYgen.
7. ▷ The GCB breaker command(s) are connected to the according easYgen.
8. ▷ Set up the Communication Interface between the devices. Refer to Communication Management ⮡ "6.6 Communication Management"for more information..

⚙ Configure LS-6

>
- Personnel: User

1. ▷ Configure the application mode ⮡ 8840 of the LS-6 device to A03 'L-MCB' .
2. ▷ To configure measurement navigate to [Configuration / Configure measurement] and enter the desired settings.
3. ▷

> When tapping voltages over power transformer, phase angle compensation may be required.

If a phase angle compensation is required, navigate to [Configuration / Configure application / Configure breakers / Configure CBA / Phase angle compensation]

> **NOTICE!**
>
> ***Component damage***
>
> Incorrect settings may cause erratic system behavior and damage to the involved components .
>
> - Set the values carefully and double check with a voltmeter at the according breaker.

4. ▷ Configure the breaker close and/or open relay(s) according to your MCB.
5. ▷ Check the synchronization settings, like phase angle, frequency window and voltage.

⚙ Configure easYgen

>
- Personnel: User

1. ▷ Configure the application mode (parameter 3444) of each easYgen device to A09 'GCB/GGB/L-MCB' .
2. ▷ Configure the measurement for generator and busbar according to the easYgen manual.
3. ▷ Configure the mains measurement according to the easYgen manual, but in relation to the load busbar voltage.
The mains measurement of the easYgen is only taken for synchronization GGB, operating range consideration and phase rotation check.
All other easYgen mains measurement functions are not used. Therefore:

- You should switch off the single mains monitoring functions or you disable mains monitoring generally by the LogicsManager “Disable mains monitoring” (parameter 15159).
- You should switch off the mains decoupling function by the parameter “Mains decoupling” (parameter 3110).

4. ▷

When tapping voltages over power transformer, phase angle compensation may be required.

If a phase angle compensation over the GCB is required, navigate to [Parameter / Configuration / Configure Application / Configure Breakers / Configure GCB / Phase angle compensation GCB].

NOTICE!

Component damage

Incorrect settings may cause erratic system behavior and damage to the involved components.

- Set the values carefully and double check with a voltmeter at the according breaker.

5. ▷ If a phase angle compensation over the GGB is required, navigate to [MCB phase angle compensation] in ToolKit.

NOTICE!

Component damage

Incorrect settings may cause erratic system behavior and damage to the involved components .

- Set the values carefully and double check with a voltmeter at the according breaker.

6. ▷ To display the mains values coming from LS-6 on the Home Page, navigate to "Show mains data" (parameter 4103) and switch to "LSx".

7. ▷

In this setup each easYgen device provides four free usable control bits for sending information to the whole device system in layer 1. These bits can be used as command variables in the LS-6.

One of the bits could for example be used to initiate alarms acknowledgement in the LS-6.

Navigate to [Parameter / Configuration / Configure LogicsManager / Configure LSx] to configure the command variables.

6.3.5.3 Multiple easYgen with one externally operated GGB in isolated operation

Overview

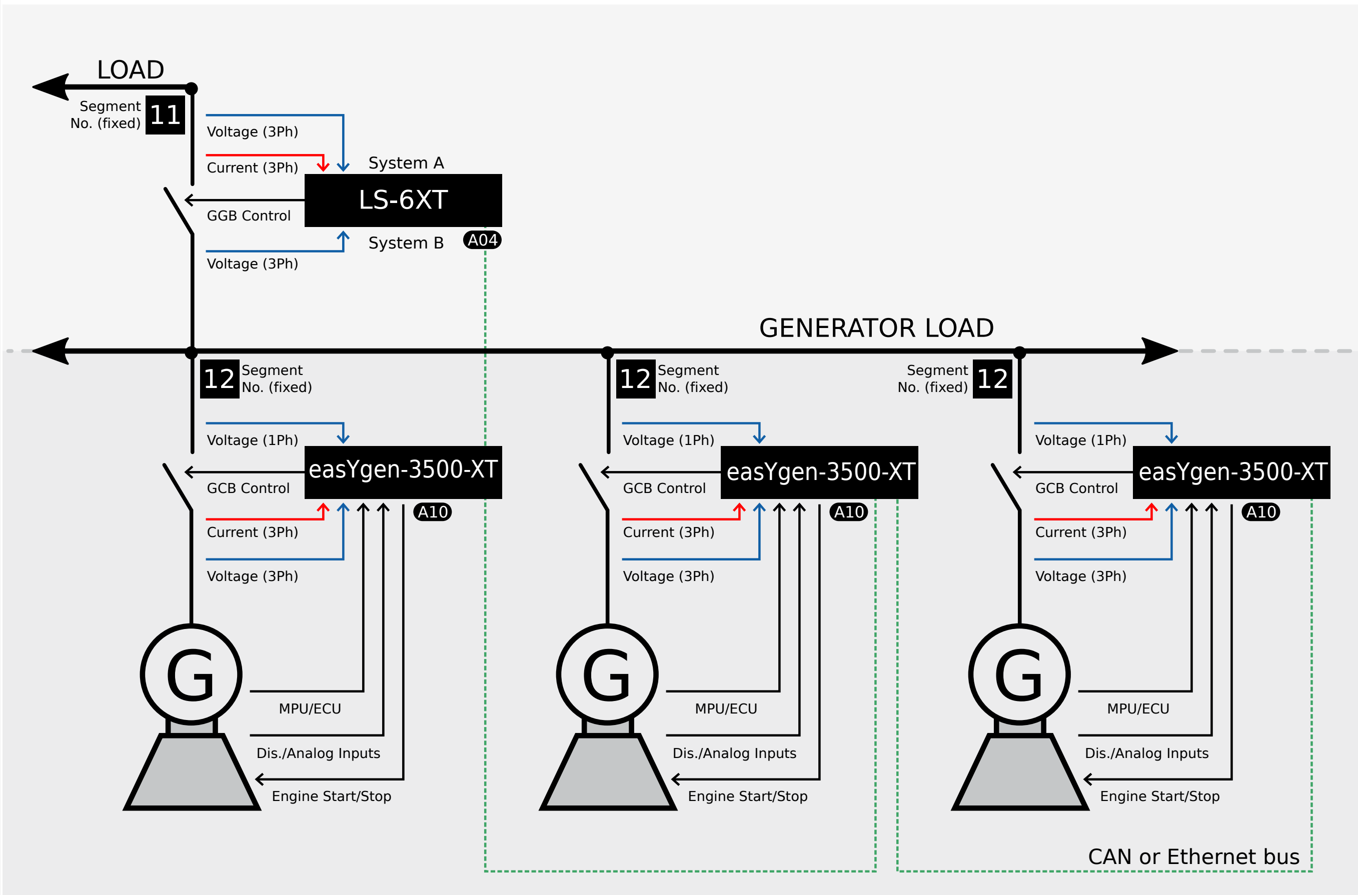


Fig. 148: Multiple easYgen with one externally operated GGB in isolated operation

One or more gensets feed on a generator busbar. The LS-6 over the GGB closes and opens the GGB.

This application includes a generator busbar and a load busbar. The mains is not present. The easYgen(s) running the same tasks as in the application mode GCB/GGB with the differentiation that only isolated operation is allowed and instead of a direct GGB handling through the easYgen, the LS-6 controls the GGB.

The decision when to close or open the GGB is coming from the easYgen(s) over the CAN or Ethernet bus. The manual control on the GGB is restricted on the easYgen(s). If a run-up synchronization is desired, the modes "with GCB" and "with GCB/GGB" are supported.

Required application modes:

- easYgen-3400XT/3500XT: A10 'GCB/L-GGB'
- LS-6: A04 'L-GGB'

General notes

This application setup is predefined and allows for no variations, except the amount of easYgen-3000XT driven generators (up to 32).

- Check whether your application is compatible with the prerequisites listed below.

Before you do any testing go sure that the communication diagnostic in all relevant devices are running without any failure.

Prerequisites LS-6

⚙

- Personnel: Qualified electrician

Ensure the following prerequisites are met:

1. ▷ The system A voltage measurement is connected to the load busbar.
2. ▷ The system B voltage measurement is connected to the generator busbar.
3. ▷ The GGB breaker feedback is connected to the LS-6 only.
4. ▷ The GGB breaker command(s) are connected to the LS-6 only.
5. ▷ Set up the Communication Interface between the devices. Refer to Communication Management ⮡ "6.6 Communication Management"for more information.

Prerequisites easYgen

⚙

- Personnel: Qualified electrician

Ensure the following prerequisites are met:

1. ▷ The generator voltage and current measurement is connected to the generator.
2. ▷ The busbar voltage measurement is connected to the generator busbar.
3. ▷ The mains voltage measurement is not used.
4. ▷ The GCB breaker feedback is connected to the according easYgen.
5. ▷ The GCB breaker command(s) are connected to the according easYgen.
6. ▷ Set up the Communication Interface between the devices. Refer to Communication Management ⮡ "6.6 Communication Management"for more information..

Configure LS-6

⚙

>
- Personnel: User

Configure the following parameters:

1. ▷ Configure the application mode 9018 of the LS-6 on CBA mode.
Configure the application mode 8840 of the LS-6 on A04 'L-GGB' .
2. ▷ To configure measurement navigate to [Configuration / Configure measurement] and enter the desired settings.
3. ▷ Configure the breaker close and/or open relay(s) according to your GGB.

Configure easYgen

⚙

>
- Personnel: User

Configure the following parameters:

1. ▷ Configure the application mode (parameter 3444) of each easYgen device to A10 'GCB/L-GGB' .
2. ▷ Configure the measurement for generator and busbar according to the easYgen manual.
3. ▷ The mains measurement is not used in this application mode. Therefore:
   - You should switch off the single mains monitoring functions or you disable mains monitoring generally by the LogicsManager “Disable mains monitoring” (parameter 15159).
   - You should switch off the mains decoupling function by the parameter “Mains decoupling” (parameter 3110).
4. ▷ When tapping voltages over power transformer, phase angle compensation may be required.

If a phase angle compensation is required, navigate to [Parameter / Configuration / Configure Application / Configure Breakers / Configure GCB / Phase angle compensation GCB].

NOTICE!

Component damage

Incorrect settings may cause erratic system behavior and damage to the involved components .

- Set the values carefully and double check with a voltmeter at the according breaker.

5. ▷

> In this setup each easYgen device provides four free usable control bits for sending information to the whole device system in layer 1. These bits can be used as command variables in the LS-6.
>
> One of the bits could for example be used to initiate alarms acknowledgement in the LS-6 or to release the mains decoupling.

Navigate to [Parameter / Configuration / Configure LogicsManager / Configure LSx] to configure the command variables.

6.3.5.4 Multiple easYgen with one externally operated GGB and one externally operated MCB

Overview

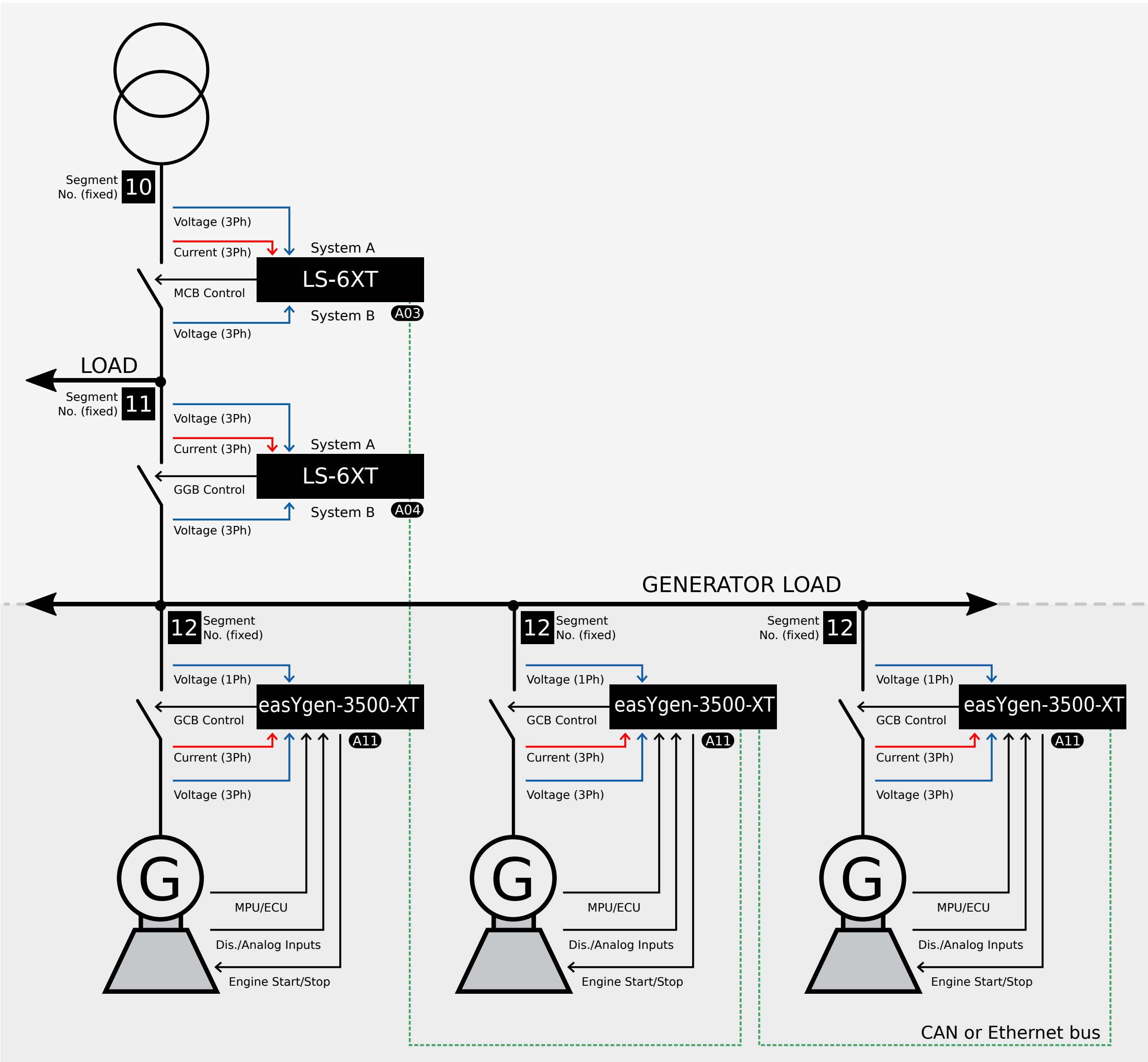


Fig. 149: Multiple easYgen with one externally operated GGB and one externally operated MCB

One or more gensets feed on a generator busbar. The easYgen(s) close and open their own generator breaker. The LS-6 between the generator busbar and load busbar close and open the common generator group breaker (GGB). The LS-6 at the interchange point to the mains closes and opens the MCB.

This application includes a generator busbar, a load busbar and one mains income. The easYgen(s) running the same tasks as in the application mode GCB/GGB/MCB with the differentiation, that instead of a direct GGB and MCB handling through the easYgen, the both LS-6 devices take over that part.

The decision when to close or open the MCB and GGB is coming from the easYgen(s) over the CAN or Ethernet bus. The manual control on the MCB and GGB is restricted on the easYgen(s). If a run-up synchronization is desired, the modes "with GCB" and "with GCB/GGB" are supported. In this setup the mains decoupling is provided by the LS-6.

Required application modes:

- easYgen-3400XT/3500XT: A11 'GCB/L-GGB/L-MCB'
- LS-6: A03 'L-MCB'
- LS-6: A04 'L-GGB'

General notes

If mains decoupling over GCB is required, refer to the corresponding chapter of the easYgen manual.

This application setup is predefined and allows for no variations, except the amount of easYgen-3000 or easYgen-3000XT driven generators (up to 32).

- Check whether your application is compatible with the prerequisites listed below.

Before you do any testing go sure that the communication diagnostic in all relevant devices are running without any failure.

Prerequisites LS-6 (MCB)

- Personnel: Qualified electrician

Ensure the following prerequisites are met:

1. ▷ The system A voltage and current measurement is connected to the mains.
2. ▷ The system B voltage measurement is connected to the load busbar.
3. ▷ The MCB breaker feedback is connected to the LS-6 only.
4. ▷ The MCB breaker command(s) are connected to the LS-6 only.

5. ▷ Set up the Communication Interface between the devices. Refer to Communication Management ⮡ "6.6 Communication Management"for more information.

Prerequisites LS-6 (GGB)

⚙

>

- Personnel: Qualified electrician

Ensure the following prerequisites are met:

1. ▷ The system A voltage measurement is connected to the load busbar.
2. ▷ The system B voltage measurement is connected to the generator busbar.
3. ▷ The GGB breaker feedback is connected to the LS-6 only.
4. ▷ The GGB breaker command(s) are connected to the LS-6 only.
5. ▷ Set up the Communication Interface between the devices. Refer to Communication Management ⮡ "6.6 Communication Management"for more information.

Prerequisites easYgen

⚙

>

- Personnel: Qualified electrician

Ensure the following prerequisites are met:

1. ▷ The generator voltage and current measurement is connected to the generator.
2. ▷ The busbar voltage measurement is connected to the generator busbar.
3. ▷ The mains voltage measurement is not used.
4. ▷ The GCB breaker feedback is connected to the according easYgen.
5. ▷ The GCB breaker command(s) are connected to the according easYgen.
6. ▷ Set up the Communication Interface between the devices. Refer to Communication Management ⮡ "6.6 Communication Management"for more information..

Configure LS-6 (MCB)

⚙

>

- Personnel: User

Configure the following parameters:

1. ▷ Configure the application mode ⮡ 9018 of the LS-6 on CBA mode.
Configure the application mode ⮡ 8840 of the LS-6 on A03 'L-MCB' .
2. ▷ To configure measurement navigate to [Configuration / Configure measurement] and enter the desired settings.

3. ▷ When tapping voltages over power transformer, phase angle compensation may be required.

If a phase angle compensation is required, navigate to [Configuration / Configure application / Configure breakers / Configure CBA / Phase angle compensation]

NOTICE!

Component damage

Incorrect settings may cause erratic system behavior and damage to the involved components .

- Set the values carefully and double check with a voltmeter at the according breaker.

4. ▷ Configure the breaker close and/or open relay(s) according to your MCB.
5. ▷ Check the synchronization setting, like phase angle, frequency window and voltage.

Configure LS-6 (GGB)

>

- Personnel: User

1. ▷ Configure the application mode ⮡▷ 9018 of the LS-6 on CBA mode.
Configure the application mode ⮡▷ 8840 of the LS-6 on A04 'L-GGB' .
2. ▷ To configure measurement navigate to [Configuration / Configure measurement] and enter the desired settings.
3. ▷ When tapping voltages over power transformer, phase angle compensation may be required.

If a phase angle compensation is required, navigate to [Configuration / Configure application / Configure breakers / Configure CBA / Phase angle compensation]

NOTICE!

Component damage

Incorrect settings may cause erratic system behavior and damage to the involved components .

- Set the values carefully and double check with a voltmeter at the according breaker.

4. ▷ Configure the breaker close and/or open relay(s) according to your GGB.
5. ▷ Check the synchronization setting, like phase angle, frequency window and voltage.

Configure easYgen

⚙

>

- Personnel: User

Configure the following parameters:

1. ▷ Configure the application mode (parameter 3444) of each easYgen device to A11 'GCB/L-GGB/L-MCB' .
2. ▷ Configure the measurement for generator and busbar according to the easYgen manual.
3. ▷ The mains measurement is not used in this application mode. Therefore:
   - You should switch off the single mains monitoring functions or you disable mains monitoring generally by the LogicsManager “Disable mains monitoring” (parameter 15159).
   - You should switch off the mains decoupling function by the parameter “Mains decoupling” (parameter 3110).
4. ▷ When tapping voltages over power transformer, phase angle compensation may be required.

   If a phase angle compensation over the GCB is required, navigate to [Parameter / Configuration / Configure Application / Configure Breakers / Configure GCB / Phase angle compensation GCB].

   NOTICE!

   Component damage

   Incorrect settings may cause erratic system behavior and damage to the involved components .

   - Set the values carefully and double check with a voltmeter at the according breaker.

5. ▷ To display the mains values coming from LS-6 on the Home Page, navigate to [Show mains data] (parameter 4103) and switch to "LSx".
6. ▷ In this setup each easYgen device provides two free usable control bits for sending information to the whole device system in layer 1. These bits can be used as command variables in the LS-6.

   One of the bits could for example be used to initiate alarms acknowledgement in the LS-6 or to release the mains decoupling.

   Navigate to [Parameter / Configuration / Configure LogicsManager / Configure LSx] to configure the command variables.

6.3.6 CBA-Mode: Setup easYgen & Independent LSx Applications (Mode A02)

Introduction

In application mode A02 'LSx' the LS-6 runs as an independent unit. The free LSx setup allows up to 32 easYgen-3400XT/3500XT and up to 16 LS-6 devices if CAN bus is used. In case of Ethernet bus connection 32 easYgen-3400XT/3500XT and up to 32 LS-6 devices are useable. The easYgen(s) are only operating their GCBs. The other breakers have to be operated by the LS-6.

The closing and opening of the breaker is controlled through the LogicsManager equations "Open CBA unload", "Open CBA immed." and "Enable close CBA".

The close and open commands are configured with LogicsManager command variables. This can be discrete inputs, remote control flags or flags coming from easYgen(s) or other LSx devices.

The operating mode MANUAL in the LS-6 is supported and provides the operator with the option to manually force a close or open of the breaker. For this purpose the LS-6 provides an operating mode button and a softkey to close and open the breaker.

> The band width of the CAN bus allows to connect up to 32 easYgens in conjunction with up to 16 LSx devices. This is always guaranteed. In particular cases it could be desired to run more than 16 LSx devices. Theoretically up to 32 LSx are possible, but it requires in return a reduced number of easYgen devices. A rule of thumb is that the total amount of easYgens and LSx shall never expire 48 devices. To be on the safe side please discuss the possible risks with the Woodward Sales Support.

General notes

> The LS-6 is expecting at least one easYgen device in the system.

> Depending on the complexity of the system equally complex external program logics may be required.

> The LS-6 application mode A02 opens a wide range of applications and requires more effort to configure the whole easYgen – LSx system.
>
> The sections below explain some of the terms and concepts required in understanding these more complex applications.

Segment number

A 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 an LSx device.

A transformer is not considered as a segment or a point of isolation. Each segment, feeder, or interconnection must be assigned a number that is unique to that segment.

The LS-6 in CBA mode manages usually 2 segments:

- System A segment
- System B segment

The LS-6 in CBA mode and activated isolation switch manages usually 3 segments:

- System A segment
- Isolation switch segment
- System B segment

Isolation switch

Some applications include existing isolation switches. An isolation switch is usually taken to interrupt two bars from each other. The breaker is usually controlled manually.

The LS-6 unit in application mode A02 can handle max.1 isolation switch. Located at the isolation switch, the LS-6 must be informed about the condition of that switch. The condition determines the segmenting.

Mains breaker

The frequency and voltage are solid. A segment number is needed. The first breaker on the mains side is the MCB.

The LS-6 is always connected with measurement system A on the mains side. The setting "Mains connection" is always set on "System A". The system A measurement gets the mains segment number.

Tie-breaker

In this setup there is no direct mains connection neither on system A or system B. For both sides a segment number is needed.

There is no clear rule for where system A or system B needs to be connected. Likely the location of the CT determines the measurement A B. The setting "Mains connection" is always set to "None".

Generator

The frequency and voltage are variable. A segment number is not needed.

Device number (control number)

All connected control units must be configured with a unique device number (control number). Hence the units are clear defined in their function and location.

The numbers 1 to 32 are reserved for the easYgen(s) (easYgen "Device number"), the numbers 33 to 64 are reserved for the LS-6 (parameter ⮡ 1702).

CAN bus Node-ID number

To communicate via the CAN bus it is necessary to configure all connected controls with a unique CAN bus Node-ID number (parameter ⮡ 8950). Usually the same number like the device ID number is taken.

Priority during breaker closure

In an emergency application the simultaneous closing of two circuit breakers is blocked via communications between the LS-6 and the easYgen. Once an easYgen is enabled for a dead bus connection, it has priority over all LS-6s (any CB controlled by an LS-6 cannot be closed).

If multiple LS-6s are enabled to close a circuit breaker at the same time the LS-6 with the lowest Device number receives the master status (all other LS-6s are inactive).

When a closure failure occurs, this LS-6 is no longer considered for dead bus closure. The next prioritized LS-6 takes over.

6.3.6.1 H-Configuration with two easYgen and two incoming mains and Tie-breaker

Overview

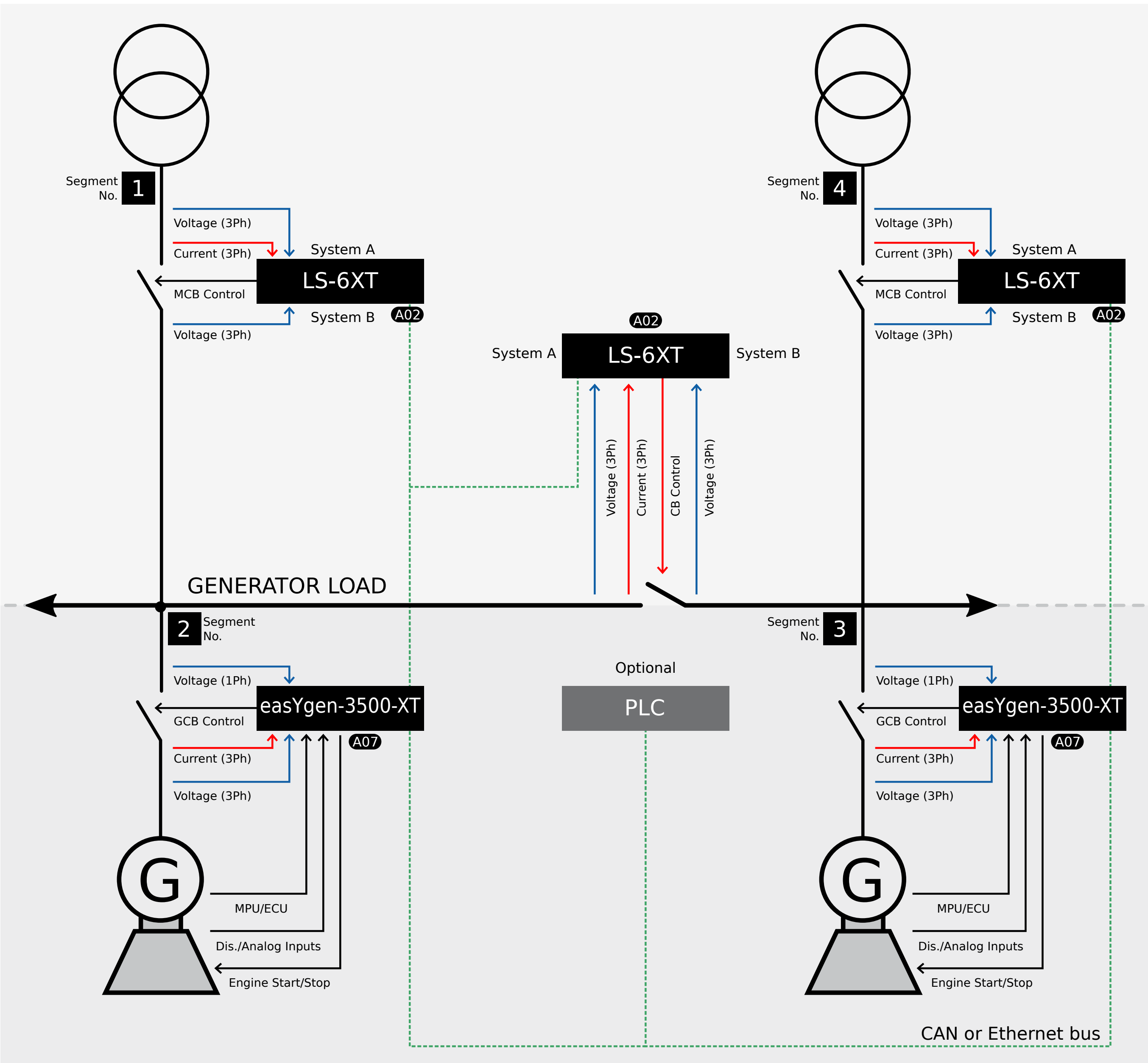


Fig. 150: H-Configuration with two easYgen and two incoming mains and tie-breaker

One or more genset(s) feed on a generator/load busbar Segment No. 2. One or more genset(s) feed on a generator/load busbar Segment No. 3. A tie-breaker is located between the both generator/load busbars. Each generator/load busbar has its own incoming mains breaker Segment No. 1/4.

The easYgen(s) are started by a remote start signal or by AMF mode and operating their GCBs. The other breakers, handled from the LS-6, receive their breaker open and close commands through orders coming from an external logic. The external logic could be a discrete input, a remote control bit, a monitor function, an easYgen command, etc..

In this example the decision when to close or open the breaker is managed by a PLC sending its orders over the CANopen protocol or by Ethernet Modbus TCP. Serial Modbus can also be used to send orders or read information from all members.

Amongst others, the breaker feedbacks of the single LS-6 are sent via the CAN or Ethernet interface and inform all other connected devices in the system, whether they are interconnected or not. This determines the argument of the regulation for the easYgen (i.e. power control, frequency control, load sharing).

Required application modes:

- easYgen-3400XT/3500XT: A07 'GCB/LSx'
- LS-6: A02 'LSx'

General notes

> Please note that the measured power of all LS-6s in the same segment are accumulated if there a several mains interchange points. The import/export control is based on this accumulated power. It is not possible to individually control the power at the single mains interchange points in the same segment.

> All units must be configured according to the requirements listed in “6.3.6 CBA-Mode: Setup easYgen & Independent LSx Applications (Mode A02)”.
>
> The following example does not contain any isolation switches, which could divide the segments.

Single line diagram

1. Draw a single line diagram that only contains essential equipment.
   In this case the schematic should contain two incoming mains with MCBs, two or more generators per generator segment, and all breakers (tie-breaker, GCB, MCB).
2. Number all easYgen control units from 1 to 32.
3. Number all system LS-6s from 33 to 48.
4. Number all CAN Node-IDs (usually the same as the device number).
5. Number all segments according to the definitions of a segment.

   > Unless special numbering conventions are required, count up continuously from left to right or right to left.

6. ▷ Draw the measurement system A and B of the single LS-6 into the single line diagram according to the definitions in ⮡ "6.3.6 CBA-Mode: Setup easYgen & Independent LSx Applications (Mode A02)".
Keep system A and B on the same side. This simplifies the configuration. The location of a CT may force you to ignore this rule but this can be compensated for in the configuration.

⚙ **Prerequisites LS-6 (incoming mains)**

>
- Personnel: Qualified electrician

1. ▷ The system A voltage and current measurement is connected to the mains.
2. ▷ The system B voltage measurement is connected to the generator/load busbar.
3. ▷ The MCB breaker feedback is connected to the LS-6 only.
4. ▷ The MCB breaker commands are connected to the LS-6 only.
5. ▷ Set up the Communication Interface between the devices. Refer to Communication Management ⮡ "6.6 Communication Management"for more information.

⚙ **Prerequisites LS-6 (tie-breaker)**

>
- Personnel: Qualified electrician

1. ▷ The system A voltage and current measurement is connected to the generator/load busbar segment Segment No. 2.
2. ▷ The system B voltage measurement is connected to the generator/load busbar segment Segment No. 3.
3. ▷ The tie-breaker feedback is connected to the LS-6 only.
4. ▷ The tie-breaker commands are connected to the LS-6 only.
5. ▷ Set up the Communication Interface between the devices. Refer to Communication Management ⮡ "6.6 Communication Management"for more information.

⚙ **Prerequisites easYgen(s)**

>
- Personnel: Qualified electrician

1. ▷ The generator voltage and current measurement is connected to the generator.
2. ▷ The busbar voltage measurement is connected to the generator/load busbar.
3. ▷ The mains voltage measurement is not used.
4. ▷ The GCB breaker feedback is connected to the according easYgen.
5. ▷ The GCB breaker commands are connected to the according easYgen.
6. ▷ Set up the Communication Interface between the devices. Refer to Communication Management ⮡ "6.6 Communication Management"for more information..

Configure LS-6 (incoming mains)

- Personnel: User

1. Configure the application mode ⮑ 9018 of the LS-6 on CBA mode.
   Configure the application mode ⮑ 8840 of the LS-6 device to A02 'LSx' .
2. Enter the device ID 33 for the LS-6, incoming mains on the left side and ID 35 for the LS-6, incoming mains on the right.
3. If the CAN interface is used take care that all devices have different CAN Node-IDs. (Usually the same number as the device number is taken).
4. For the following two steps navigate to [Configuration / Configure application / Configure segment] on each respective LS-6.
5. Configure the following parameters for the LS-6 ID 33, incoming mains on the left side:

Parameter	ID	Value
Segment No. Sy.A	⮑ 8810	1
Segment No. Sy.B	⮑ 8811	2
Segment No. isol. Switch	⮑ 8812	N/A
Mains pow. Measurement	⮑ 8813	Valid
Mains connection	⮑ 8814	System A
Isol. Switch Para	⮑ 8815	None
Variable system	⮑ 8816	System B

6. Configure the following parameters for the LS-6 ID 35, incoming mains on the right side:

Parameter	ID	Value
Segment No. Sy.A	⮑ 8810	4
Segment No. Sy.B	⮑ 8811	3
Segment No. isol. Switch	⮑ 8812	N/A
Mains pow. Measurement	⮑ 8813	Valid
Mains connection	⮑ 8814	System A
Isol. Switch Para	⮑ 8815	None
Variable system	⮑ 8816	System B

7. When tapping voltages over power transformer, phase angle compensation may be required.

   If a phase angle compensation is required, navigate to [Configuration / Configure application / Configure breakers / Configure CBA / Phase angle compensation]

NOTICE!

Component damage

Incorrect settings may cause erratic system behavior and damage to the involved components .

- Set the values carefully and double check with a voltmeter at the according breaker.

8. ▷ Configure the breaker close and/or open relay(s) according to your MCB.

9. ▷ Check the synchronization settings, like phase angle, frequency window and voltage.

10. ▷ Navigate to [Configuration / Configure application / Configure breakers / General breakers settings] and set the following parameters:

Parameter	**ID**	**Value**
Dead bus closure CBA	⮡ 3431	On
Connect A dead to B dead	⮡ 8802	Off
Connect A dead to B alive	⮡ 8803	Off
Connect A alive to B dead	⮡ 8804	Off
Dead bus closure delay time	⮡ 8805	As required
Dead bus detection max. volt	⮡ 5820	As required

11. ▷ Navigate to [Configuration / Configure application / Configure breakers / Configure synchronous network] and set the following parameters:

Parameter	**ID**	**Value**
Connect synchronous mains	⮡ 8820	Yes
Max. phase angle	⮡ 8821	20°
Delay time phi max.	⮡ 8822	1 s
Max. voltage differential	⮡ 8823	5,00 %

12. ▷ Navigate to [Configuration / Configure application / Configure breakers / Configure CBA] and set the following parameters:
Select [Open CBA unload / LogicsManager] ⮡ 12943 and configure the equation as follows:

- The LM equation opens the MCB (CBA) with unloading, if the remote control bit 1 is sent by the PLC.

▶

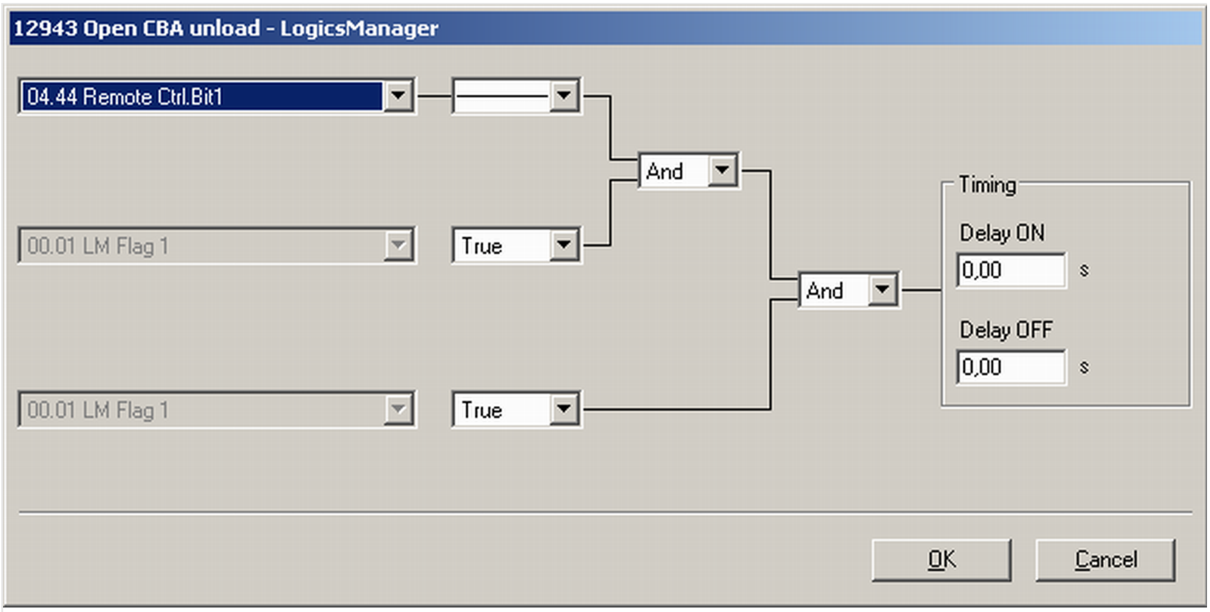


Fig. 151: LogicsManager configuration 'Open CBA unload'

13. ▷

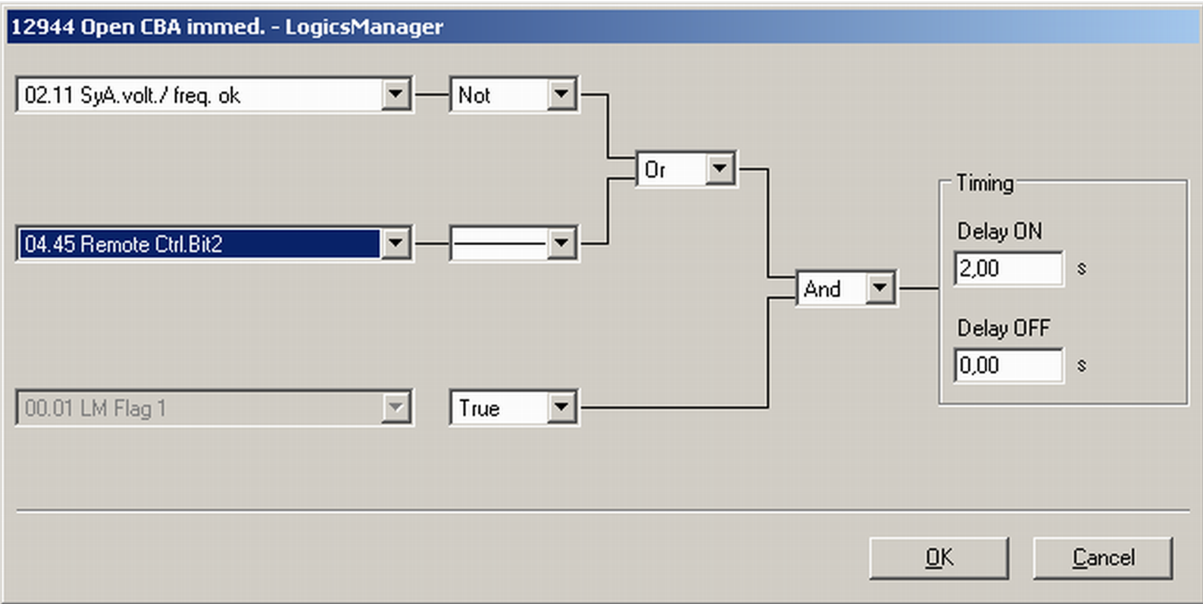


Fig. 152: LogicsManager configuration 'Open CBA immed.'

Select [Open CBA immed. / LogicsManager] ⮡ 12944 and configure the equation as follows:

- The LM equation opens the MCB (CBA) immediately, if the system A voltage / frequency is not within the configured operating ranges (refer to ⮡ "4.5.1.3 System A Operating Ranges") **OR** the remote control bit 2 sent by the PLC.

14. ▷

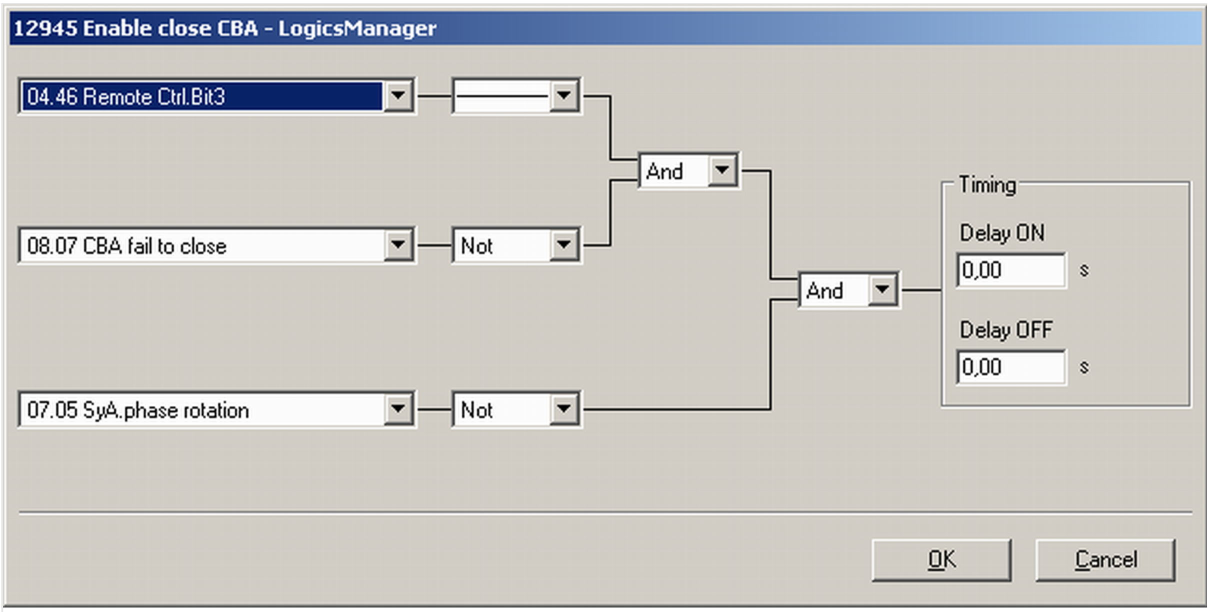


Fig. 153: LogicsManager configuration 'Enable close CBA.'

Select [Enable close CBA / LogicsManager] ⮡ 12945 and configure the equation as follows:

- The LM equation gives the release for close MCB (CBA), if the remote control bit 3 is sent by the PLC **AND** the CBA has no closure failure **AND** the system A measurement detects no phase rotation error.

The same remote control bits can be used in the upper example, because each LS-6 receives its own control bits. The different device and Node-ID separates the control bits from each other.

Configure LS-6 (tie-breaker)

>

- Personnel: User

1. ▷ Configure the application mode ⮡ 9018 of the LS-6 on CBA mode.
Configure the application mode ⮡ 8840 of the LS-6 device to A02 'LSx' .

2. ▷ Enter the device ID 34 for the LS-6.

3. ▷ If the CAN interface is used take care that all devices have different CAN Node-IDs. (Usually the same number as the device number is taken).

4. ▷ Navigate to [Configuration / Configure application / Configure segment] and configure the following parameters:

Parameter	ID	Value
Segment No. Sy.A	⮡ 8810	2
Segment No. Sy.B	⮡ 8811	3
Segment No. isol. Switch	⮡ 8812	N/A
Mains pow. Measurement (Actually system A measurement)	⮡ 8813	Invalid

Parameter	ID	Value
Mains connection	⮡ 8814	None
Isol. Switch Para	⮡ 8815	None
Variable system	⮡ 8816	System B

5. ▷ Configure the measurement system A and B.

6. ▷ When tapping voltages over power transformer, phase angle compensation may be required.

If a phase angle compensation is required, navigate to [Configuration / Configure application / Configure breakers / Configure CBA / Phase angle compensation]

NOTICE!

Component damage

Incorrect settings may cause erratic system behavior and damage to the involved components .

- Set the values carefully and double check with a voltmeter at the according breaker.

7. ▷ Configure the breaker close and/or open relay(s) according to your tie-breaker.

8. ▷ Check the synchronization settings, like phase angle, frequency window and voltage.

9. ▷ Navigate to [Configuration / Configure application / Configure breakers / General breakers settings] and set the following parameters:

Parameter	ID	Value
Dead bus closure CBA	⮡ 3431	On
Connect A dead to B dead	⮡ 8802	On
Connect A dead to B alive	⮡ 8803	On
Connect A alive to B dead	⮡ 8804	On
Dead bus closure delay time	⮡ 8805	As required
Dead bus detection max. volt	⮡ 5820	As required

10. ▷ Navigate to [Configuration / Configure application / Configure breakers / Configure synchronous network] and set the following parameters:

Parameter	ID	Value
Connect synchronous mains	⮡ 8820	Yes
Max. phase angle	⮡ 8821	20°
Delay time phi max.	⮡ 8822	1 s
Max. voltage differential	⮡ 8823	5,00 %

11. ▷ To configure the LogicsManager in regards to close and open commands for the tie-breaker navigate to [Configuration / Configure application / Configure breakers / Configure CBA].

12. ▷

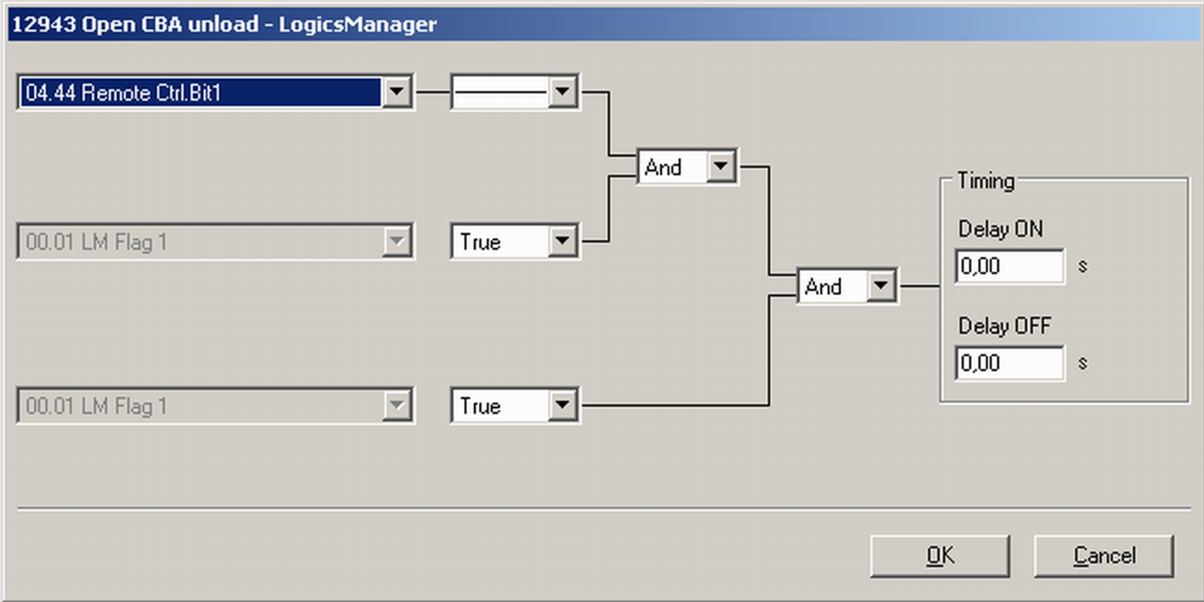


Fig. 154: LogicsManager configuration 'Open CBA unload'

Select [Open CBA unload / LogicsManager] ⮡ 12943 and configure the equation as follows:

- The LM equation opens the tie breaker with unloading, if the remote control bit 1 is sent by the PLC.

> The unloading of the tie-breaker is only executed, if one side contains a variable system. Otherwise the open command is given without unloading.

13. ▷

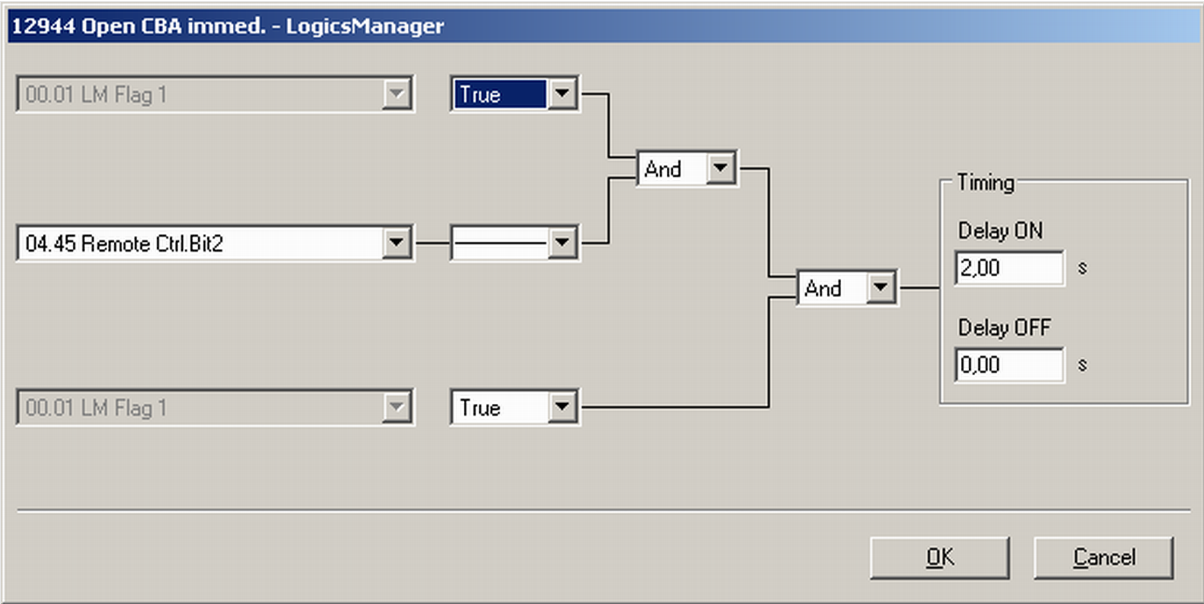


Fig. 155: LogicsManager configuration 'Open CBA immed.'

Select [Open CBA immed. / LogicsManager] ⮱▷ 12944 and configure the equation as follows:

- The LM equation opens the tie-breaker immediately, if the remote control bit 2 sent by the PLC.

14. ▷

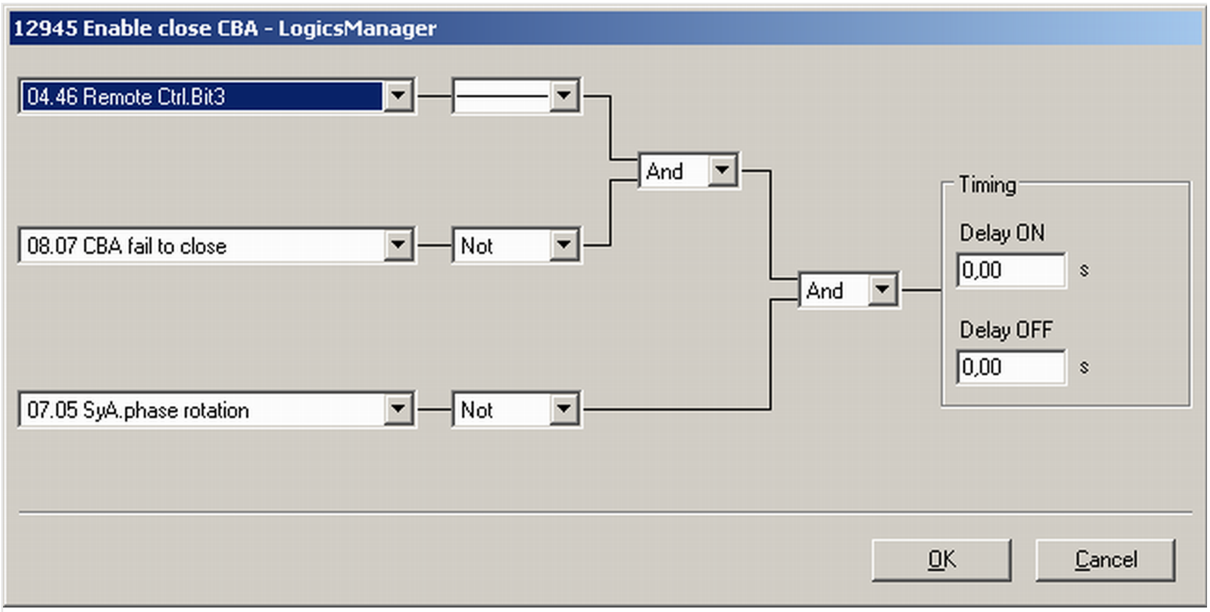


Fig. 156: LogicsManager configuration 'Enable close CBA.'

Select [Enable close CBA / LogicsManager] ⮱▷ 12945 and configure the equation as follows:

- The LM equation gives the release for close CBA, if the remote control bit 3 is sent by the PLC **AND** the CBA has no closure failure **AND** the system A measurement detects no phase rotation error.

> The same remote control bits can be used in the upper example, because each LS-6 receives its own control bits. The different device and Node-ID separates the control bits from each other.

⚙ **Configure easYgen(s)**

>

- Personnel: User

1. ▷ Configure the application mode (parameter 3444) of each easYgen device to A07 'GCB/ LSx' .

2. ▷ Enter the device ID 1 for the easYgen (usually from left to right).

3. ▷ If the CAN interface is used take care that all devices have different CAN Node-IDs. (Usually the same number as the device number is taken).

4. ▷ Navigate to [Parameter / Configuration / Configure application / Configure controller / Configure load share] to enter the basic segment numbers at the easYgen(s).

Position	Parameter	ID	Value
easYgen ID 1	Segment number	1723	2

Position	Parameter	ID	Value
Left side			
easYgen ID 2 Right side	Segment number	1723	3

5. ▷ Configure the measurement for generator and busbar according to the easYgen manual.

6. ▷ The mains measurement is not used in this application mode. Therefore:

   - You should switch off the single mains monitoring functions or you disable mains monitoring generally by the LogicsManager “Disable mains monitoring” (parameter 15159).
   - You should switch off the mains decoupling function by the parameter “Mains decoupling” (parameter 3110).

7. ▷ When tapping voltages over power transformer, phase angle compensation may be required.

   If a phase angle compensation over the GCB is required, navigate to [Parameter / Configuration / Configure Application / Configure Breakers / Configure GCB / Phase angle compensation GCB].

   NOTICE!

   Component damage

   Incorrect settings may cause erratic system behavior and damage to the involved components .

   - Set the values carefully and double check with a voltmeter at the according breaker.

8. ▷ To display the mains values coming from LS-6 on the Home Page screen, navigate to [Parameter / Configuration / Configure measurement] and set [Show mains data] (parameter 4103) to "LSx".

9. ▷ For the AMF mode the emergency run segments have to be configured accordingly.

   Navigate to [Parameter / Configuration / Configure application / Configure emergency run].
   In this application two setups are possible:

   Example setup 1

   Each generator group monitors its own generator/load busbar and mains income:

   - The easYgens in the left group are configured to "segment 1" and "segment 2".

     The easYgens on the left side start, if one of these 2 segments is running outside its operating ranges.

     On the other side the AMF mode stops, if both segments are back in operating range and the incoming mains are closed.
   - The easYgens in the right group are configured to "segment 3" and "segment 4".

     The easYgens on the right side start, if one of these 2 segments is running outside its operating ranges.

Example setup 1

On the other side the AMF mode stops, if both segments are back in operating range and the incoming mains are closed.

Example setup 2

All generators monitor both generator/load busbars and mains incomes.

- All easYgens are configured to "segment 1"; "segment 2"; "segment 3" and "segment 4".

  All easYgen(s) start, if one of these 4 segments is running outside its operating ranges.

  On the other side the AMF mode stops, if all segments are back in operating range and at least one incoming mains in the own segment is closed.

10. ▷

In this setup each easYgen device provides six free usable control bits for sending information to the whole device system in layer 1. These bits can be used as command variables in the LS-6.

One of the bits could for example be used to initiate alarms acknowledgement in the LS-6.

Navigate to [Parameter / Configuration / Configure LogicsManager / Configure LSx] to configure the command variables.

6.3.6.2 Multiple Mains/Generators with four easYgens, two incoming Mains and different Tie-breakers

Overview

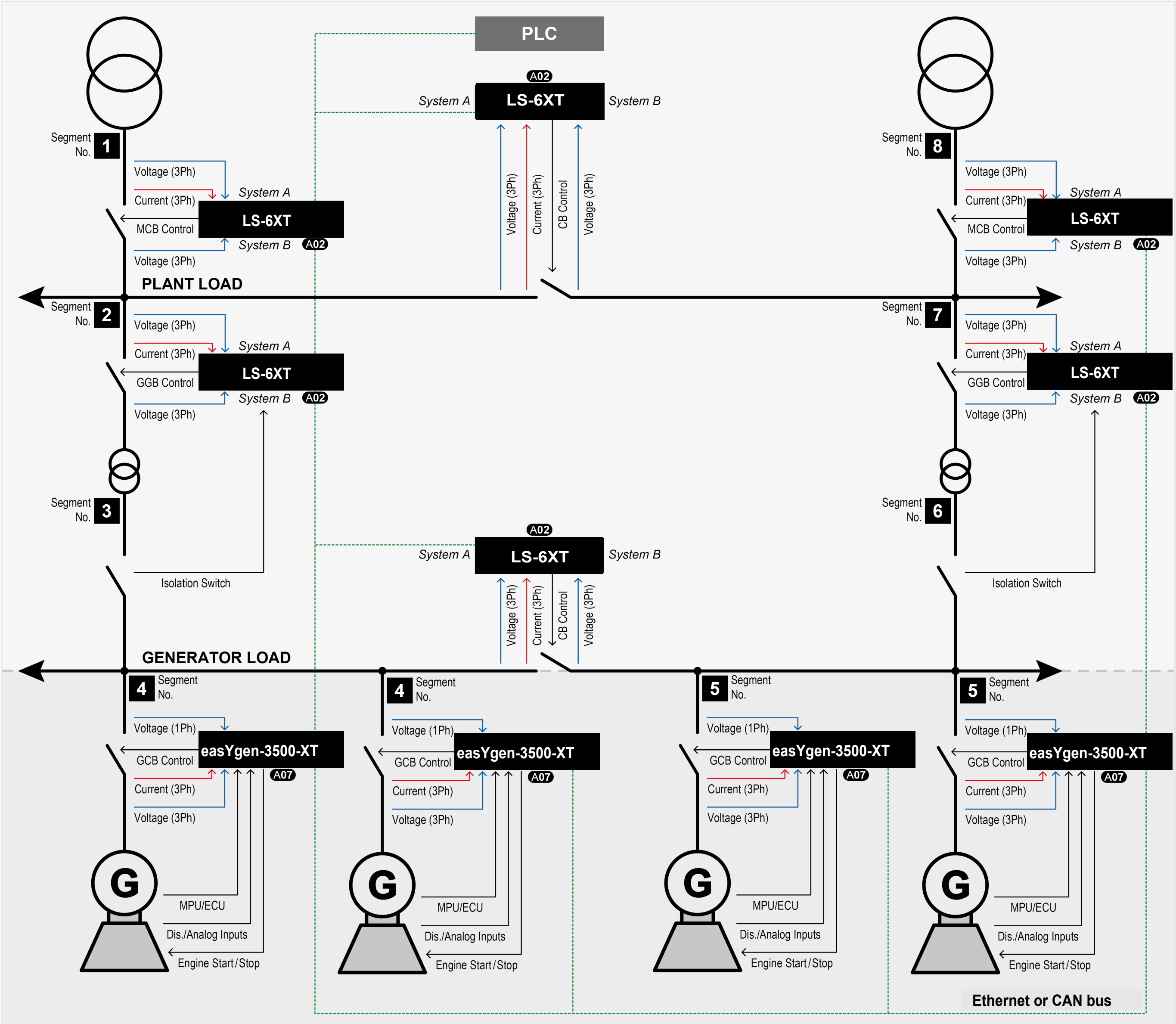


Fig. 157: Multiple Mains/Generators with four easYgen units, two incoming mains and different tie-breakers

One or more genset(s) feed on a generator/load busbar Segment No. 4. One or more genset(s) feed on a generator/load busbar Segment No. 5.

A tie-breaker is located between the both generator/load busbars. Each generator/load busbar has its own generator group breaker Segment No. 2/3 respectively Segment No. 6/7. The application contains two mains interchange points with mains breakers Segment No. 1/2 respectively Segment No. 7/8.

Another tie-breaker can connect directly the both plant/load busbars Segment No. 2/7. The application example contains a middle voltage level for the plant/load busbar and a low voltage level for the generator/load busbar. Therefore step up transformers are installed. Each step up transformer provides a manually operated isolation switch.

Each LS-6 control serves its own breaker. The LS-6s at the GGB are additionally informed about the condition of the close-by isolation switch.

The easYgen(s) are started by a remote start signal or by AMF mode and operating their GCBs. The other breakers, handled by LS-6, receive their breaker open and close commands through orders coming from an external logic. The external logic could be a discrete input, a remote control bit, a monitor function, etc..

In this example the decision when to close or open the breaker is managed by a PLC sending its orders over the CANopen or Ethernet bus. Serial Modbus can also be used to send orders or read information from all members.

Amongst others the breaker feedbacks of the single LS-6 are sent via CAN or Ethernet interface and inform all other connected devices in the system, whether they are interconnected or not. This determines the argument of the regulation for the easYgen (i.e. power control, frequency control, load sharing).

Required application modes:

- easYgen-3400XT/3500XT: A07 'GCB/LSx'
- LS-6: A02 'LSx'

General notes

All units must be configured according to the requirements listed in “6.3.6 CBA-Mode: Setup easYgen & Independent LSx Applications (Mode A02)”.

In the following example the isolation switch condition represents an important part of the segmenting.

⚙ **Prepare the easYgen – LS-6 system for configuration as follows:**

1. ▷ Draw a single line diagram that only contains essential equipment.
   In this case the schematic should contain two incoming mains with MCBs, two or more generators per generator/load busbar segment and all breakers (tie-breaker, GGB)
2. ▷ Number all easYgen control units from 1 to 32.
3. ▷ Number all system LS-6s from 33 to 48.
4. ▷ Number all CAN Node-IDs (usually the same as the device number).
5. ▷ Number all segments according to the definitions mentioned in General Functions.

   Unless special numbering conventions are required, count up continuously from left to right or right to left.
6. ▷ Draw the measurement system A and B of the single LSx into the single line diagram according to the definitions in “6.3.6 CBA-Mode: Setup easYgen & Independent LSx Applications (Mode A02)”.
   Keep system A and B on the same side. This simplifies the configuration. The location of a CT may force you to ignore this rule but this can be compensated for in the configuration.

⚙ Prerequisites LS-6 (incoming mains)

>
- Personnel: Qualified electrician

1. ▷ The system A voltage and current measurement is connected to the mains segment no. 1/8.
2. ▷ The system B voltage measurement is connected to the plant/load busbar segment no. 2/7.
3. ▷ The MCB breaker feedback is connected to the LS-6 only.
4. ▷ The MCB breaker commands are connected to the LS-6 only.
5. ▷ Set up the Communication Interface between the devices. Refer to Communication Management ⮡ “6.6 Communication Management”for more information.

⚙ Prerequisites LS-6 (GGBs)

>
- Personnel: Qualified electrician

1. ▷ The system A voltage and current measurement is connected to the plant/load busbar segment no. 2/7.
2. ▷ The system B voltage measurement is connected to the generator/load busbar segment no. 3/6.
3. ▷ The GGB feedback is connected to the LS-6 only.
4. ▷ The GGB command(s) are connected to the LS-6 only.
5. ▷ The isolation switch feedback, located between generator/load busbar and transformer(segment no.3/4 respectively segment no. 5/6), is connected to the LS-6 only.
6. ▷ Set up the Communication Interface between the devices. Refer to Communication Management ⮡ “6.6 Communication Management”for more information.

⚙ Prerequisites LS-6 (tie-breaker generator/load busbar)

>
- Personnel: Qualified electrician

1. ▷ The system A voltage and current measurement is connected to the segment no. 4.
2. ▷ The system B voltage measurement is connected to the segment no. 5.
3. ▷ The tie-breaker feedback is connected to the LS-6 only.
4. ▷ The tie-breaker command(s) are connected to the LS-6 only.
5. ▷ Set up the Communication Interface between the devices. Refer to Communication Management ⮡ “6.6 Communication Management”for more information.

⚙ Prerequisites LS-6 (tie-breaker plant/load busbar)

>

- Personnel: Qualified electrician

1. ▷ The system A voltage and current measurement is connected to the segment no. 2.
2. ▷ The system B voltage measurement is connected to the segment no. 7.
3. ▷ The tie-breaker feedback is connected to the LS-6 only.
4. ▷ The tie-breaker command(s) are connected to the LS-6 only.
5. ▷ Set up the Communication Interface between the devices. Refer to Communication Management ⮑ "6.6 Communication Management"for more information.

⚙ **Prerequisites easYgen(s)**

>

- Personnel: Qualified electrician

1. ▷ The generator voltage and current measurement is connected to the generator.
2. ▷ The busbar voltage measurement is connected to the generator/load busbar.
3. ▷ The mains voltage measurement is not used.
4. ▷ The GCB breaker feedback is connected to the according easYgen.
5. ▷ The GCB breaker command(s) are connected to the according easYgen.
6. ▷ Set up the Communication Interface between the devices. Refer to Communication Management ⮑ "6.6 Communication Management"for more information..

⚙ **Configure LS-6 (incoming mains)**

>

- Personnel: User

1. ▷ Configure the application mode ⮑ 9018 of the LS-6 on CBA mode.
Configure the application mode ⮑ 8840 of the LS-6 device to A02 'LSx' .
2. ▷ Enter the device ID 33 for the LS-6, incoming mains on the left side and ID 37 for the LS-6, incoming mains on the right.
3. ▷ Enter the CAN Node-IDs (usually the same like device ID).
4. ▷ For the following two steps navigate to [Configuration / Configure application / Configure segment] on each respective LS-6.
5. ▷ Configure the following parameters for the LS-6 ID 33, incoming mains on the left side:

Parameter	ID	Value
Segment No. Sy.A	⮑ 8810	1
Segment No. Sy.B	⮑ 8811	2
Segment No. isol. Switch	⮑ 8812	N/A
Mains pow. Measurement	⮑ 8813	Valid
Mains connection	⮑ 8814	System A
Isol. Switch Para	⮑ 8815	None

Parameter	ID	Value
Variable system	⮡ 8816	System B

6. ▷ Configure the following parameters for the LS-6 ID 37, incoming mains on the right side:

Parameter	ID	Value
Segment No. Sy.A	⮡ 8810	8
Segment No. Sy.B	⮡ 8811	7
Segment No. isol. Switch	⮡ 8812	N/A
Mains pow. Measurement	⮡ 8813	Valid
Mains connection	⮡ 8814	System A
Isol. Switch Para	⮡ 8815	None
Variable system	⮡ 8816	System B

7. ▷ Configure the measurement system A and B.

8. ▷ Configure the breaker close and/or open relay(s) according to your MCB.

9. ▷ Check the synchronization settings, like phase angle, frequency window and voltage.

10. ▷ Navigate to [Configuration / Configure application / Configure breakers / General breakers settings] and set the following parameters:

Parameter	ID	Value
Dead bus closure CBA	⮡ 3431	On
Connect A dead to B dead	⮡ 8802	Off
Connect A dead to B alive	⮡ 8803	Off
Connect A alive to B dead	⮡ 8804	On
Dead bus closure delay time	⮡ 8805	As required
Dead bus detection max. volt	⮡ 5820	As required

11. ▷ Navigate to [Configuration / Configure application / Configure breakers / Configure synchronous network] and set the following parameters:

Parameter	ID	Value
Connect synchronous mains	⮡ 8820	Yes
Max. phase angle	⮡ 8821	20°
Delay time phi max.	⮡ 8822	1 s
Max. voltage differential	⮡ 8823	5,00 %

12. ▷ To configure the LogicsManager in regards to close and open commands for the MCB navigate to [Configuration / Configure application / Configure breakers / Configure CBA].

13. ▷ Select [Open CBA unload / LogicsManager] ⮡ 12943 and configure the equation as follows:

- The LM equation opens the MCB (CBA) with unloading, if the remote control bit 1 is sent by the PLC.

▶

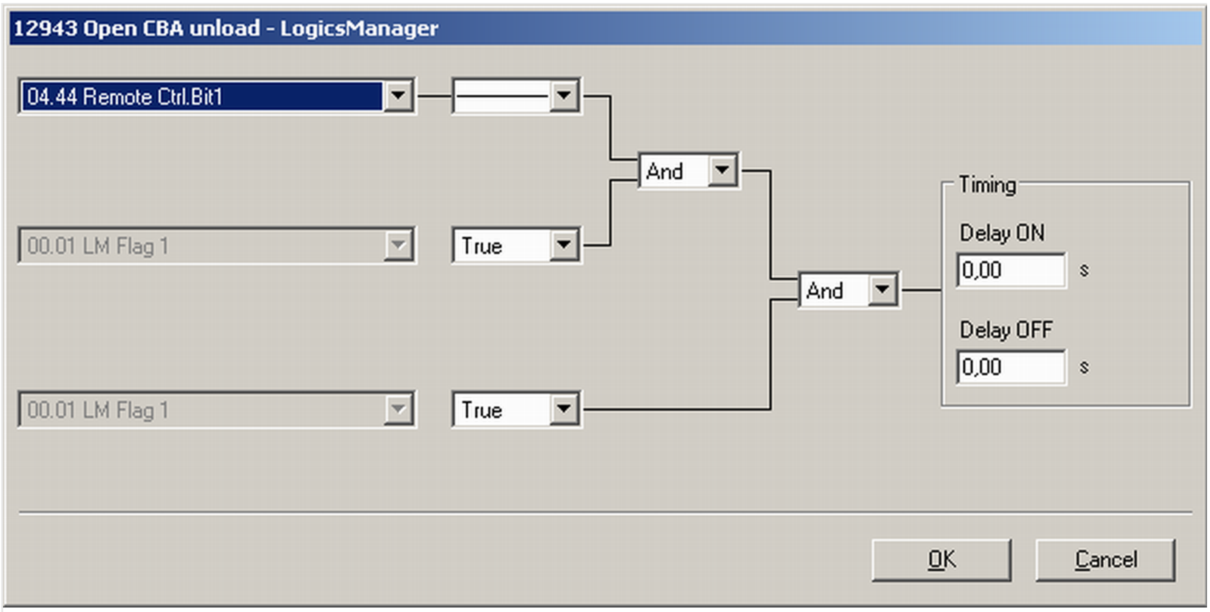


Fig. 158: LogicsManager configuration 'Open CBA unload'

14. ▷ Select [Open CBA immed. / LogicsManager] ⮱▷ 12944 and configure the equation as follows:

- The LM equation opens the MCB immediately, if the system A voltage / frequency is not within the configured operating ranges (refer to ⮱▷ "4.5.1.3 System A Operating Ranges") **OR** the remote control bit 2 sent by the PLC.

▶

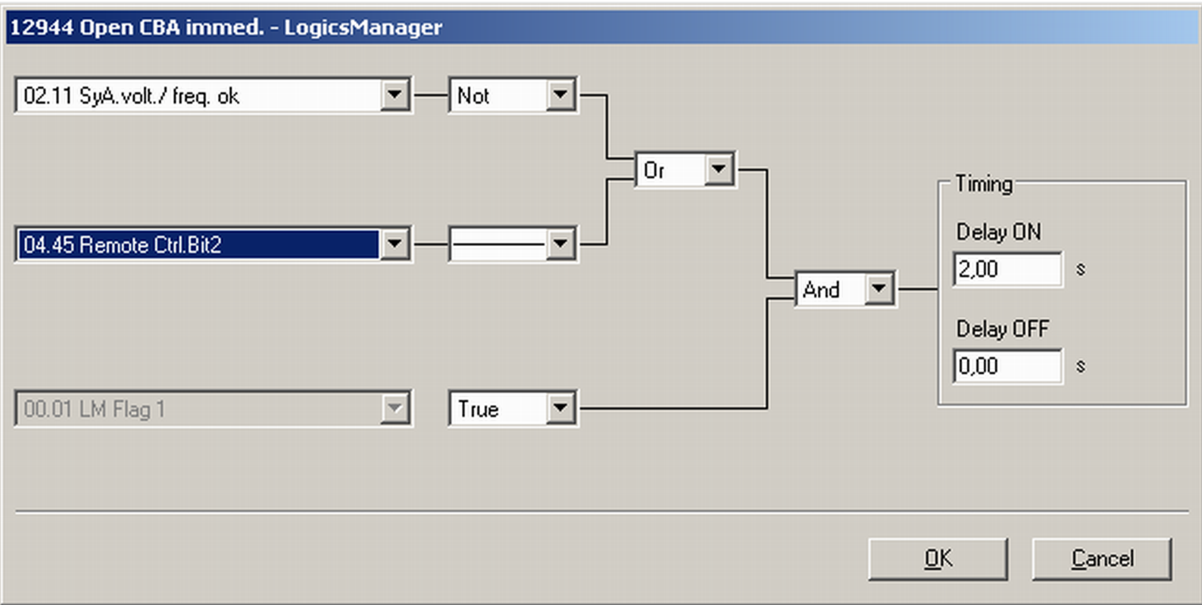


Fig. 159: LogicsManager configuration 'Open CBA immed.'

15. ▷ Select [Enable close CBA / LogicsManager] ⮱▷ 12945 and configure the equation as follows:

- The LM equation gives the release for close MCB (CBA), if the remote control bit 3 is sent by the PLC **AND** the CBA has no closure failure **AND** the system A measurement detects no phase rotation error.

The same remote control bits can be used in the upper example, because each LSx receives its own control bits. The different device and Node-ID separates the control bits from each other.

▶

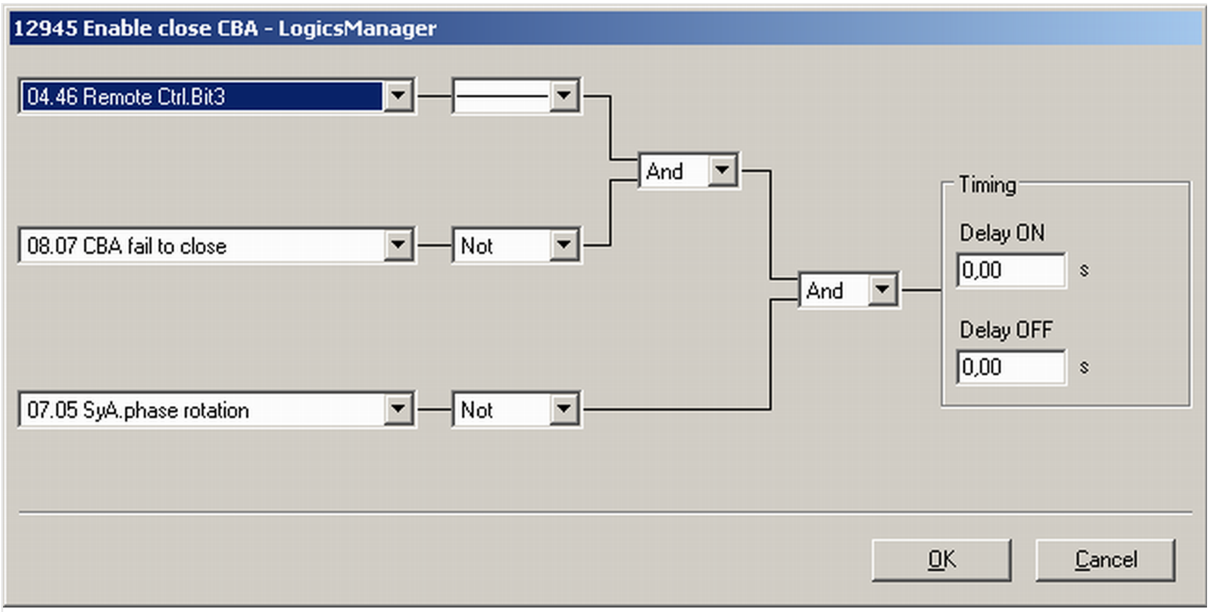


Fig. 160: LogicsManager configuration 'Enable close CBA.'

⚙ Configure LS-6 (GGBs)

>

- Personnel: User

1. ▷ Configure the application mode ⮑ 9018 of the LS-6 on CBA mode.
Configure the application mode ⮑ 8840 of the LS-6 device to A02 'LSx' .

2. ▷ Enter the device ID 34 for the LS-6, set up as GGB on the left and ID 36 for the LS-6, set up as GGB on the right.

3. ▷ If the CAN interface is used take care that all devices have different CAN Node-IDs. (Usually the same number as the device number is taken).

4. ▷ For the following two steps navigate to [Configuration / Configure application / Configure segment] on each respective LS-6.

5. ▷ Configure the following parameters for the LS-6 ID 34, set up as GGB on the left:

Parameter	ID	Value
Segment No. Sy.A	⮑ 8810	2
Segment No. Sy.B	⮑ 8811	3
Segment No. isol. Switch	⮑ 8812	4
Mains pow. Measurement (Actually system A measurement)	⮑ 8813	Invalid
Mains connection	⮑ 8814	None
Isol. Switch Para	⮑ 8815	System B

Parameter	ID	Value
Variable system	⮡ 8816	System B

6. ▷ Configure the following parameters for the LS-6 ID 36, set up as GGB on the right:

Parameter	ID	Value
Segment No. Sy.A	⮡ 8810	7
Segment No. Sy.B	⮡ 8811	6
Segment No. isol. Switch	⮡ 8812	5
Mains pow. Measurement (Actually system A measurement)	⮡ 8813	Invalid
Mains connection	⮡ 8814	None
Isol. Switch Para	⮡ 8815	System B
Variable system	⮡ 8816	System B

7. ▷ Navigate to [Configuration / Configure application / Configure breakers / General breakers settings] and configure the isolation switch feedback "isol.sw open" for a discrete input (discrete input 5 is recommended).

8. ▷ Configure the measurement system A and B.

9. ▷ Configure the breaker close and/or open relay(s) according to your GGB.

10. ▷ Check the synchronization settings, like phase angle, frequency window and voltage.

11. ▷ Navigate to [Configuration / Configure application / Configure breakers / General breakers settings] and set the following parameters:

Parameter	ID	Value
Dead bus closure CBA	⮡ 3431	On
Connect A dead to B dead	⮡ 8802	On
Connect A dead to B alive	⮡ 8803	On
Connect A alive to B dead	⮡ 8804	On
Dead bus closure delay time	⮡ 8805	As required
Dead bus detection max. volt	⮡ 5820	As required

12. ▷ Navigate to [Configuration / Configure application / Configure breakers / Configure synchronous network] and set the following parameters:

Parameter	ID	Value
Connect synchronous mains	⮡ 8820	Yes
Max. phase angle	⮡ 8821	20°
Delay time phi max.	⮡ 8822	1 s
Max. voltage differential	⮡ 8823	5,00 %

13. ▷ To configure the LogicsManager in regards to close and open commands for the GGB navigate to [Configuration / Configure application / Configure breakers / Configure CBA].

14. ▷

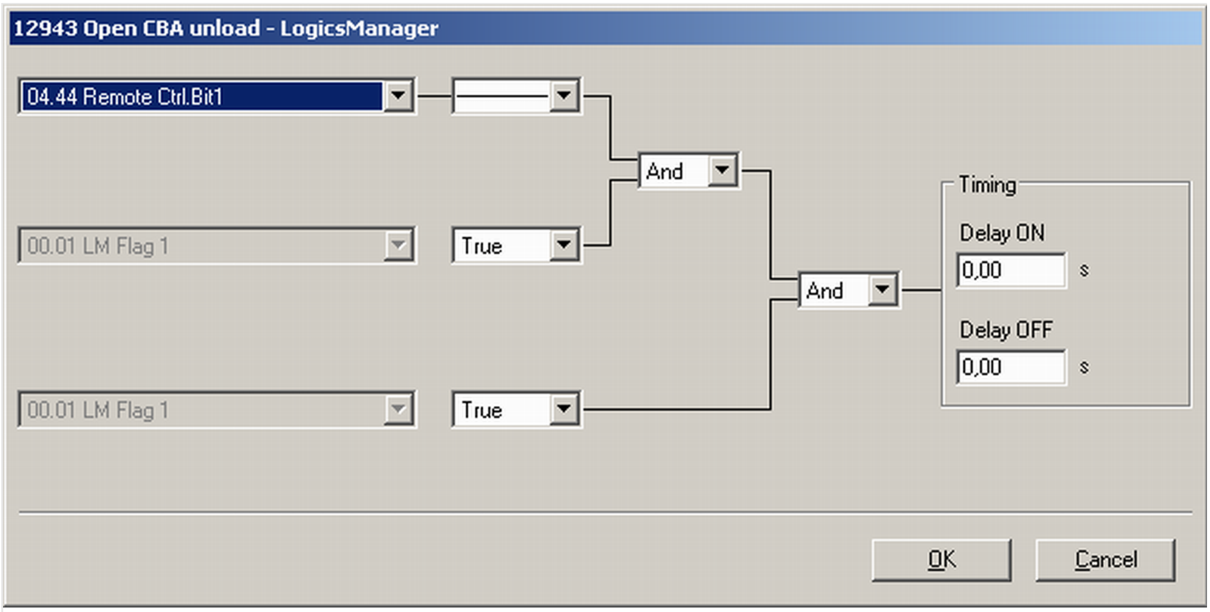


Fig. 161: LogicsManager configuration 'Open CBA unload'

Select [Open CBA unload / LogicsManager] ⮡ 12943 and configure the equation as follows:

- The LM equation opens the GGB (CBA) with unloading, if the remote control bit 1 is sent by the PLC.

15. ▷

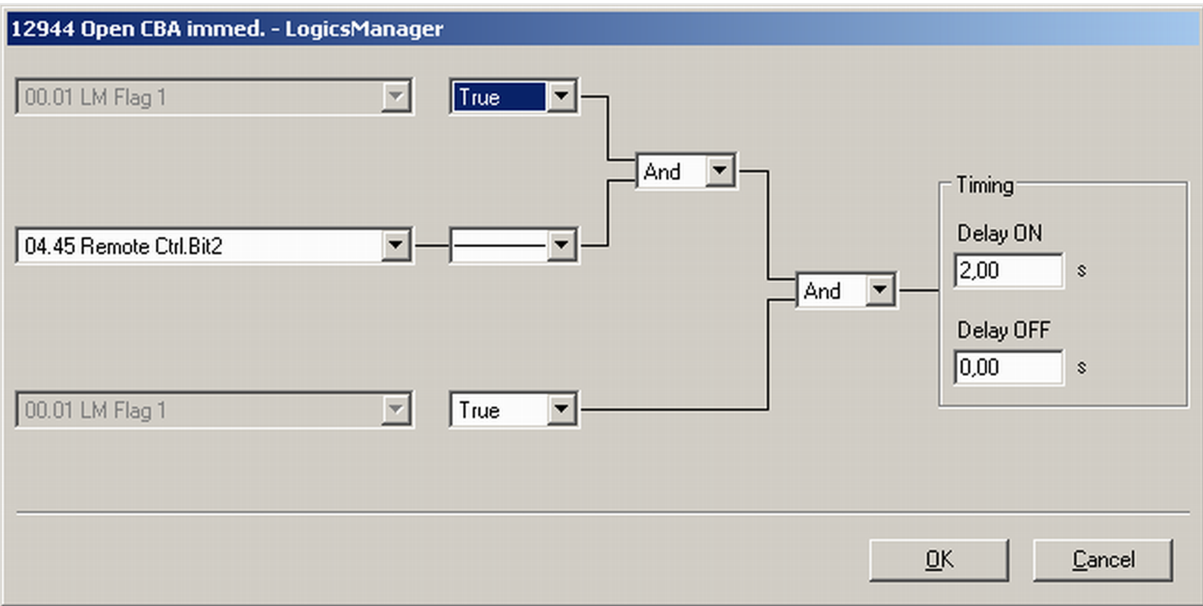


Fig. 162: LogicsManager configuration 'Open CBA immed.'

Select [Open CBA immed. / LogicsManager] ⮡ 12944 and configure the equation as follows:

- The LM equation opens the GGB (CBA) immediately, if the remote control bit 2 sent by the PLC.

16. ▷

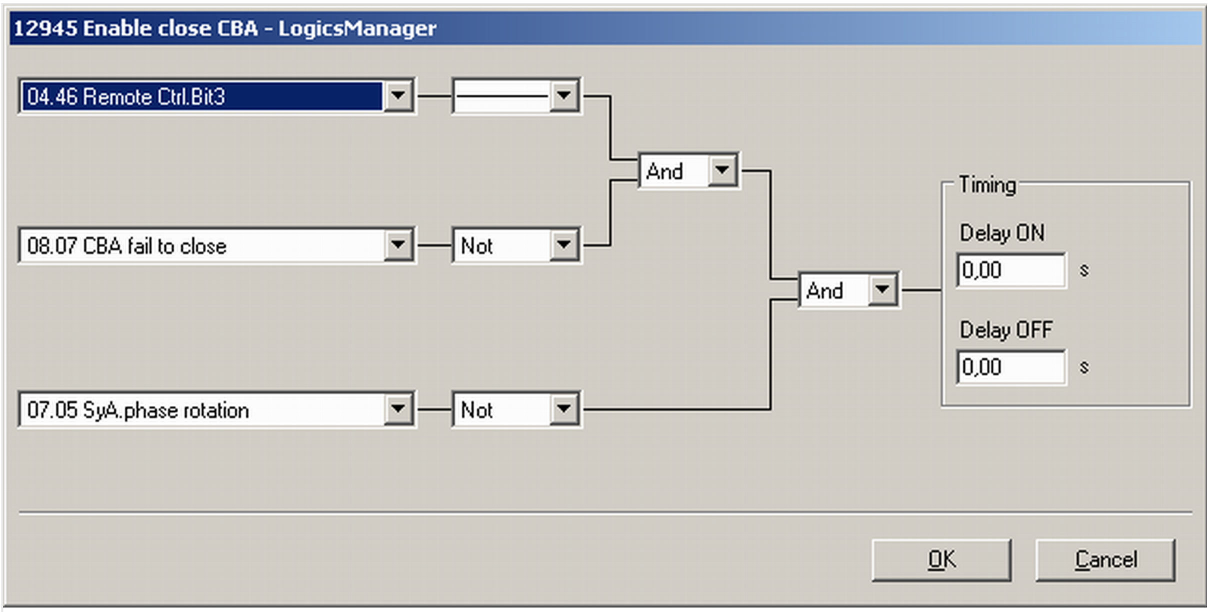


Fig. 163: LogicsManager configuration 'Enable close CBA.'

Select [Enable close CBA / LogicsManager] ⮡ 12945 and configure the equation as follows:

- The LM equation gives the release for close GGB (CBA), if the remote control bit 3 is sent by the PLC **AND** the CBA has no closure failure **AND** the system A measurement detects no phase rotation error.

> The same remote control bits can be used in the upper example, because each LS-6 receives its own control bits. The different device and Node-ID separates the control bits from each other.

Configure LS-6 (tie-breaker generator/load busbar)

- Personnel: User

1. ▷ Configure the application mode ⮡ 9018 of the LS-6 on CBA mode.
Configure the application mode ⮡ 8840 of the LS-6 device to A02 'LSx' .
2. ▷ Enter the device ID 35 for the LS-6.
3. ▷ Enter the Node-ID (usually the same like device ID).
4. ▷ Navigate to [Configuration / Configure application / Configure segment] and configure the following parameters:

Parameter	ID	Value
Segment No. Sy.A	⮡ 8810	4
Segment No. Sy.B	⮡ 8811	5
Segment No. isol. Switch	⮡ 8812	N/A
Mains pow. Measurement (Actually system A measurement)	⮡ 8813	Invalid

Parameter	ID	Value
Mains connection	⮡ 8814	None
Isol. Switch Para	⮡ 8815	None
Variable system	⮡ 8816	System A

5. ▷ Configure the measurement system A and B.

6. ▷ Configure the breaker close and/or open relay(s) according to your tie-breaker.

7. ▷ Check the synchronization settings, like phase angle, frequency window and voltage.

8. ▷ Navigate to [Configuration / Configure application / Configure breakers / General breakers settings] and set the following parameters:

Parameter	ID	Value
Dead bus closure CBA	⮡ 3431	On
Connect A dead to B dead	⮡ 8802	On
Connect A dead to B alive	⮡ 8803	On
Connect A alive to B dead	⮡ 8804	On
Dead bus closure delay time	⮡ 8805	As required
Dead bus detection max. volt	⮡ 5820	As required

9. ▷ Navigate to [Configuration / Configure application / Configure breakers / Configure synchronous network] and set the following parameters:

Parameter	ID	Value
Connect synchronous mains	⮡ 8820	Yes
Max. phase angle	⮡ 8821	20°
Delay time phi max.	⮡ 8822	1 s
Max. voltage differential	⮡ 8823	5,00 %

10. ▷ To configure the LogicsManager in regards to close and open commands for the tie-breaker navigate to [Configuration / Configure application / Configure breakers / Configure CBA].

11. ▷

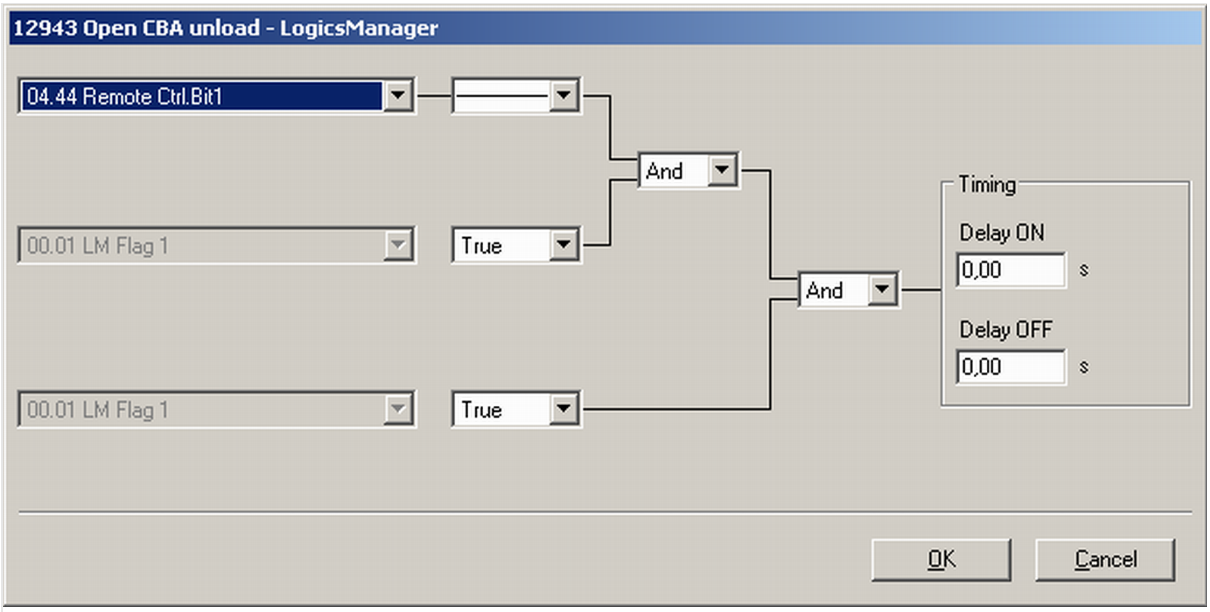


Fig. 164: LogicsManager configuration 'Open CBA unload'

Select [Open CBA unload / LogicsManager] ⮡▷ 12943 and configure the equation as follows:

- The LM equation opens the tie-breaker (CBA) with unloading, if the remote control bit 1 is sent by the PLC.

> The unloading of the tie-breaker is only executed, if one side contains a variable system. Otherwise the open command is given without unloading.

12. ▷

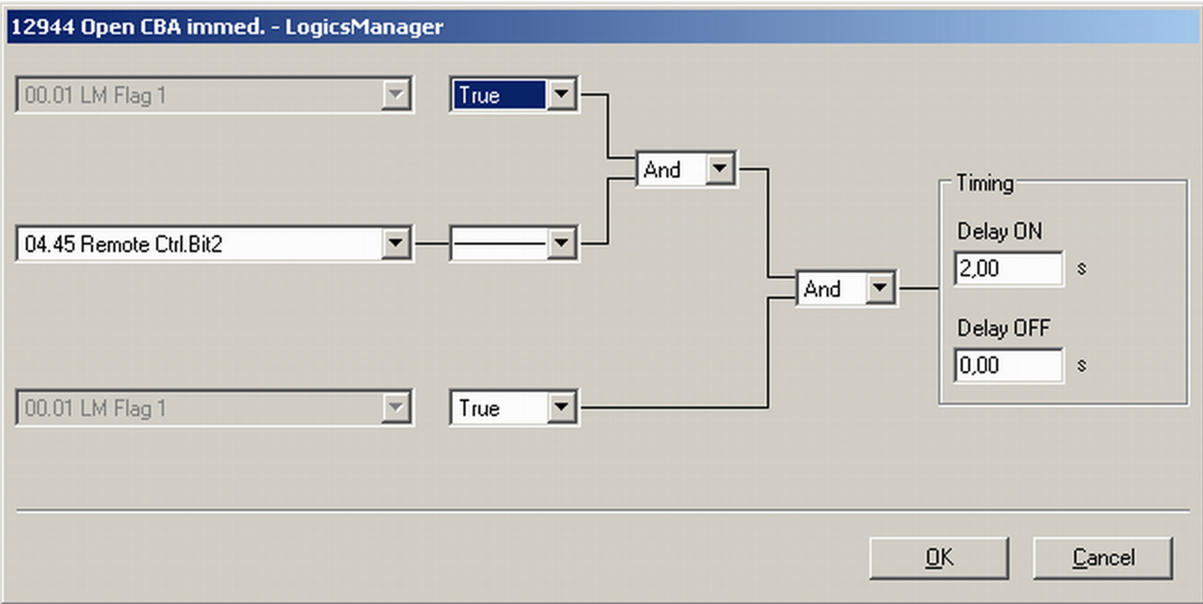


Fig. 165: LogicsManager configuration 'Open CBA immed.'

Select [Open CBA immed. / LogicsManager] ⮡▷ 12944 and configure the equation as follows:

- The LM equation opens the tie-breaker (CBA) immediately, if the remote control bit 2 sent by the PLC.

13. ▷

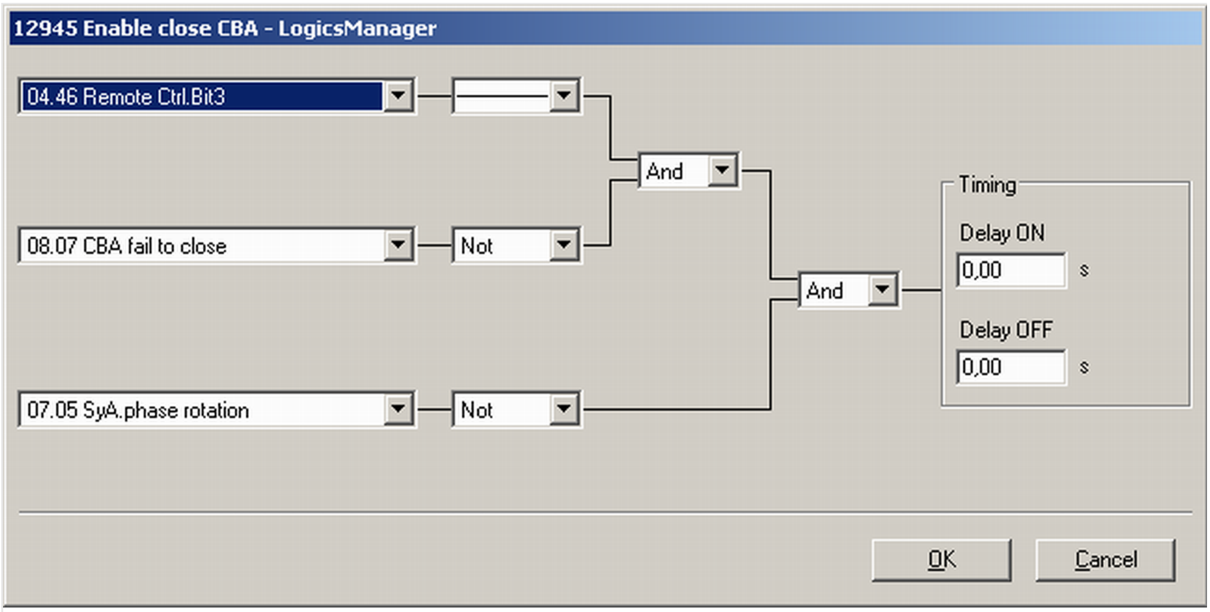


Fig. 166: LogicsManager configuration 'Enable close CBA.'

Select [Enable close CBA / LogicsManager] ⮡ 12945 and configure the equation as follows:

- The LM equation gives the release for close CBA (CBA), if the remote control bit 3 is sent by the PLC **AND** the CBA has no closure failure **AND** the system A measurement detects no phase rotation error.

> The same remote control bits can be used in the upper example, because each LS-6 receives its own control bits. The different device and node-ID separates the control bits from each other.

⚙ Configure LS-6 (tie-breaker plant/load busbar)

>

- Personnel: User

1. ▷ Configure the application mode ⮡ 9018 of the LS-6 on CBA mode.
Configure the application mode ⮡ 8840 of the LS-6 device to A02 'LSx' .

2. ▷ Enter the device ID 38 for the LS-6.

3. ▷ Enter the Node-ID (usually the same like device ID).

4. ▷ Navigate to [Configuration / Configure application / Configure segment] and configure the following parameters:

Parameter	ID	Value
Segment No. Sy.A	⮡ 8810	2
Segment No. Sy.B	⮡ 8811	7
Segment No. isol. Switch	⮡ 8812	N/A

Parameter	ID	Value
Mains pow. Measurement (Actually system A measurement)	8813	Invalid
Mains connection	8814	None
Isol. Switch Para	8815	None
Variable system	8816	System A

5. ▷ Configure the measurement system A and B.
6. ▷ Configure the breaker close and/or open relay(s) according to your tie-breaker.
7. ▷ Check the synchronization settings, like phase angle, frequency window and voltage.
8. ▷ Navigate to [Configuration / Configure application / Configure breakers / General breakers settings] and set the following parameters:

Parameter	ID	Value
Dead bus closure CBA	3431	On
Connect A dead to B dead	8802	On
Connect A dead to B alive	8803	On
Connect A alive to B dead	8804	On
Dead bus closure delay time	8805	As required
Dead bus detection max. volt	5820	As required

9. ▷ Navigate to [Configuration / Configure application / Configure breakers / Configure synchronous network] and set the following parameters:

Parameter	ID	Value
Connect synchronous mains	8820	Yes
Max. phase angle	8821	20°
Delay time phi max.	8822	1 s
Max. voltage differential	8823	5,00 %

10. ▷ To configure the LogicsManager in regards to close and open commands for the tie-breaker navigate to [Configuration / Configure application / Configure breakers / Configure CBA].

11. ▷

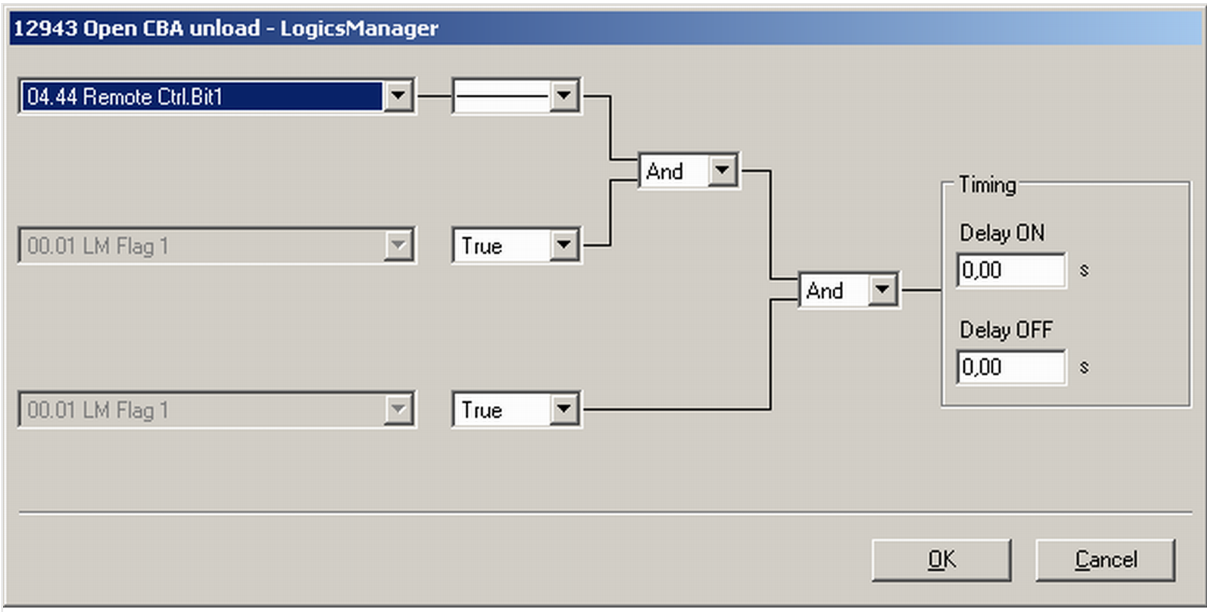


Fig. 167: LogicsManager configuration 'Open CBA unload'

Select [Open CBA unload / LogicsManager] ⮡ 12943 and configure the equation as follows:

- The LM equation opens the tie-breaker (CBA) with unloading, if the remote control bit 1 is sent by the PLC.

> The unloading of the tie-breaker is only executed, if one side contains a variable system. Otherwise the open command is given without unloading.

12. ▷

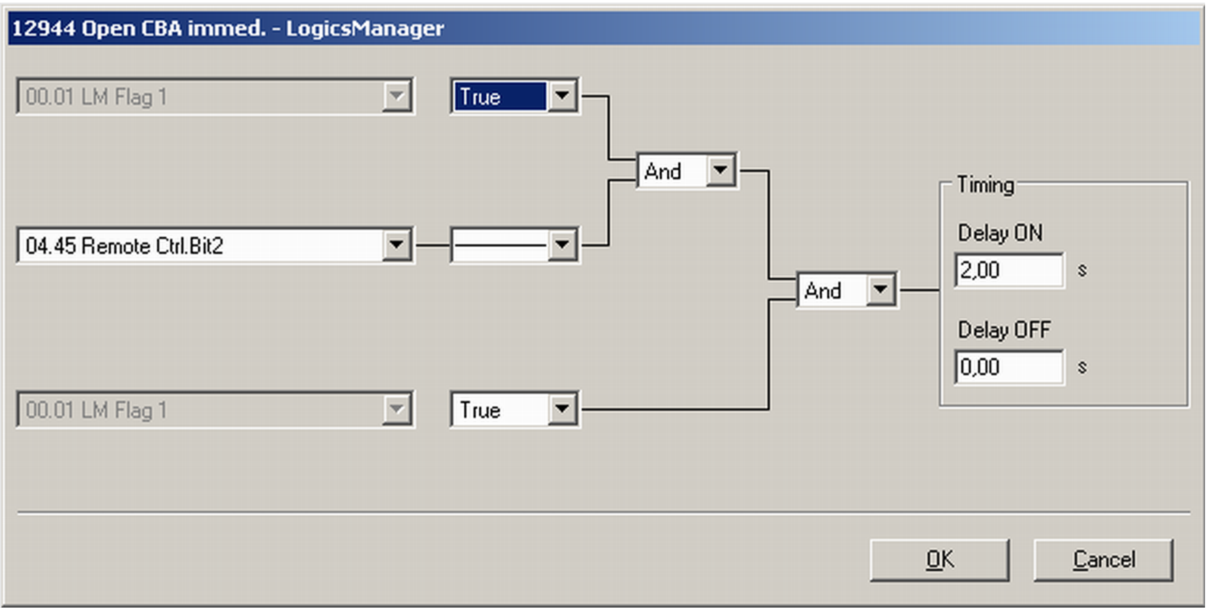


Fig. 168: LogicsManager configuration 'Open CBA immed.'

Select [Open CBA immed. / LogicsManager] ⮡ 12944 and configure the equation as follows:

- The LM equation opens the tie-breaker (CBA) immediately, if the remote control bit 2 sent by the PLC.

13. ▷

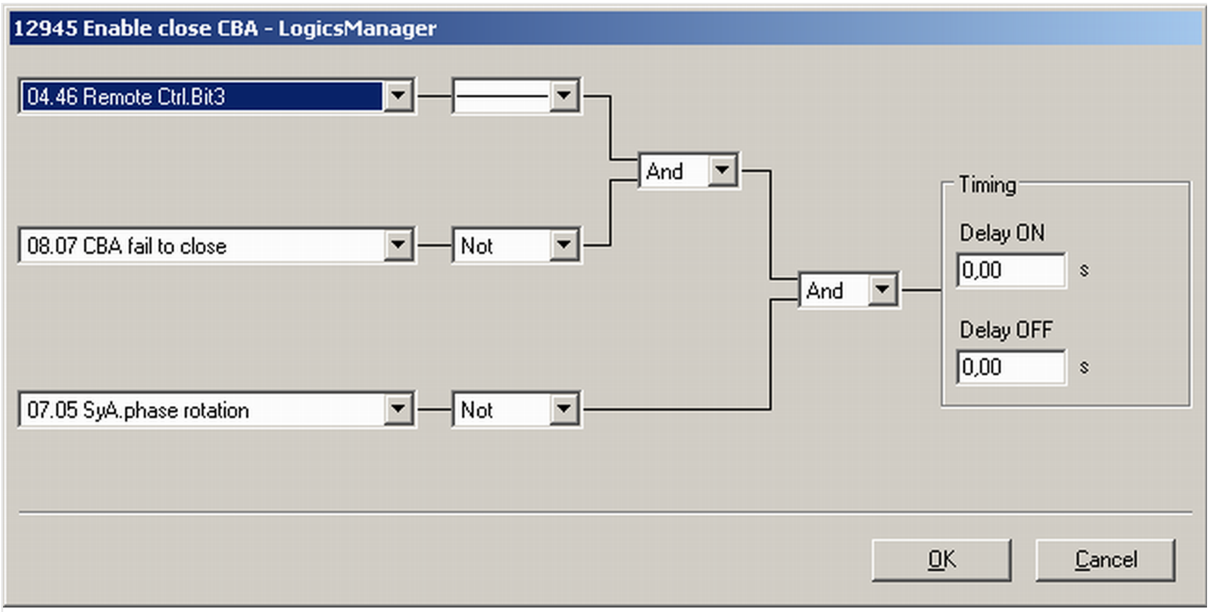


Fig. 169: LogicsManager configuration 'Enable close CBA.'

Select [Enable close CBA / LogicsManager] ⮡▷ 12945 and configure the equation as follows:

- The LM equation gives the release for close CBA (CBA), if the remote control bit 3 is sent by the PLC **AND** the CBA has no closure failure **AND** the system A measurement detects no phase rotation error.

> The same remote control bits can be used in the upper example, because each LS-6 receives its own control bits. The different device and Node-ID separates the control bits from each other.

Configure easYgen(s)

- Personnel: User

1. ▷ Configure the application mode (parameter 3444) of each easYgen device to A07 'GCB/ LSx' .
2. ▷ Enter the device ID 1 for the easYgen (usually from left to right).
3. ▷ If the CAN interface is used take care that all devices have different CAN Node-IDs. (Usually the same number as the device number is taken).
4. ▷ Navigate to [Parameter / Configuration / Configure Application / Configure Controller / Configure load share] to enter the basic segment numbers at the easYgen(s).

Position	Parameter	ID	Value
easYgen ID 1 Left side	Segment number	1723	4
easYgen ID 2	Segment number	1723	5

Position	Parameter	ID	Value
Right side			

5. ▷ Configure the measurement for generator and busbar according to the easYgen manual. The mains measurement is not used in this application mode. Therefore:

- You should switch off the single mains monitoring functions or you disable mains monitoring generally by the LogicsManager “Disable mains monitoring” (parameter 15159).
- You should switch off the mains decoupling function by the parameter “Mains decoupling” (parameter 3110).

6. ▷ When tapping voltages over power transformer, phase angle compensation may be required.

If a phase angle compensation over the GCB is required, navigate to [Parameter / Configuration / Configure Application / Configure Breakers / Configure GCB / Phase angle compensation GCB].

NOTICE!

Component damage

Incorrect settings may cause erratic system behavior and damage to the involved components .

- Set the values carefully and double check with a voltmeter at the according breaker.

7. ▷ To display the mains values coming from LS-6 on the Home Page, navigate to [Parameter / Configuration / Configure measurement] and set [Show mains data] (parameter 4103) to "LSx".

8. ▷ For the AMF mode the emergency run segments have to be configured.

Navigate to [Parameter / Configuration / Configure application / Configure emergency run].
In this application two setups are possible:

Example setup 1

Each generator group monitors its own generator/load busbar and mains income:

- The easYgens in the left group are configured to "segment 1"; "segment 2" and "segment 4".

  The easYgens on the left side start, if at least one of these 3 segments is running outside its operating ranges.
  On the other side the AMF mode stops, if all segments are back in operating range and the incoming mains are closed.
- The easYgens in the right group are configured to "segment 8"; "segment 7" and "segment 5".

  The easYgens on the right side start, if at least one of these 3 segments is running outside its operating ranges.

Example setup 1

On the other side the AMF mode stops, if all segments are back in operating range and the incoming mains are closed.

Example setup 2

All generators monitor both generator/load busbars and mains incomes.

- All easYgens are configured to "segment 1"; "segment 2"; "segment 4"; "segment 8"; "segment 7" and "segment 5".

  All easYgen(s) start, if at least one of these 6 segments is running outside its operating ranges.

  On the other side the AMF mode stops, if all segments are back in operating range and at least one incoming mains in the own segment is closed.

9. ▷ In this setup each easYgen device provides six free usable control bits for sending information to the whole device system in layer 1. These bits can be used as command variables in the LS-6.

One of the bits could for example be used to initiate alarms acknowledgement in the LS-6.

Navigate to [Parameter / Configuration / Configure LogicsManager / Configure LSx] to configure the command variables.

6.4 Breaker Mode CBA/CBB

For detailed information on the application modes, notes on safety and examples of special applications refer to the following chapters:

The CBA/CBB Modes

- Setup Stand-Alone Applications (Mode A01)
- Setup easYgen and slave LSx with 2 breaker applications (Mode A05)
- Setup easYgen and independent LSx with 2 breaker applications (Mode A02)

6.4.1 CBA/CBB-Mode: Correlating application modes

	LS-6XT (CBA/CBB Mode)		easYgen-3400XT/3500XT	
	Mode	**Symbol**	**Mode**	**Symbol**
LS-6	Single LSx	A01	N/A	N/A
LS-6 & easYgen	LSx (up to 16 unit)	A02	GCB/LSx	A07
	L-GGBMCB (max. 1 unit)	A05	GCB/L-GGBMCB	A12

6.4.2 CBA/CBB-Mode: Stand-Alone Application Mode

LS6XT (CBA/CBB Mode)		easYgen-3400XT/ 3500XT		
Mode	**Symbol**	**Mode**	**Symbol**	**Function**
Single LSx	A01	None	None	Independent synch check relay mode CBA and CBB. This application mode provides the following functions: • Handling of CBA (dead bus closure, synchronization, open) initiated by the corresponding command variables or by manual commands. • Measuring and monitoring of system A values (voltage, frequency, phase rotation, current). • Measuring of active and reactive power on system A. • Measuring of phase angle system A to system B. • Interacting as an independent synchronizer for a PLC by communication interface (CANopen, Ethernet TCP Modbus RTU slave). • Handling of CBB (dead bus closure, synchronization, open) initiated by the corresponding command variables or by manual commands. • Measuring of system B values (voltage, frequency, phase rotation, current). • Measuring of active and reactive power on system B. • Mains decoupling function in the LS-6XT configurable, if device connected with system A at mains. • Calculating of an active and reactive load.

6.4.3 CBA/CBB-Mode: LSx & easYgen-3400XT/3500XT Common Application Modes

For information on the easYgen genset control unit's application modes refer to the easYgen manual.

6.4.3.1 LSx View

LS-6XT (CBA/CBB Mode)		easYgen-3400XT/ 3500XT		
Mode	**Symbol**	**Mode**	**Symbol**	**Function**
LSx	A02	GCB/LSx	A07	Open LSx system, in combination with easYgen-3400XT/3500XT, individually configurable. Multiple LS-6XT in CBA or CBA/CBB mode are allowed. The breakers CBA and CBB are operated. This application mode provides the following functions: • Handling of CBA (dead bus closure, synchronization, open) initiated by the corresponding command variables or by manual commands. • Measuring and monitoring of system A values (voltage, frequency, phase rotation, current). • Measuring of system B values (voltage, frequency, phase rotation, current). • Measuring of active and reactive power on system A.

LS-6XT (CBA/CBB Mode)		easYgen-3400XT/ 3500XT		
Mode	**Symbol**	**Mode**	**Symbol**	**Function**
				• Measuring of phase angle system A to system B. • Recognition of segments within the easYgen / LSx system. • Dead bus arbitration with other easYgen and LSx. • Mains decoupling function in the LS-6XT configurable, if device is connected with system A at mains. • Handling of CBB (dead bus closure, synchronization, open) initiated by the corresponding command variables or by manual commands. • Measuring of active and reactive power on system B. • Calculating of an active and reactive load.
L-GGBMCB	A05	GCB/L-GGBMCB	A12	LS-6XT as GGB and MCB control in combination with easYgen-3400XT/3500XT in a fixed application. Only one LS-6XT in CBA/CBB mode is allowed. This application mode provides the following functions: • Handling of a GGB (dead bus closure, synchronization, open) initiated by the easYgen. • Handling of a MCB (dead bus closure, synchronization, open) initiated by the easYgen. • Measuring and monitoring of system A values, (mains voltage, mains frequency, mains phase rotation, mains current), transferred to easYgen. • Measuring of system B values, (voltage, frequency, phase rotation), transferred to easYgen. • Measuring of mains active and mains reactive power on system A. • Automatic configuration of the relevant parameters. • Mains decoupling function in the LS-6XT configurable. • Measuring of active and reactive power flow on system B. • Calculating of an active and reactive load.

6.4.3.2 easYgen-3400XT/3500XT View

easYgen-3400XT/ 3500XT		LS-6XT (CBA/CBB Mode)		
Mode	**Symbol**	**Mode**	**Symbol**	**Function**
GCB/LSx	A07	LSx	A02	One or more easYgen in combination with an open LSx system, individually configurable for different application. Multiple LS-6XT in CBA or CBA/CBB mode are allowed. Multiple isolated and/or mains parallel operation. The breakers CBA and CBB are operated. This application mode provides the following functions: • Handling of the GCB (dead bus closure, synchronization, open) initiated by start command in AUTO or individually in MAN mode. • Measuring and monitoring of generator values (voltage, frequency, phase rotation, current and power). • Measuring of generator busbar values (voltage, frequency). • Indicating of mains values (voltage, frequency) sent from 'Mains'-LS-6XT with the smallest ID in the own segment. • Indicating the sum of active and reactive power sent from all 'Mains'-LS-6XT in the own segment.

easYgen-3400XT/ 3500XT		LS-6XT (CBA/CBB Mode)		
Mode	**Symbol**	**Mode**	**Symbol**	**Function**
				• Regulating Import/Export power with the sum of active and reactive power sent from all 'Mains'-LS-6XT in the own segment. • The easYgen recognizes through the LSx system the active segment number. • Connection to mains (MCB is closed) is recognized via the LSx system, if one or more “Mains”-LS-6XT are available. • The close and open commands for the single LS-6XT breakers are usually not generated in the easYgen. • Mains voltage and current is usually not connected at the easYgen. • Run-up synchronization, acting on the GCB, is possible.
GCB/L-GGBMCB	A12	L-GGBMCB	A05	One or more easYgen with one LS-6XT in CBA/CBB mode, acting on the GGB and on the MCB in a fixed application. Multiple isolated and/or mains parallel operation. The same handling as in the GCB/GGB/MCB mode, but the GGB and MCB are operated by one LS-6XT. This application mode provides the following functions: • Handling of the GCB (dead bus closure, synchronization, open) initiated by start command in AUTO or individually in MAN mode. • Handling of the GGB (dead bus closure, synchronization, open) initiated by start command in AUTO or individually in MAN mode according to the rule of the GCB/GGB/MCB mode. • Handling of the MCB (dead bus closure, synchronization, open) in AUTO and MANUAL according to the rules of the GCB/GGB/MCB mode. • Measuring and monitoring of generator values (voltage, frequency, phase rotation, current and power). • Measuring of generator busbar values (voltage, frequency) • Indicating of mains values (voltage, frequency, phase angle) sent from the LS-6XT. • Indicating of active and reactive power at the interchange point sent from LS-6XT. • Regulating Import/Export power with active and reactive power sent from LS-6XT. • Run-up synchronization, acting on the GCB or GCB/GGB, is possible.

6.4.4 CBA/CBB-Mode: Setup Stand-Alone Applications (Mode A01)

Overview

The LS-6, configured to application mode A01 'Single LSx', runs as an independent unit and does not expect any other unit on the CAN or Ethernet bus.

The idea of this mode is to use the LS-6XT as a simple change over control (ATS) controlled by discrete inputs or to run it together with a PLC. The PLC receives all measurement values (voltages, current, power, phase angle) via communication interface to run closed loop synchronization. Each breaker can be individually opened and closed, whereby the LS-6 recognizes to “close only” or to synchronize.

Additionally the LS-6 can be used as a measurement transformer for displaying and monitoring values. The decoupling functions (voltage, frequency, change of frequency) can also be used when a parallel mains setup exists.

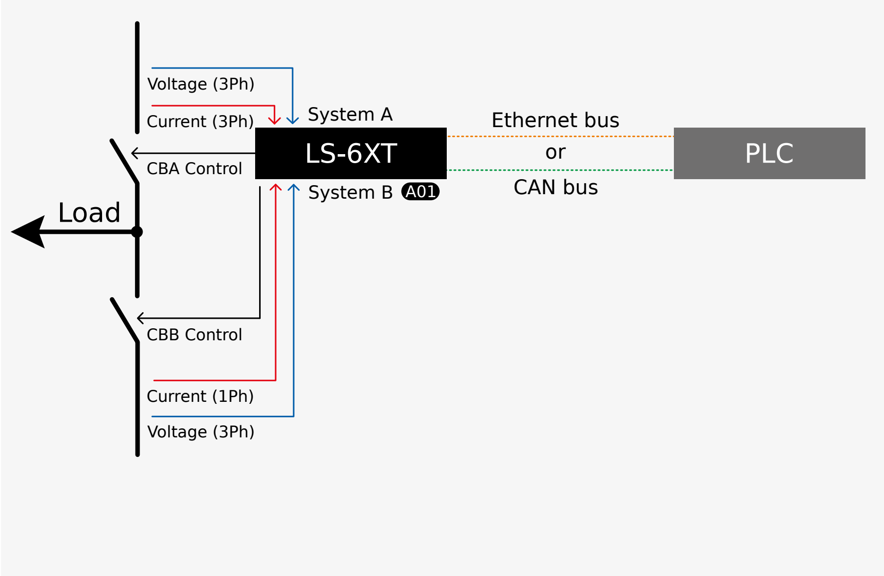


Fig. 170: Application mode A01 'Single LSx'

General notes

NOTICE!

Dead bus interlocking due to incorrect setup

No other LSx or easYgen device is expected on the CAN or Ethernet bus. After power-up the LS-6 can carry out a dead bus closure regardless if other devices are connected to the bus (arbitration time is ignored).

Nevertheless, dead bus interlocking occurs, if the LS-6 detects another device (with higher priority) within 40 seconds after power-up on the CAN bus, which wants to carry out a dead bus closure.

The LS-6 acts as if there is no other LSx in the system.

Prerequisites

- Personnel: Qualified electrician

1. ▷ For a mains decoupling function, connect the system A measurement on the mains busbar.

2. ▷ Setup the PLC to act as master and to monitor the functionality of the communication interface.

⚙ Configure LS-6

>

- Personnel: User

> The following paths a valid for the configuration via HMI. At the configuration via ToolKit the path hierarchy might be different.

1. ▷ Configure the application mode ⮑ 9018 of the LS-6 device to CBA/CBB mode.
   Set the application mode ⮑ 8992 of the LS-6 device on A01 'Single LSx'.
2. ▷ To configure measurement navigate to [Parameter / Configuration / Measurement config.] and enter the desired settings.
3. ▷
   > When tapping voltages over power transformer, phase angle compensation may be required.

   If a phase angle compensation is required, navigate to [Configuration / Configure Application / Configure breakers / Configure CBA / Phase angle compensation]

   NOTICE!

   Component damage

   Incorrect settings may cause erratic system behavior and damage to the involved components .

   - Set the values carefully and double check with a voltmeter at the according breaker.

4. ▷ If control to open and close the breaker should be handled by discrete inputs, use the default setting according to the wiring diagram (⮑ "3.2.2 Wiring Diagram").
5. ▷ If control to open and close the breaker should be handled by communication interface, the register with the remote control bits is used (LM Command variables 04.44 to 04.59, Bit 1 to Bit 16).
   For more information on how to address the according data register refer to ⮑ "7 Interfaces And Protocols".
6. ▷ Configure the breaker close command
   - To configure the close command CBA, the LogicsManager equation "Enable close CBA" can be modified.
     Navigate to [Configuration / Configure application / Configure breakers / Configure CBA / Enable close CBA] and enter the desired arguments.
   - To configure the close command CBB, the LogicsManager equation "Enable close CBB" can be modified.
     Navigate to [Configuration / Configure application / Configure breakers / Configure CBB / Enable close CBB] and enter the desired arguments.
7. ▷ Configure the breaker open command

- To configure the open command CBA, the LogicsManager equation "Open CBA immed." can be modified.

  Navigate to [Configuration / Configure application / Configure breakers / Configure CBA / Open CBA immed.] and enter the desired arguments.
- To configure the open command CBB, the LogicsManager equation "Open CBB immed." can be modified.

  Navigate to [Configuration / Configure application / Configure breakers / Configure CBB / Open CBB immed.] and enter the desired arguments.

> The open command can only be executed through the LogicsManager equation "Open CBA unload", if the PLC can influence the unloading of the breaker.

8. ▷ If manual operation via push buttons acting on DI is required

- For the CBA the two LogicsManager equations "Open CBA in manual" and "Close CBA in manual" can be used.

  Set the parameter "Open CBA in manual" to "Immediate".
- For the CBB the two LogicsManager equations "Open CBB in manual" and "Close CBB in manual" can be used.

  Set the parameter "Open CBB in manual" to "Immediate".

9. ▷ The LS-6 can be adjusted for different kinds of breaker closure.

Navigate to [Configuration / Configure application / Configure breakers / General breakers settings] to configure specific kinds of breaker closure.

Configure "Dead bus closure CBA" to generally handle any kind of dead busbar closure.

10. ▷

- Navigate to [Configuration / Configure application / Configure breakers / Breaker transition mode] to choose the correct switch over from CBA to CBB and back. Or determine here the continuous parallel mode, if desired.

6.4.5 CBA/CBB-Mode: Setup easYgen & Slave LS-6 Application (Mode A05)

Introduction

In application mode A05 'L-GGBMCB' the LS-6 runs as a slave unit. The L-GGBMCB setup allows to install one LS-6 and up to 32 easYgen-3400/3500XT devices. The easYgen(s) closes and opens its own generator circuit breaker (GCB). The LS-6 as slave opens and closes the generator group breaker (GGB) and the mains circuit breaker (MCB).

The easYgen(s) runs the same tasks as in the application mode GCB/GGB/MCB with the differentiation, that instead of a direct GGB and MCB handling through the easYgen, the LS-6 device takes over that part.

The decision when to close or open the MCB and GGB comes from the easYgen(s) over the CAN or Ethernet bus to the LS-6. Through the CBA/CBB mode the commands automatically act on the dedicated LogicsManager equations in the LS-6. Therefore 6 CB control flags are sent from the easYgen-3500XT to the LS-6. They have the following meaning:

No.	Name	Function
28.01	Command 1 to LSx easYgen (OR)	Open and close MCB
28.02	Command 2 to LSx easYgen (OR)	
28.03	Command 3 to LSx easYgen (OR)	Open and close GGB
28.04	Command 4 to LSx easYgen (OR)	
28.05	Command 5 to LSx easYgen (OR)	Handling open or closed transition
28.06	Command 6 to LSx easYgen (OR)	

The manual control of the GCB, GGB and MCB is restricted to the easYgen(s). In the LS-6 there is no Manual mode available.

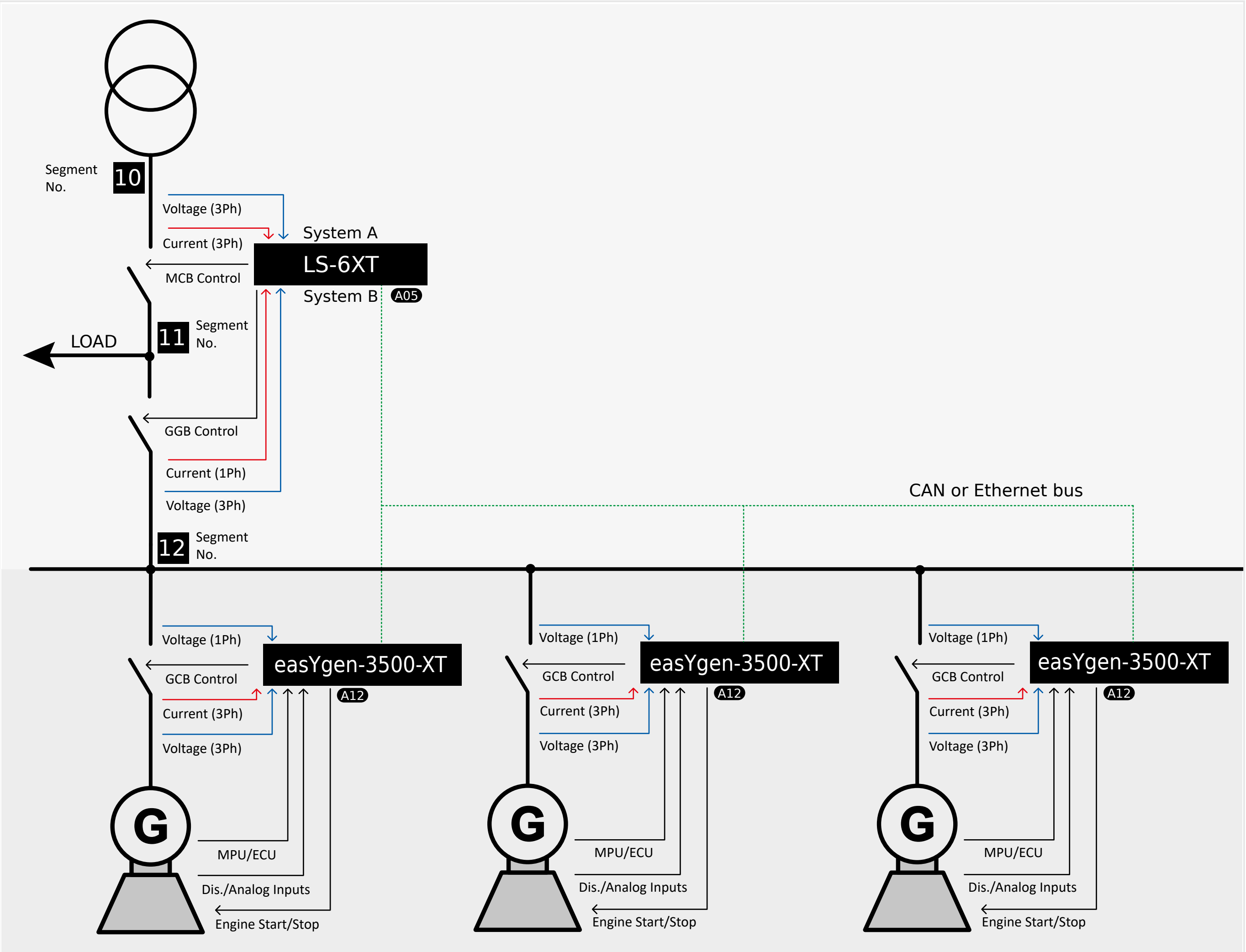


Fig. 171: Application mode A05 'L-GGBMCB' (example)

General notes

The LS-6 expects at least one easYgen device in the system.

The L-GGBMCB mode does not allow any other segmenting as demonstrated in the drawing above. If further segments are desired, the easYgen and the LS-6 must be configured to the free LSx mode: easYgen **A07** 'GCB/LSx' and LS-6 **A02** 'LSx'.

Only the easYgen-3400/3500XT version 1.13 and higher provides the mode GCB/L-GGBMCB and can perform this function in conjunction with the LS-6.

6.4.6 CBA/CBB-Mode: Setup easYgen & Independent LSx Applications (Mode A02)

Introduction

In application mode **A02** 'LSx' the LS-6 runs as an independent unit. The free LSx setup allows up to 32 easYgen-3400XT/3500XT and up to 16 LS-6 devices if CAN bus is used. In case of Ethernet bus connection 32 easYgen-3400XT/3500XT and up to 32 LS-6 devices are useable. The easYgen(s) are only operating their GCBs. The other breakers have to be operated by the LS-6.

The closing and opening of the CBA is controlled through the LogicsManager equations "Open CBA unload", "Open CBA immed." and "Enable close CBA". The closing and opening of the CBB is controlled through the LogicsManager equations "Open CBB unload", "Open CBB immed." and "Enable close CBB".

The close and open commands are configured with LogicsManager command variables. This can be discrete inputs, remote control flags or flags coming from easYgen(s) or other LS-6(s).

The operating mode MANUAL in the LS-6 is supported and provides the operator with the option to manually force a close or open of the breaker. For this purpose the LS-6 provides an operating mode button and a softkey to close and open the breaker.

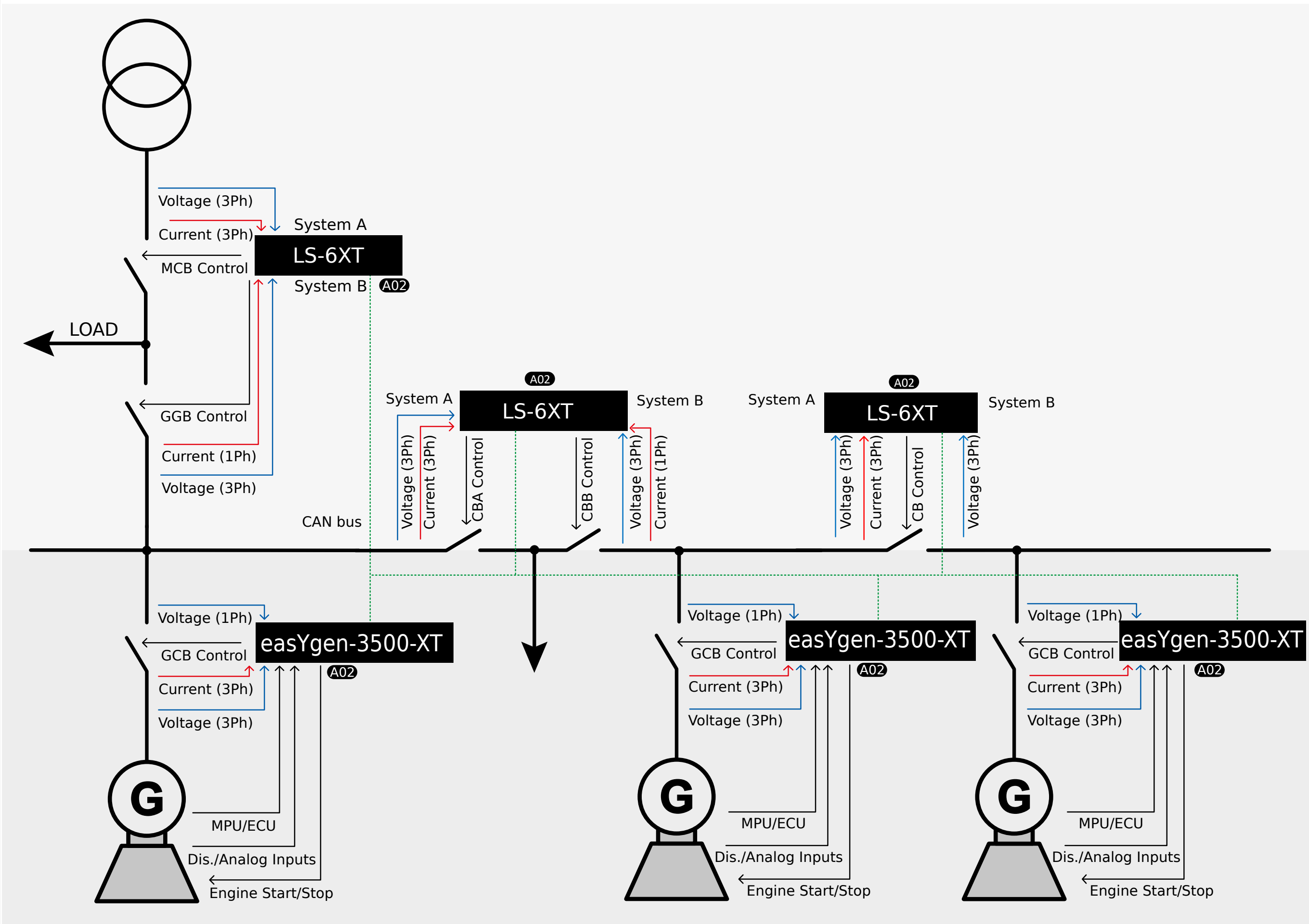


Fig. 172: LS-6 Application mode A02 'LSx' (example)

The band width of the CAN bus allows to connect up to 32 easYgens in conjunction with up to 16 LSx devices. This is always guaranteed. In particular cases it could be desired to run more than 16 LSx devices. Theoretically up to 32 LSx are possible, but it requires in return a reduced number of easYgen devices. A rule of thumb is that the total amount of easYgens and LSx shall never expire 48 devices. To be on the safe side please discuss the possible risks with the Woodward Sales Support.

General notes

The LS-6 is expecting at least one easYgen device in the system.

Depending on the complexity of the system equally complex external program logics may be required.

The LS-6 application mode A02 'LSx' opens a wide range of applications and requires more effort to configure the whole easYgen – LSx system.

The sections below explain some of the terms and concepts required in understanding these more complex applications.

Segment number

A 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 an LSx.

A transformer is not considered as a segment or a point of isolation. Each segment, feeder, or interconnection must be assigned a number that is unique to that segment.

The LS-6 in CBA/CBB mode manages 3 segments:

- System A segment
- Load segment
- System B segment

CBA (Mains breaker)

The frequency and voltage are solid. A segment number is needed. The first breaker on the mains side is the CBA.

The LS-6 is always connected with measurement system A on the mains side. The setting "Mains connection" is always set on "System A". The system A measurement gets the mains segment number.

CBB (Group breaker)

The LS-6 is always connected with measurement system B on the group breaker side. The setting "Mains connection" is always set on "System A". The system B measurement gets the busbar segment number.

Generator

The frequency and voltage are variable. A segment number is not needed.

Device number (control number)

All connected control units must be configured with a unique device number (control number). Hence the units are clear defined in their function and location.

The numbers 1 to 32 are reserved for the easYgen(s) (easYgen "Device number"), the numbers 33 to 64 are reserved for the LSx (parameter 1702 ⮱▷ 1702).

CAN bus Node-ID number

To communicate via the CAN bus it is necessary to configure all connected controls with a unique CAN bus Node-ID number (parameter ⮱▷ 8950). Usually the same number like the device ID number is taken.

Priority during breaker closure

In an emergency application the simultaneous closing of two circuit breakers is blocked via communications between the LSx and the easYgen. Once an easYgen is enabled for a dead bus connection, it has priority over all LSx (any CB controlled by an LSx cannot be closed).

If multiple LSx are enabled to close a circuit breaker at the same time the LSx with the lowest Device number receives the master status (all other LSx are inactive).

When a closure failure occurs in CBA-mode, this LSx is no longer considered for dead bus closure. The next prioritized LSx takes over.

When a closure failure occurs in CBA/CBB-mode, this LSx is no longer considered for dead bus closure. The next prioritized LSx takes over.

If the LS-6 in CBA/CBB-mode gets simultaneously instructions to close breaker A and B, the CBA closure is executed first.

6.4.6.1 H-Configuration with two easYgen and two incoming Mains and Tie-breaker

Overview

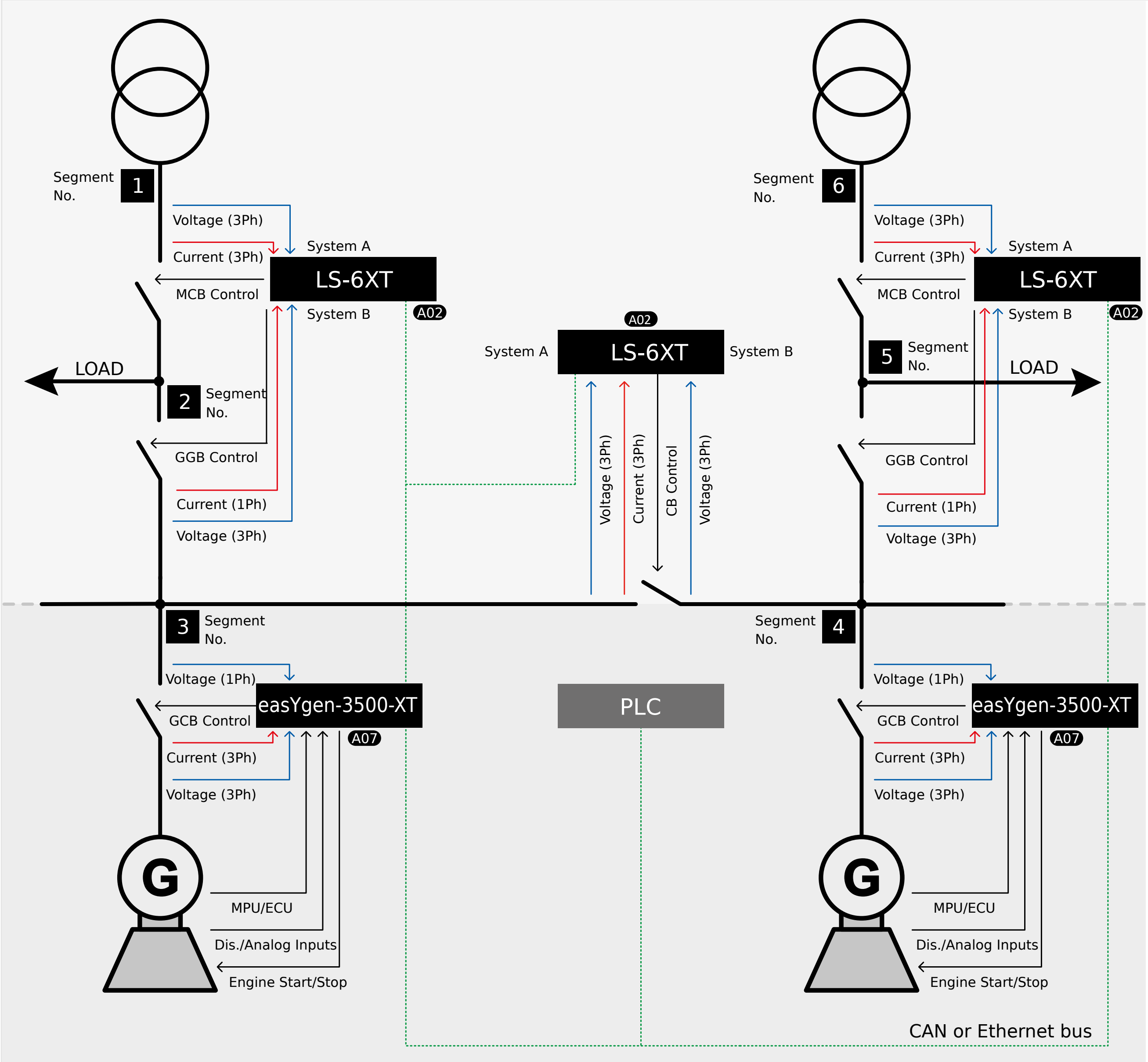


Fig. 173: H-Configuration with two easYgen and two incoming mains and tie-breaker

One or more genset(s) feed on a generator busbar (Segment No. 3). One or more genset(s) feed on a generator busbar (Segment No. 4) . On each mains income side (Segment No. 1 and 6) a load output (Segment No. 2 and 5) is installed, which is switched to mains or to generator(s) by an LS-6 in CBA/CBB mode. The LS-6 in CBA/CBB mode acts thereby with its CBA on a mains breaker (MCB) and with its CBB on a group breaker (GGB). The LS-6 in CBA/CBB mode could operate an ATS, a Changeover Panel or two separate breakers to fulfill it. Generator mains parallel operation is also possible. A tie-breaker is located between the both generator segments.

The easYgen(s) are started by a remote start signal or by AMF mode and operating their GCBs. The other breakers, handled by the LS-6 devices, receive their breaker open and close commands through orders coming from an external logic. The external logic could be a discrete input, a remote control bit, a monitor function, an easYgen command, etc..

In this example the decision when to close or open the breaker is managed by a PLC sending its orders over the CANopen or Ethernet protocol. Serial Modbus can also be used to send orders or read information from all members.

Amongst others, the breaker feedbacks of the single LS-6 are sent via the CAN or Ethernet interface and inform all other connected devices in the system, whether they are interconnected or not. This determines the argument of the regulation for the easYgen (i.e. power control, frequency control, load sharing).

Required application modes:

- easYgen-3400XT/3500XT: A07 'GCB/LSx'
- LS-6: A02 'LSx'

General notes

Please note that the measured power of all LS-6s in the same segment are accumulated if there a several mains interchange points. The import/export control is based on this accumulated power. It is not possible to individually control the power at the single mains interchange points in the same segment.

All units must be configured according to the requirements listed in "6.4.6 CBA/CBB-Mode: Setup easYgen & Independent LSx Applications (Mode A02)".

The following example does not contain any isolation switches, which could divide the segments.

Single line diagram

1. Draw a single line diagram that only contains essential equipment.
   In this case the schematic should contain two incoming mains with MCBs, two or more generators per generator segment, and all breakers (tie-breaker, GCB, GGB, MCB).
2. Number all easYgen control units from 1 to 32.
3. Number all system LSx from 33 to 48.
4. If the CAN interface is used take care that all devices have different CAN Node-IDs. (Usually the same number as the device number is taken).
5. Number all segments according to the definitions of a segment.

   Unless special numbering conventions are required, count up continuously from left to right or right to left.
6. Draw the measurement system A and B of the single LSx into the single line diagram according to the definitions in "6.4.6 CBA/CBB-Mode: Setup easYgen & Independent LSx Applications (Mode A02)".
   Keep system A and B on the same side. This simplifies the configuration. The location of a CT may force you to ignore this rule but this can be compensated for in the configuration.

Prerequisites LS-6 (incoming mains, Changeover Panel)

- Personnel: Qualified electrician

1. The system A voltage and current measurement is connected to the mains.
2. The system B voltage measurement is connected to the generator busbar.
3. The MCB breaker feedback is connected to the LS-6 (CBA).
4. The MCB breaker commands are connected to the LS-6 (CBA).
5. The GGB breaker feedback is connected to the LS-6 (CBB).
6. The GGB breaker commands are connected to the LS-6 (CBB).
7. Set up the Communication Interface between the devices. Refer to Communication Management "6.6 Communication Management" for more information.

Prerequisites LS-6 (tie-breaker)

- Personnel: Qualified electrician

1. The system A voltage and current measurement is connected to the generator busbar Segment No. 3.
2. The system B voltage measurement is connected to the generator busbar segment Segment No. 4.
3. The tie-breaker feedback is connected to the LS-6 only.
4. The tie-breaker commands are connected to the LS-6 only.
5. Set up the Communication Interface between the devices. Refer to Communication Management "6.6 Communication Management" for more information.

Prerequisites easYgen(s)

- Personnel: Qualified electrician

1. The generator voltage and current measurement is connected to the generator.
2. The busbar voltage measurement is connected to the generator busbar.
3. The mains voltage measurement is not used.
4. The GCB breaker feedback is connected to the according easYgen.
5. The GCB breaker commands are connected to the according easYgen.
6. Set up the Communication Interface between the devices. Refer to Communication Management "6.6 Communication Management" for more information..

Configure LS-6 (incoming mains, Changeover Panel)

>

- Personnel: User

1. ▷ Configure the application mode ⮡ 9018 of the LS-6 on CBA/CBB mode
Configure the application mode ⮡ 8992 of the LS-6 device on A02 'LSx'

2. ▷ Enter the device ID 33 for the LS-6, incoming mains on the left side and ID 35 for the LS-6, incoming mains on the right.

3. ▷ If the CAN interface is used take care that all devices have different CAN Node-IDs. (Usually the same number as the device number is taken).

4. ▷ For the following two steps navigate to [Configuration / Configure application / Configure segment] on each respective LS-6.

5. ▷ Configure the following parameters for the LS-6 ID 33, incoming mains on the left side:

Parameter	ID	Value
Segment number Sy.A	⮡ 8810	1
Segment number Sy.B	⮡ 8811	3
Segment number load	⮡ 8799	2
Mains pow. measurement	⮡ 8813	Valid
Mains connection	⮡ 8814	System A
Variable system	⮡ 8816	System B

6. ▷ Configure the following parameters for the LS-6 ID 35, incoming mains on the right side:

Parameter	ID	Value
Segment number Sy.A	⮡ 8810	6
Segment number Sy.B	⮡ 8811	4
Segment number load	⮡ 8799	5
Mains pow. measurement	⮡ 8813	Valid
Mains connection	⮡ 8814	System A
Variable system	⮡ 8816	System B

7. ▷ When tapping voltages over power transformer, phase angle compensation may be required.

If a phase angle compensation over the MCB is required, navigate to [Configuration / Configure application / Configure breakers / Configure CBA / Phase angle compensation]

NOTICE!

Component damage

Incorrect settings may cause erratic system behavior and damage to the involved components .

- Set the values carefully and double check with a voltmeter at the according breaker.

8. ▷ Configure the breaker close and/or open relay(s) according to your MCB (CBA).

9. ▷ Configure the breaker close and/or open relay(s) according to your GGB (CBB).

10. ▷ Check the synchronization settings, like phase angle, frequency window and voltage for CBA and CBB.

11. ▷ Navigate to [Configuration / Configure application / Configure breakers / General breakers settings] and set the following parameters:

Parameter	ID	Value
Dead bus closure CB	⮡ 3432	On
Connect A dead to B dead	⮡ 8802	Off
Connect A dead to B alive	⮡ 8803	Off
Connect A alive to B dead	⮡ 8804	Off
Dead bus closure delay time	⮡ 8805	As required
Dead bus detection max. volt	⮡ 5820	As required
Connect open load to A dead	⮡ 9013	Off
Connect open load to A alive	⮡ 9014	On
Connect open load to B dead	⮡ 9015	Off
Connect open load to B alive	⮡ 9016	On

12. ▷ Navigate to [Configuration / Configure application / Configure breakers / Configure synchronous network] and set the following parameters:

Parameter	ID	Value
Connect synchronous mains	⮡ 8820	Yes
Connect synchronous segments	⮡ 8852	No
Max. phase angle	⮡ 8821	20°
Delay time phi max.	⮡ 8822	1 s
Max. voltage differential	⮡ 8823	5,00 %

13. ▷ There are different possibilities to control the breakers. The example here is based on the assumption that a PLC or an operator from outside wants to switch the load to mains (CBA, System A) or to generator (CBB, System B). There are two control bits to set:

- Control bit 1: switch load 1 to mains
- Control bit 2: switch load 1 to generator

14. ▷ To configure the LogicsManager in regards to close and open commands for the MCB (CBA) and GGB (CBB) navigate to [Configuration / Configure application / Configure breakers / General breakers settings].

15. ▷ The both LS-6 devices connected at the mains allow a load transfer from generator to mains and vice versa. Therefore the breaker transition modes in both according LS-6 are configurable. Configure "Breaker transition mode" ⮡ 3411 to the prefered change over mode.
If there is a need to change the current configured breaker transition mode go over the LogicsManager “Transition mode 1" ⮡ 12931 and switch to another desired mode accordingly.

16. ▷ To configure the LogicsManager in regards of close and open commands for the MCB (CBA) and GGB (CBB) navigate to [Configuration / Configure application / Configure breakers / Configure CBA].

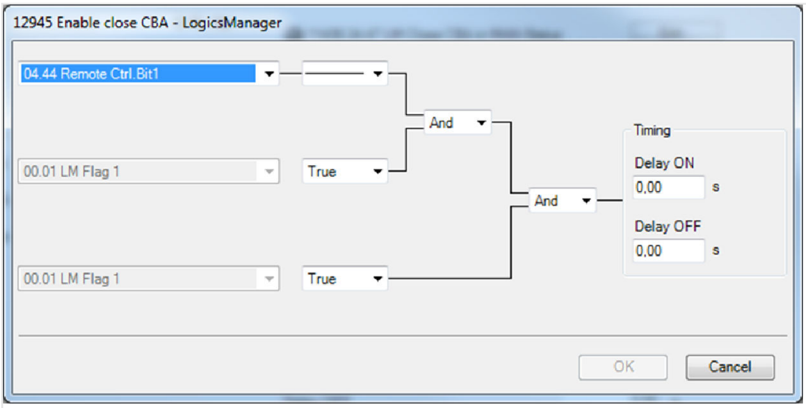
17. ▷ 

Fig. 174: LogicsManager configuration "Enable close CBA"

Configure the LogicsManager “Enable close CBA" ⮡▷ 12945 as follows: The LogicsManager equation releases the switching of load to mains by MCB (CBA) if the remote control bit 1 is sent by the PLC.

18. ▷ To configure the LogicsManager in regards to close and open commands for the MCB (CBA) and GGB (CBB) navigate to [Configuration / Configure application / Configure breakers / Configure CBB].

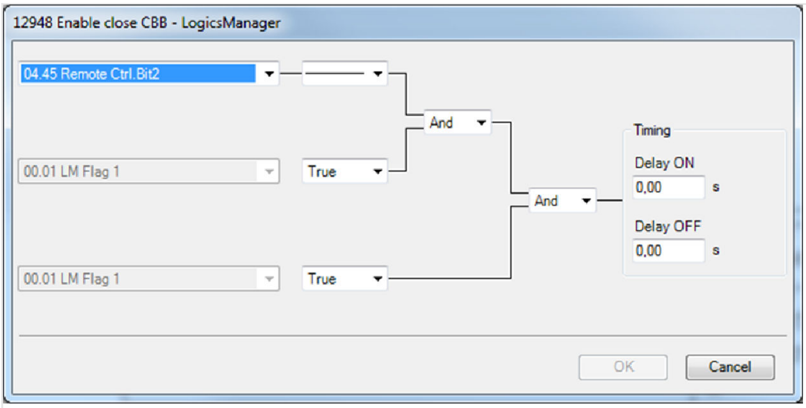
19. ▷ 

Fig. 175: LogicsManager configuration "Enable close CBB"

Configure the LogicsManager “Enable close CBB" ⮡▷ 12948 as follows: The LogicsManager equation releases the switching of load to generator by GGB (CBB) if the remote control bit 2 is sent by the PLC.

Bit 1: Enable CBA	Bit 2: Enable CBB	Action
0	0	No breaker action
1	0	Switch load 1 to mains if the relevant conditions are matched.
0	1	Switch load 1 to generator if the relevant conditions are matched.
1	1	Switch load 1 to mains if the relevant conditions are matched.

If “Enable close CBA” and “Enable close CBB” are set to the same time the CBA is prioritized.

For the LS-6 ID 35 the same remote control bits can be used because each LS-6 receives its own control bits. The different device number and the Node-ID differentiates the control bits from each other.

Configure LS-6 (tie-breaker)

- Personnel: User

1. Configure the application mode ⮡ 9018 of the LS-6 on CBA mode. Configure the application mode ⮡ 8992 of the LS-6 device to A02 'LSx'.
2. Enter the device ID 34 for the LS-6.
3. If the CAN interface is used take care that all devices have different CAN Node-IDs. (Usually the same number as the device number is taken).
4. Navigate to [Configuration / Configure application / Configure segment] and configure the following parameters:

Parameter	ID	Value
Segment No. Sy.A	⮡ 8810	3
Segment No. Sy.B	⮡ 8811	4
Segment No. isol. Switch	⮡ 8812	N/A
Mains pow. Measurement (Actually system A measurement)	⮡ 8813	Invalid
Mains connection	⮡ 8814	None
Isol. Switch Para	⮡ 8815	None
Variable system	⮡ 8816	System B

5. Configure the measurement system A and B.
6. When tapping voltages over power transformer, phase angle compensation may be required.

If a phase angle compensation over the tie-breaker is required, navigate to [Configuration / Configure application / Configure breakers / Configure CBA / Phase angle compensation]

NOTICE!

Component damage

Incorrect settings may cause erratic system behavior and damage to the involved components .

- Set the values carefully and double check with a voltmeter at the according breaker.

7. ▷ Configure the breaker close and/or open relay(s) according to your tie-breaker.

8. ▷ Check the synchronization settings, like phase angle, frequency window and voltage.

9. ▷ Navigate to [Configuration / Configure application / Configure breakers / General breakers settings] and set the following parameters:

Parameter	ID	Value
Dead bus closure CB	⮡ 3432	On
Connect A dead to B dead	⮡ 8802	On
Connect A dead to B alive	⮡ 8803	On
Connect A alive to B dead	⮡ 8804	On
Dead bus closure delay time	⮡ 8805	As required
Dead bus detection max. volt	⮡ 5820	As required

10. ▷ Navigate to [Configuration / Configure application / Configure breakers / Configure synchronous network] and set the following parameters:

Parameter	ID	Value
Connect synchronous mains	⮡ 8820	Yes
Max. phase angle	⮡ 8821	20°
Delay time phi max.	⮡ 8822	1 s
Max. voltage differential	⮡ 8823	5,00 %

11. ▷ To configure the LogicsManager in regards to close and open commands for the tie-breaker navigate to [Configuration / Configure application / Configure breakers / Configure CBA].

12. ▷

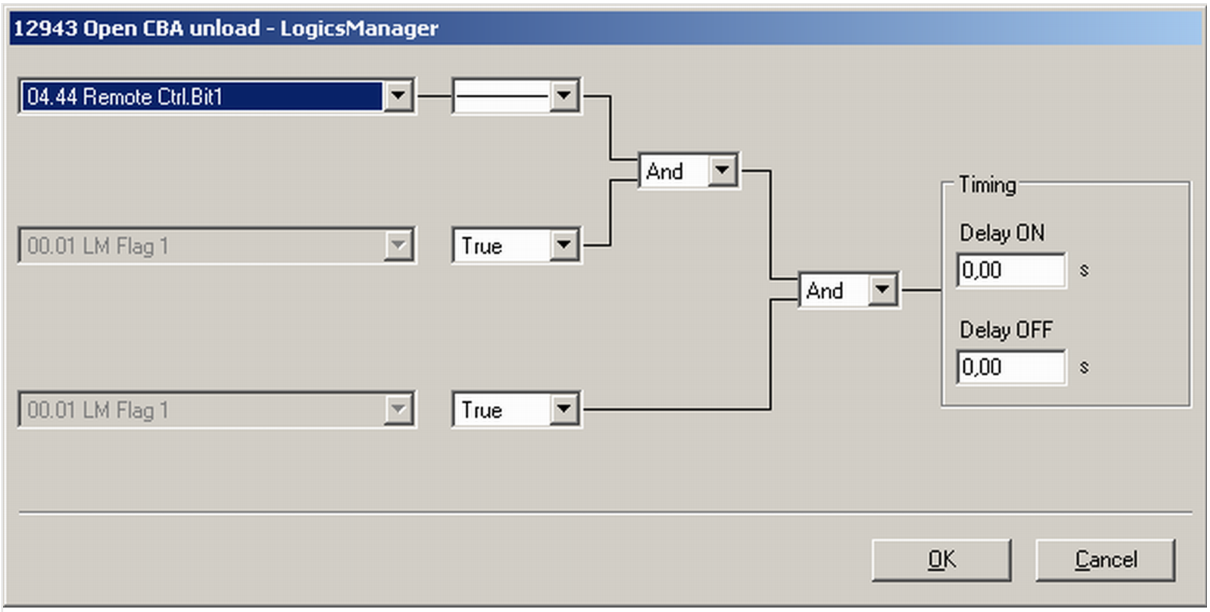


Fig. 176: LogicsManager configuration 'Open CBA unload'

Select [Open CBA unload / LogicsManager] ⮡▷ 12943 and configure the equation as follows:

- The LM equation opens the tie breaker with unloading, if the remote control bit 1 is sent by the PLC.

> The unloading of the tie-breaker is only executed, if one side contains a variable system. Otherwise the open command is given without unloading.

13. ▷

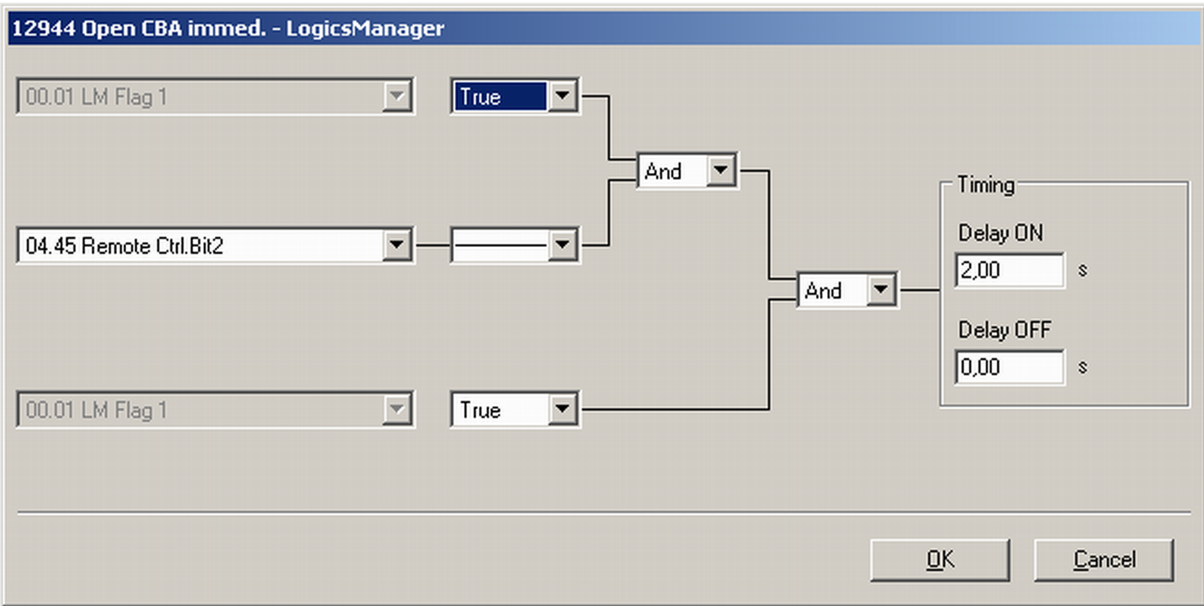


Fig. 177: LogicsManager configuration 'Open CBA immed.'

Select [Open CBA immed. / LogicsManager] ⮡▷ 12944 and configure the equation as follows:

- The LM equation opens the tie-breaker immediately, if the remote control bit 2 sent by the PLC.

14. ▷

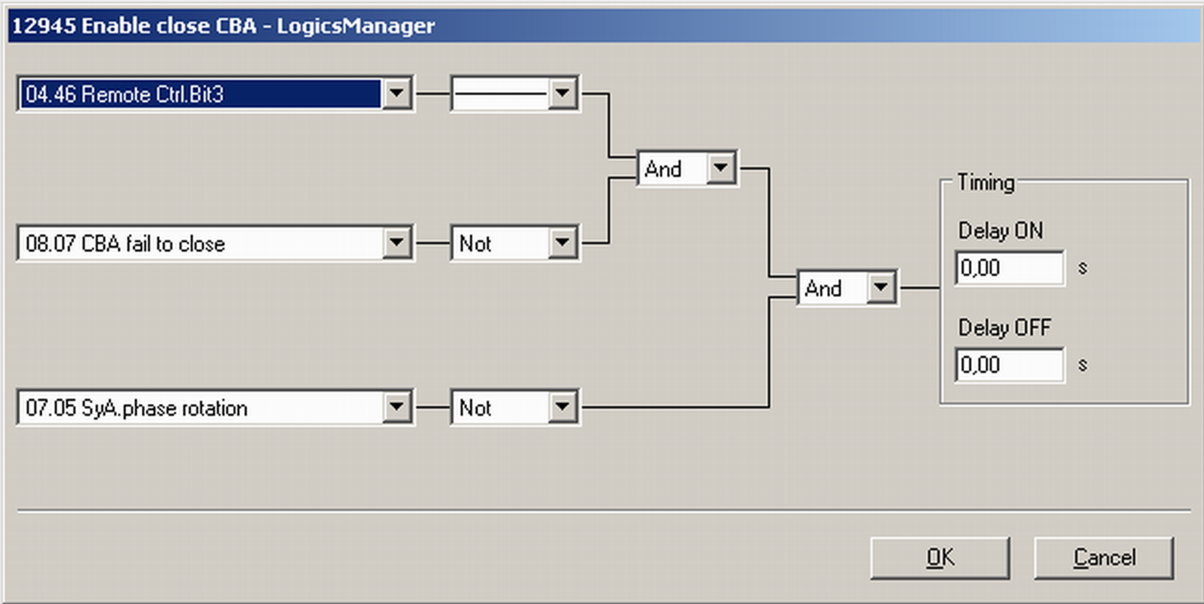


Fig. 178: LogicsManager configuration 'Enable close CBA.'

Select [Enable close CBA / LogicsManager] ⮡▷ 12945 and configure the equation as follows:

- The LM equation gives the release for close CBA, if the remote control bit 3 is sent by the PLC **AND** the CBA has no closure failure **AND** the system A measurement detects no phase rotation error.

> The same remote control bits can be used in the upper example, because each LS-6 receives its own control bits. The different device and Node-ID separates the control bits from each other.

⚙ Configure easYgen(s)

>

- Personnel: User

1. ▷ Configure the application mode (parameter 3444) of each easYgen device to A07 'GCB/LSx'.

2. ▷ Enter the device ID 1 for the easYgen (usually from left to right).

3. ▷ If the CAN interface is used take care that all devices have different CAN Node-IDs. (Usually the same number as the device number is taken).

4. ▷ Navigate to [Parameter / Configuration / Configure Application / Configure Controller / Configure load share] to enter the basic segment numbers at the easYgen(s).

Position	Parameter	ID	Value
easYgen ID 1 Left side	Segment number	1723	2
easYgen ID 2	Segment number	1723	3

Position	Parameter	ID	Value
Right side			

5. ▷ Configure the measurement for generator and busbar according to the easYgen manual.

6. ▷ The mains measurement is not used in this application mode. Therefore:

   - You should switch off the single mains monitoring functions or you disable mains monitoring generally by the LogicsManager “Disable mains monitoring” (parameter 15159).
   - You should switch off the mains decoupling function by the parameter “Mains decoupling” (parameter 3110).

7. ▷ When tapping voltages over power transformer, phase angle compensation may be required.

   If a phase angle compensation over the GCB is required, navigate to [Configuration / Application config / Breakers config. / Configure GCB / Synchronization GCB / Phase angle compensation GCB]

   NOTICE!

   Component damage

   Incorrect settings may cause erratic system behavior and damage to the involved components .

   - Set the values carefully and double check with a voltmeter at the according breaker.

8. ▷ To display the mains values coming from LS-6 on the Home Page, navigate to [Parameter / Configuration / Configure measurement] and set [Show mains data] (parameter 4103) to "LSx".

9. ▷ For the AMF mode the emergency run segments have to be configured accordingly.

   Navigate to [Parameter / Configuration / Configure application / Configure emergency run].
   In this application two setups are possible:

   Example setup 1

   Each generator group monitors its own load busbar and mains income:

   - The easYgens in the left group are configured to "segment 1" and "segment 2" and "segment 3".
     The easYgens on the left side start, if one of these 3 segments is running outside its operating ranges.
     On the other side the AMF mode stops, if the mentioned segments are back in operating range and the incoming mains are closed.
   - The easYgens in the right group are configured to "segment 4" and "segment 5" and "segment 6".
     The easYgens on the right side start, if one of these 3 segments is running outside its operating ranges.
     On the other side the AMF mode stops, if the mentioned segments are back in operating range and the incoming mains are closed.

Example setup 2

All generators monitor both load busbars and mains incomes.

- All easYgens are configured to "segment 6".

  All easYgen(s) start, if one of these 6 segments is running outside its operating ranges.
  On the other side the AMF mode stops, if all segments are back in operating range and at least one incoming mains in the own segment is closed.

10. ▷

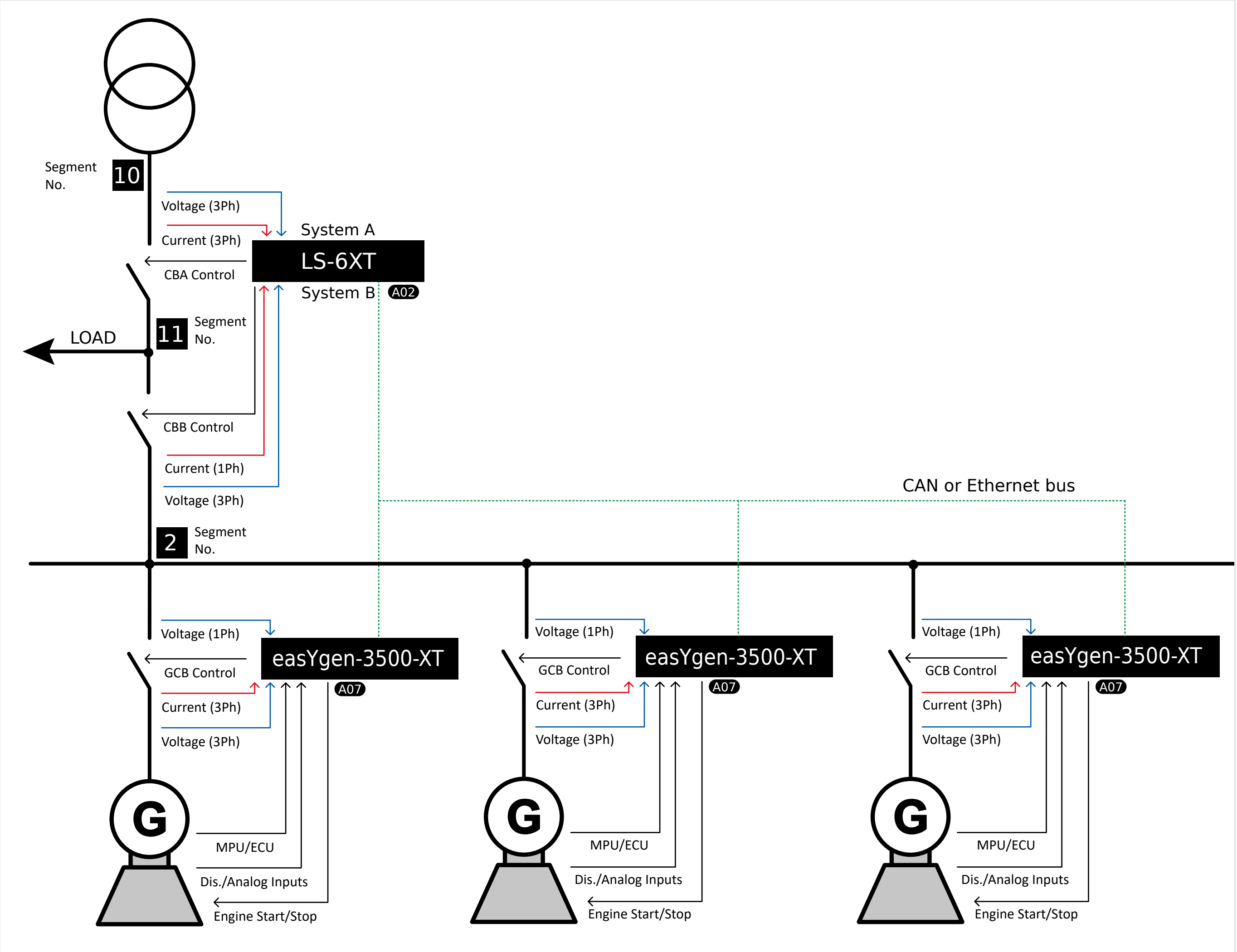
> In this setup each easYgen device provides six free usable control bits for sending information to the whole device system in layer 1. These bits can be used as command variables in the LS-6.
>
> One of the bits could for example be used to initiate alarms acknowledgement in the LS-6.

Navigate to [Parameter / Configuration / Configure LogicsManager / Configure LSx] to configure the command variables.

6.4.6.2 Setup easYgen & LS-6 Application with Logic Commands

Introduction

This application is similar to the application mode 'L-GGBMCB' but with the "Logic Commands" the LS-6 operates as a master unit in application mode A02 'LSx'. The easYgen(s) closes and opens its own generator circuit breaker (GCB) and the LS-6 opens and closes the generator group breaker (CBB) and the mains circuit breaker (CBA). In case of a mains failure (AMF mode) the LS-6 starts the generators with the command variable ("04.92 Logic cmd Gen. start").



The LS6 will be configured to Application mode LSx and Breaker mode CBA/CBB and uses the loadshare interface for sending the start command to the easYgen(s).

The easYgen will be configured to Application mode GCB/LSx and serves only the GCB.

⚙ **Prerequisites LS-6**

>

- Personnel: Qualified electrician

1. ▷ The system A voltage and current measurement is connected to the mains.
2. ▷ The system B voltage is connected to the busbar (genset).
3. ▷ The MCB and GGB breaker feedback are connected.
4. ▷ The MCB and GGB breaker commands are connected.
5. ▷ Setup the Communication Interface between the devices.

⚙ **Prerequisites easYgen**

>
- Personnel: Qualified electrician

1. ▷ The generator voltage and current measurement is connected to the generator.
2. ▷ The busbar voltage measurement is connected to the busbar.
3. ▷ The GCB breaker feedback is connected to the according easYgen.
4. ▷ The GCB breaker command(s) are connected to the according easYgen.
5. ▷ Setup the Communication Interface between the devices.

⚙ **Configure LS-6**

>
- Personnel: User

1. ▷ Configure system management

ID	Parameter	Value
1702	Device number	33

2. ▷ General breaker settings

ID	Parameter	Value
9018	Breaker mode LS6	CBA/CBB
8992	Application mode CBA/CBB	LSx
9014	Connect open load to A alive	Yes
9016	Connect open load to B alive	Yes

3. ▷ Configure CBA

ID	Parameter	Value
12945	Enable close CBA	04.88 Logic cmd CBA close & Not 08.07 CBA fail to close & Not 07.05 Syst.A ph.rot.mism.
12944	Open CBA immed.	04.89 Logic cmd CBA open & True & True

4. ▷ Configure CBB

ID	Parameter	Value
12948	Enable close CBB	04.90 Logic cmd CBB close & Not 08.05 CBB fail to close & Not 06.21 Syst.B ph.rot.mism.
12947	Open CBB immed.	04.91 Logic cmd CBB open & True & True

5. ▷ Configure Logic Commands

ID	Parameter	Value
2802	Emergency run	On

ID	Parameter	Value
2800	Mains fail delay time	3s
3408	Emerg. start with CBA failure	Yes
12882	Emerg. back to mains	02.02 LM: TRUE & True & True
3440	Min.Generator power	0.10 MW

6. ▷ Configure LSx flags

ID	Parameter	Value
12952	Flag 1 LSx	04.92 Logic cmd Gen. start & True & True

⚙ **Configure easYgen**

> - Personnel: User

1. ▷ Configure system management

ID	Parameter	Value
3444	Application mode	GCB/LSx

Table 56: General breaker settings

2. ▷ Operation mode AUTO

ID	Parameter	Value
12120	Start req. in AUTO	26.01 Flag 1 LSx device 33 & True & True

6.5 Special Applications

6.5.1 Connecting IKD 1, IKD-IN-16 and IKD-OUT-16 on on CAN Bus 1

It is possible to connect up to two IKD 1 to CAN bus 1 or up to one IKD-IN-16 with one IKD-OUT-16.

Refer to the ⮱▷ "4.7.4.3 Transmit PDO {x} (Process Data Object)" and ⮱▷ "4.7.4.2 Receive PDO {x} (Process Data Object)" for the configuration of the parameters concerned.

Refer also to ⮱▷ "7.4 CANopen Protocol" for a description of the data objects.

The LS-6XT may be configured by using the ToolKit software.

Special notes for applications with IKD-IN-16 or IKD-OUT-16:

IKD-IN-16 has 16 digital inputs channels and IKD-OUT-16 has 16 digital outputs channels in contrast to IKD 1 which has inputs **and** outputs but only 8 channels each. For this reason the IKD-IN-16 and/or IKD-OUT-16 must be configured as two IKD 1 devices.

If **only IKD-IN-16** is connected, only RPDOs for first and second IKD must be configured as described below. (No need to configure TPDO.)

If **only IKD-OUT-16** is connected, only TPDOs for first and second IKD must be configured as described below. (No need to configure RPDO.)

Transmit PDO

The LS-6XT 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 57: TPDO1 configuration (external DOs 1-8)

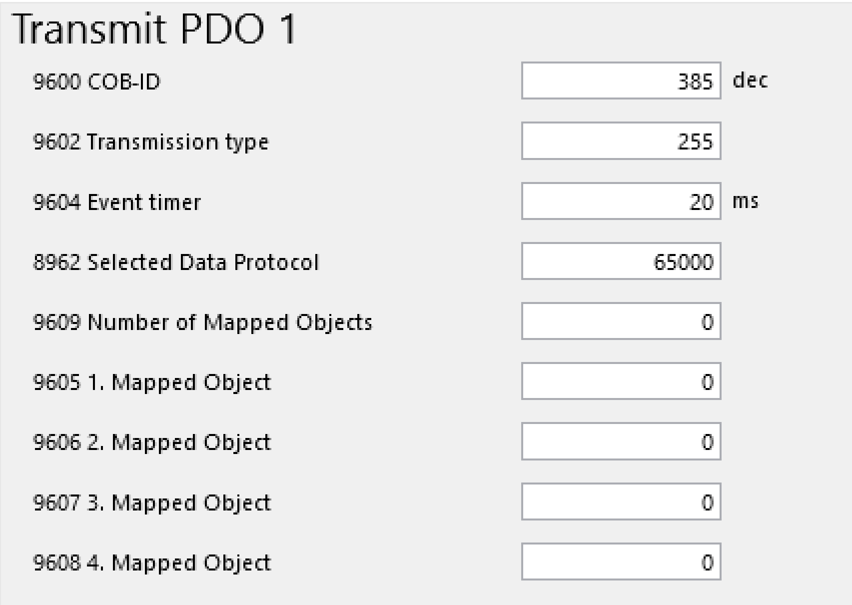


Fig. 179: TPDO configuration for IKD 1 (example ToolKit)

Receive PDO (external DIs 1-8)

The LS-6XT 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 58: RPDO1 configuration

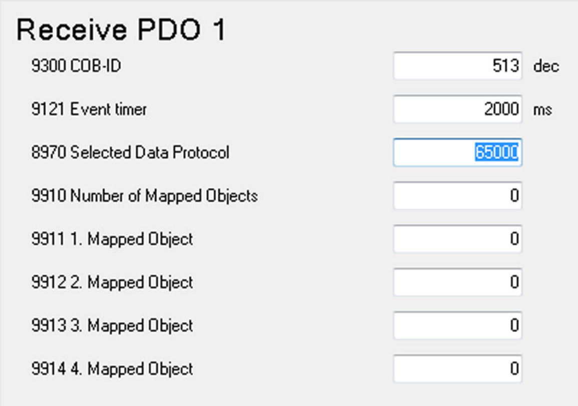


Fig. 180: RPDO configuration for IKD 1 (example ToolKit)

In addition, the IKDs themselves must be configured with the Woodward IKD configuration tool. (Refer to ⮱ "6.5.2 IKD Configuration Tool")

Configuration for a second IKD 1 (external DIs/DOs 9-16)

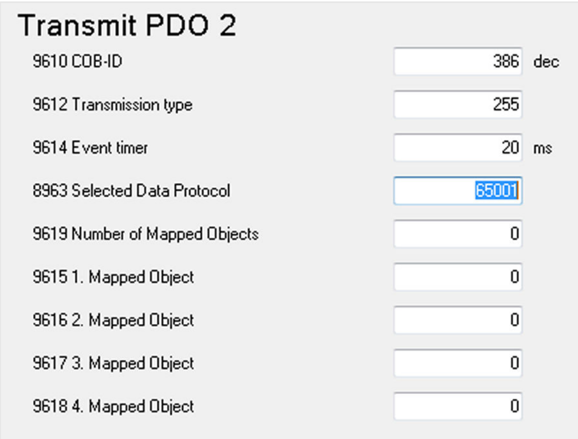


Fig. 181: TPDO configuration for 2nd IKD 1 (example ToolKit, external DOs 9-16)

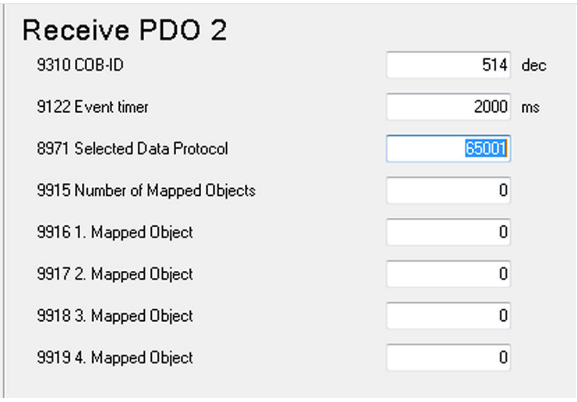


Fig. 182: RPDO configuration for 2nd IKD 1 (example ToolKit, external DIs 9-16)

6.5.2 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. ▷

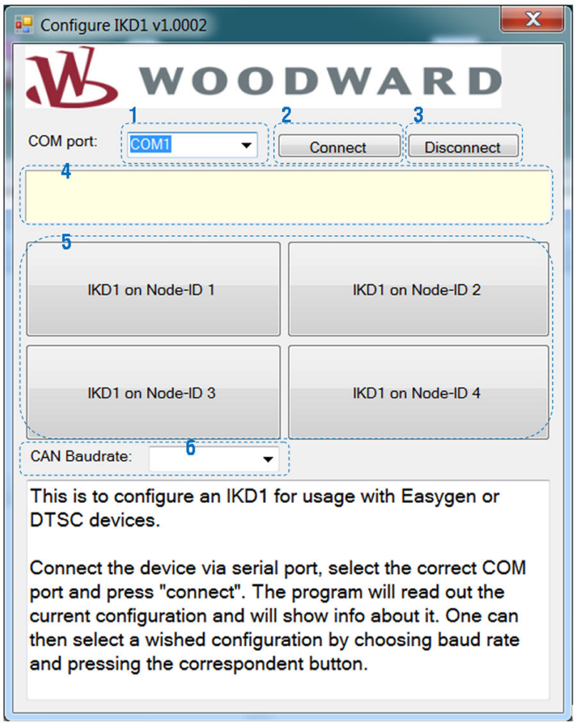


Fig. 183: IKD Configuration Tool

	»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.

6.5.3 Digital input monitoring (CBA reply)

There are existing critical digital inputs which needs to be monitored on proper function. The example in this chapter treats the CBA feedback. With this procedure the controller can recognize a wire break, a breaker issue, or an internal failure of the device. The CBA 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.

There will be created a free alarm flag if both signals are showing logically 0:0 respectively 1:1. This is not possible with two inverted signals. The free alarm goes to a Power Management System (PMS) by a relay output or over communication interface to initiate proper actions through the PMS.

Refer to figure below:

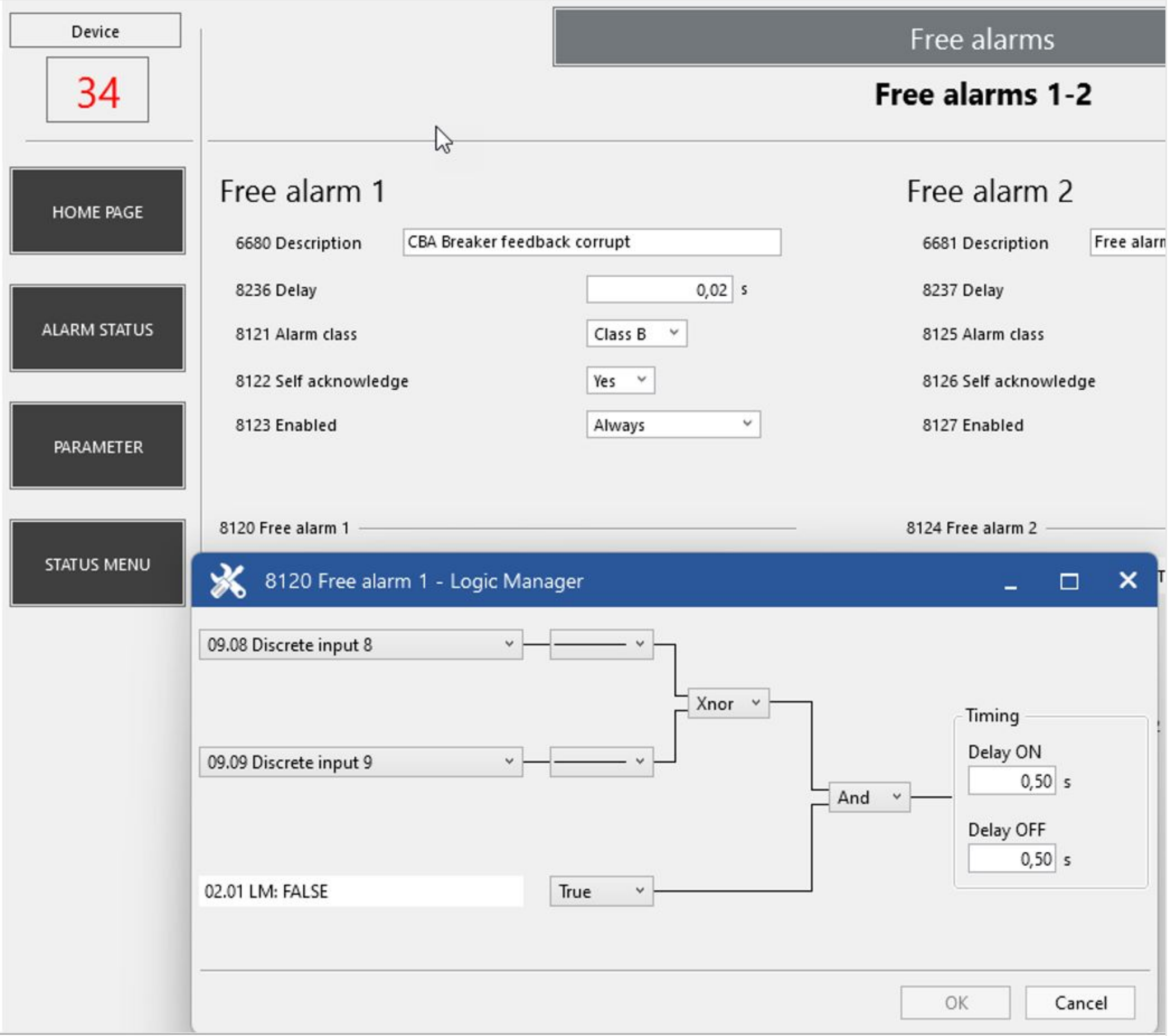


Fig. 184: DI8 and DI9 on same level causing after 0.5 s a failure flag

6.6 Communication Management

6.6.1 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 ⮑ "Diagnostic screens in the HMI" and ⮑ "Diagnostic screens in ToolKit".

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«.

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 ⮑ "9.6.5 Alarm Messages" for more details.

- **»Missing Member alarm«:**

  Occurs if a device is not recognized but exists in the actual saved constellation. See ⮑ "9.6.5 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, of the Load Share Interface parameter ⮑ 9924 or of the Application Layer parameter ⮑ 8990 will reset the saved constellation and a new System Update order needs to be triggered.

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 see ⮱ "4.5.5.13 Multi-Unit System update".

To configure the »Missing Member« Monitoring see ⮱ "4.5.5.12.3 Multi-unit missing LSx", ⮱ "4.5.5.12.1 Multi-Unit Missing easYgen" and ⮱ "4.5.5.12.2 Multi-Unit Missing GC".

The behavior and visualisation of the Communication Management differs according to the Application Layer parameter ⮱ 8990. For more information about the application layers, see ⮱ "6.1 Application Layers"

If the LS-6XT is configured to Layer 1, the system update function incorporates as well the easYgen members on the control bus. 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.

If the LS-6XT is configured to Layer 3, the system update function incorporates as well the GC 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 buses. 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. This screens should be watched, before the system update order is executed. It is located under [Status Menu / Next page / Multi-unit / Diagnostic devices].

For more details see ⮱ "6.6.2 Diagnostic Screens".

Availability

The system update function is available for all choices of Load Share Interface parameter ⮱ 9924:

- Communication over CAN 1 bus (only for layer 1)
- Communication over Ethernet network A (only for layer 1)
- Communication over redundant CAN 1 bus and Ethernet network A (only for layer 1)
- Communication over Ethernet network B (with Group Controller only for Layer 3)
- Communication over redundant Ethernet network B and C (with Group Controller only for Layer 3)

How to initiate a system update

If the LS-6XT is configured to Layer 1, the system update order can be initiated with the following options:

- By Softkey button »Syst. upd.« in the HMI. Navigate to [Next page / Multi-unit Layer 1 / Diagnostic LSx (or Diagnostic easYgen)]
- By ToolKit switch 13356 »System update«. Navigate to [Status Menu / Multi-unit Layer 1: / Diagnostic LSx (or Diagnostic easYgen)]
- By LogicsManager 86.35 with parameter 7801 »System update«. Navigate to [Parameter / Configuration: / Configure monitoring / Miscellaneous: / Multi-unit Layer 1]

If the LS-6XT is configured to Layer 3, the system update order can be initiated with the following options:

- By Softkey button »Syst. upd.« in the HMI. Navigate to [Next page / Multi-unit Layer 3 / Diagnostic LSx (or Diagnostic GC)]
- By ToolKit switch 13349 »System update«. Navigate to [Status Menu / Multi-unit Layer 3: / Diagnostic LSx (or Diagnostic GC)]
- By LogicsManager 86.35 with parameter 7801 »System update«. Navigate to [Parameter / Configuration: / Configure monitoring / Miscellaneous: / Multi-unit Layer 3]

NOTICE!

Please ensure, if you are using the LogicsManager »7801 System update«, the parameter »13356 System update«., or »13349 System update«, that the signal goes false after executing. Otherwise, all buttons relating to system update are locked.

The actual constellation of all members on the loadshare and control bus are displayed in the according diagnostic screens in HMI and ToolKit.

6.6.2 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 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 according to the configured Layer (Layer 1 or Layer 3), see below.

Availability Layer 1

For layer 1 applications there are diagnostic screens for the following devices:

- easYgen
- LSx Layer 1

For applications with GC:

- The diagnostic screens of Layer 1 show only devices which belong to the same group.
- LS-6XT devices configured to Layer 1 will show the GC of the own group in the Diagnostic Screen for LSx as device **GC (33)**
- LS-6XT devices configured to Layer 1 will show the GC of the own group in the Diagnostic Screen for easYgen as device **GC (32)**

ID	Parameter	CL	Setting range **[Default]**	Description
7801	**System update**	2	Determined by LogicsManager 86.35 **[(0 & 1) & 1]** = 11974	To select logical input(s) to cause a system update.
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 59: Parameter: Diagnostic Screen Layer 1

Diagnostic screens in the HMI

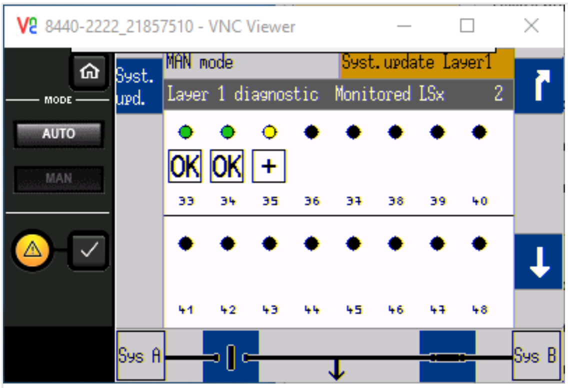


Fig. 185: Diagnostic screen LSx Layer 1 example (HMI)

The HMI diagnostic screens show, additional to the status of each device, the number of monitored devices and the »System Update« Button to activate the System Update order, see ⮱▷ Table 59. While the System Update is active, the event indication will show »System Update«.

Because of space restrictions on the display, the status text of each device is realized with symbols. Use ToolKit for text indications.

Diagnostic screens in ToolKit

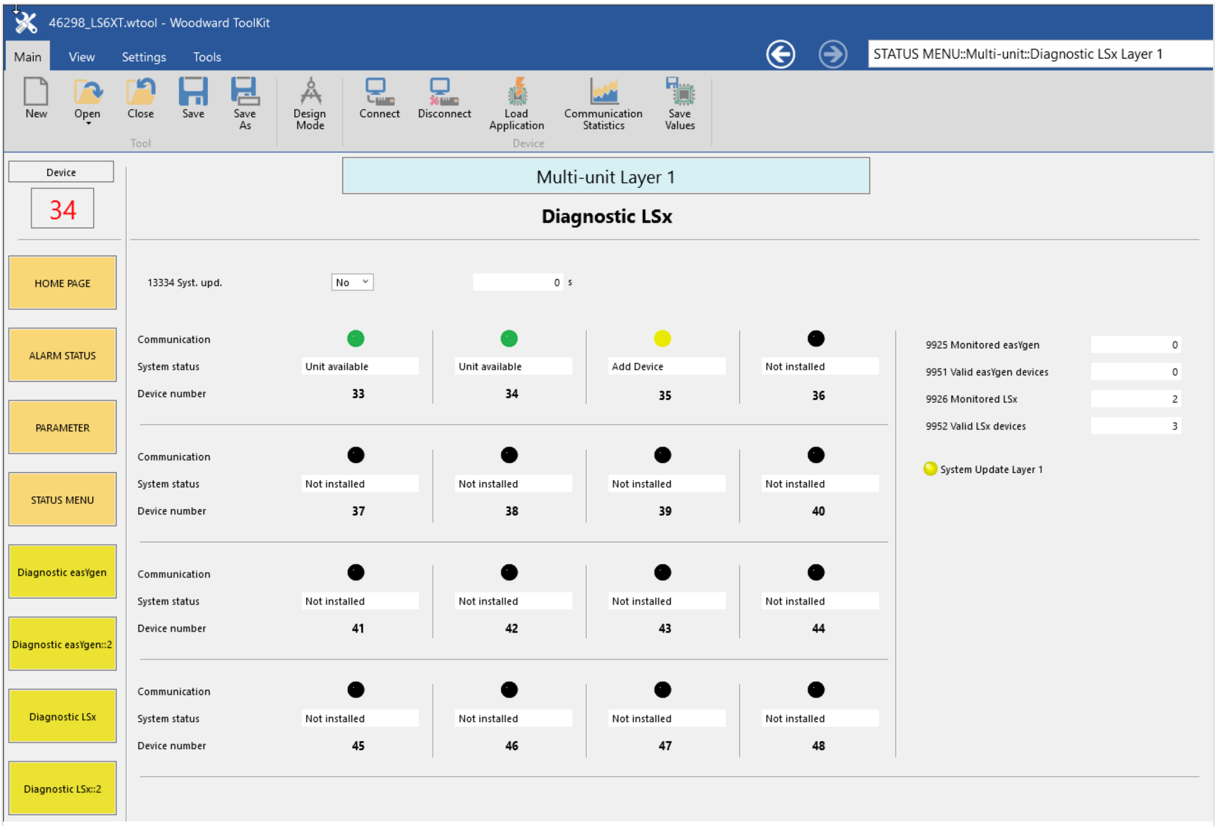


Fig. 186: Diagnostic screen LSx Layer 1 example (ToolKit)

The ToolKit diagnostic screens show, additional to the status of each device, the number of »Monitored devices«, the number of »Valid devices« and the parameter ⮱▷ 13356 »System update« to activate the System Update order, see ⮱▷ Table 59. While the System Update is active, the remaining time will be shown. An active System Update Alarm is also shown by the »System Update Layer 1« LED.

Availability Layer 3

For layer 3 applications there are diagnostic screens for the following devices:

- Group Controller,
- LSx Layer 3

ID	Parameter	CL	Setting range [Default]	Description
7801	**System update**	2	Determined by LogicsManager 86.35 **[(0 & 1) & 1]**	To select logical input(s) to cause a system update.

ID	Parameter	CL	Setting range [Default]	Description
			= 11974	
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.
9953	**Valid LSx devices**	-/-	Actual count of valid devices	Actual count of devices that has send valid data.

Table 60: 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 screens in the HMI

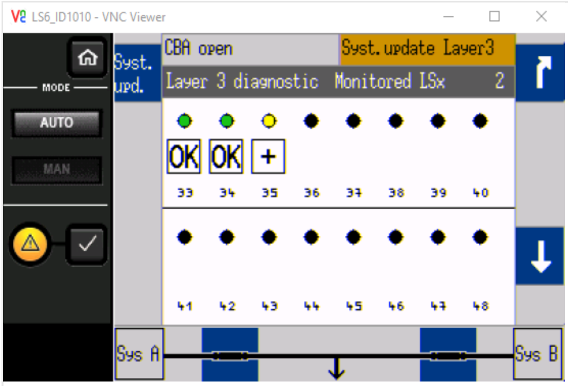


Fig. 187: Diagnostic screen LSx Layer 3 example (HMI)

The HMI diagnostic screens show, additional to the status of each device, the number of monitored devices and the »System Update« Button to activate the System Update order, see Table 60. While the System Update is active, the event indication will show »System Update«.

Because of space restrictions on the display, the status text of each device is realized with symbols. Use ToolKit for text indications.

Diagnostic screens in ToolKit

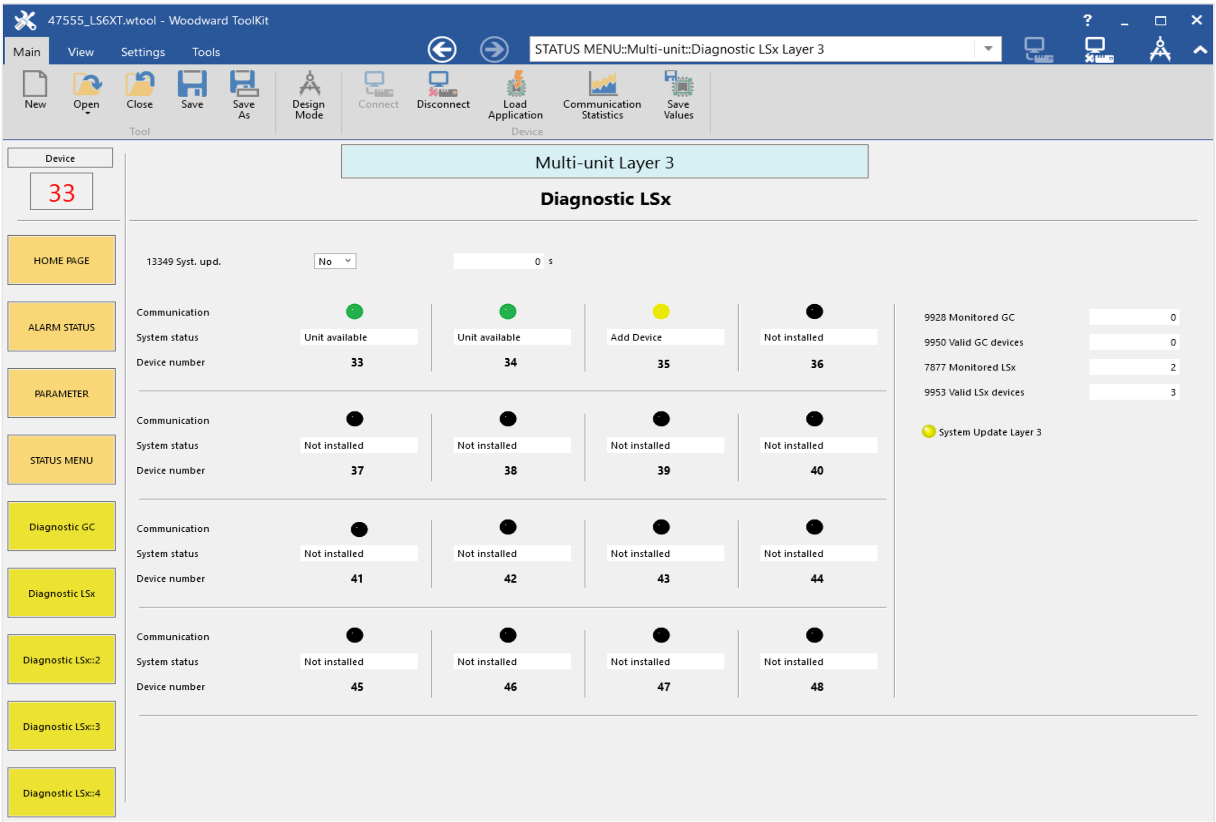


Fig. 188: Diagnostic screen LSx Layer 3 example (ToolKit)

The ToolKit diagnostic screens show, additional to the status of each device, the number of »Monitored devices«, the number of »Valid devices« and the parameter 13349 »System update« to activate the System Update order, see Table 60. While the System Update is active, the remaining time will be shown. An active System Update Alarm is also shown by the »System Update Layer 3« LED.

> 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

Diagnostic symbolic for single bus topology

Single bus topology means there is no redundant bus topology in use. Single bus topologies are load share over CAN bus or a single Ethernet network.

System and Control bus **(CAN or single Ethernet)**			
LED	**ToolKit:** **displayed text**	**LS-6XT:** **HMI**	**Explanation**
GREEN	Unit available	OK	This device is recognized and monitored with the missing member monitor according to the latest System Update order.
YELLOW	Add Device	+	This device is recognized but not registered according to the latest system update order. Therefore, the missing member monitoring does not observe the device. **System update is required!**
RED	Unit not recognized	X	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)	X (twinkling)	This only applies to the own device. There is no other device recognized according to the latest system update. This unit is suspected.

Diagnostic symbolic for redundant bus topologies

Redundant bus topology like CAN/EthernetA or EthernetB/C to provide more safety in regards of load share communication.

System and Control bus **(Redundant CAN/EthernetA)**			
LED	**ToolKit:** **displayed text**	**LS-6XT:** **HMI**	**Explanation**
GREEN	Unit available	OK	This device is recognized and monitored with the missing member monitor according to the latest System Update order.
YELLOW	Add Device	+	This device is recognized but not registered according to the latest system update order. Therefore, the missing member monitoring does not observe the device. **System update is required!**
YELLOW	Only NW CAN	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	Only NW CAN / Not installed (twinkling)	CAN (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.

System and Control bus

(Redundant CAN/EthernetA)

LED	**ToolKit:** **displayed text**	**LS-6XT:** **HMI**	**Explanation**
(twinkling)			
YELLOW	Only NW A	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)	A (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.
RED	Unit not recognized	X	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)	X (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.

System and Control bus

(Redundant EthernetB/C)

LED	**ToolKit:** **displayed text**	**LS-6XT:** **HMI**	**Explanation**
GREEN	Unit available	OK	This device is recognized and monitored with the missing member monitor according to the latest System Update order.
YELLOW	Add Device	+	This device is recognized but not registered according to the latest system update order. Therefore, the missing member monitoring does not observe the device. **System update is required!**
YELLOW	Only NW B	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)	B (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.

System and Control bus (Redundant EthernetB/C)			
LED	**ToolKit: displayed text**	**LS-6XT: HMI**	**Explanation**
YELLOW	Only NW C	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)	C (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.
RED	Unit not recognized	X	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)	X (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.

6.6.3 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. Additional to that the sum of all LS-6XT Layer 1 devices must match the number shown at parameter »9952 Valid LSx devices«, see Table 59.

> The sum of all easYgen devices must match the number shown at parameter »9951 Valid easYgen devices«.

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 LSx devices must match the number shown at parameter »9926 Monitored LSx« and »9952 Valid LSx devices«.

> The sum of all easYgen devices must match the number shown at parameter »9925 Monitored easYgen« and »9951 Valid easYgen«.

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 ⮡ “6.6.3 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. Additional to that the sum of all LS-6XT Layer 3 devices must match the number shown at parameter »9953 Valid LSx devices«, see ⮡ Table 60.

> The sum of all GC devices must match the number shown at parameter »9950 Valid GC devices«.

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 LSx devices must match the number shown at parameter »7877 Monitored LSx« and »9953 Valid LSx devices«.

> The sum of all GC devices must match the number shown at parameter »9928 Monitored GC« and »9950 Valid GC 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 LS-6XT Layer 1 devices must match the numbers shown at parameters »9926 Monitored LSx« and »9952 Valid LSx devices«, see Table 59

> The sum of all easYgen devices must match the number shown at parameter »9925 Monitored easYgen« and »9951 Valid easYgen«.

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 LS-6XT Layer 3 devices must match the numbers shown at parameters »7877 Monitored LSx« and »9953 Valid LSx devices«, see Table 60

> The sum of all GC devices must match the number shown at parameter »9928 Monitored GC« and »9950 Valid GC devices«.

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

6.6.4 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 LS-6 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 ⮱ "6.6.2 Diagnostic Screens"). They indicate whether system data arrives at the LS-6 at all.
2. Use the flags "08.78 easYgen LS timeout", "08.79 LSx LS timeout layer1" and "08.80 Redundancy LS timeout": The LS-6 can store the configured and overflowed 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).
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 engaged 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 and easYgen 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 ⮱ "6.8 Ethernet Communication - General Measures to optimize bus load on LS-6 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 and/or LSx 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**
   7497 Timeout cycles data: 5 -> (Timeout data after 80ms x 12 + 80ms x 5 = 1360ms)

2. If easYgen and/or LSx 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)

6.7 Ethernet Interconnectivity

Introduction

The LS-6 offers the possibility to send and receive data via the Ethernet communication bus. To configure the data transfer from LS-6 to easYgen 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 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 are also send able. 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: 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

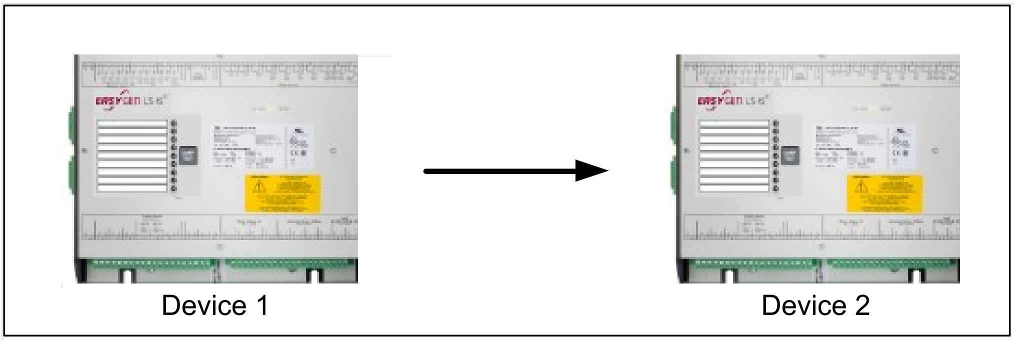


Fig. 189: Device 1 sends data to device 2

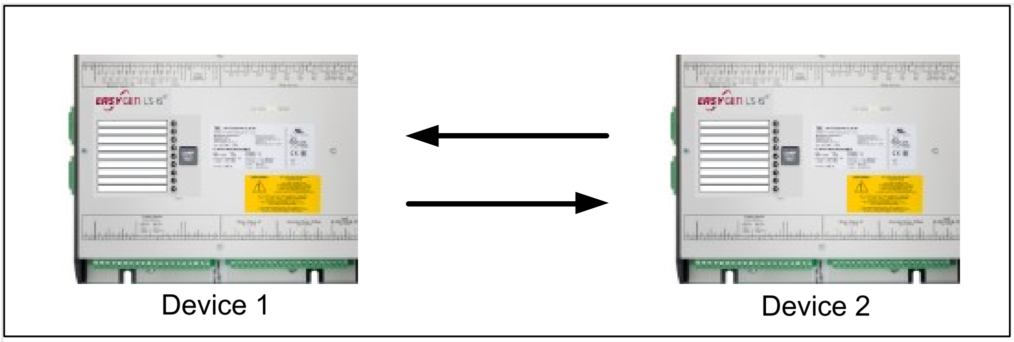


Fig. 190: *Device 1 and Device 2 exchange their data*

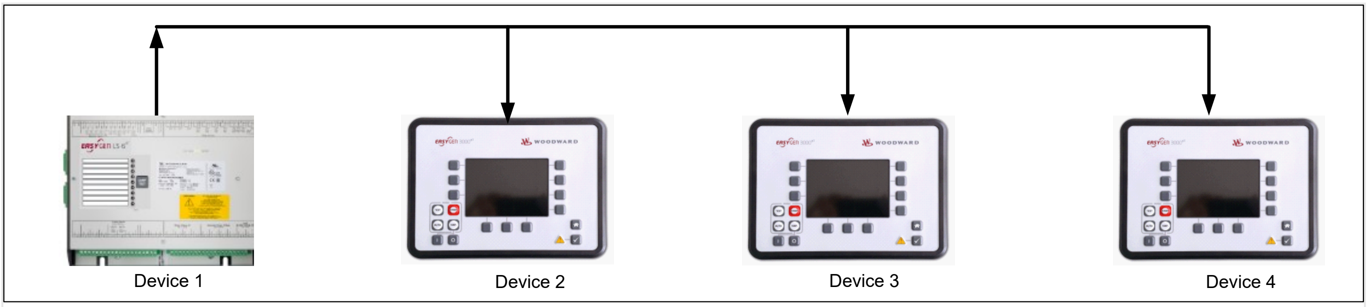


Fig. 191: *Device 1 sends data to device 2, 3 and 4*

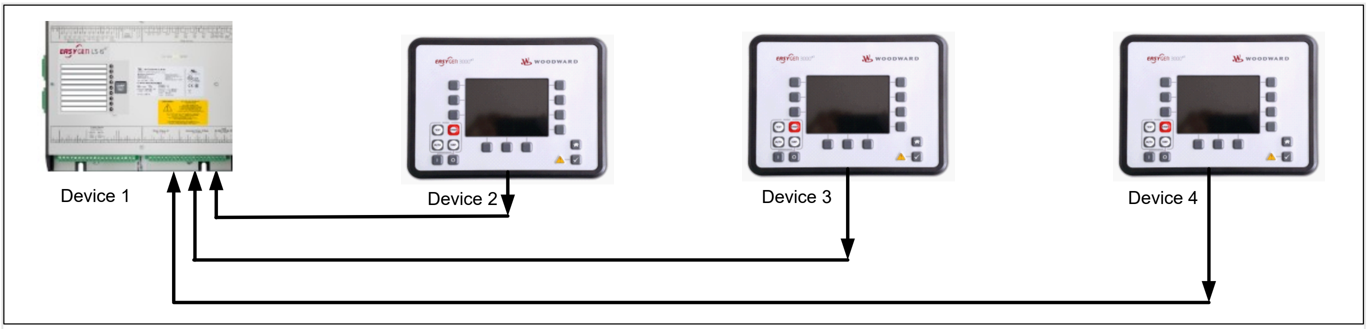


Fig. 192: *Device 1 receives data from device 2, 3 and 4*

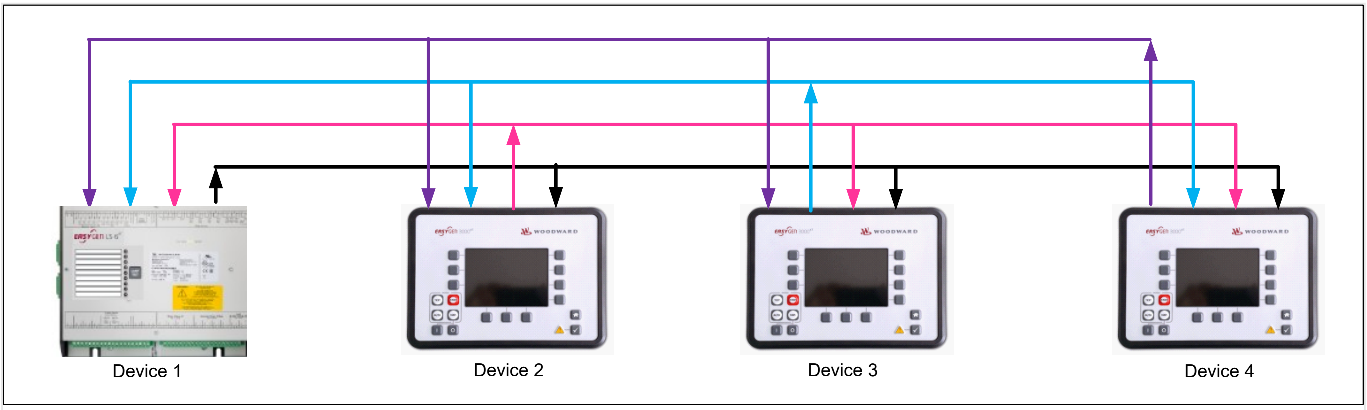


Fig. 193: *Each Device receives data from the other devices*

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

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. You find it under STATUS MENU/Interfaces/Ethernet/Interconnectivity.

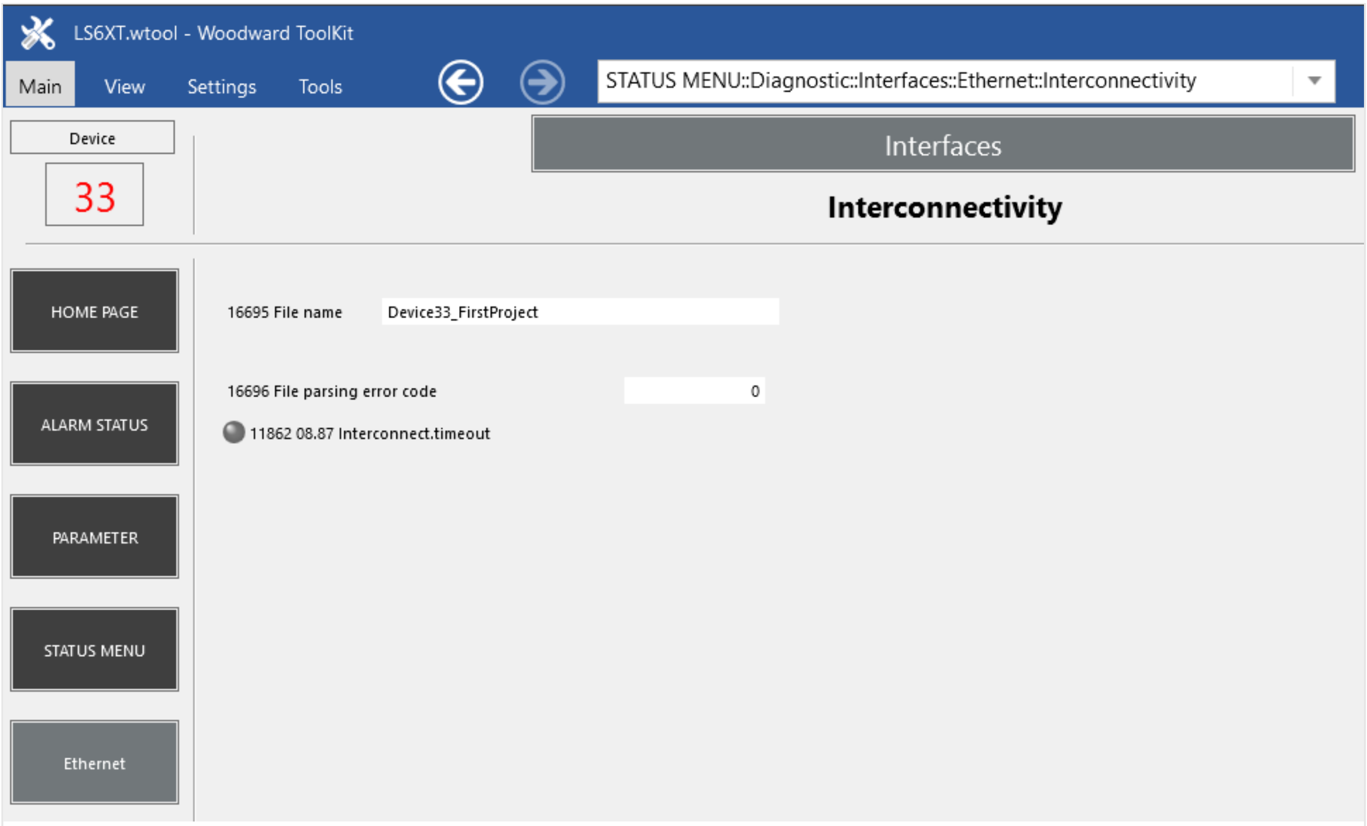


Fig. 194: Interconnectivity ToolKit status page

16695 File name:
This field shows the "Description". This is the comment in the map file, text defined by the PC tool.

16696 File parsing error code:
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:

16696 File parsing error code:	
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.
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:
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.

6.8 Ethernet Communication - General Measures to optimize bus load on LS-6 devices

General

The LS-6 (and its platform derivates) 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 LS-6 additionally.

CPU System Load as Indicator

The LS-6 provides a CPU load diagnostic on display (also accessible on Modbus). You can navigate to it with: Next Page/Diagnostic/Miscellaneous/ CPU Load diagnostic

CPU Load diagnostic indication			
10296	System load	0 to 100 %	System Load

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 LS-6. The system load should not exceed 25% 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 LS-6 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	80 ms	20 %	37 %

Application	Set up	7488 Transmission rate	Max. System load	Min. Idle load
	• Interconnectivity with 31 messages. Transmission rate is 100ms. • "7489 Timeout cycles" = 5 • "7497 Timeout cycles data" = 12			
Load sharing and control with 64 Devices on Ethernet B	• Remote Panel on Ethernet A • Interconnectivity with 63 messages. Transmission rate is 100ms. • "7489 Timeout cycles" = 5 • "7497 Timeout cycles data" = 12	80 ms	23 %	32 %
Load sharing and control with 32 Devices on Ethernet B /C (redundant)	• Remote Panel on Ethernet A • Interconnectivity with 31 messages. Transmission rate is 100ms. • "7489 Timeout cycles" = 5 • "7497 Timeout cycles data" = 12	80 ms	23 %	32 %
Load sharing and control with 64 Devices on Ethernet B /C (redundant)	• Remote Panel on Ethernet A • Interconnectivity with 63 messages. Transmission rate is 200ms. • "7489 Timeout cycles" = 5 • "7497 Timeout cycles data" = 5	160 ms	23 %	32 %

LS-6XT Software 2.13 and previous (without buffer): Maximal Number of Devices

Please take in mind that with LS-6XT 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. Refer to chapter “6.2.4 Ethernet Communication - General Measures to optimize bus load on LS-6 devices” to see what the 2.14 can achieve. This table informs you what number of devices can be achieved for a proper Ethernet communication.

Ethernet Communication		
LS-6XT 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 • Remote Panel on Ethernet A • "7489 Timeout cycles" = 10	13 devices	80 ms
• Redundant Mode - Load sharing and control on Ethernet A or B • Remote Panel on Ethernet A • "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.

6.9 CANopen Application

6.9.1 Remote Control

6.9.1.1 Remote Acknowledgment

It is possible to acknowledge alarms in the LS-6XT via CAN/Modbus. Therefore, the logical command variable (04.14) have to be configured with the LogicsManager.

- 04.14 Remote acknowledge

Two different methods to perform a remote Acknowledgment using 04.14 Remote acknowledge is detailed in the below.

These are the "Remote Acknowledgment via RPDO" and "Remote Acknowledgment via default SDO communication channel". The advantages and the disadvantages of these two methods are as follows.

RPDO	Default SDO communication channel
Classical communication for CANopen devices	Configuration process
One message	Two messages
No validation of the received answer	Validation answer, if message has been received by the unit
Only working in operational mode	May take longer in case of communication with two messages

Table 61: Comparison

6.9.1.1.1 RPDO

Configure CAN interface 1

CANopen Master (parameter ⮡ 8993) must be enabled, if there is no PLC taking over the master function.

⚙

1. ▷ Either on the front panel or using ToolKit navigate to menu [Configure CAN interface / Configure CAN interface 1].

2. ▷ Configure the parameter listed below.

ID	Parameter	Value	Comment
8993	CANopen Master	On	CANopen Master is enabled.

Configure RPDO

⚙

1. ▷ Either on the front panel or using ToolKit navigate to menu [Configure CAN interface 1 / Receive PDO 1].

2. ▷ Configure the parameters listed below.

ID	Parameter	Value	Comment
9300	COB-ID	00000201 (hex)	COB-ID set to 00000201.
9910	Number of Mapped Objects	1	One mapped object is configured
9911	1. Mapped Object	00503	The 1st mapped object is set to control parameter 503.

▶

Setting the COB-ID to 201 (hex) is exemplary; usually, the PDOs are in the range of 181 (hex) to 57F (hex).

With this setting, the Receive PDO is configured to overtake the received data coming in by COB-ID 201 into the ID 503. The number of mapped objects is here 1.

Refer to ➥ "9.3.5 Additional Data Identifier" 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 LS-6XT address ID 503.

ID (hex)	Description	Data (hex)
201	Remote Acknowledge	sequence of: 0000, 1000; 0000, 1000
		Notes The message 1000hex must be sent twice to acknowledge an alarm completely. The first rising edge (0000hex followed by 1000hex) disables the horn and the second rising edge resets the alarm.

6.9.1.1.2 Default SDO Communication Channel

Another possibility for a remote Acknowledgment is to send the request via default SDO communication channel. The device listens to the CAN ID 600 (hex) + Node-ID internally to perform the desired control, the reply is on CAN ID 580 (hex) + Node-ID.

The following examples show the request format on CANopen with different Node-IDs.

The request on the bus is sent via the control parameter ID 503 of the device.

The value 2000 (hex) is calculated internally:

- 503 (dec) -- 1F7 (hex)
- 1F7+2000 (hex) = 21F7 (hex)

Please note that high and low bytes are exchanged in the sent address. The data (hex) shows the state of parameter 503 to achieve the required control.

Node-ID 33 (standard value)

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

Identifier	Description	Data (hex)
621	Remote Acknowledge	sequence of: • 2B F7 21 01 **00** 00 00 00 2B F7 21 01 **10** 00 00 00 • 2B F7 21 01 **00** 00 00 00 2B F7 21 01 **10** 00 00 00
		Notes The message 2B F7 21 01 10 00 00 00 must be sent twice to acknowledge an alarm completely. The first rising edge (2B F7 21 01 00 00 00 00 followed by 2B F7 21 01 10 00 00 00) disables the horn and the second rising edge resets the alarm.

Node-ID (not standard value)

If the Node-ID of the device is intended to be different from the standard value, the parameter "Node-ID CAN bus 1" (parameter 8950) must be configured accordingly. Node-ID 2 is used in the following example.

⚙

1. ▷ Either on the front panel or using ToolKit navigate to menu [Configure CAN interface / Configure CAN interface 1].
2. ▷ Configure the parameter listed below.

2.

ID	Parameter	Value	Comment
8950	Node-ID CAN bus 1	002 (hex)	Node-ID set to 002.

▶ With this setting, the Node-ID of the CAN interface 1 is set to 002.

The request on the bus is sent via the control parameter 503 of the device.

The hexadecimal value 2000 is calculated internally:

- 503 (dec) -- 1F7 (hex)
- 1F7 (hex) + 2000 (hex) = 21F7 (hex)

Please note that high and low bytes are exchanged in the sent address.

The data (hex) shows the state of parameter 503 to achieve the required control.

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

Identifier	Description	Data (hex)
602	Remote Acknowledge	sequence of: • 2B F7 21 01 **00** 00 00 00 2B F7 21 01 **10** 00 00 00 • 2B F7 21 01 **00** 00 00 00 2B F7 21 01 **10** 00 00 00
		Notes The message 2B F7 21 01 10 00 00 00 must be sent twice to acknowledge an alarm completely. The first rising edge (2B F7 21 01 00 00 00 00 followed by 2B F7 21 01 10 00 00 00) disables the horn and the second rising edge resets the alarm.

Additional SDO communication channels

It is also possible to allow several PLCs to start/stop/acknowledge the unit in addition to the default SDO communication channel. Four additional SDO communication channels are provided for this. The additional SDO 127 (dec) is used in the following example.

⚙

1. ▷ Either on the front panel or using ToolKit navigate to menu [Configure CAN interface 1 / Additional Server SDOs].

2. ▷ Configure the parameters listed below.

ID	Parameter	Value	Comment
12801	2. Node-ID	127 (dec) = 7F (hex)	SDO communication channel is configured to 127

▶ With this setting, an additional SDO communication channel is configured to 127.

The control request is equal to the request via default SDO communication channel, but the device will listen to messages including the configured address as well.

The device listens to the CAN ID 600 (hex) + 2. Node-ID internally to perform the desired control, the reply from the easYgen is sent on CAN ID 580 (hex) + 2. Node-ID.

- Receive CAN ID 67F (hex) (600 (hex) + 7F (hex))
- Receive CAN ID 5FF (hex) (580 (hex) + 7F (hex))

The same is valid for the additional SDO communication channels 3, 4, and 5.

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

Identifier	Description	Data (hex)
67F	Remote Acknowledge	2B F7 21 01 10 00 00 00

If parameters are written or read via two or more SDO communication channels at the same time (before the first has answered), the second one will be refused.

6.9.1.2 Transmitting A Remote Control Bit

It is possible to transmit a remote control bit via the CANopen protocol. Such a remote control bit can be sent by a PLC to remotely control the LS-6 if this remote control bit is used as a command variable in a LogicsManager function.

Configure RPDO

⚙

1. ▷ Either on the front panel or using ToolKit navigate to menu [Configure CAN interface 1 / Receive PDO 1].
2. ▷ Configure the parameters listed below.

ID	Parameter	Value	Comment
9300	COB-ID	00000334 (hex)	COB-ID set to 00000334.
9910	Number of Mapped Objects	1	One mapped object is configured
9911	1. Mapped Object	00505	The 1st mapped object is set to control parameter 505.

▶

Setting the COB-ID to 334 (hex) is exemplary; usually, the PDOs are in the range of 181 (hex) to 57F (hex).

With this setting, the Receive PDO is set to the address, for which the device is listening on the bus. The number of mapped objects is 1 since 1 mapped object is used. The request on the bus is sent with the control parameter 505 of the device as mapped object 1.

Refer to ⮡ "9.3.5 Additional Data Identifier" for a list of additional parameter groups.

CANopen message

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

Remote control bit 1 is set:

- 1 (dec) = 0001 (hex) → 01 00 according to the CANopen protocol

ID (hex)	Description	Data (hex)
334	Remote Control Bit 1 (PDO)	01 00

6.9.1.3 Default SDO Communication Channel

Another possibility for transmitting is to send the value via default SDO communication channel. The device listens to the CAN ID 600 (hex) + Node-ID internally to perform the desired control, the reply is on CAN ID 580 hex) + Node-ID.

The following example shows the send format on CANopen with Node-ID 33.

The value is sent on the bus via the control parameter 249 of the device.

The hexadecimal value 2000 is calculated internally:

- 249 (dec) -- 1F9 (hex)
- 1FB (hex) + 2000 (hex) = 21F9 (hex)

Please note that high and low bytes are exchanged in the sent value.

ID (hex)	Description	Data (hex)
621	Remote Control Bit 1 (SDO)	2B F9 21 01 01 00 00 00

The data (hex) shows the state of parameter 249 to achieve the required control.

The table above shows exemplary sends data for the device on the CANopen bus in line 2.

6.9.2 Sending A Data Protocol via TPDO

This is a configuration example for sending an object (data protocol 5302) on CAN ID 2AE (hex) every 20 ms on TPDO1. For this, TPDO1 must be configured as follows:

⚙

1. ▷ Either on the front panel or using ToolKit navigate to menu [Configure CAN interface 1 / Transmit PDO 1].
2. ▷ Configure the parameters listed below.

ID	Parameter	Value	Comment
9600	COB-ID	000002AE (hex)	COB-ID set to 000002AE.
9602	Transmission type	255	The number of required sync messages is set to 255.
9604	Event timer	20 ms	Object is sent every 20 ms.
8962	Selected data protocol	5302	Data protocol 5302 is used.
9609	Number of Mapped Objects	0	No mapped object is configured

The data to be sent (Mapped Objects) may be provided on request by configuring the Sync Message (parameter ⮱▷ 9100) and the Transmission Type (parameter ⮱▷ 9602, ⮱▷ 9612, ⮱▷ 9622, ⮱▷ 9632, or ⮱▷ 12793) of a TPDO. The unit is requested to send its data by sending a Sync Message.

The number of required Sync Messages is determined by the setting of the Transmission Type.

If the data is to be sent on request, Bit 30 of the Sync Message (parameter ⮱▷ 9100) must be configured to "0" and the CANopen Master (parameter ⮱▷ 8993) function must be configured to "Off".

Additional example

The Transmission Type of TPDO 1 (parameter ⮱▷ 9602) is configured to "2" in the following example. This means that a message of the configured TPDO is sent by the unit after two Sync Messages have been sent to the unit.

⚙

1. ▷ Either on the front panel or using ToolKit navigate to menu [Configure CAN interface 1 / Transmit PDO 1].
2. ▷ Configure the parameters listed below.

ID	Parameter	Value	Comment
9600	COB-ID	000002AE (hex)	COB-ID set to 000002AE.
9602	Transmission type	2	The number of required sync messages is set to 2.
9604	Event timer	20 ms	Object is sent every 20 ms.
8962	Selected data protocol	5302	Data protocol 5302 is used.
9609	Number of Mapped Objects	0	No mapped object is configured

The recorded data shows that the data of the Mapped Object (in this example Mux 5) is sent (⮡ Table 62) after sending the Sync Message twice (⮡ Table 63).

ID (hex)	Description	Data (hex)
80	-	-

Table 62: Cyclical sending of data - sync message request

No.	Count	ID (hex)	Data (hex)
1	2	80	-
2	1	2AE	8B 13

Table 63: Cyclical sending of data - reply

6.9.3 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?

Error	Possible diagnosis
	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?

6.10 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.

6.10.1 Remote Control

6.10.1.1 Remote Acknowledgment

The Woodward controller may be configured to perform Acknowledgment functions remotely through the Modbus protocol. The required procedure is detailed in the following steps.

Please find remote control parameter 505 described at: ⮡ " Remote control word 3". It works similar like 503 described below.

The following descriptions refer to the remote control parameter 503 as described in ⮡ "9.3.5 Additional Data Identifier".

It may be necessary to shift the address by 1 depending on the used PC software. In this case, the address would be 504 for example.

Be sure to check both possibilities in case of remote control problems.

ID	Parameter	Setting range	Data type
503	Remote control word 1	0 to 65535	UNSIGNED 16

- Modbus address = 40000 + (Par. ID +1) = 40504
- Modbus length = 1 (UNSIGNED 16)

In order to issue a command, the respective bit of object 21F7 (hex), i.e. parameter 503, must be enabled. The following bits are used for this:

- Bit 4 Acknowledgment bit:

  This bit activates the LogicsManager command variable 04.14 "Remote acknowledge". This bit must be set and reset twice to acknowledge an alarm completely. The first rising edge disables the horn and the second rising edge resets the alarm.

The following Modscan32 screenshot (⮡ Fig. 195) shows the configurations made to remote control parameter 503. It is possible to set the format to binary to view single bits using the "display options".

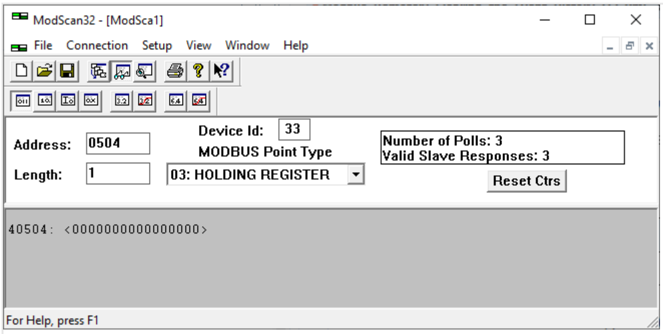


Fig. 195: Modbus - remote control parameter 503

Example: External Acknowledge

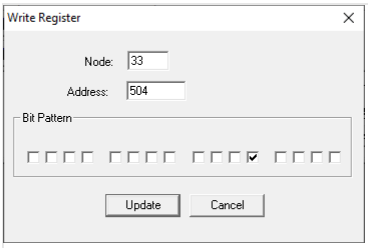


Fig. 196: Modbus - write register - external acknowledge

By double-clicking the address, a Write Register command may be issued.

⮡ Fig. 196 shows how bit 4 is set using the ModScan32 Software.

6.10.2 Modbus Changing Parameter Settings

6.10.2.1 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 + 1) = 41707
- Modbus length = 1 (UNSIGNED 16)

>

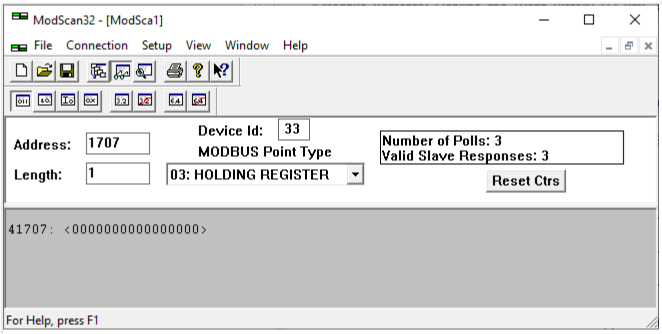


Fig. 197: Modscan32 at address 41707

1. ▷ Use the "display options" to set the value format to binary.
2. ▷ Double-click the address to issue a `Write Register` command.

▶

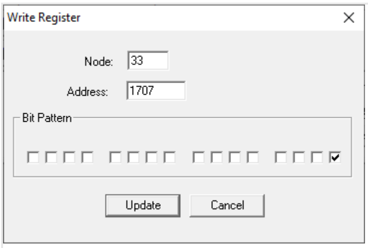


Fig. 198: Write register - clear event history

⮡ Fig. 198 shows how bit 0 is enabled using the ModScan32 Software.

6.10.3 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 64 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 64: Modbus - exception responses

6.10.4 Modbus Telegram Mapper (Customer Written Data Protocols)

6.10.4.1 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 LS-6XT database (Index No.), AnalogManager Variables and LogicsManager Command Variables to a customer specific protocol.

6.10.4.2 Configuration

Woodward offers the TelegramMapper PC software for free and enables LS-6XT 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 LS-6XT model will be available/selectable:

- AnalogManager variables
- LogicsManager variables
- the LS-6XT 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 LS-6XT device
- HTML-file for easy to read documentation of the (self) created data protocol
- MAP-file for further edits with the TelegramMapper software

To load your created Data Protocol(s) - the scp-file(s) - into your LS-6XT device use 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

5003, 5011 etc. Navigate to “Parameter/Configuration/Configure interfaces/Modbus protocol”.

6.10.4.3 Status/diagnostic Modbus Telegram Mapper

The LS-6XT 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.

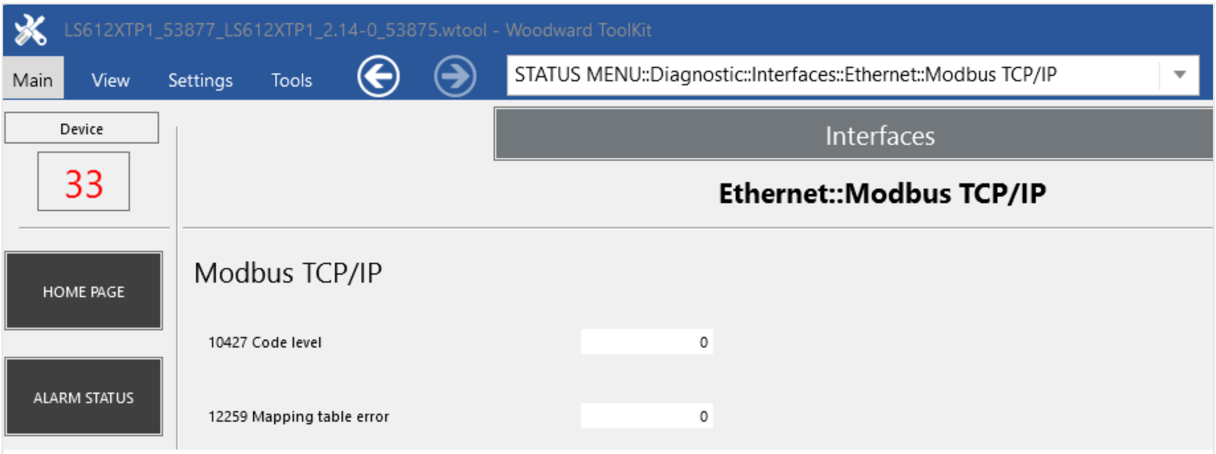


Fig. 199: Status Modbus mapping table error

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)

6.10.5 Modbus master

6.10.5.1 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.

6.10.5.2 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.

6.10.5.3 Status/diagnostic Modbus master

Toolkit is providing a screen for some Modbus master diagnostics.

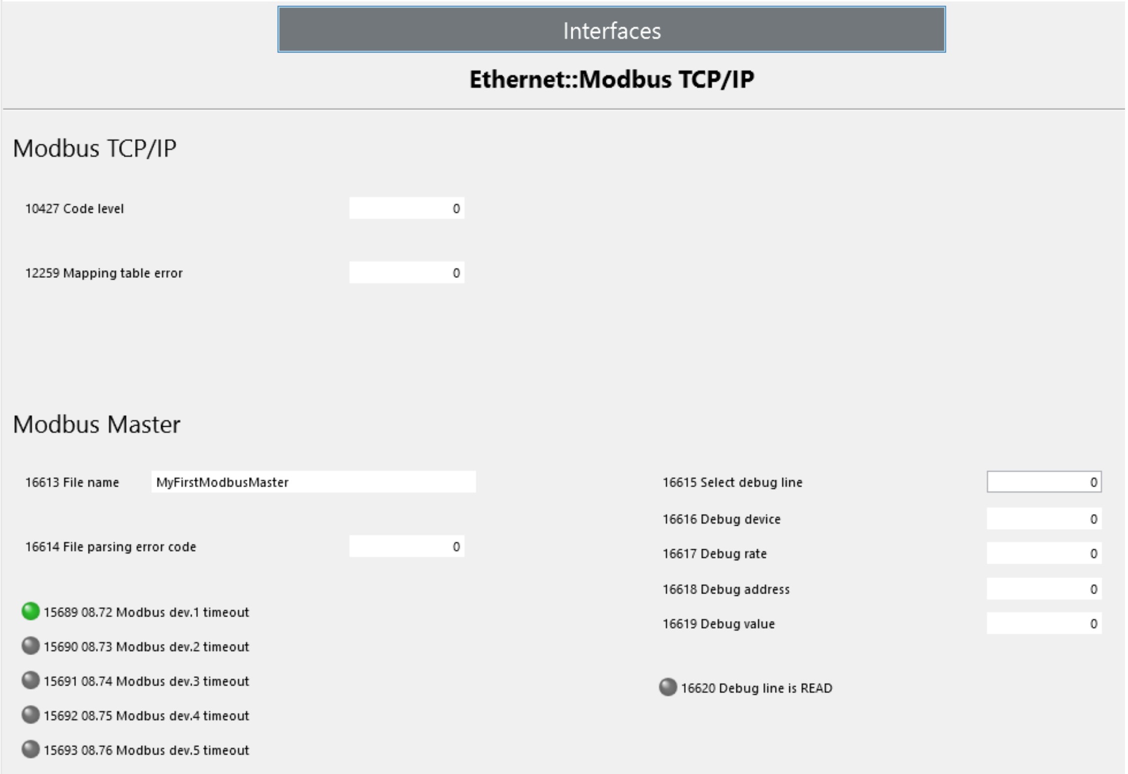


Fig. 200: Status Modbus

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

For interfaces terminal overview refer to ⮡ "3.3 Setup Interfaces"

7.1 CAN Interfaces

7.1.1 CAN Interface 1 (Guidance level)

The CAN interface 1 is a freely configurable CANopen interface with 5 RPDOs (receive messages), 5 TPDOs (send messages) and 4 additional Server SDOs.

CAN interface 1 is also used for load sharing.

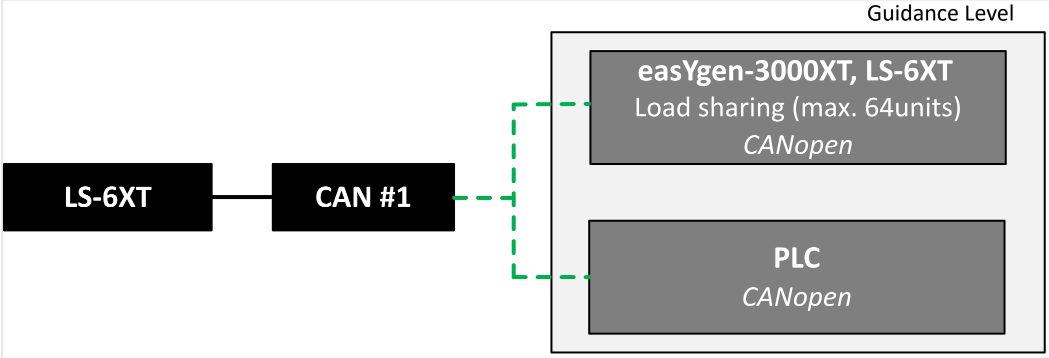


Fig. 201: CAN interface 1

7.2 Ethernet Interfaces

General notes

The Ethernet network provides a fast communication capability to different devices, like remote panel, PLC or SCADA systems. The common protocol Modbus TCP is there for the preferred communication protocol. Additionally the Ethernet connection supports the Woodward protocol Servlink for ToolKit and other Woodward own monitoring tools (like remote panel and SCADA visualization tool). The LS-6XT also provides a UDP protocol for system relevant and time discrete information exchange.

Ethernet IP addresses

The actual IP address in Network A, subnet mask and gateway IP address can be viewed under Next Page (Status Menu) / Diagnostic / Interfaces / Ethernet / Ethernet A. ⮡ Fig. 202

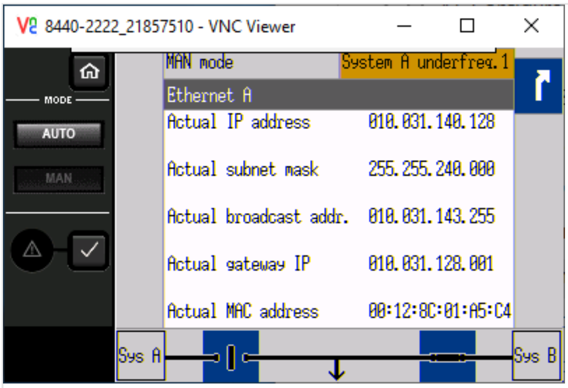


Fig. 202: Ethernet Network A screen

The actual IP address in Network B and the subnet mask can be viewed under Next Page (Status Menu) / Diagnostic / Interfaces / Ethernet / Ethernet B. ⮡ Fig. 203

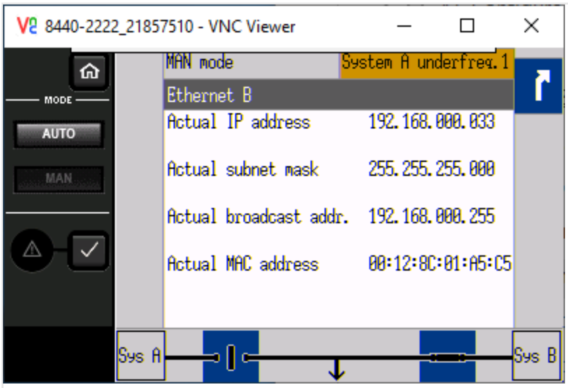


Fig. 203: Ethernet Network B screen

The actual IP address in Network C and the subnet mask can be viewed under Next Page (Status Menu) / Diagnostic / Interfaces / Ethernet / Ethernet C ⮡ Fig. 204.

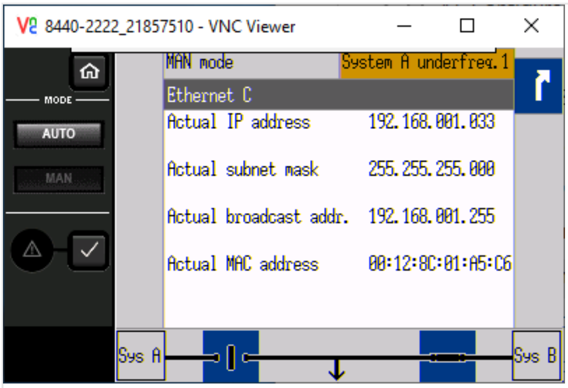


Fig. 204: Ethernet Network C screen

7.3 Serial Interfaces

7.3.1 RS-485 Interface (Serial Interface 2)

A freely configurable RS-485 Modbus RTU Slave interface is provided to add PLC connectivity. It is also possible to configure the unit, visualize measured data and alarm messages, and control the unit remotely.

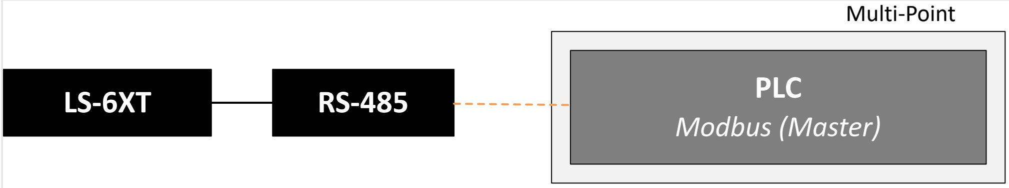


Fig. 205: RS-485 interface

7.3.2 USB interface (USB 2.0, slave)

Service port

The USB interface follows the USB 2.0 standard but is - as a service port - reserved for ToolKit and special Woodward usage.

7.4 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) = $b_{-1} * 2^{-1} + ... + b_1 * 2^1 + b_0 * 2^0$

Please note that the bit sequence starts on the left with the least significant byte.

Example: Value 266 = 10A hex of type UNSIGNED16 is transmitted on the bus in two octets, first 0A hex and then 01 hex.

The following UNSIGNED data types are transmitted as follows:

Octet Number	1.	2.	3.	4.	5.	6.	7.	8.
UNSIGNED8	b_7 to b_0							
UNSIGNED16	b_7 to b_0	b_{15} to b_8						
UNSIGNED24	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}					
UNSIGNED32	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}				
UNSIGNED40	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}			
UNSIGNED48	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}	b_{47} to b_{40}		
UNSIGNED56	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}	b_{47} to b_{40}	b_{55} to b_{48}	
UNSIGNED64	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}	b_{47} to b_{40}	b_{55} to b_{48}	b_{63} to b_{56}

Table 65: Transfer syntax for data type UNSIGNEDn

Data format "Signed Integer"

SIGNED type data has integers as values. The range is between 0 and 2^{-1}. The data is shown by the bit sequence of length n.

- Bit sequence:

$b = b_0$ to b_{-1}

- Value shown:

SIGNEDn(b) = $b_{-2} * 2^{-2} + ... + b_1 * 2^1 + b_0 * 2^0$

if $b_{-1} = 0$

- And with two’s complement:

SIGNEDn(b) = SIGNEDn(^b)-1

if $b_{-1} = 1$

Please note that the bit sequence starts on the left with the least significant byte.

Example: The value -266 = FEF6 hex of type SIGNED16 is transmitted in two octets, first F6 hex and then FE hex.

Octet Number	1.	2.	3.	4.	5.	6.	7.	8.
SIGNED8	b_7 to b_0							
SIGNED16	b_7 to b_0	b_{15} to b_8						
SIGNED24	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}					
SIGNED32	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}				
SIGNED40	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}			
SIGNED48	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}	b_{47} to b_{40}		
SIGNED56	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}	b_{47} to b_{40}	b_{55} to b_{48}	
SIGNED64	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}	b_{47} to b_{40}	b_{55} to b_{48}	b_{63} to b_{56}

Table 66: Transfer syntax for data type INTEGER

7.5 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:

- ⟹ http://www.modbus.org/specs.php

There are also various tools available on the internet. We recommend using ModScan32 which is a Windows application designed to operate as a Modbus Master device for accessing data points in a connected Modbus Slave device. It is designed primarily as a testing device for verification of correct protocol operation in new or existing systems.

A trial version download is available from the following website:

- ⟹ http://www.win-tech.com/html/modscan32.htm

Address range

The controller Modbus Slave module distinguishes between visualization data and configuration & remote control data. The different data is accessible over a split address range and can be read via the "Read Holding Register" function.

Furthermore, controller parameters and remote control data can be written with the "Preset Single Registers" function or "Preset Multiple Registers" (⮑ Fig. 206)

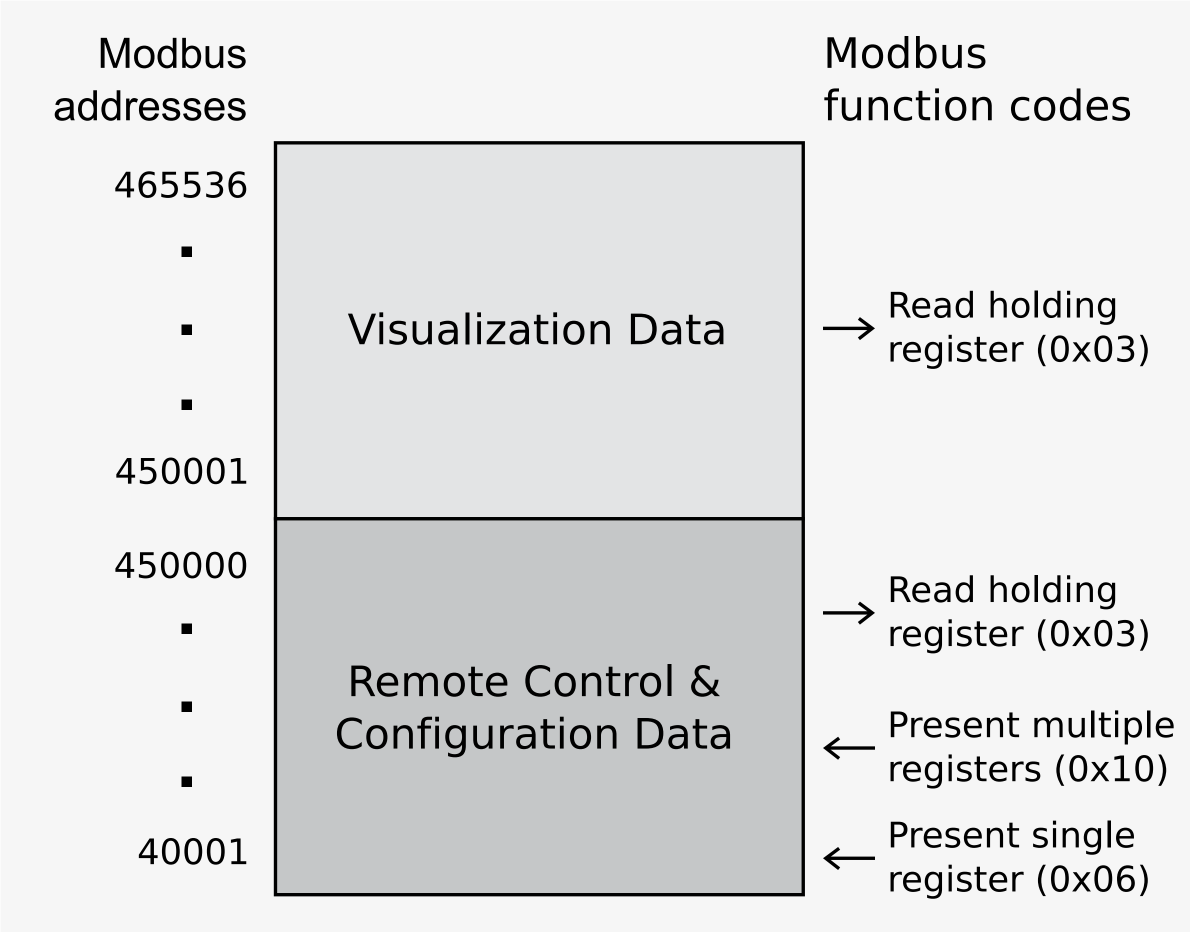


Fig. 206: Address range

All addresses in this document comply with the Modicon address convention. Some PLCs or PC programs use different address conventions depending on their implementation. Then the address must be increased and the leading 4 may be omitted.

Please refer to your PLC or program manual for more information. This determines the address sent over the bus in the Modbus telegram. The Modbus starting address 450001 of the visualization data may become bus address 50000 for example.

Visualization

The visualization over Modbus is provided in a very fast data protocol where important system data like alarm states, AC measurement data, switch states and various other information may be polled.

According to the Modbus addressing range, the visualization protocol can be reached on addresses starting at 450001. On this address range it is possible to do block reads from 1 up to 128 Modbus registers at a time.

Modbus read addresses	Description	Multiplier	Units
450001	Protocol-ID, always 5300		–

Modbus read addresses	Description	Multiplier	Units
450002	Scaling Power (16 bits) Exponent 10x W (5;4;3;2)		
....	....	.....	.....
	....		
....	....	.....	.....
450273	Free AnalogManager Value 16 (long)		

Table 67: Address range block read

"4.7.3 Modbus protocol" is only an excerpt of the data protocol. It conforms to the data protocol 5010.

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 128 registers.

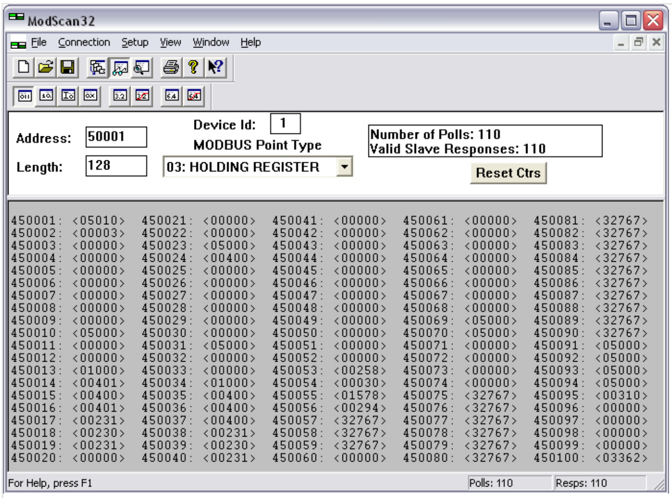


Fig. 207: Visualization configurations

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 68: 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 69 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 69: Data types

> Woodward recommends to make a break time of 10 ms after receiving the data of the last Modbus request.

7.6 Load Sharing

General information

The maximum number of participating LS-6XT devices for load sharing depends on the application layer ⮡ 8990.

- **Layer 1**

  32 participating LS-6XT devices

  Both CAN and Ethernet interfaces can handle load share.

- **Layer 3**

  64 participating LS-6XT devices

  Ethernet interfaces handle the load share.

The Load share via Ethernet interface uses UDP broadcast messages.

Load share timeouts

The LS-6 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**
  - 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 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.

  - easYgen LS timeout

    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 "Redund. LS timeout" is shown with state True and the LogicsManager flag "08.80 Redundancy LS timeout" is TRUE until the loadshare message is received again.

Load share monitoring

The LS-6XT provides parameters for monitoring the load sharing:

- **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 “4.5.5.12.3 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 “4.5.5.13 Multi-Unit System update”.

- **Load Share Interface Redundancy is Lost**

  Beside the automatic handling of redundant load share line messages the LS-6 can inform the operator if a redundant load share communication line get lost. Preassumption for that is an enabled redundant load share line like "CAN/Ethernet A" or "Ethernet B/C" in conjunction with a successful system update procedure. For additional information refer to “4.5.5.14 Load Share Interface Redundancy is Lost”.

Load share communication

The following parameters allows to select the interface for load share communication. Refer to “4.4.5 Configure Load Share” for detailed information.

ID	Text	Setting range	Default value
9924	Load share Interface	**CAN** Off Ethernet A	CAN

ID	Text	Setting range	Default value
		Ethernet B/C CAN1/Ethernet A Ethernet B	

Woodward recommends to configure the Node-IDs (parameter ⮡ 8950) for units, which participate in load sharing, as low as possible to facilitate a fast establishing of communication.

7.6.1 Load Share via CAN

Bus load

The bus load increases with the number of units participating in load sharing.

The following parameters affect the bus load:

- Number of CAN participants
- Baud rate
- Transfer rate of load share messages
- Transfer rate of visualization protocols

We recommend to consider whether all data has to be sent on the CAN bus when planning the CAN bus. It is also possible to send visualization data via RS-485 for example.

Measures to reduce the bus load

If you need to reduce the bus load of the load share CAN bus, the following methods may be used:

- Increase the baud rate (parameter ⮡ 3156) under consideration of the bus length (refer to ⮡ "3.3.4 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 RS-485 interface 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 ⮡ "4.7.6 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

7.6.2 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 ⮡ "4.7.5 Ethernet Interfaces" and ⮡ "7.2 Ethernet Interfaces".

8 Technical Specifications

8.1 Technical Data

Product label

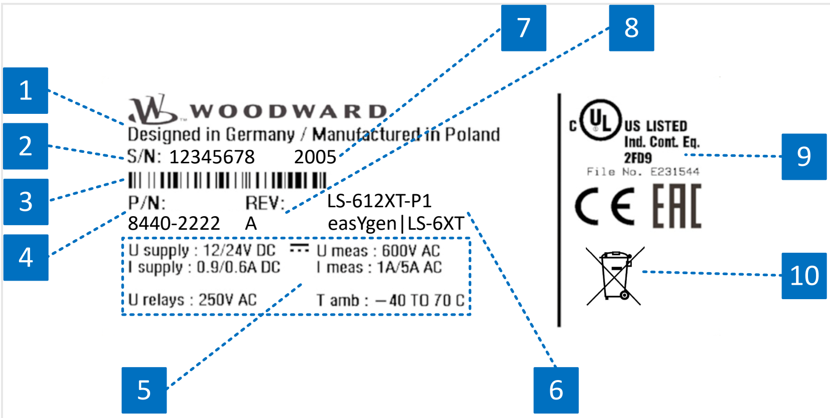


Fig. 208: Product label

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. 209: 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	System A	3.0 × I_{rated}
	System B	approx. 1.5 × I_{rated}
Maximum power consumption per path		< 0.10 VA
Rated short-time current (1 s)		50.0 A

Battery Voltage

Measuring values, battery voltage	Galvanically isolated
Input voltage range	8 to 40 V_{DC}

8.1.2 Ambient Variables

CAUTION!

Device Operating Voltage

Connect the unit only to a DC power source that complies with the safety extra-low voltage (SELV) requirements.

Power supply	12/24 V_{DC} (8 to 40.0 V_{DC}), SELV
Intrinsic consumption	max. 27 W
Degree of pollution	2
Maximum elevation	4,000 m ASL
Insulation voltage	100 V_{DC} Marine applications: 40 V_{DC}
Overvoltage (≤ 2 min)	80 V_{DC}
Reverse voltage protection	Over the full supply range
Input capacitance	5,000 µF
Unit Power Supply	Negative potential grounded or positive potential grounded or ungrounded

8.1.3 Inputs/Outputs

Discrete inputs 'DI xx'

Discrete inputs	Galvanically isolated
Input range ($V_{cont.\ dig.\ input}$)	Rated voltage 12/24 V_{DC} (8 to 40.0 V_{DC})
Input resistance	approx. 20 kΩ

Discrete outputs 'R xx' (relay outputs)

Discrete/relay outputs	Potential free Configurable via LogicsManager	Galvanically isolated
Contact material		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^{TM}	Freely scalable
Maximum permissible voltage against Engine Ground		9 V
Maximum permissible voltage between Engine Ground & PE		100 V
Resolution		16 Bit
0/4 to 20 mA input	Internal load	~50 Ω
0 to 2000 Ω input	Load current	≤ 2.3 mA
0 to 1V input	Input resistance	approx. ~91 kΩ

Analog outputs 'AO 01' (Type 1: ±20 mA \| ±10 V \| PWM)

Analog output	Freely scalable	Galvanically isolated
Resolution		min. 12 bit
Configurable as	(bipolar)	±20 mA, ±10 V_{DC}
PWM output		±10 V_{DC}, 500 Hz duty cycle
Shunt resistor		max. 500 Ω
Galvanically isolation to PE		min. 100 V_{AC}

Analog outputs 'AO 02' (Type 1: ±20 mA \| ±10 V \| PWM)

Analog output	Freely scalable	Galvanically isolated
Resolution		min. 12 bit
Configurable as	(bipolar)	±20 mA, ±10 V_{DC}
PWM output		±10 V_{DC}, 500 Hz duty cycle
Shunt resistor		max. 500 Ω
Basic isolation to PE		500 V_{RMS}
Reinforced isolation to PE		300 V_{RMS}

8.1.4 Interfaces

USB (slave)

USB 2.0 interface	Galvanically isolated
Type	USB 2.0 standard; slave (Type B)

Data rate	max. 12 Mbit/s
Insulation	Galvanically isolated
Bus Voltage	5 V
Current consumption	approx. 10 mA

RS-485 interface

RS-485 interface	Galvanically isolated
Insulation voltage (continuously)	100 V_{AC}
Insulation test voltage (1 s)	1700 V_{DC}
Version	RS-485 Standard

CAN bus interface

CAN bus interface	Galvanically isolated
Insulation voltage (continuously)	100 V_{AC}
Insulation test voltage (1 s)	1700 V_{DC}
Version	CAN bus
Internal line termination	Not available

Ethernet interface

Ethernet bus interface	Galvanically isolated Only one MAC ID is required
Insulation voltage (continuously)	100 V_{AC}
Insulation test voltage (1 s)	1700 V_{DC}
Version	Ethernet 10/100Base-T/TX
Ethernet plug socket	RJ45 standard, shielded 2 LEDs to indicate communication.
Ethernet cable	CAT 5 or 5e (class D) Shielding: F/UTP according to ISO/IEC 11801 (foil overall shielding, pairs unshielded)
Green LED	Indicates link activity (blinking during data transmission)
Yellow LED	Indicates link status (regarding speed): 10 Mb/s: LED switched-off 100 Mb/s: LED switched-on
Internal shield termination	Available

8.1.5 Real Time Clock Battery

Type	Lithium
Life span (operation without power supply)	approx. 5 years
Battery field replacement	Not allowed. Please contact your Woodward service partner.

8.1.6 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	
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 G^2/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 (LR): Application Marine 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	2005 - Electromagnetic compatibility (EMC). Generic standards. Immunity for industrial environment

EN 61000-6-4	2007 + A1: 2011 - Electromagnetic compatibility (EMC). Generic standards. Emission standard for industrial environments
EN 61326-1	2013 - Electrical equipment for measurement, control and laboratory use. EMC requirements. General requirements (according to industrial electromagnetic environment)

8.3 Accuracy

The accuracy declaration is defined by the according measurement ranges. The rated maximum of the single ranges are taken as 100%.

This results in the definitions:

- Range 1: 69/120 V rated = 100%
- Range 2: 277/480 V rated = 100%
- Range 3: 400/690 V rated = 100%

Measuring value	Display	Accuracy	Measuring start	Notes
Frequency				
System A	15.0 to 85.0 Hz	0.1% (of 85 Hz)	5% (of PT secondary voltage setting)[1]	
System B	30.0 to 85.0 Hz			
Voltage				
Wye System A / System B / Auxiliary voltage	0 to 650 kV	0.5% , Class 0.5 [2] related to: 69/277/400 V (Wye) 120/480/690 V (Delta)	1.5% (of PT secondary voltage setting)[1]	
Delta System A / System B / Auxiliary voltage			2% (of PT secondary voltage setting)[1]	
Power supply/Battery	0 to 40 V_{DC}	±0.5% related to 40 V	Related on the measurement range 8 to 40 V	0.5% equals 0.2 V (±0.2 V)
Current				
System A	0 to 32,000 A	0.5% (of 1/5 A)[3] Class 0.5	1% (of 1.3/6.5 A)[3]	
Max. value				
System B/ground current				
Real power				
Actual total real power value	-2 to 2 GW	1% (of 69/277/400 V x 1/5 A)[2/3]	Measuring starts with detecting the zero passage of current/ voltage	
Reactive power				
Actual value in L1, L2, L3	-2 to 2 Gvar	1%	Measuring starts with detecting the zero	

Measuring value	Display	Accuracy	Measuring start	Notes
		(of 69/277/400 V x 1/5 A)[2/3]	passage of current/ voltage	
Power factor				
Actual value power factor L1	lagging 0.000 to 1.000 to leading 0.000	1%	1% (of 1.3/6.5 A)[3]	1.000 is displayed for measuring values below the measuring start
Miscellaneous				
Real energy	0 to 4,200 GWh		0.36% (of 1.3/6.5 A)[3]	Not calibrated
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
Analog Inputs				
0 to 20 mA	Freely scalable	±0.5% related to 20 mA		2 wire input. 0.5% equals 0.1 mA ⇒ ± 0.1 mA)
0 to 2000 Ω	Freely scalable	±0.5% related to 2000 Ω		1 wire input (related to engine ground)[4]
0 to 1 V	Freely scalable	±0.5% related to 1 V		2 wire input. 0.5% equals 0.005 V⇒ ± 0.005 V)
Analog Outputs				
Type 1: ±20 mA | ±10 V | PWM	Freely scalable	≤1%		

[1] Setting of the parameter for the PT secondary rated voltage

[2] Depending on the used measuring range (120/480/690 V)

[3] Depending on the CT input definition (1/5 A) by customer settings. The LS-6 hardware covers both 1 A and 5 A ranges.

[4] Some senders, like the VDO senders, are operating in the working range 0 to 200 Ohms. For sure, the 0.5% accuracy cannot be directly assigned to these senders. Therefore the accuracy percentage tolerance will be expanded accordingly. On the other hand, measurements have shown that under usual circumstances (at 20°C, no EMC surge or burst present) an accuracy of 1% for such senders can be kept.

Reference conditions

The reference conditions for measuring the accuracy are listed below.

Input voltage	Sinusoidal rated voltage
Input current	Sinusoidal rated current
Frequency	Rated frequency
Power supply	Rated voltage ± 2%
Power factor (cos φ)	1.000
Ambient temperature	23 °C ± 2 K
Warm-up period	20 minutes

8.4 Protection (ANSI)

"ANSI Code" related Protection Functions

Protection		**related ANSI #**
System A:	Voltage / frequency	59 / 27 / 81O / 81U
	Phase shift / rotation field / ROCOF (df/dt)	78
	Synch Check	25

System B and Auxiliary voltage provides an operating range monitoring.

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.

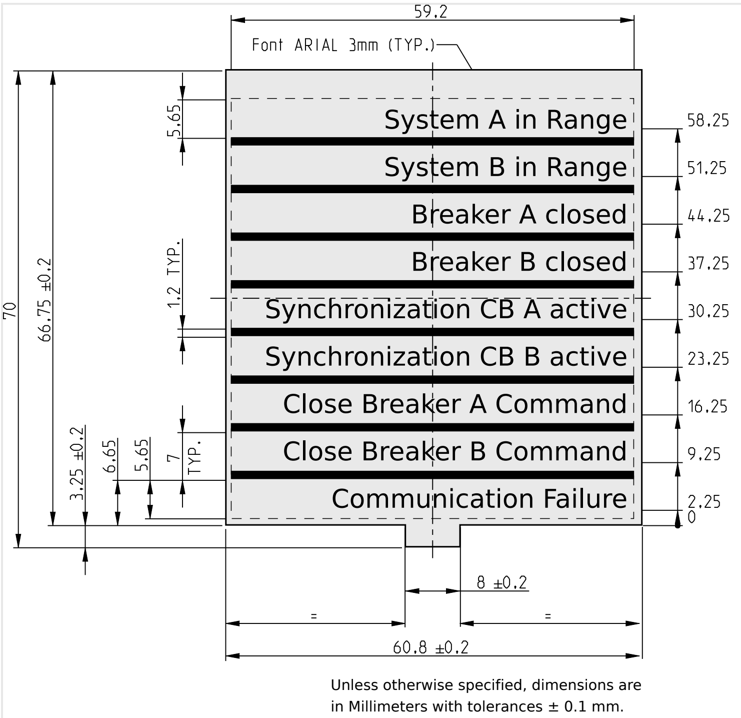


Fig. 210: Dimension of paper strip for easYgen | LS612XT

9.2 Characteristics

9.2.1 Triggering Characteristics

Two-level overshoot monitoring

This triggering characteristic is used for System A overvoltage, System A overfrequency and battery overvoltage.

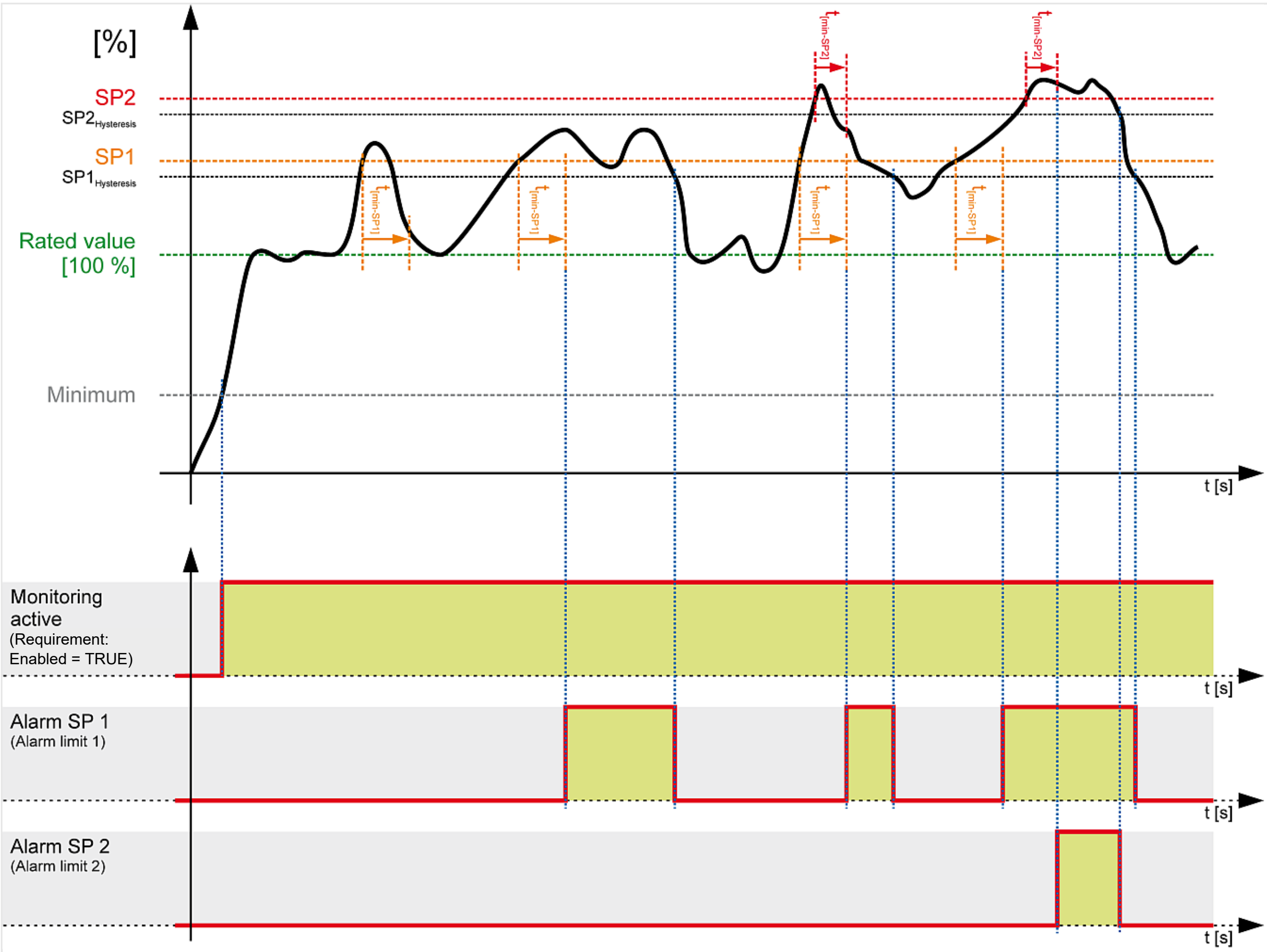


Fig. 211: Two-level overshoot monitoring

Two-level undershoot monitoring

This triggering characteristic is used for System A undervoltage, System A underfrequency and battery undervoltage.

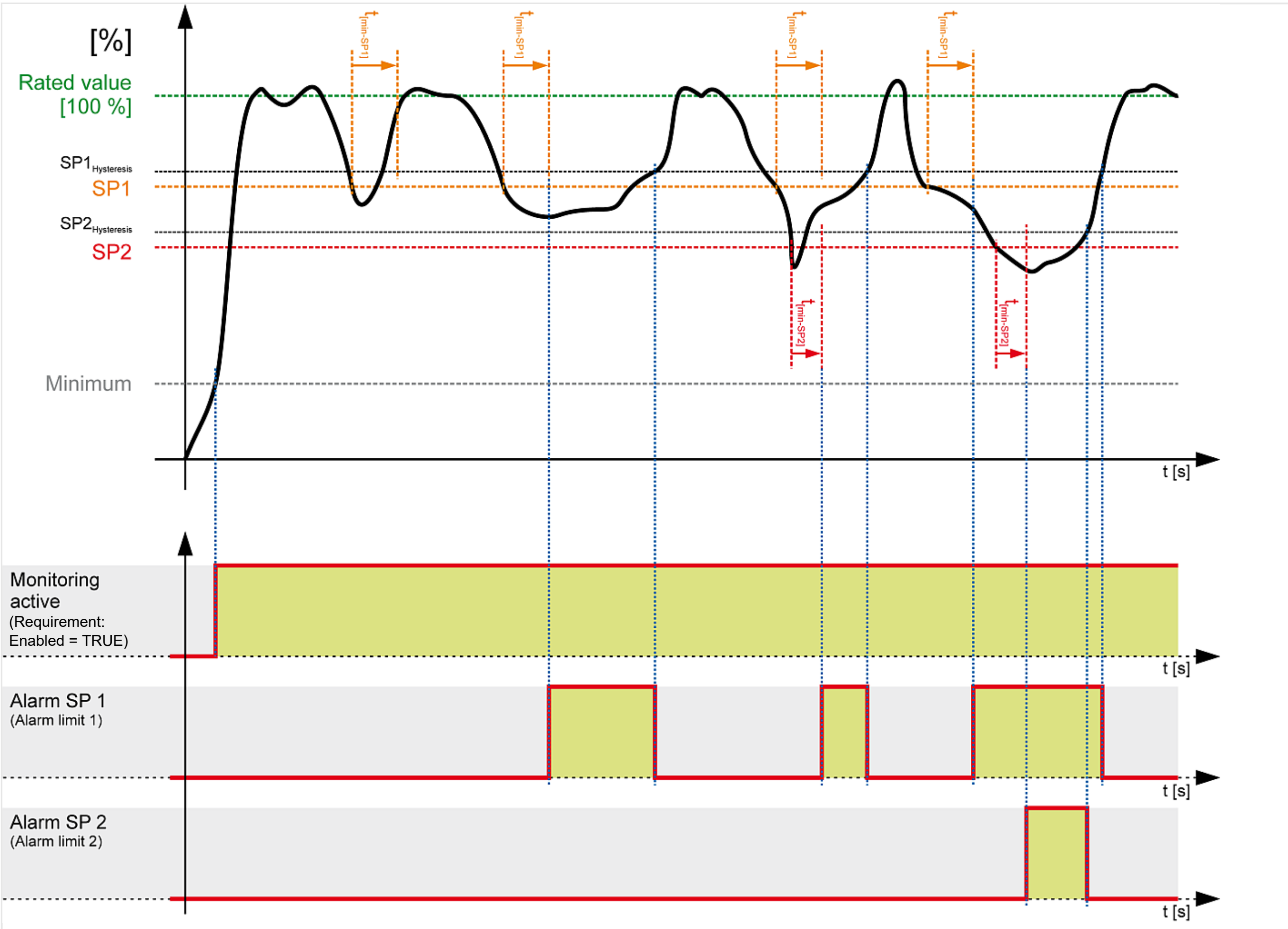


Fig. 212: Two-level undershoot monitoring

One-level asymmetry monitoring

This triggering characteristic is used for System A voltage asymmetry monitoring.

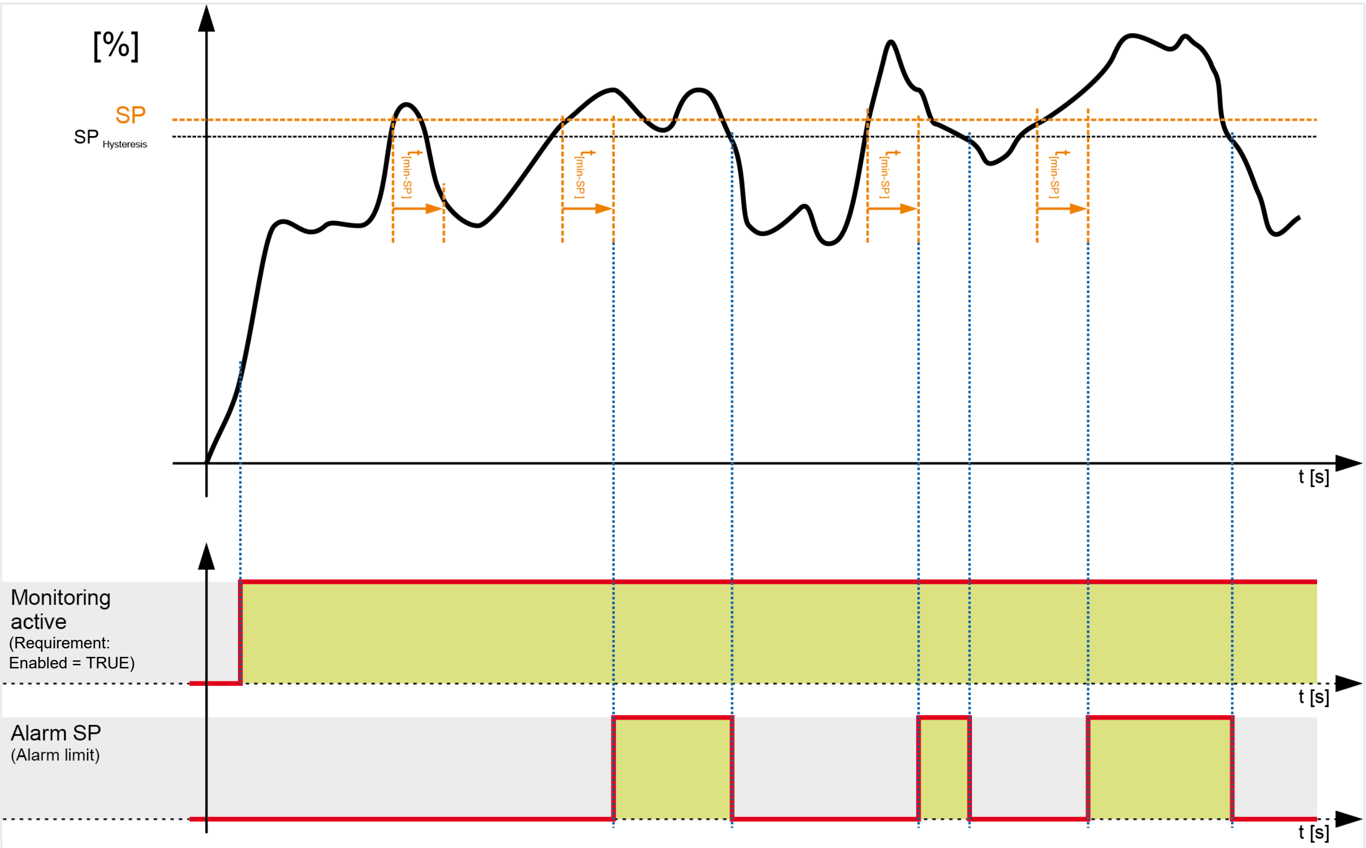


Fig. 213: One-level asymmetry monitoring

9.2.2 VDO Inputs Characteristics

Since VDO sensors are available in different types, the index numbers of the characteristic curve tables are listed.

⚙

1. ▷ Always order VDO sensors with the correct characteristic curve. Manufacturers of VDO sensors usually list these tables in their catalogs.

9.2.2.1 VDO Input "Pressure"

0 to 5 bar/0 to 72 psi - Index "III"

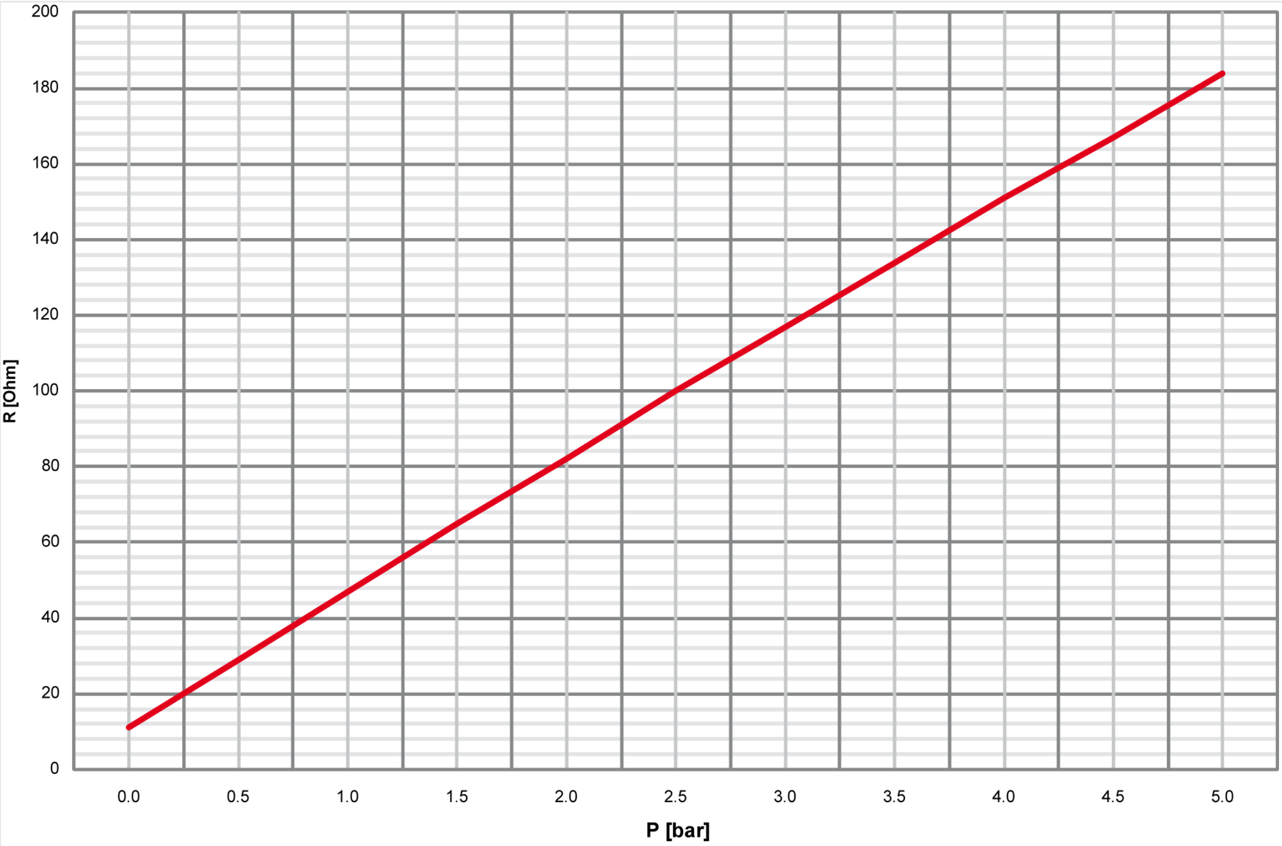


Fig. 214: Characteristics diagram VDO 0 to 5 bar, Index "III"

P [bar]	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
P [psi]	0	7.25	14.50	21.76	29.00	36.26	43.51	50.76	58.02	65.27	72.52
R [Ohm]	11	29	47	65	82	100	117	134	151	167	184

0 to 10 bar/0 to 145 psi - Index "IV"

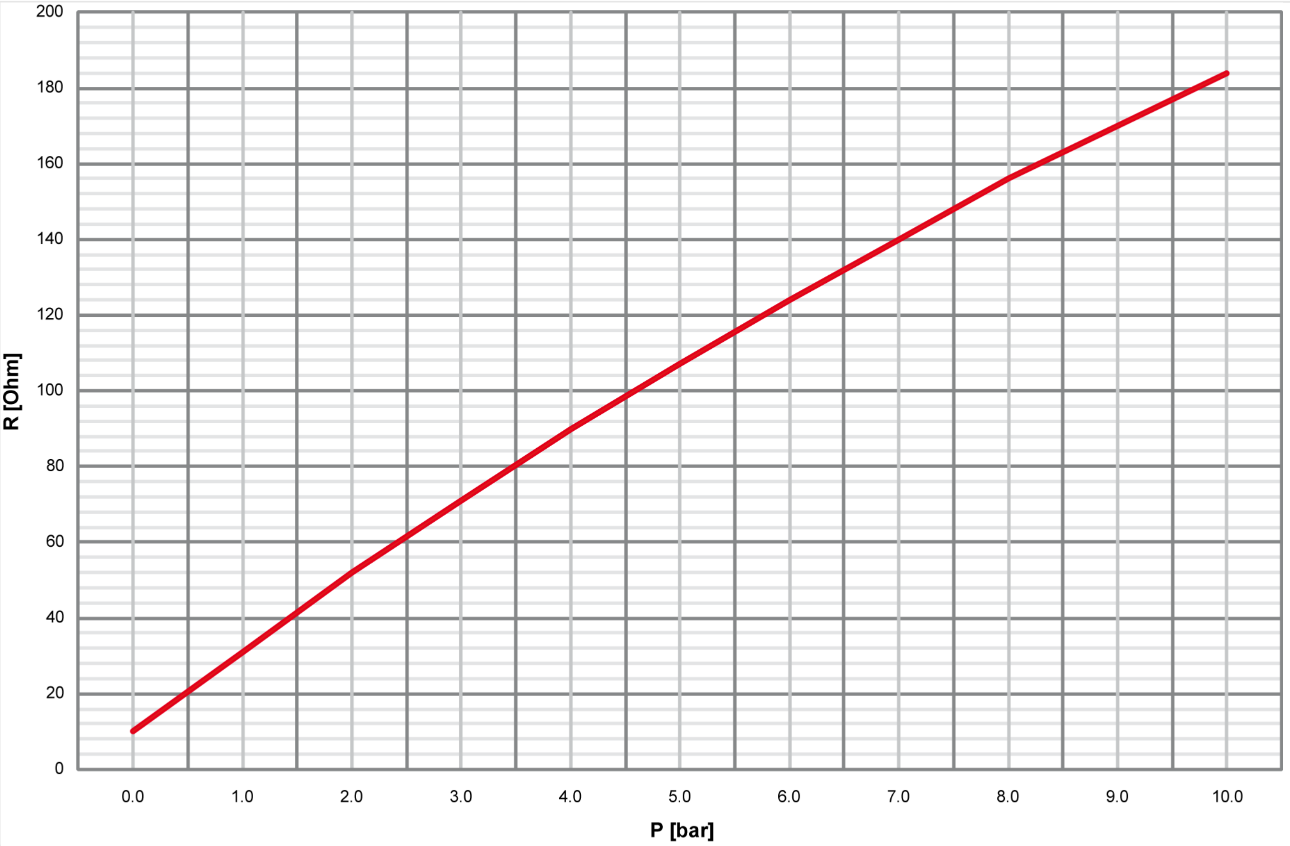


Fig. 215: Characteristics diagram VDO 0 to 10 bar, Index "IV"

P [bar]	0	0.5	1	1.5	2	3	4	5	6	7	8	8.5	9	10
P [psi]	0	7.25	14.50	21.76	29.00	43.51	58.02	72.52	87.02	101.53	116.03	123.28	130.53	145.04
R [Ohm]	10	21	31	42	52	71	90	107	124	140	156	163	170	184

9.2.2.2 VDO Input "Temperature"

40 to 120 °C/104 to 248 °F - Index "92-027-004"

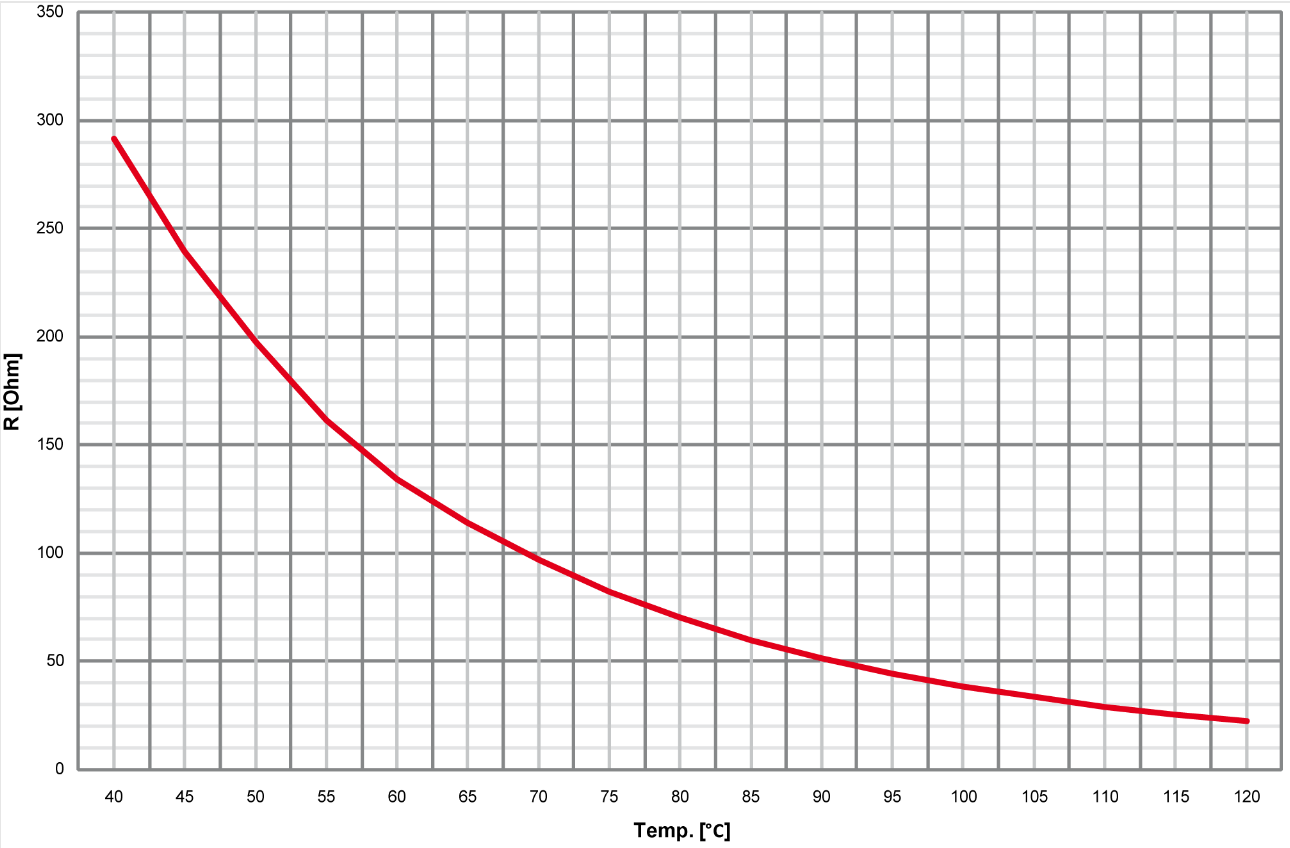


Fig. 216: Characteristics diagram VDO 40 to 120 °C - detail, Index "92-027-004"

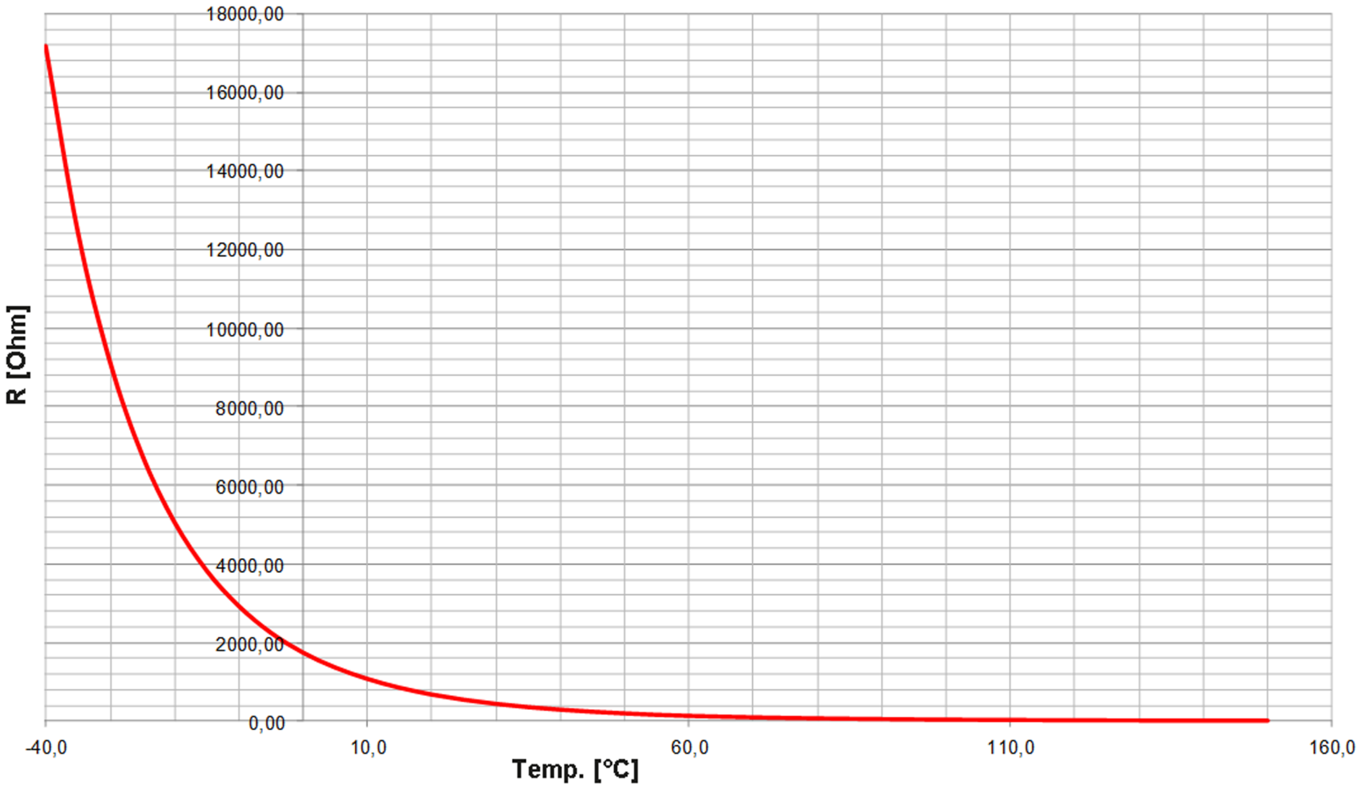


Fig. 217: Characteristics diagram VDO -40 to 120 °C - full range, Index "92-027-004"

Temp. [°C]	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
Temp. [°F]	-40	-31	-22	-13	-4	5	14	23	32	41	50
R [Ohm]	17162.4	12439.5	9134.5	6764.5	5067.6	3833.9	2929.9	2249.4	1743.1	1364.0	1075.6
... continued with further points:											
Temp. [°C]	15	20	25	30	35	40	45	50	55	60	65
Temp. [°F]	59	68	77	86	95	104	113	122	131	140	149
R [Ohm]	850.1	677.0	543.5	439.3	356.6	291.5	239.6	197.3	161.5	134.0	114.0
... continued with further points:											
Temp. [°C]	70	75	80	85	90	95	100	105	110	115	120
Temp. [°F]	158	167	176	185	194	203	212	221	230	239	248
R [Ohm]	97.1	82.4	70.1	59.7	51.2	44.3	38.5	33.4	29.1	25.5	22.4
... and finally continued with further points:											
Temp. [°C]	125	130	135	140	145	150					
Temp. [°F]	257	266	275	284	293	302					

R [Ohm]	19.75	17.44	15.46	13.75	12.26	10.96					

50 to 150 °C/122 to 302 °F - Index "92-027-006"

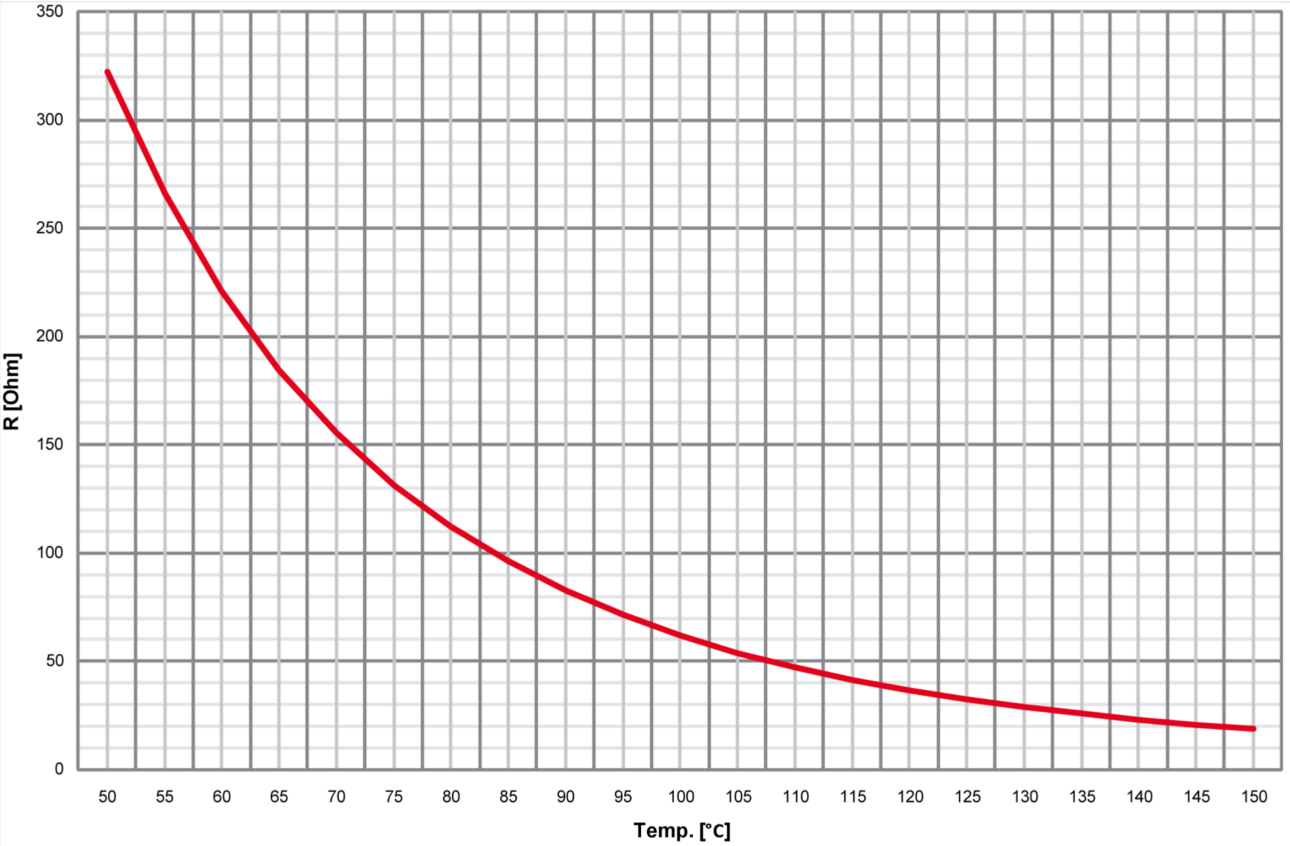


Fig. 218: Characteristics diagram VDO 50 to 150 °C - detail, Index "92-027-006"

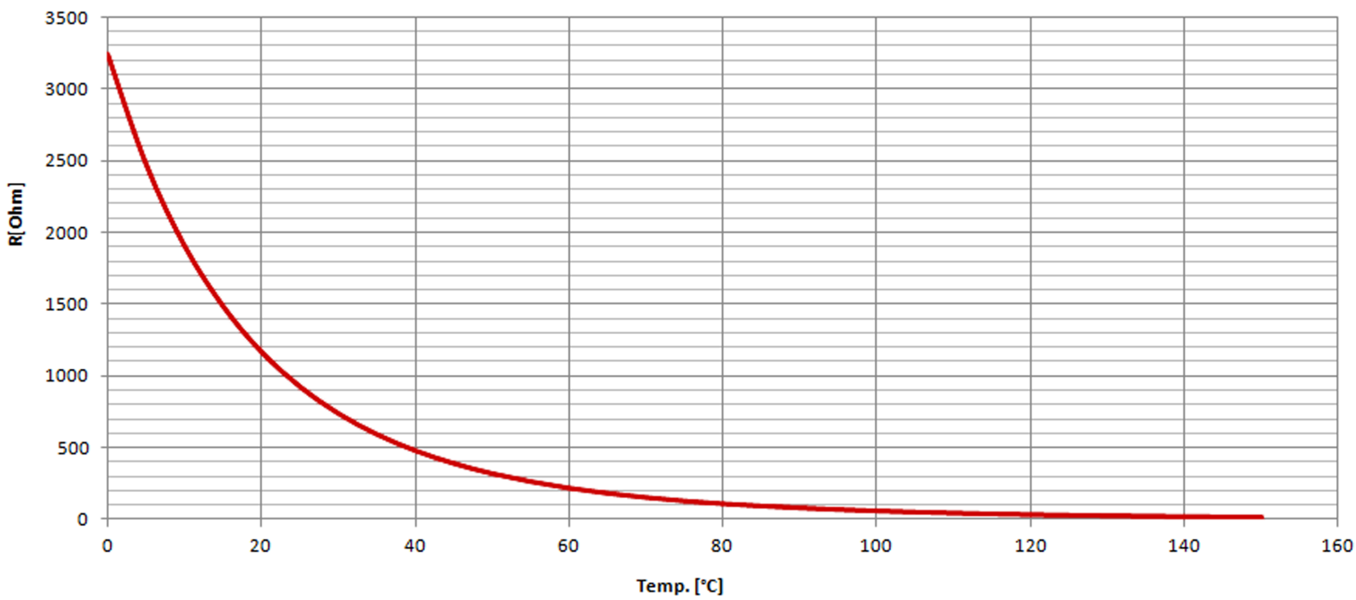


Fig. 219: Characteristics diagram VDO 0 to 120 °C - full range, Index "92-027-006"

Temp. [°C]	0	5	10	15	20	25	30	35	40	45	50
Temp. [°F]	32	41	50	59	68	77	86	95	104	113	122
R [Ohm]	3240.18	2743.6	1905.87	1486.65	1168.64	926.71	739.98	594,9	481,53	392.57	322.17

Temp. [°C]	55	60	65	70	75	80	85	90	95	100	105
Temp. [°F]	131	140	149	158	167	176	185	194	203	212	221
R [Ohm]	266.19	221.17	184.72	155.29	131.38	112.08	96.40	82.96	71.44	61.92	54.01

Temp. [°C]	110	115	120	125	130	135	140	145	150	
Temp. [°F]	230	239	248	257	266	275	284	293	302	
R [Ohm]	47.24	41.42	36.51	32.38	28.81	25.70	23.00	20.66	18.59	

9.2.2.3 Pt100 RTD

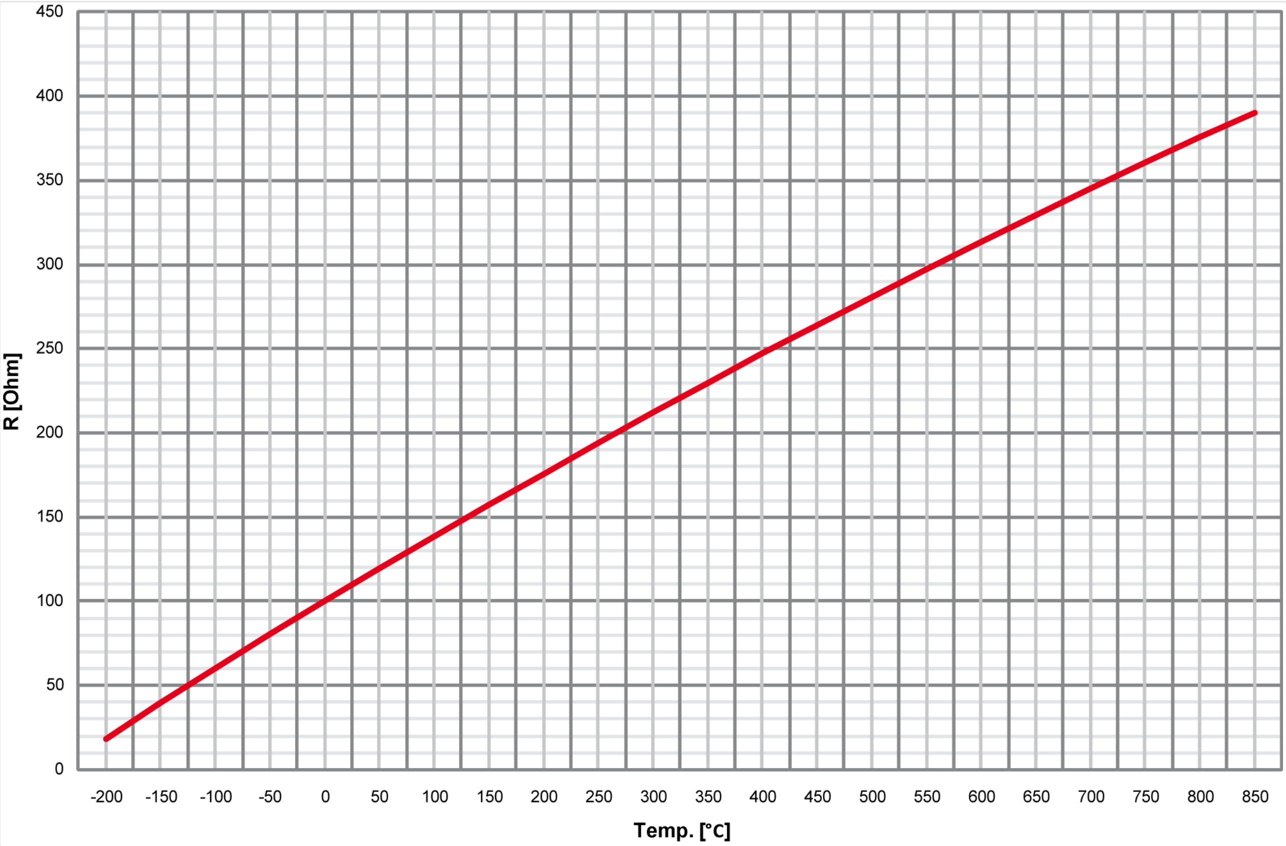


Fig. 220: Characteristics diagram Pt100

Temp. [°C]	-200	-150	-100	-50	0	10	20	30	40	50	60
Temp. [°F]	-328	-238	-148	-58	32	50	68	86	104	122	140
R [Ohm]	18.5	39.7	60.25	80.7	100	103.9	107.8	111.7	115.5	119.4	123.2

Temp. [°C]	70	80	90	100	125	150	175	200	225	250	300
Temp. [°F]	158	176	194	212	257	302	347	392	437	482	572
R [Ohm]	127.1	130.9	134.7	138.5	147.9	157.3	166.6	175.8	188.6	194.1	212.0

Temp. [°C]	350	400	450	500	550	600	650	700	750	800	850
Temp. [°F]	662	752	842	932	1022	1112	1202	1292	1382	1472	1562
R [Ohm]	229.7	247.0	264.1	280.9	297.4	313.6	329.5	345.1	360.5	375.5	390.25

9.2.2.4 Pt1000 RTD

The characteristic of the Pt1000 temperature sender accords the characteristic diagram Pt100 at which the R value is to multiply with 10. Refer to “9.2.2.3 Pt100 RTD” for details.

9.2.2.5 NTC-Sender "AB_94099" (AB-Elektronik Sachsen GmbH)

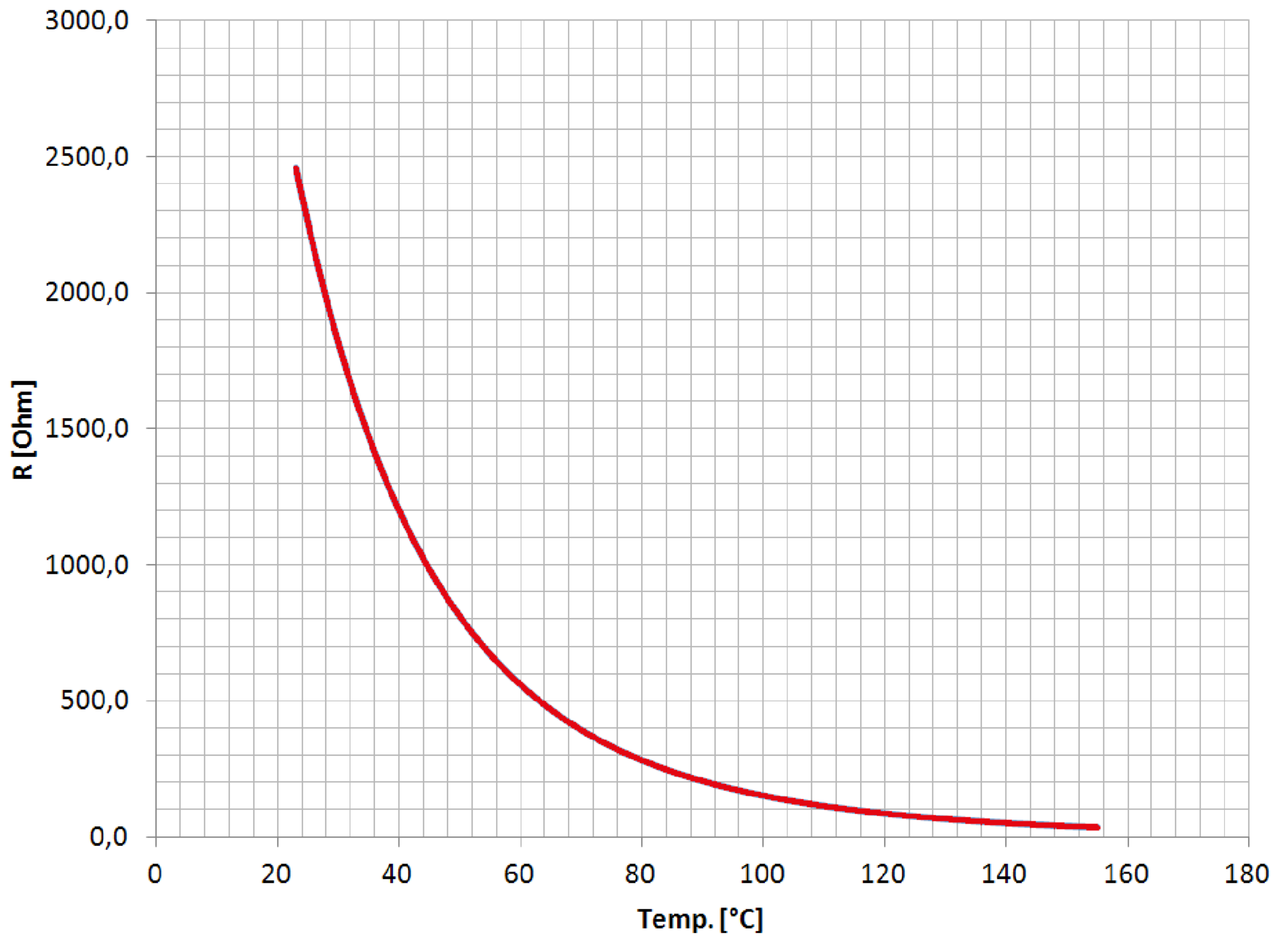


Fig. 221: Characteristic diagram "AB_94099"

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

- 5301: Basic Visualization
- 5302: Basic Visualization (based on 5301)
- 5303: Basic Visualization (based on 5302)

- 6000: Load Share Message
- 6003: LS-6XT Communication
- 65000: External Discrete I/O 1 to 8 (IKD1)
- 65001: External Discrete I/O 9 to 16 (IKD1)

Modbus

- 5300: 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 5300 (Basic Visualization)

Modbus-Address	Size	Index	Description	Unit	Scale	Model
50000	int16		Protocol-ID, always 5300			All
50001	int16	3181	Skaling Power (16 bits) Exponent 10x W (5;4;3;2)			All
50002	int16	3182	Skaling Volts (16 bits) Exponent 10x V (2;1;0;-1)			All
50003	int16	3183	Skaling Amps (16 bits) Exponent 10x A (0;-1)			All
50004			Internal			
50005			Internal			
50006			Internal			
50007			Internal			
50008			Internal			
Topic AC System A values						
50009	int16	144	System A frequency	Hz	*100	All
50010	int16	246	Total system A active power AC measurement	W	format defined by index 3181 (Modbus-Address 50001)	All
50011	int16	247	Total system A reactive power AC measurement	var	format defined by index 3181 (Modbus-Address 50001)	All
50012	int16	160	System A power factor		*1000	All
50013	int16	248	System A voltage L1-L2	V	format defined by index 3182 (Modbus-Address 50002)	All

Modbus-Address	Size	Index	Description	Unit	Scale	Model
50014	int16	249	System A voltage L2-L3	V	format defined by index 3182 (Modbus-Address 50002)	All
50015	int16	250	System A voltage L3-L1	V	format defined by index 3182 (Modbus-Address 50002)	All
50016	int16	251	System A voltage L1-N	V	format defined by index 3182 (Modbus-Address 50002)	All
50017	int16	252	System A voltage L2-N	V	format defined by index 3182 (Modbus-Address 50002)	All
50018	int16	253	System A voltage L3-N	V	format defined by index 3182 (Modbus-Address 50002)	All
50019	int16	255	System A current 1	A	format defined by index 3183 (Modbus-Address 50003)	All
50020	int16	256	System A current 2	A	format defined by index 3183 (Modbus-Address 50003)	All
50021	int16	257	System A current 3	A	format defined by index 3183 (Modbus-Address 50003)	All
50022	int16		Total system A active power	W	format defined by index 3181 (Modbus-Address 50001)	All
50023	int16	209	Auxiliary Voltage Frequency	Hz	*100	All
50024	int16		Auxiliary Voltage L1-L2 (L1-N)	V	format defined by index 3182 (Modbus-Address 50002)	All

Modbus-Address	Size	Index	Description	Unit	Scale	Model
50025	int16	2540	Number of closes of CBA		*1	All
50026	int16		Total system A reactive power	var	format defined by index 3181 (Modbus-Address 50001)	All
50027	int16		Internal			
50028	int16		Internal			
Topic AC System B values						
50029	int16	147	System B frequency	Hz	*100	All
50030	int16	258	Total system B active power AC measurement	W	format defined by index 3181 (Modbus-Address 50001)	All
50031	int16	259	Total system B reactive power AC measurement	var	format defined by index 3181 (Modbus-Address 50001)	All
50032	int16	208	System B power factor		*1000	All
50033	int16	260	System B voltage L1-L2	V	format defined by index 3182 (Modbus-Address 50002)	All
50034	int16	261	System B voltage L2-L3	V	format defined by index 3182 (Modbus-Address 50002)	All
50035	int16	262	System B voltage L3-L1	V	format defined by index 3182 (Modbus-Address 50002)	All
50036	int16	263	System B voltage L1-N	V	format defined by index 3182 (Modbus-Address 50002)	All
50037	int16	264	System B voltage L2-N	V	format defined by index 3182 (Modbus-Address 50002)	All
50038	int16	265	System B voltage L3-N	V	format defined by index 3182 (Modbus-	All

Modbus-Address	Size	Index	Description	Unit	Scale	Model
					Address 50002)	
50039	int16	266	System B current L1	A	format defined by index 3183 (Modbus-Address 50003)	All
50040	int16		Total system B active power	W	format defined by index 3181 (Modbus-Address 50001)	All
50041	int16	2547	Number of closes of CBB		*1	All
50042	int16		Total system B reactive power	var	format defined by index 3181 (Modbus-Address 50001)	All
50043	int16		Internal			
Topic AC System values						
50044	int16		Internal			
50045	int16		Internal			
50046	int16		Internal			
50047	int16		Internal			
50048	int16		Internal			
Topic DC Analogue Values						
50049	int16	10110	Battery voltage	V	*10	All
50050	int16	10111	Analog input 1		changeable	All
50051	int16	10112	Analog input 2		changeable	All
50052	int16	10115	Analog input 3		changeable	All
50053	int16		Internal			
50054	int16		Internal			
50055	int16		Internal			
50056	int16		Internal			
50057	int16		Internal			
50058	int16		Internal			
Topic Control and Status						
50059	uint16	10202	BITLIST: State Display			
50060	uint16	8018	BITLIST: Visualisation Remote and CB-Control			
			Internal		Mask: 0001h	
			Internal		Mask: 0002h	
			Internal		Mask: 0004h	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			Internal		Mask: 0008h	
			Internal		Mask: 0010h	
			Internal		Mask: 0020h	
			Internal		Mask: 0040h	
			Internal		Mask: 0080h	
			28.01 Command to CB-control 1 (OR'ed)		Mask: 0100h	All
			28.02 Command to CB-control 2 (OR'ed)		Mask: 0200h	All
			28.03 Command to CB-control 3 (OR'ed)		Mask: 0400h	All
			28.04 Command to CB-control 4 (OR'ed)		Mask: 0800h	All
			28.05 Command to CB-control 5 (OR'ed)		Mask: 1000h	All
			28.06 Command to CB-control 6 (OR'ed)		Mask: 2000h	All
			Internal			
			Internal			
50061	uint16	10146	BITLIST: LogicManagerBits			
			Internal		Mask: 0001h	
			Internal		Mask: 0002h	
			Internal		Mask: 0004h	
			11.07 Active second		Mask: 0008h	All
			11.06 Active minute		Mask: 0010h	All
			11.05 Active hour		Mask: 0020h	All
			11.04 Active day in month		Mask: 0040h	All
			11.03 Active weekday		Mask: 0080h	All
			11.02 Time 2 overrun		Mask: 0100h	All
			11.01 Time 1 overrun		Mask: 0200h	All
			Internal		Mask: 0400h	
			04.05 Acknowledge was executed		Mask: 0800h	All
			01.09 Shutdown alarms are active (alarm class C-F)		Mask: 1000h	All
			Internal		Mask: 2000h	
			Internal		Mask: 4000h	
			Internal		Mask: 8000h	
50062	uint16	10147	BITLIST: LogicManagerBits1			
			Internal		Mask: 0001h	
			Internal		Mask: 0002h	
			Internal		Mask: 0004h	
			Internal		Mask: 0008h	
			99.12 LM Relay 12		Mask: 0010h	All
			99.11 LM Relay 11		Mask: 0020h	All

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			99.10 LM Relay 10		Mask: 0040h	All
			99.09 LM Relay 9		Mask: 0080h	All
			99.08 LM Relay 8		Mask: 0100h	All
			99.07 LM Relay 7		Mask: 0200h	All
			Internal		Mask: 0400h	All
			99.05 LM Relay 5		Mask: 0800h	All
			99.04 LM Relay 4		Mask: 1000h	All
			99.03 LM Relay 3		Mask: 2000h	All
			99.02 LM Relay 2		Mask: 4000h	All
			99.01 LM Relay 1 (ready for operation)		Mask: 8000h	All
50063	uint16	10140	BITLIST: LogicManagerBits2			
			Internal		Mask: 0001h	
			86.17 LM Operation mode MANUAL		Mask: 0002h	All
			86.16 LM Operation mode AUTOMATIC		Mask: 0004h	All
			Internal		Mask: 0008h	
			86.15 LM External acknowledge		Mask: 0010h	All
			Internal		Mask: 0020h	
			Internal		Mask: 0040h	
			Internal		Mask: 0080h	
			96.08 LM Internal flag 8		Mask: 0100h	All
			96.07 LM Internal flag 7		Mask: 0200h	All
			96.06 LM Internal flag 6		Mask: 0400h	All
			96.05 LM Internal flag 5		Mask: 0800h	All
			96.04 LM Internal flag 4		Mask: 1000h	All
			96.03 LM Internal flag 3		Mask: 2000h	All
			96.02 LM Internal flag 2		Mask: 4000h	All
			96.01 LM Internal flag 1		Mask: 8000h	All
50064	uint16	10148	BITLIST: LogicManagerBits3			
			Internal		Mask: 0001h	
			Internal		Mask: 0002h	
			Internal		Mask: 0004h	
			Internal		Mask: 0008h	
			Internal		Mask: 0010h	
			Internal		Mask: 0020h	
			Internal		Mask: 0040h	
			Internal		Mask: 0080h	
			01.08 Warning alarms are active (alarm class A, B)		Mask: 0100h	All

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			01.07 All alarm classes are active		Mask: 0200h	All
			01.10 Centralized alarms are active (alarm class B-F)		Mask: 0400h	All
			04.04 Lamp test		Mask: 0800h	All
			Internal		Mask: 1000h	
			Internal		Mask: 2000h	
			Internal		Mask: 4000h	
			Internal		Mask: 8000h	
50065	uint16	10150	BITLIST: LogicManagerBits4			
			Internal		Mask: 0001h	
			Internal		Mask: 0002h	
			96.16 LM Internal flag 16		Mask: 0004h	All
			96.15 LM Internal flag 15		Mask: 0008h	All
			96.14 LM Internal flag 14		Mask: 0010h	All
			96.13 LM Internal flag 13		Mask: 0020h	All
			96.12 LM Internal flag 12		Mask: 0040h	All
			96.11 LM Internal flag 11		Mask: 0080h	All
			96.10 LM Internal flag 10		Mask: 0100h	All
			96.09 LM Internal flag 9		Mask: 0200h	All
			Internal		Mask: 0400h	
			Internal		Mask: 0800h	
			Internal		Mask: 1000h	
			Internal		Mask: 2000h	
			Internal		Mask: 4000h	
			Internal		Mask: 8000h	
50066	uint16	10162	BITLIST: LogicManagerBits6			
			86.40 LM Synchronization mode RUN		Mask: 0001h	All
			86.39 LM Synchronization mode PERMISSIVE		Mask: 0002h	All
			86.38 LM Synchronization mode CHECK		Mask: 0004h	All
			Internal		Mask: 0008h	
			Internal		Mask: 0010h	
			Internal		Mask: 0020h	
			Internal		Mask: 0040h	
			Internal		Mask: 0080h	
			Internal		Mask: 0100h	
			Internal		Mask: 0200h	
			Internal		Mask: 0400h	
			Internal		Mask: 0800h	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			Internal		Mask: 1000h	
			Internal		Mask: 2000h	
			Internal		Mask: 4000h	
			Internal		Mask: 8000h	
50067	uint16	10136	BITLIST: Monitoring analog inputs			
			08.03 Battery under voltage threshold 1		Mask: 0001h	All
			08.01 Battery over voltage threshold 1		Mask: 0002h	All
			08.04 Battery under voltage threshold 2		Mask: 0004h	All
			08.02 Battery over voltage threshold 2		Mask: 0008h	All
			Internal		Mask: 0010h	
			Internal		Mask: 0020h	
			Internal		Mask: 0040h	
			Internal		Mask: 0080h	
			Internal		Mask: 0100h	
			Internal		Mask: 0200h	
			Internal		Mask: 0400h	
			Internal		Mask: 0800h	
			Internal		Mask: 1000h	
			Internal		Mask: 2000h	
			Internal		Mask: 4000h	
			Internal		Mask: 8000h	
50068	uint16	4139	BITLIST: Monitoring operation windows			
			02.06 Aux.Voltage voltage in range (based on System B voltage window)		Mask: 0001h	All
			02.07 Aux.Voltage frequency in range (based on System B frequency window)		Mask: 0002h	All
			02.08 Aux.Voltage v and f in range (ready for operation, 02.06 AND 02.07 are TRUE)		Mask: 0004h	All
			02.21 Aux.Voltage is dead (based on Dead bus detection limit ID5820)		Mask: 0008h	All
			Internal		Mask: 0010h	
			Internal		Mask: 0020h	
			02.11 System A voltage and frequency in range (ready for operation, 02.09 AND 02.10 are TRUE)		Mask: 0040h	All
			Internal		Mask: 0080h	
			Internal		Mask: 0100h	
			02.10 System A frequency in range (based on System B frequency window)		Mask: 0200h	All
			Internal		Mask: 0400h	
			Internal		Mask: 0800h	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			02.09 Sytem A voltage in range (based on System B voltage window)		Mask: 1000h	All
			02.05 System B voltage and frequency in range (ready for operation, 02.03 AND 02.04 are TRUE)		Mask: 2000h	All
			02.04 System B frequency in range (based on System A Operating frequency window)		Mask: 4000h	All
			02.03 System B voltage in range (based on System A Operating voltage window)		Mask: 8000h	All
50069	uint16	1791	BITLIST: Monitoring system A			
			Internal		Mask: 0001h	
			Internal		Mask: 0002h	
			Internal		Mask: 0004h	
			Internal		Mask: 0008h	
			Internal		Mask: 0010h	
			Internal		Mask: 0020h	
			02.13 System A phase rotation: Clock Wise (CW, forward, right turn)		Mask: 0040h	All
			02.12 System A phase rotation: Counter Clock Wise (CCW, reverse, left turn)		Mask: 0080h	All
			Internal		Mask: 0100h	
			Internal		Mask: 0200h	
			Internal		Mask: 0400h	
			Internal		Mask: 0800h	
			Internal		Mask: 1000h	
			Internal		Mask: 2000h	
			Internal		Mask: 4000h	
			Internal		Mask: 8000h	
50070	uint16	1792	BITLIST: Monitoring system B			
			Internal		Mask: 0001h	
			Internal		Mask: 0002h	
			Internal		Mask: 0004h	
			Internal		Mask: 0008h	
			Internal		Mask: 0010h	
			Internal		Mask: 0020h	
			02.15 System B phase rotation: Clock Wise (CW, forward, right turn)		Mask: 0040h	All
			02.14 System B phase rotation: Counter Clock Wise (CCW, reverse, left turn)		Mask: 0080h	All
			Internal		Mask: 0100h	
			Internal		Mask: 0200h	
			Internal		Mask: 0400h	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			Internal		Mask: 0800h	
			Internal		Mask: 1000h	
			Internal		Mask: 2000h	
			Internal		Mask: 4000h	
			Internal		Mask: 8000h	
50071	uint16		BITLIST: LogicManagerBits			
			96.17 LM Internal flag 17		Mask: 0001h	All
			96.18 LM Internal flag 18		Mask: 0002h	All
			96.19 LM Internal flag 19		Mask: 0004h	All
			96.20 LM Internal flag 20		Mask: 0008h	All
			96.21 LM Internal flag 21		Mask: 0010h	All
			96.22 LM Internal flag 22		Mask: 0020h	All
			96.23 LM Internal flag 23		Mask: 0040h	All
			96.24 LM Internal flag 24		Mask: 0080h	All
			96.25 LM Internal flag 25		Mask: 0100h	All
			96.26 LM Internal flag 26		Mask: 0200h	All
			96.27 LM Internal flag 27		Mask: 0400h	All
			96.28 LM Internal flag 28		Mask: 0800h	All
			96.29 LM Internal flag 29		Mask: 1000h	All
			96.30 LM Internal flag 30		Mask: 2000h	All
			96.31 LM Internal flag 31		Mask: 4000h	All
			96.32 LM Internal flag 32		Mask: 8000h	All
50072	uint16	4153	BITLIST: ControlBits1			
			04.01 Operating Mode Automatic		Mask: 0001h	All
			04.03 Operating Mode Manual		Mask: 0002h	All
			04.04 Lamp test request		Mask: 0004h	All
			04.07 CB A is closed		Mask: 0008h	All
			24.39 Isolation Switch is open (Only CBA) or 04.06 CB B is closed (Only CBA/CBB)		Mask: 0010h	All
			04.11 Mains settling is active		Mask: 0020h	All
			04.18 Synchronisation CB B procedure is active		Mask: 0040h	All
			04.19 Open command CB B is active		Mask: 0080h	All
			04.20 Close command CB B is active		Mask: 0100h	All
			04.21 Synchronisation CB A procedure is active		Mask: 0200h	All
			04.22 Open command CB A is active		Mask: 0400h	All
			04.23 Close command CB A is active		Mask: 0800h	All
			04.28 Unloading CB B is active		Mask: 1000h	All

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			04.29 Unloading CB A is active		Mask: 2000h	All
			04.41 Breaker Transition Mode Alternative 1		Mask: 4000h	All
			04.42 Breaker Transition Mode Alternative 2		Mask: 8000h	All
50073	uint16	4154	BITLIST: ControlBits2			
			Initialisation CB A closure counter		Mask: 0001h	All
			04.62 Dead bus closure procedure is active		Mask: 0002h	All
			04.61 Synchrounous mains closure procedure is active		Mask: 0004h	All
			28.01 Command 1 to LS6 (OR'ed) cf. ID8018		Mask: 0008h	All
			28.02 Command 2 to LS6 (OR'ed) cf. ID8018		Mask: 0010h	All
			28.03 Command 3 to LS6 (OR'ed) cf. ID8018		Mask: 0020h	All
			28.04 Command 4 to LS6 (OR'ed) cf. ID8018		Mask: 0040h	All
			28.05 Command 5 to LS6 (OR'ed) cf. ID8018		Mask: 0080h	All
			28.06 Command 6 to LS6 (OR'ed) cf. ID8018		Mask: 0100h	All
			Mains at "left" position (directly or isolation switch) for Tookit grid indication		Mask: 0200h	All
			Mains at "right" position (directly or isolation switch) for Tookit grid indication		Mask: 0400h	All
			System A connected to mains		Mask: 0800h	All
			System B connected to mains		Mask: 1000h	All
			02.25 Mains parallel operation		Mask: 2000h	All
			02.24 System B is dead		Mask: 4000h	All
			02.23 System A is dead		Mask: 8000h	All
50074	uint16	4155	BITLIST: ControlBits3			
			Internal		Mask: 0001h	
			Internal		Mask: 0002h	
			Internal		Mask: 0004h	
			Internal		Mask: 0008h	
			Internal		Mask: 0010h	
			Internal		Mask: 0020h	
			Internal		Mask: 0040h	
			Internal		Mask: 0080h	
			Internal		Mask: 0100h	
			Internal		Mask: 0200h	
			Internal		Mask: 0400h	
			Internal		Mask: 0800h	
			02.13 System A Phase rotation CW		Mask: 1000h	All
			02.12 System A Phase rotation CCW		Mask: 2000h	All
			02.15 System B Phase rotation CW		Mask: 4000h	All

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			02.14 System B Phase rotation CCW		Mask: 8000h	All
50075	uint16	10191	BITLIST: LogicManagerBits10			
			87.31 Enable mains decoupling		Mask: 0001h	All
			87.32 Open CBA		Mask: 0002h	All
			87.33 Immediate open CBA		Mask: 0004h	All
			87.34 Enable to close CBA		Mask: 0008h	All
			87.35 Open CBB		Mask: 0010h	All
			87.36 Immediate open CBB		Mask: 0020h	All
			87.37 Enable to close CBB		Mask: 0040h	All
			87.38 LM variable system is A		Mask: 0080h	All
			87.41 Flag 1 LS6		Mask: 0100h	All
			87.42 Flag 2 LS6		Mask: 0200h	All
			87.43 Flag 3 LS6		Mask: 0400h	All
			87.44 Flag 4 LS6		Mask: 0800h	All
			87.45 Flag 5 LS6		Mask: 1000h	All
			Internal		Mask: 2000h	
			Internal		Mask: 4000h	
			Internal		Mask: 8000h	
50076	uint16	10138	BITLIST: Monitoring System B			
			Internal		Mask: 0001h	
			Internal		Mask: 0002h	
			Internal		Mask: 0004h	
			Internal		Mask: 0008h	
			Internal		Mask: 0010h	
			Internal		Mask: 0020h	
			Internal		Mask: 0040h	
			Internal		Mask: 0080h	
			08.46 CB B unload mismatch		Mask: 0100h	All
			Internal		Mask: 0200h	
			06.21 System B Phase Rotation		Mask: 0400h	All
			Internal		Mask: 0800h	
			Internal		Mask: 1000h	
			Internal		Mask: 2000h	
			Internal		Mask: 4000h	
			Internal		Mask: 8000h	
50077	uint16	10135	BITLIST: Monitoring System A			
			07.21 Syst.A import power 1		Mask: 0001h	P2

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			07.22 Syst.A import power 2		Mask: 0002h	P2
			07.05 System A phase rotation		Mask: 0004h	All
			07.26 System A voltage asymmetry (with negative sequence)		Mask: 0008h	All
			07.23 Syst.A export power 1		Mask: 0010h	P2
			07.24 Syst.A export power 2		Mask: 0020h	P2
			07.25 System A decoupling		Mask: 0040h	All
			07.14 System A Phase shift		Mask: 0080h	All
			07.13 System A under voltage threshold 2		Mask: 0100h	All
			07.12 System A under voltage threshold 1		Mask: 0200h	All
			07.11 System A over voltage threshold 2		Mask: 0400h	All
			07.10 System A over voltage threshold 1		Mask: 0800h	All
			07.09 System A under frequency threshold 2		Mask: 1000h	All
			07.08 System A under frequency threshold 1		Mask: 2000h	All
			07.07 System A over frequency threshold 2		Mask: 4000h	All
			07.06 System A over frequency threshold 1		Mask: 8000h	All
50078	uint16	4138	BITLIST: Monitoring System A			
			07.30 QV Monitoring step 2 tripped		Mask: 0001h	All
			07.29 QV Monitoring step 1 tripped		Mask: 0002h	All
			08.36 CB A unload mismatch		Mask: 0004h	All
			07.27 Voltage increase (10 min)		Mask: 0008h	All
			Internal		Mask: 0010h	
			07.28 Time-dependent voltage monitoring FRT		Mask: 0020h	All
			Internal		Mask: 0040h	
			07.15 df/dt (ROCOF)		Mask: 0080h	All
			07.49 Inv. time overcurr.		Mask: 0100h	P2
			07.48 Unbalanced load 2		Mask: 0200h	P2
			07.47 Unbalanced load 1		Mask: 0400h	P2
			07.46 Syst.A overcurrent 3		Mask: 0800h	P2
			07.45 Syst.A overcurrent 2		Mask: 1000h	P2
			07.44 Syst.A overcurrent 1		Mask: 2000h	P2
			Internal		Mask: 4000h	
			Internal		Mask: 8000h	
50079	uint16		BITLIST: Visualisation Remote and CB-Control with CAN-Input.			
			04.44 Remote Control Bit 1		Mask: 0001h	All
			04.45 Remote Control Bit 2		Mask: 0002h	All
			04.46 Remote Control Bit 3		Mask: 0004h	All

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			04.47 Remote Control Bit 4		Mask: 0008h	All
			04.48 Remote Control Bit 5		Mask: 0010h	All
			04.49 Remote Control Bit 6		Mask: 0020h	All
			04.50 Remote Control Bit 7		Mask: 0040h	All
			04.51 Remote Control Bit 8		Mask: 0080h	All
			04.52 Remote Control Bit 9		Mask: 0100h	All
			04.53 Remote Control Bit 10		Mask: 0200h	All
			04.54 Remote Control Bit 11		Mask: 0400h	All
			04.55 Remote Control Bit 12		Mask: 0800h	All
			04.56 Remote Control Bit 13		Mask: 1000h	All
			04.57 Remote Control Bit 14		Mask: 2000h	All
			04.58 Remote Control Bit 15		Mask: 4000h	All
			04.59 Remote Control Bit 16		Mask: 8000h	All
50080	uint16	4150	BITLIST: ControlBits5			
			Internal		Mask: 0001h	
			Internal		Mask: 0002h	
			Internal		Mask: 0004h	
			Internal		Mask: 0008h	
			Internal		Mask: 0010h	
			Internal		Mask: 0020h	
			Internal		Mask: 0040h	
			Internal		Mask: 0080h	
			Internal		Mask: 0100h	
			Internal		Mask: 0200h	
			02.30 Deadbus closure condition		Mask: 0400h	All
			02.29 Synch. Condition		Mask: 0800h	All
			02.28 Synch. check relay		Mask: 1000h	All
			Internal		Mask: 2000h	
			04.63 Synchronous segment closure procedure is active		Mask: 4000h	All
			Internal		Mask: 8000h	
50081	int16		Internal			
50082	int16		Internal			
50083	int16		Internal			
50084	int16		Internal			
50085	int16		Internal			
Topic Descrete Inputs						
50086	int16	10106	BITLIST: States Digital Inputs			

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			State Digital Input 1	Bit	Mask: 8000h	All
			State Digital Input 2	Bit	Mask: 4000h	All
			State Digital Input 3	Bit	Mask: 2000h	All
			State Digital Input 4	Bit	Mask: 1000h	All
			State Digital Input 5	Bit	Mask: 0800h	All
			State Digital Input 6	Bit	Mask: 0400h	All
			State Digital Input 7	Bit	Mask: 0200h	All
			State Digital Input 8	Bit	Mask: 0100h	All
			State Digital Input 9	Bit	Mask: 0080h	All
			State Digital Input 10	Bit	Mask: 0040h	All
			State Digital Input 11	Bit	Mask: 0020h	All
			State Digital Input 12	Bit	Mask: 0010h	All
			Internal	Bit	Mask: 0008h	
			Internal	Bit	Mask: 0004h	
			Internal	Bit	Mask: 0002h	
			Internal	Bit	Mask: 0001h	
50087	int16		Internal			
50088	int16		Internal			
50089	int16		Internal			
Topic Descrete Outputs						
50090	uint16	10107	BITLIST: Relay Outputs 1			
			Relay-Output 1 (inverted)	Bit	Mask: 8000h	All
			Relay-Output 2	Bit	Mask: 4000h	All
			Relay-Output 3	Bit	Mask: 2000h	All
			Relay-Output 4	Bit	Mask: 1000h	All
			Relay-Output 5	Bit	Mask: 0800h	All
			Relay-Output 6	Bit	Mask: 0400h	All
			Relay-Output 7	Bit	Mask: 0200h	All
			Relay-Output 8	Bit	Mask: 0100h	All
			Relay-Output 9	Bit	Mask: 0080h	All
			Relay-Output 10	Bit	Mask: 0040h	All
			Relay-Output 11	Bit	Mask: 0020h	All
			Relay-Output 12	Bit	Mask: 0010h	All
			Internal	Bit	Mask: 0008h	
			Internal	Bit	Mask: 0004h	
			Internal	Bit	Mask: 0002h	
			Internal	Bit	Mask: 0001h	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
50091	int16		Internal			
50092	int16		Internal			
Topic Alarm Management						
Subtopic General						
50093	uint16	10131	BITLIST: Alarm Class Latched			
			Internal	Bit	Mask: 8000h	
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 2000h	
			Internal	Bit	Mask: 1000h	
			Internal	Bit	Mask: 0800h	
			Internal	Bit	Mask: 0400h	
			01.10 Centralized alarms are active (alarm class B, C, D, E, F)	Bit	Mask: 0200h	All
			01.09 Shutdown alarm are active (alarm class C, D, E, F)	Bit	Mask: 0100h	All
			01.08 Warning alarms are active (alarm class A, B)	Bit	Mask: 0080h	All
			01.07 All alarm classes are active	Bit	Mask: 0040h	All
			01.06 Alarm class F latched	Bit	Mask: 0020h	All
			01.05 Alarm class E latched	Bit	Mask: 0010h	All
			01.04 Alarm class D latched	Bit	Mask: 0008h	All
			01.03 Alarm class C latched	Bit	Mask: 0004h	All
			01.02 Alarm class B latched	Bit	Mask: 0002h	All
			01.01 Alarm class A latched	Bit	Mask: 0001h	All
50094	uint16	10160	BITLIST: LogicManagerBits5			
			Internal	Bit	Mask: 8000h	
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 2000h	
			Internal	Bit	Mask: 1000h	
			Internal	Bit	Mask: 0800h	
			Internal	Bit	Mask: 0400h	
			Internal	Bit	Mask: 0200h	
			Internal	Bit	Mask: 0100h	
			Internal	Bit	Mask: 0080h	
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0020h	
			Internal	Bit	Mask: 0010h	
			Internal	Bit	Mask: 0008h	
			Internal	Bit	Mask: 0004h	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			01.11 New Alarm triggered	Bit	Mask: 0002h	All
			01.12 Horn	Bit	Mask: 0001h	All
50095	uint16	10149	BITLIST: Alarm2			
			08.30 Timeout Synchronisation CB B	Bit	Mask: 8000h	All
			08.31 Timeout Synchronisation CB A	Bit	Mask: 4000h	All
			Internal	Bit	Mask: 2000h	
			Internal	Bit	Mask: 1000h	
			08.33 System A / System B phase rotation mismatch	Bit	Mask: 0800h	All
			Internal	Bit	Mask: 0400h	
			Internal	Bit	Mask: 0200h	
			Internal	Bit	Mask: 0100h	
			Internal	Bit	Mask: 0080h	
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0020h	
			Internal	Bit	Mask: 0010h	
			08.17 Number of member mismatch	Bit	Mask: 0008h	All
			Internal	Bit	Mask: 0004h	All
			Internal	Bit	Mask: 0002h	
			Internal	Bit	Mask: 0001h	
50096	uint16	10133	BITLIST: Alarm1			
			Internal	Bit	Mask: 8000h	
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 2000h	
			Internal	Bit	Mask: 1000h	
			Internal	Bit	Mask: 0800h	
			Internal	Bit	Mask: 0400h	
			Internal	Bit	Mask: 0200h	
			08.05 CB B close not successful	Bit	Mask: 0100h	All
			08.06 CB B open not successful	Bit	Mask: 0080h	All
			08.07 CB A close not successful	Bit	Mask: 0040h	All
			08.08 CB A open not successful	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0010h	
			Internal	Bit	Mask: 0008h	
			Internal	Bit	Mask: 0004h	
			08.19 CANopen error interface 2	Bit	Mask: 0002h	P2
			08.18 CANopen error interface 1	Bit	Mask: 0001h	All
50097	int16		Internal			

Modbus-Address	Size	Index	Description	Unit	Scale	Model
50098	int16		Internal			
50099	int16		Internal			
50100	int16		Internal			
50101	uint16	10202	BITLIST: State Display			
50102	int16		Internal			
50103	uint16	4153	BITLIST: ControlBits1			
			04.01 Operating Mode Automatic		Mask: 0001h	All
			04.03 Operating Mode Manual		Mask: 0002h	All
			04.04 Lamp test request		Mask: 0004h	All
			04.07 CB A is closed		Mask: 0008h	All
			24.39 Isolation Switch is open (Only CBA) or 04.06 CB B is closed (Only CBA/CBB)		Mask: 0010h	All
			04.11 Mains settling is active		Mask: 0020h	All
			04.18 Synchronisation CB B procedure is active		Mask: 0040h	All
			04.19 Open command CB B is active		Mask: 0080h	All
			04.20 Close command CB B is active		Mask: 0100h	All
			04.21 Synchronisation CB A procedure is active		Mask: 0200h	All
			04.22 Open command CB A is active		Mask: 0400h	All
			04.23 Close command CB A is active		Mask: 0800h	All
			04.28 Unloading CB B is active		Mask: 1000h	All
			04.29 Unloading CB A is active		Mask: 2000h	All
			04.41 Breaker Transition Mode Alternative 1		Mask: 4000h	All
			04.42 Breaker Transition Mode Alternative 2		Mask: 8000h	All
50104	uint16	4154	BITLIST: ControlBits2			
			Initialisation CB A closure counter		Mask: 0001h	All
			04.62 Dead bus closure procedure is active		Mask: 0002h	All
			04.61 Synchrounous mains closure procedure is active		Mask: 0004h	All
			28.01 Command 1 to LS6 (OR'ed) cf. ID8018		Mask: 0008h	All
			28.02 Command 2 to LS6 (OR'ed) cf. ID8018		Mask: 0010h	All
			28.03 Command 3 to LS6 (OR'ed) cf. ID8018		Mask: 0020h	All
			28.04 Command 4 to LS6 (OR'ed) cf. ID8018		Mask: 0040h	All
			28.05 Command 5 to LS6 (OR'ed) cf. ID8018		Mask: 0080h	All
			28.06 Command 6 to LS6 (OR'ed) cf. ID8018		Mask: 0100h	All
			Mains at "left" position (directly or isolation switch) for Tookit grid indication		Mask: 0200h	All
			Mains at "right" position (directly or isolation switch) for Tookit grid indication		Mask: 0400h	All

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			System A connected to mains		Mask: 0800h	All
			System B connected to mains		Mask: 1000h	All
			02.25 Mains parallel operation		Mask: 2000h	All
			02.24 System B is dead		Mask: 4000h	All
			02.23 System A is dead		Mask: 8000h	All
50105	uint16	4155	BITLIST: ControlBits3			
			Internal		Mask: 0001h	
			Internal		Mask: 0002h	
			Internal		Mask: 0004h	
			Internal		Mask: 0008h	
			Internal		Mask: 0010h	
			Internal		Mask: 0020h	
			Internal		Mask: 0040h	
			Internal		Mask: 0080h	
			Internal		Mask: 0100h	
			Internal		Mask: 0200h	
			Internal		Mask: 0400h	
			Internal		Mask: 0800h	
			02.13 System A Phase rotation CW		Mask: 1000h	All
			02.12 System A Phase rotation CCW		Mask: 2000h	All
			02.15 System B Phase rotation CW		Mask: 4000h	All
			02.14 System B Phase rotation CCW		Mask: 8000h	All
50106	int16		Internal			
50107	int16		Internal			
Subtopic System A						
50108	int16		Internal			
50109	int16		Internal			
Subtopic System B						
50110	int16		Internal			
50111	int16		Internal			
Subtopic Digital Inputs						
50112	uint16	10132	BITLIST: Alarms Digital Inputs 1 latched (unacknowledged)			
			State Digital Input 8 (reply CB A)	Bit	Mask: 8000h	All
			State Digital Input 7	Bit	Mask: 4000h	All
			State Digital Input 6	Bit	Mask: 2000h	All
			State Digital Input 5	Bit	Mask: 1000h	All
			State Digital Input 4	Bit	Mask: 0800h	All

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			State Digital Input 3	Bit	Mask: 0400h	All
			State Digital Input 2	Bit	Mask: 0200h	All
			State Digital Input 1	Bit	Mask: 0100h	All
			Internal	Bit	Mask: 0080h	
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0020h	
			Internal	Bit	Mask: 0010h	
			State Digital Input 12	Bit	Mask: 0008h	All
			State Digital Input 11	Bit	Mask: 0004h	All
			State Digital Input 10	Bit	Mask: 0002h	All
			State Digital Input 9	Bit	Mask: 0001h	All
50113	int16	16377	BITLIST: Alarms External Digital Inputs 1 - 16 latched (unacknowledged)			
			External Digital input 16	Bit	Mask: 8000h	All
			External Digital input 15	Bit	Mask: 4000h	All
			External Digital input 14	Bit	Mask: 2000h	All
			External Digital input 13	Bit	Mask: 1000h	All
			External Digital input 12	Bit	Mask: 0800h	All
			External Digital input 11	Bit	Mask: 0400h	All
			External Digital input 10	Bit	Mask: 0200h	All
			External Digital input 9	Bit	Mask: 0100h	All
			External Digital input 8	Bit	Mask: 0080h	All
			External Digital input 7	Bit	Mask: 0040h	All
			External Digital input 6	Bit	Mask: 0020h	All
			External Digital input 5	Bit	Mask: 0010h	All
			External Digital input 4	Bit	Mask: 0008h	All
			External Digital input 3	Bit	Mask: 0004h	All
			External Digital input 2	Bit	Mask: 0002h	All
			External Digital input 1	Bit	Mask: 0001h	All
50114	int16	10284	BITLIST: Alarms External Digital Inputs 17 - 32 latched (unacknowledged)			
			External Digital input 32	Bit	Mask: 8000h	P2
			External Digital input 31	Bit	Mask: 4000h	P2
			External Digital input 30	Bit	Mask: 2000h	P2
			External Digital input 29	Bit	Mask: 1000h	P2
			External Digital input 28	Bit	Mask: 0800h	P2
			External Digital input 27	Bit	Mask: 0400h	P2
			External Digital input 26	Bit	Mask: 0200h	P2

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			External Digital input 25	Bit	Mask: 0100h	P2
			External Digital input 24	Bit	Mask: 0080h	P2
			External Digital input 23	Bit	Mask: 0040h	P2
			External Digital input 22	Bit	Mask: 0020h	P2
			External Digital input 21	Bit	Mask: 0010h	P2
			External Digital input 20	Bit	Mask: 0008h	P2
			External Digital input 19	Bit	Mask: 0004h	P2
			External Digital input 18	Bit	Mask: 0002h	P2
			External Digital input 17	Bit	Mask: 0001h	P2
Subtopic Flexible Thresholds (prepared)						
50115	int16		Internal			
50116	int16		Internal			
Subtopic DC Analogue Values Wirebreak						
50117	uint16	10137	BITLIST: Alarms Analog Inputs Wire Break latched (unacknowledged)			
			Internal	Bit	Mask: 0001h	
			10.01 Analog inp. 1, wire break	Bit	Mask: 0002h	All
			10.02 Analog inp. 2, wire break	Bit	Mask: 0004h	All
			10.03 Analog inp. 3, wire break	Bit	Mask: 0008h	All
			Internal	Bit	Mask: 0010h	
			Internal	Bit	Mask: 0020h	
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			Internal	Bit	Mask: 0100h	
			Internal	Bit	Mask: 0200h	
			Internal	Bit	Mask: 0400h	
			Internal	Bit	Mask: 0800h	
			Internal	Bit	Mask: 1000h	
			Internal	Bit	Mask: 2000h	
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50118	int16		Internal			
50119	int16		Internal			
Subtopic EG3000 Controlls						
50120	uint16		BITLIST: Status from Device 1			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50121	uint16		BITLIST: Status from Device 2			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50122	uint16		BITLIST: Status from Device 3			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50123	uint16		BITLIST: Status from Device 4			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50124	uint16		BITLIST: Status from Device 5			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50125	uint16		BITLIST: Status from Device 6			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50126	uint16		BITLIST: Status from Device 7			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50127	uint16		BITLIST: Status from Device 8			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50128	uint16		BITLIST: Status from Device 9			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			Internal	Bit	Mask: 8000h	
50129	uint16		BITLIST: Status from Device 10			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50130	uint16		BITLIST: Status from Device 11			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50131	uint16		BITLIST: Status from Device 12			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50132	uint16		BITLIST: Status from Device 13			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50133	uint16		BITLIST: Status from Device 14			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50134	uint16		BITLIST: Status from Device 15			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50135	uint16		BITLIST: Status from Device 16			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50136	uint16		BITLIST: Status from Device 17			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50137	uint16		BITLIST: Status from Device 18			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50138	uint16		BITLIST: Status from Device 19			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50139	uint16		BITLIST: Status from Device 20			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50140	uint16		BITLIST: Status from Device 21			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50141	uint16		BITLIST: Status from Device 22			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
50142	uint16		BITLIST: Status from Device 23			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50143	uint16		BITLIST: Status from Device 24			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50144	uint16		BITLIST: Status from Device 25			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50145	uint16		BITLIST: Status from Device 26			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50146	uint16		BITLIST: Status from Device 27			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50147	uint16		BITLIST: Status from Device 28			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50148	uint16		BITLIST: Status from Device 29			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50149	uint16		BITLIST: Status from Device 30			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50150	uint16		BITLIST: Status from Device 31			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All

Modbus-Address	Size	Index	Description	Unit	Scale	Model
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50151	uint16		BITLIST: Status from Device 32			
			Generator Voltage and Frequency ok	Bit	Mask: 0001h	All
			Busbar Voltage and Frequency ok	Bit	Mask: 0002h	All
			Mains Voltage and Frequency ok	Bit	Mask: 0004h	All
			4th System Voltage and Frequency ok	Bit	Mask: 0008h	All
			Busbar1 Dead Busbar Detection	Bit	Mask: 0010h	All
			Busbar2 Dead Busbar Detection	Bit	Mask: 0020h	All
			Internal	Bit	Mask: 0040h	
			Internal	Bit	Mask: 0080h	
			29.01 command to CB-control 1	Bit	Mask: 0100h	All
			29.02 command to CB-control 2	Bit	Mask: 0200h	All
			29.03 command to CB-control 3	Bit	Mask: 0400h	All
			29.04 command to CB-control 4	Bit	Mask: 0800h	All
			29.05 command to CB-control 5	Bit	Mask: 1000h	All
			29.06 command to CB-control 6	Bit	Mask: 2000h	All
			Internal	Bit	Mask: 4000h	
			Internal	Bit	Mask: 8000h	
50152	int16		Free AnalogManager Value 1			All
50153	int16		Free AnalogManager Value 2			All
50154	int16		Free AnalogManager Value 3			All
50155	int16		Free AnalogManager Value 4			All
50156	int16		Free AnalogManager Value 5			All
50157	int16		Free AnalogManager Value 6			All
50158	int16		Free AnalogManager Value 7			All
50159	int16		Free AnalogManager Value 8			All
50160	int16		Free AnalogManager Value 9			All
50161	int16		Free AnalogManager Value 10			All
50162	int16		Free AnalogManager Value 11			All
50163	int16		Free AnalogManager Value 12			All
50164	int16		Free AnalogManager Value 13			All
50165	int16		Free AnalogManager Value 14			All
50166	int16		Internal			

Modbus-Address	Size	Index	Description	Unit	Scale	Model
50167	int16		Internal			
50168	int16		Internal			
50169	int16		Internal			
50170	int16		Internal			
50171	int16		Internal			
50172	int16		Internal			
50173	int16		Internal			
50174	int16		Internal			
50175	int16		Internal			
50176	int16		Internal			
50177	int16		Internal			
50178	int16		Internal			
50179	int16		Internal			
50180	int16		Internal			
50181	int16		Internal			
50182	int16		Internal			
50183	int16		Internal			
Int32 (Long)						
Topic AC System A						
50184	int32	337	System A total active power AC measurement	W	*1	All
50186	int32	136	System A total reactive power AC measurement	var	*1	All
50188	int32	137	System A total apparent power	VA	*1	All
50190	int32	170	Av. system A Wye-Voltage	V	*10	All
50192	int32	171	Av. system A Delta-Voltage	V	*10	All
50194	int32	185	Av. system A Current	A	*1000	All
50196	int32	111	System A current 1	A	*1000	All
50198	int32	112	System A current 2	A	*1000	All
50200	int32	113	System A current 3	A	*1000	All
50202	int32	108	System A voltage L1-L2	V	*10	All
50204	int32	109	System A voltage L2-L3	V	*10	All
50206	int32	110	System A voltage L3-L1	V	*10	All
50208	int32	114	System A voltage L1-N	V	*10	All
50210	int32	115	System A voltage L2-N	V	*10	All
50212	int32	116	System A voltage L3-N	V	*10	All
50214	int32	125	System A active power 1-N	W	*1	All
50216	int32	126	System A active power 2-N	W	*1	All
50218	int32	127	System A active power 3-N	W	*1	All

Modbus-Address	Size	Index	Description	Unit	Scale	Model
50220	int32	2520	System A positive active energy	MWh	*100	All
50222	int32	135	System A total active power	W	*1	All
50224	int32	182	Auxiliary Voltage L1-L2 (L1-N -> index 231)	V	*10	All
50226	int32	169	System A total reactive power	var	*1	All
50228	int32		Internal			
Topic AC System B						
50230	int32	338	System B total active power AC measurement	W	*1	All
50232	int32	150	System B total reactive power AC measurement	var	*1	All
50234	int32	173	Av. system B Wye-Voltage	V	*10	All
50236	int32	174	Av. system B Delta-Voltage	V	*10	All
50238	int32	207	Av. system B Current	A	*1000	All
50240	int32	134	System B current L1	A	*1000	All
50242	int32	118	System B voltage L1-L2	V	*10	All
50244	int32	119	System B voltage L2-L3	V	*10	All
50246	int32	120	System B voltage L3-L1	V	*10	All
50248	int32	121	System B voltage L1-N	V	*10	All
50250	int32	122	System B voltage L2-N	V	*10	All
50252	int32	123	System B voltage L3-N	V	*10	All
50254	int32	140	System B total active power	W	*1	All
50256	int32	172	System B total reactive power	var	*1	All
Topic AC System values						
50258	int32	2424	System A neg. active energy	MWh	*100	All
50260	int32	2522	System A pos. reactive energy	Mvarh	*100	All
50262	int32	2526	System A neg. reactive energy	Mvarh	*100	All
50264	int32		Internal			
50266	int32		Internal			
50268	int32		Internal			
50270	int32		Free AnalogManager Value 15 (long)			All
50272	int32		Free AnalogManager Value 16 (long)			All

9.3.2 Protocol 5301 (Basic Visualization)

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
0	1-2	uint16		Protocol-ID, always 5301			All
0	3-6	int32	136	System A total reactive power	var	*1	All
1	1-2	int16	160	System A power factor (cos.phi)		*1000	All

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
1	3-6	int32	170	System A average wye voltage	V	*10	All
2	1-2	int16	144	System A frequency	Hz	*100	All
2	3-6	int32	171	System A average delta voltage	V	*10	All
3	1-2	int16	10202	Operation modes			All
				13280 = CB A request			All
				13264 = Unloading CB A			All
				13210 = CB A Dead bus closure			All
				13260 = Synchronization CB A			All
				13205 = Mains settling time running			All
				13257 = Open CB A			All
				13279 = Synchron. Network close CB A			All
				13265 = Synchronization Permissive			All
				13266 = Synchronization Check			All
				13267 = Synchronization OFF			All
				13286 = Synchr. Segments close CB A			All
				13256 = Unloading CB B			All
				13261 = CBB - CBA delay			All
				13262 = CBA - CBB delay			All
				13259 = Synchronization CB B			All
				13255 = Open CB B			All
				13340 = CB B request			All
				13209 = CB B Dead bus closure			All
3	3-6	int32	337	System A total active power AC measurement	W	*1	All
4	1-2	uint16	10107	BITLIST: Digital outputs 1 to 6			
				Relay-Output 1 (inverted)		Mask: 8000h	All
				Relay-Output 2		Mask: 4000h	All
				Relay-Output 3		Mask: 2000h	All
				Relay-Output 4		Mask: 1000h	All
				Relay-Output 5		Mask: 0800h	All
				Relay-Output 6		Mask: 0400h	All
				Relay-Output 7		Mask: 0200h	All
				Relay-Output 8		Mask: 0100h	All
				Relay-Output 9		Mask: 0080h	All
				Relay-Output 10		Mask: 0040h	All
				Relay-Output 11		Mask: 0020h	All
				Relay-Output 12		Mask: 0010h	All
				Internal		Mask: 0008h	

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				Internal		Mask: 0004h	
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
4	3-6	int32	185	System A current average	A	*1000	All
5	1-2	uint16	8018	BITLIST: Command Bits			
				Internal		Mask: 0001h	
				Internal		Mask: 0002h	
				Internal		Mask: 0004h	
				Internal		Mask: 0008h	
				Internal		Mask: 0010h	
				Internal		Mask: 0020h	
				Internal		Mask: 0040h	
				Internal		Mask: 0080h	
				28.01 Command to CB-control 1 (OR'ed)		Mask: 0100h	All
				28.02 Command to CB-control 2 (OR'ed)		Mask: 0200h	All
				28.03 Command to CB-control 3 (OR'ed)		Mask: 0400h	All
				28.04 Command to CB-control 4 (OR'ed)		Mask: 0800h	All
				28.05 Command to CB-control 5 (OR'ed)		Mask: 1000h	All
				28.06 Command to CB-control 6 (OR'ed)		Mask: 2000h	All
				Internal		Mask: 4000h	
				Internal		Mask: 8000h	
5	3-6	int32	111	System A current 1	A	*1000	All
6	1-2	int16	10110	Battery voltage	V	*10	All
6	3-6	int32	112	System A current 2	A	*1000	All
7	1-2	uint16	10146	BITLIST: LogicsManager Bits 1			
				Internal		Mask: 0001h	All
				Internal		Mask: 0002h	All
				Internal		Mask: 0004h	All
				11.07 Active second		Mask: 0008h	All
				11.06 Active minute		Mask: 0010h	All
				11.05 Active hour		Mask: 0020h	All
				11.04 Active day in month		Mask: 0040h	All
				11.03 Active weekday		Mask: 0080h	All
				11.02 Time 2 overrun		Mask: 0100h	All
				11.01 Time 1 overrun		Mask: 0200h	All
				Internal		Mask: 0400h	
				04.05 Acknowledge was executed		Mask: 0800h	All

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				01.09 Shutdown alarm active (alarm C-F)		Mask: 1000h	All
				Internal		Mask: 2000h	
				Internal		Mask: 4000h	
				Internal		Mask: 8000h	
7	3-6	int32	113	System A current 3	A	*1000	All
8	1-2	uint16	10147	BITLIST: LogicsManager Bits 2			
				99.01 LM Relay 1		Mask: 8000h	All
				99.02 LM Relay 2		Mask: 4000h	All
				99.03 LM Relay 3		Mask: 2000h	All
				99.04 LM Relay 4		Mask: 1000h	All
				99.05 LM Relay 5		Mask: 0800h	All
				Internal		Mask: 0400h	
				99.07 LM Relay 7		Mask: 0200h	All
				99.08 LM Relay 8		Mask: 0100h	All
				99.09 LM Relay 9		Mask: 0080h	All
				99.10 LM Relay 10		Mask: 0040h	All
				99.11 LM Relay 11		Mask: 0020h	All
				99.12 LM Relay 12		Mask: 0010h	All
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
8	3-6	int32	108	System A voltage 1-2	V	*10	All
9	1-2	uint16	10140	BITLIST: LogicsManager Bits 3			
				96.01 LM Internal flag 1		Mask: 8000h	All
				96.02 LM Internal flag 2		Mask: 4000h	All
				96.03 LM Internal flag 3		Mask: 2000h	All
				96.04 LM Internal flag 4		Mask: 1000h	All
				96.05 LM Internal flag 5		Mask: 0800h	All
				96.06 LM Internal flag 6		Mask: 0400h	All
				96.07 LM Internal flag 7		Mask: 0200h	All
				96.08 LM Internal flag 8		Mask: 0100h	All
				Internal		Mask: 0080h	
				Internal		Mask: 0040h	
				Internal		Mask: 0020h	
				86.15 LM External acknowledge		Mask: 0010h	All
				internal		Mask: 0008h	

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				86.16 LM Operation mode AUTOMATIC		Mask: 0004h	All
				86.17 LM Operation mode MANUAL		Mask: 0002h	All
				Internal		Mask: 0001h	
9	3-6	int32	114	System A voltage 1-N	V	*10	All
10	1-2	uint16	10148	BITLIST: LogicsManager Bits 4			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				04.04 Lamp test		Mask: 0800h	All
				01.10 Centralized alarms active (alarm B-F)		Mask: 0400h	All
				01.07 All alarm classes are active		Mask: 0200h	All
				01.08 Warning alarms active (alarm A, B)		Mask: 0100h	All
				Internal		Mask: 0080h	
				Internal		Mask: 0040h	
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
10	3-6	int32	109	System A voltage 2-3	V	*10	All
11	1-2	uint16	10150	BITLIST: LogicsManager Bits 5			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				Internal		Mask: 0800h	
				Internal		Mask: 0400h	
				96.09 LM Internal flag 9		Mask: 0200h	All
				96.10 LM Internal flag 10		Mask: 0100h	All
				96.11 LM Internal flag 11		Mask: 0080h	All
				96.12 LM Internal flag 12		Mask: 0040h	All
				96.13 LM Internal flag 13		Mask: 0020h	All
				96.14 LM Internal flag 14		Mask: 0010h	All
				96.15 LM Internal flag 15		Mask: 0008h	All
				96.16 LM Internal flag 16		Mask: 0004h	All

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
11	3-6	int32	115	System A voltage 2-N	V	*10	All
12	1-2	uint16	10160	BITLIST: LogicsManager Bits 6			
				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	
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	
				01.11 New Alarm triggered		Mask: 0002h	All
				01.12 Horn		Mask: 0001h	
12	3-6	int32	110	System A voltage 3-1	V	*10	All
13	1-2	uint16	10162	BITLIST: LogicsManager Bits 7			
				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	
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				Internal		Mask: 0008h	
				86.38 LM Synchronization mode CHECK		Mask: 0004h	All
				86.39 LM Synchronization mode PERMISSIVE		Mask: 0002h	All

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				86.40 LM Synchronization mode RUN		Mask: 0001h	All
13	3-6	int32	116	System A voltage 3-N	V	*10	All
14	1-2	uint16	10131	BITLIST: Alarm classes latched			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				Internal		Mask: 0800h	
				Internal		Mask: 0400h	
				01.10 Centralized alarms are active (alarm class B, C, D, E, F)		Mask: 0200h	
				01.09 Shutdown alarm are active (alarm class C, D, E, F)		Mask: 0100h	
				01.08 Warning alarms are active (alarm class A, B)		Mask: 0080h	
				01.07 All alarm classes are active		Mask: 0040h	
				Alarm class F latched		Mask: 0020h	All
				Alarm class E latched		Mask: 0010h	All
				Alarm class D latched		Mask: 0008h	All
				Alarm class C latched		Mask: 0004h	All
				Alarm class B latched		Mask: 0002h	All
				Alarm class A latched		Mask: 0001h	All
14	3-6	int32	2520	System A positive active energy	MWh	*100	All
15	1-2	uint16	10132	BITLIST: Alarm digital inputs			
				State Digital Input 8 latched		Mask: 8000h	All
				State Digital Input 7 latched		Mask: 4000h	All
				State Digital Input 6 latched		Mask: 2000h	All
				State Digital Input 5 latched		Mask: 1000h	All
				State Digital Input 4 latched		Mask: 0800h	All
				State Digital Input 3 latched		Mask: 0400h	All
				State Digital Input 2 latched		Mask: 0200h	All
				State Digital Input 1 latched		Mask: 0100h	All
				Internal		Mask: 0080h	
				Internal		Mask: 0040h	
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				State Digital Input 12 latched		Mask: 0008h	
				State Digital Input 11 latched		Mask: 0004h	
				State Digital Input 10 latched		Mask: 0002h	

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				State Digital Input 9 latched		Mask: 0001h	
15	3-6	int32	173	System B average wye voltage	V	*10	All
16	1-2	int16	147	System B frequency	Hz	*100	All
16	3-6	int32	174	System B average delta voltage	V	*10	All
17	1-2	int16	10111	AI 1 Input			All
17	3-6	int32	207	System B current average	A	*1000	All
18	1-2	int16	208	System B power factor (cos.phi)		*1000	All
18	3-6	int32	338	System B total active power AC measurement	W	*1	All
19	1-2	uint16	10137	BITLIST: Alarm analog inputs			
				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	
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				10.03 Analog inp. 3, wire brake		Mask: 0008h	
				10.02 Analog inp. 2, wire brake		Mask: 0004h	
				10.01 Analog inp. 1, wire brake		Mask: 0002h	All
				Internal		Mask: 0001h	
19	3-6	int32	150	System B total reactive power	var	*1	All
20	1-2	uint16	534	BITLIST: Remote Control Bits			
				04.59 [extended group] Interface control 16		Mask: 8000h	All
				04.58 [extended group] Interface control 15		Mask: 4000h	All
				04.57 [extended group] Interface control 14		Mask: 2000h	All
				04.56 [extended group] Interface control 13		Mask: 1000h	All
				04.55 [extended group] Interface control 12		Mask: 0800h	All
				04.54 [extended group] Interface control 11		Mask: 0400h	All
				04.53 [extended group] Interface control 10		Mask: 0200h	All
				04.52 [extended group] Interface control 9		Mask: 0100h	All
				04.51 [extended group] Interface control 8		Mask: 0080h	All
				04.50 [extended group] Interface control 7		Mask: 0040h	All

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				04.49 [extended group] Interface control 6		Mask: 0020h	All
				04.48 [extended group] Interface control 5		Mask: 0010h	All
				04.47 [extended group] Interface control 4		Mask: 0008h	All
				04.46 [extended group] Interface control 3		Mask: 0004h	All
				04.45 [extended group] Interface control 2		Mask: 0002h	All
				04.44 [extended group] Interface control 1		Mask: 0001h	All
20	3-6	int32	134	System B current 1	A	*1000	All
21	1-2	uint16	10136	BITLIST: AlarmBits Battery			
				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	
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				08.02 Battery over voltage threshold 2		Mask: 0008h	All
				08.04 Battery under voltage threshold 2		Mask: 0004h	All
				08.01 Battery over voltage threshold 1		Mask: 0002h	All
				08.03 Battery under voltage threshold 1		Mask: 0001h	All
21	3-6	int32	118	System B voltage 1-2	V	*10	All
22	1-2	uint16	4139	BITLIST: Monitoring operation window			
				02.03 System B voltage in range (based on System B Operating voltage window)		Mask: 8000h	All
				02.04 System B frequency in range (based on System B Operating frequency window)		Mask: 4000h	All
				02.05 System B voltage and frequency in range (ready for operation, 02.03 AND 02.04 are TRUE)		Mask: 2000h	All
				02.09 Sytem A voltage in range (based on System A voltage window)		Mask: 1000h	All
				Internal		Mask: 0800h	
				Internal		Mask: 0400h	
				02.10 System A frequency in range (based on System A frequency window)		Mask: 0200h	All
				Internal		Mask: 0100h	

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				Internal		Mask: 0080h	
				02.11 System A voltage and frequency in range (ready for operation, 02.09 AND 02.10 are TRUE)		Mask: 0040h	All
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				02.21 Aux.Voltage is dead (based on Dead bus detection limit ID5820)		Mask: 0008h	All
				02.08 Aux.Voltage v and f in range (ready for operation, 02.06 AND 02.07 are TRUE)		Mask: 0004h	All
				02.07 Aux.Voltage frequency in range (based on System B frequency window)		Mask: 0002h	All
				02.06 Aux.Voltage voltage in range (based on System B voltage window)		Mask: 0001h	All
22	3-6	int32	121	System B voltage 1-N	V	*10	All
23	1-2	uint16		BITLIST: Monitoring System A Bits3			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				Internal		Mask: 0800h	
				Internal		Mask: 0400h	
				Internal		Mask: 0200h	
				Internal		Mask: 0100h	
				02.12 System A phase rotation: Counter Clock Wise (CCW, reverse, left turn)		Mask: 0080h	All
				02.13 System A phase rotation: Clock Wise (CW, forward, right turn)		Mask: 0040h	All
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
23	3-6	int32	119	System B voltage 2-3	V	*10	All
24	1-2	uint16		BITLIST: Monitoring System B Bits2			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				Internal		Mask: 0800h	

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				Internal		Mask: 0400h	
				Internal		Mask: 0200h	
				Internal		Mask: 0100h	
				02.14 System B phase rotation: Counter Clock Wise (CCW, reverse, left turn)		Mask: 0080h	All
				02.15 System B phase rotation: Clock Wise (CW, forward, right turn)		Mask: 0040h	All
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
24	3-6	int32	122	System B voltage 2-N	V	*10	All
25	1-2	uint16	4150	BITLIST: Control Bits 4			
				Internal		Mask: 8000h	
				04.63 Synchr. Segment closure active		Mask: 4000h	All
				Internal		Mask: 2000h	
				02.28 Synch. Check Relay		Mask: 1000h	All
				02.29 Synch. Condition		Mask: 0800h	All
				02.30 Dead bus closure condition		Mask: 0400h	All
				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	
				Internal		Mask: 0001h	
25	3-6	int32	120	System B voltage 3-1	V	*10	All
26	1-2	uint16	10149	BITLIST: Alarm Bits 2			
				08.30 Timeout Synchronisation CB B		Mask: 8000h	All
				08.31 Timeout Synchronisation CB A		Mask: 4000h	All
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				08.33 System A / System B phase rotation different		Mask: 0800h	All

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				Internal		Mask: 0400h	All
				Internal		Mask: 0200h	
				Internal		Mask: 0100h	
				Internal		Mask: 0080h	
				Internal		Mask: 0040h	
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				08.17 Number of member mismatch		Mask: 0008h	All
				Internal		Mask: 0004h	All
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
26	3-6	int32	123	System B voltage 3-N	V	*10	All
27	1-2	uint16	4153	BITLIST: Control Bits 1			
				04.42 Breaker transition mode altern. 2		Mask: 8000h	All
				04.41 Breaker transition mode altern. 1		Mask: 4000h	All
				04.29 Unloading CB A is active		Mask: 2000h	All
				04.28 Unloading CB B is active		Mask: 1000h	All
				04.23 Close command CB A is active		Mask: 0800h	All
				04.22 Open command CB A is active		Mask: 0400h	All
				04.21 Synchronisation CB A procedure is active		Mask: 0200h	All
				04.20 Close command CB B is active		Mask: 0100h	All
				04.19 Open command CB B is active		Mask: 0080h	All
				04.18 Synchronisation CB B procedure is active		Mask: 0040h	All
				04.11 Mains settling is active		Mask: 0020h	All
				24.39 Isolation Switch is open or 04.06 CB B is closed		Mask: 0010h	All
				04.07 CB A is closed		Mask: 0008h	All
				04.04 Lamp test request		Mask: 0004h	All
				04.03 Operating Mode Manual		Mask: 0002h	All
				04.01 Operating Mode Automatic		Mask: 0001h	All
27	3-4	uint16	4154	BITLIST: Control Bits 2			All
				02.23 System A is dead		Mask: 8000h	All
				02.24 System B is dead		Mask: 4000h	All
				02.25 Mains parallel operation		Mask: 2000h	All
				System B Mains connected		Mask: 1000h	All
				System A Mains connected		Mask: 0800h	All

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				Mains at "right" position (directly or isolation switch) for Tookit grid indication		Mask: 0400h	All
				Mains at "left" position (directly or isolation switch) for Tookit grid indication		Mask: 0200h	All
				28.06 Command 6 to LSx (OR'ed)		Mask: 0100h	All
				28.05 Command 5 to LSx (OR'ed)		Mask: 0080h	All
				28.04 Command 4 to LSx (OR'ed)		Mask: 0040h	All
				28.03 Command 3 to LSx (OR'ed)		Mask: 0020h	All
				28.02 Command 2 to LSx (OR'ed)		Mask: 0010h	All
				28.01 Command 1 to LSx (OR'ed)		Mask: 0008h	All
				04.61 Synchronous Mains Closure Procedure is active		Mask: 0004h	All
				04.62 Dead Bus Closure Procedure is active		Mask: 0002h	All
				Increment Close Counter CBA		Mask: 0001h	All
27	5-6	uint16	4155	BITLIST: Control Bits 3			
				Syst. B Phase rotation CCW (for Toolkit)		Mask: 8000h	All
				Syst. B Phase rotation CW (for Toolkit)		Mask: 4000h	All
				Syst. A Phase rotation CCW (for Toolkit)		Mask: 2000h	All
				Syst. A Phase rotation CW (for Toolkit)		Mask: 1000h	All
				Internal		Mask: 0800h	
				Internal		Mask: 0400h	
				Internal		Mask: 0200h	
				Internal		Mask: 0100h	
				Internal		Mask: 0080h	
				Internal		Mask: 0040h	
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				Syst. A Phase rotation CW (for Toolkit)		Mask: 0008h	All
				Syst. A Phase rotation CCW (for Toolkit)		Mask: 0004h	All
				Syst. B Phase rotation CW (for Toolkit)		Mask: 0002h	All
				Syst. B Phase rotation CCW (for Toolkit)		Mask: 0001h	All
28	1-2	uint16	10133	BITLIST: Alarm Bits 1			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				Internal		Mask: 0800h	
				Internal		Mask: 0400h	
				Internal		Mask: 0200h	

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				08.05 CB B close not successful		Mask: 0100h	All
				08.06 CB B open not successful		Mask: 0080h	All
				08.07 CB A close not successful		Mask: 0040h	All
				08.08 CB A open not successful		Mask: 0020h	All
				Internal		Mask: 0010h	
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	
				Internal		Mask: 0002h	
				08.18 CANopen error interface 1		Mask: 0001h	All
28	3-4	uint16	10191	BITLIST: LogicsManager Bits 11			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				24.45 Flag 5 LSx		Mask: 1000h	All
				24.44 Flag 4 LSx		Mask: 0800h	All
				24.43 Flag 3 LSx		Mask: 0400h	All
				24.42 Flag 2 LSx		Mask: 0200h	All
				24.41 Flag 1 LSx		Mask: 0100h	All
				24.38 LM variable system is A		Mask: 0080h	All
				24.37 Enable to close CB B		Mask: 0040h	All
				24.36 Immediate open CB B		Mask: 0020h	All
				24.35 Open CB B		Mask: 0010h	All
				24.34 Enable to close CBA		Mask: 0008h	All
				24.33 Immediate open CB A		Mask: 0004h	All
				24.32 Open CBA		Mask: 0002h	All
				24.31 Enable mains decoupling		Mask: 0001h	All
28	5-6	uint16	10138	BITLIST: Monitoring System B Bits1			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				Internal		Mask: 0800h	
				06.21 System B Phase Rotation mismatch		Mask: 0400h	All
				Internal		Mask: 0200h	
				08.46 CB B unload mismatch		Mask: 0100h	All
				Internal		Mask: 0080h	
				Internal		Mask: 0040h	

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
29	1-2	uint16	10135	BITLIST: Monitoring System A Bits1			
				07.06 System A over frequency threshold 1		Mask: 8000h	All
				07.07 System A over frequency threshold 2		Mask: 4000h	All
				07.08 System A under frequency threshold 1		Mask: 2000h	All
				07.09 System A under frequency threshold 2		Mask: 1000h	All
				07.10 System A over voltage threshold 1		Mask: 0800h	All
				07.11 System A over voltage threshold 2		Mask: 0400h	All
				07.12 System A under voltage threshold 1		Mask: 0200h	All
				07.13 System A under voltage threshold 2		Mask: 0100h	All
				07.14 System A Phase shift		Mask: 0080h	All
				07.25 System A decoupling		Mask: 0040h	All
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				07.26 System A voltage asymmetry (with negative sequence)		Mask: 0008h	All
				07.05 System A phase rotation mismatch		Mask: 0004h	All
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
29	3-4	uint16	4138	BITLIST: Monitoring System A Bits2			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				Internal		Mask: 0800h	
				Internal		Mask: 0400h	
				Internal		Mask: 0200h	
				Internal		Mask: 0100h	
				07.15 System A df/dt		Mask: 0080h	All
				Internal		Mask: 0040h	
				07.28 System A time-dependet voltage		Mask: 0020h	All
				Internal		Mask: 0010h	
				07.27 System A voltage increase		Mask: 0008h	All

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				08.36 CB A unload mismatch		Mask: 0004h	All
				07.29 QV Monitoring step 1 tripped		Mask: 0002h	All
				07.30 QV Monitoring step 2 tripped		Mask: 0001h	All
29	5-6	uint16		BITLIST: Digital information			
				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	
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	

9.3.3 Protocol 5302 (Basic Visualization)

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
0	1-2	uint16		Protocol-ID, always 5302			All
0	3-6	int32	136	System A total reactive power	var	*1	All
1	1-2	int16	160	System A power factor (cos.phi)		*1000	All
1	3-6	int32	170	System A average wye voltage	V	*10	All
2	1-2	int16	144	System A frequency	Hz	*100	All
2	3-6	int32	171	System A average delta voltage	V	*10	All
3	1-2	int16	10202	Operation modes			All
				13280 = CB A request			All
				13264 = Unloading CB A			All
				13210 = CB A Dead bus closure			All
				13260 = Synchronization CB A			All
				13205 = Mains settling time running			All
				13257 = Open CB A			All

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				13279 = Synchron. Network close CB A			All
				13265 = Synchronization Permissive			All
				13266 = Synchronization Check			All
				13267 = Synchronization OFF			All
				13286 = Synchr. Segments close CB A			All
				13256 = Unloading CB B			All
				13261 = CBB - CBA delay			All
				13262 = CBA - CBB delay			All
				13259 = Synchronization CB B			All
				13255 = Open CB B			All
				13340 = CB B request			All
				13209 = CB B Dead bus closure			All
3	3-6	int32	337	System A total active power AC measurement	W	*1	All
4	1-2	uint16	10107	BITLIST: Digital outputs 1 to 6			
				Relay-Output 1 (inverted)		Mask: 8000h	All
				Relay-Output 2		Mask: 4000h	All
				Relay-Output 3		Mask: 2000h	All
				Relay-Output 4		Mask: 1000h	All
				Relay-Output 5		Mask: 0800h	All
				Relay-Output 6		Mask: 0400h	All
				Relay-Output 7		Mask: 0200h	All
				Relay-Output 8		Mask: 0100h	All
				Relay-Output 9		Mask: 0080h	All
				Relay-Output 10		Mask: 0040h	All
				Relay-Output 11		Mask: 0020h	All
				Relay-Output 12		Mask: 0010h	All
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
4	3-6	int32	185	System A current average	A	*1000	All
5	1-2	uint16	8018	BITLIST: Command Bits			
				Internal		Mask: 0001h	
				Internal		Mask: 0002h	
				Internal		Mask: 0004h	
				Internal		Mask: 0008h	
				Internal		Mask: 0010h	

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				Internal		Mask: 0020h	
				Internal		Mask: 0040h	
				Internal		Mask: 0080h	
				28.01 Command to CB-control 1 (OR'ed)		Mask: 0100h	All
				28.02 Command to CB-control 2 (OR'ed)		Mask: 0200h	All
				28.03 Command to CB-control 3 (OR'ed)		Mask: 0400h	All
				28.04 Command to CB-control 4 (OR'ed)		Mask: 0800h	All
				28.05 Command to CB-control 5 (OR'ed)		Mask: 1000h	All
				28.06 Command to CB-control 6 (OR'ed)		Mask: 2000h	All
				Internal		Mask: 4000h	
				Internal		Mask: 8000h	
5	3-6	int32	111	System A current 1	A	*1000	All
6	1-2	int16	10110	Battery voltage	V	*10	All
6	3-6	int32	112	System A current 2	A	*1000	All
7	1-2	uint16	10146	BITLIST: LogicsManager Bits 1			
				Internal		Mask: 0001h	All
				Internal		Mask: 0002h	All
				Internal		Mask: 0004h	All
				11.07 Active second		Mask: 0008h	All
				11.06 Active minute		Mask: 0010h	All
				11.05 Active hour		Mask: 0020h	All
				11.04 Active day in month		Mask: 0040h	All
				11.03 Active weekday		Mask: 0080h	All
				11.02 Time 2 overrun		Mask: 0100h	All
				11.01 Time 1 overrun		Mask: 0200h	All
				Internal		Mask: 0400h	
				04.05 Acknowledge was executed		Mask: 0800h	All
				01.09 Shutdown alarm active (alarm C-F)		Mask: 1000h	All
				Internal		Mask: 2000h	
				Internal		Mask: 4000h	
				Internal		Mask: 8000h	
7	3-6	int32	113	System A current 3	A	*1000	All
8	1-2	uint16	10147	BITLIST: LogicsManager Bits 2			
				99.01 LM Relay 1		Mask: 8000h	All
				99.02 LM Relay 2		Mask: 4000h	All
				99.03 LM Relay 3		Mask: 2000h	All
				99.04 LM Relay 4		Mask: 1000h	All

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				99.05 LM Relay 5		Mask: 0800h	All
				Internal		Mask: 0400h	
				99.07 LM Relay 7		Mask: 0200h	All
				99.08 LM Relay 8		Mask: 0100h	All
				99.09 LM Relay 9		Mask: 0080h	All
				99.10 LM Relay 10		Mask: 0040h	All
				99.11 LM Relay 11		Mask: 0020h	All
				99.12 LM Relay 12		Mask: 0010h	All
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
8	3-6	int32	108	System A voltage 1-2	V	*10	All
9	1-2	uint16	10140	BITLIST: LogicsManager Bits 3			
				96.01 LM Internal flag 1		Mask: 8000h	All
				96.02 LM Internal flag 2		Mask: 4000h	All
				96.03 LM Internal flag 3		Mask: 2000h	All
				96.04 LM Internal flag 4		Mask: 1000h	All
				96.05 LM Internal flag 5		Mask: 0800h	All
				96.06 LM Internal flag 6		Mask: 0400h	All
				96.07 LM Internal flag 7		Mask: 0200h	All
				96.08 LM Internal flag 8		Mask: 0100h	All
				Internal		Mask: 0080h	
				Internal		Mask: 0040h	
				Internal		Mask: 0020h	
				86.15 LM External acknowledge		Mask: 0010h	All
				internal		Mask: 0008h	
				86.16 LM Operation mode AUTOMATIC		Mask: 0004h	All
				86.17 LM Operation mode MANUAL		Mask: 0002h	All
				Internal		Mask: 0001h	
9	3-6	int32	114	System A voltage 1-N	V	*10	All
10	1-2	uint16	10148	BITLIST: LogicsManager Bits 4			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				04.04 Lamp test		Mask: 0800h	All

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				01.10 Centralized alarms active (alarm B-F)		Mask: 0400h	All
				01.07 All alarm classes are active		Mask: 0200h	All
				01.08 Warning alarms active (alarm A, B)		Mask: 0100h	All
				Internal		Mask: 0080h	
				Internal		Mask: 0040h	
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
10	3-6	int32	109	System A voltage 2-3	V	*10	All
11	1-2	uint16	10150	BITLIST: LogicsManager Bits 5			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				Internal		Mask: 0800h	
				Internal		Mask: 0400h	
				96.09 LM Internal flag 9		Mask: 0200h	All
				96.10 LM Internal flag 10		Mask: 0100h	All
				96.11 LM Internal flag 11		Mask: 0080h	All
				96.12 LM Internal flag 12		Mask: 0040h	All
				96.13 LM Internal flag 13		Mask: 0020h	All
				96.14 LM Internal flag 14		Mask: 0010h	All
				96.15 LM Internal flag 15		Mask: 0008h	All
				96.16 LM Internal flag 16		Mask: 0004h	All
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
11	3-6	int32	115	System A voltage 2-N	V	*10	All
12	1-2	uint16	10160	BITLIST: LogicsManager Bits 6			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				Internal		Mask: 0800h	
				Internal		Mask: 0400h	

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				Internal		Mask: 0200h	
				Internal		Mask: 0100h	
				Internal		Mask: 0080h	
				Internal		Mask: 0040h	
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	
				01.11 New Alarm triggered		Mask: 0002h	All
				01.12 Horn		Mask: 0001h	
12	3-6	int32	110	System A voltage 3-1	V	*10	All
13	1-2	uint16	10162	BITLIST: LogicsManager Bits 7			
				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	
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				Internal		Mask: 0008h	
				86.38 LM Synchronization mode CHECK		Mask: 0004h	All
				86.39 LM Synchronization mode PERMISSIVE		Mask: 0002h	All
				86.40 LM Synchronization mode RUN		Mask: 0001h	All
13	3-6	int32	116	System A voltage 3-N	V	*10	All
14	1-2	uint16	10131	BITLIST: Alarm classes latched			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				Internal		Mask: 0800h	
				Internal		Mask: 0400h	
				01.10 Centralized alarms are active (alarm class B, C, D, E, F)		Mask: 0200h	

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				01.09 Shutdown alarm are active (alarm class C, D, E, F)		Mask: 0100h	
				01.08 Warning alarms are active (alarm class A, B)		Mask: 0080h	
				01.07 All alarm classes are active		Mask: 0040h	
				Alarm class F latched		Mask: 0020h	All
				Alarm class E latched		Mask: 0010h	All
				Alarm class D latched		Mask: 0008h	All
				Alarm class C latched		Mask: 0004h	All
				Alarm class B latched		Mask: 0002h	All
				Alarm class A latched		Mask: 0001h	All
14	3-6	int32	2520	System A positive active energy	MWh	*100	All
15	1-2	uint16	10132	BITLIST: Alarm digital inputs			
				State Digital Input 8 latched		Mask: 8000h	All
				State Digital Input 7 latched		Mask: 4000h	All
				State Digital Input 6 latched		Mask: 2000h	All
				State Digital Input 5 latched		Mask: 1000h	All
				State Digital Input 4 latched		Mask: 0800h	All
				State Digital Input 3 latched		Mask: 0400h	All
				State Digital Input 2 latched		Mask: 0200h	All
				State Digital Input 1 latched		Mask: 0100h	All
				Internal		Mask: 0080h	
				Internal		Mask: 0040h	
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				State Digital Input 12 latched		Mask: 0008h	
				State Digital Input 11 latched		Mask: 0004h	
				State Digital Input 10 latched		Mask: 0002h	
				State Digital Input 9 latched		Mask: 0001h	
15	3-6	int32	173	System B average wye voltage	V	*10	All
16	1-2	int16	147	System B frequency	Hz	*100	All
16	3-6	int32	174	System B average delta voltage	V	*10	All
17	1-2	int16	10111	AI 1 Input			All
17	3-6	int32	207	System B current average	A	*1000	All
18	1-2	int16	208	System B power factor (cos.phi)		*1000	All
18	3-6	int32	338	System B total active power AC measurement	W	*1	All
19	1-2	uint16	10137	BITLIST: Alarm analog inputs			
				Internal		Mask: 8000h	

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				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	
				10.03 Analog inp. 3, wire brake		Mask: 0008h	
				10.02 Analog inp. 2, wire brake		Mask: 0004h	
				10.01 Analog inp. 1, wire brake		Mask: 0002h	All
				Internal		Mask: 0001h	
19	3-6	int32	150	System B total reactive power	var	*1	All
20	1-2	uint16	534	BITLIST: Remote Control Bits			
				04.59 [extended group] Interface control 16		Mask: 8000h	All
				04.58 [extended group] Interface control 15		Mask: 4000h	All
				04.57 [extended group] Interface control 14		Mask: 2000h	All
				04.56 [extended group] Interface control 13		Mask: 1000h	All
				04.55 [extended group] Interface control 12		Mask: 0800h	All
				04.54 [extended group] Interface control 11		Mask: 0400h	All
				04.53 [extended group] Interface control 10		Mask: 0200h	All
				04.52 [extended group] Interface control 9		Mask: 0100h	All
				04.51 [extended group] Interface control 8		Mask: 0080h	All
				04.50 [extended group] Interface control 7		Mask: 0040h	All
				04.49 [extended group] Interface control 6		Mask: 0020h	All
				04.48 [extended group] Interface control 5		Mask: 0010h	All
				04.47 [extended group] Interface control 4		Mask: 0008h	All
				04.46 [extended group] Interface control 3		Mask: 0004h	All
				04.45 [extended group] Interface control 2		Mask: 0002h	All
				04.44 [extended group] Interface control 1		Mask: 0001h	All
20	3-6	int32	134	System B current 1	A	*1000	All
21	1-2	uint16	10136	BITLIST: AlarmBits Battery			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				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	
				08.02 Battery over voltage threshold 2		Mask: 0008h	All
				08.04 Battery under voltage threshold 2		Mask: 0004h	All
				08.01 Battery over voltage threshold 1		Mask: 0002h	All
				08.03 Battery under voltage threshold 1		Mask: 0001h	All
21	3-6	int32	118	System B voltage 1-2	V	*10	All
22	1-2	uint16	4139	BITLIST: Monitoring operation window			
				02.03 System B voltage in range (based on System B Operating voltage window)		Mask: 8000h	All
				02.04 System B frequency in range (based on System B Operating frequency window)		Mask: 4000h	All
				02.05 System B voltage and frequency in range (ready for operation, 02.03 AND 02.04 are TRUE)		Mask: 2000h	All
				02.09 Sytem A voltage in range (based on System A voltage window)		Mask: 1000h	All
				Internal		Mask: 0800h	
				Internal		Mask: 0400h	
				02.10 System A frequency in range (based on System A frequency window)		Mask: 0200h	All
				Internal		Mask: 0100h	
				Internal		Mask: 0080h	
				02.11 System A voltage and frequency in range (ready for operation, 02.09 AND 02.10 are TRUE)		Mask: 0040h	All
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				02.21 Aux.Voltage is dead (based on Dead bus detection limit ID5820)		Mask: 0008h	All
				02.08 Aux.Voltage v and f in range (ready for operation, 02.06 AND 02.07 are TRUE)		Mask: 0004h	All
				02.07 Aux.Voltage frequency in range (based on System B frequency window)		Mask: 0002h	All

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				02.06 Aux.Voltage voltage in range (based on System B voltage window)		Mask: 0001h	All
22	3-6	int32	121	System B voltage 1-N	V	*10	All
23	1-2	uint16		BITLIST: Monitoring System A Bits3			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				Internal		Mask: 0800h	
				Internal		Mask: 0400h	
				Internal		Mask: 0200h	
				Internal		Mask: 0100h	
				02.12 System A phase rotation: Counter Clock Wise (CCW, reverse, left turn)		Mask: 0080h	All
				02.13 System A phase rotation: Clock Wise (CW, forward, right turn)		Mask: 0040h	All
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
23	3-6	int32	119	System B voltage 2-3	V	*10	All
24	1-2	uint16		BITLIST: Monitoring System B Bits2			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				Internal		Mask: 0800h	
				Internal		Mask: 0400h	
				Internal		Mask: 0200h	
				Internal		Mask: 0100h	
				02.14 System B phase rotation: Counter Clock Wise (CCW, reverse, left turn)		Mask: 0080h	All
				02.15 System B phase rotation: Clock Wise (CW, forward, right turn)		Mask: 0040h	All
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
24	3-6	int32	122	System B voltage 2-N	V	*10	All
25	1-2	uint16	4150	BITLIST: Control Bits 4			
				Internal		Mask: 8000h	
				04.63 Synchr. Segment closure active		Mask: 4000h	All
				Internal		Mask: 2000h	
				02.28 Synch. Check Relay		Mask: 1000h	All
				02.29 Synch. Condition		Mask: 0800h	All
				02.30 Dead bus closure condition		Mask: 0400h	All
				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	
				Internal		Mask: 0001h	
25	3-6	int32	120	System B voltage 3-1	V	*10	All
26	1-2	uint16	10149	BITLIST: Alarm Bits 2			
				08.30 Timeout Synchronisation CB B		Mask: 8000h	All
				08.31 Timeout Synchronisation CB A		Mask: 4000h	All
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				08.33 System A / System B phase rotation different		Mask: 0800h	All
				Internal		Mask: 0400h	All
				Internal		Mask: 0200h	
				Internal		Mask: 0100h	
				Internal		Mask: 0080h	
				Internal		Mask: 0040h	
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				08.17 Number of member mismatch		Mask: 0008h	All
				Internal		Mask: 0004h	All
				Internal		Mask: 0002h	

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				Internal		Mask: 0001h	
26	3-6	int32	123	System B voltage 3-N	V	*10	All
27	1-2	uint16	4153	BITLIST: Control Bits 1			
				04.42 Breaker transition mode altern. 2		Mask: 8000h	All
				04.41 Breaker transition mode altern. 1		Mask: 4000h	All
				04.29 Unloading CB A is active		Mask: 2000h	All
				04.28 Unloading CB B is active		Mask: 1000h	All
				04.23 Close command CB A is active		Mask: 0800h	All
				04.22 Open command CB A is active		Mask: 0400h	All
				04.21 Synchronisation CB A procedure is active		Mask: 0200h	All
				04.20 Close command CB B is active		Mask: 0100h	All
				04.19 Open command CB B is active		Mask: 0080h	All
				04.18 Synchronisation CB B procedure is active		Mask: 0040h	All
				04.11 Mains settling is active		Mask: 0020h	All
				24.39 Isolation Switch is open or 04.06 CB B is closed		Mask: 0010h	All
				04.07 CB A is closed		Mask: 0008h	All
				04.04 Lamp test request		Mask: 0004h	All
				04.03 Operating Mode Manual		Mask: 0002h	All
				04.01 Operating Mode Automatic		Mask: 0001h	All
27	3-4	uint16	4154	BITLIST: Control Bits 2			All
				02.23 System A is dead		Mask: 8000h	All
				02.24 System B is dead		Mask: 4000h	All
				02.25 Mains parallel operation		Mask: 2000h	All
				System B Mains connected		Mask: 1000h	All
				System A Mains connected		Mask: 0800h	All
				Mains at "right" position (directly or isolation switch) for Tookit grid indication		Mask: 0400h	All
				Mains at "left" position (directly or isolation switch) for Tookit grid indication		Mask: 0200h	All
				28.06 Command 6 to LSx (OR'ed)		Mask: 0100h	All
				28.05 Command 5 to LSx (OR'ed)		Mask: 0080h	All
				28.04 Command 4 to LSx (OR'ed)		Mask: 0040h	All
				28.03 Command 3 to LSx (OR'ed)		Mask: 0020h	All
				28.02 Command 2 to LSx (OR'ed)		Mask: 0010h	All
				28.01 Command 1 to LSx (OR'ed)		Mask: 0008h	All
				04.61 Synchronous Mains Closure Procedure is active		Mask: 0004h	All

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				04.62 Dead Bus Closure Procedure is active		Mask: 0002h	All
				Increment Close Counter CBA		Mask: 0001h	All
27	5-6	uint16	4155	BITLIST: Control Bits 3			
				Syst. B Phase rotation CCW (for Toolkit)		Mask: 8000h	All
				Syst. B Phase rotation CW (for Toolkit)		Mask: 4000h	All
				Syst. A Phase rotation CCW (for Toolkit)		Mask: 2000h	All
				Syst. A Phase rotation CW (for Toolkit)		Mask: 1000h	All
				Internal		Mask: 0800h	
				Internal		Mask: 0400h	
				Internal		Mask: 0200h	
				Internal		Mask: 0100h	
				Internal		Mask: 0080h	
				Internal		Mask: 0040h	
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				Syst. A Phase rotation CW (for Toolkit)		Mask: 0008h	All
				Syst. A Phase rotation CCW (for Toolkit)		Mask: 0004h	All
				Syst. B Phase rotation CW (for Toolkit)		Mask: 0002h	All
				Syst. B Phase rotation CCW (for Toolkit)		Mask: 0001h	All
28	1-2	uint16	10133	BITLIST: Alarm Bits 1			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				Internal		Mask: 0800h	
				Internal		Mask: 0400h	
				Internal		Mask: 0200h	
				08.05 CB B close not successful		Mask: 0100h	All
				08.06 CB B open not successful		Mask: 0080h	All
				08.07 CB A close not successful		Mask: 0040h	All
				08.08 CB A open not successful		Mask: 0020h	All
				Internal		Mask: 0010h	
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	
				Internal		Mask: 0002h	
				08.18 CANopen error interface 1		Mask: 0001h	All
28	3-4	uint16	10191	BITLIST: LogicsManager Bits 11			

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				24.45 Flag 5 LSx		Mask: 1000h	All
				24.44 Flag 4 LSx		Mask: 0800h	All
				24.43 Flag 3 LSx		Mask: 0400h	All
				24.42 Flag 2 LSx		Mask: 0200h	All
				24.41 Flag 1 LSx		Mask: 0100h	All
				24.38 LM variable system is A		Mask: 0080h	All
				24.37 Enable to close CB B		Mask: 0040h	All
				24.36 Immediate open CB B		Mask: 0020h	All
				24.35 Open CB B		Mask: 0010h	All
				24.34 Enable to close CBA		Mask: 0008h	All
				24.33 Immediate open CB A		Mask: 0004h	All
				24.32 Open CBA		Mask: 0002h	All
				24.31 Enable mains decoupling		Mask: 0001h	All
28	5-6	uint16	10138	BITLIST: Monitoring System B Bits1			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				Internal		Mask: 0800h	
				06.21 System B Phase Rotation mismatch		Mask: 0400h	All
				Internal		Mask: 0200h	
				08.46 CB B unload mismatch		Mask: 0100h	All
				Internal		Mask: 0080h	
				Internal		Mask: 0040h	
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
29	1-2	uint16	10135	BITLIST: Monitoring System A Bits1			
				07.06 System A over frequency threshold 1		Mask: 8000h	All
				07.07 System A over frequency threshold 2		Mask: 4000h	All
				07.08 System A under frequency threshold 1		Mask: 2000h	All

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				07.09 System A under frequency threshold 2		Mask: 1000h	All
				07.10 System A over voltage threshold 1		Mask: 0800h	All
				07.11 System A over voltage threshold 2		Mask: 0400h	All
				07.12 System A under voltage threshold 1		Mask: 0200h	All
				07.13 System A under voltage threshold 2		Mask: 0100h	All
				07.14 System A Phase shift		Mask: 0080h	All
				07.25 System A decoupling		Mask: 0040h	All
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				07.26 System A voltage asymmetry (with negative sequence)		Mask: 0008h	All
				07.05 System A phase rotation mismatch		Mask: 0004h	All
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
29	3-6	int32	135	System A total active power	W	*1	All
30	1-2	uint16	4138	BITLIST: Monitoring System A Bits2			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				Internal		Mask: 0800h	
				Internal		Mask: 0400h	
				Internal		Mask: 0200h	
				Internal		Mask: 0100h	
				07.15 System A df/dt		Mask: 0080h	All
				Internal		Mask: 0040h	
				07.28 System A time-dependet voltage		Mask: 0020h	All
				Internal		Mask: 0010h	
				07.27 System A voltage increase		Mask: 0008h	All
				08.36 CB A unload mismatch		Mask: 0004h	All
				07.29 QV Monitoring step 1 tripped		Mask: 0002h	All
				07.30 QV Monitoring step 2 tripped		Mask: 0001h	All
30	3-6	int32	140	System B total active power	W	*1	All

9.3.4 Protocol 5303 (Basic Visualization)

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
0	1-2	uint16		Protocol-ID, always 5303			All
0	3-6	int32	136	System A total reactive power	var	*1	All
1	1-2	int16	160	System A power factor (cos.phi)		*1000	All
1	3-6	int32	170	System A average wye voltage	V	*10	All
2	1-2	int16	144	System A frequency	Hz	*100	All
2	3-6	int32	171	System A average delta voltage	V	*10	All
3	1-2	int16	10202	Operation modes			All
				13280 = CB A request			All
				13264 = Unloading CB A			All
				13210 = CB A Dead bus closure			All
				13260 = Synchronization CB A			All
				13205 = Mains settling time running			All
				13257 = Open CB A			All
				13279 = Synchron. Network close CB A			All
				13265 = Synchronization Permissive			All
				13266 = Synchronization Check			All
				13267 = Synchronization OFF			All
				13286 = Synchr. Segments close CB A			All
				13256 = Unloading CB B			All
				13261 = CBB - CBA delay			All
				13262 = CBA - CBB delay			All
				13259 = Synchronization CB B			All
				13255 = Open CB B			All
				13340 = CB B request			All
				13209 = CB B Dead bus closure			All
3	3-6	int32	337	System A total active power AC measurement	W	*1	All
4	1-2	uint16	10107	BITLIST: Digital outputs 1 to 6			
				Relay-Output 1 (inverted)		Mask: 8000h	All
				Relay-Output 2		Mask: 4000h	All
				Relay-Output 3		Mask: 2000h	All
				Relay-Output 4		Mask: 1000h	All
				Relay-Output 5		Mask: 0800h	All
				Relay-Output 6		Mask: 0400h	All
				Relay-Output 7		Mask: 0200h	All
				Relay-Output 8		Mask: 0100h	All
				Relay-Output 9		Mask: 0080h	All

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				Relay-Output 10		Mask: 0040h	All
				Relay-Output 11		Mask: 0020h	All
				Relay-Output 12		Mask: 0010h	All
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
4	3-6	int32	185	System A current average	A	*1000	All
5	1-2	uint16	8018	BITLIST: Command Bits			
				Internal		Mask: 0001h	
				Internal		Mask: 0002h	
				Internal		Mask: 0004h	
				Internal		Mask: 0008h	
				Internal		Mask: 0010h	
				Internal		Mask: 0020h	
				Internal		Mask: 0040h	
				Internal		Mask: 0080h	
				28.01 Command to CB-control 1 (OR'ed)		Mask: 0100h	All
				28.02 Command to CB-control 2 (OR'ed)		Mask: 0200h	All
				28.03 Command to CB-control 3 (OR'ed)		Mask: 0400h	All
				28.04 Command to CB-control 4 (OR'ed)		Mask: 0800h	All
				28.05 Command to CB-control 5 (OR'ed)		Mask: 1000h	All
				28.06 Command to CB-control 6 (OR'ed)		Mask: 2000h	All
				Internal		Mask: 4000h	
				Internal		Mask: 8000h	
5	3-6	int32	111	System A current 1	A	*1000	All
6	1-2	int16	10110	Battery voltage	V	*10	All
6	3-6	int32	112	System A current 2	A	*1000	All
7	1-2	uint16	10146	BITLIST: LogicsManager Bits 1			
				Internal		Mask: 0001h	All
				Internal		Mask: 0002h	All
				Internal		Mask: 0004h	All
				11.07 Active second		Mask: 0008h	All
				11.06 Active minute		Mask: 0010h	All
				11.05 Active hour		Mask: 0020h	All
				11.04 Active day in month		Mask: 0040h	All
				11.03 Active weekday		Mask: 0080h	All

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				11.02 Time 2 overrun		Mask: 0100h	All
				11.01 Time 1 overrun		Mask: 0200h	All
				Internal		Mask: 0400h	
				04.05 Acknowledge was executed		Mask: 0800h	All
				01.09 Shutdown alarm active (alarm C-F)		Mask: 1000h	All
				Internal		Mask: 2000h	
				Internal		Mask: 4000h	
				Internal		Mask: 8000h	
7	3-6	int32	113	System A current 3	A	*1000	All
8	1-2	uint16	10147	BITLIST: LogicsManager Bits 2			
				99.01 LM Relay 1		Mask: 8000h	All
				99.02 LM Relay 2		Mask: 4000h	All
				99.03 LM Relay 3		Mask: 2000h	All
				99.04 LM Relay 4		Mask: 1000h	All
				99.05 LM Relay 5		Mask: 0800h	All
				Internal		Mask: 0400h	
				99.07 LM Relay 7		Mask: 0200h	All
				99.08 LM Relay 8		Mask: 0100h	All
				99.09 LM Relay 9		Mask: 0080h	All
				99.10 LM Relay 10		Mask: 0040h	All
				99.11 LM Relay 11		Mask: 0020h	All
				99.12 LM Relay 12		Mask: 0010h	All
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
8	3-6	int32	108	System A voltage 1-2	V	*10	All
9	1-2	uint16	10140	BITLIST: LogicsManager Bits 3			
				96.01 LM Internal flag 1		Mask: 8000h	All
				96.02 LM Internal flag 2		Mask: 4000h	All
				96.03 LM Internal flag 3		Mask: 2000h	All
				96.04 LM Internal flag 4		Mask: 1000h	All
				96.05 LM Internal flag 5		Mask: 0800h	All
				96.06 LM Internal flag 6		Mask: 0400h	All
				96.07 LM Internal flag 7		Mask: 0200h	All
				96.08 LM Internal flag 8		Mask: 0100h	All
				Internal		Mask: 0080h	

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				Internal		Mask: 0040h	
				Internal		Mask: 0020h	
				86.15 LM External acknowledge		Mask: 0010h	All
				internal		Mask: 0008h	
				86.16 LM Operation mode AUTOMATIC		Mask: 0004h	All
				86.17 LM Operation mode MANUAL		Mask: 0002h	All
				Internal		Mask: 0001h	
9	3-6	int32	114	System A voltage 1-N	V	*10	All
10	1-2	uint16	10148	BITLIST: LogicsManager Bits 4			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				04.04 Lamp test		Mask: 0800h	All
				01.10 Centralized alarms active (alarm B-F)		Mask: 0400h	All
				01.07 All alarm classes are active		Mask: 0200h	All
				01.08 Warning alarms active (alarm A, B)		Mask: 0100h	All
				Internal		Mask: 0080h	
				Internal		Mask: 0040h	
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
10	3-6	int32	109	System A voltage 2-3	V	*10	All
11	1-2	uint16	10150	BITLIST: LogicsManager Bits 5			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				Internal		Mask: 0800h	
				Internal		Mask: 0400h	
				96.09 LM Internal flag 9		Mask: 0200h	All
				96.10 LM Internal flag 10		Mask: 0100h	All
				96.11 LM Internal flag 11		Mask: 0080h	All
				96.12 LM Internal flag 12		Mask: 0040h	All

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				96.13 LM Internal flag 13		Mask: 0020h	All
				96.14 LM Internal flag 14		Mask: 0010h	All
				96.15 LM Internal flag 15		Mask: 0008h	All
				96.16 LM Internal flag 16		Mask: 0004h	All
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
11	3-6	int32	115	System A voltage 2-N	V	*10	All
12	1-2	uint16	10160	BITLIST: LogicsManager Bits 6			
				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	
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	
				01.11 New Alarm triggered		Mask: 0002h	All
				01.12 Horn		Mask: 0001h	
12	3-6	int32	110	System A voltage 3-1	V	*10	All
13	1-2	uint16	10162	BITLIST: LogicsManager Bits 7			
				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	
				Internal		Mask: 0020h	

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				Internal		Mask: 0010h	
				Internal		Mask: 0008h	
				86.38 LM Synchronization mode CHECK		Mask: 0004h	All
				86.39 LM Synchronization mode PERMISSIVE		Mask: 0002h	All
				86.40 LM Synchronization mode RUN		Mask: 0001h	All
13	3-6	int32	116	System A voltage 3-N	V	*10	All
14	1-2	uint16	10131	BITLIST: Alarm classes latched			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				Internal		Mask: 0800h	
				Internal		Mask: 0400h	
				01.10 Centralized alarms are active (alarm class B, C, D, E, F)		Mask: 0200h	
				01.09 Shutdown alarm are active (alarm class C, D, E, F)		Mask: 0100h	
				01.08 Warning alarms are active (alarm class A, B)		Mask: 0080h	
				01.07 All alarm classes are active		Mask: 0040h	
				Alarm class F latched		Mask: 0020h	All
				Alarm class E latched		Mask: 0010h	All
				Alarm class D latched		Mask: 0008h	All
				Alarm class C latched		Mask: 0004h	All
				Alarm class B latched		Mask: 0002h	All
				Alarm class A latched		Mask: 0001h	All
14	3-6	int32	2520	System A positive active energy	MWh	*100	All
15	1-2	uint16	10132	BITLIST: Alarm digital inputs			
				State Digital Input 8 latched		Mask: 8000h	All
				State Digital Input 7 latched		Mask: 4000h	All
				State Digital Input 6 latched		Mask: 2000h	All
				State Digital Input 5 latched		Mask: 1000h	All
				State Digital Input 4 latched		Mask: 0800h	All
				State Digital Input 3 latched		Mask: 0400h	All
				State Digital Input 2 latched		Mask: 0200h	All
				State Digital Input 1 latched		Mask: 0100h	All
				Internal		Mask: 0080h	
				Internal		Mask: 0040h	
				Internal		Mask: 0020h	

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				Internal		Mask: 0010h	
				State Digital Input 12 latched		Mask: 0008h	
				State Digital Input 11 latched		Mask: 0004h	
				State Digital Input 10 latched		Mask: 0002h	
				State Digital Input 9 latched		Mask: 0001h	
15	3-6	int32	173	System B average wye voltage	V	*10	All
16	1-2	int16	147	System B frequency	Hz	*100	All
16	3-6	int32	174	System B average delta voltage	V	*10	All
17	1-2	int16	10111	AI 1 Input			All
17	3-6	int32	207	System B current average	A	*1000	All
18	1-2	int16	208	System B power factor (cos.phi)		*1000	All
18	3-6	int32	338	System B total active power AC measurement	W	*1	All
19	1-2	uint16	10137	BITLIST: Alarm analog inputs			
				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	
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				10.03 Analog inp. 3, wire brake		Mask: 0008h	
				10.02 Analog inp. 2, wire brake		Mask: 0004h	
				10.01 Analog inp. 1, wire brake		Mask: 0002h	All
				Internal		Mask: 0001h	
19	3-6	int32	150	System B total reactive power	var	*1	All
20	1-2	uint16	534	BITLIST: Remote Control Bits			
				04.59 [extended group] Interface control 16		Mask: 8000h	All
				04.58 [extended group] Interface control 15		Mask: 4000h	All
				04.57 [extended group] Interface control 14		Mask: 2000h	All
				04.56 [extended group] Interface control 13		Mask: 1000h	All
				04.55 [extended group] Interface control 12		Mask: 0800h	All
				04.54 [extended group] Interface control 11		Mask: 0400h	All

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				04.53 [extended group] Interface control 10		Mask: 0200h	All
				04.52 [extended group] Interface control 9		Mask: 0100h	All
				04.51 [extended group] Interface control 8		Mask: 0080h	All
				04.50 [extended group] Interface control 7		Mask: 0040h	All
				04.49 [extended group] Interface control 6		Mask: 0020h	All
				04.48 [extended group] Interface control 5		Mask: 0010h	All
				04.47 [extended group] Interface control 4		Mask: 0008h	All
				04.46 [extended group] Interface control 3		Mask: 0004h	All
				04.45 [extended group] Interface control 2		Mask: 0002h	All
				04.44 [extended group] Interface control 1		Mask: 0001h	All
20	3-6	int32	134	System B current 1	A	*1000	All
21	1-2	uint16	10136	BITLIST: AlarmBits Battery			
				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	
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				08.02 Battery over voltage threshold 2		Mask: 0008h	All
				08.04 Battery under voltage threshold 2		Mask: 0004h	All
				08.01 Battery over voltage threshold 1		Mask: 0002h	All
				08.03 Battery under voltage threshold 1		Mask: 0001h	All
21	3-6	int32	118	System B voltage 1-2	V	*10	All
22	1-2	uint16	4139	BITLIST: Monitoring operation window			
				02.03 System B voltage in range (based on System B Operating voltage window)		Mask: 8000h	All
				02.04 System B frequency in range (based on System B Operating frequency window)		Mask: 4000h	All
				02.05 System B voltage and frequency in range (ready for operation, 02.03 AND 02.04 are TRUE)		Mask: 2000h	All
				02.09 Sytem A voltage in range (based on System A voltage window)		Mask: 1000h	All
				Internal		Mask: 0800h	

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				Internal		Mask: 0400h	
				02.10 System A frequency in range (based on System A frequency window)		Mask: 0200h	All
				Internal		Mask: 0100h	
				Internal		Mask: 0080h	
				02.11 System A voltage and frequency in range (ready for operation, 02.09 AND 02.10 are TRUE)		Mask: 0040h	All
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				02.21 Aux.Voltage is dead (based on Dead bus detection limit ID5820)		Mask: 0008h	All
				02.08 Aux.Voltage v and f in range (ready for operation, 02.06 AND 02.07 are TRUE)		Mask: 0004h	All
				02.07 Aux.Voltage frequency in range (based on System B frequency window)		Mask: 0002h	All
				02.06 Aux.Voltage voltage in range (based on System B voltage window)		Mask: 0001h	All
22	3-6	int32	121	System B voltage 1-N	V	*10	All
23	1-2	uint16		BITLIST: Monitoring System A Bits3			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				Internal		Mask: 0800h	
				Internal		Mask: 0400h	
				Internal		Mask: 0200h	
				Internal		Mask: 0100h	
				02.12 System A phase rotation: Counter Clock Wise (CCW, reverse, left turn)		Mask: 0080h	All
				02.13 System A phase rotation: Clock Wise (CW, forward, right turn)		Mask: 0040h	All
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
23	3-6	int32	119	System B voltage 2-3	V	*10	All
24	1-2	uint16		BITLIST: Monitoring System B Bits2			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				Internal		Mask: 0800h	
				Internal		Mask: 0400h	
				Internal		Mask: 0200h	
				Internal		Mask: 0100h	
				02.14 System B phase rotation: Counter Clock Wise (CCW, reverse, left turn)		Mask: 0080h	All
				02.15 System B phase rotation: Clock Wise (CW, forward, right turn)		Mask: 0040h	All
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
24	3-6	int32	122	System B voltage 2-N	V	*10	All
25	1-2	uint16	4150	BITLIST: Control Bits 4			
				Internal		Mask: 8000h	
				04.63 Synchr. Segment closure active		Mask: 4000h	All
				Internal		Mask: 2000h	
				02.28 Synch. Check Relay		Mask: 1000h	All
				02.29 Synch. Condition		Mask: 0800h	All
				02.30 Dead bus closure condition		Mask: 0400h	All
				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	
				Internal		Mask: 0001h	
25	3-6	int32	120	System B voltage 3-1	V	*10	All
26	1-2	uint16	10149	BITLIST: Alarm Bits 2			
				08.30 Timeout Synchronisation CB B		Mask: 8000h	All
				08.31 Timeout Synchronisation CB A		Mask: 4000h	All

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				08.33 System A / System B phase rotation different		Mask: 0800h	All
				Internal		Mask: 0400h	All
				Internal		Mask: 0200h	
				Internal		Mask: 0100h	
				Internal		Mask: 0080h	
				Internal		Mask: 0040h	
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				08.17 Number of member mismatch		Mask: 0008h	All
				Internal		Mask: 0004h	All
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
26	3-6	int32	123	System B voltage 3-N	V	*10	All
27	1-2	uint16	4153	BITLIST: Control Bits 1			
				04.42 Breaker transition mode altern. 2		Mask: 8000h	All
				04.41 Breaker transition mode altern. 1		Mask: 4000h	All
				04.29 Unloading CB A is active		Mask: 2000h	All
				04.28 Unloading CB B is active		Mask: 1000h	All
				04.23 Close command CB A is active		Mask: 0800h	All
				04.22 Open command CB A is active		Mask: 0400h	All
				04.21 Synchronisation CB A procedure is active		Mask: 0200h	All
				04.20 Close command CB B is active		Mask: 0100h	All
				04.19 Open command CB B is active		Mask: 0080h	All
				04.18 Synchronisation CB B procedure is active		Mask: 0040h	All
				04.11 Mains settling is active		Mask: 0020h	All
				24.39 Isolation Switch is open or 04.06 CB B is closed		Mask: 0010h	All
				04.07 CB A is closed		Mask: 0008h	All
				04.04 Lamp test request		Mask: 0004h	All
				04.03 Operating Mode Manual		Mask: 0002h	All
				04.01 Operating Mode Automatic		Mask: 0001h	All
27	3-4	uint16	4154	BITLIST: Control Bits 2			All
				02.23 System A is dead		Mask: 8000h	All
				02.24 System B is dead		Mask: 4000h	All

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				02.25 Mains parallel operation		Mask: 2000h	All
				System B Mains connected		Mask: 1000h	All
				System A Mains connected		Mask: 0800h	All
				Mains at "right" position (directly or isolation switch) for Tookit grid indication		Mask: 0400h	All
				Mains at "left" position (directly or isolation switch) for Tookit grid indication		Mask: 0200h	All
				28.06 Command 6 to LSx (OR'ed)		Mask: 0100h	All
				28.05 Command 5 to LSx (OR'ed)		Mask: 0080h	All
				28.04 Command 4 to LSx (OR'ed)		Mask: 0040h	All
				28.03 Command 3 to LSx (OR'ed)		Mask: 0020h	All
				28.02 Command 2 to LSx (OR'ed)		Mask: 0010h	All
				28.01 Command 1 to LSx (OR'ed)		Mask: 0008h	All
				04.61 Synchronous Mains Closure Procedure is active		Mask: 0004h	All
				04.62 Dead Bus Closure Procedure is active		Mask: 0002h	All
				Increment Close Counter CBA		Mask: 0001h	All
27	5-6	uint16	4155	BITLIST: Control Bits 3			
				Syst. B Phase rotation CCW (for Toolkit)		Mask: 8000h	All
				Syst. B Phase rotation CW (for Toolkit)		Mask: 4000h	All
				Syst. A Phase rotation CCW (for Toolkit)		Mask: 2000h	All
				Syst. A Phase rotation CW (for Toolkit)		Mask: 1000h	All
				Internal		Mask: 0800h	
				Internal		Mask: 0400h	
				Internal		Mask: 0200h	
				Internal		Mask: 0100h	
				Internal		Mask: 0080h	
				Internal		Mask: 0040h	
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				Syst. A Phase rotation CW (for Toolkit)		Mask: 0008h	All
				Syst. A Phase rotation CCW (for Toolkit)		Mask: 0004h	All
				Syst. B Phase rotation CW (for Toolkit)		Mask: 0002h	All
				Syst. B Phase rotation CCW (for Toolkit)		Mask: 0001h	All
28	1-2	uint16	10133	BITLIST: Alarm Bits 1			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				Internal		Mask: 0800h	
				Internal		Mask: 0400h	
				Internal		Mask: 0200h	
				08.05 CB B close not successful		Mask: 0100h	All
				08.06 CB B open not successful		Mask: 0080h	All
				08.07 CB A close not successful		Mask: 0040h	All
				08.08 CB A open not successful		Mask: 0020h	All
				Internal		Mask: 0010h	
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	
				08.19 CANopen error interface 2		Mask: 0002h	P2
				08.18 CANopen error interface 1		Mask: 0001h	All
28	3-4	uint16	10191	BITLIST: LogicsManager Bits 11			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				24.45 Flag 5 LSx		Mask: 1000h	All
				24.44 Flag 4 LSx		Mask: 0800h	All
				24.43 Flag 3 LSx		Mask: 0400h	All
				24.42 Flag 2 LSx		Mask: 0200h	All
				24.41 Flag 1 LSx		Mask: 0100h	All
				24.38 LM variable system is A		Mask: 0080h	All
				24.37 Enable to close CB B		Mask: 0040h	All
				24.36 Immediate open CB B		Mask: 0020h	All
				24.35 Open CB B		Mask: 0010h	All
				24.34 Enable to close CBA		Mask: 0008h	All
				24.33 Immediate open CB A		Mask: 0004h	All
				24.32 Open CBA		Mask: 0002h	All
				24.31 Enable mains decoupling		Mask: 0001h	All
28	5-6	uint16	10138	BITLIST: Monitoring System B Bits1			
				Internal		Mask: 8000h	
				Internal		Mask: 4000h	
				Internal		Mask: 2000h	
				Internal		Mask: 1000h	
				Internal		Mask: 0800h	
				06.21 System B Phase Rotation mismatch		Mask: 0400h	All
				Internal		Mask: 0200h	

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				08.46 CB B unload mismatch		Mask: 0100h	All
				Internal		Mask: 0080h	
				Internal		Mask: 0040h	
				Internal		Mask: 0020h	
				Internal		Mask: 0010h	
				Internal		Mask: 0008h	
				Internal		Mask: 0004h	
				Internal		Mask: 0002h	
				Internal		Mask: 0001h	
29	1-2	uint16	10135	BITLIST: Monitoring System A Bits1			
				07.06 System A over frequency threshold 1		Mask: 8000h	All
				07.07 System A over frequency threshold 2		Mask: 4000h	All
				07.08 System A under frequency threshold 1		Mask: 2000h	All
				07.09 System A under frequency threshold 2		Mask: 1000h	All
				07.10 System A over voltage threshold 1		Mask: 0800h	All
				07.11 System A over voltage threshold 2		Mask: 0400h	All
				07.12 System A under voltage threshold 1		Mask: 0200h	All
				07.13 System A under voltage threshold 2		Mask: 0100h	All
				07.14 System A Phase shift		Mask: 0080h	All
				07.25 System A decoupling		Mask: 0040h	All
				07.24 Syst.A export power 2		Mask: 0020h	P2
				07.23 Syst.A export power 1		Mask: 0010h	P2
				07.26 System A voltage asymmetry (with negative sequence)		Mask: 0008h	All
				07.05 System A phase rotation mismatch		Mask: 0004h	All
				07.22 Syst.A import power 2		Mask: 0002h	P2
				07.21 Syst.A import power 1		Mask: 0001h	P2
29	3-6	int32	135	System A total active power	W	*1	All
30	1-2	uint16	4138	BITLIST: Monitoring System A Bits2			
				Internal		Mask: 8000h	P2
				Internal		Mask: 4000h	P2
				07.44 Syst.A overcurrent 1		Mask: 2000h	P2
				07.45 Syst.A overcurrent 2		Mask: 1000h	P2
				07.46 Syst.A overcurrent 3		Mask: 0800h	P2
				07.47 Unbalanced load 1		Mask: 0400h	P2
				07.48 Unbalanced load 2		Mask: 0200h	P2
				07.49 Inv. time overcurr.		Mask: 0100h	P2
				07.15 System A df/dt		Mask: 0080h	All

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				Internal		Mask: 0040h	
				07.28 System A time-dependet voltage		Mask: 0020h	All
				Internal		Mask: 0010h	
				07.27 System A voltage increase		Mask: 0008h	All
				08.36 CB A unload mismatch		Mask: 0004h	All
				07.29 QV Monitoring step 1 tripped		Mask: 0002h	All
				07.30 QV Monitoring step 2 tripped		Mask: 0001h	All
30	3-6	int32	140	System B total active power	W	*1	All
31	1-2	uint16	16377	BITLIST: External Digital Inputs 1-16 (latched)			
				External Digital Input 16		Mask: 8000h	All
				External Digital Input 15		Mask: 4000h	All
				External Digital Input 14		Mask: 2000h	All
				External Digital Input 13		Mask: 1000h	All
				External Digital Input 12		Mask: 0800h	All
				External Digital Input 11		Mask: 0400h	All
				External Digital Input 10		Mask: 0200h	All
				External Digital Input 9		Mask: 0100h	All
				External Digital Input 8		Mask: 0080h	All
				External Digital Input 7		Mask: 0040h	All
				External Digital Input 6		Mask: 0020h	All
				External Digital Input 5		Mask: 0010h	All
				External Digital Input 4		Mask: 0008h	All
				External Digital Input 3		Mask: 0004h	All
				External Digital Input 2		Mask: 0002h	All
				External Digital Input 1		Mask: 0001h	All
31	3-4	uint16	10284	BITLIST: External Digital Inputs 17-32 (latched)			
				External Digital Input 32		Mask: 8000h	P2
				External Digital Input 31		Mask: 4000h	P2
				External Digital Input 30		Mask: 2000h	P2
				External Digital Input 29		Mask: 1000h	P2
				External Digital Input 28		Mask: 0800h	P2
				External Digital Input 27		Mask: 0400h	P2
				External Digital Input 26		Mask: 0200h	P2
				External Digital Input 25		Mask: 0100h	P2
				External Digital Input 24		Mask: 0080h	P2
				External Digital Input 23		Mask: 0040h	P2
				External Digital Input 22		Mask: 0020h	P2

CAN Mux	CAN Byte	Size	Index	Description	Unit	Scale	Model
				External Digital Input 21		Mask: 0010h	P2
				External Digital Input 20		Mask: 0008h	P2
				External Digital Input 19		Mask: 0004h	P2
				External Digital Input 18		Mask: 0002h	P2
				External Digital Input 17		Mask: 0001h	P2
31	5-6	unit16		internal			
32	1-2	unit16		internal			
32	3-6	int32	169	System A total reactive power	var	*1	All
33	1-2	unit16		internal			
33	3-6	int32	172	System B total reactive power	var	*1	All
34	1-6			internal			
35	1-6			internal			
36	1-6			internal			
37	1-6			internal			
38	1-6			internal			
39	1-6			internal			
40	1-6			internal			

9.3.5 Additional Data Identifier

9.3.5.1 Receive Data (sent from remote control to the LS-6XT)

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 LS-6XT with the internet as long the security aspects are not considered! Consider an IP responsible person to discuss proper security procedures like placing routers and fire walls.

Take care for sufficient protection of Ethernet communication.

Remote control word 1

Object 21F7h (Parameter 503)

This object is required for remote control. The data type is UNSIGNED16.

Para-meter no.	Object ID	Name		Unit	Data type	Note
503	21F7h	Control word 1		Bit field	unsigned16	
		Bit 15	Not used			
		Bit 14	Not used			
		Bit 13	Not used			
		Bit 12	Not used			
		Bit 11	Not used			
		Bit 10	Not used			
		Bit 9	Not used			
		Bit 8	Not used			
		Bit 7	Not used			
		Bit 6	Not used			
		Bit 5	Not used			
		Bit 4	Ext. Acknowledge (rising edge) Must be set twice to acknowledge			To acknowledge, a 0 must be written and then a 1
		Bit 3	Must always be set to 0			
		Bit 2	Must always be set to 0			
		Bit 1	Not used			
		Bit 0	Not used			

Table 70: Remote control telegram

Bit 4 "Reset alarms"	This bit controls the LogicsManager input command variable 04.14. The remote acknowledge bit must be set and reset twice to acknowledge an alarm completely. The first rising edge disables the horn and the second rising edge resets the alarm.
Ext. acknowledge	The command variable "04.14 Remote acknowledge" is the reflection of the control bit. The LS-6XT deactivates the horn with the first change from "0" to "1" of the logical output "External acknowledge", and acknowledges all alarm messages, which have occurred and are no longer active, with the second change from "0" to "1".

Remote control word 3

Object 21F9h (Parameter 505)

This object is required for remote control. These remote control bits can be used by a PLC to send control signals via SDO or PDO, which can then be used as command variables in the LogicsManager to control the LS-6XT. The data type is UNSIGNED16.

Bit 15 = 1 (ID 541)	Remote control bit 16 (command variable 04.59)
Bit 14 = 1 (ID 542)	Remote control bit 15 (command variable 04.58)
Bit 13 = 1 (ID 543)	Remote control bit 14 (command variable 04.57)
Bit 12 = 1 (ID 544)	Remote control bit 13 (command variable 04.56)
Bit 11 = 1 (ID 545)	Remote control bit 12 (command variable 04.55)
Bit 10 = 1 (ID 546)	Remote control bit 11 (command variable 04.54)
Bit 9 = 1 (ID 547)	Remote control bit 10 (command variable 04.53)
Bit 8 = 1 (ID 548)	Remote control bit 9 (command variable 04.52)
Bit 7 = 1 (ID 549)	Remote control bit 8 (command variable 04.51)
Bit 6 = 1 (ID 550)	Remote control bit 7 (command variable 04.50)
Bit 5 = 1 (ID 551)	Remote control bit 6 (command variable 04.49)
Bit 4 = 1 (ID 552)	Remote control bit 5 (command variable 04.48)
Bit 3 = 1 (ID 553)	Remote control bit 4 (command variable 04.47)
Bit 2 = 1 (ID 554)	Remote control bit 3 (command variable 04.46)
Bit 1 = 1 (ID 555)	Remote control bit 2 (command variable 04.45)
Bit 0 = 1 (ID 556)	Remote control bit 1 (command variable 04.44)

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 LS-6XT. 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.

Additional these indices can be mapped to RPDOs or can be written via Modbus. The values are available in the AnalogManager group 24.

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

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)

9.3.5.2 Transmit Data (sent from LS-6XT 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

9.4 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

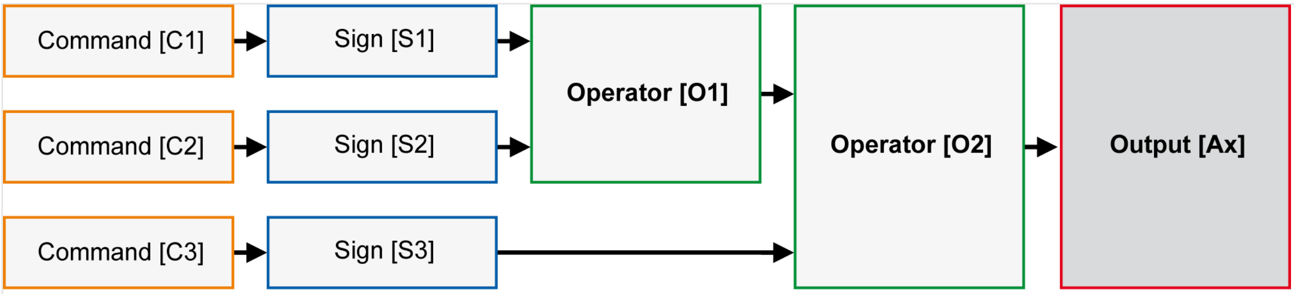


Fig. 222: LogicsManager - function overview

- **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.

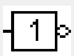
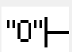
- **Operator**

  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 "9.4.4 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.

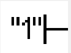
[Sx] - Sign {x}		
	1 [True; always "1"]	The value [Cx] is ignored and this logic path will always be TRUE.

Table 71: Signs

[Ox] - Operator {x}	
AND	Logical AND
NAND	Logical negated AND
OR	Logical OR
NOR	Logical negated OR
XOR	Exclusive OR
NXOR	Exclusive negated OR

Table 72: Operators

For the various display formats of the corresponding logical symbols refer to "9.4.3 Logical Symbols".

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

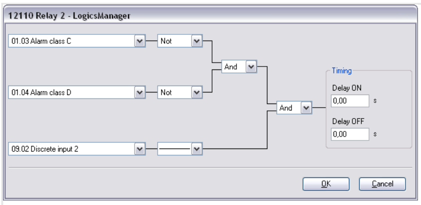


Fig. 223: Programming example (ToolKit)

- 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 Shutdown 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.
01.12 Horn	True if a new alarm (higher A) is triggered and time (parameter

HMI Text	Note
	1756) for horn reset has not exceeded.

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 System B voltage ok	TRUE as long as the system B voltage is within the operating range.
02.04 System B freq. ok	TRUE as long as the system B frequency is within the operating range.
02.05 Syst.B volt./freq. ok	TRUE as long as the system B voltage and frequency are within the operating ranges (02.03. and 02.04 are TRUE).
02.06 Aux.volt. volt. ok	TRUE as long as the "Auxiliary voltage" voltage is within the operating range.
02.07 Aux.volt. freq. ok	TRUE as long as the "Auxiliary voltage" frequency is within the operating range.
02.08 Aux.volt.volt/freq ok	TRUE as long as the "Auxiliary voltage" voltage and frequency are within the operating ranges (02.06. and 02.07 are TRUE).
02.09 System A voltage ok	TRUE as long as the system A voltage is within the operating range.
02.10 System A freq. ok	TRUE as long as the system A frequency is within the operating range.
02.11 Syst.A volt./freq. ok	TRUE as long as the system A voltage and frequency are within the operating ranges (02.09. and 02.10 are TRUE).
02.12 System A 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 System A 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 System B 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.
02.15 System B rot. CW	TRUE as long as the respective rotation field is detected in case of a three-phase voltage measurement

HMI Text	Note
	at the respective measuring location.
02.21 Aux.volt.is dead	TRUE as long as the busbar voltage is below the value configured in parameter 5820 (Dead bus detection max. volt.)
02.23 System A is dead	TRUE as long as the system A voltage is below the value configured in parameter 5820 (Dead bus detection max. volt.)
02.24 System B is dead	TRUE as long as the system B voltage is below the value configured in parameter 5820 (Dead bus detection max. volt.)
02.25 Gen. is mains par.	TRUE if system A (B) is mains connected and system B (A) is variable and CBA is closed and at least one GCB (easYgen) at a relevant segment is closed. (It can be used to enable mains decoupling.)
02.28 Sync.check relay	Indicates phase matching or Dead Bus conditions met. TRUE if synchronization conditions (02.29) OR if Dead Bus conditions (02.30) are active. Warning No dead bus interlocking.
02.29 Sync. condition	Indicates phase matching conditions met. TRUE if synchronization conditions are TRUE defined by parameters 5711, 5712, 5710, 5713, 5714 and 5717.
02.30 Dead bus cl. cond.	Indicates Dead Bus conditions.
02.45 Mns.release breaker	TRUE if mains breaker reconnection is released.

9.4.2.3 Group 04: Application conditions

HMI Text	Note
04.01 Operat. mode AUTO	TRUE if operating mode AUTOMATIC is active.
04.03 Operat. mode MAN	TRUE if operating mode MANUAL is active.
04.04 Lamp test	TRUE if the lamp test is active.
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.)

HMI Text	Note
04.06 Iso.sw./ CBB closed	TRUE if DI 5 (Reply CB B) is de-energized.
04.07 CBA is closed	TRUE if DI 8 (Reply CB B) is de-energized.
04.11 Mains settling	TRUE if a mains failure detected. FALSE if the mains settling timer has expired.
04.14 Remote acknowledge	TRUE if a remote acknowledge is active (Control word 503)
04.18 Synchron. CBB active	TRUE if the CB B shall be synchronized.
04.19 Opening CBB relay act	
04.20 Closing CBB active	TRUE if the CB B close relay is energized.
04.21 Syn. CBA is active	TRUE if the CB A shall be synchronized.
04.22 Opening CBA relay act	TRUE if an CB A open command is active.
04.23 Closing CBA active	TRUE if an CB A close command is active.
04.28 Unloading CBB	TRUE if generator is unloading.
04.29 Unloading CBA	TRUE if CB A unloading is active.
04.41 Transition mode 1	TRUE if the result LM "12931 Transition mode 1" is true.
04.42 Transition mode 2	TRUE if the result LM "12932 Transition mode 2" is true. (LM 12931 has priority.)
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)
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 Syn.mains close act.	TRUE if synchronous mains closure is active.
04.62 Dead bus close act.	TRUE if dead bus closure CB A or CB B is active.
04.63 Syn.segm. close act.	TRUE if synchronous segments closure is active.

HMI Text	Note
04.64 Key activation	TRUE as long as the "Key activation time" is running. Only relevant for versions with front panel (HMI).
04.65 System update active	TRUE if System Update (teach in process) is active.
04.70 Opening CBB active	TRUE if the CB B is to be opened. (Independent of the relay NC/NO.)
04.72 Opening CBA active	TRUE if the CB A is to be opened. (Independent of the relay NC/NO.)
04.88 Logic cmd CBA close	Logic command function. Request to close CBA
04.89 Logic cmd CBA open	Logic command function. Request to open CBA
04.90 Logic cmd CBB close	Logic command function. Request to close CBB
04.91 Logic cmd CBB open	Logic command function. Request to open CBB
04.92 Logic cmd Gen. start	Logic command function. Generator start request
04.93 No easYgen detected	Loadshare interface, no easYgen detected
04.94 Variable system is B	False: Variable system is A True: Variable system is B

9.4.2.4 Group 06: System B related alarms

TRUE if the alarm is active or latched.

HMI Text	Note
06.21 Syst.B ph.rot.mism.	System B phase rotation mismatch
06.32 System B AC wiring	System B AC wiring plausibility

9.4.2.5 Group 07: System A related alarms

TRUE if the alarm is active or latched.

HMI Text	Note
07.05 Syst.A ph.rot.mism.	System A phase rotation
07.06 System A overfreq. 1	System A over frequency 1
07.07 System A overfreq. 2	System A over frequency 2
07.08 System A underfreq. 1	System A under frequency 1
07.09 System A underfreq. 2	System A under frequency 2
07.10 Syst.A overvoltage 1	System A overvoltage 1
07.11 Syst.A overvoltage 2	System A overvoltage 2
07.12 Syst.A undervoltage 1	System A undervoltage 1
07.13 Syst.A undervoltage 2	System A undervoltage 2
07.14 System A phase shift	System A phase shift
07.15 System A df/dt	System A df/dt (Change of frequency)

HMI Text	Note
07.25 System A decoupling	System A decoupling
07.26 Syst.A volt.asymmetry	System A voltage asymmetry
07.27 System A volt.incr.	System A voltage increase (10 minutes. moving average)
07.28 Time-dep. voltage 1	Time-dependent voltage monitoring 1 (FRT)
07.29 Syst.A QV mon. 1	System A QV monitoring step 1
07.30 Syst.A QV mon. 2	System A QV monitoring step 2
07.31 Time-dep. voltage 2	Time-dependent voltage monitoring 2 (FRT)
07.32 System A AC wiring	System A AC wiring plausibility
07.33 Time-dep. voltage 3	Time-dependent voltage monitoring 3 (FRT)
07.34 FRT ROCOF enable	This flag is FALSE if any "Time-dependent voltage monitoring" (FRT) is initialized. Otherwise it is TRUE. It can be used to block temporary "Phase shift" and "df/dt" monitoring if FRT is initialized.

9.4.2.6 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
08.05 CBB fail to close	CBB close not successful
08.06 CBB fail to open	CBB open not successful
08.07 CBA fail to close	CBA close not successful
08.08 CBA fail to open	CBA open not successful
08.17 Missing members	Number of members mismatched
08.18 CANopen Interface 1	CANopen error interface 1
08.27 Missing easYgen	At least one easYgen is missing.
08.28 Missing LSx Layer 1	At least one LSx Layer 1 is missing.
08.30 Synchron. time CBB	Timeout synchronization CBB
08.31 Synchron. time CBA	Timeout Synchronization CBA
08.33 Phase rot. mismatch	Phase rotation mismatch monitoring
08.36 CBA unload mismatch	CBA unloading mismatched
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.
08.46 CBB unload mismatch	CBB unloading mismatched

HMI Text	Note
08.47 Voltage plausibility	Voltage plausibility
08.50 Syst.upd.r/y twinkle	System update red or yellow LED twinkling Red twinkle: if there is no device recognized according to the last system update. Yellow twinkle: if there is no device detected according to the last system update on one redundant interface. (This is no alarm, only a LM.)
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
08.55 Operating range 1	Operating range 1
08.56 Operating range 2	Operating range 2
08.57 Operating range 3	Operating range 3
08.58 Operating range 4	Operating range 4
08.59 Operating range 5	Operating range 5
08.60 Operating range 6	Operating range 6
08.61 Limit appl.layer	Limit application layer 1 Value of segment or device number in Layer 1 operation is limited to maximum 64.
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.update 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.update Layer 3	System Update Layer 3 There is a device detected in the layer 3 communication network which is not taught in. (A system update is required.)
08.69 CL transition fault	Closed transition fault CBA or CBB has not opened in the configured time.
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

HMI Text	Note
08.79 LSx LS timeout layer1	No received loadshare message for a specified timeout of any teached in LSx layer 1
08.80 Redundancy LS timeout	No received loadshare message (of one of the redundant interfaces) for a specified timeout of any teached in device
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
08.87 Interconnect.timeout	Timeout status from the interconnectivity.
08.88 System plausibility	One or more devices in the system with the same segment number have a different status (System A, System B).

9.4.2.7 Group 09: Alarms discrete inputs

TRUE if the alarm is active or latched.

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	
09.12 Discrete input 12	

9.4.2.8 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

9.4.2.9 Group 11: Clock and timer

HMI Text	Note
11.01 Timer 1	TRUE if Timer 1 overrun

HMI Text	Note
11.02 Timer 2	TRUE if Timer 2 overrun
11.03 Active weekday	TRUE if configured weekday is active.
11.04 Active day	TRUE if configured day in month is active.
11.05 Active hour	TRUE if configured hour is active.
11.06 Active minute	TRUE if configured minute is active.
11.07 Active second	TRUE if configured second is active.

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
13.04 Discrete output 4	Relay 4
13.05 Discrete output 5	Relay 5
13.06 Discrete output 6	Relay 6

HMI Text	Note
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	
15.25 Flexible limit 25	
15.26 Flexible limit 26	
15.27 Flexible limit 27	

HMI Text	Note
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 16: Free alarms latched

TRUE if the alarm is active or latched.

HMI Text	Note
16.01 Free alarm 1 latched	
16.02 Free alarm 2 latched	
16.03 Free alarm 3 latched	
16.04 Free alarm 4 latched	
16.05 Free alarm 5 latched	
16.06 Free alarm 6 latched	
16.07 Free alarm 7 latched	
16.08 Free alarm 8 latched	
16.09 Free alarm 9 latched	
16.10 Free alarm 10 latched	
16.11 Free alarm 11 latched	
16.12 Free alarm 12 latched	
16.13 Free alarm 13 latched	
16.14 Free alarm 14 latched	
16.15 Free alarm 15 latched	
16.16 Free alarm 16 latched	

9.4.2.14 Group 17: System alarms

TRUE if the alarm is active or latched.

HMI Text	Note
17.08 Decoupling CBA<->CBB	Tripping according to parameter 3110.

9.4.2.15 Group 26: Flags from LSx 33-48 (Layer 1)

TRUE if the flag in the corresponding LSx device is set.

HMI Text	Note
26.01 Flag 1 LSx device 33	
26.02 Flag 2 LSx device 33	
26.03 Flag 3 LSx device 33	
26.04 Flag 4 LSx device 33	
26.05 Flag 5 LSx device 33	
26.06 Flag 1 LSx device 34	
26.07 Flag 2 LSx device 34	
26.08 Flag 3 LSx device 34	
26.09 Flag 4 LSx device 34	
26.10 Flag 5 LSx device 34	
26.11 Flag 1 LSx device 35	
26.12 Flag 2 LSx device 35	
26.13 Flag 3 LSx device 35	
26.14 Flag 4 LSx device 35	
26.15 Flag 5 LSx device 35	
26.16 Flag 1 LSx device 36	
26.17 Flag 2 LSx device 36	
26.18 Flag 3 LSx device 36	
26.19 Flag 4 LSx device 36	
26.20 Flag 5 LSx device 36	
26.21 Flag 1 LSx device 37	
26.22 Flag 2 LSx device 37	
26.23 Flag 3 LSx device 37	
26.24 Flag 4 LSx device 37	
26.25 Flag 5 LSx device 37	
26.26 Flag 1 LSx device 38	
26.27 Flag 2 LSx device 38	
26.28 Flag 3 LSx device 38	
26.29 Flag 4 LSx device 38	
26.30 Flag 5 LSx device 38	
26.31 Flag 1 LSx device 39	
26.32 Flag 2 LSx device 39	

HMI Text	Note
26.33 Flag 3 LSx device 39	
26.34 Flag 4 LSx device 39	
26.35 Flag 5 LSx device 39	
26.36 Flag 1 LSx device 40	
26.37 Flag 2 LSx device 40	
26.38 Flag 3 LSx device 40	
26.39 Flag 4 LSx device 40	
26.40 Flag 5 LSx device 40	
26.41 Flag 1 LSx device 41	
26.42 Flag 2 LSx device 41	
26.43 Flag 3 LSx device 41	
26.44 Flag 4 LSx device 41	
26.45 Flag 5 LSx device 41	
26.46 Flag 1 LSx device 42	
26.47 Flag 2 LSx device 42	
26.48 Flag 3 LSx device 42	
26.49 Flag 4 LSx device 42	
26.50 Flag 5 LSx device 42	
26.51 Flag 1 LSx device 43	
26.52 Flag 2 LSx device 43	
26.53 Flag 3 LSx device 43	
26.54 Flag 4 LSx device 43	
26.55 Flag 5 LSx device 43	
26.56 Flag 1 LSx device 44	
26.57 Flag 2 LSx device 44	
26.58 Flag 3 LSx device 44	
26.59 Flag 4 LSx device 44	
26.60 Flag 5 LSx device 44	
26.61 Flag 1 LSx device 45	
26.62 Flag 2 LSx device 45	
26.63 Flag 3 LSx device 45	
26.64 Flag 4 LSx device 45	
26.65 Flag 5 LSx device 45	
26.66 Flag 1 LSx device 46	
26.67 Flag 2 LSx device 46	
26.68 Flag 3 LSx device 46	
26.69 Flag 4 LSx device 46	
26.70 Flag 5 LSx device 46	

HMI Text	Note
26.71 Flag 1 LSx device 47	
26.72 Flag 2 LSx device 47	
26.73 Flag 3 LSx device 47	
26.74 Flag 4 LSx device 47	
26.75 Flag 5 LSx device 47	
26.76 Flag 1 LSx device 48	
26.77 Flag 2 LSx device 48	
26.78 Flag 3 LSx device 48	
26.79 Flag 4 LSx device 48	
26.80 Flag 5 LSx device 48	

9.4.2.16 Group 27: Flags from LSx 49-64 (Layer 1)

TRUE if the flag in the corresponding LSx device is set.

HMI Text	Note
27.01 Flag 1 LSx device 49	
27.02 Flag 2 LSx device 49	
27.03 Flag 3 LSx device 49	
27.04 Flag 4 LSx device 49	
27.05 Flag 5 LSx device 49	
27.06 Flag 1 LSx device 50	
27.07 Flag 2 LSx device 50	
27.08 Flag 3 LSx device 50	
27.09 Flag 4 LSx device 50	
27.10 Flag 5 LSx device 50	
27.11 Flag 1 LSx device 51	
27.12 Flag 2 LSx device 51	
27.13 Flag 3 LSx device 51	
27.14 Flag 4 LSx device 51	
27.15 Flag 5 LSx device 51	
27.16 Flag 1 LSx device 52	
27.17 Flag 2 LSx device 52	
27.18 Flag 3 LSx device 52	
27.19 Flag 4 LSx device 52	
27.20 Flag 5 LSx device 52	
27.21 Flag 1 LSx device 53	
27.22 Flag 2 LSx device 53	
27.23 Flag 3 LSx device 53	

HMI Text	Note
27.24 Flag 4 LSx device 53	
27.25 Flag 5 LSx device 53	
27.26 Flag 1 LSx device 54	
27.27 Flag 2 LSx device 54	
27.28 Flag 3 LSx device 54	
27.29 Flag 4 LSx device 54	
27.30 Flag 5 LSx device 54	
27.31 Flag 1 LSx device 55	
27.32 Flag 2 LSx device 55	
27.33 Flag 3 LSx device 55	
27.34 Flag 4 LSx device 55	
27.35 Flag 5 LSx device 55	
27.36 Flag 1 LSx device 56	
27.37 Flag 2 LSx device 56	
27.38 Flag 3 LSx device 56	
27.39 Flag 4 LSx device 56	
27.40 Flag 5 LSx device 56	
27.41 Flag 1 LSx device 57	
27.42 Flag 2 LSx device 57	
27.43 Flag 3 LSx device 57	
27.44 Flag 4 LSx device 57	
27.45 Flag 5 LSx device 57	
27.46 Flag 1 LSx device 58	
27.47 Flag 2 LSx device 58	
27.48 Flag 3 LSx device 58	
27.49 Flag 4 LSx device 58	
27.50 Flag 5 LSx device 58	
27.51 Flag 1 LSx device 59	
27.52 Flag 2 LSx device 59	
27.53 Flag 3 LSx device 59	
27.54 Flag 4 LSx device 59	
27.55 Flag 5 LSx device 59	
27.56 Flag 1 LSx device 60	
27.57 Flag 2 LSx device 60	
27.58 Flag 3 LSx device 60	
27.59 Flag 4 LSx device 60	
27.60 Flag 5 LSx device 60	
27.61 Flag 1 LSx device 61	

HMI Text	Note
27.62 Flag 2 LSx device 61	
27.63 Flag 3 LSx device 61	
27.64 Flag 4 LSx device 61	
27.65 Flag 5 LSx device 61	
27.66 Flag 1 LSx device 62	
27.67 Flag 2 LSx device 62	
27.68 Flag 3 LSx device 62	
27.69 Flag 4 LSx device 62	
27.70 Flag 5 LSx device 62	
27.71 Flag 1 LSx device 63	
27.72 Flag 2 LSx device 63	
27.73 Flag 3 LSx device 63	
27.74 Flag 4 LSx device 63	
27.75 Flag 5 LSx device 63	
27.76 Flag 1 LSx device 64	
27.77 Flag 2 LSx device 64	
27.78 Flag 3 LSx device 64	
27.79 Flag 4 LSx device 64	
27.80 Flag 5 LSx device 64	

9.4.2.17 Group 28: LSx 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 LSx(OR)	
28.02 Command 2 to LSx(OR)	
28.03 Command 3 to LSx(OR)	
28.04 Command 4 to LSx(OR)	
28.05 Command 5 to LSx(OR)	
28.06 Command 6 to LSx(OR)	

9.4.2.18 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	

HMI Text	Note
29.04 Command 4 easYgen 1	
29.05 Command 5 easYgen 1	
29.06 Command 6 easYgen 1	
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	

HMI Text	Note
29.42 Command 6 easYgen 7	
29.43 Command 1 easYgen 8	
29.44 Command 2 easYgen 8	
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	

HMI Text	Note
29.80 Command 2 easYgen 14	
29.81 Command 3 easYgen 14	
29.82 Command 4 easYgen 14	
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	

9.4.2.19 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	

HMI Text	Note
30.17 Command 5 easYgen 19	
30.18 Command 6 easYgen 19	
30.19 Command 1 easYgen 20	
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	

HMI Text	Note
30.55 Command 1 easYgen 26	
30.56 Command 2 easYgen 26	
30.57 Command 3 easYgen 26	
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	
30.91 Command 1 easYgen 32	
30.92 Command 2 easYgen 32	

HMI Text	Note
30.93 Command 3 easYgen 32	
30.94 Command 4 easYgen 32	
30.95 Command 5 easYgen 32	
30.96 Command 6 easYgen 32	

9.4.2.20 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)
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)

HMI Text	Note
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)
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)

HMI Text	Note
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)

9.4.2.21 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)

HMI Text	Note
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)
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)

HMI Text	Note
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)
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)

9.4.2.22 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)

HMI Text	Note
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)
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)

HMI Text	Note
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)
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)

9.4.2.23 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)

HMI Text	Note
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)
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)

HMI Text	Note
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)
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)

9.4.2.24 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)

9.4.2.25 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)
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)

HMI Text	Note
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)
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)

HMI Text	Note
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)
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)

9.4.2.26 Group 54: Modbus Master flags

TRUE if the flag is active

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
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

HMI Text	Note
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
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

HMI Text	Note
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
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

9.4.2.27 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.SysB act.pwr.	AM External measured system B active power
81.20 AM Ext.SysB react.pwr	AM External measured System B reactive power
81.33 AM Ext.SysA act.pwr.	AM External measured system A active power
81.43 AM Ext.SysA react.pwr	AM External measured System A reactive power

9.4.2.28 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

HMI Text	Note
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
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

HMI Text	Note
82.40 AM Flexible limit 40	AM Monitored flexible limit 40

9.4.2.29 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
86.16 LM: Operat. mode AUTO	LM External "Set mode Auto"
86.17 LM: Operat. mode MAN	LM External "Set mode Man"
86.27 LM: Ext.Syst.A decpl.	LM System A failure by external device is requested
86.30 LM: Lock keypad 1	LM Lock keypad 1
86.33 LM: 2nd disp.bright.	LM Enable second display brightness
86.35 LM: System update	LM System update
86.38 LM: Syn. mode CHECK	LM Synchronization mode CHECK
86.39 LM: Syn. mode PERMIS.	LM Synchronization mode PERMISSIVE
86.40 LM: Syn. mode RUN	LM Synchronization mode RUN
86.43 LM: RP Full mode	LM Remote Panel "Full Mode"
86.44 LM: RP Annunciator	LM Remote Panel "Annunciator mode"
86.45 LM: RP Off mode	LM Remote Panel "Off mode"
86.52 LM: Back to mains	LM: Back to mains after emergency mode
86.93 LM: Transition mode 1	LM Breaker Transition Mode Alternative 1
86.94 LM: Transition mode 2	LM Breaker Transition Mode Alternative 2

9.4.2.30 Group 87: LM Results 2

TRUE if the result of the corresponding LogicsManager equation is true.

HMI Text	Note
87.31 LM: Enable Syst.A dec	LM Enable System A decoupling
87.32 LM: Open CBA unload	LM: Open CBA with unloading
87.33 LM: Open CBA immed.	LM: Open CBA with immediately
87.34 LM: Enable close CBA	LM Enable to close CBA
87.35 LM: Open CBB unload	LM: Open CBB with unloading
87.36 LM: Open CBB immed.	LM: Open CBB with immediately
87.37 LM: Enable close CBB	LM Enable to close CBB
87.38 LM: Variab. system A	LM Variable system is A
87.39 LM: Isol.sw open	LM Isolation switch is closed
87.40 LM: Lock monitoring	LM Lock monitoring
87.41 LM: Flag 1 LSx	

HMI Text	Note
87.42 LM: Flag 2 LSx	
87.43 LM: Flag 3 LSx	
87.44 LM: Flag 4 LSx	
87.45 LM: Flag 5 LSx	
87.46 LM: Open CBB in MAN	LM Open CBB in Manual
87.47 LM: Close CBB in MAN	LM Close CBB in Manual
87.48 LM: Open CBA in MAN	LM Open CBA in Manual
87.49 LM: Close CBA in MAN	LM Close CBA in Manual
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	
87.72 LM: Disab.Syst.A mon.	LM Disable System A monitoring
87.73 LM: Syst.A decouplCBB	LM System A decoupling by CBB

9.4.2.31 Group 88: LM Results 3 (Free alarms)

TRUE if the result of the corresponding LogicsManager equation is true.

HMI Text	Note
88.01 LM: Free alarm 1	LM Free alarm 1 active
88.02 LM: Free alarm 2	LM Free alarm 2 active
88.03 LM: Free alarm 3	LM Free alarm 3 active
88.04 LM: Free alarm 4	LM Free alarm 4 active
88.05 LM: Free alarm 5	LM Free alarm 5 active
88.06 LM: Free alarm 6	LM Free alarm 6 active
88.07 LM: Free alarm 7	LM Free alarm 7 active
88.08 LM: Free alarm 8	LM Free alarm 8 active
88.09 LM: Free alarm 9	LM Free alarm 9 active
88.10 LM: Free alarm 10	LM Free alarm 10 active
88.11 LM: Free alarm 11	LM Free alarm 11 active
88.12 LM: Free alarm 12	LM Free alarm 12 active
88.13 LM: Free alarm 13	LM Free alarm 13 active
88.14 LM: Free alarm 14	LM Free alarm 14 active
88.15 LM: Free alarm 15	LM Free alarm 15 active

HMI Text	Note
88.16 LM: Free alarm 16	LM Free alarm 16 active

9.4.2.32 Group 90: AnalogManager Internal values 0 (Customer screens)

TRUE if the boolean result of the corresponding AnalogManager equation is true.

HMI Text	Note
90.01 AM Cust.screen 1.1	AM Customer screen 1 row 1
90.02 AM Cust.screen 1.2	AM Customer screen 1 row 2
90.03 AM Cust.screen 1.3	AM Customer screen 1 row 3
90.04 AM Cust.screen 1.4	AM Customer screen 1 row 4
90.05 AM Cust.screen 1.5	AM Customer screen 1 row 5
90.06 AM Cust.screen 1.6	AM Customer screen 1 row 6
90.07 AM Cust.screen 1.7	AM Customer screen 1 row 7
90.08 AM Cust.screen 1.8	AM Customer screen 1 row 8
90.09 AM Cust.screen 1.9	AM Customer screen 1 row 9
90.51 AM Cust.screen 2.1	AM Customer screen 2 row 1
90.52 AM Cust.screen 2.2	AM Customer screen 2 row 2
90.53 AM Cust.screen 2.3	AM Customer screen 2 row 3
90.54 AM Cust.screen 2.4	AM Customer screen 2 row 4
90.55 AM Cust.screen 2.5	AM Customer screen 2 row 5
90.56 AM Cust.screen 2.6	AM Customer screen 2 row 6
90.57 AM Cust.screen 2.7	AM Customer screen 2 row 7
90.58 AM Cust.screen 2.8	AM Customer screen 2 row 8
90.59 AM Cust.screen 2.9	AM Customer screen 2 row 9

9.4.2.33 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	
91.08 AM Internal value 8	
91.09 AM Internal value 9	

HMI Text	Note
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	

9.4.2.34 Group 93: AnalogManager Analog outputs 1

TRUE if the boolean result of the corresponding AnalogManager equation is true.

HMI Text	Note
93.01 AM Data source AO1	AM Analog output 1 data source
93.02 AM Data source AO2	AM Analog output 2 data source

9.4.2.35 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

HMI Text	Note
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
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

9.4.2.36 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	

9.4.2.37 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	
99.04 LM: Relay 4	
99.05 LM: Relay 5	
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 Symbols

The following symbols are used for the graphical programming of the LogicsManager. The symbols are shown according to the IEC standard by default.

- Use parameter ⮡▷ 4117 to change display mode to ASA standard.

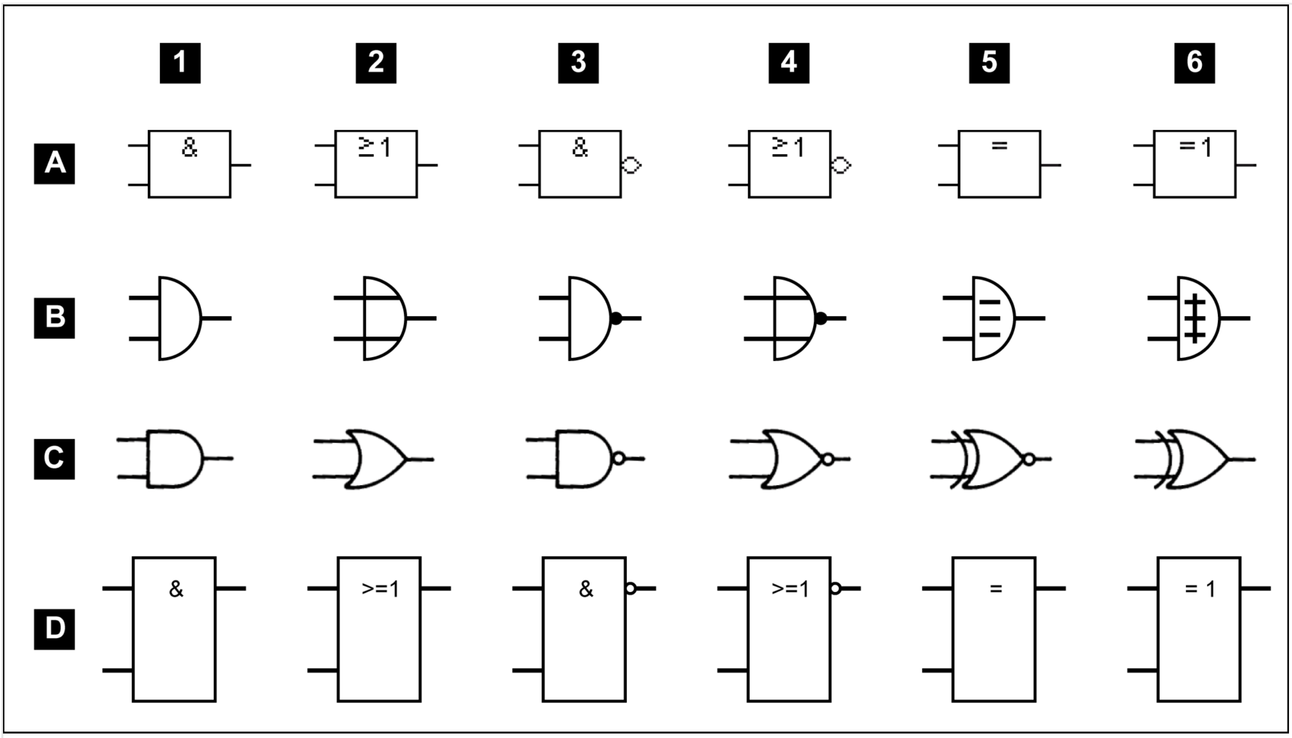


Fig. 224: Logical symbols

Row	... according to standard:
A	IEC (default)
B	DIN 40 700
C	ASA US MIL (configurable)
D	IEC617-12

Meaning of the columns					
1	**2**	**3**	**4**	**5**	**6**
AND	OR	NAND	NOR	NXOR	XOR

AND			OR			NAND			NOR			NXOR			XOR		
x1	**x2**	**y**	**x1**	**x2**	**y**	**x1**	**x2**	**y**	**x1**	**x2**	**y**	**x1**	**x2**	**y**	**x1**	**x2**	**y**
0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0
0	1	0	0	1	1	0	1	1	0	1	0	0	1	0	0	1	1
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 73: Truth table

9.4.4 Logical Outputs

The logical outputs or combinations may be grouped into three categories:

- Internal logical flags
- Internal functions
- Relay outputs

The numbers of the logical outputs in the third column may again be used as input variable for other outputs in the LogicsManager.

Internal flags

32 internal logical flags may be programmed to activate/deactivate functions. This permits more than 3 commands to be included in a logical function. They may be used like "auxiliary flags".

Name	Function	Number	ID
LM: Flag 1	Internal flag 1	96.01	10700
LM: Flag 2	Internal flag 2	96.02	10701
LM: Flag 3	Internal flag 3	96.03	10702
LM: Flag 4	Internal flag 4	96.04	10703

Name	Function	Number	ID
LM: Flag 5	Internal flag 5	96.05	10704
LM: Flag 6	Internal flag 6	96.06	10705
LM: Flag 7	Internal flag 7	96.07	10706
LM: Flag 8	Internal flag 8	96.08	10707
LM: Flag 9	Internal flag 9	96.09	11609
LM: Flag 10	Internal flag 10	96.10	11610
LM: Flag 11	Internal flag 11	96.11	11611
LM: Flag 12	Internal flag 12	96.12	11612
LM: Flag 13	Internal flag 13	96.13	11613
LM: Flag 14	Internal flag 14	96.14	11614
LM: Flag 15	Internal flag 15	96.15	11615
LM: Flag 16	Internal flag 16	96.16	11616
LM: Flag 17	Internal flag 17	96.17	12232
LM: Flag 18	Internal flag 18	96.18	12234
LM: Flag 19	Internal flag 19	96.19	12236
LM: Flag 20	Internal flag 20	96.20	12238
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

LSx flags

5 internal logical LSx 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 on the CAN bus. The flags of all LSx are received (as 26.01 to 27.80) by the LSx and the easYgen. They can be used as inputs for the LogicsManager.

Name	Function	Number	ID
LM: Flag 1 LSx	LSx flag 1	87.41	11430
LM: Flag 2 LSx	LSx flag 2	87.42	11431
LM: Flag 3 LSx	LSx flag 3	87.43	11432

Name	Function	Number	ID
LM: Flag 4 LSx	LSx flag 4	87.44	11433
LM: Flag 5 LSx	LSx flag 5	87.45	11434

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: Operat. mode AUTO	Activation of the AUTOMATIC operating mode (parameter (parameter ⮱▷ 12510)	86.16	10715
LM: Operat. mode MAN	Activation of the MANUAL operating mode (parameter ⮱▷ 12520)	86.17	10716
LM: Lock keypad 1	Activation of lock keypad (parameter ⮱▷ 12978)	86.30	11924
LM: System update	Activation of lock keypad (parameter ⮱▷ 7801)	86.35	11974
LM: Syn. mode CHECK	Used for checking a synchronizer prior to commissioning. The system actively synchronizes generator(s) by issuing speed and voltage bias commands, but does not issue a breaker closure command. (parameter ⮱▷ 12906)	86.38	11617
LM: Syn. mode PERMIS.	The system acts in a synch check mode. The system 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. (parameter ⮱▷ 12907)	86.39	11618
LM: Syn. mode RUN	Normal operating mode. The system actively synchronizes and issues breaker closure commands. (parameter ⮱▷ 12908)	86.40	11619
LM: RP Full mode	Activation of lock keypad (parameter ⮱▷ 7857)	86.43	11994
LM: RP Annunciator	Activation of lock keypad (parameter ⮱▷ 7858)	86.44	11995
LM: RP Off mode	Activation of lock keypad (parameter ⮱▷ 7859)	86.45	11996
LM: Transition mode 1	Activation of the breaker transition mode 1. The breaker transition mode 1 determines (as option) how the load is transferred from system A to B and vice versa.(parameter ⮱▷ 12931)	86.93	11922
LM: Transition mode 2	Activation of the breaker transition mode 1. The breaker transition mode 1 determines (as option) how the load is transferred from system A to B and vice versa.(parameter ⮱▷ 12932)	86.94	11923
LM: Enable Syst. A dec	Enable System A decoupling (parameter ⮱▷ 12942)	87.31	11420
LM: Open CBA unload	(parameter ⮱▷ 12943)	87.32	11421
LM: Open CBA immed.	(parameter ⮱▷ 12944)	87.33	11422
LM: Enable close CBA	(parameter ⮱▷ 12945)	87.34	11423
LM: Open CBB unload	(parameter ⮱▷ 12946)	87.35	11424
LM: Open CBB immed.	(parameter ⮱▷ 12947)	87.36	11425
LM: Enable close CBB	(parameter ⮱▷ 12948)	87.37	11426
LM: Variab. system A	(parameter ⮱▷ 12949)	87.38	11427
LM: Isol.sw. open	(parameter ⮱▷ 12950)	87.39	11428

Name	Function	Number	ID
LM: Lock Monitoring	(parameter ⮱▷ 12959)	87.40	11429
LM: Open CBB in MAN	(parameter ⮱▷ 12976)	87.46	11435
LM: Close CBB in MAN	(parameter ⮱▷ 12977)	87.47	11436
LM: Open CBA in MAN	(parameter ⮱▷ 12974)	87.48	11437
LM: Close CBA in MAN	(parameter ⮱▷ 12975)	87.49	11438
LM: Disab.Syst.A mon.	(parameter ⮱▷ 15159)	87.72	11461
LM: Syst.A decoupl.CBB	(parameter ⮱▷ 15160)	87.73	11462

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 'Centralized alarm (horn)' If this logical output becomes true, the relay output 2 will be activated	99.02	11871
LM: Relay 3	LogicsManager; pre-assigned with 'System B not OK' If this logical output becomes true, the relay output 3 will be activated	99.03	11872
LM: Relay 4	LogicsManager; pre-assigned with 'System A not OK' If this logical output becomes true, the relay output 4 will be activated	99.04	11873
LM: Relay 5	Fixed to 'Open CBA' or LogicsManager if '3398 CBA open relay' is configured to 'Not used'. If this logical output becomes true, the relay output 5 will be activated	99.05	11874
Relay 6	Fixed to 'Close CBA' (no LogicsManager)	04.23	11672
LM: Relay 7	Fixed to 'Open CBB' or LogicsManager if '9018 Breaker mode LS6' is configured to 'CBA' or '3403 CBB open relay' is configured to 'Not used'. If this logical output becomes true, the relay output 7 will be activated	99.07	11876
LM: Relay 8	Fixed to 'Close CBB' or LogicsManager if '9018 Breaker mode LS6' is configured to 'CBA'. If this logical output becomes true, the relay output 8 will be activated	99.08	11877
LM: Relay 9	LogicsManager; pre-assigned with 'Auxiliary voltage and frequency ok' If this logical output becomes true, the relay output 9 will be activated	99.09	11878

Name	Function	Number	ID
LM: Relay 10	LogicsManager; pre-assigned with 'Operation mode manual' If this logical output becomes true, the relay output 10 will be activated	99.10	11879
LM: Relay 11	LogicsManager; pre-assigned with 'Warning alarm' If this logical output becomes true, the relay output 11 will be activated	99.11	11880
LM: Relay 12	LogicsManager; pre-assigned with 'Shutdown alarm' If this logical output becomes true, the relay output 12 will be activated	99.12	11881

LEDs

All LEDs may be controlled directly by the LogicsManager.

Name	Function	Number	ID
LM: LED 1	LogicsManager; pre-assigned with 'System A OK' If this logical output becomes true, LED 1 will be activated	87.51	11440
LM: LED 2	LogicsManager; pre-assigned with 'System B OK' If this logical output becomes true, LED 2 will be activated	87.52	11441
LM: LED 3	LogicsManager; pre-assigned with 'CBA closed' If this logical output becomes true, LED 3 will be activated	87.53	11442
LM: LED 4	LogicsManager; pre-assigned with 'Isolation switch/CBB closed' If this logical output becomes true, LED 4 will be activated	87.54	11443
LM: LED 5	LogicsManager; pre-assigned with 'Synchronisation CBA' If this logical output becomes true, LED 5 will be activated	87.55	11444
LM: LED 6	LogicsManager; pre-assigned with 'Synchronisation CBB' If this logical output becomes true, LED 6 will be activated	87.56	11445
LM: LED 7	LogicsManager; pre-assigned with 'Closing CBA' If this logical output becomes true, LED 7 will be activated	87.57	11446
LM: LED 8	LogicsManager; pre-assigned with 'Closing CBB' If this logical output becomes true, LED 8 will be activated	87.58	11447

9.4.5 Factory Settings

LogicsManager's default definition

ID	Name	Function
7801	System update	(False And True) And True

ID	Name	Function
7857	RP Full mode	(02.02 LM TRUE And True) And True
7858	RP Annunciator	(02.01 LM FALSE And True) And True
7859	RP Off mode	(02.01 LM FALSE And True) And True
8120	Free alarm 1	(02.01 LM FALSE And True) And True
8124	Free alarm 2	(02.01 LM FALSE And True) And True
8128	Free alarm 3	(02.01 LM FALSE And True) And True
8132	Free alarm 4	(02.01 LM FALSE And True) And True
8136	Free alarm 5	(02.01 LM FALSE And True) And True
8140	Free alarm 6	(02.01 LM FALSE And True) And True
8144	Free alarm 7	(02.01 LM FALSE And True) And True
8148	Free alarm 8	(02.01 LM FALSE And True) And True
8154	Free alarm 9	(02.01 LM FALSE And True) And True
8158	Free alarm 10	(02.01 LM FALSE And True) And True
8165	Free alarm 11	(02.01 LM FALSE And True) And True
8170	Free alarm 12	(02.01 LM FALSE And True) And True
8174	Free alarm 13	(02.01 LM FALSE And True) And True
8178	Free alarm 14	(02.01 LM FALSE And True) And True
8182	Free alarm 15	(02.01 LM FALSE And True) And True
8186	Free alarm 16	(02.01 LM FALSE And True) And True
12110	Relay 2	(01.12 Horn And True) And True
12130	Relay 5	(02.01 LM FALSE And True) And True
12150	Relay 7	(02.01 LM FALSE And True) And True
12160	Relay 8	(02.01 LM FALSE And True) And True
12170	Relay 9	(02.08 Aux.volt.volt/freq. ok And True) And True
12180	Relay 10	(04.03 Operat. mode MAN And True) And True
12200	Inhibit emerg.run	(FALSE 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	(Not 02.05 Syst.B volt./freq. ok And True) And True
12320	Relay 4	(Not 02.11 Syst.A volt./freq. ok 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
12510	Operat. mode AUTO	(02.01 LM FALSE And True) And True
12520	Operat. mode MAN	(02.01 LM FALSE And True) And True
12560	Relay 11	(01.08 Warning alarm And True) And True
12580	Ready for op. OFF (Relay 1)	(False And False) And True
12590	Relay 12	(01.09 Shutdown alarm And True) And True
12882	Emerg. back to mains	(02.02 LM TRUE And True) And True
12883	Generator remote start	(FALSE And True) And True

ID	Name	Function
12906	Syn. mode CHECK	(02.01 LM FALSE And True) And True
12907	Syn. mode PERMIS.	(02.01 LM FALSE And True) And True
12908	Syn. mode RUN	(02.01 LM FALSE And True) And True
12910	Flag 9	(02.01 LM FALSE And True) And True
12911	Flag 10	(02.01 LM FALSE And True) And True
12912	Flag 11	(02.01 LM FALSE And True) And True
12913	Flag 12	(02.01 LM FALSE And True) And True
12914	Flag 13	(02.01 LM FALSE And True) And True
12915	Flag 14	(02.01 LM FALSE And True) And True
12916	Flag 15	(02.01 LM FALSE And True) And True
12917	Flag 16	(02.01 LM FALSE And True) And True
12922	Ext.Syst.A decoupl.	(False And True) And True
12931	Transition mode 1	(False And True) And True
12932	Transition mode 2	(False And True) And True
12936	Bypass min. Pgen.	(False And True) And True
12942	Enable System A dec.	(04.07 CBA is closed And 04.06 Iso.sw./CBB closed) And True
12943	Open CBA unload	(09.06 Discrete input 6 And True) And True
12944	Open CBA immed.	(02.01 LM FALSE And True) And True
12945	Enable close CBA	(09.07 Discrete input 7 And Not 08.07 CBA fail to closeTrue) And Not 06.21 Syst.B ph.rot.mism.
12946	Open CBB unload	(09.03 Discrete input 3 And True) And True
12947	Open CBB immed.	(False And True) And True
12948	Enable close CBB	(09.04 Discrete input 4 And Not 08.05 CBB fail to closeTrue) And Not 06.21 Syst.B ph.rot.mism.
12949	Variab. system A	(02.01 LM FALSE And True) And True
12950	Isol.sw open	(09.05 Discrete input 5 And True) And True
12952	Flag 1 LSx	(02.01 LM FALSE And True) And True
12953	Flag 2 LSx	(02.01 LM FALSE And True) And True
12954	Flag 3 LSx	(02.01 LM FALSE And True) And True
12955	Flag 4 LSx	(02.01 LM FALSE And True) And True
12956	Flag 5 LSx	(02.01 LM FALSE And True) And True
12959	Lock Monitoring	(09.01 Discrete input 1 And True) And True
12962	LED 1	(02.11 Syst.A volt./freq. ok And True) And True
12963	LED 2	(02.05 Syst.B volt./freq. ok And True) And True
12964	LED 3	(04.07 CBA is closed And True) And True
12965	LED 4	(04.06 Iso.sw./ CBB closed And True) And True
12966	LED 5	(04.21 Syn. CBA is active And True) And True
12967	LED 6	(04.18 Synchron. CBB active And True) And True
12968	LED 7	(04.23 Closing CBA active And True) And True

ID	Name	Function
12969	LED 8	(04.20 Closing CBB active And True) And True
12974	Open CBA in MAN	(02.01 LM FALSE And True) And True
12975	Close CBA in MAN	(02.01 LM FALSE And True) And True
12976	Open CBB in MAN	(False And True) And True
12977	Close CBB in MAN	(False And True) And True
12978	Lock keypad 1	(02.01 LM FALSE And True) And True
15159	Disab.Syst.A mon.	(False And True) And True
15160	System A decoupl.CBB	(False And True) And True

Table 74: Factory settings by ID: LogicsManager

Overview pre-configuation Relay Outputs

Simple (function)	Extended (configuration)	Result
[99.01] Relay 1 [R01] - Ready for operation OFF Relay will be de-energized if unit is not ready for operation or the logics manager output is TRUE. Deactivated by default	(False And False) And True (Delay ON, Delay OFF = 0 s	FALSE
[99.02] Relay 2 [R02] - Centralized alarm (horn) / freely configurable Relay energizes if the internal condition 'Horn' is TRUE	(01.12 Horn And True) And True (Delay ON, Delay OFF = 0 s)	dependent on Logics Command Variable [01.12]
[99.03] Relay 3 [R03] - System B not ok / freely configurable Relay energizes if the internal condition 'System B ok' is FALSE	(Not 02.05 Syst.B volt./freq. ok And True) And True (Delay ON, Delay OFF = 0 s)	dependent on Logics Command Variable [02.05]
[99.04] Relay 4 [R04] - System A not ok / freely configurable Relay energizes if the internal condition 'System A ok' is FALSE	(Not 02.11 Syst.A volt./freq. ok And True) And True (Delay ON, Delay OFF = 0 s)	dependent on Logics Command Variable [02.11]
[99.05] Relay 5 [R05] - Open CBA / freely configurable If 'CBA open relay' is used, pre-configured to 'Open CBA'. Relay energizes if 'Opening CBA active' is active. Else deactivated by default.	(False And False) And True (Delay ON, Delay OFF = 0 s)	dependent on application mode and Logics Command Variable [04.22]
[99.06] Relay 6 [R06] -Restricted to Command: Closing CBA active Relay energizes if a 'Closing CBA active' is active.	(Restricted)	dependent on Logics Command Variable [04.23]
[99.07] Relay 7 [R07] - Open CBB / freely configurable In breaker mode'CBA/CBB' and if 'CBB open relay' is used, pre-configured to	(False And False) And True (Delay ON, Delay OFF = 0 s)	dependent on application mode and Logics

Simple (function)	Extended (configuration)	Result
'Open CBB'. Relay energizes if 'Opening CBB active' is active. Else deactivated by default.		Command Variable [04.19]
[99.08] Relay 8 [R08] - Close CBB / freely configurable	(False And False) And True (Delay ON, Delay OFF = 0 s)	dependent on application mode and Logics Command Variable [04.20]
In breaker mode'CBA/CBB' pre-configured to 'Close CBB'. Relay energizes if 'Closing CBB active' is active. Else deactivated by default.		
[99.09] Relay 9 [R09] - Auxiliary voltage and frequency ok / freely configurable	(02.08 Aux.volt.volt/freq ok And True) And True (Delay ON, Delay OFF = 0 s)	dependent Logics Command Variable [02.08]
Relay energizes if the internal condition 'Aux.volt.volt/freq ok' is TRUE		
[99.10] Relay 10 [R10] - OPeration mode manual / freely configurable	(04.03 Operat. mode MAN And True) And True (Delay ON, Delay OFF = 0 s)	dependent on Logics Command Variable [04.03]
Relay energizes if the internal condition 'Operat. mode MAN' is TRUE		
[99.11] Relay 11 [R11] - Warning alarm class active / freely configurable	(01.08 Warning Alarm And True) And True (Delay ON, Delay OFF = 0 s)	dependent on Logics Command Variable [01.08]
Relay energizes if one of the alarm classes A or B is active		
[99.12] Relay 12 [R12] - Shutdown alarm class active / freely configurable	(01.09 Shutdown Alarm And True) And True (Delay ON, Delay OFF = 0 s)	dependent on Logics Command Variable [01.09]
Relay energizes if one of the alarm classes C, D, E or F is active		

Discrete inputs

Number	LM	ID	Alarm class		Pre-assigned to
DI 01	09.01	10900	Control	freely configurable	Lock monitoring
DI 02	09.02	10901	Control	freely configurable	External Acknowledge
DI 03	09.03	10902	Control	freely configurable	Open CBB
DI 04	09.04	10903	Control	freely configurable	Enable close CBB
DI 05	09.05	10904	Control	restricted use for CBB open reply in breaker mode 'CBA/CBB'	unassigned (in breaker mode 'CBA')
DI 06	09.06	10905	Control	freely configurable	Open CBA
DI 07	09.07	10906	Control	freely configurable	Enable close CBA
DI 08	09.08	10907	Control	restricted use for CBA open reply	-

Number	LM	ID	Alarm class		Pre-assigned to
DI 09	09.09	10908	B	freely configurable	unassigned
DI 10	09.10	10909	B	freely configurable	unassigned
DI 11	09.11	10910	B	freely configurable	unassigned
DI 12	09.12	10911	B	freely configurable	unassigned

9.5 AnalogManager Reference

9.5.1 AnalogManager Overview

To enhance flexibility of programming the functions of the LS6 series, an AnalogManager is used.

All analog values may be used as data sources for the analog outputs (refer to ⮡ "4.4.1.5.1 Analog Outputs 1 and 2"), the flexible limit monitoring (refer to ⮡ "4.5.4 Flexible Limits").

- Every data source is indicated by a group number and a sub-number.
- Some values are percentage values and relate 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: System A values

The percentage value is related on the following values:

- System A rated voltage
- system rated frequency
- System A rated current
- power factor 1
- System A rated active power
- System A rated reactive power
- System A rated active and System A rated reactive power

HMI Text	Note
01.01 Syst.A volt.L-N [%]	System A Voltage wye average
01.02 Syst.A volt.L1-N [%]	System A voltage L1-N
01.03 Syst.A volt.L2-N [%]	System A voltage L2-N
01.04 Syst.A volt.L3-N [%]	System A voltage L3-N
01.05 Syst.A volt.L-L [%]	System A voltage delta average
01.06 Syst.A volt.L1-L2 [%]	System A voltage L1-L2
01.07 Syst.A volt.L2-L3 [%]	System A voltage L2-L3
01.08 Syst.A volt.L3-L1 [%]	System A voltage L3-L1
01.09 Syst.A frequency [%]	System A frequency
01.10 Syst.A freq.L1-L2 [%]	System A frequency L1-L2
01.11 Syst.A freq.L2-L3 [%]	System A frequency L2-L3
01.12 Syst.A freq.L3-L1 [%]	System A frequency L3-L1
01.13 Syst.A current [%]	System A average current
01.14 Syst.A current L1 [%]	System A current L1
01.15 Syst.A current L2 [%]	System A current L2
01.16 Syst.A current L3 [%]	System A current L3
01.17 Syst.A curr.max.L1[%]	Dragged System A current L1
01.18 Syst.A curr.max.L2[%]	Dragged System A current L2
01.19 Syst.A curr.max.L3[%]	Dragged System A current L3
01.20 Syst.A PF [%]	System A power factor
01.21 Syst.A PF L1 [%]	System A power factor L1
01.22 Syst.A PF L2 [%]	System A power factor L2
01.23 Syst.A PF L3 [%]	System A power factor L3
01.24 Syst.A act.power [%]	Total System A active power
01.25 Syst.A act.pwr.L1 [%]	System A active power L1-N

HMI Text	Note
01.26 Syst.A act.pwr.L2 [%]	System A active power L2-N
01.27 Syst.A act.pwr.L3 [%]	System A active power L3-N
01.28 Syst.A react.pwr. [%]	Total System A reactive power
01.29 Syst.A react.pwrL1[%]	System A reactive power L1-N
01.30 Syst.A react.pwrL2[%]	System A reactive power L2-N
01.31 Syst.A react.pwrL3[%]	System A reactive power L3-N
01.32 Syst.A app.power [%]	Total System A apparent power
01.33 Syst.A app.pwr.L1 [%]	System A apparent power L1-N
01.34 Syst.A app.pwr.L2 [%]	System A apparent power L2-N
01.35 Syst.A app.pwr.L3 [%]	System A apparent power L3-N
01.37 Syst.A ext.act.pwr[%]	System A external measured active power by AI
01.42 Sy.A ext.react.pwr[%]	System A external measured reactive power
01.43 System A ext. PF [%]	System A external power factor (calculated with ext. active/reactive power)
01.51 Syst.A volt.L-N [V]	System A voltage wye average
01.52 Syst.A volt.L1-N [V]	System A voltage L1-N
01.53 Syst.A volt.L2-N [V]	System A voltage L2-N
01.54 Syst.A volt.L3-N [V]	System A voltage L3-N
01.55 Syst.A volt.L-L [V]	System A voltage delta average
01.56 Syst.A volt.L1-L2 [V]	System A voltage L1-L2
01.57 Syst.A volt.L2-L3 [V]	System A voltage L2-L3
01.58 Syst.A volt.L3-L1 [V]	System A voltage L3-L1
01.59 Syst.A frequency [Hz]	System A frequency
01.60 Syst.A freq.L1-L2[Hz]	System A frequency L1-L2
01.61 Syst.A freq.L2-L3[Hz]	System A frequency L2-L3
01.62 Syst.A freq.L3-L1[Hz]	System A frequency L3-L1
01.63 Syst.A current [A]	System A average current
01.64 Syst.A current L1 [A]	System A current L1
01.65 Syst.A current L2 [A]	System A current L2
01.66 Syst.A current L3 [A]	System A current L3
01.67 Syst.A curr.max.L1[A]	Dragged System A current L1
01.68 Syst.A curr.max.L2[A]	Dragged System A current L2
01.69 Syst.A curr.max.L3[A]	Dragged System A current L3
01.70 Syst.A PF	System A power factor
01.71 Syst.A PF L1	System A power factor L1
01.72 Syst.A PF L2	System A power factor L2
01.73 Syst.A PF L3	System A power factor L3
01.74 Syst.A act.power [W]	Total System A active power
01.75 Syst.A act.pwr.L1 [W]	System A active power L1-N

HMI Text	Note
01.76 Syst.A act.pwr.L2 [W]	System A active power L2-N
01.77 Syst.A act.pwr.L3 [W]	System A active power L3-N
01.78 Syst.A react.pwr[var]	Total System A reactive power
01.79 Sy.A react.pwrL1[var]	System A reactive power L1-N
01.80 Sy.A react.pwrL2[var]	System A reactive power L2-N
01.81 Sy.A react.pwrL3[var]	System A reactive power L3-N
01.82 Syst.A app.power [VA]	Total System A apparent power
01.83 Syst.A app.pwr.L1[VA]	System A apparent power L1-N
01.84 Syst.A app.pwr.L2[VA]	System A apparent power L2-N
01.85 Syst.A app.pwr.L3[VA]	System A apparent power L3-N
01.87 Syst.A ext.act.pwr[W]	System A external measured active power by AI
01.92 SyA ext.reac.pwr[var]	System A external measured reactive power
01.93 System A ext. PF	System A external power factor (calculated with ext. active/reactive power)

9.5.2.2 Group 02: System B values

The percentage value is related on the following values:

- System B rated voltage
- system rated frequency
- System B rated current
- power factor 1
- System B rated active power
- System B rated reactive power
- System B rated active and System B rated reactive power

HMI Text	Note
02.01 System B volt.L-N [%]	System B voltage wye average
02.02 Syst.B volt.L1-N [%]	System B voltage 1-N
02.03 Syst.B volt.L2-N [%]	System B voltage 2-N
02.04 Syst.B volt.L3-N [%]	System B voltage 3-N
02.05 System B volt.L-L [%]	System B voltage delta average
02.06 Syst.B volt.L1-L2 [%]	System B voltage 1-2
02.07 Syst.B volt.L2-L3 [%]	System B voltage 2-3
02.08 Syst.B volt.L3-L1 [%]	System B voltage 3-1
02.09 Syst.B frequency [%]	System B frequency
02.10 Syst.B freq.L1-L2 [%]	System B frequency 1-2
02.11 Syst.B freq.L2-L3 [%]	System B frequency 2-3

HMI Text	Note
02.12 Syst.B freq.L3-L1 [%]	System B frequency 3-1
02.13 System B current [%]	System B average current
02.14 Syst.B current L1 [%]	System B current 1
02.15 Syst.B current L2 [%]	System B current 2
02.16 Syst.B current L3 [%]	System B current 3
02.17 Syst.B curr.max.L1[%]	System B dragged current 1
02.18 Syst.B curr.max.L2[%]	System B dragged current 2
02.19 Syst.B curr.max.L3[%]	System B dragged current 3
02.20 System B PF [%]	System B power factor
02.21 System B PF L1 [%]	System B power factor 1
02.22 System B PF L2 [%]	System B power factor 2
02.23 System B PF L3 [%]	System B power factor 3
02.24 Syst.B act.power [%]	System B active power
02.25 Syst.B act.pwr.L1 [%]	System B power 1-N
02.26 Syst.B act.pwr.L2 [%]	System B power 2-N
02.27 Syst.B act.pwr.L3 [%]	System B power 3-N
02.28 Syst.B react.pwr. [%]	System B reactive power
02.29 Syst.B react.pwrL1[%]	System B reactive power 1-N
02.30 Syst.B react.pwrL2[%]	System B reactive power 2-N
02.31 Syst.B react.pwrL3[%]	System B reactive power 3-N
02.32 Syst.B app.power [%]	System B total apparent power
02.33 Syst.B app.pwr.L1 [%]	System B apparent power 1-N
02.34 Syst.B app.pwr.L2 [%]	System B apparent power 2-N
02.35 Syst.B app.pwr.L3 [%]	System B apparent power 3-N
02.36 Syst.B ext.act.pwr[%]	System B external measured active power by AI
02.37 Sy.B ext.react.pwr[%]	System B external measured reactive power
02.38 System B ext. PF [%]	System B external power factor (calculated with ext. active/reactive power)
02.51 Syst.B volt.L-N [V]	System B voltage wye average
02.52 Syst.B volt.L1-N [V]	System B voltage 1-N
02.53 Syst.B volt.L2-N [V]	System B voltage 2-N
02.54 Syst.B volt.L3-N [V]	System B voltage 3-N
02.55 Syst.B volt.L-L [V]	System B voltage delta average
02.56 Syst.B volt.L1-L2 [V]	System B voltage 1-2
02.57 Syst.B volt.L2-L3 [V]	System B voltage 2-3
02.58 Syst.B volt.L3-L1 [V]	System B voltage 3-1
02.59 Syst.B frequency [Hz]	System B frequency
02.60 Syst.B freq.L1-L2[Hz]	System B frequency 1-2
02.61 Syst.B freq.L2-L3[Hz]	System B frequency 2-3

HMI Text	Note
02.62 Syst.B freq.L3-L1[Hz]	System B frequency 3-1
02.63 Syst.B current [A]	System B average current
02.64 Syst.B current L1 [A]	System B current 1
02.65 Syst.B current L2 [A]	System B current 2
02.66 Syst.B current L3 [A]	System B current 3
02.67 Syst.B curr.max.L1[A]	System B dragged current 1
02.68 Syst.B curr.max.L2[A]	System B dragged current 2
02.69 Syst.B curr.max.L3[A]	System B dragged current 3
02.70 System B PF	System B power factor
02.71 System B PF L1	System B power factor 1
02.72 System B PF L2	System B power factor 2
02.73 System B PF L3	System B power factor 3
02.74 Syst.B act.power [W]	System B total active power
02.75 Syst.B act.pwr.L1 [W]	System B active power 1-N
02.76 Syst.B act.pwr.L2 [W]	System B active power 2-N
02.77 Syst.B act.pwr.L3 [W]	System B active power 3-N
02.78 Syst.B react.pwr[var]	System B total reactive power
02.79 Sy.B react.pwrL1[var]	System B reactive power 1-N
02.80 Sy.B react.pwrL2[var]	System B reactive power 2-N
02.81 Sy.B react.pwrL3[var]	System B reactive power 3-N
02.82 Syst.B app.power [VA]	System B total apparent power
02.83 Syst.B app.pwr.L1[VA]	System B apparent power 1-N
02.84 Syst.B app.pwr.L2[VA]	System B apparent power 2-N
02.85 Syst.B app.pwr.L3[VA]	System B apparent power 3-N
02.86 Syst.B ext.act.pwr[W]	System B external measured active power by AI
02.87 SyB ext.reac.pwr[var]	System B external measured reactive power
02.88 System B ext. PF	System B external power factor (calculated with ext. active/reactive power)

9.5.2.3 Group 03: Busbar 1 values

The percentage value is related on the following values:

- auxiliary voltage rated voltage
- system rated frequency

HMI Text	Note

9.5.2.4 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
06.04 Analog input 4	
06.05 Analog input 5	
06.06 Analog input 6	
06.07 Analog input 7	
06.08 Analog input 8	
06.09 Analog input 9	
06.10 Analog input 10	

9.5.2.5 Group 10: Internal values

HMI Text	Note
10.01 ZERO	Zero
10.02 ONE	One
10.04 Battery voltage [%]	Battery voltage
10.45 Syst.B Gen act.P [%]	Actual generator active power with connection to the segment number from System B.
10.46 Syst.B Gen act.Q [%]	Actual generator reactive power with connection to the segment number from System B.
10.54 Battery voltage [V]	Battery voltage
10.79 RTC Year	RTC Year
10.80 RTC Month	RTC Month
10.81 RTC Day	RTC Day
10.82 RTC Hour	RTC Hour
10.83 RTC Minute	RTC Minute
10.84 RTC Second	RTC Second
10.85 RTC Weekday	RTC Weekday
10.95 Syst.B Gen act.P [kW]	Actual generator active power with connection to the segment number from System B.
10.96 Sy.B Gen act.Q [kvar]	Actual generator reactive power with connection to the segment number from System B.
10.97 Closed GCBs syst.B	Closed generator breaker with connection to the segment number from System B.

9.5.2.6 Group 13: Constants

HMI Text	Note
13.01 Free constant 1	Free constant 1
13.02 Free constant 2	Free constant 2

HMI Text	Note
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

9.5.2.7 Group 21: CAN1 Receive

HMI Text	Note
21.01 CAN1 RPDO1.1	CAN1 RPDO1.1
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

HMI Text	Note
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

TRUE if the flag is active

HMI Text	Note
54.01 Mapped AM value 1	Modbus Master mapped AM value 1
54.02 Mapped AM value 2	Modbus Master mapped AM value 2
54.03 Mapped AM value 3	Modbus Master mapped AM value 3
54.04 Mapped AM value 4	Modbus Master mapped AM value 4
54.05 Mapped AM value 5	Modbus Master mapped AM value 5
54.06 Mapped AM value 6	Modbus Master mapped AM value 6
54.07 Mapped AM value 7	Modbus Master mapped AM value 7
54.08 Mapped AM value 8	Modbus Master mapped AM value 8
54.09 Mapped AM value 9	Modbus Master mapped AM value 9
54.10 Mapped AM value 10	Modbus Master mapped AM value 10
54.11 Mapped AM value 11	Modbus Master mapped AM value 11
54.12 Mapped AM value 12	Modbus Master mapped AM value 12
54.13 Mapped AM value 13	Modbus Master mapped AM value 13
54.14 Mapped AM value 14	Modbus Master mapped AM value 14
54.15 Mapped AM value 15	Modbus Master mapped AM value 15
54.16 Mapped AM value 16	Modbus Master mapped AM value 16
54.17 Mapped AM value 17	Modbus Master mapped AM value 17
54.18 Mapped AM value 18	Modbus Master mapped AM value 18
54.19 Mapped AM value 19	Modbus Master mapped AM value 19
54.20 Mapped AM value 20	Modbus Master mapped AM value 20

HMI Text	Note
54.21 Mapped AM value 21	Modbus Master mapped AM value 21
54.22 Mapped AM value 22	Modbus Master mapped AM value 22
54.23 Mapped AM value 23	Modbus Master mapped AM value 23
54.24 Mapped AM value 24	Modbus Master mapped AM value 24
54.25 Mapped AM value 25	Modbus Master mapped AM value 25
54.26 Mapped AM value 26	Modbus Master mapped AM value 26
54.27 Mapped AM value 27	Modbus Master mapped AM value 27
54.28 Mapped AM value 28	Modbus Master mapped AM value 28
54.29 Mapped AM value 29	Modbus Master mapped AM value 29
54.30 Mapped AM value 30	Modbus Master mapped AM value 30
54.31 Mapped AM value 31	Modbus Master mapped AM value 31
54.32 Mapped AM value 32	Modbus Master mapped AM value 32
54.33 Mapped AM value 33	Modbus Master mapped AM value 33
54.34 Mapped AM value 34	Modbus Master mapped AM value 34
54.35 Mapped AM value 35	Modbus Master mapped AM value 35
54.36 Mapped AM value 36	Modbus Master mapped AM value 36
54.37 Mapped AM value 37	Modbus Master mapped AM value 37
54.38 Mapped AM value 38	Modbus Master mapped AM value 38
54.39 Mapped AM value 39	Modbus Master mapped AM value 39
54.40 Mapped AM value 40	Modbus Master mapped AM value 40
54.41 Mapped AM value 41	Modbus Master mapped AM value 41
54.42 Mapped AM value 42	Modbus Master mapped AM value 42
54.43 Mapped AM value 43	Modbus Master mapped AM value 43
54.44 Mapped AM value 44	Modbus Master mapped AM value 44
54.45 Mapped AM value 45	Modbus Master mapped AM value 45
54.46 Mapped AM value 46	Modbus Master mapped AM value 46
54.47 Mapped AM value 47	Modbus Master mapped AM value 47
54.48 Mapped AM value 48	Modbus Master mapped AM value 48
54.49 Mapped AM value 49	Modbus Master mapped AM value 49
54.50 Mapped AM value 50	Modbus Master mapped AM value 50
54.51 Mapped AM value 51	Modbus Master mapped AM value 51
54.52 Mapped AM value 52	Modbus Master mapped AM value 52
54.53 Mapped AM value 53	Modbus Master mapped AM value 53
54.54 Mapped AM value 54	Modbus Master mapped AM value 54
54.55 Mapped AM value 55	Modbus Master mapped AM value 55
54.56 Mapped AM value 56	Modbus Master mapped AM value 56
54.57 Mapped AM value 57	Modbus Master mapped AM value 57
54.58 Mapped AM value 58	Modbus Master mapped AM value 58

HMI Text	Note
54.59 Mapped AM value 59	Modbus Master mapped AM value 59
54.60 Mapped AM value 60	Modbus Master mapped AM value 60
54.61 Mapped AM value 61	Modbus Master mapped AM value 61
54.62 Mapped AM value 62	Modbus Master mapped AM value 62
54.63 Mapped AM value 63	Modbus Master mapped AM value 63
54.64 Mapped AM value 64	Modbus Master mapped AM value 64
54.65 Mapped AM value 65	Modbus Master mapped AM value 65
54.66 Mapped AM value 66	Modbus Master mapped AM value 66
54.67 Mapped AM value 67	Modbus Master mapped AM value 67
54.68 Mapped AM value 68	Modbus Master mapped AM value 68
54.69 Mapped AM value 69	Modbus Master mapped AM value 69
54.70 Mapped AM value 70	Modbus Master mapped AM value 70
54.71 Mapped AM value 71	Modbus Master mapped AM value 71
54.72 Mapped AM value 72	Modbus Master mapped AM value 72
54.73 Mapped AM value 73	Modbus Master mapped AM value 73
54.74 Mapped AM value 74	Modbus Master mapped AM value 74
54.75 Mapped AM value 75	Modbus Master mapped AM value 75
54.76 Mapped AM value 76	Modbus Master mapped AM value 76
54.77 Mapped AM value 77	Modbus Master mapped AM value 77
54.78 Mapped AM value 78	Modbus Master mapped AM value 78
54.79 Mapped AM value 79	Modbus Master mapped AM value 79
54.80 Mapped AM value 80	Modbus Master mapped AM value 80
54.81 Mapped AM value 81	Modbus Master mapped AM value 81
54.82 Mapped AM value 82	Modbus Master mapped AM value 82
54.83 Mapped AM value 83	Modbus Master mapped AM value 83
54.84 Mapped AM value 84	Modbus Master mapped AM value 84
54.85 Mapped AM value 85	Modbus Master mapped AM value 85
54.86 Mapped AM value 86	Modbus Master mapped AM value 86
54.87 Mapped AM value 87	Modbus Master mapped AM value 87
54.88 Mapped AM value 88	Modbus Master mapped AM value 88
54.89 Mapped AM value 89	Modbus Master mapped AM value 89
54.90 Mapped AM value 90	Modbus Master mapped AM value 90
54.91 Mapped AM value 91	Modbus Master mapped AM value 91
54.92 Mapped AM value 92	Modbus Master mapped AM value 92
54.93 Mapped AM value 93	Modbus Master mapped AM value 93
54.94 Mapped AM value 94	Modbus Master mapped AM value 94
54.95 Mapped AM value 95	Modbus Master mapped AM value 95
54.96 Mapped AM value 96	Modbus Master mapped AM value 96

HMI Text	Note
54.97 Mapped AM value 97	Modbus Master mapped AM value 97
54.98 Mapped AM value 98	Modbus Master mapped AM value 98
54.99 Mapped AM value 99	Modbus Master 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.SysB act.pwr.	External measured System B active power
81.20 AM Ext.SysB react.pwr	External measured System B reactive power
81.33 AM Ext.SysA act.pwr.	External measured System A active power
81.43 AM Ext.SysA react.pwr	External measured System A 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
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

HMI Text	Note
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 90: Internal Values 0

Analog outputs of function-related AnalogManagers.

HMI Text	Note
90.01 AM Cust.screen 1.1	Customer defined screen 1 row 1
90.02 AM Cust.screen 1.2	Customer defined screen 1 row 2
90.03 AM Cust.screen 1.3	Customer defined screen 1 row 3
90.04 AM Cust.screen 1.4	Customer defined screen 1 row 4
90.05 AM Cust.screen 1.5	Customer defined screen 1 row 5
90.06 AM Cust.screen 1.6	Customer defined screen 1 row 6
90.07 AM Cust.screen 1.7	Customer defined screen 1 row 7
90.08 AM Cust.screen 1.8	Customer defined screen 1 row 8
90.09 AM Cust.screen 1.9	Customer defined screen 1 row 9
90.51 AM Cust.screen 2.1	Customer defined screen 2 row 1
90.52 AM Cust.screen 2.2	Customer defined screen 2 row 2
90.53 AM Cust.screen 2.3	Customer defined screen 2 row 3
90.54 AM Cust.screen 2.4	Customer defined screen 2 row 4
90.55 AM Cust.screen 2.5	Customer defined screen 2 row 5

HMI Text	Note
90.56 AM Cust.screen 2.6	Customer defined screen 2 row 6
90.57 AM Cust.screen 2.7	Customer defined screen 2 row 7
90.58 AM Cust.screen 2.8	Customer defined screen 2 row 8
90.59 AM Cust.screen 2.9	Customer defined screen 2 row 9

9.5.2.13 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

9.5.2.14 Group 93: Analog Outputs 1

Analog outputs of function-related AnalogManagers.

HMI Text	Note
93.01 AM Data source AO1	Analog output 1 data source
93.02 AM Data source AO2	Analog output 2 data source

9.5.3 Reference Values

9.5.3.1 System A Rated Voltage

System A voltage values

(Wye and Delta and average values)

User defined max. output value = 100% means, that the 100% refer to the System A 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 System B Rated Voltage

System B voltage values

(Wye, Delta, Average, and dragged values)

User defined max. output value = 100% means, that the 100% refer to the System B 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 Nominal Frequency

System A, System B, Auxilary voltage frequency values

User defined max. output value = 100% means, that the 100% refer to the nominal frequency. If parameter “Source value at maximal output” is set to “+100.00%” this will result in that the Analog output delivers its maximum output value if a for example 50Hz are the nominal value and 50V are measured.

9.5.3.4 System A/System B rated active/reactive Power

System A and System B active/ reactive/ apparent power values

User defined max. output value = 100% means, that the 100% refer to the rated active power value. If parameter “Source value at maximal output” is set to “+100.00%” this will result in that the Analog output delivers its maximum output value if a for example 1000kW are the nominal value and 1000kW are measured. If only 200kW are measured this will result in an Analog output value of 20% end scale.

9.5.3.5 System A/System B Power Factor

System A and System B Power factors

User defined max. output value = 100% means, that 50% refers to power factor 1.00.

If the power factor moves to lagging (inductive) the output goes to 100%. If the power factor goes to leading (capacitive), the output goes to 0%.

Examples:

0,05% = -0,001(capacitive)

99,95% = 0,001(inductive)

100% = 0% = cosphi 0

9.5.3.6 System A Rated Current

System A current values

(Wye,Delta,Average and dragged values)

User defined max. output value = 100% means, that the 100% refer to the rated System A current. If parameter “Source value at maximal output” is set to “+100.00%” this will result in that the Analog output delivers its maximum output value if a for example 1000A are the nominal value and 1000A are measured. If only 200A are measured this will result in an Analog output value of 20% end scale.

9.5.3.7 System B rated Current

System B current values

(Wye,Delta,Average and dragged values)

User defined max. output value = 100% means, that the 100% refer to the rated System B current. If parameter “Source value at maximal output” is set to “+100.00%” this will result in that the Analog output delivers its maximum output value if a for example 1000A are the nominal value and 1000A are measured. If only 200A are measured this will result in an Analog output value of 20% end scale.

9.5.3.8 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.

9.5.3.9 Fixed Value 10000

Analog inputs, GAP values

User defined max. output value = 100% means, that the 100% refer to a fixed value of 10000. If parameter “Source value at maximal output” is set to “+100.00%” this will result in that the Analog output delivers its maximum output value if a for example “10000” is delivered by GAP.

9.5.3.10 Auxiliary voltage Rated Voltage

Auxiliary voltages (delta values)

User defined max. output value = 100% means, that the 100% refer to the nominal Auxiliary voltage. If parameter “Source value at maximal output” is set to “+100.00%”

this will result in that the Analog output delivers its maximum output value if a for example 400V are the nominal value and 400V are measured.

9.5.3.11 Display Value Format

The analog input values refer to the display value format (refer to parameter ⮡ 1035).

Delimiters like decimal points or commas are ignored. If the display value format is 0.01 bar for example, a value of 5 bar corresponds with 00500.

Analog output example

- An analog input is configured to VDO 120 °C characteristic.
- The source value at maximum output is configured to 00100 (i.e. 100 °C).
- The source value at minimum output is configured to 00020 (i.e. 20 °C).
- The analog output range is configured to 0 to 20 mA.

- If a value of 20 °C (or below) is measured, the analog output issues its lower limit (i.e. 0 mA).
- If a value of 100 °C (or above) is measured, the analog output issues its upper limit (i.e. 20 mA).
- If a value of 60 °C is measured, the analog output issues 50% of its upper limit (i.e. 10 mA).
- If a value of 84 °C is measured, the analog output issues 80% of its upper limit (i.e. 16 mA).

Flexible limit example

- An analog input is configured to VDO 10 bar characteristic.
- If the flexible limit is to be configured to 5.23 bar, it must be entered as 00523.

See the fixed display value formats below:

Analog input type	Display value format	Example value	Example format
VDO 5 bar	0.01 bar	5.0 bar	500
VDO 10 bar	0.01 bar	6.6 bar	660
VDO 120 °C	1 °C	69 °C	69
VDO 150 °C	1 °C	73 °C	73
Pt100	1 °C	103 °C	103

Table 75: Display value format

9.5.4 Factory Settings

AnalogManager's default settings

ID	Name	Operator	Default setting/value
5200	AM Data source AO1	Analog1 ("A1 =")	06.01 Analog input 1
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	96.01 LM: Flag 1
		Logic2 "L2"	96.01 LM: Flag 1
		Operators	
		Operators-Unary1	NOT
		Operators-Unary2	NOT
5214	AM Data source AO2	Analog1 ("A1 =")	06.01 Analog input 1
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	96.01 LM: Flag 1
		Logic2 "L2"	96.01 LM: Flag 1
		Operators	
		Operators-Unary1	NOT
		Operators-Unary2	NOT
5780	AM Ext.System B act.pwr	Analog1 ("A1 =")	06.02 Analog input 2
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	5
		Operators-Unary1	—————
		Operators-Unary2	—————
5794	AM Ext.Syst.B react.pwr	Analog1 ("A1 =")	10.01 ZERO
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	5
		Operators-Unary1	—————

ID	Name	Operator	Default setting/value
		Operators-Unary2	――――――
6009	AM Ext.System A act.pwr	Analog1 ("A1 =")	06.01 Analog input 1
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	5
		Operators-Unary1	――――――
		Operators-Unary2	――――――
6029	AM Ext.Syst.A react.pwr	Analog1 ("A1 =")	10.01 ZERO
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	5
		Operators-Unary1	――――――
		Operators-Unary2	――――――
4206 4223 4240 4257 4276 4286 4296	AM FlexLim 1 source AM FlexLim 2 source AM FlexLim 3 source AM FlexLim 4 source AM FlexLim 5 source AM FlexLim 6 source AM FlexLim 7 source	Analog1 ("A1 =")	10.01 ZERO
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	5
		Operators-Unary1	――――――
		Operators-Unary2	――――――
6006 6016 6026 6026 + (N * 10) ... 6326	AM FlexLim 8 source AM FlexLim 9 source AM FlexLim 10 source AM FlexLim 10 + N source (N = 1, 2, ...30) ... AM FlexLim 40 source	Analog1 ("A1 =")	10.01 ZERO
		Analog2 ("A2 =")	10.01 ZERO
		Constant1 ("C1 =")	0
		Function Type ("Type =")	Pass through
		Logic1 "L1"	02.01 LM FALSE
		Logic2 "L2"	02.01 LM FALSE
		Operators	5
		Operators-Unary1	――――――
		Operators-Unary2	――――――
7690	AM Customer screen 1.1	Analog1 ("A1 =")	10.01 ZERO

ID	Name	Operator	Default setting/value
7695	AM Customer screen 1.2	Analog2 ("A2 =")	10.01 ZERO
7700	AM Customer screen 1.3	Constant1 ("C1 =")	0
7705	AM Customer screen 1.4	Function Type ("Type =")	Pass through
7710	AM Customer screen 1.5	Logic1 "L1"	02.01 LM FALSE
7715	AM Customer screen 1.6	Logic2 "L2"	02.01 LM FALSE
7720	AM Customer screen 1.7	Operators	———————
7725	AM Customer screen 1.8	Operators-Unary1	———————
7730	AM Customer screen 2.9	Operators-Unary2	———————
7735	AM Customer screen 2.1		
7740	AM Customer screen 2.2		
7745	AM Customer screen 2.3		
7750	AM Customer screen 2.4		
7755	AM Customer screen 2.5		
7760	AM Customer screen 2.6		
7765	AM Customer screen 2.7		
7770	AM Customer screen 2.8		
7775	AM Customer screen 2.9		
9640	AM Internal value 1	Analog1 ("A1 =")	10.01 ZERO
9644	AM Internal value 2	Analog2 ("A2 =")	10.01 ZERO
9648	AM Internal value 3	Constant1 ("C1 =")	0
9652	AM Internal value 4	Function Type ("Type =")	Pass through
9656	AM Internal value 5	Logic1 "L1"	02.01 LM FALSE
9660	AM Internal value 6	Logic2 "L2"	02.01 LM FALSE
9664	AM Internal value 7	Operators	5
9668	AM Internal value 8	Operators-Unary1	———————
9672	AM Internal value 9	Operators-Unary2	———————
9676	AM Internal value 10		
9680	AM Internal value 11		
9684	AM Internal value 12		
9688	AM Internal value 13		
9692	AM Internal value 14		
9696	AM Internal value 15		
9700	AM Internal value 16		

Table 76: Factory settings: AnalogManager

9.6 Event And Alarm Reference

9.6.1 Status messages

Message text	ID	Meaning
AUTO mode	14353	Operation mode AUTOMATIC is active
MAN mode	14355	Operation mode MANUAL is active
CBB dead bus close	13209	Dead bus closing of the CBB
Unloading CBA	13264	Unloading the CBA
Unloading CBB	13256	Unloading the CBB
CBB -> CBA Delay	13261	CBB - CBA delay time is active If the breaker logic is configured to Open Transition and a transfer from System B to System A supply is initiated, the transfer time delay will start after the replay "CBB is open" is received. The CBA close command will be issued after the transfer time has expired.
CBA dead bus close	13210	Dead bus closing of the CBA
CBA -> CBB Delay	13262	CBA - CBB delay time is active If the breaker logic is configured to Open Transition and a transfer from System A to System B supply is initiated, the transfer time delay will start after the replay "CBA is open" is received. The CBB close command will be issued after the transfer time has expired.
Synchronization CBB	13259	The CBB will be synchronized The control tries to synchronize the CBB.
Synchronization CBA	13260	The CBA will be synchronized The control tries to synchronize the CBA.
Mains settling	13205	Mains settling time is active. When the control unit detects that the mains fault is no longer present and power has been restored, the mains settling timer begins counting down.
CBB open	13255	The CBB is being opened A CBB open command has been issued.
CBA open	13257	The CBA is being opened A CBA open command has been issued.
CBB Request	13340	CBB request There is a command to open or close the CBB, but the execution is already blocked by the priority of a breaker command of another LSx or the LSx is still arbitrating the priority.
CBA Request	13280	CBA request There is a command to open or close the CBA, but the execution is already blocked by the priority of a breaker command of another LSx or the LSx is still arbitrating the priority.

Message text	ID	Meaning
Synch. PERMISSIVE	13265	Synchronization mode PERMISSIVE. The frequency / voltage regulation for synchronization is disabled. The according breaker close pulse is enabled.
Synch. CHECK	13266	Synchronization mode CHECK. The frequency / voltage regulation for synchronization is enabled. The according breaker close pulse is disabled
Synch. OFF	13267	Synchronization mode OFF. The frequency / voltage regulation for synchronization is disabled. The close pulse is disabled.
Syn. mains close CBA	13279	Synchronous mains close CBA. The LS-6XT has detected that System A and System B are connected to mains and is closing the CBA according to the synchronous mains condition.
Syn. segm. close CBA	13286	Synchronous segment close CBA. The LS-6XT has detected that System A and System B are already alternatively connected and is closing the CBA according to the synchronous segments condition.
Syn. mains close CBB	15030	Synchronous mains close CBB. The LS-6XT has detected that System A and System B are connected to mains and is closing the CBB according to the synchronous mains condition.
Syn. segm. close CBB	15029	Synchronous segment close CBB. The LS-6XT has detected that System A and System B are already alternatively connected and is closing the CBB according to the synchronous segments condition.
System update	14763	System update is active The system update procedure is ongoing.

9.6.2 Event Message

Message text	ID	Meaning
Startup power supply	14778	The power supply from the unit is switched on
AUTO mode	14353	The unit is switched to AUTO mode
MAN mode	14355	The unit is switched to MAN mode
CBA opened	14700	The CBA reply signals CBA is open
CBA closed	14701	The CBA reply signals CBA is closed
CBB opened	14702	The CBB reply signals CBB is open
CBB closed	14703	The CBB reply signals CBB is closed

Message text	ID	Meaning
System A is ok	14724	The system A is okay (frequency and voltage)
System B is ok	14727	The system B is okay (frequency and voltage)
Close command CBA	14730	Control command CBA close
Open command CBA	14731	Control command CBA open
Close command CBB	14732	Control command CBB close
Open command CBB	14733	Control command CBB open
System update	14763	System update is active

9.6.3 Event History

General notes

The event history is a 1000 entry FIFO (First In/First Out) memory for logging alarm events and operation states of the unit. As new event messages are entered into the history, the oldest messages are deleted once 1000 events have occurred.

For additional information refer to ⮡ "5 Operation".

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 ⮡ "4.3.4.1 Password System - Parameter Overview").

Three ways to reset Event History

- **ToolKit**: Click the »Clear all « button at [STATUS MENU / Diagnostic: Event History].

  (Read Event History at the same page)

- **HMI/display**: Go to [Parameter / Configure system management / Factory default settings] and select »Yes«, then »Clear eventlog« appears. Select »Yes« for »Clear event log«

  (To read Event History go to: [Next Page / Diagnostic / Event History])

- **Parameter/remote**:Set parameter ⮡ 1706»Clear eventlog«) to "TRUE" (1)

- The complete event history is now being cleared

9.6.4 Alarm Classes

Application mode "CBA"

The control functions are structured in the following alarm classes:

Alarm class	Visible in the display	LED "Alarm" & horn	Relay "Command: open CBA"
A	yes	no	no
Warning Alarm	This alarm does not open a breaker. A message output without a centralized alarm occurs: • Alarm text.		
B	yes	yes	no
Warning Alarm	This alarm does not open a breaker. An output of the centralized alarm occurs and the command variable 3.05 (horn) is issued. • Alarm text + flashing LED "Alarm" + Relay centralized alarm (horn).		
C	yes	yes	with unloading
Shutdown Alarm	With this alarm the CBA is opened with unloading. • Alarm text + flashing LED "Alarm" + Relay centralized alarm (horn) + CBA open with unloading .		
D	yes	yes	immediately
Shutdown Alarm	With this alarm the CBA is opened immediately. • Alarm text + flashing LED "Alarm" + Relay centralized alarm (horn) + CBA open immediately.		
E	yes	yes	immediately
Shutdown Alarm	With this alarm the CBA is opened immediately. • Alarm text + flashing LED "Alarm" + Relay centralized alarm (horn)+ CBA open immediately.		
F	yes	yes	immediately
Shutdown Alarm	With this alarm the CBA is opened immediately. • Alarm text + flashing LED "Alarm" + Relay centralized alarm (horn)+ CBA open immediately.		
Control	no	no	no
Control Signal	This signal issues a control command only. It may be assigned to a discrete input for example to get a control signal, which may be used in the LogicsManager. No alarm message and no entry in the alarm list or the event history will be issued. This signal is always self-acknowledging, but considers a delay time and may also be configured with "Monitoring lockable".		

Application mode "CBA/CBB"

The control functions are structured in the following alarm classes:

Alarm class	Visible in the display	LED "Alarm" & horn	Relay "Command: open CBA"	Relay "Command: open CBB"
A	yes	no	no	no
Warning Alarm	This alarm does not open a breaker. A message output without a centralized alarm occurs: • Alarm text.			
B	yes	yes	no	no
Warning Alarm	This alarm does not open a breaker. An output of the centralized alarm occurs and the command variable 3.05 (horn) is issued. • Alarm text + flashing LED "Alarm" + Relay centralized alarm (horn).			
C	yes	yes	with unloading	no

Alarm class	Visible in the display	LED "Alarm" & horn	Relay "Command: open CBA"	Relay "Command: open CBB"
Shutdown Alarm	With this alarm the CBA is opened with unloading. • Alarm text + flashing LED "Alarm" + Relay centralized alarm (horn) + CBA open with unloading.			
D	yes	yes	immediately	no
Shutdown Alarm	With this alarm the CBA is opened immediately. • Alarm text + flashing LED "Alarm" + Relay centralized alarm (horn) + CBA open immediately.			
E	yes	yes	no	with unloading
Shutdown Alarm	With this alarm the CBB is opened with unloading. • Alarm text + flashing LED "Alarm" + Relay centralized alarm (horn) + CBB open with unloading.			
F	yes	yes	no	immediately
Shutdown Alarm	With this alarm the CBB is opened immediately. • Alarm text + flashing LED "Alarm" + Relay centralized alarm (horn) + CBB open immediately.			
Control	no	no	no	no
Control Signal	This signal issues a control command only. It may be assigned to a discrete input for example to get a control signal, which may be used in the LogicsManager. No alarm message and no entry in the alarm list or the event history will be issued. This signal is always self-acknowledging, but considers a delay time and may also be configured with "Monitoring lockable".			

9.6.5 Alarm Messages

9.6.5.1 No alarm

Message text	ID	Meaning
No alarm active	13328	There is no alarm active.

9.6.5.2 System B monitoring

Message text	ID	Meaning
Syst.B phase rot.	3955	System B rotating field mismatch The system B rotating field does not correspond with the configured direction.

9.6.5.3 System A monitoring

Message text	ID	Meaning
System A overfreq.1	2862	System A (Mains) overfrequency, limit value 1 The system A frequency has exceeded the limit value 1 for system A overfrequency.
System A overfreq.2	2863	System A (Mains) overfrequency, limit value 2

Message text	ID	Meaning
		The system A frequency has exceeded the limit value 2 for system A overfrequency.
System A underfreq.1	2912	System A (Mains) underfrequency, limit value 1 The system A frequency has fallen below the limit value 1 for system A underfrequency.
System A underfreq.2	2913	System A (Mains) overfrequency, limit value 2 The system A frequency has fallen below the limit value 2 for system A underfrequency.
Syst.A overvoltage 1	2962	System A (Mains) overvoltage, limit value 1 The system A (Mains) voltage has exceeded the limit value 1 for system A overvoltage.
Syst.A overvoltage 2	2963	Mains overvoltage, limit value 2 The system A (Mains) voltage has exceeded the limit value 2 for system A overvoltage.
Syst.A undervolt. 1	3012	System A (Mains) undervoltage, limit value 1 The system A (Mains) voltage has fallen below the limit value 1 for system A undervoltage.
Syst.A undervolt. 2	3013	System A (Mains) undervoltage, limit value 2 The system A (Mains) voltage has fallen below the limit value 2 for system A undervoltage.
System A phase shift	3057	System A (Mains) phase shift A system A (Mains) phase shift, which has exceeded the configured limit, has occurred.
System A df/dt	3106	System A df/dt (ROCOF) A system A (Mains) df/dt, which has exceeded the configured limit, has occurred.
System A decoupling	3114	System A (Mains) decoupling is initiated One or more monitoring function(s) considered for the mains decoupling functionality has triggered.
Decoupling CBA<->CBB	5147	Decoupling CBA < - > CBB During decoupling there was a change over from the preferred breaker to the other.
Syst.A phase rot.	3975	System A rotating field mismatch The system A rotating field does not correspond with the configured direction.
Syst.A volt. asym.	3928	System A voltage asymmetry The system A voltage asymmetry has exceeded the limit.
System A volt. incr.	8834	System A voltage increase monitor has tripped The System A voltage has exceeded for a longer time period the voltage increase criteria.
CBA unload mismatch	8838	CBA unloading mismatch

Message text	ID	Meaning
		While unloading CBA the defined limit of load is not reached in the defined time.
CBB unload mismatch	3124	CBB unloading mismatch While unloading CBB the defined limit of load is not reached in the defined time.
System A QV mon.1	3288	QV monitoring, delay time 1 The System A reactive power has exceeded the limit with delay time 1.
System A QV mon.2	3289	QV monitoring, delay time 2 The System A reactive power has exceeded the limit with delay time 2.
Time dep. voltage 1	4958	Time-dependent voltage, limit value 1 The measured voltage falls below/exceeds the configured criteria.
Time dep. voltage 2	5022	Time-dependent voltage, limit value 2 The measured voltage falls below/exceeds the configured criteria.
Time dep. voltage 3	4980	Time-dependent voltage, limit value 3 The measured voltage falls below/exceeds the configured criteria.

9.6.5.4 Operating Range Monitoring

Message text	ID	Meaning
		Operating range monitoring alarm. The device stocks because of a logical circumstance. The operating range monitor indicates an alarm with an error number. The number stands for a failed check procedure. For more information refer to chapter "Operating Range Failure".
Oper.range failed 1	2665	Check 1 in CBA mode: • The command LM "Enable CBA to close" is TRUE AND • The CBA feedback is open AND • No communication member on network is recogized Check 1 in CBA/CBB mode: Relating to CBA • The command LM "Enable CBA to close" is TRUE AND • The CBA feedback is open AND • No communication member on network is recogized Relating to CBB • The command LM "Enable CBB to close" is TRUE AND • The CBB feedback is open AND • No communication member on network is recogized
Oper.range failed 2	2666	Check 1 in CBA mode: • The command LM "Enable CBA to close" is TRUE AND • The CBA feedback is open AND

Message text	ID	Meaning
		• Synchronous mains or synchronous segments are detected but not allowed to connect. Check 1 in CBA/CBB mode: • Relating to CBA • The command LM "Enable CBA to close" is TRUE AND • The CBA feedback is open AND • Synchronous mains or synchronous segments are detected but not allowed to connect. Relating to CBB • The command LM "Enable CBB to close" is TRUE AND • The CBB feedback is open AND • Synchronous mains or synchronous segments are detected but not allowed to connect.
Oper.range failed 3	2667	• The command LM "Enable CBA to close" is TRUE AND • The CBA feedback is open AND • A CBA dead busbar closure is detected but not allowed to execute AND • The alarm class for opening the breaker is not active
Oper.range failed 4	2668	• The command LM "Enable CBA to close" is TRUE AND • The CBB feedback is closed AND (CBA/CBB mode only) • The CBA feedback is open AND • The System A or B is not in range for synchronization • The alarm class for opening the breaker CBA is not active
Oper.range failed 5	2669	• The command LM "Enable CBB to close" is TRUE AND • The CBB feedback is open • A CBB dead busbar closure is detected but not allowed to execute AND • The alarm class for opening the breaker CBB is not active
Oper.range failed 6	2670	• The command LM "Enable CBB to close" is TRUE AND • The CBB feedback is open • A CBB dead busbar closure is detected but not allowed to execute AND • The alarm class for opening the breaker CBB is not active

9.6.5.5 Breaker Monitoring

Message text	ID	Meaning
CBB fail to close	2603	CBB failed to close The LS6XT has attempted to close the CB B the configured maximum number of attempts and failed.
CBB fail to open	2604	CBB failed to open

Message text	ID	Meaning
		The LS6XT has attempted to open the CB B within the configured time and failed.
CBB syn. timeout	3064	CBB synchronization time exceeded The LS6XT has failed to synchronize the CBB within the configured synchronization time.
CBA fail to close	2623	CBA failed to close The LS6XT has attempted to close the CBA the configured maximum number of attempts and failed.
CBA fail to open	2624	Failed CBA open The LS6XT is still receiving the reply CBA closed after the CBA open monitoring timer has expired.
CBA syn. timeout	3074	CBA synchronization time exceeded The LS6XT has failed to synchronize the CBA within the configured synchronization time.
Ph.rotation mismatch	2944	System A/System B phase rotation difference System A or System B has different rotating fields. A CB closure is blocked.
CL transition fault	2438	Closed transition monitoring alarm The both breakers controlled in closed transition mode were longer simultaneously closed as the monitor allows. (Usually < 210ms).

9.6.5.6 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.

9.6.5.7 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.

9.6.5.8 Multi-unit Monitoring

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.

Message text	ID	Meaning
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.
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.
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 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.

9.6.5.9 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	

Message text	ID	Meaning
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	
Flexible limit 36	10053	
Flexible limit 37	10054	
Flexible limit 38	10055	
Flexible limit 39	10056	
Flexible limit 40	10057	

9.6.5.10 Digital Inputs Monitoring

Message text	ID	Meaning
		Discrete input 1-12, energized / de-energized The actual state of the monitored discrete input is energized / de-energized (depending on the configuration) for at least the configured time. This text may be assigned customer defined. The Indication here is the default text.
Discrete input 1	10600	
Discrete input 2	10601	
Discrete input 3	10602	

Message text	ID	Meaning
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	

9.6.5.11 External Digital Inputs Monitoring

Message text	ID	Meaning
Ext. Discrete input 1	16360	
Ext. Discrete input 2	16361	
Ext. Discrete input 3	16362	
Ext. Discrete input 4	16364	
Ext. Discrete input 5	16365	
Ext. Discrete input 6	16366	
Ext. Discrete input 7	16367	
Ext. Discrete input 8	16368	
Ext. Discrete input 9	16369	
Ext. Discrete input 10	16370	
Ext. Discrete input 11	16371	
Ext. Discrete input 12	16372	
Ext. Discrete input 13	16373	
Ext. Discrete input 14	16374	
Ext. Discrete input 15	16375	
Ext. Discrete input 16	16376	

9.6.5.12 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	

Message text	ID	Meaning
Wb:Analog input 2	10015	
Wb:Analog input 3	10060	

9.6.5.13 Free Configurable Alarms

Message text	ID	Meaning
		16 free configurable Alarms. The alarm text is configurable. The indication here is the default text.
Free alarm 1	8120	
Free alarm 2	8124	
Free alarm 3	8128	
Free alarm 4	8132	
Free alarm 5	8136	
Free alarm 6	8140	
Free alarm 7	8144	
Free alarm 8	8148	
Free alarm 9	8154	
Free alarm 10	8158	
Free alarm 11	8165	
Free alarm 12	8170	
Free alarm 13	8174	
Free alarm 14	8178	
Free alarm 15	8182	
Free alarm 16	8186	

9.6.5.14 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.
Bat. undervoltage 2	10006	Battery undervoltage, limit value 2 The battery voltage has fallen below the limit value 2 for battery undervoltage.
System A AC wiring	10093	AC wiring issue of system A voltages

Message text	ID	Meaning
		One or more of the system A voltages are wrong wired (detected by plausibility checking of frequencies).
System B AC wiring	10095	AC wiring issue of system B voltages One or more of the system B voltages are wrong wired (detected by plausibility checking of frequencies).
Voltage plausibility	2996	AC voltages does not match to breaker feedbacks. If the connection between System A and System B is connected, based on breaker feedbacks, the monitoring function compares on equal status flags of System A and B.
Limit appl.layer	4049	Limitation from the device number or segment number in application layer 1 is active. In layer 1 these parameter are limited to max. 64
System plausibility	18483	In the LSx system there is one or more other device with the same segment number but different system condition (system im range or system is dead).

9.7 Additional Application Information

9.7.1 Synchronization Of System A and System B

Synchronization Table

The table below gives an overview about the synchronization of systems A with system B.

Drawing index:

- Yes: The synchronization is executed
- blocked: The synchronization is blocked
- n.a.: not applicable (not possible to configure)
- Not allowed (*1:

  The neutral could not be located in the middle of the delta voltages
- Not allowed (*2:

  These constellations are not applicable

System A \ System B			1Ph2W Ph-Ph left	1Ph2W Ph-Ph right	1Ph2W Ph-N left	1Ph2W Ph-N right	3Ph4W left	3Ph4W right	3Ph3W left	3Ph3W right	1Ph3W (Ph-N)
1Ph2W	Ph-Ph	left	Yes	n.a.	n.a.	n.a.	Yes	blocked	Yes	blocked	Not allowed (*2
1Ph2W	Ph-Ph	right	n.a.	Yes	n.a.	n.a.	blocked	Yes	blocked	Yes	Not allowed (*2
1Ph2W	Ph-N	left	n.a.	n.a.	Yes	n.a.	Yes	blocked	Not allowed (*1	blocked	Yes
1Ph2W	Ph-N	right	n.a.	n.a.	n.a.	Yes	blocked	Yes	blocked	Not allowed (*1	Yes
3Ph4W 3Ph4W OD		left	Yes	blocked	Yes	blocked	Yes	blocked	Yes	blocked	Not allowed (*2
3Ph4W 3Ph4W OD		right	blocked	Yes	blocked	Yes	blocked	Yes	blocked	Yes	Not allowed (*2
3Ph3W		left	Yes	blocked	Not allowed (*1	blocked	Yes	blocked	Yes	blocked	Not allowed (*2
3Ph3W		right	blocked	Yes	blocked	Not allowed (*1	blocked	Yes	blocked	Yes	Not allowed (*2
1Ph3W (Ph-N)			Not allowed (*2	Not allowed (*2	Yes	Yes	Not allowed (*2	Not allowed (*2	Not allowed (*2	Not allowed (*2	Yes

Fig. 225: LS-6XT Synchronization Table - Two Systems A-B

9.7.2 Safety measures (UL mandatory)

General

This chapter provides recommendations on how to configure the LS-6XT 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 initiate a proper action to bring the switchgear panel into a safe condition. (For example, open the breaker and lock it or keep it in the last condition and lock it). What exactly is to do depends on the application and location. It shall be considered.	☐
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 “6.5.3 Digital input monitoring (CBA 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 CB, monitor with the PLC the successful execution.	☐
3a	If the CBA shall be opened by the LS-6XT, the CBA fail to open alarm must be routed to R1 output "Ready for operation" (Self-test relay, refer to item 1). • Enable the CBA monitoring alarm. 2620 • Include into the LogicsManager of the relay 1 "Ready for op. OFF" 12580 the “08.08 CBA fail to open” alarm or place a second relay to force the opening of the breaker.	☐
3b	If the CBB shall be opened by the LS-6XT, the CBB fail to open alarm must be routed to R1 output "Ready for operation" (Self-test relay, refer to item 1). • Enable the CBB monitoring alarm. 2600 • Include into the LogicsManager of the relay 1 "Ready for op. OFF" 12580 the “08.06 CBB fail to open” alarm or place a second relay to force the opening of the breaker.	☐
4	Further monitoring functions in the LS-6XT are to consider for security purposes and troubleshooting: • Operating range failure monitoring 2660, it signals that the device is blocked and gives out a failure number for diagnostic. The failure number is explained in the technical manual. • Voltage plausibility monitoring 2991, it signals in the CBA/CBB mode that something does not match with the breaker feedback in combination with System A and System B measurement. • System plausibility monitoring 18478, It monitors whether all measurement ranges within of a system of LS-6XT devices are match under each other. • Monitor with the PMS a correct Import/Export power regulation at the interchange point if the function relies on the LS-6XT current measurement. • System A phase rotation, 3970 • System B phase rotation, 3950 • CBA unload mismatch, 8819 • CBB unload mismatch, 3125	☐
5	Recommended monitoring functions in the LS-6XT for availability purposes: • Power supply (Battery) voltage monitoring (3500, 3506)	☐
6	Communication interface monitoring: • Load share bus (CAN/Ethernet) Missing Member monitoring (4060, 4066, 4040, 4136)	☐

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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