

# LS-5 Series

Manual | Circuit Breaker Control



**LS-511/521 Marine**

Software Version 1.0302

37542B

Designed in Germany

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## Brief Overview

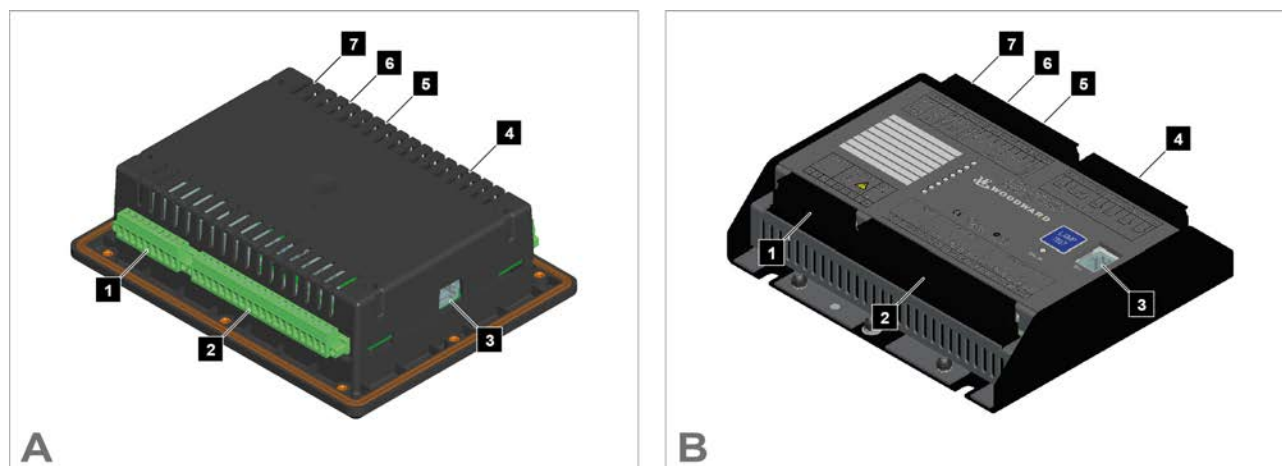


Fig. 1: LS-5 Series (housing variants)

A LS-52x (plastic housing with display)

B LS-51x (sheet metal housing)

1 System A CT terminal

2 System A / System B PT terminal

3 Service port connector (USB/RS-232)<sup>1</sup>

4 Relay outputs terminal

5 Discrete inputs terminal

6 CAN bus interface terminal

7 RS-485 interface terminal



<sup>1</sup> Optional configuration cable for ToolKit configuration software and external extensions/applications required:

- USB connector: DPC-USB direct configuration cable – P/N 5417-1251
- RS-232 connector: DPC-RS-232 direct configuration cable – P/N 5417-557

The LS-5 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-3400/3500 genset control units.

## Sample application setup

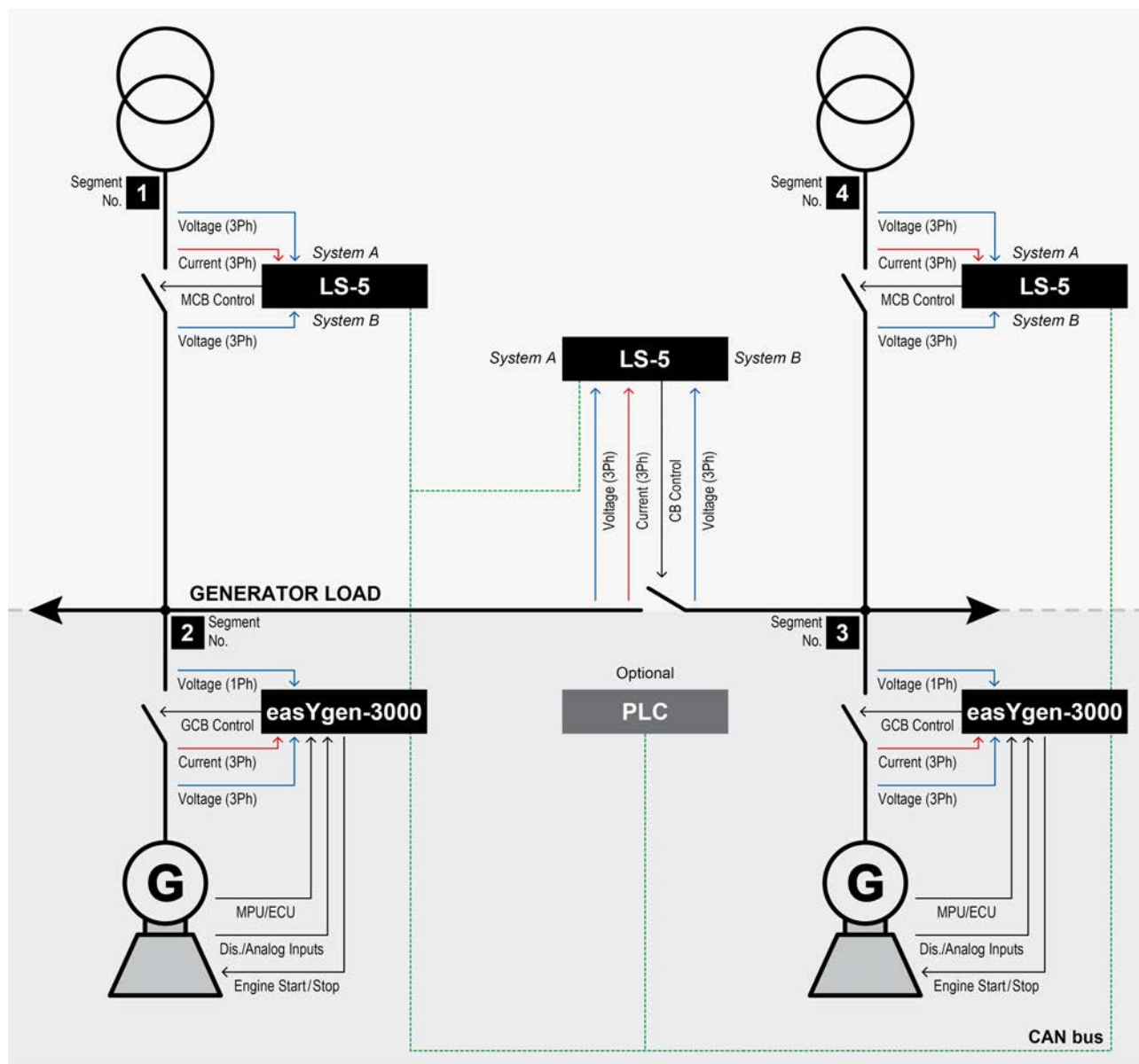


Fig. 2: Sample application setup

A typical application mode for the control unit is the use as an external mains circuit breaker.

- One or more gensets feed on a load busbar.
- The easYgen(s) close and open their own generator breaker.
- The LS-5 at the interchange point closes and opens the MCB.



For a listing of additional application modes and setups please refer to chapter 6 "Application" on page 163.

## Marine features

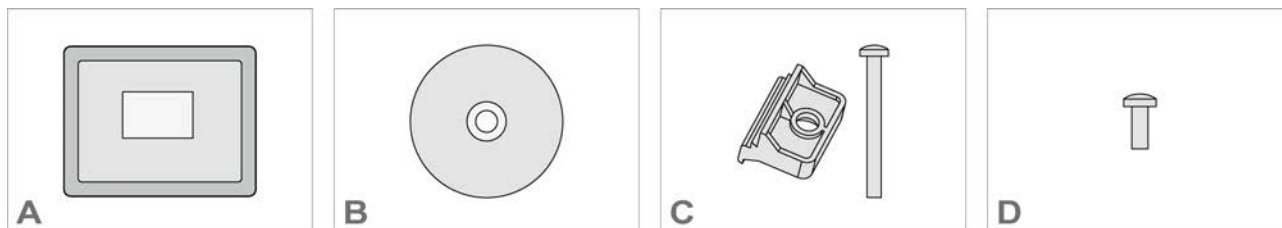


*The LS-511/521 Marine controllers have some additional features compared to the standard LS-511/521 controllers. The differences are listed below.*

- *Second CBA feedback (CBA closed) with monitoring feature. Refer to parameters 4128 ↗ p. 109 and 5124 ↗ p. 101 for details.*

## Scope of delivery

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



*Fig. 3: Scope of delivery - schematic*

- A LS-5 circuit breaker control
- B Product CD (configuration software and manual)
- C Clamp fastener installation material - 4x (LS-52x only)
- D Screw kit installation material - 8x



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# 1 General Information

## 1.1 About This Manual

### 1.1.1 Revision History

Rev.	Date	Editor	Changes
B	2014-09-09	GG	No product changes.  New German Lloyd (GL) certifications for successfully approved hardware and software added on page <a href="#">Chapter 8.1.7 "Approvals"</a> on page 236.
A	2013-03-04	GG	<b>Corrections</b>  ■ Undesired breaker close for synchronization when one system is configured to 1Ph2W and the other system to 3Ph4W: problem solved.  <b>Manual</b>  ■ Preferred versions of ToolKit and .NET Framework updated. Refer to <a href="#">Chapter 5.1.1 "Install ToolKit"</a> on page 139 for details.  ■ New overview table for synchronization matches System A with System B. Refer to <a href="#">Chapter 9.5.1 "Synchronization Of System A and System B"</a> on page 333 for details.  ■ Minor changes.
NEW	2012-07-17	GG	<b>Manual</b>  ■ Release

### 1.1.2 Depiction Of Notes And Instructions

#### Safety instructions

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



#### **DANGER!**

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



#### **WARNING!**

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



#### **CAUTION!**

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



#### **NOTICE!**

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





#### Tips and recommendations



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

#### Additional markings

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

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

## 1.2 Copyright And Disclaimer

### Disclaimer

All information and instructions in this operating 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 GmbH assumes no liability for damages due to:

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

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

### Copyright

This operating manual is protected by copyright. No part of this operating manual may be reproduced in any form or incorporated into any information retrieval system without written permission of Woodward GmbH.

Delivery of the operating manual to third parties, duplication in any form - including excerpts - as well as exploitation and/or communication of the content, are not permitted without a written declaration of release by Woodward GmbH.

Actions to the contrary exact damage compensation. We reserve the right to enforce additional claims.

## 1.3 Service And Warranty

Our Customer Service is available for technical information. Please see page 2 for the contact data.

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



*For information on the locally applicable warranty terms, please refer to the sales documents provided with the product.*

## 1.4 Safety

### 1.4.1 Intended Use

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

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

- Intended use requires operation of the control unit within the specifications listed in [Chapter 8.1 "Technical Data" on page 233](#).
- All permissible applications are outlined in [Chapter 6 "Application" on page 163](#).
- Intended use also includes compliance with all instructions and safety notes presented in this manual.
- Any use which exceeds or differs from the intended use shall be considered improper use.
- No claims of any kind for damage will be entertained if such claims result from improper use.



#### **NOTICE!**

##### **Damage due to improper use!**

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

Improper use includes, but is not limited to:

- Operation outside the specified operation conditions.

### 1.4.2 Personnel



#### **WARNING!**

##### **Hazards due to insufficiently qualified personnel!**

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

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

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

#### **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 which he is active and is 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.



### 1.4.3 General Safety Notes

#### Electrical hazards

**DANGER!****Life-threatening hazard from electric shock!**

There is an imminent life-threatening hazard from electric shocks from live parts. Damage to insulation or to specific components can pose a life-threatening hazard.

- Only a qualified electrician should perform work on the electrical equipment.
- Immediately switch off the power supply and have it repaired if there is damage to the insulation.
- Before beginning work at live parts of electrical systems and resources, cut the electricity and ensure it remains off for the duration of the work. Comply with the five safety rules in the process:
  - cut electricity;
  - safeguard against restart;
  - ensure electricity is not flowing;
  - earth and short-circuit; and
  - cover or shield neighbouring live parts.
- Never bypass fuses or render them inoperable. Always use the correct amperage when changing fuses.
- 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 (overtemperature, or overpressure, 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.

### 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.

### Electrostatic discharge

Protective equipment: ■ ESD wrist band



#### **NOTICE!**

##### **Damage from electrostatic discharge**

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

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



1. ➤ Avoid build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as easily as synthetics.
2. ➤ Before 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.
3. ➤ 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.

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



*If instructed by this manual to remove the PCB from the control cabinet, follow these precautions:*

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



*For additional information on how to prevent damage to electronic components caused by improper handling, read and observe the precautions in:*

- *"Woodward manual 82715, Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules".*

## Notes on marine usage

Marine usage of the LS-5 circuit breaker control requires additional precautions as listed below:



*The specified marine approvals are only valid for plastic housing units, if they are installed using the screw kit.*

- *Use all 8 screws and tighten accordingly.*

- The LS-5 Series has no internally isolated power supply.



### **NOTICE!**

#### **Malfunctions due to insufficient protection against electromagnetic interference**

Exposure electromagnetic interference may cause malfunctions or incorrect internal readings.

- Install an EMI filter (i.e. SCHAFFNER - FN 2070-3-06) for the power supply inputs when using the control unit in marine applications.



*Some additional, independent safety and protection devices are necessary to meet safety requirements of Rules and Regulations of marine Classification Societies.*

- *Please refer to the corresponding documents issued by marine Classification Societies for the applicable requirements.*

### 1.4.4 Protective Equipment And Tools

#### Protective gear

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

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

The cumulative required personal protective equipment is detailed below:

##### **ESD wrist band**

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

#### Tools

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

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

The cumulative required tools are detailed below:

##### **Torque screwdriver**

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

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

## 2 System Overview

This chapter provides a basic overview of the circuit breaker control unit.

Refer to the comprehensive chapters indicated below to commission the control unit:

- [Chapter 3 “Installation” on page 25](#) provides information on how to mount the unit and setup connections.
- [Chapter 4 “Configuration” on page 59](#) provides information on basic setup and reference information on all configurable parameters.
- [Chapter 5 “Operation” on page 139](#) provides information on how to access the unit via the front panel or remotely using the ToolKit software provided by Woodward.
- [Chapter 6 “Application” on page 163](#) provides application examples as well as instructions for the corresponding required configuration.
- [Chapter 7 “Interfaces And Protocols” on page 225](#) provides reference information on the usage of the interfaces and protocols provided by the control unit.

### 2.1 Display And Status Indicators

#### LS-52x display



Fig. 4: Display

The display (Fig. 4) as part of the LS-52x is used for direct access to status information and configuration.



For information on the usage of the graphical user interface refer to [Chapter 5.2 “Front Panel Access” on page 149](#).

The LS-51x is not equipped with a display and requires remote access for configuration ([Chapter 5.1 “Access Via PC \(ToolKit\)” on page 139](#)).

#### LS-51x LEDs

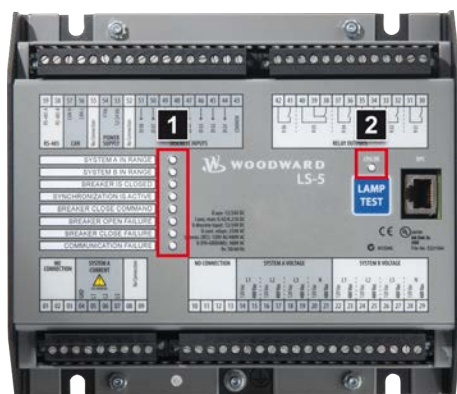


Fig. 5: Position of LEDs

- 1 LEDs representing LogicsManager states
- 2 LED 'CPU OK'

The LS-51x unit with metal housing and without display and buttons features 9 LEDs (Fig. 5) on the front plate.

The LEDs indicate the following states:

State	Indication
NOT illuminated	Not triggered (LogicsManager condition not met).
Illuminated red	Triggered (LogicsManager condition met).

Table 1: LEDs 'LogicsManager states'



State	Indication
 NOT illuminated	CPU error/unit offline.
 Illuminated green	CPU OK.

Table 2: LED 'CPU OK'



**Defaults**

The 8 LEDs representing LogicsManager states are triggered based on the settings of parameters 12962 to 12969 p. 134 to 12969 p. 134.

The conditions printed next to the LEDs on the sheet metal housing represent the corresponding LogicsManager's parameter defaults.

2.2 Hardware Interfaces (Terminals)

The LS-51x/52x (Fig. 6) provides the following terminals.

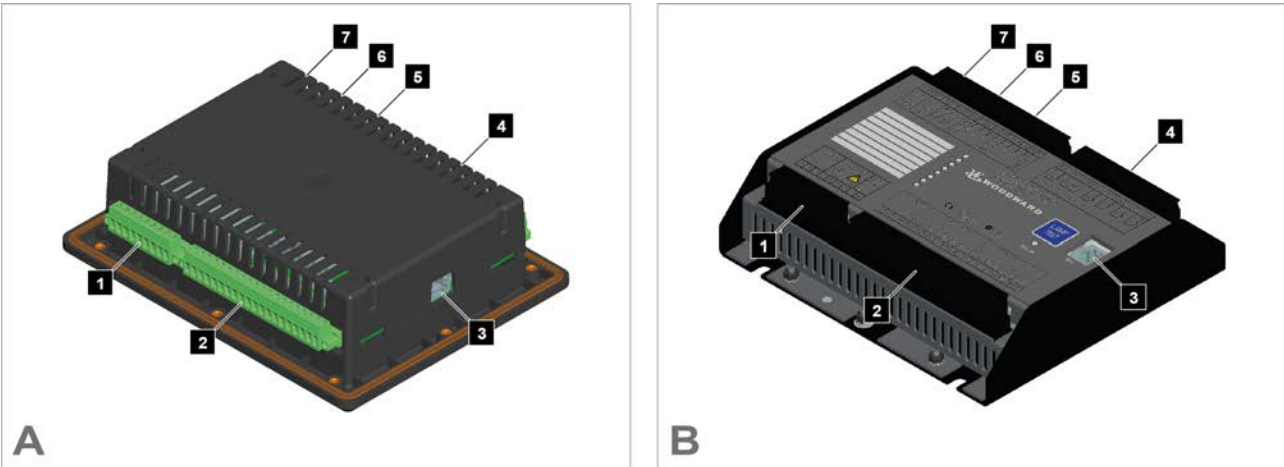


Fig. 6: LS-5 Series (housing variants)

- A

LS-52x (plastic housing with display)
- B

LS-51x (sheet metal housing)
- 1

System A CT terminal
- 2

System A / System B PT terminal
- 3

Service port connector (USB/RS-232)<sup>1</sup>
- 4

Relay outputs terminal
- 5

Discrete inputs terminal
- 6

CAN bus interface terminal
- 7

RS-485 interface terminal



<sup>1</sup> Optional configuration cable for ToolKit configuration software and external extensions/applications required:

- USB connector: DPC-USB direct configuration cable – P/N 5417-1251
- RS-232 connector: DPC-RS-232 direct configuration cable – P/N 5417-557



For information on how to setup connections refer to [Chapter 3.3 “Setup Connections”](#) on page 30.

For information on the interfaces and protocols refer to [Chapter 7 “Interfaces And Protocols”](#) on page 225.

## 2.3 Application Modes Overview

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



For detailed information on the application modes and special applications refer to [Chapter 6 “Application”](#) on page 163.

	Mode LS-5	Symbol	Mode easYgen	Symbol
LS-5	Single LS5	<b>A01</b>	N/A	N/A
LS-5 & easYgen	LS5 (up to 16 unit)	<b>A02</b>	GCB/LS5	<b>A07</b>
	L-MCB (max. 1 unit)	<b>A03</b>	GCB/L-MCB	<b>A08</b>
			GCB/GGB/L-MCB	<b>A09</b>
	L-GGB (max. 1 unit)	<b>A04</b>	GCB/L-GGB	<b>A10</b>
	L-GGB (max. 1 unit)	<b>A04</b>	GCB/L-GGB/L-MCB	<b>A11</b>
	L-MCB (max. 1 unit)	<b>A03</b>		





### 3 Installation

#### 3.1 Mount Unit (Sheet Metal Housing)

##### Dimensions

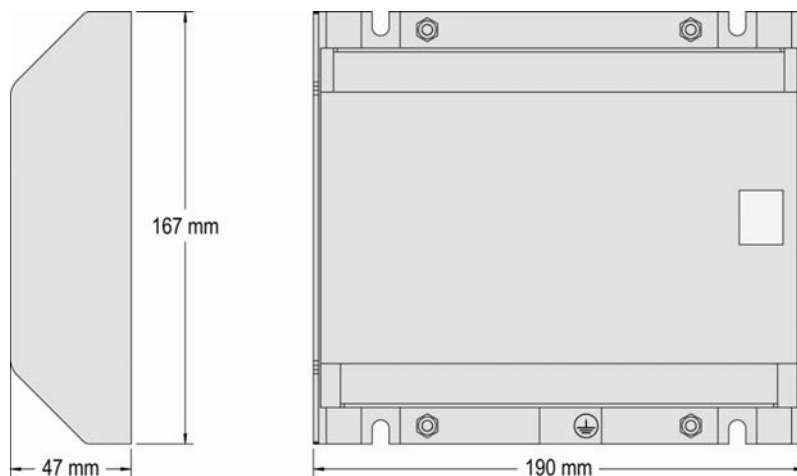


Fig. 7: Sheet metal housing - dimensions

##### Mounting into a cabinet

Special tool: ■ Torque screwdriver

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

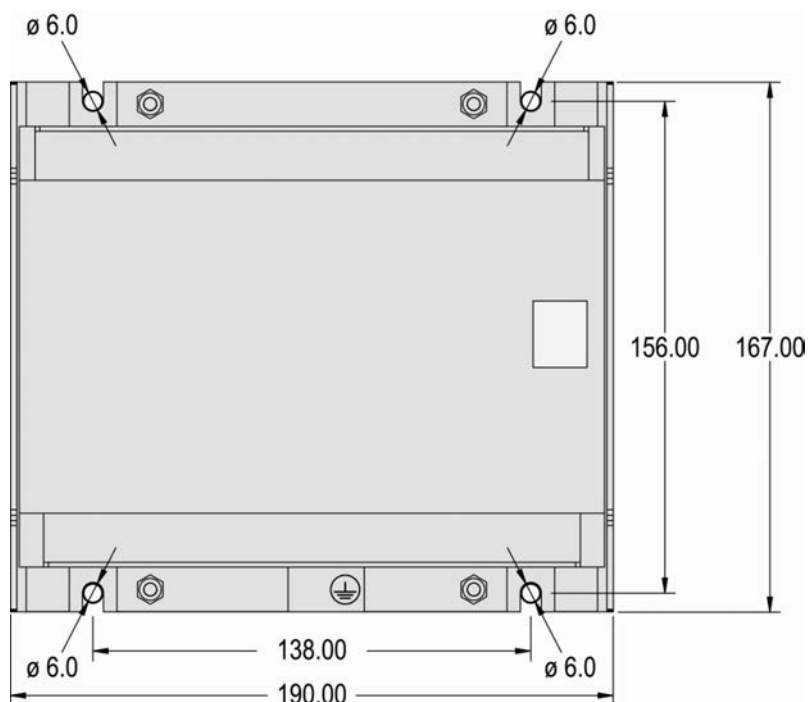


Fig. 8: Sheet metal housing - drill plan

1. ➤ Drill the holes according to the dimensions in Fig. 8 (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.*



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

## 3.2 Mount Unit (Plastic Housing)

Mount the unit **either** using the clamp fasteners (☞ Chapter 3.2.1 “Clamp Fastener Installation” on page 27) **or** the screw kit (☞ Chapter 3.2.2 “Screw Kit Installation” on page 29).



- Don't drill holes if you want to use the clamp fasteners. If the holes are drilled into the panel, the clamp fasteners cannot be used anymore.
- Some versions of the plastic housing are not equipped with nut inserts and may not be fastened with the screw kit.
- In order to enhance the protection to IP 66, fasten the unit with the screw kit instead of the clamp fastener hardware.

## Dimensions

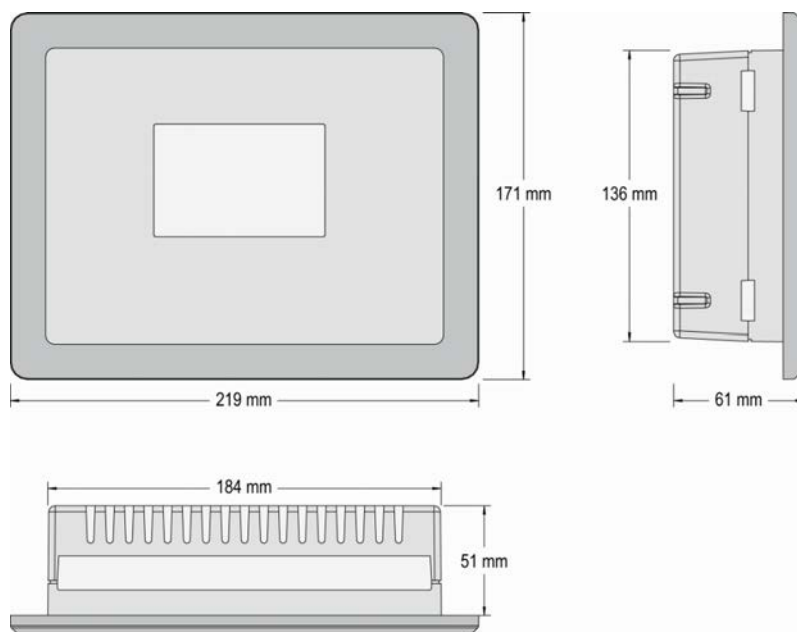


Fig. 9: Plastic housing - dimensions

Panel cutout

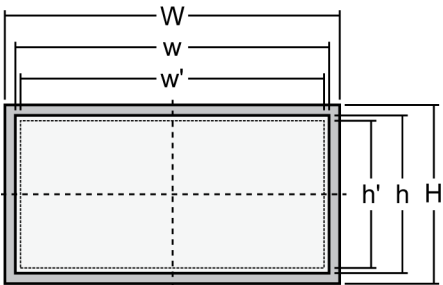


Fig. 10: Cutout schematic

Measure	Description			Tolerance
H	Height	Total	171 mm	---
h		Panel cutout	138 mm	+ 1.0 mm
h'		Housing dimension	136 mm	
W	Width	Total	219 mm	---
w		Panel cutout	186 mm	+ 1.1 mm
w'		Housing dimension	184 mm	
	Depth	Total	61 mm	---



The maximum permissible corner radius is 3.5 mm.

3.2.1 Clamp Fastener Installation

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

1. ➔ Cut out the panel according to the dimensions in Fig. 10.



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

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

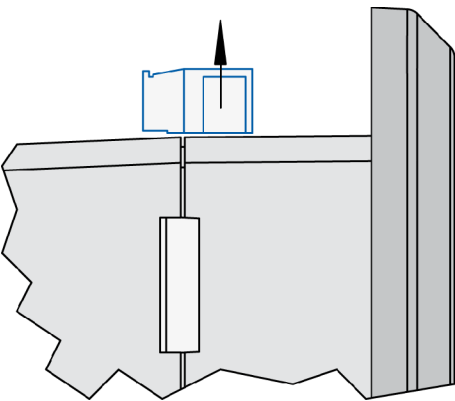


Fig. 11: Remove terminals

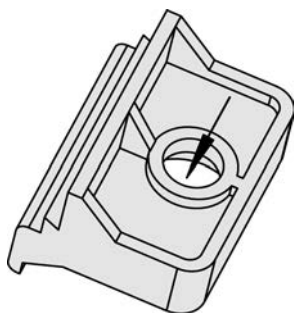


Fig. 12: Insert screws in clamps

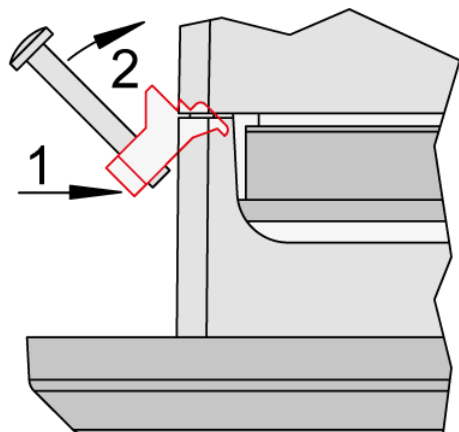


Fig. 13: Attach clamp inserts

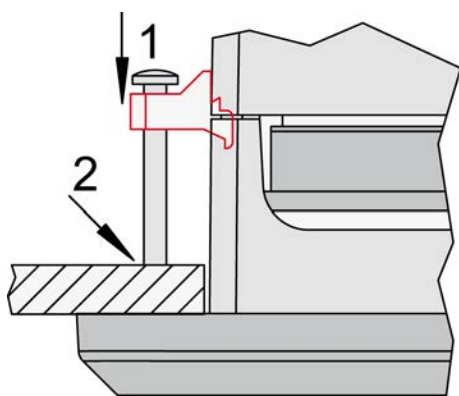


Fig. 14: Tighten clamping screws

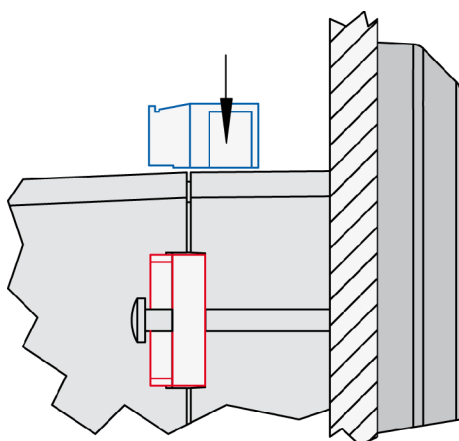


Fig. 15: Reattach terminals

3. ➔ Insert the four clamping screws into the clamp inserts from the shown side (Fig. 12; opposite the nut insert) until they are almost flush. Do not completely insert the screws into the clamp inserts.

4. ➔ Insert the unit into the panel cutout. Verify that the unit fits correctly in the cutout. If the panel cutout is not big enough, enlarge it accordingly.

5. ➔ Re-install the clamp inserts by tilting the insert to a 45° angle. (Fig. 13/1) Insert the nose of the insert into the slot on the side of the housing. (Fig. 13/2) Raise the clamp insert so that it is parallel to the control panel.

6. ➔ Tighten the clamping screws (Fig. 14/1) until the control unit is secured to the control panel (Fig. 14/2). Over tightening of these screws may result in the clamp inserts or the housing breaking. Do not exceed the recommended tightening torque of 0.1 Nm.

7. ➔ Reattach the wire connection terminal strip (Fig. 15) and secure them with the side screws.

### 3.2.2 Screw Kit Installation



The housing is equipped with 8 nut inserts (Fig. 16), which must all be tightened properly to achieve the required degree of protection.

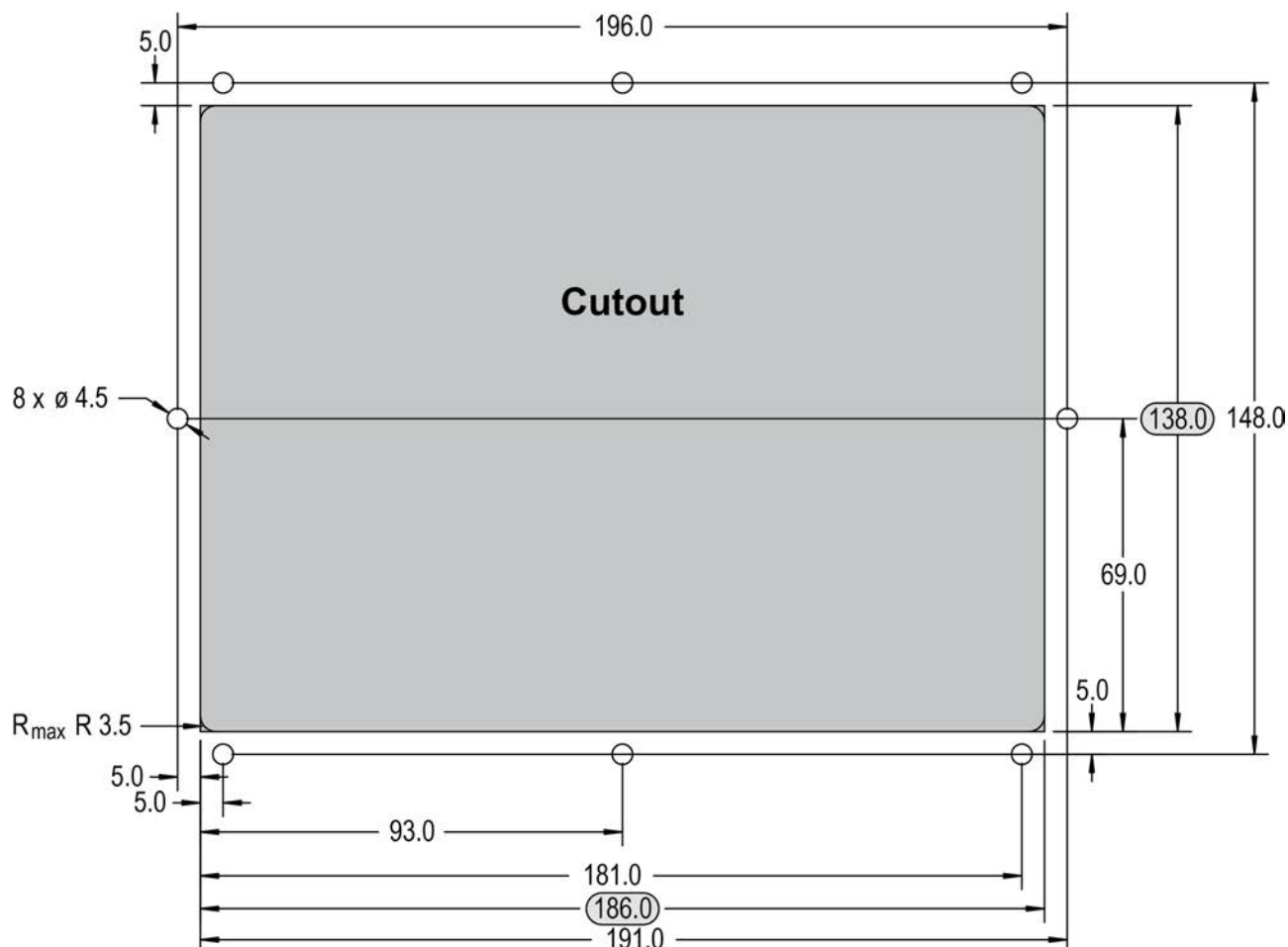


Fig. 16: Plastic housing - drill plan

Special tool: ■ Torque screwdriver

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

1. ➤ Cut out the panel and drill the holes according to the dimensions in Fig. 16 (dimensions shown in mm).
2. ➤ Insert the unit into the panel cutout. Verify that the unit fits correctly in the cutout. If the panel cutout is not big enough, enlarge it accordingly.

3. ➔ Insert the screws and tighten to 0.6 Nm (5.3 pound inches) of torque.



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



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

### 3.3 Setup Connections

#### General notes



#### NOTICE!

##### Malfunctions due to literal use of example values

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

- For definite values please refer to chapter [Chapter 8 “Technical Specifications”](#) on page 233.

#### Wire sizes

AWG	mm <sup>2</sup>	AWG	mm <sup>2</sup>	AWG	mm <sup>2</sup>	AWG	mm <sup>2</sup>	AWG	mm <sup>2</sup>	AWG	mm <sup>2</sup>
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 3: Conversion chart - wire sizes

#### 3.3.1 Terminal Allocation

##### General notes

The device terminals are allocated as follows:

- Plastic housing - shown in Fig. 17
- Sheet metal housing - shown in Fig. 18

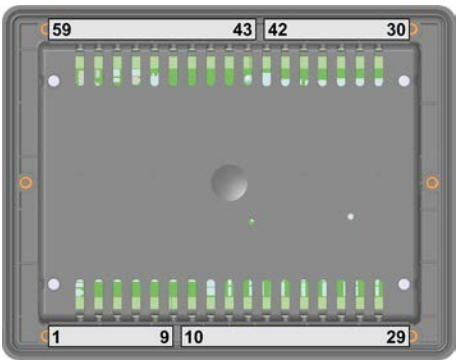


Fig. 17: Plastic housing

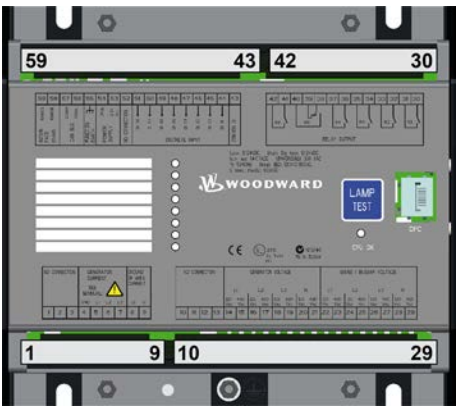
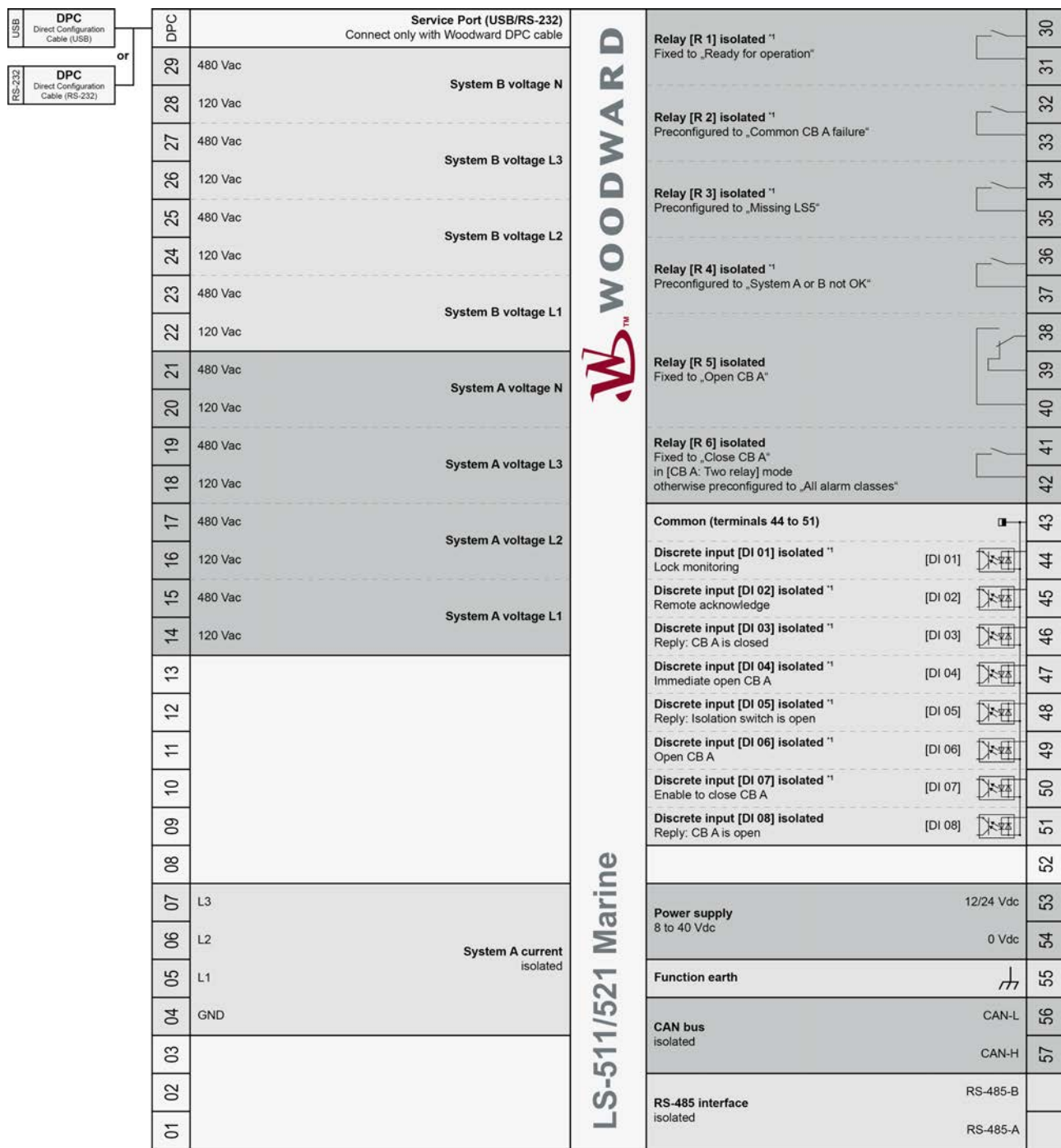


Fig. 18: Sheet metal housing

### 3.3.2 Wiring Diagram



Subject to technical modifications.

<sup>1</sup> = configurable via LogicsManager

LS-511/521 Marine Wiring Diagram | Rev. NEW

Fig. 19: Wiring diagram



### 3.3.3 Power Supply

#### General notes



**WARNING!**

**Risk of electric shock - plastic housing**

- Connect Function Earth to the unit to avoid the risk of electric shock.  
Setup the connection using screw-plug-terminal 55.
- The conductor providing the connection must have a wire larger than or equal to 2.5 mm<sup>2</sup> (14 AWG).  
The connection must be performed properly.



**WARNING!**

**Risk of electric shock - sheet metal housing**

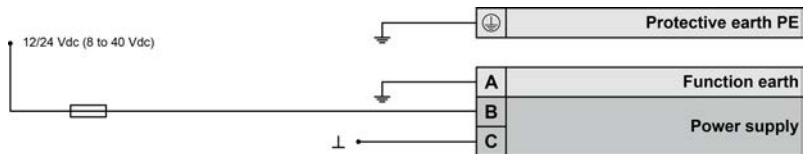
- Connect Protective Earth (PE) to the unit to avoid the risk of electric shock.  
Use the protective earth (PE) connector located at the bottom center of the sheet metal housing.
- The conductor providing the connection must have a wire larger than or equal to 2.5 mm<sup>2</sup> (14 AWG).  
The connection must be performed properly.



*Woodward recommends to use one of the following slow-acting protective devices in the supply line to terminal 53:*

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

#### Schematic and terminals



*Fig. 20: Power supply - wiring*

Terminal		Description	A <sub>max</sub>
A	55	Function earth (LS-52x models only)	2.5 mm <sup>2</sup>
B	53	12/24Vdc (8 to 40.0 Vdc)	2.5 mm <sup>2</sup>
C	54	0 Vdc	2.5 mm <sup>2</sup>

*Table 4: Power supply - terminal assignment*

### Characteristics

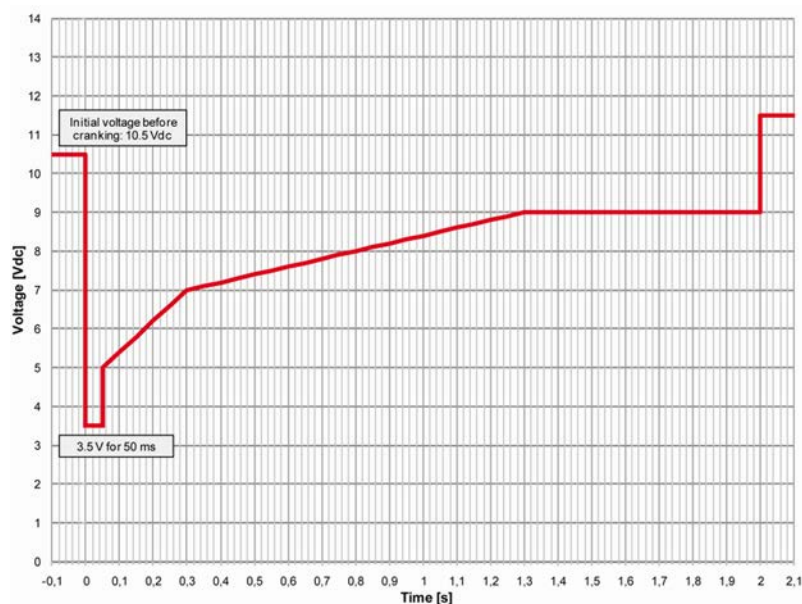


Fig. 21: Power supply - crank waveform

### 3.3.4 Voltage Measuring

#### General notes



#### NOTICE!

##### Incorrect readings due to improper setup

The control unit will not measure voltage correctly if the 120 V and 480 V inputs are utilized simultaneously.

- Never use both sets of voltage measuring inputs.



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

#### 3.3.4.1 System A Voltage

##### General notes



If parameter 1800 ↗ p. 71 ("SyA PT secondary rated volt.") is configured with a value between 50 and 130 V, the 120 V input terminals must be used for proper measurement.

If parameter 1800 ↗ p. 71 ("SyA PT secondary rated volt.") is configured with a value between 131 and 480 V, the 480 V input terminals must be used for proper measurement.

Schematic and terminals

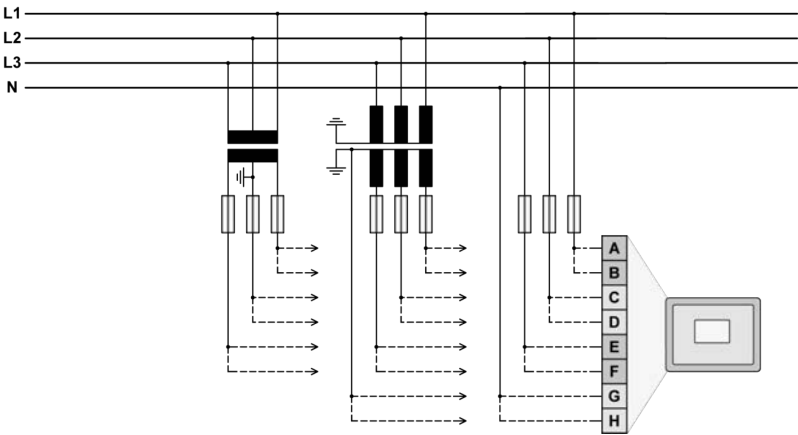


Fig. 22: Voltage measuring - system A - wiring

Terminal		Description		A <sub>max</sub>
A	14	System A voltage - L1	120 Vac	2.5 mm <sup>2</sup>
B	15		480 Vac	2.5 mm <sup>2</sup>
C	16	System A voltage - L2	120 Vac	2.5 mm <sup>2</sup>
D	17		480 Vac	2.5 mm <sup>2</sup>
E	18	System A voltage - L3	120 Vac	2.5 mm <sup>2</sup>
F	19		480 Vac	2.5 mm <sup>2</sup>
G	20	System A voltage - N	120 Vac	2.5 mm <sup>2</sup>
H	21		480 Vac	2.5 mm <sup>2</sup>

Table 5: Voltage measuring - system A - terminal assignment

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

System A windings

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.

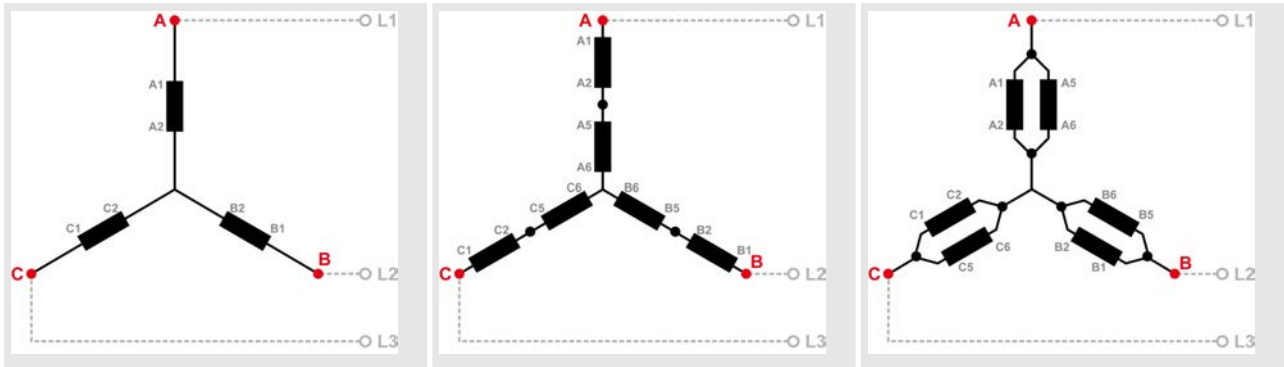


Table 6: System A windings - 3Ph 4W OD

Measuring inputs

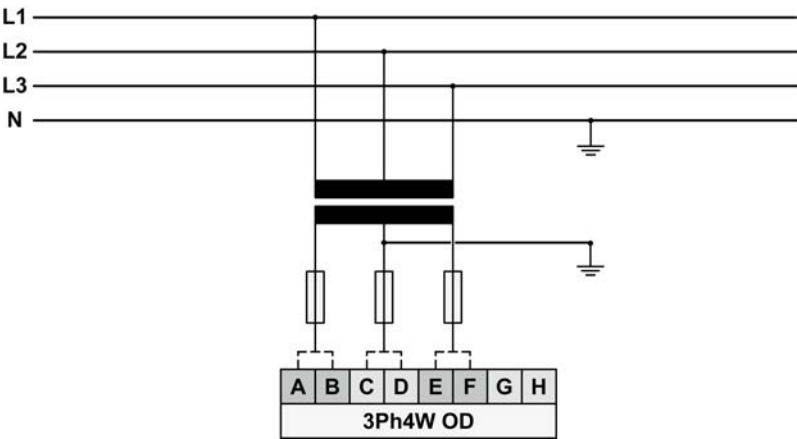


Fig. 23: Measuring inputs - 3Ph 4W OD

Terminal assignment

3Ph 4W	Wiring terminals							
Rated voltage (range)	120 V (50 to 130 V <sub>eff.</sub> )				480 V (131 to 480 V <sub>eff.</sub> )			
Measuring range (max.)	0 to 150 Vac				0 to 600 Vac			
Terminal	A	C	E	G	B	D	F	H
	14	16	18	20	15	17	19	21
Phase	L1	L2	L3	---	L1	L2	L3	---



For different voltage systems, different wiring terminals have to be used.

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

System A windings

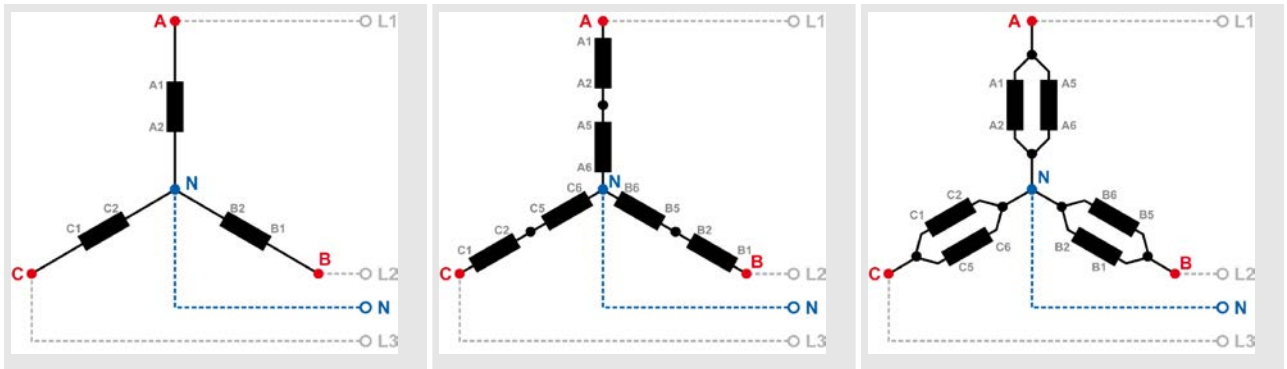


Table 7: System A windings - 3Ph 4W

Measuring inputs

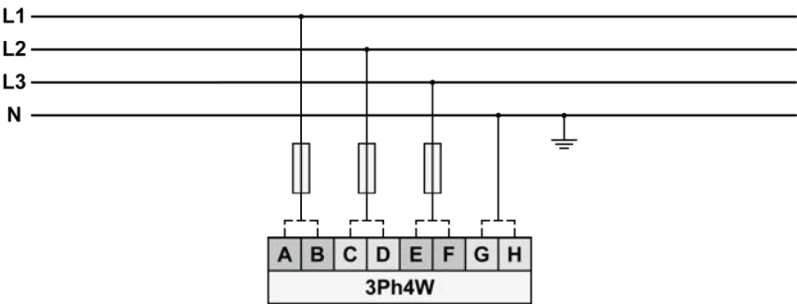


Fig. 24: Measuring inputs - 3Ph 4W

Terminal assignment

3Ph 4W	Wiring terminals							
Rated voltage (range)	120 V (50 to 130 V <sub>eff.</sub> )				480 V (131 to 480 V <sub>eff.</sub> )			
Measuring range (max.)	0 to 150 Vac				0 to 600 Vac			
Terminal	A	C	E	G	B	D	F	H
	14	16	18	20	15	17	19	21
Phase	L1	L2	L3	N	L1	L2	L3	N



For different voltage systems, different wiring terminals have to be used.

Incorrect measurements are possible, if both voltage systems use the same N terminal.

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

System A windings

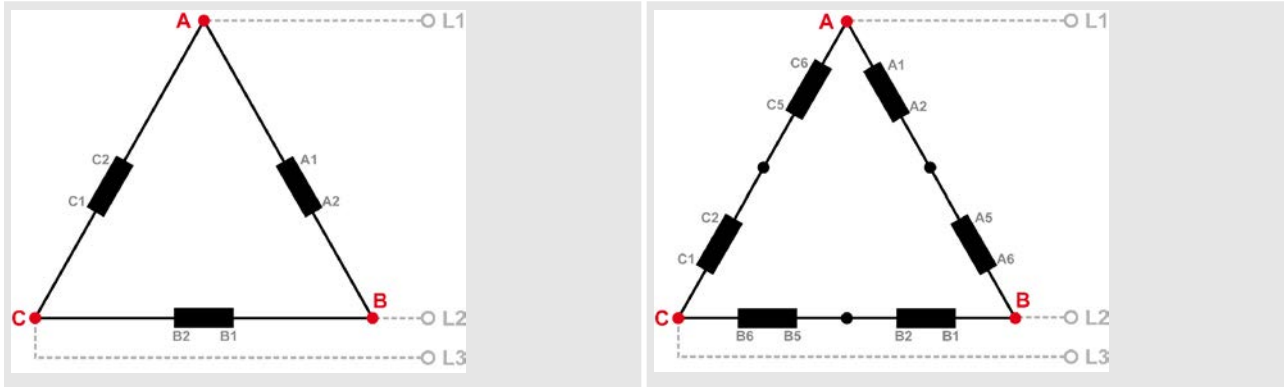


Table 8: System A windings - 3Ph 3W

Measuring inputs

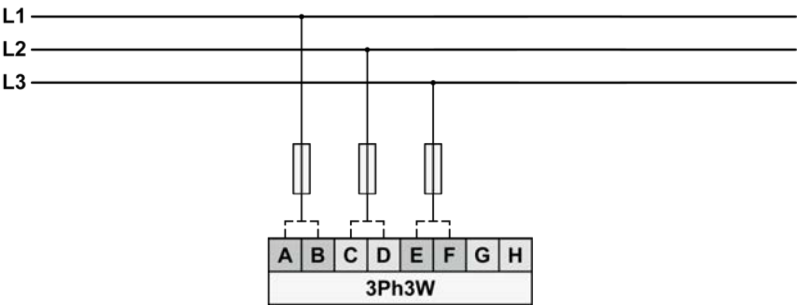


Fig. 25: Measuring inputs - 3Ph 3W

Terminal assignment

3Ph 3W	Wiring terminals							
Rated voltage (range)	120 V (50 to 130 V <sub>eff.</sub> )				480 V (131 to 480 V <sub>eff.</sub> )			
Measuring range (max.)	0 to 150 Vac				0 to 600 Vac			
Terminal	A	C	E	G	B	D	F	H
	14	16	18	20	15	17	19	21
Phase	L1	L2	L3	---	L1	L2	L3	---



For different voltage systems, different wiring terminals have to be used.

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

System A windings

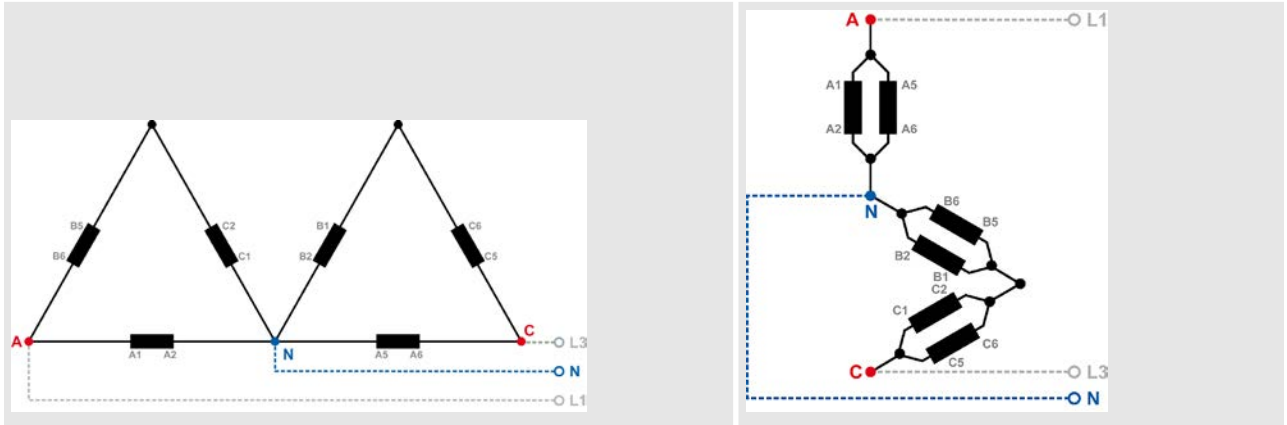


Table 9: System A windings - 1Ph 3W

Measuring inputs

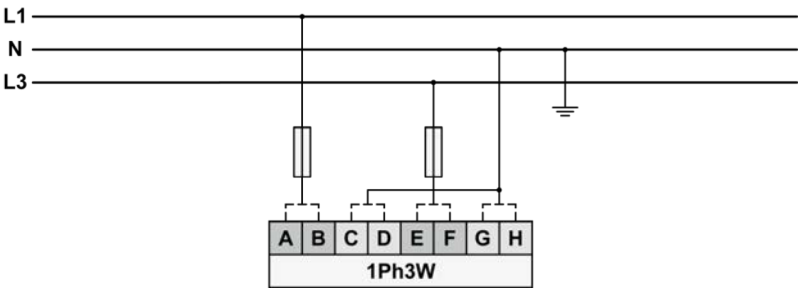


Fig. 26: Measuring inputs - 1Ph 3W

Terminal assignment

1Ph 3W	Wiring terminals							
Rated voltage (range)	120 V (50 to 130 V <sub>eff.</sub> )				480 V (131 to 480 V <sub>eff.</sub> )			
Measuring range (max.)	0 to 150 Vac				0 to 600 Vac			
Terminal	A	C	E	G	B	D	F	H
	14	16	18	20	15	17	19	21
Phase	L1	N	L3	N	L1	N	L3	N



For different voltage systems, different wiring terminals have to be used.

Incorrect measurements are possible, if both voltage systems use the same N terminal.

3.3.4.1.5 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-5 consistently.

'1Ph 2W' Phase-Neutral Measuring  
System A windings

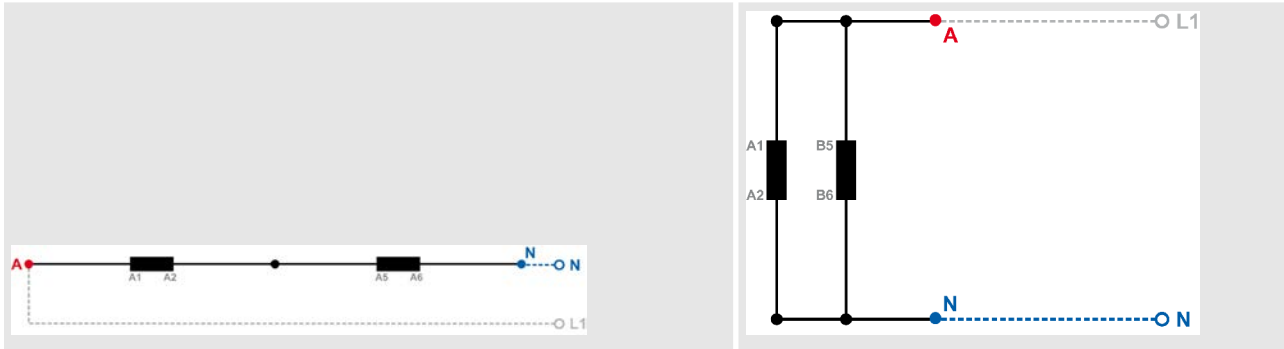


Table 10: System A windings - 1Ph 2W (phase neutral)

Measuring inputs

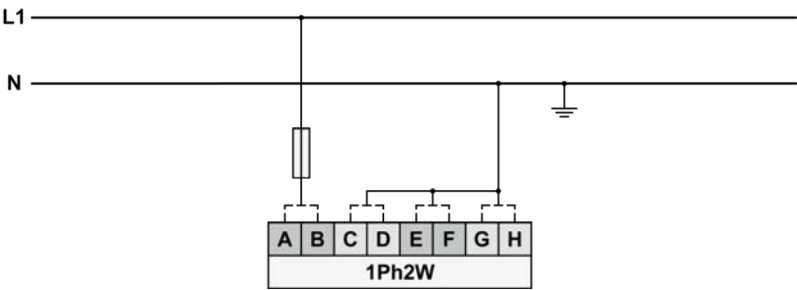


Fig. 27: Measuring inputs - 1Ph 2W (phase neutral)

Terminal assignment

1Ph 2W	Wiring terminals							
Rated voltage (range)	120 V (50 to 130 V <sub>eff.</sub> )				480 V (131 to 480 V <sub>eff.</sub> )			
Measuring range (max.)	0 to 150 Vac				0 to 600 Vac			
Terminal	A	C	E	G	B	D	F	H
	14	16	18	20	15	17	19	21
Phase	L1	N	N	N	L1	N	N	N



For different voltage systems, different wiring terminals have to be used.  
Incorrect measurements are possible if both voltage systems use the same N terminal.



'1Ph 2W' Phase-Phase Measuring  
System A windings

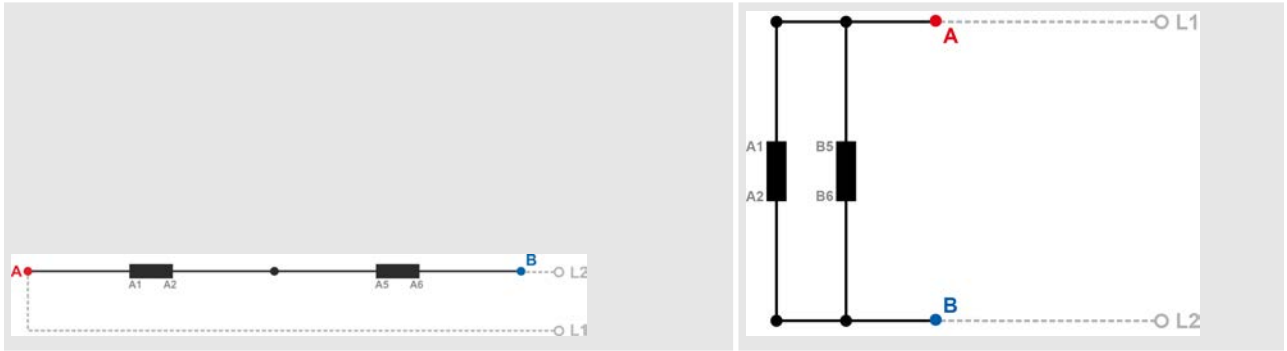


Table 11: System A windings - 1Ph 2W (phase-phase)

Measuring inputs

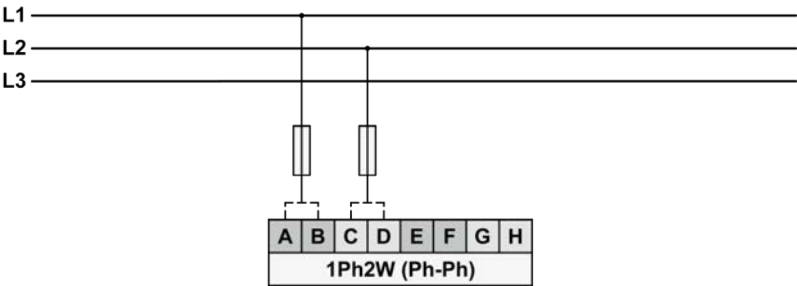


Fig. 28: Measuring inputs - 1Ph 2W (phase-phase)

Terminal assignment

1Ph 2W	Wiring terminals							
Rated voltage (range)	120 V (50 to 130 V <sub>eff.</sub> )				480 V (131 to 480 V <sub>eff.</sub> )			
Measuring range (max.)	0 to 150 Vac				0 to 600 Vac			
Terminal	A	C	E	G	B	D	F	H
	14	16	18	20	15	17	19	21
Phase	L1	L2	---	---	L1	L2	---	---



For different voltage systems, different wiring terminals have to be used.

3.3.4.2 System B Voltage

General notes



If parameter 1803 ↻ p. 72 ("SyB PT secondary rated volt.") is configured with a value between 50 and 130 V, the 120 V input terminals must be used for proper measurement.

If parameter 1803 ↻ p. 72 ("SyB PT secondary rated volt.") is configured with a value between 131 and 480 V, the 480 V input terminals must be used for proper measurement.

Schematic and terminals

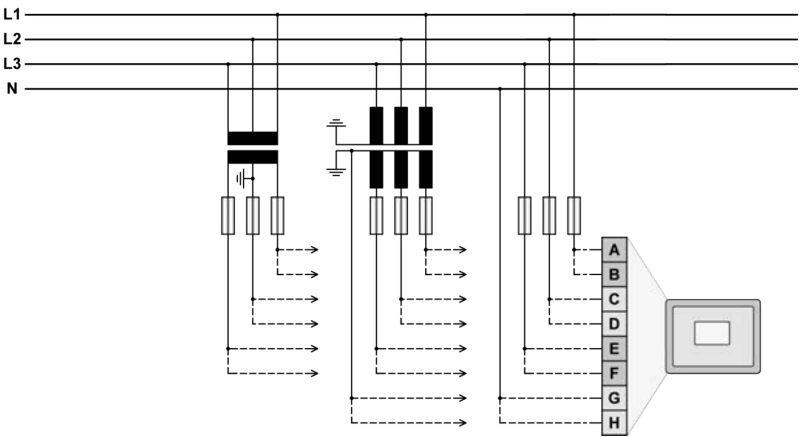


Fig. 29: Voltage measuring - system B - wiring

Terminal		Description		A <sub>max</sub>
A	22	System B voltage - L1	120 Vac	2.5 mm <sup>2</sup>
B	23		480 Vac	2.5 mm <sup>2</sup>
C	24	System B voltage - L2	120 Vac	2.5 mm <sup>2</sup>
D	25		480 Vac	2.5 mm <sup>2</sup>
E	26	System B voltage - L3	120 Vac	2.5 mm <sup>2</sup>
F	27		480 Vac	2.5 mm <sup>2</sup>
G	28	System B voltage - N	120 Vac	2.5 mm <sup>2</sup>
H	29		480 Vac	2.5 mm <sup>2</sup>

Table 12: Voltage measuring - system B - terminal assignment

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

System B windings

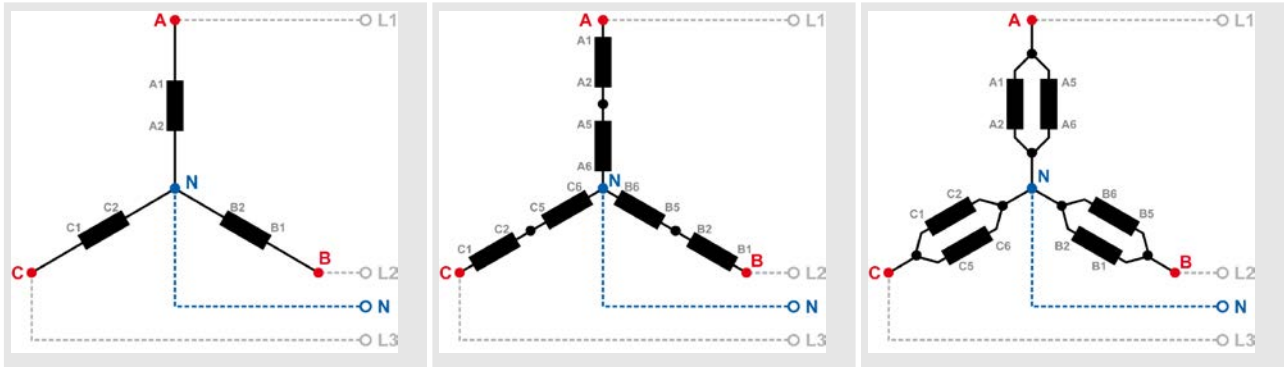


Table 13: System B windings - 3Ph 4W

Measuring inputs

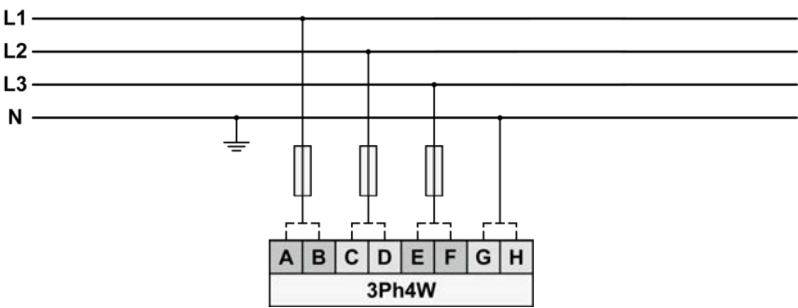


Fig. 30: Measuring inputs - 3Ph 4W

Terminal assignment

3Ph 4W	Wiring terminals							
Rated voltage (range)	120 V (50 to 130 V <sub>eff.</sub> )				480 V (131 to 480 V <sub>eff.</sub> )			
Measuring range (max.)	0 to 150 Vac				0 to 600 Vac			
Terminal	A	C	E	G	B	D	F	H
	22	24	26	28	23	25	27	29
Phase	L1	L2	L3	N	L1	L2	L3	N



For different voltage systems, different wiring terminals have to be used.

Incorrect measurements are possible if both voltage systems use the same N terminal.

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

System B windings

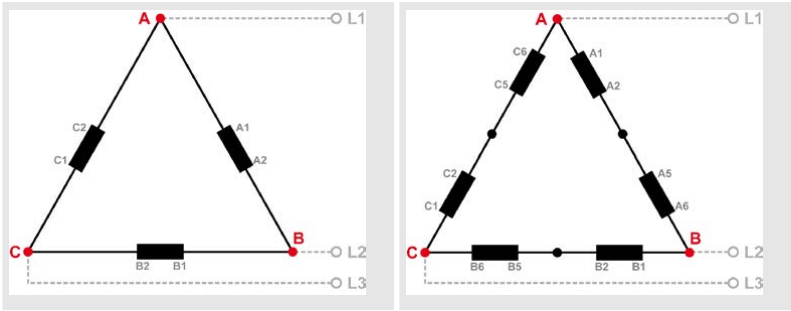


Table 14: System B windings - 3Ph 3W

Measuring inputs

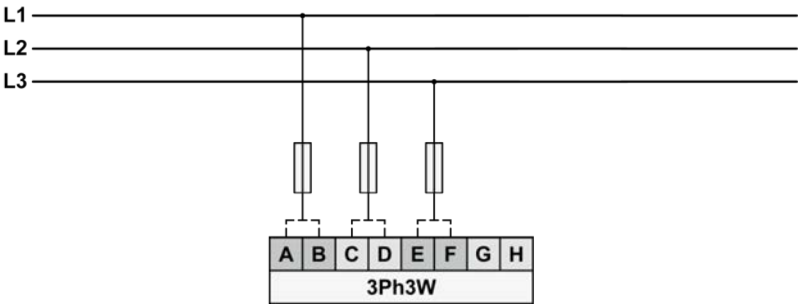


Fig. 31: Measuring inputs - 3Ph 3W

Terminal assignment

3Ph 3W	Wiring terminals							
Rated voltage (range)	120 V (50 to 130 V <sub>eff.</sub> )				480 V (131 to 480 V <sub>eff.</sub> )			
Measuring range (max.)	0 to 150 Vac				0 to 600 Vac			
Terminal	A	C	E	G	B	D	F	H
	22	24	26	28	23	25	27	29
Phase	L1	L2	L3	---	L1	L2	L3	---



For different voltage systems, different wiring terminals have to be used.

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

System B windings

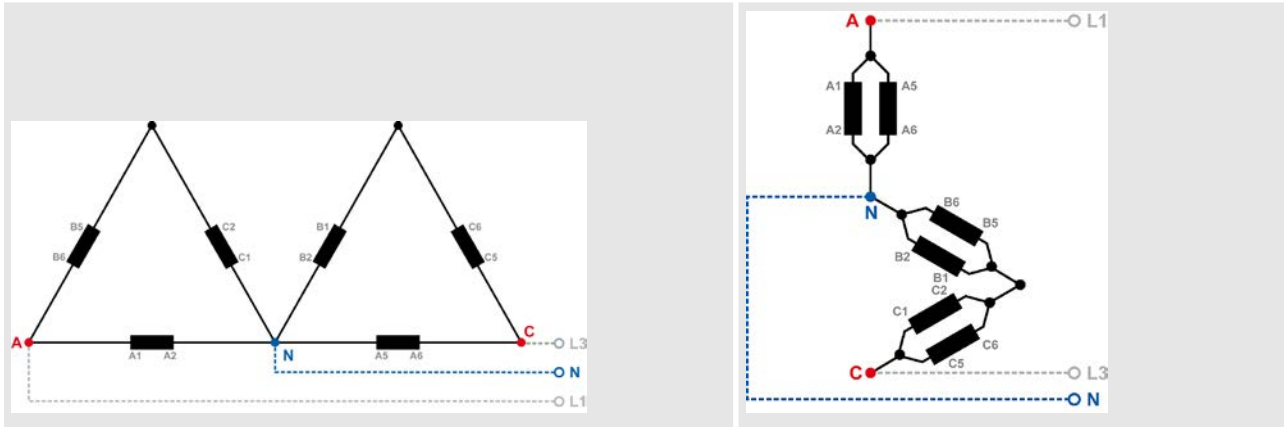


Table 15: System B windings - 1Ph 3W

Measuring inputs

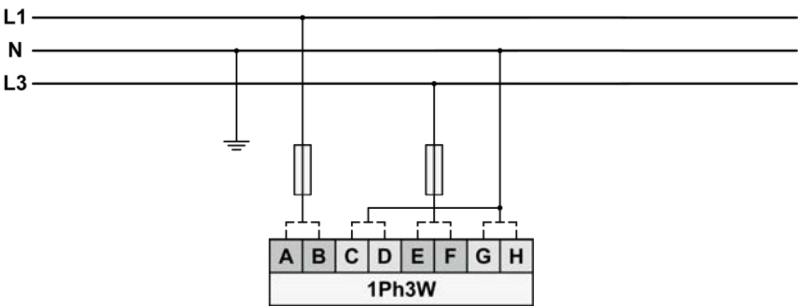


Fig. 32: Measuring inputs - 1Ph 3W

Terminal assignment

1Ph 3W	Wiring terminals							
Rated voltage (range)	120 V (50 to 130 V <sub>eff.</sub> )				480 V (131 to 480 V <sub>eff.</sub> )			
Measuring range (max.)	0 to 150 Vac				0 to 600 Vac			
Terminal	A	C	E	G	B	D	F	H
	22	24	26	28	23	25	27	29
Phase	L1	N	L3	N	L1	N	L3	N



For different voltage systems, different wiring terminals have to be used.  
Incorrect measurements are possible, if both voltage systems use the same N terminal.

3.3.4.2.4 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 easYgen consistently.

'1Ph 2W' Phase-Neutral Measuring  
System B windings

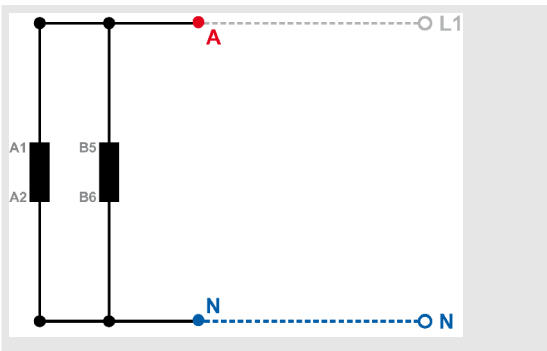
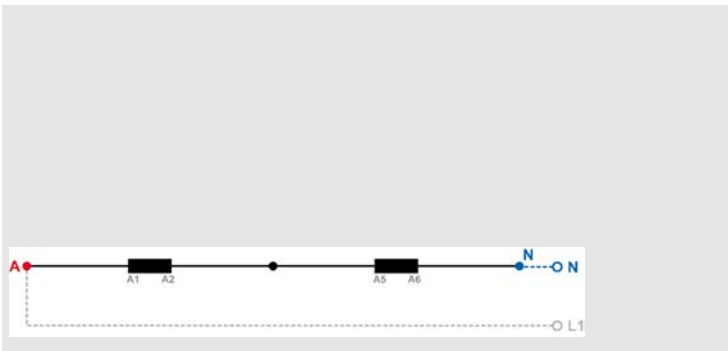


Table 16: System B windings - 1Ph 2W (phase neutral)

Measuring inputs

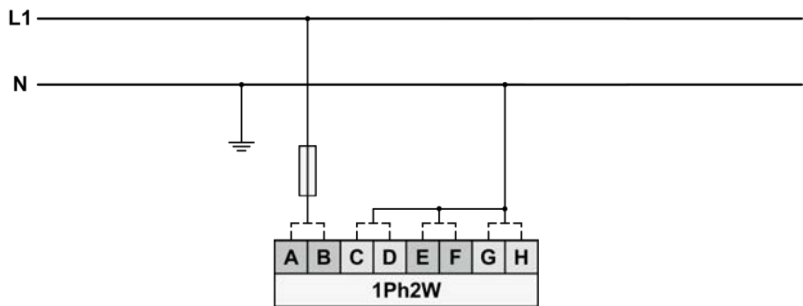


Fig. 33: Measuring inputs - 1Ph 2W (phase neutral)

Terminal assignment

1Ph 2W	Wiring terminals							
Rated voltage (range)	120 V (50 to 130 V <sub>eff.</sub> )				480 V (131 to 480 V <sub>eff.</sub> )			
Measuring range (max.)	0 to 150 Vac				0 to 600 Vac			
Terminal	A	C	E	G	B	D	F	H
	22	24	26	28	23	25	27	29
Phase	L1	N	N	N	L1	N	N	N



For different voltage systems, different wiring terminals have to be used.

Incorrect measurements are possible, if both voltage systems use the same N terminal.

'1Ph 2W' Phase-Phase Measuring  
System B windings

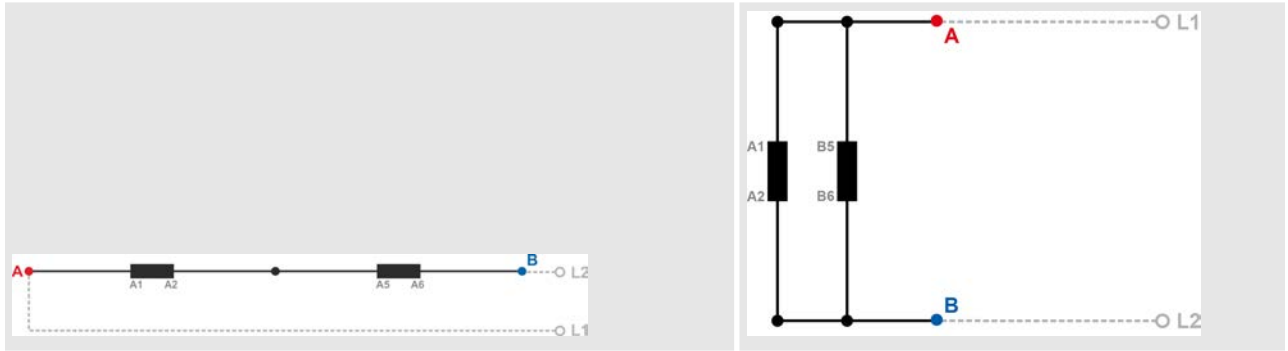


Table 17: System B windings - 1Ph 2W (phase-phase)

Measuring inputs

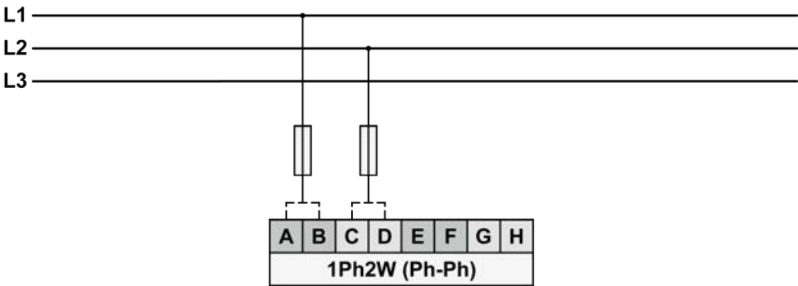


Fig. 34: Measuring inputs - 1Ph 2W (phase-phase)

Terminal assignment

1Ph 2W	Wiring terminals							
Rated voltage (range)	120 V (50 to 130 V <sub>eff.</sub> )				480 V (131 to 480 V <sub>eff.</sub> )			
Measuring range (max.)	0 to 150 Vac				0 to 600 Vac			
Terminal	A	C	E	G	B	D	F	H
	22	24	26	28	23	25	27	29
Phase	L1	L2	---	---	L1	L2	---	---



For different voltage systems, different wiring terminals have to be used.

3.3.5 Current Measuring (System A)

General notes



**WARNING!**

**Dangerous voltages due to missing load**

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



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

Schematic and terminals

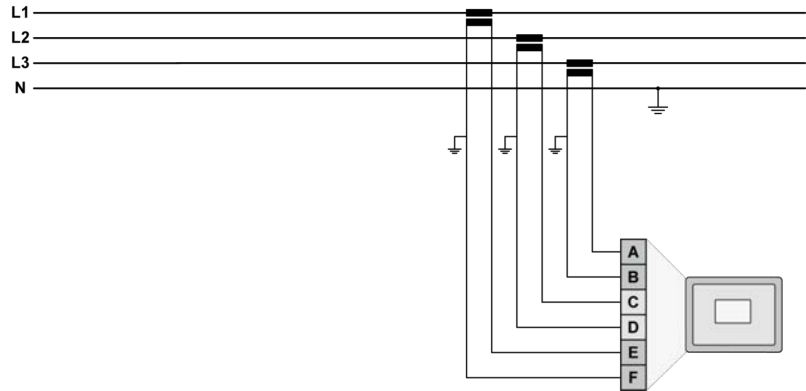


Fig. 35: Current measuring - system A - wiring

Terminal		Description	A <sub>max</sub>
A	7	System A current - L3	2.5 mm <sup>2</sup>
B	4	System A current - L3 (GND)	2.5 mm <sup>2</sup>
C	6	System A current - L2	2.5 mm <sup>2</sup>
D	4	System A current - L2 (GND)	2.5 mm <sup>2</sup>
E	5	System A current - L1	2.5 mm <sup>2</sup>
F	4	System A current - L1 (GND)	2.5 mm <sup>2</sup>

Table 18: Current measuring - system A - terminal assignment

3.3.5.1 Parameter Setting 'L1 L2 L3'

Schematic and terminals

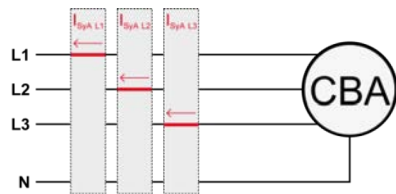


Fig. 36: Current measuring - system A, L1 L2 L3

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





"Phase L1 and L3" applies if the system A voltage measurement is configured to 1Ph 3W (Chapter 3.3.4.1.4 "Parameter Setting '1Ph 3W' (1-phase, 3-wire)" on page 38).

3.3.5.2 Parameter Setting 'Phase L1' 'Phase L2' 'Phase L3'

Schematic and terminals

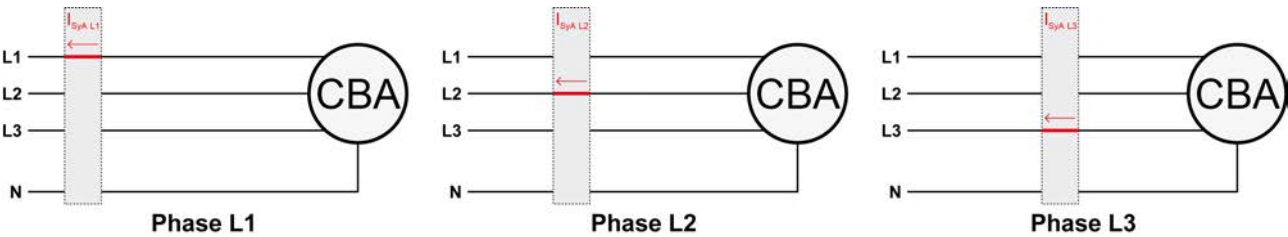


Fig. 37: Current measuring - system A, 'Phase L1' 'Phase L2' 'Phase L3'

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

### 3.3.6 Power Measuring

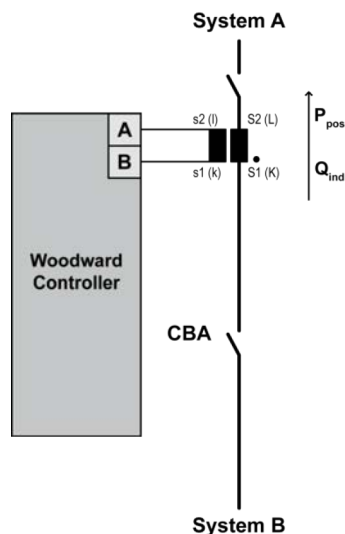


Fig. 38: Power measuring - wiring

If the unit's current transformers are wired according to the diagram (Fig. 38), the following values are displayed.

Terminal		Description
A	5	System A Current L1
B	4	System A Current GND

Parameter	Description	Sign displayed
Positive real power	Power flow from System B to System A	+ Positive
Inductive ( $\cos \phi$ )	Inductive power flow from System B to System A	+ Positive

### 3.3.7 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

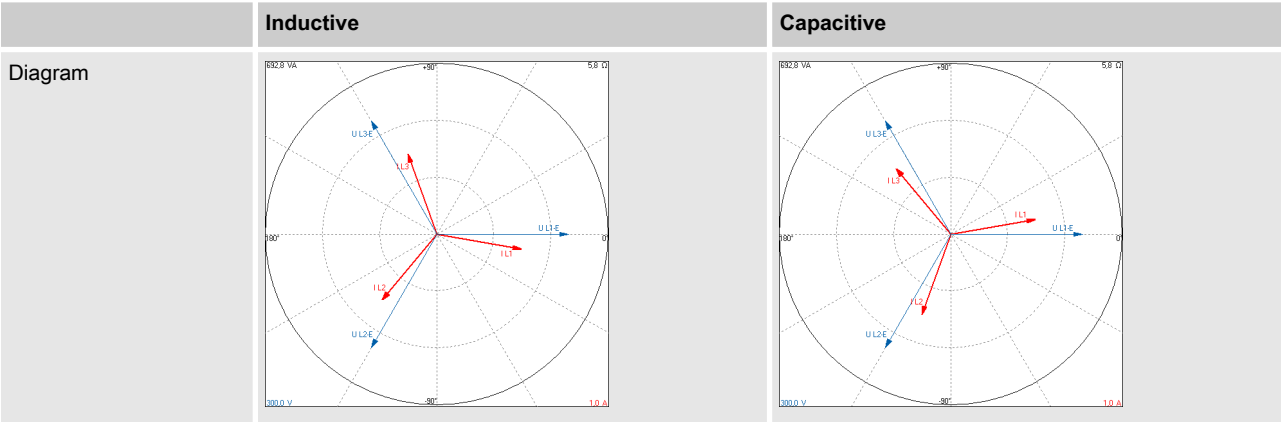
	Inductive	Capacitive
Load type	Electrical load whose current waveform lags the voltage waveform thus having a lagging power factor. Some inductive loads such as electric motors have a large startup current requirement resulting in lagging power factors.	Electrical load whose current waveform leads the 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)
Reactive power display on the unit	70 kvar (positive)	-60 kvar (negative)
Output of the interface	+ (positive)	- (negative)
Current relation to voltage	Lagging	Leading
Generator state	Overexcited	Underexcited

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

Phasor diagram



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



3.3.8 Discrete Inputs

General notes



The discrete inputs are electrically isolated which permits the polarity of the connections to be either positive or negative.

- All discrete inputs must use the same polarity, either positive or negative signals, due to the common ground.

Schematic and terminal assignment

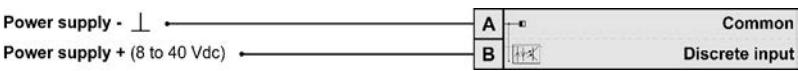


Fig. 39: Discrete input - positive polarity signal



Fig. 40: Discrete input - negative polarity signal

Terminal		Description		A <sub>max</sub>
A	B			
43	44	Discrete Input [DI 01]	Preconfigured to "Lock monitoring" <sup>1</sup>	2.5 mm <sup>2</sup>
GND	45	Discrete Input [DI 02]	Preconfigured to "Remote acknowledge" <sup>1</sup>	2.5 mm <sup>2</sup>
Common ground	46	Discrete Input [DI 03]	Fixed to "Reply: CB A is closed" if second feedback CB A activated and parameter 4128 ↗ p. 109 is configured to "On" <sup>1</sup>	2.5 mm <sup>2</sup>
	47	Discrete Input [DI 04]	Preconfigured to "Immediate open CB A" <sup>1</sup>	2.5 mm <sup>2</sup>
	48	Discrete Input [DI 05]	Preconfigured to "Reply: Isolation switch is open" <sup>1</sup>	2.5 mm <sup>2</sup>
	49	Discrete Input [DI 06]	Preconfigured to "Open CB A (with unloading)" <sup>1</sup>	2.5 mm <sup>2</sup>
	50	Discrete Input [DI 07]	Preconfigured to "Enable to close CB A" <sup>1</sup>	2.5 mm <sup>2</sup>
	51	Discrete Input [DI 08]	Fixed to "Reply: CB A is open"	2.5 mm <sup>2</sup>



<sup>1</sup> configurable via LogicsManager

Operation logic

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

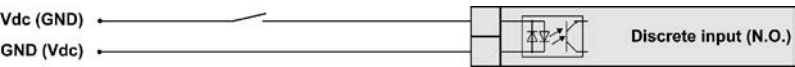


Fig. 41: Discrete inputs - state N.O.

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. 42: Discrete inputs - state N.C.

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

The N.O. or N.C. contacts may be connected to the signal terminal as well as to the ground terminal of the discrete input (↗ "Schematic and terminal assignment" on page 51).

3.3.9 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 [Chapter 3.5 "Connecting 24 V Relays"](#) on page 58.

Schematic and terminals

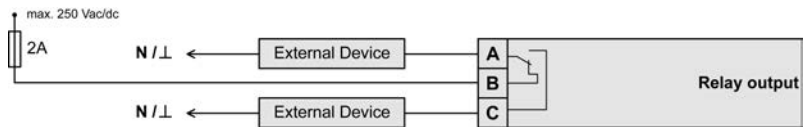


Fig. 43: Relay outputs - schematic

Terminal		Description			A <sub>max</sub>
Common	N.O.				
A	C	Form A			
30	31	Relay output [R 01]	All	Fixed to "Ready for operation" <sup>1</sup>	2.5 mm <sup>2</sup>
32	33	Relay output [R 02]	All	Preconfigured to "Common CB A failure" <sup>1</sup>	2.5 mm <sup>2</sup>
34	35	Relay output [R 03]	All	Preconfigured to "Missing LS5" <sup>1</sup>	2.5 mm <sup>2</sup>
36	37	Relay output [R 04]	All	Preconfigured to "System A or B not OK" <sup>1</sup>	2.5 mm <sup>2</sup>
41	42	Relay output [R 06]	All	Fixed to "Close CB A" in [CB A: Two relay] mode otherwise preconfigured to "All alarm classes" <sup>1</sup>	2.5 mm <sup>2</sup>

Terminal			Description			A <sub>max</sub>
Common	N.C.	N.O.				
A	B	C	Form C			
38	39	40	Relay output [R 05]	All	Fixed to "Open CB A"	2.5 mm <sup>2</sup>



**Notes**

<sup>1</sup> configurable via LogicsManager



- Notes**
- **LogicsManager:** Using the function *LogicsManager* it is possible to freely program the relays for all application modes.
  - **N.O.:** normally open (make) contact
  - **N.C.:** normally closed (break) contact

3.3.10 Serial Interface

3.3.10.1 RS-485 Interface

General notes



Please note that the RS-485 interface only operates in half-duplex mode.

Pin assignment

Terminal	Description	A <sub>max</sub>
58	RS-485-B (TxD-)	N/A
59	RS-485-A (TxD+)	N/A

Table 19: Pin assignment

RS-485 half-duplex

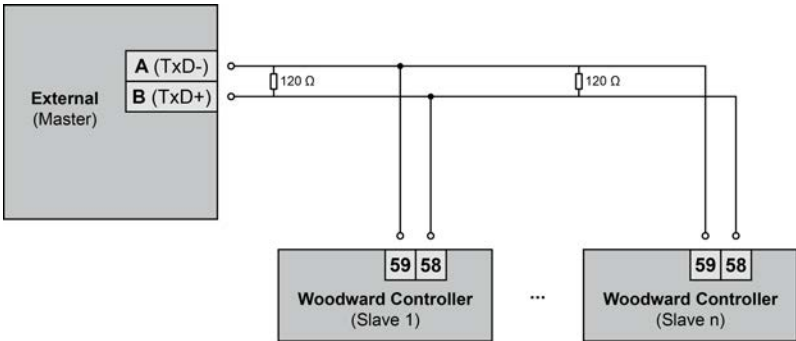


Fig. 44: RS-485 - connection for half-duplex operation

3.3.11 Service Port

Service port connector

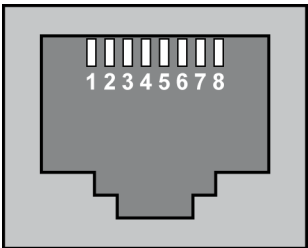


Fig. 45: Service port connector (RJ-45)

The Woodward specific service port is a connector (RJ-45) to extend the interfaces of the controller.



The service port can be **only** used in combination with an optional Woodward direct configuration cable (DPC).

**Direct configuration cable (DPC)**

The DPC cable is used to configure the device with the ToolKit configuration software and external extensions/applications.

There are two versions available:

- DPC-USB direct configuration cable
- DPC-RS-232 direct configuration cable

**DPC-USB direct configuration cable**

Use the DPC-USB direct configuration cable if you want to connect the Woodward controller to an external device (master) which is equipped with an USB port.

Order item number:

- DPC-USB direct configuration cable – P/N 5417-1251

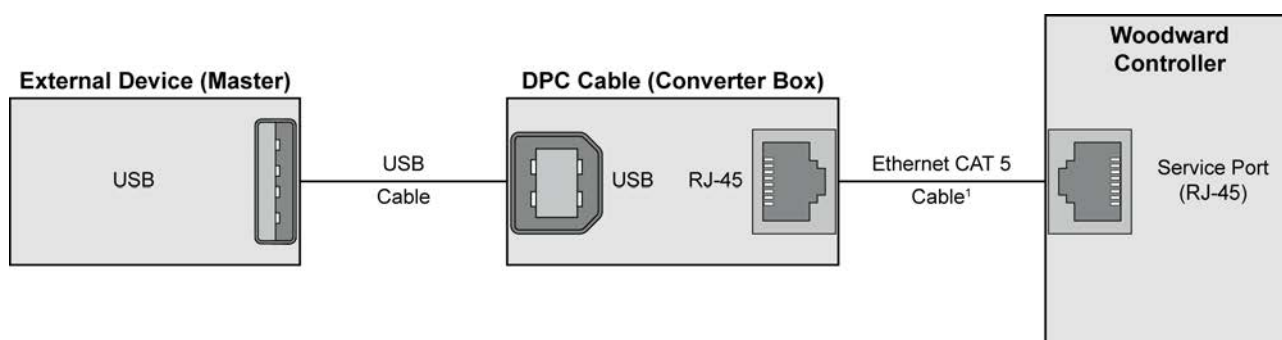


Fig. 46: DPC-USB wiring - schematic



<sup>1</sup> Use the Ethernet CAT 5 cable which is supplied with the DPC-USB converter. The maximum cable length must not exceed 0.5 m.

**DPC-RS-232 direct configuration cable**

Use the DPC-RS-232 direct configuration cable if you want to connect the Woodward controller to an external device (master) which is equipped with an RS-232 port.

Order item number:

- DPC-RS-232 direct configuration cable – P/N 5417-557

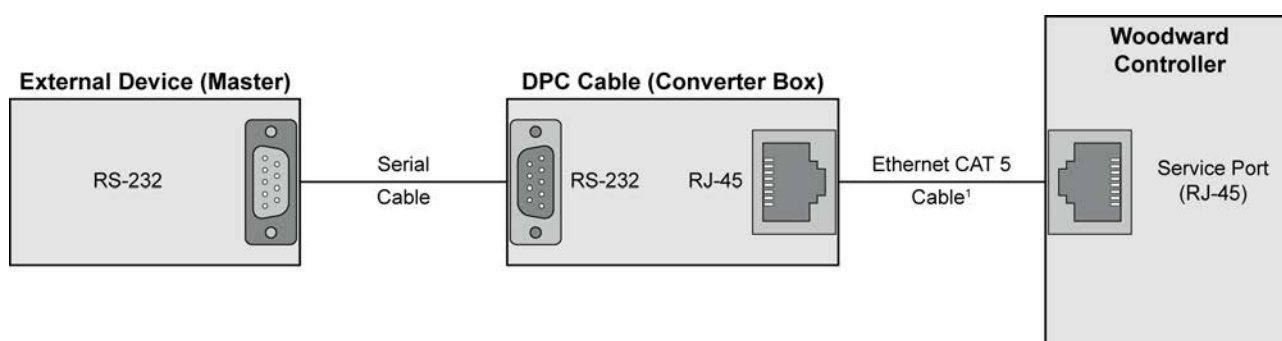


Fig. 47: DPC-RS-232 wiring - schematic



<sup>1</sup> Use the Ethernet CAT 5 cable which is supplied with the DPC-RS-232 converter. The maximum cable length must not exceed 0.5 m.



For a continuous operation with the direct configuration cable DPC-RS-232 (e.g. remote control of controller), it is required to use at least revision F (P/N 5417-557 Rev. F) of the DPC-RS-232. When using a DPC-RS-232 of an earlier revision, problems may occur in continuous operation. The shield connector (6.3 mm tab connector) at the DPC-RS-232 of revision F (P/N 5417-557 Rev. F) and above must be connected to ground.

3.4 CAN Bus Interface

Pin assignment

Terminal	Description	A <sub>max</sub>
56	CAN-L	N/A
57	CAN-H	N/A

Table 20: 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 Ohms, 1/4 W) at both ends. The termination resistor is connected between CAN-H and CAN-L (Fig. 48).

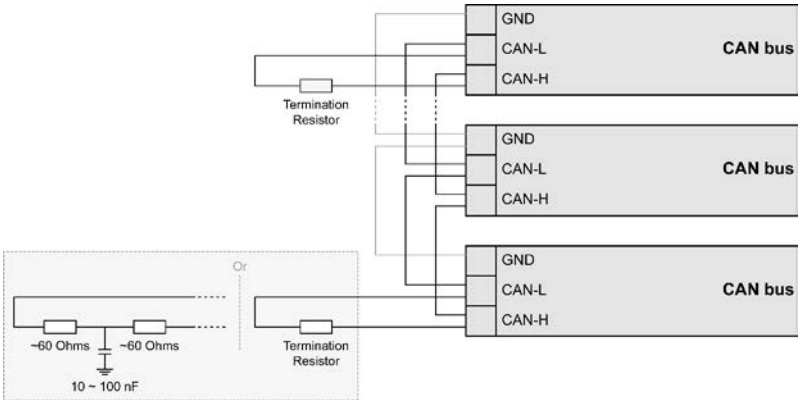


Fig. 48: CAN bus - termination

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 (Fig. 48).

Maximum CAN bus length

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

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



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

Bus shielding

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

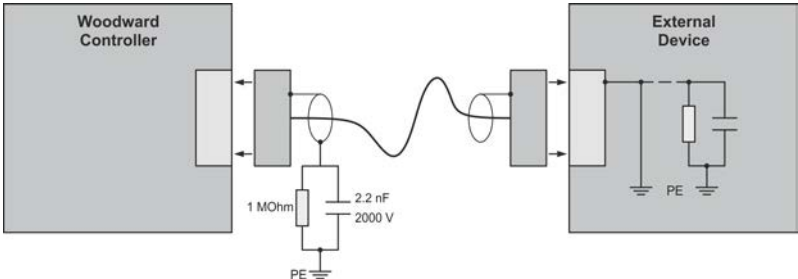


Fig. 49: Bus shielding (external RC element)

Troubleshooting



*If data is not transmitting on the CAN bus, check the 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 LIYCY (TP) 2×2×0.25
- UNITRONIC-Bus LD 2×2×0.22

### 3.5 Connecting 24 V Relays


**NOTICE!**

**Damage to adjacent electronic components due to induced voltages**

- Implement protection circuits as detailed below.

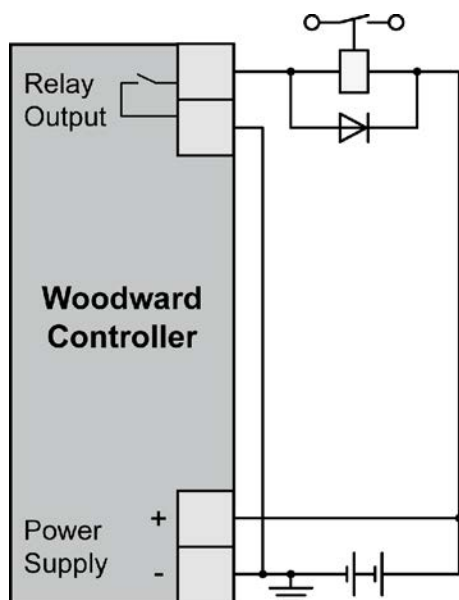


Fig. 50: Protection circuit (example)



Fig. 50 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
		<ul style="list-style-type: none"> <li>Uncritical dimensioning</li> <li>Lowest possible induced voltage</li> <li>Very simple and reliable</li> </ul>	High release delay
		<ul style="list-style-type: none"> <li>Uncritical dimensioning</li> <li>High energy absorption</li> <li>Very simple setup</li> <li>Suitable for AC voltage</li> <li>Reverse polarity protected</li> </ul>	No attenuation below VVDR
		<ul style="list-style-type: none"> <li>HF attenuation by energy storage</li> <li>Immediate shut-off limiting</li> <li>Attenuation below limiting voltage</li> <li>Very suitable for AC voltage</li> <li>Reverse polarity protected</li> </ul>	Exact dimensioning required

## 4 Configuration

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.*

### 4.1 Basic Setup

#### 4.1.1 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.*

ID	Parameter	CL	Setting range [Default]	Description
1700	<b>Language</b> (Set language)	0	selectable languages [English]	The desired language for the unit display text is configured here.
1710	<b>Hour</b>	0	hour 0 to 23 h [real-time clock]	The hour of the clock time is set here.
				<b>Example</b> <ul style="list-style-type: none"> <li>■ 0 = 0th hour of the day (midnight).</li> <li>■ 23 = 23rd hour of the day (11 pm).</li> </ul>
1709	<b>Minute</b>	0	0 to 59 min [real-time clock]	The minute of the clock time is set here.
				<b>Example</b> <ul style="list-style-type: none"> <li>■ 0 = 0th minute of the hour</li> <li>■ 59 = 59th minute of the hour</li> </ul>
1708	<b>Second</b>	0	0 to 59 s [real-time clock]	The second of the clock time is set here.

ID	Parameter	CL	Setting range [Default]	Description
				<b>Example</b> <ul style="list-style-type: none"> <li>0 = 0th second of the minute</li> <li>59 = 59th second of the minute</li> </ul>
1698	Transfer time to clock	0	Yes	Adjusted time will be transferred to the unit.
			No	Adjusted time will be not transferred to the unit.
				<b>Notes</b> This parameter may only be configured using ToolKit.
1711	Day	0	day 1 to 31 [real-time clock]	The day of the date is set here.
				<b>Example</b> <ul style="list-style-type: none"> <li>1 = 1st day of the month.</li> <li>31 = 31st day of the month.</li> </ul>
1712	Month	0	month 1 to 12 [real-time clock]	The month of the date is set here.
				<b>Example</b> <ul style="list-style-type: none"> <li>1 = 1st month of the year.</li> <li>12 = 12th month of the year.</li> </ul>
1713	Year	0	year 0 to 99 [real-time clock]	The year of the date is set here.
				<b>Example</b> <ul style="list-style-type: none"> <li>0 = Year 2000</li> <li>99 = Year 2099</li> </ul>
1699	Transfer date to clock	0	Yes	Adjusted date will be transferred to the unit.
			No	Adjusted date will be not transferred to the unit.
				<b>Notes</b> This parameter may only be configured using ToolKit.
4591	Daylight saving time	2		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.
			On	Daylight saving time is enabled.
			[Off]	Daylight saving time is disabled.

ID	Parameter	CL	Setting range [Default]	Description
				<b>Notes</b> Do not change the time manually during the hour of the automatic time change if DST is enabled to avoid a wrong time setting. Events or alarms, which occur during this hour might have a wrong time stamp.
4594	DST begin time	2	0 to 23 [2]	The real-time clock will be advanced by one hour when this time is reached on the DST begin date.
				<b>Example</b> ■ 0 = 0th hour of the day (midnight) ■ 23 = 23rd hour of the day (11 pm)
				<b>Notes</b> This parameter is only displayed, if Daylight saving time (parameter 4591 ↗ p. 60) is set to "On".
4598	DST begin weekday	2	Sunday to Saturday [Sunday]	The weekday for the DST begin date is configured here
				<b>Notes</b> This parameter is only displayed, if Daylight saving time (parameter 4591 ↗ p. 60) 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.
				<b>Notes</b> This parameter is only displayed, if Daylight saving time (parameter 4591 ↗ p. 60) is set to "On".
4593	DST begin month	2	1 to 12 [3]	The month for the DST begin date is configured here.
				<b>Example</b> ■ 1 = 1st month of the year ■ 12 = 12th month of the year
				<b>Notes</b> This parameter is only displayed, if Daylight saving time (parameter 4591 ↗ p. 60) is set to "On".
4597	DST end time	2	0 to 23 [3]	The real-time clock will fall back by one hour when this time is reached on the DST end date

ID	Parameter	CL	Setting range [Default]	Description
				<b>Example</b> <ul style="list-style-type: none"> <li>0 = 0th hour of the day (midnight).</li> <li>23 = 23rd hour of the day (11 pm).</li> </ul>
				<b>Notes</b> This parameter is only displayed, if Daylight saving time (parameter 4591 ↗ p. 60) is set to "On".
4599	DST end weekday	2	Sunday to Saturday [Sunday]	The weekday for the DST end date is configured here  <b>Notes</b> This parameter is only displayed, if Daylight saving time (parameter 4591 ↗ p. 60) 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.
				<b>Notes</b> This parameter is only displayed, if Daylight saving time (parameter 4591 ↗ p. 60) is set to "On".
4596	DST end month	2	1 to 12 [10]	The month for the DST begin date is configured here.
				<b>Example</b> <ul style="list-style-type: none"> <li>1 = 1st month of the year</li> <li>12 = 12th month of the year</li> </ul>
				<b>Notes</b> This parameter is only displayed, if Daylight saving time (parameter 4591 ↗ p. 60) 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 ↗ "Daylight saving time - configuration example" Table on page 62 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

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

*Table 21: 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 22: Daylight saving time - exemplary dates*

## 4.1.2 Configure Display

The contrast and the brightness of the display may be adjusted using this screen.

## 4.1.3 Enter Password

### General notes

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

A distinction is made between the access levels as follows:

Code level	
<p>Code level CL0 (User Level)</p> <p>Standard password = none</p>	<p>This code level permits for monitoring of the system and limited access to the parameters.</p> <p>Configuration of the control is not permitted.</p> <p>Only the parameters for setting the language, the date, the time, and the horn reset time are accessible.</p> <p>The unit powers up in this code level.</p>
<p>Code level CL1 (Service Level)</p> <p>Standard password = "0 0 0 1"</p>	<p>This code level entitles the user to change selected non-critical parameters, such as setting the parameters accessible in CL0 plus Bar/PSI, °C/°F.</p> <p>The user may also change the password for level CL1.</p> <p>Access granted by this password expires two hours after the password has been entered and the user is returned to the CL0 level.</p>
<p>Code level CL2 (Temporary Commissioning Level)</p> <p>No standard password available</p>	<p>This code level grants temporary access to most of the parameters. The password is calculated from the random number generated when the password is initially accessed.</p> <p>It is designed to grant a user one-time access to a parameter without having to give him a reusable password. The user may also change the password for level CL1.</p> <p>Access granted by this password expires two hours after the password has been entered and the user is returned to the CL0 level. The password for the temporary commissioning level may be obtained from the vendor.</p>
<p>Code level CL3 (Commissioning Level)</p> <p>Standard password = "0 0 0 3"</p>	<p>This code level grants complete and total access to most of the parameters. In addition, the user may also change the passwords for levels CL1, CL2 and CL3.</p> <p>Access granted by this password expires two hours after the password has been entered and the user is returned to the CL0 level.</p>



*Once the code level is entered, access to the configuration menus will be permitted for two hours or until another password is entered into the control. If a user needs to exit a code level then code level, CL0 should be entered. This will block unauthorized configuration of the control.*

*A user may return to CL0 by allowing the entered password to expire after two hours or by changing any one digit on the random number generated on the password screen and entering it into the unit.*

*It is possible to disable expiration of the password by entering "0000" after the CL1 or CL3 password has been entered. Access to the entered code level will remain enabled until another password is entered. Otherwise, the code level would expire when loading the standard values (default 0000) via ToolKit.*



**Code level display**

The current code level is indicated by the corresponding numeric value (e.g. "*Code level display*": "1") in the configuration menu screens. The value indicates that all parameters of a higher code level are "locked".

ID	Parameter	CL	Setting range [Default]	Description
10400	Password display	0	0000 to 9999 [random number]	The password for configuring the control via the front panel must be entered here.
10405	Code level display	0	(display only) [0]	This value displays the code level, which is currently enabled for access via the front panel display.
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.
10407	Code level CAN interface 1	0	(display only) [0]	This value displays the code level, which is currently enabled for access via the CAN interface #1.
10401	Password for serial interface 1	0	0000 to 9999 [random number]	The password for configuring the control via RS-232 serial interface #1 must be entered here.
10406	Code level serial interface 1	0	(display only) [0]	This value displays the code level, which is currently enabled for access via RS-232 serial interface #1.
10430	Password for serial interface 2	2	0000 to 9999 [random number]	The password for configuring the control via RS-485 serial interface #1 must be entered here..
10420	Code level serial interface 2	0	(display only) [0]	This value displays the code level, which is currently enabled for access via RS-485 serial interface #1.

**4.1.4 System Management**

ID	Parameter	CL	Setting range [Default]	Description
1702	Device number	2	33 to 64 [33]	<p>A unique address is assigned to the control through 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.</p> <p>All other bus addresses are calculated on the number entered in this parameter.</p> <p><b>Notes</b></p> <p>The unit must be restarted after changing the device number to ensure proper operation.</p> <p>No access in the application modes <b>A03</b> and <b>A04</b>.</p>
4556	Configure display backlight	2	On	The display backlight is always enabled.
			Off	The display backlight is always disabled.

ID	Parameter	CL	Setting range [Default]	Description
			[Key activate]	The display backlight will be dimmed, if no soft key is pressed for the time configured in parameter 4557 ↗ p. 66.
4557	Time until backlight shut- down	2	1 to 999 min [120 min]	If no soft key has been pressed for the time configured here, the display backlight will be dimmed.
				<b>Notes</b> This parameter is only effective, if parameter 4556 ↗ p. 65 is configured to "Key activate".
12978	Lock keypad	2	Determined by LogicsManager	The result of the LogicsManager evaluation determines the following:  <b>True:</b> <ul style="list-style-type: none"> <li>■ The buttons "MAN" and "AUTO" are locked.</li> <li>■ The softkey "OPEN"/"CLOSE" are locked.</li> <li>■ Acknowledge of alarms is blocked.</li> <li>■ All parameters with the exception of display relevant parameters are not accessible.</li> </ul> <b>False</b> <ul style="list-style-type: none"> <li>■ Full access is granted depending on the code level.</li> </ul>
				<b>Notes</b> Please be aware that this function is able to block the device front panel access.  Typically this function is triggered by an external key switch connected to a discrete input. This discrete input should be configured to "Control" (DI {x} Alarm class) or "Self acknowledge" (DI {x} Self acknowledge).  In case of misconfiguration an external access is only possible via external interface or ToolKit configuration software.  In case of misconfiguration the access is only possible via an external interface or ToolKit configuration software.
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	0	Yes	All parameters, which the enabled access code grants privileges to, will be restored to factory default values.
			[No]	All parameters will remain as currently configured.
				<b>Notes</b> This parameter is only displayed, if Factory Settings (parameter 10417 ↗ p. 66) is set to "Yes".
10500	Start Boot- loader	2	00000 [42405]	The bootloader is utilized for uploading application software only. The proper enable code must be entered while the control is in access code level CL3 or higher to perform this function.
				<b>Notes</b> This parameter is only displayed, if Factory Settings (parameter 10417 ↗ p. 66) is set to "Yes".  This function is used for uploading application software and may only be used by authorized Woodward service personnel!

ID	Parameter	CL	Setting range [Default]	Description
1706	Clear eventlog	2	Yes	The event history will be cleared.
			[No]	The event history will not be cleared.
				<b>Notes</b> This parameter is only displayed, if Factory Settings (parameter 10417 ↗ p. 66) is set to "Yes".

## 4.1.5 Password System

### 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-232/485 interface, and via the CAN bus).*

ID	Parameter	CL	Setting range [Default]	Description
10415	Basic code level	1	1 to 9999 [-]	The password for the code level "Service" is defined in this parameter. Refer to ↗ Chapter 4.1.3 "Enter Password" on page 63 for default values.
10413	Commissioning code level	3	1 to 9999 [-]	The password for the code level "Commission" is defined in this parameter. Refer to ↗ Chapter 4.1.3 "Enter Password" on page 63 for default values.
10414	Commissioning code level	3	1 to 9999 [-]	The algorithm for calculating the password for the code level "Temporary Commissioning" is defined in this parameter.
10412	Temp. super-comm. level code	5	1 to 9999 [-]	The algorithm for calculating the password for the code level "Temporary Supercommissioning" is defined in this parameter.
10411	Supercommissioning level code	5	1 to 9999 [-]	The password for the code level "Supercommissioning" is defined in this parameter. Refer to ↗ Chapter 4.1.3 "Enter Password" on page 63 for default values.

## 4.2 Configure Measurement

ID	Parameter	CL	Setting range [Default]	Description
1750	System rated frequency	2	50 / 60 Hz [50 Hz]	The rated frequency of the system is used as a reference figure for all frequency related functions, which use a percentage value, like frequency monitoring, breaker operation windows or the Analog Manager.
1766	SyA. rated voltage	2	50 to 650000 V [400 V]	The sytem A potential transformer primary voltage is entered in this parameter.  The system A rated voltage is used as a reference figure for all system A voltage related functions, which use a percentage value, like sytem A voltage monitoring, breaker operation windows or the Analog Manager.
1768	SyB. rated voltage	2	50 to 650000 V [400 V]	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 BS voltage monitoring, breaker operation windows or the Analog Manager.
1752	SyA. rated active power [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.
1758	SyA. rated react. power [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.
1754	SyA. rated current	2	1 to 32000 A [300 A]	This value specifies the system A rated current, which is used as a reference figure for related functions.
1858	1Ph2W voltage measuring	2	[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.
			<b>Notes</b> For information on measuring principles refer to <a href="#">Chapter 3.3.4.1 "System A Voltage" on page 34.</a>	
1859	1Ph2W phase rotation	2	[CW]	A clockwise rotation field is considered for 1Ph 2W measuring .
			CCW	A counter-clockwise rotation field is considered for 1Ph 2W measuring.
			<b>Notes</b> The measurement of phase rotation with 1Ph2W is not possible. For this reason monitoring phase rotation mismatch is working with this supposed phase rotation.  For information on measuring principles refer to <a href="#">Chapter 3.3.4.1 "System A Voltage" on page 34.</a>	
1851	SyA. 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

ID	Parameter	CL	Setting range [Default]	Description
			[3Ph 4W]	<p>Measurement is performed Line-Neutral (WYE connected system) and Line-Line (Delta connected system). The protection depends on the setting of parameter 1771 <a href="#">↗</a> p. 72.</p> <p>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.</p> <p>Monitoring refers to the following voltages:</p> <ul style="list-style-type: none"> <li>■ VL12, VL23 and VL31 (parameter 1771 <a href="#">↗</a> p. 72 configured to "Phase-phase")</li> <li>■ VL1N, VL2N and VL3N (parameter 1771 <a href="#">↗</a> p. 72 configured to "Phase-neutral")</li> <li>■ VL12, VL23, VL31, VL1N, VL2N and VL3N (parameter 1771 <a href="#">↗</a> p. 72 configured to "All")</li> </ul>
			3Ph 3W	<p>Measurement is performed Line-Line (Delta connected system). Phase voltages must be connected for proper calculation.</p> <p>Measurement, display and protection are adjusted according to the rules for Delta connected systems.</p> <p>Monitoring refers to the following voltages:</p> <ul style="list-style-type: none"> <li>■ VL12, VL23, VL31</li> </ul>
			1Ph 2W	<p>Measurement is performed Line-Neutral (WYE connected system) if parameter 1858 <a href="#">↗</a> p. 68 is configured to "Phase - neutral" and Line-Line (Delta connected system) if parameter 1858 <a href="#">↗</a> p. 68 is configured to "Phase - phase".</p> <p>Measurement, display and protection are adjusted according to the rules for phase-phase systems.</p> <p>Monitoring refers to the following voltages:</p> <ul style="list-style-type: none"> <li>■ VL1N, VL12</li> </ul>
			1Ph 3W	<p>Measurement is performed Line-Neutral (WYE connected system) and Line-Line (Delta connected system). The protection depends on the setting of parameter 1771 <a href="#">↗</a> p. 72.</p> <p>Measurement, display, and protection are adjusted according to the rules for single-phase systems.</p> <p>Monitoring refers to the following voltages:</p> <ul style="list-style-type: none"> <li>■ VL13 (parameter 1771 <a href="#">↗</a> p. 72 configured to "Phase-phase")</li> <li>■ VL1N, VL3N (parameter 1771 <a href="#">↗</a> p. 72 configured to "Phase-neutral")</li> <li>■ VL1N, VL3N (parameter 1771 <a href="#">↗</a> p. 72 configured to "All")</li> </ul>
				<p><b>Notes</b></p> <p>If this parameter is configured to 1Ph 3W, the system A rated voltages (parameters 1766 <a href="#">↗</a> p. 68 must be entered as Line-Line (Delta).</p> <p>For information on measuring principles refer to <a href="#">↗ Chapter 3.3.4.1 "System A Voltage" on page 34.</a></p>
1850	SyA. current measuring	2	[L1 L2 L3]	<p>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</p>
			Phase L{1/2/3}	<p>Only one phase is monitored. Measurement, display and protection are adjusted according to the rules for single-phase measurement.</p> <p>Monitoring refers to the selected phase.</p>

ID	Parameter	CL	Setting range [Default]	Description
				<b>Notes</b> <p>This parameter is only effective if system A voltage measuring (parameter 1851 ↗ p. 68) is configured to "3Ph 4W" or "3Ph 3W".</p> <p>For information on measuring principles refer to ↗ <i>Chapter 3.3.4.1 "System A Voltage" on page 34.</i></p>
1853	<b>SyB. voltage measuring</b>	2	[3Ph 4W]	<p>Measurement is performed Line-Neutral (WYE connected system) and Line-Line (Delta connected system). The protection depends on the setting of parameter 1770 ↗ p. 94.</p> <p>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.</p> <p>Monitoring refers to the following voltages:</p> <ul style="list-style-type: none"> <li>■ VL12, VL23 and VL31 (parameter 1770 ↗ p. 94 configured to "Phase-phase")</li> <li>■ VL1N, VL2N and VL3N (parameter 1770 ↗ p. 94 configured to "Phase-neutral")</li> </ul>
			3Ph 3W	<p>Measurement is performed Line-Line (Delta connected system). Phase voltages must be connected for proper calculation.</p> <p>Measurement, display and protection are adjusted according to the rules for Delta connected systems.</p> <p>Monitoring refers to the following voltages:</p> <ul style="list-style-type: none"> <li>■ VL12, VL23, VL31</li> </ul>
			1Ph 2W	<p>Measurement is performed Line-Neutral (WYE connected system) if parameter 1858 ↗ p. 68 is configured to "Phase - neutral" and Line-Line (Delta connected system) if parameter 1858 ↗ p. 68 is configured to "Phase - phase".</p> <p>Measurement, display and protection are adjusted according to the rules for phase-phase systems.</p> <p>Monitoring refers to the following voltages:</p> <ul style="list-style-type: none"> <li>■ VL1N, VL12</li> </ul>
			1Ph 3W	<p>Measurement is performed Line-Neutral (WYE connected system) and Line-Line (Delta connected system).</p> <p>The protection depends on the setting of parameter 1770 ↗ p. 94. Measurement, display, and protection are adjusted according to the rules for single-phase systems.</p> <p>Monitoring refers to the following voltages:</p> <ul style="list-style-type: none"> <li>■ VL13 (parameter 1770 ↗ p. 94 configured to "Phase-phase")</li> <li>■ VL1N, VL3N (parameter 1770 ↗ p. 94 configured to "Phase-neutral")</li> </ul>
				<b>Notes</b> <p>If this parameter is configured to 1Ph 3W, the system B rated voltages (parameter 1768 ↗ p. 68) must be entered as Line-Line (Delta).</p> <p>For information on measuring principles refer to ↗ <i>Chapter 3.3.4.1 "System A Voltage" on page 34.</i></p>

## 4.2.1 Configure Transformer

### General notes

This controller is available in two different hardware versions with either 1A [../1] or 5A [../5] current transformer inputs.

The setpoints for specific parameters will differ depending upon the hardware version, indicated on the data plate.

- [1] LS-5xx-1 = Current transformer with ../1 A rated current
- [5] LS-5xx-5 = Current transformer with ../5 A rated current

ID	Parameter	CL	Setting range [Default]	Description
1801	SyA. PT primary rated voltage	2	50 to 650000 V [400 V]	<p>Some applications may require the use of potential transformers to facilitate measuring the voltages. The rating of the primary side of the potential transformer must be entered into this parameter.</p> <p>If the application does not require potential transformers at sytem A (i.e. the voltage is 480 V or less), then this voltage will be entered into this parameter.</p>
1800	SyA. PT secondary rated voltage	2	50 to 480 V [400 V]	<p>Some applications may require the use of potential transformers to facilitate measuring the voltages. The rating of the secondary side of the potential transformer must be entered into this parameter.</p> <p>If the application does not require potential transformers at system A (i.e. the voltage is 480 V or less), then this voltage will be entered into this parameter.</p> <ul style="list-style-type: none"> <li>■ Rated voltage: 120 Vac (this parameter configured between 50 and 130 V) System A voltage: Terminals 14/16/18/20</li> <li>■ Rated voltage: 480 Vac (this parameter configured between 131 and 480 V) System A voltage: Terminals 15/17/19/21</li> </ul> <p><b>Notes</b></p> <p>WARNING: Only connect the measured voltage to either the 120 Vac or the 480 Vac inputs. Do not connect both sets of inputs to the measured system.</p> <p>The control unit is equipped with dual voltage measuring inputs. The voltage range of these measurement inputs is dependent upon input terminals are used. This value refers to the secondary voltages of the potential transformers, which are directly connected to the control unit.</p>
1806	SyA. CT primary rated current	2	1 to 32000 A/x [500 A/x]	<p>The input of the current transformer ratio is necessary for the indication and control of the actual monitored value.</p> <p>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).</p> <p>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.</p>
1804	SyB. PT primary rated voltage	2	50 to 650000 V [400 V]	<p>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.</p> <p><b>Notes</b></p> <p>If the application does not require potential transformers (i.e. the measured voltage is 480 V or less), then the measured voltage will be entered into this parameter.</p>

ID	Parameter	CL	Setting range [Default]	Description
1803	<b>SyB. PT secondary rated voltage</b>	2	50 to 480 V [400 V]	<p>Some applications may require the use of potential transformers to facilitate measuring the mains voltages. The rating of the secondary side of the potential transformer must be entered into this parameter.</p> <p>If the application does not require potential transformers (i.e. the measured voltage is 480 V or less), then the measured voltage will be entered into this parameter.</p> <ul style="list-style-type: none"> <li>■ Rated voltage: 120 Vac (this parameter configured between 50 and 130 V) System B voltage: Terminals 22/24/26/28</li> <li>■ Rated voltage: 480 Vac (this parameter configured between 131 and 480 V) System B Voltage: Terminals 23/25/27/29</li> </ul>
				<p><b>Notes</b></p> <p>WARNING: Only connect the measured voltage to either the 120 Vac or the 480 Vac inputs. Do not connect both sets of inputs to the measured system.</p> <p>The control is equipped with dual voltage measuring inputs. The voltage range of these measurement inputs is dependent upon input terminals are used. This value refers to the secondary voltages of the potential transformers, which are directly connected to the control.</p>

## 4.3 Configure Monitoring

### 4.3.1 System A

ID	Parameter	CL	Setting range [Default]	Description
1771	<b>SyA. voltage monitoring</b>	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).
			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	<p>The phase-phase <b>and</b> phase-neutral voltage will be monitored and all subsequent parameters concerning voltage monitoring "system A" are referred to this value (VL-L &amp; VL-N).</p> <p>This setting is only effective if "SyA. voltage measuring" (parameter 1851 ↗ p. 68) is configured to "3Ph 4W".</p>



ID	Parameter	CL	Setting range [Default]	Description
				<b>Notes</b> <p>WARNING: This parameter influences the protective functions.</p> <p>Please be aware that if "SyA. voltage monitoring" (parameter 1771 ↗ p. 72) is configured to "All" and the function ↗ Chapter 4.3.1.12 "System A Voltage Increase" on page 89 is used, that this function only monitors "Phase - neutral".</p>
2801	Mains settling time	2	0 to 9999 s [20 s]	<p>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.</p> <p>This parameter permits delaying the switching of the load from the generator to the mains.</p> <p>The display indicates "Mains settling" during this time.</p>

#### 4.3.1.1 System A Operating Voltage / Frequency

##### General notes



*If system A is configured and wired for mains, the system A operating voltage/frequency parameters can be used to trigger mains failure conditions and activate an emergency run.*

*The system A values must be within these ranges to synchronize the CBA.*

- *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 mains 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 mains frequency will be considered as being out of the operating limits as soon as it falls below 45 Hz and will be considered as being within the operating limits again as soon as it exceeds 47.5 Hz (45 Hz + 2.5 Hz).

ID	Parameter	CL	Setting range [Default]	Description
5810	Upper voltage limit	2	100 to 150 % [110 %]	The maximum permissible positive deviation of the system A voltage from the system A rated voltage (parameter 1768 ↗ p. 68) is configured here.  This value may be used as a voltage limit switch. The conditional state of this switch may be used as a command variable for the LogicsManager (02.09).
5814	Hysteresis upper voltage limit	2	0 to 50 % [2 %]	If the system A voltage has exceeded the limit configured in parameter 5810 ↗ p. 74, 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 1768 ↗ p. 68) 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 ↗ p. 74, 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	100.0 to 150.0 % [105.0 %]	The maximum permissible positive deviation of the system A frequency from the rated system frequency (parameter 1750 ↗ p. 68) 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).
5816	Hysteresis upper frequency limit	2	0 to 50 % [0.5 %]	If the system A frequency has exceeded the limit configured in parameter 5812 ↗ p. 74, 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	50.0 to 100.0 % [95.0 %]	The maximum permissible negative deviation of the system A frequency from the rated system frequency (parameter 1750 ↗ p. 68) 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).
5817	Hysteresis lower frequency limit	2	0 to 50 % [0.5 %]	If the system A frequency has fallen below the limit configured in parameter 5813 ↗ p. 74, the frequency must exceed the limit and the value configured here, to be considered as being within the operating limits again.

### 4.3.1.2 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 mains protection thresholds. If a threshold is exceeded, the LS-5 initiates a breaker opening and separates the system B from the mains at the defined breaker.

The following thresholds are monitored:

- Overfrequency level 1 (↗ Chapter 4.3.1.3 “System A Overfrequency (Levels 1 & 2) ANSI# 81O” on page 76)
- Overfrequency level 2 (↗ Chapter 4.3.1.3 “System A Overfrequency (Levels 1 & 2) ANSI# 81O” on page 76)
- Underfrequency level 1 (↗ Chapter 4.3.1.4 “System A Underfrequency (Level 1 & 2) ANSI# 81U” on page 77)
- Underfrequency level 2 (↗ Chapter 4.3.1.4 “System A Underfrequency (Level 1 & 2) ANSI# 81U” on page 77)

- Overvoltage level 1 if parameterized for decoupling  
([↗ Chapter 4.3.1.5 "System A Overvoltage \(Level 1 & 2\) ANSI# 59" on page 78](#))
- Overvoltage level 2 ([↗ Chapter 4.3.1.5 "System A Overvoltage \(Level 1 & 2\) ANSI# 59" on page 78](#))
- Undervoltage level 1 if parameterized ([↗ Chapter 4.3.1.6 "System A Undervoltage \(Level 1 & 2\) ANSI# 27" on page 80](#))
- Undervoltage level 2 ([↗ Chapter 4.3.1.6 "System A Undervoltage \(Level 1 & 2\) ANSI# 27" on page 80](#))
- Phase shift or df/dt ([↗ Chapter 4.3.1.8 "Phase Shift" on page 83](#))
- Voltage increase if parameterized for decoupling  
([↗ Chapter 4.3.1.12 "System A Voltage Increase" on page 89](#))

If one of these protective functions is triggered, the display indicates "SyA. decoupling" (the logical command variable "07.25" will be enabled) and an active level 2 alarm.



*The decoupling function is optimized on the relay output "CBA 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 must be considered.*

ID	Parameter	CL	Setting range [Default]	Description
12942	Enable SyA. decoupling	2	Determined by LogicsManager	<p>If LogicsManager 24.31 is true, decoupling is "On".</p> <p><b>Notes</b></p> <p>For information on the LogicsManager and its default settings see <a href="#">↗ Chapter 9.3.1 "LogicsManager Overview" on page 299.</a></p>
3058	Change of frequency	2	Off	Change of frequency is not monitored.
			[Ph. shift]	Change of frequency is monitored on phase shift.
			df/dt (ROCOF)	Change of frequency is monitored on df/dt.
3111	Alarm class	2	A/B/C/D/E/F/ Control	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
			[B]	For additional information refer to <a href="#">↗ Chapter 9.4.1 "Alarm Classes" on page 328.</a>
3112	Self acknowledge	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	<p>The control unit does not automatically reset the alarm when the fault condition is no longer detected.</p> <p>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).</p>

### 4.3.1.3 System A Overfrequency (Levels 1 & 2) ANSI# 810

#### General notes

There are two overfrequency alarm levels available in the control. Both alarms are definite time alarms and are illustrated in the figure below. The figure diagrams a frequency trend and the associated pickup times and length of the alarms. Monitoring of the frequency is accomplished in two steps.



*If this protective function is triggered, the display indicates "SyA. overfrequency 1" or "SyA. overfrequency 2" and the logical command variable "07.06" or "07.07" will be enabled.*

Refer to Chapter 9.1.1 "Triggering Characteristics" on page 241 for the triggering characteristic of this monitoring function.



*The system A overfrequency Level 2 limit configuration parameters are located below the "SyA. decoupling" function menu on the display.*

ID	Parameter	CL	Setting range [Default]	Description
2850 2856	<b>Monitoring</b> (Limit 1/Limit 2)	2	[On]	Overfrequency monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: Level 1 limit < limit 2).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
2854 2860	<b>Limit</b> (Limit 1/Limit 2)	2	100.0 to 130.0 % 2854: <b>[100.4 %]</b> 2860: <b>[102.0 %]</b>	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.
				<b>Notes</b> This value refers to the System rated frequency (parameter 1750  p. 68).
2855 2561	<b>Delay</b> (Limit 1/Limit 2)	2	0.02 to 99.99 s <b>[0.06 s]</b>	If the monitored system A frequency value exceeds the threshold value for the delay time configured here, an alarm will be issued.
				<b>Notes</b> If the monitored frequency falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.
2851 2857	<b>Alarm class</b> (Limit 1/Limit 2)	2	Class A/B/C/D/E/F/ Control 2851: <b>[A]</b> 2857: <b>[B]</b>	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				<b>Notes</b> For additional information refer to  Chapter 9.4.1 "Alarm Classes" on page 328
2852 2858	<b>Self acknowl- edge</b>	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.

ID	Parameter	CL	Setting range [Default]	Description
	(Limit 1/Limit 2)		[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).
2853 2859	<b>Monitoring lockable</b> (Limit 1/Limit 2)	2	Yes	Monitoring for fault conditions is only performed if "Lock Monitoring Status 24.40" is false.
			[No]	Monitoring for this fault condition is continuously enabled regardless of "Lock Monitoring Status 24.40".

#### 4.3.1.4 System A Underfrequency (Level 1 & 2) ANSI# 81U

##### General notes

There are two underfrequency alarm levels available in the control. Both alarms are definite time alarms and are illustrated in the figure below. The figure diagrams a frequency trend and the associated pickup times and length of the alarms. Monitoring of the frequency is performed in two steps.



*If this protective function is triggered, the display indicates "SyA. underfrequency 1" or "SyA. underfrequency 2" and the logical command variable "07.08" or "07.09" will be enabled.*

Refer to Chapter 9.1.1 "Triggering Characteristics" on page 241 for the triggering characteristic of this monitoring function.



*The system A underfrequency Level 2 limit configuration parameters are located below the "SyA. decoupling" function menu on the display.*

ID	Parameter	CL	Setting range [Default]	Description
2900 2906	<b>Monitoring</b> (Limit 1/Limit 2)	2	[On]	Underfrequency monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: Level 1 limit > limit 2).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
2904 2910	<b>Limit</b> (Limit 1/Limit 2)	2	50.0 to 130.0 % 2904: [99.6 %] 2910: [98.0 %]	The percentage values that are to be monitored for each threshold limit are defined here.  If this value is reached or exceeded for at least the delay time without interruption, the action specified by the alarm class is initiated.
				<b>Notes</b> This value refers to the System rated frequency (parameter 1750  p. 68).
2905 2911	<b>Delay</b> (Limit 1/Limit 2)	2	0.02 to 99.99 s 2905: [1.50 s] 2911: [0.06 s]	If the monitored frequency value falls below the threshold value for the delay time configured here, an alarm will be issued.

ID	Parameter	CL	Setting range [Default]	Description
				<b>Notes</b> If the monitored frequency falls below the threshold (plus the hysteresis) before the delay expires the time will be reset.
2901 2907	<b>Alarm class</b> (Limit 1/Limit 2)	2	Class A/B/C/D/E/F/ Control  2901: <b>[A]</b> 2907: <b>[B]</b>	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				<b>Notes</b> For additional information refer to <a href="#">Chapter 9.4.1 "Alarm Classes"</a> on page 328
2902 2908	<b>Self acknowl- edge</b> (Limit 1/Limit 2)	2	Yes   <b>[No]</b>	The control unit automatically clears the alarm if the fault condition is no longer detected.   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).
2903 2909	<b>Monitoring lockable</b>	2	<b>[Yes]</b>   No	Monitoring for fault conditions is only performed if "Lock Monitoring Status 24.40" is false.   Monitoring for this fault condition is continuously enabled regardless of "Lock Monitoring Status 24.40".

## 4.3.1.5 System A Overvoltage (Level 1 & 2) ANSI# 59

### General notes

Voltage is monitored depending on parameter "SyA. voltage measuring" (parameter 1851 [p. 68](#)). There are two overvoltage alarm levels available in the control. Both alarms are definite time alarms and are illustrated in the figure below. The figure diagrams a frequency trend and the associated pickup times and length of the alarms. Monitoring of the voltage is done in two steps.



*If this protective function is triggered, the display indicates "SyA. overvoltage 1" or "System A overvoltage 2" and the logical command variable "07.10" or "07.11" will be enabled.*

Refer to [Chapter 9.1.1 "Triggering Characteristics"](#) on page 241 for the triggering characteristic of this monitoring function.



*The system A overvoltage Level 2 limit configuration parameters are located below the "SyA. decoupling" function menu on the display.*

ID	Parameter	CL	Setting range [Default]	Description
2950 2956	<b>Monitoring</b>	2	<b>[On]</b>	Overvoltage monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: Level 1 limit < limit 2).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
2954 2960	<b>Limit</b>	2	50.0 to 150.0 % 2954: <b>[108.0 %]</b> 2960: <b>[110.0 %]</b>	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.
				<b>Notes</b>  This value refers to the System rated frequency (parameter 1766 ↗ p. 68).
2955 2961	<b>Delay</b> (Limit 1/Limit2)	2	0.02 to 99.99 s 2955: <b>[1.50 s]</b> 2961: <b>[0.06 s]</b>	If the monitored voltage value exceeds the threshold value for the delay time configured here, an alarm will be issued.
				<b>Notes</b>  If the monitored voltage falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.
2951 2957	<b>Alarm class</b> (Limit 1/Limit2)	2	Class A/B/C/D/E/F/ Control  2951: <b>[A]</b> 2957: <b>[B]</b>	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				<b>Notes</b>  For additional information refer to ↗ Chapter 9.4.1 "Alarm Classes" on page 328
2953 2959	<b>Self acknowl- edge</b> (Limit 1/Limit2)	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			<b>[No]</b>	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).
2953 2959	<b>Monitoring lockable</b> (Limit 1/Limit2)	2	Yes	Monitoring for fault conditions is only performed if "Lock Monitoring Status 24.40" is false.
			<b>[No]</b>	Monitoring for this fault condition is continuously enabled regardless of "Lock Monitoring Status 24.40".
8845	<b>SyA. decou- pling</b>	2		System A decoupling by overvoltage level 1
			On	Tripping of system A overvoltage level 1 causes decoupling.
			<b>[Off]</b>	Tripping of system A overvoltage level 1 does not cause decoupling.

#### 4.3.1.6 System A Undervoltage (Level 1 & 2) ANSI# 27

##### General notes

Voltage is monitored depending on parameter "SyA. voltage measuring" (parameter 1851 ↗ p. 68). There are two undervoltage alarm levels available in the control. Both alarms are definite time alarms and are illustrated in the figure below. The figure diagrams a frequency trend and the associated pickup times and length of the alarms. Monitoring of the voltage is done in two steps.



*If this protective function is triggered, the display indicates "SyA. undervoltage 1" or "SyA. undervoltage 2" and the logical command variable "07.12" or "07.13" will be enabled.*

Refer to ↗ Chapter 9.1.1 "Triggering Characteristics" on page 241 for the triggering characteristic of this monitoring function.



*The system A undervoltage Level 2 limit configuration parameters are located below the "SyA. decoupling" function menu on the display.*

ID	Parameter	CL	Setting range [Default]	Description
3000 3006	<b>Monitoring</b> Limit 1/Limit 2	2	[On]  Off	Undervoltage monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: Level 1 limit < limit 2).  Monitoring is disabled for Level 1 limit and/or Level 2 limit.
3004 3010	<b>Limit</b> Limit 1/Limit 2	2	45.0 to 150.0 % 3004: [92.0 %] 3010: [90.0 %]	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.
				<b>Notes</b> This value refers to the System rated frequency (parameter 1766 ↗ p. 68).
3005 3011	<b>Delay</b>	2	0.02 to 99.99 s 3005: [1.50 s] 3011: [0.06 s]	If the monitored voltage value falls below the threshold value for the delay time configured here, an alarm will be issued.
				<b>Notes</b> If the monitored voltage exceeds the threshold (plus the hysteresis) before the delay expires the time will be reset.
3001 3007	<b>Alarm class</b> Limit 1/Limit 2	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.
				<b>Notes</b> For additional information refer to ↗ Chapter 9.4.1 "Alarm Classes" on page 328



ID	Parameter	CL	Setting range [Default]	Description
3002 3008	<b>Self acknowl- edge</b>  Limit 1/Limit 2	2	Yes  [No]	The control unit automatically clears the alarm if the fault condition is no longer detected.  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).
3003 3009	<b>Monitoring lockable</b>  Limit 1/Limit 2	2	[Yes]  No	Monitoring for fault conditions is only performed if "Lock Monitoring Status 24.40" is false.  Monitoring for this fault condition is continuously enabled regardless of "Lock Monitoring Status 24.40".
8844	<b>SyA. decou- pling</b>	2	 On [Off]	System A decoupling by undervoltage level 1  Tripping of system A undervoltage level 1 causes decoupling.  Tripping of system A undervoltage level 1 does not cause decoupling.

#### 4.3.1.7 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. To prevent malfunction, a minimum current (parameter 3287 ↗ p. 82) must be configured.

QV monitoring is triggered if the following conditions are fulfilled: (Refer to Fig. 51 for details).

- QV monitoring is configured to "On" (parameter 3292 ↗ p. 82)
- Measured reactive power is higher than the configured "Reactive power threshold" (parameter 3291 ↗ p. 82)
- Measured average current is higher than the configured "Minimum current" (parameter 3287 ↗ p. 82)
- Measured voltages are below the configured "Limit undervoltage" (parameter 3285 ↗ p. 82)

As a result Timer 1 and Timer 2 are starting. If the delay time "Delay step 1" (parameter 3283 ↗ p. 83) has exceeded, LogicsManager 07.29 becomes TRUE and the corresponding alarm message "SyA. QV monitoring 1" is indicated. If the delay time "Delay step 2" (parameter 3284 ↗ p. 83) has exceeded, LogicsManager 07.30 becomes TRUE and the corresponding alarm message "SyA. QV monitoring 2" is indicated.

If parameter "SyA. decoupling" (parameter 3295 ↗ p. 83) is configured to "On" the decoupling function is assigned to "Delay step 1" (parameter 3283 ↗ p. 83) or "Delay step 2" (parameter 3284 ↗ p. 83).



*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.*

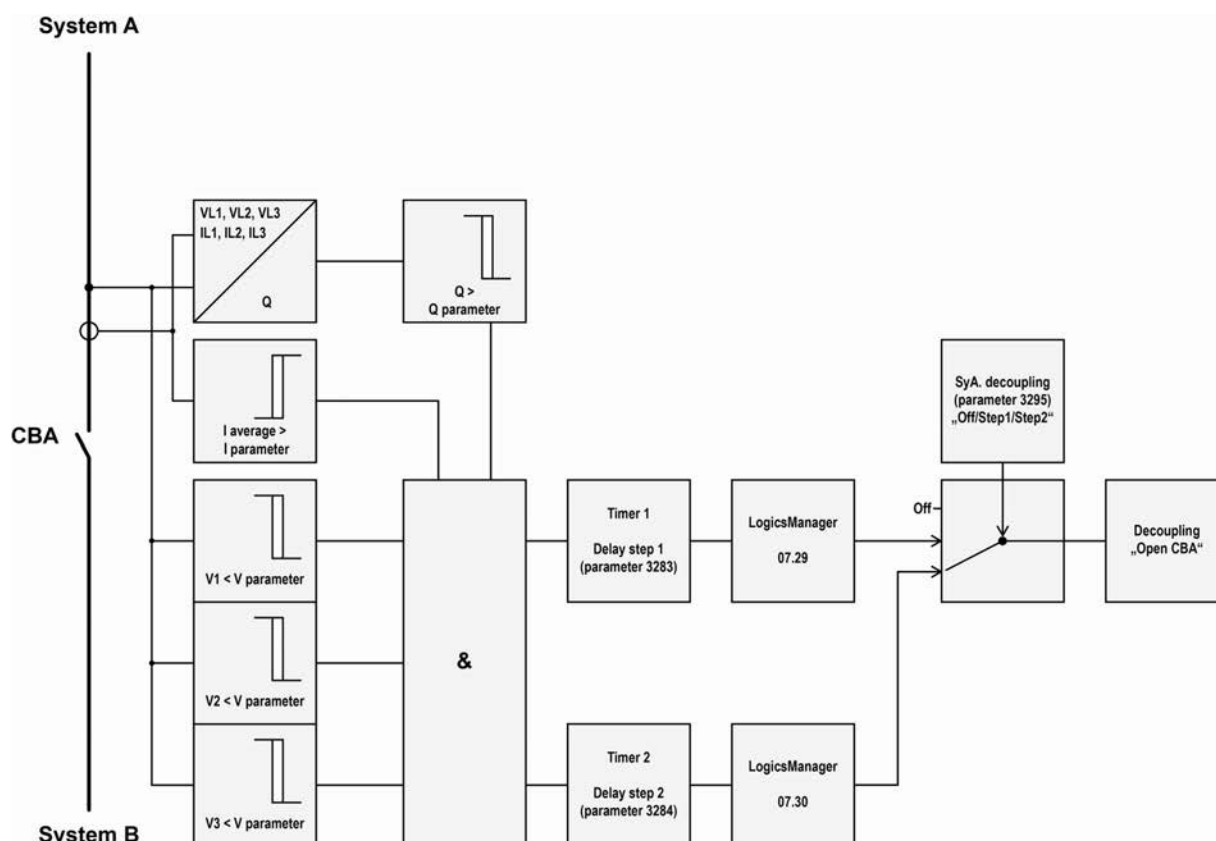


Fig. 51: QV monitoring - schematic

ID	Parameter	CL	Setting range [Default]	Description
3292	<b>Monitoring</b>	2	[On]	QV monitoring is carried out according to the following parameters.
			Off	No monitoring is carried out.
3285	<b>Limit under-voltage</b>	2	45 to 150 % [85 %]	The percentage voltage value that is to be monitored is defined here. If the voltages of all phases (one phase in 1Ph 2W system) are below this limit, the voltage condition for tripping the monitoring function is TRUE.
				<b>Notes</b> This value refers to the "SyA. rated voltage" (parameter 1766 ↗ p. 68).
3287	<b>Minimum current</b>	2	0 to 100 % [10 %]	The percentage current value that is to be monitored is defined here. If the average system A current has been exceeded this limit, the current condition for tripping the monitoring function is TRUE.
				<b>Notes</b> This value refers to the "SyA. rated current" (parameter 1754 ↗ p. 68).
3291	<b>Reactive power threshold</b>	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.
				<b>Notes</b> This value refers to the "SyA. rated react. power [kvar]" (parameter 1758 ↗ p. 68).

ID	Parameter	CL	Setting range [Default]	Description
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 "SyA. QV mon. 1" will be issued and LogicsManager 07.29 becomes TRUE.
				<b>Notes</b> The decoupling function is only activated if "SyA. decoupling" (parameter 3295 ↗ p. 83) is configured to "Step 1".
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 "SyA. QV mon. 2" will be issued and LogicsManager 07.30 becomes TRUE.
				<b>Notes</b> The decoupling function is only activated if "SyA. decoupling" (parameter 3295 ↗ p. 83) is configured to "Step 2".
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.
				<b>Notes</b> For additional information refer to ↗ Chapter 9.4.1 "Alarm Classes" on page 328
3293	Self acknowl- edge	2	[Yes]	The control unit automatically clears the alarm if the fault condition is no longer detected.
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected.  The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgement" (via a discrete input or via an interface).
3294	Monitoring lockable	2	Yes	Monitoring for fault conditions is only performed if Lock Monitoring Status 24.40 is false.
			[No]	Monitoring for this fault condition is continuously enabled regardless of Lock Monitoring Status 24.40.
3295	SyA. decou- pling	2	[Off]	The QV monitoring function is ignored in the decoupling function.
			Step 1	Tripping of QV monitoring step 1 causes decoupling
			Step 2	Tripping of QV monitoring step 2 causes decoupling

#### 4.3.1.8 Phase Shift

##### General notes

A vector/phase shift is defined as the sudden variation of the voltage curve which may be caused by a major generator load change.

The unit 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.

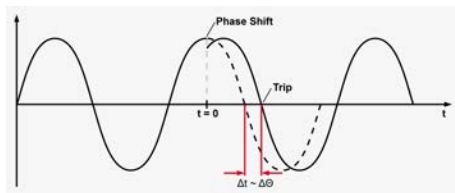


Fig. 52: Phase shift

A vector/phase shift as shown in Fig. 52 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-phase or one/three-phase. The monitoring can be configured in different ways. The vector/phase shift monitor can also be used as an additional method to decouple from the grid. Vector/phase shift monitoring is only enabled after the monitored voltage exceeds 50% of the PT secondary rated voltage.



### Function "Voltage cycle duration not within the permissible range"

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



The "Phase shift" configuration parameters are located below the "SyA. decoupling" function menu on the display.

ID	Parameter	CL	Setting range [Default]	Description
3053	Monitoring	2	[1- and 3-phase]	During single-phase voltage phase/vector shift monitoring, tripping occurs if the phase/vector shift exceeds the configured threshold value (parameter 3054 ↗ p. 84) in at least one of the three phases.
			3-phase	During three-phase voltage phase/vector shift monitoring, tripping occurs only if the phase/vector shift exceeds the specified threshold value (parameter 3055 ↗ p. 84) in all three phases within 2 cycles.
				<b>Notes</b> If a phase/vector shift occurs in one or two phases, the single-phase threshold value (parameter 3054 ↗ p. 84) is taken into consideration; if a phase/vector shift occurs in all three phases, the three-phase threshold value (parameter 3055 ↗ p. 84) 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.
3054	Limit 1-phase	2	3 to 30° [20°]	If the electrical angle of the voltage shifts more than this configured value in any single phase, an alarm with the class configured in parameter 3051 ↗ p. 84 is initiated. The decoupling procedure will open the CBA.
3055	Limit 3-phase	2	3 to 30° [8°]	If the electrical angle of the voltage shifts more than this configured value in all three phases, an alarm with the class configured in parameter 3051 ↗ p. 84 is initiated. The decoupling procedure will open the CBA.
3051	Alarm class	2	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.
				<b>Notes</b> For additional information see ↗ Chapter 9.4.1 "Alarm Classes" on page 328.

ID	Parameter	CL	Setting range [Default]	Description
3052	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).
3056	Monitoring lockable	2	Yes	Monitoring for fault conditions is only performed if "Lock Monitoring Status 24.40" is false.
			[No]	Monitoring for this fault condition is continuously enabled regardless of "Lock Monitoring Status 24.40".

#### 4.3.1.9 df/dt (ROCOF)

##### General notes

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).



The "df/dt (ROCOF)" configuration parameters are located below the "SyA. decoupling" function menu on the display.

ID	Parameter	CL	Setting range [Default]	Description
3104	Limit	2	0.1 to 9.9 Hz/s [2.6 Hz/s]	The df/dt threshold is defined here. If this value is reached or exceeded for at least the delay time without interruption, an alarm with the class configured in parameter 3101 ↗ p. 86 is initiated.  The decoupling procedure will open the CBA.
3105	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	Alarm class	2	A/B/C/D/E/F/ Control	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
			[B]	<b>Notes</b> For additional information see <a href="#">Chapter 9.4.1 "Alarm Classes" on page 328</a> .
3102	Self acknowl- edge	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected.  The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgement" (via a discrete input or via an interface).
3103	Monitoring lockable	2	Yes	Monitoring for fault conditions is only performed if "Lock Monitoring Status 24.40" is false.
			[No]	Monitoring for this fault condition is continuously enabled regardless of "Lock Monitoring Status 24.40".

### 4.3.1.10 System A 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 (generator, breakers, cable, busbars, etc.).

This function will block a connection of systems with wrong 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.
- The configured alarm class is of class C or 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 "SyA. phase rotation" and the logical command variable "07.05" will be enabled.*



*This monitoring function is only enabled if system A voltage measuring (parameter 1853 ↗ p. 70) is configured to "3Ph 4W" or "3Ph 3W" and the measured voltage exceeds 50 % of the rated voltage (parameter 1768 ↗ p. 68) or if system A voltage measuring (parameter 1853 ↗ p. 70) is configured to "1Ph 2W" (in this case, the phase rotation is not evaluated, but defined by the 1Ph2W phase rotation (parameter 1859 ↗ p. 68)).*

ID	Parameter	CL	Setting range [Default]	Description
3970	<b>Monitoring</b>	2	[On]	Phase rotation monitoring is carried out according to the following parameters.
			Off	No monitoring is carried out.
3974	<b>SyA. phase rotation</b>	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	<b>Alarm class</b>	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.
				<b>Notes</b> For additional information refer to ↗ Chapter 9.4.1 "Alarm Classes" on page 328
3972	<b>Self acknowledge</b>	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).

ID	Parameter	CL	Setting range [Default]	Description
3973	<b>Monitoring lockable</b>	2	Yes	Monitoring for fault conditions is only performed if "Lock Monitoring Status 24.40" is false.
			[No]	Monitoring for this fault condition is continuously enabled regardless of "Lock Monitoring Status 24.40".

#### 4.3.1.11 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). Voltage asymmetry monitoring is only active if "SyA. voltage measuring" (parameter 1851 ↗ p. 68) is configured to "3Ph 4W" or "3Ph 3W". The threshold is defined as the percentage of that value relative to the nominal delta voltage. The protective function is triggered if this percentage value is exceeded.



*If this protective function is triggered, the display indicates "SyA. volt. asymmetry" and the logical command variable "06.18" will be enabled.*

Refer to ↗ Chapter 9.1.1 "Triggering Characteristics" on page 241 for the triggering characteristic of this monitoring function.



*This monitoring function is only enabled if system A voltage measuring (parameter 1851 ↗ p. 68) is configured to "3Ph 4W" or "3Ph 3W".*

ID	Parameter	CL	Setting range [Default]	Description
3921	<b>Monitoring</b>	2	[On]	Voltage asymmetry monitoring is carried out according to the following parameters.
			Off	No monitoring is carried out.
3924	<b>Limit</b>	2	0.5 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.
				<b>Notes</b>  This value refers to the 'SyA rated voltage' (parameter 1766 ↗ p. 68).
3925	<b>Delay</b>	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.
				<b>Notes</b>  If the monitored voltage asymmetry falls below the threshold (minus the hysteresis) before the delay expires the time will be reset



ID	Parameter	CL	Setting range [Default]	Description
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.
				<b>Notes</b> For additional information refer to <a href="#">Chapter 9.4.1 "Alarm Classes"</a> on page 328
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	Monitoring lockable	2	Yes	Monitoring for fault conditions is only performed if "Lock Monitoring Status 24.40" is false.
			[No]	Monitoring for this fault condition is continuously enabled regardless of "Lock Monitoring Status 24.40".

#### 4.3.1.12 System A Voltage Increase

##### General notes

Voltage is monitored depending on parameter "Monitoring" (parameter 8806 [p. 90](#)). This function allows the monitoring of the voltage quality over a longer time period. It is realized as a 10 minute moving average<sup>1</sup>. The function is only active, if system A is within the operation window. If "SyA. voltage measuring" (parameter 1853 [p. 70](#)) 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 [p. 91](#)). The parameter "SyA. decoupling volt. incr." (parameter 8808 [p. 90](#)) determines if a voltage increase shall trigger a system A decoupling or not.



*If this protective function is triggered, the display indicates "SyA. volt. increase". The alarm can be incorporated into the system A decoupling function.*



The average is set to "SyA. rated voltage" (parameter 1766 ↗ p. 68) if:

- Frequency is not in the operation window OR
- Monitoring (parameter 8806 ↗ p. 90) is "Off" OR
- "Monitoring lockable" is active (parameter 8833 ↗ p. 91) OR
- Monitoring is tripped AND the measured voltage is again in the operation window

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 operation window AND
- The system A settling time is over



Please be aware that if "SyA. voltage monitoring" (parameter 1771 ↗ p. 72) is configured to "All" and the system A voltage increase monitoring (parameter 8806 ↗ p. 90) is used, that this function only monitors "Phase - neutral".



<sup>1</sup> Please be aware that this monitoring function was changed with software version 1.01xx or higher. For an older version of this manual please contact our sales support.

ID	Parameter	CL	Setting range [Default]	Description
8806	<b>Monitoring</b>	2	On	Voltage increase monitoring is carried out according to the following parameters.
			[Off]	No monitoring is carried out.
8807	<b>Limit</b>	2	100 to 150 %	The percentage voltage value that is to be monitored is defined here.
			[110 %]	If the average voltage over 10 minutes is higher, the action specified by the alarm class is initiated.
				<b>Notes</b> This value refers to the "SyA. rated voltage" (parameter 1766 ↗ p. 68).
8808	<b>SyA. decoupling voltage increase</b>	2	Yes	Voltage increase monitoring does cause decoupling.
			[No]	Voltage increase monitoring does not cause decoupling.
8831	<b>Alarm class</b>	2	Class A/B/C/D/E/F/ Control	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
			[B]	<b>Notes</b> For additional information refer to ↗ Chapter 9.4.1 "Alarm Classes" on page 328

ID	Parameter	CL	Setting range [Default]	Description
8832	<b>Self acknowl- edge</b>	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).
8833	<b>Monitoring lockable</b>	2	Yes	Monitoring for fault conditions is only performed if "Lock Monitoring Status 24.40" is false
			[No]	Monitoring for this fault condition is continuously enabled regardless of "Lock Monitoring Status 24.40".
8849	<b>AND character- istics</b>	2	On	If the 10 minute voltage averages of <b>all</b> phases exceed the limit, the monitoring is tripping.
			[Off]	If the 10 minute voltage average of <b>at least one</b> phase exceeds the limit, the monitoring is tripping.

#### 4.3.1.13 System A Time-Dependent Voltage

##### General notes

Voltage is monitored depending on parameter "SyA. voltage measuring" (parameter 1851 ↗ p. 68). This monitoring function is supporting a dynamic stabilization of mains. For this reason a FRT (Fault-Ride-Through) curve can be defined.

Furthermore it can be configured either as undervoltage or over-voltage monitoring (parameter 4953 ↗ p. 92). If the measured voltage of at least one phase (depends on the settings of parameter 4952 ↗ p. 92) falls below/exceeds the configured "Initial threshold" (parameter 4970 ↗ p. 92), the time-dependent voltage 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 LogicsManager 07.28 becomes TRUE. The system A decoupling function became active, if configured. If the measured voltage falls below/exceeds the configured "Fallback threshold" (parameter 4978 ↗ p. 93) for at least the configured "Fallback time" (parameter 4968 ↗ p. 93), 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. 53 shows the default FRT curve for time-dependent voltage monitoring. The curve shows the device default values according to a typical grid code requirement.



*The time points should always have an ascending order. The fallback threshold (parameter 4978 ↗ p. 93) should always be configured to a value higher/lower than the initial threshold (parameter 4970 ↗ p. 92).*

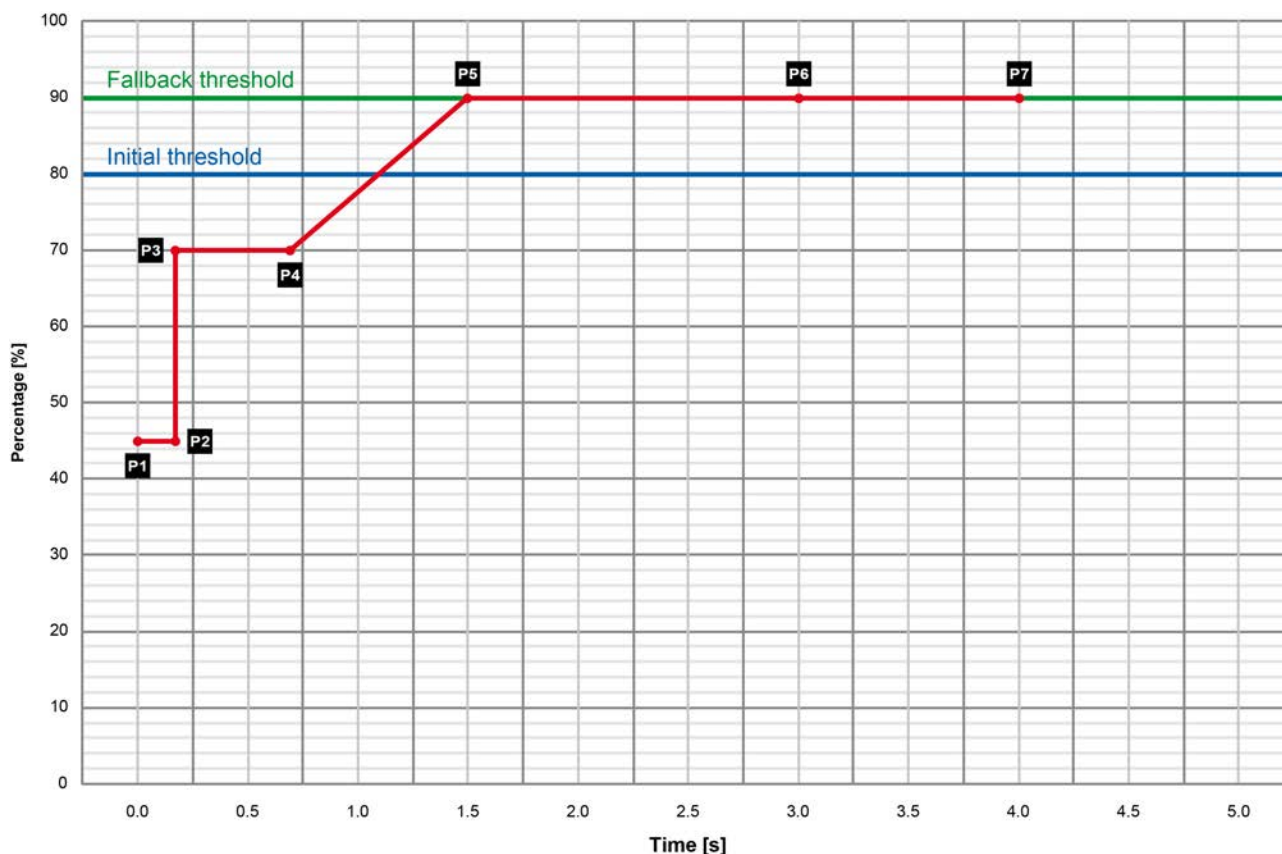


Fig. 53: Time-dependent voltage monitoring

P1	0.00 s → 45.0 %	P6	3.00 s → 90.0 %
P2	0.15 s → 45.0 %	P7	4.00 s → 90.0 %
P3	0.15 s → 70.0 %	Fallback threshold	90.0 %
P4	0.70 s → 70.0 %	Initial threshold	80.0 %
P5	1.50 s → 90.0 %	Fallback time	1.00 s

ID	Parameter	CL	Setting range [Default]	Description
4950	Monitoring	2	On	Time-dependent voltage monitoring is carried out according to the following parameters.
			[Off]	No monitoring is carried out.
4952	AND characteristics	2	On	Each phase falls below/exceeds the threshold for tripping.
			[Off]	At least one phase falls below/exceeds the threshold for tripping.
4953	Monitoring at	2		Selects whether the system shall do over- or undervoltage monitoring.
			[Underrun]	The undervoltage monitoring is carried out (The monitoring function triggers if the measured voltage is below the curve).
			Overrun	The overvoltage monitoring is carried out (The monitoring function triggers if the measured voltage exceeds the curve).
4970	Init threshold	2	0.0 to 150.0 % [80.0 %]	The time-dependent voltage monitoring initial threshold is configured here. If the measured voltage falls below/exceeds this threshold, the monitoring sequence starts and the voltage threshold will change in time according to the configured threshold curve points.  If the measured voltage falls below/exceeds this curve, the monitoring function triggers and the configured relay will energize.

ID	Parameter	CL	Setting range [Default]	Description
4978	<b>Fallback threshold</b>	2	0.0 to 150.0 % [90.0 %]	The time-dependent voltage monitoring fallback voltage is configured here. If the measured voltage falls below/exceeds the voltage configured here for at least the configured "Fallback time" (parameter 4968 ↗ p. 93), the monitoring sequence will be reset.
				<b>Notes</b> This parameter should always be configured to a value higher/lower than the "Init threshold" (parameter 4970 ↗ p. 92) for proper operation. The parameter "Point 7 voltage" (parameter 4977 ↗ p. 93) is used as fallback threshold if it is configured to a value higher/lower than the parameter "Fallback threshold" (parameter 4978 ↗ p. 93).
4968	<b>Fallback time</b>	2	0.00 to 320.00 s [1.00 s]	The time-dependent voltage monitoring fallback time is configured here. If the measured voltage falls below/exceeds the configured "Fallback threshold" (parameter 4978 ↗ p. 93) for at least the time configured here, the monitoring sequence will be reset.
4961	<b>Point {x} time</b> [x = 1 to 7]	2	0.00 to 320.00 s	The time values of time-dependent voltage monitoring time points are configured here.
4962			4961: [0.00 s]	
4963			4962: [0.15 s]	
4964			4963: [0.15 s]	
4965			4964: [0.70 s]	
4966			4965: [1.50 s]	
4967			4966: [3.00 s] 4967: [4.00 s]	
4971	<b>Point {x} voltage</b> [x = 1 to 7]	2	0.0 to 150.0 %	The voltage values of time-dependent voltage monitoring voltage points are configured here.
4972			4971: [45.0 %]	
4973			4972: [45.0 %]	
4974			4973: [70.0 %]	
4975			4974: [70.0 %]	
4976			4975: [90.0 %]	
4977			4976: [90.0 %] 4977: [90.0 %]	
				<b>Notes</b> Please avoid a setting between 0.1 % and 5.0 %.
4951	<b>Alarm class</b>	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.
				<b>Notes</b> For additional information refer to ↗ Chapter 9.4.1 "Alarm Classes" on page 328
4959	<b>Self acknowledge</b>	2	[Yes]	The control unit automatically clears the alarm if the fault condition is no longer detected.

ID	Parameter	CL	Setting range [Default]	Description
			No	The control unit does not automatically reset the alarm when the fault condition is no longer detected.  The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgement" (via a discrete input or via an interface).
4999	<b>Monitoring lockable</b>	2	Yes	Monitoring for fault conditions is only performed if "Lock Monitoring Status 24.40" is false.
			[No]	Monitoring for this fault condition is continuously enabled regardless of "Lock Monitoring Status 24.40".
4989	<b>SyA. decoupling</b>	2	On	Time-dependent voltage monitoring does cause decoupling.
			[Off]	Time-dependent voltage monitoring does not cause decoupling.

### 4.3.2 System B

ID	Parameter	CL	Setting range [Default]	Description
1770	<b>SyB. voltage monitoring</b>	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 (VL-L).
			Phase - neutral	The phase-neutral voltage will be monitored and all subsequent parameters concerning voltage monitoring "system B" are referred to this value (VL-N).
				<b>Notes</b>  WARNING: This parameter influences the protective functions.

#### 4.3.2.1 System B Operating Voltage / Frequency

##### General notes



*The operating voltage/frequency parameters are used to check if the values are in range when performing a dead bus closure and synchronization.*

*It is recommended to configure the operating limits within the monitoring limits.*

ID	Parameter	CL	Setting range [Default]	Description
5800	Upper voltage limit	2	100 to 150 % [110 %]	The maximum permissible positive deviation of the system B voltage from the system B rated voltage (parameter 1768 ↗ p. 68) 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	2	50 to 100 % [90 %]	The maximum permissible negative deviation of the system B voltage from the system B rated voltage (parameter 1768 ↗ p. 68) 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	2	100.0 to 150.0 % [105.0 %]	The maximum permissible positive deviation of the system B frequency from the rated system frequency (parameter 1750 ↗ p. 68) 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	2	50.0 to 100.0 % [95.0 %]	The maximum permissible negative deviation of the system B frequency from the rated system frequency (parameter 1750 ↗ p. 68) 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).

#### 4.3.2.2 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 (generator, breakers, cable, busbars, etc.).

This function will block a connection of systems with wrong 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.
- The configured alarm class is of class C or D (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 generator. The voltage phase rotation alarm checks the phase rotation of the voltages and the configured phase rotation to ensure they are identical.

The directions of rotation are differentiated as "clockwise" and "counter clockwise". With a clockwise field the direction of rotation is "L1-L2-L3"; with a counter clockwise field the direction of rotation is "L1-L3-L2".

If the control is configured for a clockwise rotation and the voltages into the unit are calculated as counterclockwise the alarm will be initiated. The direction of configured rotation being monitored by the control unit is displayed on the screen.



*If this protective function is triggered, the display indicates "SyB. phase rotation" and the logical command variable "06.21" will be enabled.*



*This monitoring function is only enabled if "SyB. voltage measuring" (parameter 1851 & p. 68) is configured to "3Ph 4W" or "3Ph 3W" and the measured voltage exceeds 50 % of the rated voltage (parameter 1766 & p. 68) or if "SyB. voltage measuring" (parameter 1851 & p. 68) is configured to "1Ph 2W" (in this case, the phase rotation is not evaluated, but defined by the 1Ph2W phase rotation (parameter 1859 & p. 68)).*

ID	Parameter	CL	Setting range [Default]	Description
3950	<b>Monitoring</b>	2	On	Phase rotation monitoring is carried out according to the following parameters.
			[Off]	No monitoring is carried out.
3954	<b>SyB. phase rotation</b>	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	<b>Alarm class</b>	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.
				<b>Notes</b> For additional information refer to & Chapter 9.4.1 "Alarm Classes" on page 328
3952	<b>Self acknowl- edge</b>	2	Yes	The control unit automatically clears the alarm if the fault condition is no longer detected.



ID	Parameter	CL	Setting range [Default]	Description
			[No]	The control unit does not automatically reset the alarm when the fault condition is no longer detected.  The alarm must be acknowledged and reset by manually pressing the appropriate buttons or by activating the LogicsManager output "External acknowledgement" (via a discrete input or via an interface).
3953	Monitoring lockable	2	Yes	Monitoring for fault conditions is only performed if "Lock Monitoring Status 24.40" is false.
			[No]	Monitoring for this fault condition is continuously enabled regardless of "Lock Monitoring Status 24.40".

### 4.3.3 Breaker

#### 4.3.3.1 Configure CBA

##### General notes

Circuit breaker monitoring contains two alarms: A "breaker reclose" alarm and a "breaker open" alarm.

##### "Breaker reclose alarm"

If the control initiates a close of the breaker and the breaker fails to close after the configured number of attempts the monitoring CBA alarm will be initiated (refer to parameter "CBA maximum attempts of closure", parameter 3419 ↗ p. 98).



*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 ↗ p. 98).



*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 [B]	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.

ID	Parameter	CL	Setting range [Default]	Description
				<b>Notes</b> For additional information refer to <a href="#">Chapter 9.4.1 "Alarm Classes"</a> on page 328
3419	<b>CBA maximum closing attempts</b>	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	<b>CBA open monitoring</b>	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 <a href="#">p. 97</a> is issued.
2622	<b>CBA monitoring lockable</b>	2	Yes	Monitoring for fault conditions is only performed if "Lock Monitoring Status 24.40 is false".
			[No]	Monitoring for this fault condition is continuously enabled regardless of "Lock Monitoring Status 24.40".

### 4.3.3.2 Synchronization CBA

ID	Parameter	CL	Setting range [Default]	Description
3070	<b>Monitoring</b>	2	[On]	Monitoring of the CBA synchronization is carried out according to the following parameters.
			Off	Monitoring is disabled.
3073	<b>Delay</b>	2	3 to 999 s [60 s]	If it was not possible to synchronize the CBA within the 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	<b>Alarm class</b>	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.
				<b>Notes</b> For additional information refer to <a href="#">Chapter 9.4.1 "Alarm Classes"</a> on page 328
3072	<b>Self acknowledge</b>	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).

ID	Parameter	CL	Setting range [Default]	Description
3075	<b>Monitoring lockable</b>	2	Yes	Monitoring for fault conditions is only performed if "Lock Monitoring Status 24.40" is false.
			[No]	Monitoring for this fault condition is continuously enabled regardless of "Lock Monitoring Status 24.40".

#### 4.3.3.3 CBA Unload Mismatch

ID	Parameter	CL	Setting range [Default]	Description
8819	<b>Unload trip level CBA</b>	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.
				<b>Notes</b> This value refers to the "SyA. rated active power" (parameter 1752 ↗ p. 68).
8835	<b>Delay</b>	2	1 to 999 s [60 s]	If the monitored system A power does not fall below the limit configured in parameter 8819 ↗ p. 99 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	<b>Alarm class</b>	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.
				<b>Notes</b> For additional information refer to ↗ Chapter 9.4.1 "Alarm Classes" on page 328
8837	<b>Self acknowledge</b>	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	<b>Monitoring lockable</b>	2	Yes	Monitoring for fault conditions is only performed if "Lock Monitoring Status 24.40 is false."
			[No]	Monitoring for this fault condition is continuously enabled regardless of "Lock Monitoring Status 24.40".

#### 4.3.3.4 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 ↗ p. 68) and system B voltage measuring (parameter 1853 ↗ p. 70) are configured to "3Ph 4W" or "3Ph 3W" and the measured voltage exceeds 50 % of the rated voltage (parameter 1766 ↗ p. 68) or if system A voltage measuring (parameter 1851 ↗ p. 68) and system B voltage measuring (parameter 1853 ↗ p. 70) are configured to "1Ph 2W". In this case, the phase rotation is not evaluated, but defined by the 1Ph2W phase rotation (parameter 1859 ↗ p. 68).*

ID	Parameter	CL	Setting range [Default]	Description
2940	<b>Monitoring</b>	2	[On]	Phase rotation monitoring is carried out according to the following parameters
			Off	Monitoring is disabled.
2941	<b>Alarm class</b>	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.
				<b>Notes</b> For additional information refer to ↗ Chapter 9.4.1 "Alarm Classes" on page 328
2942	<b>Self acknowledge</b>	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	<b>Monitoring lockable</b>	2	Yes	Monitoring for fault conditions is only performed if "Lock Monitoring Status 24.40 is false".
			[No]	Monitoring for this fault condition is continuously enabled regardless of "Lock Monitoring Status 24.40".

#### 4.3.3.5 Monitor Feedback CBA

##### General notes

The following table shows the logical context of the CBA feedback monitoring.



*This monitoring function is only enabled if Second feedback CBA (parameter 4128 ↗ p. 109) is configured to "On".*

	Error	Open	Closed	Error
[DI 03]	0	0	1	1
[DI 08]	0	1	0	1

Table 23: Truth table

ID	Parameter	CL	Setting range [Default]	Description
5124	<b>Monitoring</b>	2	[On]	Monitoring of the CBA feedback is carried out according to the following parameters.
			Off	Monitoring is disabled.
5128	<b>Delay</b>	2	0.02 to 99.99 s [10.00 s]	If the discrete inputs [DI 03] and [DI 08] are both energized or de-energized for the delay time configured here, the alarm message "Feedback CBA mism." is issued. Please refer to ↗ "Truth table" Table on page 101 for details.
5125	<b>Alarm class</b>	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.
				<b>Notes</b> For additional information refer to ↗ Chapter 9.4.1 "Alarm Classes" on page 328
5126	<b>Self acknowl- edge</b>	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).
5127	<b>Monitoring lockable</b>	2	Yes	Monitoring for fault conditions is only performed if "Lock Monitoring Status 24.40" is false.
			[No]	Monitoring for this fault condition is continuously enabled regardless of "Lock Monitoring Status 24.40".

## 4.3.4 Miscellaneous

### 4.3.4.1 Alarm Acknowledgement

ID	Parameter	CL	Setting range [Default]	Description
1756	<b>Time until horn reset</b>	0	0 to 1,000 s	After each alarm of alarm class B through F occurs, the alarm LED flashes and the horn (command variable 01.12) is enabled. After the delay time "time until horn reset" has expired, the flashing LED changes into a steady light and the horn (command variable 01.12) is disabled. The alarm LED flashes until the alarm has been acknowledged either via the push button, the LogicsManager, or the interface.
				<b>Notes</b> If this parameter is configured to 0, the horn will remain active until it will be acknowledged.
12490	<b>Ext. acknowledge</b> (External acknowledgment of alarms)	2	Determined by LogicsManager  [[DI 02 & 1] & 1]	It is possible to acknowledge all alarms simultaneously from remote, e.g. with a discrete input. The logical output of the LogicsManager has to become TRUE twice.  The first time is for acknowledging the horn, the second for all alarm messages. The On-delay time is the minimum time the input signals have to be "1". The Off-delay time is the time how long the input conditions have to be "0" before the next high signal is accepted.  Once the conditions of the LogicsManager have been fulfilled the alarms will be acknowledged.  The first high signal into the discrete input acknowledges the command variable 01.12 (horn).  The second high signal acknowledges all inactive alarm messages.
				<b>Notes</b> For information on the LogicsManager and its default settings see <a href="#">Chapter 9.3.1 "LogicsManager Overview" on page 299</a> .
12959	<b>Lock Monitoring</b>	2	Determined by LogicsManager  [[DI 01 & 1] & 1]	As long as the conditions of the LogicsManager have been fulfilled, all monitoring functions which are configured "Monitoring lockable" to "Yes" are locked.

### 4.3.4.2 CAN Interface

#### General notes

The CANopen interface 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	<b>Monitoring</b>	2	On	CANopen interface monitoring is carried out according to the following parameters.
			[Off]	Monitoring is disabled.
3154	<b>Delay</b>	2	0.01 to 650.00 s	The maximum receiving break is configured with this parameter.
			[0.20 s]	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	<b>Alarm class</b>	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.
				<b>Notes</b> For additional information refer to <a href="#">Chapter 9.4.1 "Alarm Classes"</a> on page 328
3152	<b>Self acknowledge</b>	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).
3153	<b>Monitoring lockable</b>	2	Yes	Monitoring for fault conditions is only performed if "Lock Monitoring Status 24.40 is false".
			[No]	Monitoring for this fault condition is continuously enabled regardless of "Lock Monitoring Status 24.40".

#### 4.3.4.3 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. 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 [Chapter 9.1.1 "Triggering Characteristics"](#) on page 241 for the triggering characteristic of this monitoring function.

ID	Parameter	CL	Setting range [Default]	Description
3450 3456	<b>Monitoring</b>	2	[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).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.

ID	Parameter	CL	Setting range [Default]	Description
3454 3460	<b>Limit</b>	2	8.0 to 42.0 V 3454: <b>[32.0 V]</b> 3460: <b>[35.0 V]</b>	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	<b>Delay</b>	2	0.02 to 99.99 s 3455: <b>[5.00 s]</b> 3461: <b>[1.00 s]</b>	If the monitored battery voltage exceeds the threshold value for the delay time configured here, an alarm will be issued.
				<b>Notes</b> If the monitored battery voltage falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.
3451 3457	<b>Alarm class</b>	2	Class A/B/C/D/E/F/ Control  <b>[B]</b>	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				<b>Notes</b> For additional information refer to <a href="#">Chapter 9.4.1 "Alarm Classes"</a> on page 328
3452 3458	<b>Self acknowledge</b>	2	<b>[Yes]</b>	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).
3453 3459	<b>Monitoring lockable</b>  (Limit 1 / Limit 2)	2	<b>[Yes]</b>	Monitoring for fault conditions is only performed if "Lock Monitoring Status 24.40 is false".
			No	Monitoring for this fault condition is continuously enabled regardless of "Lock Monitoring Status 24.40".

## 4.3.4.4 Battery Undervoltage (Level 1 & 2)

### General notes

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



*If this protective function is triggered, the display indicates "Bat. undervoltage 1" or "Bat. undervoltage 2" and the logical command variable "08.03" or "08.04" will be enabled.*

Refer to [Chapter 9.1.1 "Triggering Characteristics"](#) on page 241 for the triggering characteristic of this monitoring function.



ID	Parameter	CL	Setting range [Default]	Description
3500 3506	Monitoring	2	[On]	Undervoltage monitoring of the battery voltage is carried out according to the following parameters. Both values may be configured independent from each other (prerequisite: Level 1 > Level 2).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.
3504 3510	Limit	2	8.0 to 42.0 V	The threshold values that are to be monitored are defined here.
			3404: [24.0 V] 3510: [20.0 V]	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.
				<b>Notes</b> 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 3405: [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.
				<b>Notes</b> If the battery voltage exceeds the threshold (plus the hysteresis) again before the delay expires the time will be reset.
3501 3507	Alarm class	2	Class A/B/C/D/E/F/ Control [B]	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed.
				<b>Notes</b> For additional information refer to <a href="#">Chapter 9.4.1 "Alarm Classes"</a> on page 328
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 acknowledgement" (via a discrete input or via an interface).
3503 3509	Monitoring lockable	2	Yes	Monitoring for fault conditions is only performed if "Lock Monitoring Status 24.40 is false".
			[No]	Monitoring for this fault condition is continuously enabled regardless of "Lock Monitoring Status 24.40".

#### 4.3.4.5 Multi-Unit Missing Members

##### General notes

The multi-unit missing members monitoring function checks whether all participating units are available (sending data on the CAN bus).

If the number of available units is less than the number of members configured in parameter 4063 ↗ p. 106 for at least the delay time, the display indicates "Missing members" and the logical command variable "08.17" will be enabled.



*After energizing the unit, a delay is started, which allows a possible "Missing members" alarm to become active. This delay depends on the Node-ID of the unit (parameter 8950 ↗ p. 124) and the transfer rate of a load share / LS-5 fast message (parameter 9921 ↗ p. 122) and may last for approximately 140 seconds for a high Node-ID (e.g. 127). This delay serves for detecting the Master of a CAN bus connection. Approximately two minutes after energizing the unit, the alarm delay will be set to a fix time, which depends on the setting of parameter 9921 ↗ p. 122 (Transfer rate LS fast message) and is in the range between 3 to 9 seconds.*

ID	Parameter	CL	Setting range [Default]	Description
4060	<b>Monitoring</b>	2	On	Multi-unit missing members monitoring is carried out.
			[Off]	Monitoring is disabled.
				<b>Notes</b> This parameter only applies to application mode <b>A02</b> .
4063	<b>Number of LS5 communicating</b>	2	2 to 64	The number participating of LS-5 units is configured here.
4061	<b>Alarm class</b>	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.
				<b>Notes</b> For additional information refer to ↗ Chapter 9.4.1 "Alarm Classes" on page 328.
4062	<b>Self acknowledge</b>	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 acknowledgement" (via a discrete input or via an interface).

## 4.4 Configure Application

### 4.4.1 Application Mode

#### General notes

The unit can be configured to four different application modes. For additional information refer to ↗ Chapter 6 "Application" on page 163.



*In the application modes **A03** and **A04** some parameters are fixed to the corresponding parameters in the easYgen.*

## 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 ↗ p. 65)	Variable system (parameter 8816 ↗ p. 117)
Node-ID CAN bus 1 (parameter 8950 ↗ p. 124)	Synchronization mode (parameter 5728 ↗ p. 115)
Startup in mode (parameter 8827 ↗ p. 121)	Mains power measurement (parameter 8813 ↗ p. 116)
Isolation switch (parameter 8815 ↗ p. 116)	Dead bus closure (parameter 8801 ↗ p. 114)
Segment number System A (parameter 8810 ↗ p. 116)	Connect A dead to B dead (parameter 8802 ↗ p. 114)
Segment number System B (parameter 8811 ↗ p. 116)	Connect A dead to B alive (parameter 8803 ↗ p. 114)
Mains connection (parameter 8814 ↗ p. 116)	Connect A alive to B dead (parameter 8804 ↗ p. 114)
Open CBA in manual (parameter 8828 ↗ p. 109)	Connect synchronous mains (parameter 8820 ↗ p. 109)
Max. phase angle (parameter 8821 ↗ p. 110)	Delay time phi max. (parameter 8822 ↗ p. 110)

## Hidden parameters



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

LM: Enable close CBA (parameter 12945 ↗ p. 111)	LM: Enable close CBA (24.34)
LM: Open CBA immediately (parameter 12944 ↗ p. 110)	LM: Open CBA immediately (24.33)
LM: Open CBA unload (parameter 12943 ↗ p. 110)	LM: Open CBA unload (24.32)
LM: Operation mode AUTO (parameter 12510 ↗ p. 121)	LM: Operation mode MAN (parameter 12520 ↗ p. 121)

LM: Open CBA in MAN (parameter 12957 ↗ p. 110)	LM: Open CBA in MAN (24.46)
LM: Close CBA in MAN (parameter 12958 ↗ p. 110)	LM: Close CBA in MAN (24.47)

ID	Parameter	CL	Setting range [Default]	Description
8840	Application mode LS5	1	Single LS5	<b>Application mode A01</b> In this application mode, there is only one single LS-5 unit.
			[LS5]	<b>Application mode A02</b> This is the application mode for multiple LS-5 units operation. In this mode a PLC can control the LS-5 units.
			L-MCB	<b>Application mode A03</b> In this application mode, the easYgen is controlling the MCB via the LS-5. The operation mode is fixed to automatic.
			L-GGB	<b>Application mode A04</b> In this application mode, the easYgen is controlling the GGB via the LS-5. The operation mode is fixed to automatic.
12950	Isolation switch is open	2	Determined by LogicsManager [(24.39 & 1) & 1]	As long as the conditions of the LogicsManager have been fulfilled, the LS-5 assumes an open isolation switch (else a closed isolation switch).

## 4.4.2 Breakers

### 4.4.2.1 Configure CBA

ID	Parameter	CL	Setting range [Default]	Description
8800	CBA control	2	1 Relay	A CBA is operated and if necessary monitored. Relay [R5] (38/39/40) is used and fixed to this function.
			[2 Relays]	A CBA is operated and if necessary monitored. Relay [R5] (38/39/40) is used for the open function, relay [R6] (41/42) to close it. The opening and closing is carried out with the pulse method.
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 frequency at the entered time before the synchronous point.
3422	Dead bus reclose delay	3	1 to 999 s [30 s]	The delay time between the closing attempts.
				<b>Notes</b> This delay time has only an effect if a deadbus closure is performed.
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.

ID	Parameter	CL	Setting range [Default]	Description
			Yes	Before every close-pulse, an open-pulse is issued for defined duration (parameter 5718 ↗ p. 109). 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 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.
				<b>Notes</b> With the exception of application mode <b>A01</b> , unloading is skipped, if no closed GCB in the relevant segments is detected. No access in application modes <b>A03</b> and <b>A04</b> .
4128	Second feed-back CBA	2	[On]	A second CBA feedback is carried out. The redundancy of the CBA feedback is a safety feature. If this parameter is configured to "On" the CBA feedback is measured by [DI 03] "CBA closed" and [DI 08] "CBA open". Both signals must be inverted to each other and the unit latches the last valid feedback. The function releases the CBA feedback monitoring.
			Off	The CBA feedback is only carried out by [DI 08] "CBA open". The CBA feedback monitoring is disabled.
				<b>Notes</b> Please refer to ↗ Chapter 4.3.3.5 "Monitor Feedback CBA" on page 100 for details.
8820	Connect synchronous mains	2	Yes	Closing the CBA in case of synchronous mains is possible if <ul style="list-style-type: none"> <li>■ System A and System B are detected as mains connected and</li> <li>■ The angle is in the configuration window of parameter 8821 ↗ p. 110 for at least the time configured in parameter 8822 ↗ p. 110.</li> </ul>
			[No]	Closing the CBA in case of synchronous mains (System A and System B are mains connected) is not allowed.
				<b>Notes</b> 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 application modes <b>A03</b> and <b>A04</b> .
8852	Connect synchronous segments	2	Yes	Closing the CBA in case of synchronous segments is possible if <ul style="list-style-type: none"> <li>■ System A and System B are detected as already connected and</li> <li>■ The angle is in the configuration window of parameter 8821 ↗ p. 110 for at least the time configured in parameter 8822 ↗ p. 110.</li> </ul> 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.
				<b>Notes</b> No access in application modes <b>A03</b> and <b>A04</b> .

## Configuration

Configure Application > Breakers > Configure CBA

ID	Parameter	CL	Setting range [Default]	Description
8821	<b>Max phase angle</b>	2	0 to 20° [20°]	Maximum admissible angle between both voltage systems in case of connecting synchronous mains.
				<b>Notes</b> No access in application modes <b>A03</b> and <b>A04</b> .
8822	<b>Delay time phi max</b>	2	0 to 99 s [1 s]	Defines the time how long the phase angle (parameter 8821 ↗ p. 110) between both voltage systems needs to be below the configured maximum permissible angle before connecting synchronous mains.
				<b>Notes</b> No access in application modes <b>A03</b> and <b>A04</b> .
12957	<b>Open CBA in MAN</b>	2	Determined by LogicsManager	Once the conditions of the LogicsManager have been fulfilled the LS-5 opens the CBA immediately or with unloading (according to parameter 8828 ↗ p. 109), if no other LS-5 with higher priority likes to do the same.
				<b>Notes</b> 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 <b>A03</b> and <b>A04</b> .
12958	<b>Close CBA in MAN</b>	2	Determined by LogicsManager	Once the conditions of the LogicsManager have been fulfilled the LS-5 closes the CBA, if no other LS-5 with higher priority likes to do the same. (Provided the conditions for dead bus closure or synchronization are true.)
				<b>Notes</b> 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 <b>A03</b> and <b>A04</b> .
12943	<b>Open CBA unload</b>	2	Determined by LogicsManager [(09.06&1)&1]	Once the conditions of the LogicsManager have been fulfilled the LS-5 opens the CBA with unloading, if no other LS-5 with higher priority likes to do the same.
				<b>Notes</b> 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 <b>A03</b> and <b>A04</b> .
12944	<b>Open CBA immediately</b>	2	Determined by LogicsManager [(09.04&1)&1]	Once the conditions of the LogicsManager have been fulfilled the LS-5 opens the CBA immediately.
				<b>Notes</b> Only in operation mode AUTOMATIC. No access in application modes <b>A03</b> and <b>A04</b> .

ID	Parameter	CL	Setting range [Default]	Description
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-5 closes the CBA, if no other LS-5 with higher priority likes to do the same. (Provided the conditions for dead bus closure or synchronization are true.)  <b>Notes</b>  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 <b>A03</b> and <b>A04</b> .

#### 4.4.2.2 Phase Angle Compensation

##### 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 *“Determining the phase angle deviation (connected mains voltage)” on page 111.*
- When mains voltage cannot be connected but the vector group of the transformer is known, follow the steps in *“Calculating the phase angle deviation (known transformer vector group)” on page 112*

##### 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-5 screen (synchronization angle phi).
2. ➤ Enter the displayed value into parameter 8824 ➤ p. 113.



##### 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°:



*To calculate the resulting value, assume the low voltage side of the transformer always lags behind the high voltage side (phase angle deviation  $\alpha$ ).*

➔ Calculate the phase angle deviation as follows:

	High voltage side = System [A]	High voltage side = System [B]
$\alpha < 180^\circ$	$\alpha$	$-\alpha$
$\alpha > 180^\circ$	$-360^\circ + \alpha$	$360^\circ - \alpha$

Table 24: Calculation of the phase angle deviation

ID	Parameter	CL	Setting range [Default]	Description
5730	<b>Synchroniza- tion CBA</b>	2	<b>[Slip fre- quency]</b>	The LS-5 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-5 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.
				<b>Notes</b> This parameter has no impact on Command Variables 02.28 Sync. Check Relay and 02.29 Sync. Condition.
5711	<b>Pos. freq. dif- ferential MCB</b> (Positive fre- quency differen- tial MCB)	2	0.02 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 value specifies the upper frequency (positive value corresponds to positive slip system B frequency is higher than the system A frequency).
5712	<b>Neg. freq. dif- ferential CBA</b> (Negative fre- quency differen- tial 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 value specifies the lower frequency limit (negative value corresponds to negative slip system B frequency is less than the system A frequency).
5710	<b>Voltage differ- ential CBA</b>	2	0.50 to 20.00 % [5.00 %]	The maximum permissible voltage differential for closing CBA is configured here.  <b>Notes</b> 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 ↗ p. 95/5801 ↗ p. 95/5810 ↗ p. 74/5811 ↗ p. 74), the command: "CBA close" may be issued.



ID	Parameter	CL	Setting range [Default]	Description
8825	Phase angle compensation	2		This parameter defines if the parameter 8824 ↗ p. 113 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.
				<b>Notes</b> <p>WARNING: Ensure the following parameters are configured correctly to prevent erroneous synchronization settings. Incorrect wiring of the system cannot be compensated for with this parameter!</p> <p>Please check during initial commissioning the phase angle and the synchronization with a zero voltmeter.</p> <p><b>Recommendation:</b> For safety reasons, please mark the LS-5 with a label showing the configured phase angle compensation.</p>
8824	Phase angle	2	-180 to 180° [0°]	<p>This parameter compensates phase angle deviations, which can be caused by transformers (e.g. a delta to wye transformer) located within the electrical system.</p>
				<b>Notes</b> <p>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.</p> <p>For information on how to determine the phase angle deviation refer to ↗ "Phase angle compensation" on page 111.</p> <p>WARNING: Ensure this parameter is configured correctly to prevent erroneous synchronization settings. Incorrect wiring of the system cannot be compensated for with this parameter!</p>

#### 4.4.2.3 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 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 Dead Bus Closure CBA

## 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 ↗ p. 114, 8803 ↗ p. 114 or 8804 ↗ p. 114).

ID	Parameter	CL	Setting range [Default]	Description
8801	Dead bus closure CBA	2	On	Dead bus closure possible according to the conditions defined by parameters 8802 ↗ p. 114, 8803 ↗ p. 114, 8804 ↗ p. 114 and 5820 ↗ p. 114.
			[Off]	No dead bus closure possible.
				<b>Notes</b> No access in application modes <b>A03</b> and <b>A04</b> .
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.
				<b>Notes</b> No access in application modes <b>A03</b> and <b>A04</b> .
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.
				<b>Notes</b> No access in application modes <b>A03</b> and <b>A04</b> .
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.
				<b>Notes</b> No access in application modes <b>A03</b> and <b>A04</b> .
8805	Dead bus closure delay time	2	0.0 to 20.0 s [5.0 s]	The system voltage must below the value configured in parameter 5820 ↗ p. 114 for at least the time defined here to detect a dead bus condition of a system.
				<b>Notes</b> The delay time starts as soon as the measured voltage is below the value configured in parameter 5820 ↗ p. 114. The delay time is independent of LogicsManager "Enable close CBA" (parameter 12945 ↗ p. 111).
5820	Dead bus detection max. voltage	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 ↗ p. 114, a dead bus condition is detected.

## 4.4.2.5 Synchronization Configuration



*For synchronization with two systems please see additionally ↗ Chapter 9.5.1 "Synchronization Of System A and System B" on page 333.*

ID	Parameter	CL	Setting range [Default]	Description
5728	<b>Synchroniza- tion mode</b>	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.
			Ctrl by LM	The synchronization mode is controlled by LogicsManager (12907 ↗ p. 115, 12906 ↗ p. 115 and 12908 ↗ p. 116).  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
				<b>Notes</b>  The device will still perform a dead busbar closure if the conditions are valid.  No access in the application modes <b>A03</b> and <b>A04</b> .
12907	<b>Syn. mode PERM.</b>  (Synchroniza- tion mode PER- MISSIVE)	2	Determined by LogicsManager  [(0&1)&1]	Once the conditions of the LogicsManager have been fulfilled the PERMISSIVE synchronization mode will be enabled.
				<b>Notes</b>  For information on the LogicsManager and its default settings see ↗ Chapter 9.3.1 "LogicsManager Overview" on page 299.
12906	<b>Syn. mode CHECK</b>  (Synchroniza- tion 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.
				<b>Notes</b>  For information on the LogicsManager and its default settings see ↗ Chapter 9.3.1 "LogicsManager Overview" on page 299.

ID	Parameter	CL	Setting range [Default]	Description
12908	<b>Syn. mode RUN</b> (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.
				<b>Notes</b> For information on the LogicsManager and its default settings see <a href="#">Chapter 9.3.1 "LogicsManager Overview" on page 299</a> .

### 4.4.3 Configure Segment

ID	Parameter	CL	Setting range [Default]	Description
8810	<b>Segment number Sy.A</b>	2	1 to 64 [1]	Segment number for system A.
				<b>Notes</b> No access in the application modes <b>A03</b> and <b>A04</b> .
8811	<b>Segment number Sy.B</b>	2	1 to 64 [1]	Segment number for system B.
				<b>Notes</b> No access in the application modes <b>A03</b> and <b>A04</b> .
8812	<b>Segment number isol. switch</b>	2	1 to 64 [1]	Segment number isolation switch (if available).
8813	<b>Mains pow. measurem.</b>	2	Valid	The measured power is used for mains real power control.
			[Invalid]	The measured power is not used for power control.
				<b>Notes</b> No access in the application modes <b>A03</b> and <b>A04</b> .
8814	<b>Mains connection</b>	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.
				<b>Notes</b> No access in the application modes <b>A03</b> and <b>A04</b> .
8815	<b>Isol. switch</b>	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.
				<b>Notes</b> No access in the application modes <b>A03</b> and <b>A04</b> .

ID	Parameter	CL	Setting range [Default]	Description
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.
				<b>Notes</b> No access in the application modes <b>A03</b> and <b>A04</b> .

4.4.4 Inputs And Outputs

4.4.4.1 Discrete Inputs

General notes

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

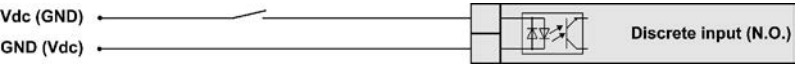


Fig. 54: Discrete inputs - alarm/control inputs - operation logic (state N.O.)

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.

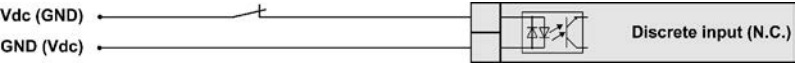




Fig. 55: Discrete inputs - alarm/control inputs - operation logic (state N.C.)

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.



Discrete input 8 is always used for the circuit breaker replies and cannot be configured.

### Internal discrete inputs - terminal assignment

Number	Terminal	Assignment (all application modes)
[DI 01]	44	Alarm input (LogicsManager); pre-configured for 'Lock monitoring'
[DI 02]	45	Control input (LogicsManager); pre-configured for 'Remote acknowledge'
[DI 03]	46	Control input (LogicsManager); pre-configured for 'Reply: CBA is closed'
[DI 04]	47	Alarm input (LogicsManager); pre-configured for 'Immediate open CBA'
[DI 05]	48	Control input (LogicsManager); pre-configured for 'Reply: Isolation switch is open'
[DI 06]	49	Control input (LogicsManager); pre-configured for 'Open CBA (with unloading)'
[DI 07]	50	Control input (LogicsManager); pre-configured for 'Enable to close CBA'

### Parameter IDs



The following parameters are used to configure the discrete inputs 1 through 7. The parameter IDs refer to discrete input 1.

- Refer to “Discrete inputs - parameter IDs” Table on page 118 for the parameter IDs of the parameters DI 2 through DI 7.

	DI 1	DI 2	DI 3	DI 4	DI 5	DI 6	DI 7
Text	1400	1410	1420	1430	1440	1450	1460
Operation	1201	1221	1241	1261	1281	1301	1321
Delay	1200	1220	1240	1260	1280	1300	1320
Alarm class	1202	1222	1242	1262	1282	1302	1322
Monitoring lockable	1203	1223	1243	1263	1283	1303	1323
Self acknowledged	1204	1224	1244	1264	1284	1304	1324

Table 25: Discrete inputs - parameter IDs

ID	Parameter	CL	Setting range [Default]	Description
1400	DI {x} Text	2	user defined (4 to 16 characters) For default see  Table on page	<p>If the discrete input is enabled with alarm class, this text is displayed on the control unit screen.</p> <p>The event history will store this text message as well.</p>
				<p><b>Notes</b></p> <p>This parameter may only be configured using ToolKit.</p> <p>If the DI is used as control input with the alarm class "Control", you may enter here its function (e.g. external acknowledgement) for a better overview within the configuration.</p>

ID	Parameter	CL	Setting range [Default]	Description
1201	DI {x} Operation	2		<p>The discrete inputs may be operated by an normally open (N.O.) or normally closed (N.C.) contact.</p> <p>The idle circuit current input can be used to monitor for a wire break.</p> <p>A positive or negative voltage polarity referred to the reference point of the DI may be applied.</p>
			[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).
1200	DI {x} Delay	2	0.08 to 650.00 s DI 01: [0.20 s] DI 04: [0.20 s] Other DIs: [0.50 s]	<p>A delay time in seconds can be assigned to each alarm or control input.</p> <p>The discrete input must be enabled without interruption for the delay time before the unit reacts.</p> <p>If the discrete input is used within the LogicsManager this delay is taken into account as well.</p>
1202	DI {x} Alarm class	2		<p>An alarm class may be assigned to the discrete input.</p> <p>The alarm class is executed when the discrete input is enabled.</p>
			A/B	Warning alarm classes
			C/D/E/F	Shutdown alarm classes
			[Control]	<p>Signal to issue a control command only.</p> <p>If "control" has been configured, there will be no entry in the event history and a function out of the LogicsManager (🔗 <i>Chapter 9.3.1 "LogicsManager Overview" on page 299</i>) can be assigned to the discrete input.</p>
1203	DI {x} Monitoring lockable	2	Yes	Monitoring for fault conditions is only performed if "Lock Monitoring Status 24.40" is false.
			[No]	Monitoring for this fault condition is continuously enabled regardless of "Lock Monitoring Status 24.40".
1204	DI {x} Self acknowledge	2	Yes	The control automatically clears the alarm if the fault condition is no longer detected.
			[No]	<p>The control does not automatically reset the alarm when the fault condition is no longer detected.</p> <p>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).</p>
				<p><b>Notes</b></p> <p>If the DI is configured with the alarm class "Control", self acknowledgement is always active.</p>

#### 4.4.4.2 Discrete Outputs (LogicsManager)

##### General notes

The discrete outputs are controlled via the LogicsManager.



For information on the LogicsManager and its default settings see [Chapter 9.3.1 "LogicsManager Overview" on page 299](#).

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

Relay		Application
No.	Terminal	
[R 01]	30/31	LogicsManager; pre-assigned with 'Ready for operation'
[R 02]	32/33	LogicsManager; pre-assigned with 'Common CBA failure'
[R 03]	34/35	LogicsManager; pre-assigned with 'Missing LS5'
[R 04]	36/37	LogicsManager; pre-assigned with 'System A or B not OK'
[R 05]	38/39/40	Fixed to 'Open CBA'
[R 06]	41/42	Fixed to 'Close CBA' if CBA is controlled by 2 relays <b>otherwise</b> LogicsManager pre-assigned with 'All Alarm classes'

Table 26: Relay outputs - assignment



### CAUTION!

#### Uncontrolled operation due to faulty configuration

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

- Signal this fault independently of the unit if the availability of the plant is important.

ID	Parameter	CL	Setting range [Default]	Description
12580	<b>Ready for op. Off</b> (Ready for operation OFF)	2	Determined by LogicsManager	The "Ready for operation OFF" relay is energized by default if the power supply exceeds 8 V.  Once the conditions of the LogicsManager have been fulfilled, the relay will be de-energized. This LogicsManager output may be configured with additional conditions, which may signal a PLC an "out of operation" condition by de-energizing the relay on terminals 30/31, like "shutdown alarm" or no "AUTO mode" present.
				<b>Notes</b> For information on the LogicsManager and its default settings see <a href="#">Chapter 9.3.1 "LogicsManager Overview" on page 299</a> .
12110	<b>Relay {x}</b>	2	Determined by LogicsManager	Once the conditions of the LogicsManager have been fulfilled, the relay will be energized.
				<b>Notes</b> For information on the LogicsManager and its default settings see <a href="#">Chapter 9.3.1 "LogicsManager Overview" on page 299</a> .



## Parameter IDs



The parameter ID above refers to relay 2.

- Refer to “Discrete outputs - relay parameter IDs” Table on page 121 for the parameter IDs of the parameters for relay 3 to relay 6.

	R 1	R 2	R 3	R 4	R 5	R 6
Parameter ID	12580	12110	12310	12320	12130	12140

Table 27: Discrete outputs - relay parameter IDs

#### 4.4.5 Automatic Run

ID	Parameter	CL	Setting range [Default]	Description
8827	<b>Startup in mode</b>  (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.
			Last	The unit starts in the last operating mode the control was in prior to being de-energized.
				<b>Notes</b> No access in the application modes <b>A03</b> and <b>A04</b> .
12510	<b>Operat. mode AUTO</b>  (Activate operating mode AUTOMATIC )	2	Determined by LogicsManager  [(0 & 1) & 1]	Once the conditions of the LogicsManager have been fulfilled the unit will change into operating mode AUTOMATIC.  If AUTOMATIC mode is selected via the LogicsManager it is not possible to change operating modes via the front panel.
				<b>Notes</b> No access in the application modes <b>A03</b> and <b>A04</b> .  For information on the LogicsManager and its default settings see  Chapter 9.3.1 “LogicsManager Overview” on page 299.
12520	<b>Operat. mode MAN</b>  (Activate operating mode MANUAL)	2	Determined by LogicsManager  [(0 & 1) & 1]	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.
				<b>Notes</b> No access in the application modes <b>A03</b> and <b>A04</b> .  For information on the LogicsManager and its default settings see  Chapter 9.3.1 “LogicsManager Overview” on page 299.

## 4.5 Configure Interfaces

### 4.5.1 General

ID	Parameter	CL	Setting range [Default]	Description
8051	Toolkit inter- face	2	[Serial 1]	Toolkit is working at Serial #1 interface (RS-232)
			Serial 2	Toolkit is working at Serial #2 interface (RS-485)

### 4.5.2 CAN Interface

#### 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.*

ID	Parameter	CL	Setting range [Default]	Description
9923	Comm. LS5 <-> gen. device	2		The interface, which is used for transmitting the LS-5 data and easYgen load share data is configured here.
			[CAN #1]	Use CAN interface 1.
			Off	Deactivate interface.
9921	Transfer rate fast message	2	0.10 to 0.30 s [0.10 s]	The transfer rate defines the time delay between two fast CAN messages.
				<b>Notes</b> In case of CAN systems with a high bus load (e.g. long distance between the units with low baud rate), a shorter transfer rate (higher time setting) helps to reduce the bus load.
9920	Comm. LS5 <-> gen. CAN-ID	2	2xx Hex / 3xx Hex / 4xx Hex / [5xx Hex]	The first digit of the CAN ID or the range (i.e. 2xx means 200 through 2FF) is configured here.  The last two digits will be assigned by the control with the settings from the device number (parameter 1702 ↗ p. 65)

#### 4.5.2.1 CAN Interface 1

#### COB-ID messages



*Parameters 9100 ↗ p. 124 and 9101 ↗ p. 125 use synchronization and time messages that adhere to the following structure.*

UNSIGN D 32	MSB				LSB
Bits	31	30	29	28-11	10-0
11 bit ID	X	0/1	X	000000000 000000000	11 bit iden- tifier

Bit number	Value	Meaning
31 (MSB)	X	N/A
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	No	Yes
	Bit 30 = 1; Bit 31 = 1	Yes	Yes
Default	Bit 30 = 0; Bit 31 = 0	No	No
	Bit 30 = 1; Bit 31 = 0	Yes	No
	Bit 30 = 0; Bit 31 = 1	No	Yes <sup>1</sup>
	Bit 30 = 1; Bit 31 = 1	Yes	Yes <sup>1</sup>
On	Bit 30 = 0; Bit 31 = 0	No	No
	Bit 30 = 1; Bit 31 = 0	Yes	No
	Bit 30 = 0; Bit 31 = 1	No	Yes
	Bit 30 = 1; Bit 31 = 1	Yes	Yes



<sup>1</sup> If CANopen master (lowest Node-ID).

ID	Parameter	CL	Setting range [Default]	Description
3156	<b>Baudrate</b>	2	20 / 50 / 100 / 125 / 250 / 500 / 800 / 1000 kBaud  [250 kBd]	This parameter defines the used baud rate. Please note, that all participants on the CAN bus must use the same baud rate.
8950	<b>Node-ID CAN bus 1</b>	2	1 to 127 (dec)  [33]	<p>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.</p> <p>This address number may only be used once on the CAN bus. All additional addresses are calculated based on this unique device number.</p> <p><b>Notes</b></p> <p>We recommend to configure the Node-IDs for units, which participate in load sharing, as low as possible to facilitate establishing of communication.</p> <p>No access in the application modes <b>A03</b> and <b>A04</b>.</p>
8993	<b>CANopen Master</b>	2	<div></div> <div>[Default Master]</div> <div>On</div> <div>Off</div> <div></div>	<p>One bus participant must take over the network management and put the other participants into "operational" mode. The LS-5 is able to perform this task.</p> <p>The unit starts up in "operational" mode and sends a "Start_Remote_node" message after a short delay (the delay is the Node-ID (parameter 8950 ↗ p. 124) in seconds, i.e. if the Node-ID is configured to 2, the message will be sent after 2 seconds). If more than one easYgen / LS-5 is configured to Default Master, the unit with the lower Node-ID will take over control. Therefore, the CAN bus devices, which are intended to act as Default Master should be assigned a low Node-ID. No other device on the CAN bus (except the easYgens / LS-5s) may operate as Master).</p> <p>The unit is the CANopen Master and automatically changes into operational mode and transmits data.</p> <p>The unit is a CANopen Slave. An external Master must change into operational mode.</p> <p><b>Notes</b></p> <p>If this parameter is configured to "Off", the Master controller (for example a PLC) must send a "Start_Remote_node" message to initiate the load share message transmission of the easYgen.</p> <p>If no "Start_Remote_node" message would be sent, the complete system would not be operational.</p>
9120	<b>Producer heartbeat time</b>	2	0 to 65500 ms  [2000 ms]	<p>Independent from the CANopen Master configuration, the unit transmits a heartbeat message with this configured heartbeat cycle time.</p> <p>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.</p>
9100	<b>COB-ID SYNC Message</b>	2	1 to FFFFFFFF hex  [80 hex]	<p>This parameter defines whether the unit generates the SYNC message or not.</p> <p>The message complies with CANopen specification: object 1005; subindex 0 defines the COB-ID of the synchronization object (SYNC).</p> <p><b>Notes</b></p> <p>The structure of this object is shown in ↗ "COB-ID messages" on page 122.</p>
8940	<b>Producer SYNC Message time</b>	2	0 to 65000 ms  [20 ms]	This is the cycle time of the SYNC message. If the unit is configured for this function (parameter 9100 ↗ p. 124) it will send the SYNC message with this interval. The time configured here will be rounded up to the next 10 ms step.

ID	Parameter	CL	Setting range [Default]	Description
9101	<b>COB-ID TIME Message</b>	2	1 to FFFFFFFF hex [100 hex]	This parameter defines whether the unit generates the TIME message or not.  Complies with CANopen specification: object 1012, subindex 0; defines the COB-ID of the time object (TIME).
				<b>Notes</b>  The structure of this object is shown in <a href="#">🔗 “COB-ID messages” on page 122.</a>

#### 4.5.2.2 Additional Server SDOs (Service Data Objects)

##### General notes



*The CAN bus is a field bus and subject to various disturbances. Therefore, it cannot be guaranteed that every request will be answered. We recommend to repeat a request, which is not answered within reasonable time.*

The first Node-ID is the standard Node-ID of CAN interface 1 (parameter 8950 [🔗 p. 124](#)).

ID	Parameter	CL	Setting range [Default]	Description
33040	<b>2. Node-ID</b>	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, 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.
33041	<b>3. Node-ID</b>	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, 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.
33042	<b>4. Node-ID</b>	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, 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.
33043	<b>5. Node-ID</b>	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, 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.

#### 4.5.2.3 Receive PDO 1 (Process Data Object)

##### General notes

RPDO mapping is carried out as shown in (Fig. 56).

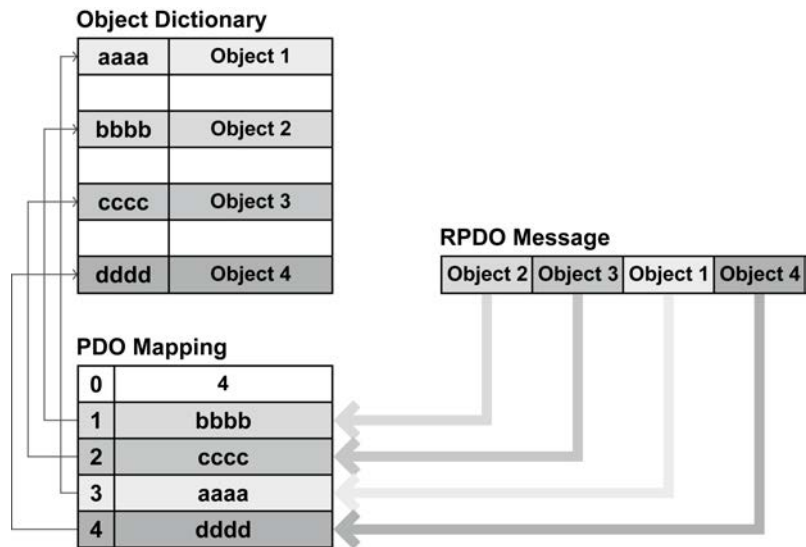


Fig. 56: RPDO mapping principle

COB-ID parameters



Parameter 9300 p. 127 uses communication parameters that adhere to the following structure.

UNSIGNED 32	MSB				LSB
Bits	31	30	29	28-11	10-0
11 bit ID	0/1	X	X	000000000 000000000	11 bit identifier

Bit number	Value	Meaning
31 (MSB)	0	PDO exists / is valid
	1	PDO does not exist / is not valid
30	X	N/A
29	X	N/A
28-11	0	Always
10-0 (LSB)	X	Bits 10-0 of COB-ID



PDO valid / not valid allows to select, which PDOs are used in the operational state.

ID	Parameter	CL	Setting range [Default]	Description
9300	COB-ID	2	1 to FFFFFFFF hex  [80000000 hex]	<p>This parameter contains the communication parameters for the PDOs, the device is able to receive.</p> <p>Complies with CANopen specification: object 1400 (for RPDO 1, 1401 for RPDO 2 and 1402 for RPDO 3), subindex 1.</p> <p><b>Notes</b></p> <p>The structure of this object is shown in <a href="#">“COB-ID parameters”</a> on page 126.</p> <p>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.</p>
9121	Event-timer	2	0 to 65,500 ms  [2,000 ms]	<p>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.</p> <p><b>Notes</b></p> <p>Complies with CANopen specification: object 1400 (for RPDO 1, 1401 for RPDO 2 and 1402 for RPDO 3), subindex 5</p>

#### 4.5.2.4 Transmit PDO {x} (Process Data Object)

##### General notes

TPDO mapping is carried out as shown in (Fig. 57).

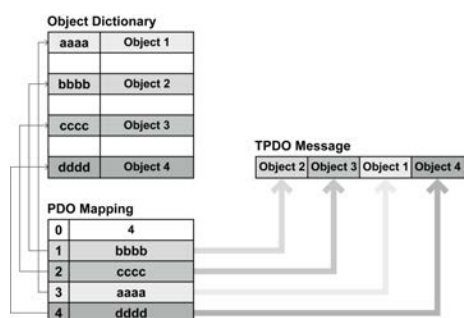


Fig. 57: TPDO mapping



*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 [Chapter 9.2 “Data Protocols”](#) on page 243):*

- 1,2 UNSIGNED16 or SIGNED16
- 3,4 UNSIGNED16 or SIGNED16
- 5,6 UNSIGNED16 or SIGNED16
- 1,2,3,4 UNSIGNED32 or SIGNED32
- 3,4,5,6 UNSIGNED32 or SIGNED32
- etc.

*The object ID is identical with the parameter ID when configuring via front panel or ToolKit.*

##### COB-ID parameters



*Parameters 9600 [p. 129/9610](#) [p. 129/9620](#) [p. 129](#) use communication parameters that adhere to the following structure.*

## Configuration

Configure Interfaces > CAN Interface > Transmit PDO {x} (Process ...

UNSIGNED 32	MSB				LSB
Bits	31	30	29	28-11	10-0
11 bit ID	0/1	X	X	000000000 000000000	11 bit identifier

Bit number	Value	Meaning
31 (MSB)	0	PDO exists / is valid
	1	PDO does not exist / is not valid
30	X	N/A
29	X	N/A
28-11	0	Always
10-0 (LSB)	X	Bits 10-0 of COB-ID



*PDO valid / not valid allows to select, which PDOs are used in the operational state.*

## Transmission types



*Parameters 9602 ↗ p. 129/9612 ↗ p. 129/9622 ↗ p. 129 are used to select one of the following transmission types.*

Transmission type	PDO transmission				
	Cyclic	Acyclic	Synchronous	Asynchronous	RTR only
0	Will not be sent				
1-240	X		X		
241-251	Will not be sent				
252	Will not be sent				
253	Will not be sent				
254				X	
255				X	





A value between 1 and 240 means that the PDO is transferred synchronously and cyclically. The transmission type indicating the number of SYNC, which are necessary to trigger PDO transmissions.

Receive PDOs are always triggered by the following SYNC upon reception of data independent of the transmission types 0 to 240. For TPDOs, transmission type 254 and 255 means, the application event is the event timer.

ID	Parameter	CL	Setting range [Default]	Description
9600 9610 9620	<b>COB-ID</b>	2	1 to FFFFFFFF hex  [80000000 hex]	<p>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.</p> <p>Complies with CANopen specification: object 1800 for (TPDO 1, 1801 for TPDO 2 and 1802 for TPDO 3), subindex 1.</p> <p><b>Notes</b></p> <p>The structure of this object is shown in <a href="#">“COB-ID parameters” on page 127</a></p> <p>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.</p>
9602 9612 9622	<b>Transmission type</b>	2	0 to 255  [255]	<p>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 <a href="#">p. 124</a>).</p> <p><b>Notes</b></p> <p>Complies with CANopen specification: object 1800 (for TPDO 1, 1801 for TPDO 2 and 1802 for TPDO 3), subindex 2.</p> <p>The description of the transmission type is shown in <a href="#">“Transmission types” on page 128</a>.</p>
9604 9614 9624	<b>Event timer</b>	2	0 to 65500 ms  [20 ms]	<p>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.</p> <p><b>Notes</b></p> <p>Complies with CANopen specification: object 1800 (for TPDO 1, 1801 for TPDO 2 and 1802 for TPDO 3), subindex 5</p>
8962 8963 8964	<b>Selected Data Protocol</b>	2	0 to 65535 8962: [5301] 8963: [0] 8964: [0]	<p>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.</p> <p>Possible data protocol IDs are:</p>
			5301	Data telegram
9609 9619 9629	<b>Number of Mapped Objects</b>	2	0 to 4  [0]	<p>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.</p> <p><b>Notes</b></p> <p>Complies with CANopen specification: object 1A00 (for TPDO 1, 1A01 for TPDO 2 and 1A02 for TPDO 3), subindex 0</p>

ID	Parameter	CL	Setting range [Default]	Description
9605 9615 9625	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.
				<b>Notes</b> Complies with CANopen specification: object 1A00 (for TPDO 1, 1A01 for TPDO 2 and 1A02 for TPDO 3), subindex 1
9606 9616 9626	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.
				<b>Notes</b> Complies with CANopen specification: object 1A00 (for TPDO 1, 1A01 for TPDO 2 and 1A02 for TPDO 3), subindex 2
9607 9617 9627	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.
				<b>Notes</b> Complies with CANopen specification: object 1A00 (for TPDO 1, 1A01 for TPDO 2 and 1A02 for TPDO 3), subindex 3
9608 9618 9628	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.
				<b>Notes</b> Complies with CANopen specification: object 1A00 (for TPDO 1, 1A01 for TPDO 2 and 1A02 for TPDO 3), subindex 4

### 4.5.3 RS-232 Interface

ID	Parameter	CL	Setting range [Default]	Description
3163	Baudrate	2	2.4 / 4.8 / 9.6 / 14.4 / <b>[19.2]</b> / 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.
3161	Parity	2	<b>[No]</b> / Even / Odd	The used parity of the interface is set here.
3162	Stop bits	2	<b>[One]</b> / Two	The number of stop bits is set here.
3185	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.
3186	Reply delay time	2	0.00 to 1.00 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 also required if an external interface converter to RS-485 is used for example.

#### 4.5.4 RS-485 Interface

ID	Parameter	CL	Setting range [Default]	Description
3170	Baudrate	2	2.4 / 4.8 / 9.6 / 14.4 / <b>[19.2]</b> / 38.4 / 56 / 115 kBaud	This parameter defines the baud rate for communications. Please note, that all participants on the bus must use the same baud rate.
3171	Parity	2	<b>[No]</b> / Even / Odd	The used parity of the interface is set here.
3172	Stop bits	2	<b>[One]</b> / Two	The number of stop bits is set here.
3188	ModBus Slave ID	2	0 to 255 <b>[33]</b>	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 <b>[0.00 s]</b>	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 halfduplex mode.

#### 4.5.5 Modbus Protocol (5300 Multiple)

ID	Parameter	CL	Setting range [Default]	Description
3181	Power [W] exponent 10 <sup>x</sup>	2	2 to 5 <b>[3]</b>	This setting adjusts the format of the 16 bit power values in the data telegram.
				<b>Notes</b> For an example refer to ⓘ <i>"Power measurement example" on page 131.</i>
3182	Voltage [V] exponent 10 <sup>x</sup>	2	-1 to 2 <b>[0]</b>	This setting adjusts the format of the 16 bit voltage values in the data telegram.
				<b>Notes</b> For an example refer to ⓘ <i>"Voltage measurement example" on page 132.</i>
3183	Current [A] exponent 10 <sup>x</sup>	2	-1 to 0 <b>[0]</b>	This setting adjusts the format of the 16 bit current values in the data telegram.
				<b>Notes</b> For an example refer to ⓘ <i>"Current measurement example" on page 132.</i>

#### Power measurement example



Refer to parameter 3181 ⓘ p. 131.

## Configuration

Configure Interfaces > Modbus Protocol (5300 Mult...

- The measurement range is 0...250 kW
- Momentarily measurement value = 198.5 kW (198.500 W)

Setting	Meaning	Calculation	Transfer value (16Bit, max. 32767)	Possible display format
2	$10^2$	$198500 \text{ W} / 10^2$	1985	198.5 kW
3	$10^3$	$198500 \text{ W} / 10^3$	198	198 kW
4	$10^4$	$198500 \text{ W} / 10^4$	9	N/A
5	$10^5$	$198500 \text{ W} / 10^5$	1	N/A

### Voltage measurement example



Refer to parameter 3182 ↗ p. 131.

- The measurement range is 0...480 V
- Momentarily measurement value = 477.8 V

Setting	Meaning	Calculation	Transfer value (16Bit, max. 32767)	Possible display format
-1	$10^{-1}$	$477.8 \text{ V} / 10^{-1}$	4778	47.8 V
0	$10^0$	$477.8 \text{ V} / 10^0$	477	477 V
1	$10^1$	$477.8 \text{ V} / 10^1$	47	N/A
2	$10^2$	$477.8 \text{ V} / 10^2$	4	N/A

### Current measurement example



Refer to parameter 3183 ↗ p. 131.

- The measurement range is 0...500 A
- Momentarily measurement value = 345.4 A

Setting	Meaning	Calculation	Transfer value (16Bit, max. 32767)	Possible display format
-1	$10^{-1}$	$345.4 \text{ A} / 10^{-1}$	3454	345.4 A
0	$10^0$	$345.4 \text{ A} / 10^0$	345	345 A

## 4.6 Configure LogicsManager

### Logical symbols

The LS-5 LogicsManager screens show logical symbols according to the IEC standard.



Refer to [Chapter 9.3.2 “Logical Symbols”](#) on page 301 for a table of symbols according to the different standards.

### Internal flags

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



The flag parameters are listed as one entry in the parameter table below. For the parameter IDs of each individual flag parameter refer to [“Flag parameter IDs \(1 to 8\)” Table on page 133](#).

Flag {x}	Flag 1	Flag 2	Flag 3	Flag 4	Flag 5	Flag 6	Flag 7	Flag 8
Parameter ID yyyy	12230	12240	12250	12260	12270	12280	12290	12300

Table 28: 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 yyyy	12910	12911	12912	12913	12914	12915	12916	12917

Table 29: Flag parameter IDs (9 to 16)



For conditions and explanation of programming please refer to [Chapter 9.3.1 “LogicsManager Overview”](#) on page 299.

### LS-5

Each LS-5 has five special flags (“Flag 1 LS5” to “Flag 5 LS5”) which can be defined via LogicsManager. They are transmitted via CAN bus. These flags (26.01 to 27.80) are received by the other LS-5 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 [“LS5 flag parameter IDs” Table on page 134](#)

Flag {x} LS-5	Flag 1 LS-5	Flag 2 LS-5	Flag 3 LS-5	Flag 4 LS-5	Flag 5 LS-5
Parameter ID yyyy	12952	12953	12954	12955	12956

Table 30: LS5 flag parameter IDs



For conditions and explanation of programming please refer to [Chapter 9.3.1 “LogicsManager Overview” on page 299](#).

## LED

Each LS-5 has eight LED flags ("LED 1" to "LED 8") which can be defined via LogicsManager.

LED (internal) flags (24.51 to 24.58) within the LogicsManager logical outputs may be programmed and used for multiple functions.



The LED configuration is used in the LS-51x to control the LEDs. In the LS-52x version the LED flags can be used as additional internal flags.



The flag parameters are listed as one entry in the parameter table below. For the parameter IDs of each individual flag parameter refer to [“LED flag parameter IDs” Table on page 134](#).



For conditions and explanation of programming please refer to [Chapter 9.3.1 “LogicsManager Overview” on page 299](#).

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

Table 31: LED flag parameter IDs

## Timers

**Daily time setpoints**

Utilizing the LogicsManager it is possible to establish specific times of the day that functions (i.e. generator exerciser) can be enabled.

The two daily time setpoints are activated each day at the configured time. Using the LogicsManager these setpoints may be configured individually or combined to create a time range.

**Active time setpoint**

Utilizing the LogicsManager it is possible to establish specific days (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.

ID	Parameter	CL	Setting range [Default]	Description
yyyyy	<b>Flag {x}</b>	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 <a href="#">“LED flag parameter IDs” Table on page 134.</a>
yyyyy	<b>Flag {x} LS5</b>	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 <a href="#">“LED flag parameter IDs” Table on page 134.</a>
yyyyy	<b>LED {x}</b>	2	Determined by LogicsManager	<b>LS-51x:</b> The flags are used to control the LED states. The default values are defined on the provided paper strip.  <b>LS-52x:</b> 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 <a href="#">“LED flag parameter IDs” Table on page 134.</a>

## Configuration

### Configure LogicsManager

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.  <b>Example</b> ■ 0 = 0th hour of the day (midnight). ■ 23 = 23rd hour of the day (11pm).
1651 1656	Timer {x}: Minute	2	0 to 59 min [0 min]	Enter the minute of the daily time setpoint here.  <b>Example</b> ■ 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.  <b>Example</b> ■ 0 = 0th second of the minute. ■ 59 = 59th second of the minute.
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.  <b>Example</b> ■ 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.  <b>Example</b> ■ 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.  <b>Example</b> ■ 0 = 0th minute of the hour. ■ 59 = 59th minute of the hour.
1660	Active second	2	0 to 59 s [0 s]	Enter the second of the active switch point here.  The active time setpoint is enabled every minute during the indicated second.  <b>Example</b> ■ 0 = 0th second of the minute. ■ 59 = 59th second of the minute.
1670	Monday active	2		Please enter the days of the weekly workdays.
			[Yes]	The switch point is enabled every Monday.
			No	The switch point is disabled every Monday.
1671	Tuesday active	2		Please enter the days of the weekly workdays.
			[Yes]	The switch point is enabled every Tuesday.



ID	Parameter	CL	Setting range [Default]	Description
			No	The switch point is disabled every Tuesday.
1672	<b>Wednesday active</b>	2		Please enter the days of the weekly workdays.
			[Yes]	The switch point is enabled every Wednesday.
			No	The switch point is disabled every Wednesday.
1673	<b>Thursday active</b>	2		Please enter the days of the weekly workdays.
			[Yes]	The switch point is enabled every Thursday.
			No	The switch point is disabled every Thursday.
1674	<b>Friday active</b>	2		Please enter the days of the weekly workdays.
			[Yes]	The switch point is enabled every Friday.
			No	The switch point is disabled every Friday.
1675	<b>Saturday active</b>	2		Please enter the days of the weekly workdays.
			Yes	The switch point is enabled every Saturday.
			[No]	The switch point is disabled every Saturday.
1676	<b>Sunday active</b>	2		Please enter the days of the weekly workdays.
			Yes	The switch point is enabled every Sunday.
			[No]	The switch point is disabled every Sunday.

## 4.7 Configure Counters

ID	Parameter	CL	Setting range [Default]	Description
2541	<b>Counter value preset</b>	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 ↗ p. 137.
2542	<b>CBA set number of closures</b>	2	Yes	The current value of the CBA close counter is overwritten with the value configured in "Counter value present". 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

The LS-5 can be operated, monitored and configured using the following access methods:

- Access via the front panel (LS-52x only)
  - ↳ Chapter 5.2 “Front Panel Access” on page 149
- External access with a PC using the ToolKit configuration software.
  - ↳ Chapter 5.1 “Access Via PC (ToolKit)” on page 139
- External command access using Modbus/CANopen protocols
  - ↳ Chapter 7 “Interfaces And Protocols” on page 225

### 5.1 Access Via PC (ToolKit)

#### Version



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

- Required version: 4.5.1 or higher
- For information on how to obtain the latest version see ↳ “Load from the website” on page 140.

#### 5.1.1 Install ToolKit

##### Load from CD

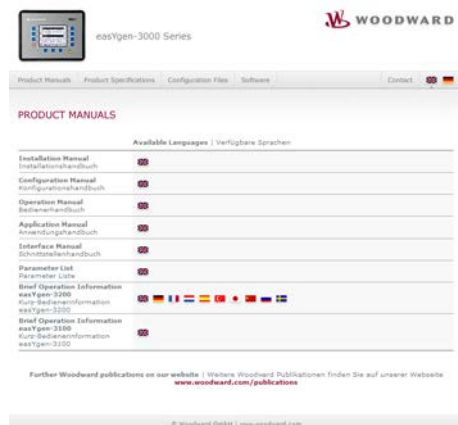


Fig. 58: Product CD - HTML menu



Fig. 59: HTML menu section 'Software'

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

⇒ The HTML menu is opened automatically in a browser.



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

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

2. ➤ Go to section “Software” and follow the instructions described there.

### Load from the website



*The latest version of the ToolKit software can be obtained from our website.*

*The latest version of Microsoft .NET Framework can be obtained from Microsoft website.*

To get the software from the website:

1. ➤ Go to <http://www.woodward.com/software>
2. ➤ Select ToolKit in the list and click the "Go" button.
3. ➤ Click "More Info" to get further information about ToolKit.
4. ➤ Choose the preferred software version and click "Download".
5. ➤ Login with your e-mail address or register first.
  - ⇒ The download will start immediately.

### Minimum system requirements

- Microsoft Windows® 7, Vista, XP (32- & 64-bit; support for XP will end on 2014-April-8)
- Microsoft .NET Framework Ver. 4.0
- 1 GHz Pentium® CPU
- 512 MB of RAM
- Screen
  - Resolution: 800 by 600 pixels
  - Colors: 256
- Serial Port
- Serial Extension Cable
- CD-ROM drive



*Microsoft .NET Framework 4.0 must be installed on your computer to be able to install ToolKit.*

- *If not already installed, Microsoft .NET Framework 4.0 will be installed automatically (internet connection required).*
- *Alternatively use the .NET Framework 4.0 installer found on the Product CD.*

### Installation

To install ToolKit:

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

## 5.1.2 Install ToolKit Configuration Files

### Load from CD

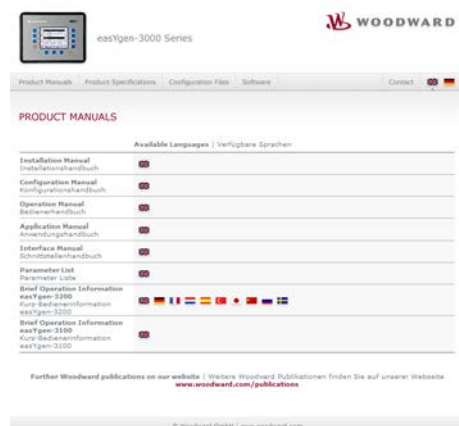


Fig. 60: Product CD - HTML menu

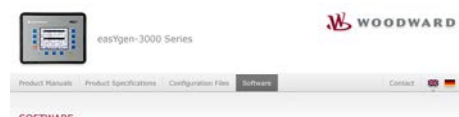


Fig. 61: HTML menu section 'Software'

### Load from the website

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

⇒ The HTML menu is opened automatically in a browser.



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

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

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



*The latest version of the ToolKit software can be obtained from our website.*

To get the software from the website:

1. ➤ Go to <http://www.woodward.com/software/configfiles>
  2. ➤ Insert the part number (P/N) and revision of your device into the corresponding fields.
  3. ➤ Select "ToolKit" in the "application type" list.
  4. ➤ Click "Search".
  5. ➤ Download the file displayed in the search result.
- ⇒ The file is a ZIP archive which must be extracted for use in ToolKit.

**ToolKit files**

*.WTOOL	
File name composition:	[P/N1] <sup>1</sup> -[Revision]_[Language ID]_[P/N2] <sup>2</sup> -[Revision]_[# of visualized gens].WTOOL
Example file name:	8440-1234-NEW_US_5418-1234-NEW.WTOOL
File content:	Display screens and pages for online configuration, which are associated with the respective *.SID file.

*.SID	
File name composition:	[P/N2] <sup>2</sup> -[Revision].SID
Example file name:	5418-1234-NEW.SID
File content:	All display and configuration parameters available in ToolKit.

*.WSET	
File name composition:	[user defined].WSET
Example file name:	device_settings.WSET
File content:	Default settings of the ToolKit configuration parameters provided by the SID file or user-defined settings read from the unit.

- <sup>1</sup> P/N1 = Part number of the unit
- <sup>2</sup> P/N2 = Part number of the software in the unit

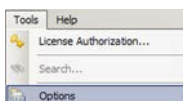
**5.1.3 Configure ToolKit**

Fig. 62: Tools menu

To change ToolKit settings:

1. ➤ Select “Tools ➔ Options”.

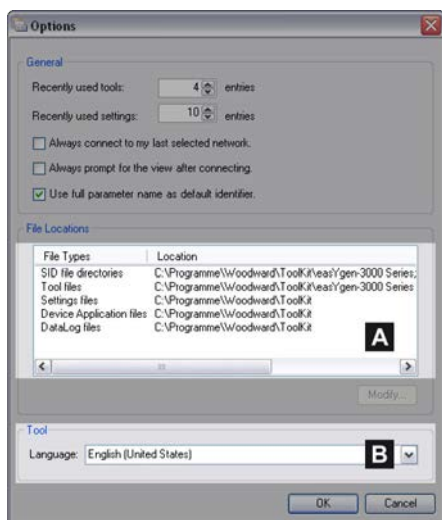


Fig. 63: Options window

⇒ The “Options” window is displayed.

2. ➤ Adjust settings as required.



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

⇒ Changes take effect after clicking “OK”.



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

- A File locations
- B Language setting for tools

### 5.1.4 Connect ToolKit

#### Standard connection

To connect ToolKit and the LS-5 unit:

1. ➔



*The USB/RS-232 serial interface is only provided via the optional Woodward DPC (direct configuration cable), which must be connected to the service port.*


*For additional information refer to  
Chapter 7.3.1 "Service Port (RS-232/USB)"  
on page 226.*

Plug the DPC cable into the service port. Use a USB/null modem cable to connect the USB/RS-232 serial port of the DPC to a serial USB/COM port of the PC.




*If the PC does not have a serial port to connect the null modem cable to, use a USB to serial adapter.*

2. ➔ Open ToolKit from the Windows Start Menu path "Programs ➔ Woodward ➔ ToolKit 3.x".

3. ➔ From the main ToolKit window, select "File ➔ Open Tool..." click the "Open Tool" icon  on the tool bar.

4. ➔ Locate and select the desired tool file (\*.WTOOL) in the ToolKit data file directory and click "Open".

5. ➔ From the main ToolKit window, click Device then click "Connect", or select the Connect icon  on the toolbar.

⇒ The connect dialog will open if the option is enabled.

6. ➔ Select the COM port that is connected to the communication cable.

7. ➔ Click the "Connect" button.

⇒ The identifier of the device that ToolKit is connected to, will display in the status bar.

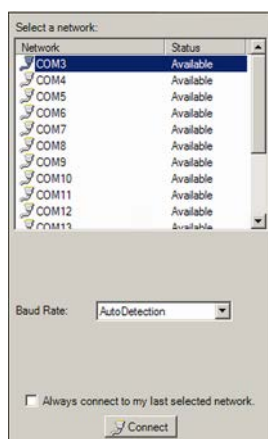


Fig. 64: Connect dialog



Fig. 65: Communications window

8. ➔ If the communications window opens, select "ToolConfigurator" from the "Tool Device" list and close the communications window.

⇒ If the device is security enabled, the login dialog will appear.

9. Enter the login data if required.

⇒ Now you are able to edit the LS-5 parameters in the main window.



*Any changes are written automatically to the control unit's memory after pressing [Enter] to confirm them..*

### CAN bus connection

It is also possible to connect to the unit via CAN bus, if a suitable CAN adapter is used.



*We recommend to use the IXXAT USB-to-CAN converter which must use the VCI V3 driver.*

To connect ToolKit via CAN:

1. Install the required drivers of the USB-to-CAN converter.

2. Connect the unit.

3. Open ToolKit and select a tool.

4. Select "Connect".

5. Select the CAN connection in the "Connect" window.

6. Configure the correct baud rate and timeout in the properties dialog of the "Connect" window.



*The Password for CAN Interface 1 (parameter 10402 ↗ p. 65) must be entered before being able to edit the parameters via CAN.*

### CAN connection troubleshooting

Fault description	Cause	Remedy
Connection error (ToolKit freezes when trying to establish a connection)	Active connections via infrared ports	Temporarily deactivate the infrared port (including virtual ports)
	Active connections via bluetooth	Temporarily deactivate bluetooth (including virtual ports)
	Additional CANopen devices connected to the bus	Contact Woodward support or provide missing .sid file for additional CANopen device (↗ "SID files for additional CANopen devices" on page 144)

### SID files for additional CANopen devices

When connecting a PC to the LS-5 via CAN bus, other external CANopen devices (like a Phoenix Contact I/O expansion board, for example) may cause ToolKit to fail to connect.

A cause may be that ToolKit looks for a SID file for the external device, which does not exist.

A special \*.sid file can be created in this case.





For additional support feel free to contact Woodward.

- Create a SID (text) file with the following content:

```
<?xml version="1.0" encoding="utf-8"?>
<ServiceInterfaceDefinition
  xmlns:xsi="http://www.w3.org/
    2001/XMLSchema-instance"
  Identifier="[device application name]"
  Specification="EmptyFile">
</ServiceInterfaceDefinition>
```
- Name the file [CANopen device identifier].sid
- Store the file in the configured SID directory

5.1.5 View And Set Values In ToolKit

Basic navigation ToolKit offers the following graphical elements for basic navigation:

Graphical element	Caption	Description
	Navigation buttons	Select main and subordinate configuration pages
	Navigation list	To directly select a configuration page based on its name
	Buttons "Previous page" and "Next page"	To go to the previous/next configuration page (as ordered in the list)

Value and status fields

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

- To change the value of a value or option field:
1. Enter the value or select an option from the drop-down list.
  2. Press *[Enter]* to confirm.
    - ⇒ The new value is written directly to the unit.

Visualization



Values displayed by visualization graphical elements cannot be changed.

Graphical element	Caption	Description
	System setup visualization	Displays breaker status
	Warning indicator	Displays status of warning alarms [on/off]
	Error indicator	Displays status of shutdown alarms [on/off]

Search

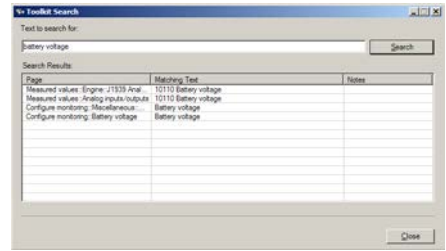


Fig. 66: Search dialog

Value trending

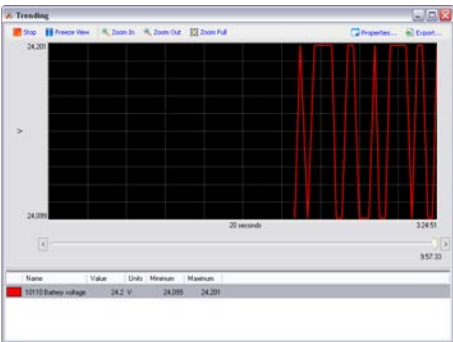


Fig. 67: Trending screen

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

To find a parameter/setting/monitoring value:

1. ➤ Select *Tools ➔ Search* from the menu.  
⇒ The *Search* dialog opens.
2. ➤ Enter a search term and press *[Enter]*.  
⇒ The results are displayed in the table.
3. ➤ Double-click a table entry to go to the visualization/configuration page that includes this parameter/setting/monitoring value.








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

To select values for trending screen:

1. ➤ Right-click an analog value field on any configuration/visualization page and select *“Add to trend”* from the context-menu.
2. ➤ Select *Tools ➔ Trending* from the menu.  
⇒ The trending screen opens.
3. ➤ Click the *“Start”* button to initiate charting.
4. ➤ Click the *“Stop”* button to stop charting the values.

**5.** To store the tracked data select *“Export”*

- ⇒ The tracked data is exported to a .CSV (comma separated values) file which can be viewed/edited/analysed in external applications (e.g. MS Excel/OpenOffice.org Calc).

Graphical element	Caption	Description
 Start	<i>“Start”</i>	Start value charting
 Stop	<i>“Stop”</i>	Stop value charting
 Zoom In  Zoom Out  Zoom Full	Zoom controls	Adjust detail of value chart
 Export...	<i>“Export”</i>	Export to .CSV
 Properties...	<i>“Properties”</i>	Change scale limits, sample rate, time span, colors

## 5.1.6 Special Screens

The following ToolKit screens provide overviews to the states of connected easYgen and LS-5 units in the network.

### States easYgen

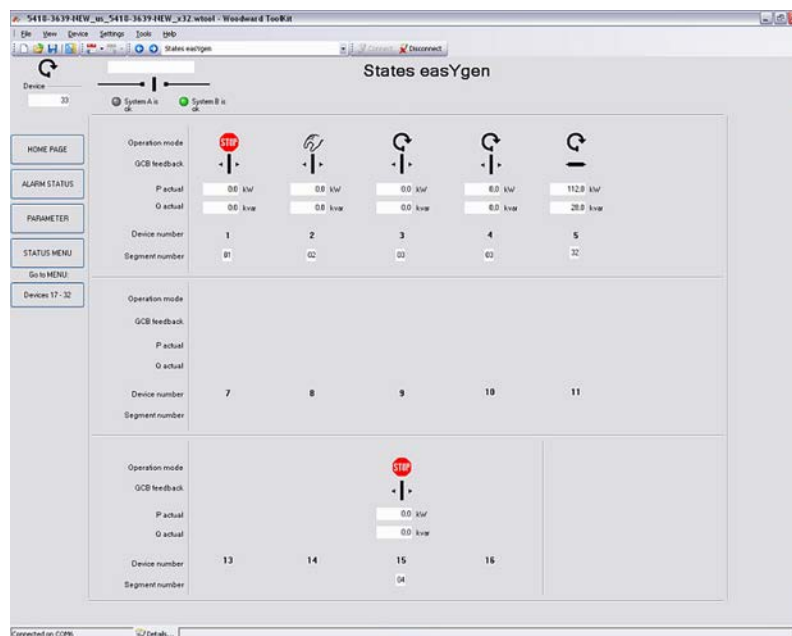







Fig. 68: States easYgen

Symbol	Description
	Operating mode STOP is active.
	Operating mode MANUAL is active.
	Operating mode AUTOMATIC is active.
	Breaker is open.
	Breaker is closed.

States LS-5

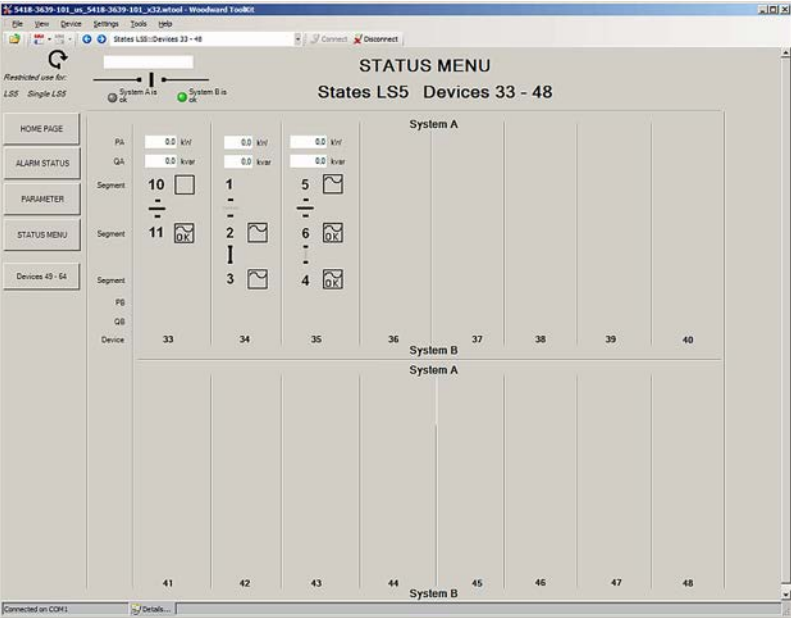









Fig. 69: States LS-5

Symbol	Description
	Voltage is below dead bus limit.
	Voltage is higher than dead bus limit but not in range.
	Voltage and frequency are in operation window.
	Breaker is open.
	Breaker is closed.

Symbol	Description
	Isolation switch is open.
	Isolation switch is closed.

## 5.2 Front Panel Access

### 5.2.1 Basic Navigation

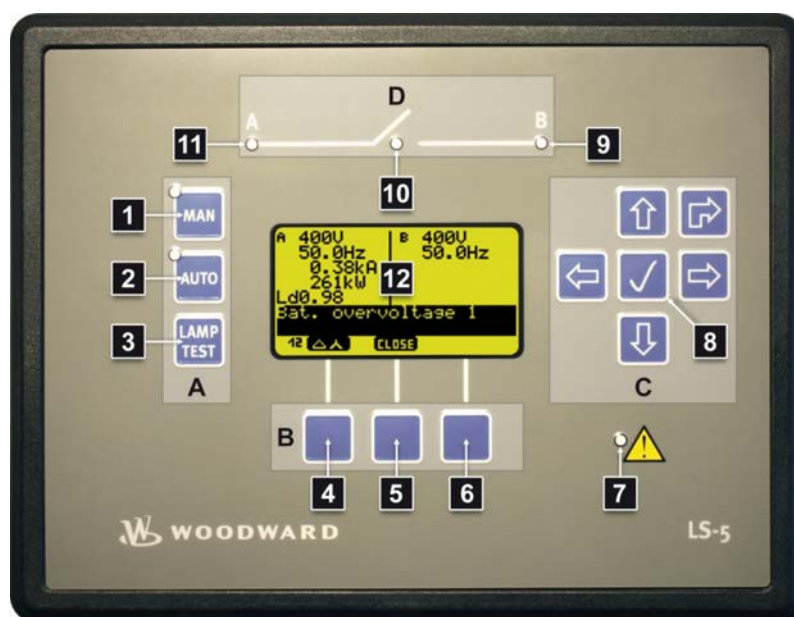






Fig. 70: Front panel and display





- A (1..3) Button group "Hardware"
- B (4..6) Button group "Display" (Softkeys)
- C Button group "Navigation" (Softkeys)
- D (9..11) LEDs "Breaker/system states"

Fig. 70 shows the front panel/display of the LS-52x with buttons, LEDs and LCD display. A short description of the front panel is given below.




[A] Button group "Hardware"




No.	Button	Function (all screens)
1		<p>Change into MANUAL operating mode. The LED indicates that the operation mode is active.</p> <p>When MANUAL is selected, breaker control is performed manually via the button  (No. 5).</p> <p>If the control unit is configured to application mode <b>A03</b> or <b>A04</b> (parameter 8840 ↗ p. 108) the button has no function.</p>
2		<p>Change into AUTOMATIC operating mode. The LED indicates that the operation mode is active.</p> <p>When AUTOMATIC is selected, the control unit manages all breaker control functions. These functions are performed in accordance with how the control unit is configured.</p>
3		Perform lamp test.

[B] Button group "Display"




No.	Button	Function (main screen)	Function (other screens)
4		<p>Toggle between delta/wye voltage display. The index of the "V" symbol indicates whether delta or wye voltage is displayed and which phases are displayed.</p> <p>Refer to ↗ "Measuring values" Table on page 157.</p>	The push button has only a function if a graphic icon is assigned (No. 12).
5		<p>AUTOMATIC operating mode – No function.</p> <p>MANUAL operating mode – Open / Close Breaker.</p>	The push button has only a function if a graphic icon is assigned (No. 12).
6		No function.	The push button has only a function if a graphic icon is assigned (No. 12).
7		The LED indicates that alarm messages are active/present in the control unit.	

[C] Button group "Navigation"

No.	Button	Function (main screen)	Function (other screens)
8		Display the "Alarm list" screen.	Scroll up / Raise value
		Display the "Main menu" screen.	Scroll down / Lower value
		Display the "Parameter" screen.	Scroll right

No.	Button	Function (main screen)	Function (other screens)
		No function.	Scroll left / Enter menu (if graphic icon is assigned)
		Reset "Horn".	Enter / Acknowledge
		No function.	Return to last screen

### [D] LEDs "Breaker/system states"

No.	Button	Function (all screens)
9		<p>The LED indicates three states:</p> <p><b>Off:</b> Voltage is below dead bus limit (parameter 5820 ↗ p. 114).</p> <p><b>Blinking:</b> Voltage higher than dead bus limit (parameter 5820 ↗ p. 114) but voltage or frequency are not in range.</p> <p><b>On:</b> Voltage / frequency in operation window.</p>
10		<p>The LED indicates two states:</p> <p><b>Off:</b> Breaker is open.</p> <p><b>On:</b> Breaker is closed.</p>
11		<p>The LED indicates three states:</p> <p><b>Off:</b> Voltage is below dead bus limit (parameter 5820 ↗ p. 114).</p> <p><b>Blinking:</b> Voltage higher than dead bus limit (parameter 5820 ↗ p. 114) but voltage or frequency are not in range.</p> <p><b>On:</b> Voltage / frequency in operation window.</p>

### Display / main screen


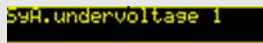




Fig. 71: Main screen

The display shows context-sensitive softkey symbols, measuring values, operation modes and alarms.

After power-up the control unit displays the main screen (Fig. 71).

The main screen contains the following basic sections:

No	Display section	Function
12		<p><b>A:</b> Shows the System A values.</p> <p><b>B:</b> Shows the System B values.</p>
		This display section shows the "Status Messages" and "Alarm Messages".






No	Display section	Function
		This display section shows a symbol indicating the selected display mode.
		This display section shows a symbol indicating the breaker state ("open"/"closed"). The icon is only displayed in operating mode "MANUAL".














*If the control unit has been configured for external operating mode selection, the "AUTO" and "MAN" buttons have no function. The operating mode cannot be changed.*

## Softkeys








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

Softkey symbol	Caption	Description
	Increase	Increase value.
	Decrease	Decrease value.
	Help	Access help screen.
	Toggle	Toggle between the configurable elements.
	Reset	Reset the maximum value display.

## Status symbols

Menu screen	Symbol	Description
Alarm List		Indicates that corresponding alarm condition is still present.
States easYgen		STOP operating mode.
		MANUAL operating mode.
		AUTOMATIC operating mode.
		Breaker open (GCB).
		Breaker closed (GCB).
		Segment number.
		Device number.
States LS-5		Segment numbers and breaker open.
		Segment numbers and breaker closed.
		Segment numbers and isolation switch open.



Menu screen	Symbol	Description
		Segment numbers and isolation switch closed.
		Indicates voltage and frequency are in range.
		Indicates voltage or frequency are not in range.
		Own LS-5 device number.
		Other LS-5 device numbers.
Various Screens		Variable is TRUE (LogicsManager). The bit is enabled (CAN interface). Relay activated (Discrete outputs)
		Variable is FALSE (LogicsManager). The bit is disabled (CAN interface). Relay deactivated (Discrete outputs)

## Menu structure

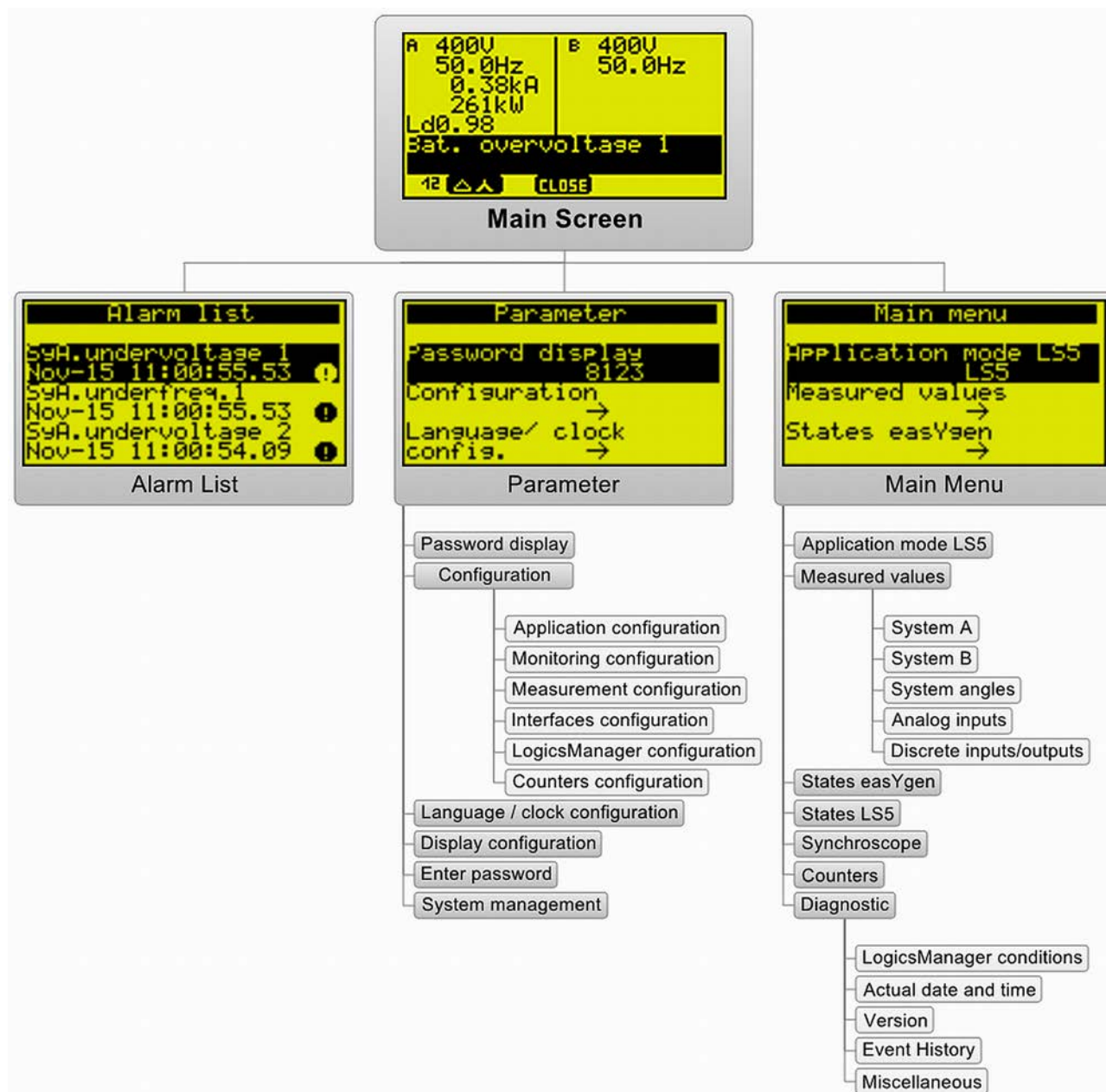


Fig. 72: Menu structure



The following chapters list notes on specific menu screens.

For information on standard softkeys and status symbols refer to Chapter 5.2.1 "Basic Navigation" on page 149.

## 5.2.2 Standard Menu Screens



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

For information on standard softkeys and status symbols refer to [Chapter 5.2.1 “Basic Navigation”](#) on page 149.

For information on all other menu screens refer to [Chapter 5.2.3 “Specialised Menu Screens”](#) on page 157.

### 5.2.2.1 Navigation Screens



Fig. 73: Navigation screen (example)

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

Navigation screens:

- Main Menu
- Measured values
- Diagnostic
- Parameter
- Configuration

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



Sub-menu entries are only displayed if the required or a higher code level is set.

### 5.2.2.2 Status/Monitoring Screens



Fig. 74: Status/Monitoring screen (example)

Status/Monitoring screens display monitored values or set parameters.

Screen	Notes
System A	Displays all measured system A values.
System B	Displays all measured system B values.
System angles	Displays the real system angles between system A and system B without phase angle compensation (parameter 8824 <a href="#">p. 113</a> ).
Analog inputs	Displays all measured battery voltages.
Version	Displays the serial number of the unit and the firm- and software P/N, version, and revision.
Counters	---
Actual date and time	---
Miscellaneous	---

Table 32: Status/Monitoring screens

Unit	Value
V	Voltage
A	Current
kW	Real power
Kvar	Reactive power
Hz	Frequency
Lg	Lagging
Ld	Leading

Table 33: Units of measured values

### 5.2.2.3 Value Setting Screens



Fig. 75: Value setting screen (example)

Screen	Notes
Application mode LS-5	Set the current application mode.
Display configuration	Allows the display contrast to be configured.
Enter password	Allows the password to be entered for a specific code level.
Application configuration	---
Monitoring configuration	---
Measurement configuration	---
Interfaces configuration	---
Counters configuration	---
Language clock configuration	---
System Management	---

Table 34: Value setting screens

➡ Use the following buttons in a value setting screen to select, change and confirm a setting.

Button/Softkey	Description
	Select previous value/entry.
	Select next value/entry.
	Increase selected value.
	Decrease selected value.
	Confirm and store changed value.
	Return without any changes.

## 5.2.3 Specialised Menu Screens

### 5.2.3.1 Main Screen Voltage Display

The voltage display softkey on the main screen changes the type of voltage display.



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

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

Press [ ]:	Symbol	Displayed voltage	Displayed at parameter setting			
			3Ph4W	3Ph3W	1Ph2W	1Ph3W
0× (6×)		Delta L1-L2	Yes	Yes	Yes <sup>1</sup>	---
1×		Delta L2-L3	Yes	Yes	---	---
2×		Delta L3-L1	Yes	Yes	---	Yes
3×		Wye L1-N	Yes	---	Yes <sup>1</sup>	Yes
4×		Wye L2-N	Yes	---	---	---
5×		Wye L3-N	Yes	---	---	Yes

Table 35: Measuring values



<sup>1</sup> depends on setting of parameter 1858 ↗ p. 68.

### 5.2.3.2 Alarm List



Fig. 76: 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).*



*A maximum of 16 alarm messages can be displayed. If 16 alarm messages are already displayed and further alarm messages occur, these will not be displayed before displayed alarm messages are acknowledged and thus deleted from the list.*

Symbol/Button	Description
	Indicates that corresponding alarm condition is still present.
	Acknowledge the selected alarm message (displayed inverted).



Acknowledgement 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'.

5.2.3.3      Synchroscope

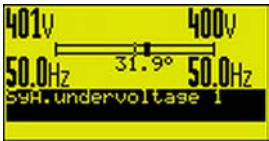



Fig. 77: Synchroscope screen LS-5

The square symbol indicates the actual phase angle between system A and system B. A complete left position of the square symbol means  $-180^\circ$  and complete right position means  $+180^\circ$ .  
The frequency and voltage differences are indicated in the display.



The shown value is not the real angle between system A and system B if the phase angle compensation (parameter 8824 ↗ p. 113) is active. The configured phase angle compensation is added to the angle.

Symbol/Button	Description
	Indicates the actual phase angle between system A and system B.

5.2.3.4      LogicsManager Conditions

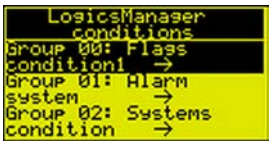





Fig. 78: LogicsManager conditions screen

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



Fig. 79: Command variables screen (example)

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

### 5.2.3.5 LogicsManager



Fig. 80: LogicsManager screen

Some parameters of the LS-5 are configured via the LogicsManager.

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

Symbol/Button	Description
	Scroll up one command variable within section.
	Scroll down one command variable within section.
	Navigate to next command variable section
	Toggle between the configurable elements.
	Confirm the configured option of the selected LogicsManager parameter.
	Show help screen (displays logical operators)

### 5.2.3.6 Event History



Fig. 81: Event History screen

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

Symbol/Button	Description
+	Indicates a condition that is still active.
-	The condition is no longer present.

### 5.2.3.7 States easYgen






Fig. 82: States easYgen screen

This screen displays the states of the easYgen devices.

#### Status symbols

Symbol	Description
	STOP operating mode.
	MANUAL operating mode.
	AUTOMATIC operating mode.
	Breaker open (GCB).

Symbol	Description
	Breaker closed (GCB).
	Segment number.
	Device number.

5.2.3.8 States LS-5

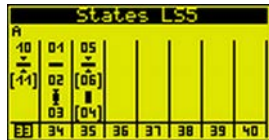










Fig. 83: States LS-5 screen

This screen displays the states of the LS-5 devices.

Status symbols

Symbol	Description
	Segment numbers and breaker open.
	Segment numbers and breaker closed.
	Segment numbers and isolation switch open.
	Segment numbers and isolation switch closed.
	Indicates voltage and frequency are in range.
	Indicates voltage or frequency are not in range.
	Own LS-5 device number.
	Other LS-5 device numbers.

5.2.3.9 Discrete Inputs/Outputs

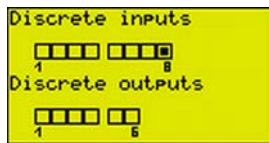






Fig. 84: Discrete inputs/outputs screen

This screen displays discrete inputs' and discrete outputs' status.



*The configured logic for the discrete input "N.O./N.C." will determine how the LS-5 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.*

Type	Symbol	State
Input		energized
		de-energized
Output		relay activated
		relay de-activated



5.2.3.10 CAN Interface 1 State



Fig. 85: CAN interface state screen (example)

Symbol		Description
	TRUE/enabled	The bit is enabled.
	FALSE/disabled	The bit is disabled.

Section	Bit	Assignment
Can bus 1 state	1	A TPDO has incorrect mapping parameters
	3	A TPDO has more than 8 bytes
CAN 1 monitoring (active state)	{x}	RPDO {x} is not received at the moment
CAN 1 monitoring (latched state)	{x}	RPDO {x} has not been received

Table 36: Bit assignments

5.3 Restore Language Setting

Due to the multilingual capability of the unit, it may happen that the display language of the LS-5 is set to a language, the operator is unable to read or understand.

In this case, the following proceeding helps to restore the desired language.









*The default setting is English.*

In order to change the language setting, press the softkeys in the following order:



Fig. 86: Front panel and display

1. ➤ Press softkey  until you return to the starting screen (as shown in Fig. 86).
2. ➤ Press softkey  once to access the "Parameter" screen.
3. ➤ Press softkey  twice to access the "Language / clock config." screen.
4. ➤ Press softkey  twice to edit the language setting.
5. ➤ Press softkey  to select the desired language.
6. ➤ Press softkey  once to commit the language setting.
  - ⇒ The desired display language is restored.

## 6 Application

### 6.1 Application Modes Overview

#### General notes

The LS-5 circuit breaker control units are designed to enable complex power management applications with multiple incoming mains and bus breakers in combination with easYgen-3400/3500 equipped genset controllers.

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-5 as well in the easYgen-3400/3500 are provided.

These application modes are created because some preconfigurations 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 shall help to guide through the settings according to the mode.*

The control units can be used stand-alone (↪ Chapter 6.1.1 “LS-5: Stand-Alone Application Mode” on page 164) or common applications with Woodward easYgen-3400/3500 genset control units (↪ Chapter 6.1.2 “LS-5 & easYgen-3400/3500: Common Application Modes (LS-5 View)” on page 164 and ↪ Chapter 6.1.3 “easYgen-3400/3500 & LS-5: Common Application Modes (easYgen-3400/3500 View)” on page 166).



*For detailed information on the application modes, notes on safety and examples of special applications refer to the following chapters:*

- ↪ Chapter 6.2 “Setup Stand-Alone Applications (Mode A01)” on page 168
- ↪ Chapter 6.3 “Setup easYgen & Slave LS-5 Applications (Mode A03 & A04)” on page 171
- ↪ Chapter 6.4 “Setup easYgen & Independent LS-5 Applications (Mode A02)” on page 189

#### Correlating application modes

	Mode LS-5	Symbol	Mode easYgen	Symbol
LS-5	Single LS5	<b>A01</b>	N/A	N/A
LS-5 & easYgen	LS5 (up to 16 unit)	<b>A02</b>	GCB/LS5	<b>A07</b>
	L-MCB (max. 1 unit)	<b>A03</b>	GCB/L-MCB	<b>A08</b>
			GCB/GGB/L-MCB	<b>A09</b>
	L-GGB (max. 1 unit)	<b>A04</b>	GCB/L-GGB	<b>A10</b>
	L-GGB (max. 1 unit)	<b>A04</b>	GCB/L-GGB/L-MCB	<b>A11</b>
	L-MCB (max. 1 unit)	<b>A03</b>		

### 6.1.1 LS-5: Stand-Alone Application Mode

LS-511/521		easYgen-3400/3500		
Mode	Symbol	Mode	Symbol	Function
Single LS5	<b>A01</b>	None	None	<p>Independent synch check relay mode.</p> <p>This application mode provides the following functions:</p> <ul style="list-style-type: none"> <li>■ Handling of CBA (dead bus closure, synchronization, open) initiated by the corresponding command variables or by manual commands.</li> <li>■ Measuring and monitoring of system A values (voltage, frequency, phase rotation, current).</li> <li>■ Measuring of system B values (voltage, frequency, phase rotation).</li> <li>■ Measuring of active and reactive power on system A.</li> <li>■ Measuring of phase angle system A to system B.</li> <li>■ Interacting as an independent synchronizer for a PLC by communication interface (CANopen, Modbus RTU slave).</li> </ul>

### 6.1.2 LS-5 & easYgen-3400/3500: Common Application Modes (LS-5 View)



*For information on the easYgen genset control unit's application modes refer to the easYgen manual.*

LS-511/521		easYgen-3400/3500		
Mode	Symbol	Mode	Symbol	Function
LS5	<b>A02</b>	GCB/LS5	<b>A07</b>	<p>Open LS-5 system, in combination with easYgen-3400/3500, individually configurable.</p> <p>This application mode provides the following functions:</p> <ul style="list-style-type: none"> <li>■ Handling of CBA (dead bus closure, synchronization, open) initiated by the corresponding command variables or by manual commands.</li> <li>■ Measuring and monitoring of system A values (voltage, frequency, phase rotation, current).</li> <li>■ Measuring of system B values (voltage, frequency, phase rotation).</li> <li>■ Measuring of active and reactive power on system A.</li> <li>■ Measuring of phase angle system A to system B.</li> <li>■ Recognition of segments within the easYgen / LS-5 system.</li> <li>■ Dead bus arbitration with other easYgen and LS-5.</li> <li>■ Mains decoupling function in the LS-5 configurable, for LS-5 connected with system A at mains.</li> </ul>
L-MCB	<b>A03</b>	GCB/L-MCB	<b>A08</b>	<p>LS-5 as MCB control in combination with easYgen-3400/3500 in a fixed application.</p> <p>This application mode provides the following functions:</p> <ul style="list-style-type: none"> <li>■ Handling of a MCB (dead bus closure, synchronization, open) initiated by the easYgen.</li> <li>■ Measuring and monitoring of system A values, (mains voltage, mains frequency, mains phase rotation, mains current), transferred to easYgen.</li> </ul>

LS-511/521		easYgen-3400/3500		
Mode	Symbol	Mode	Symbol	Function
		GCB/GGB/ L-MCB	<b>A09</b>	<ul style="list-style-type: none"> <li>■ Measuring of system B values, (voltage, frequency, phase rotation), transferred to easYgen.</li> <li>■ Measuring of mains active and mains reactive power on system A.</li> <li>■ Automatic configuration of the relevant parameters.</li> <li>■ Mains decoupling function in the LS-5 configurable.</li> </ul>
L-GGB	<b>A04</b>	GCB/L-GGB	<b>A10</b>	<p>LS-5 as GGB control in combination with easYgen-3400/3500 in a fixed application.</p> <p>This application mode provides the following functions:</p> <ul style="list-style-type: none"> <li>■ Handling of a GGB (dead bus closure, synchronization, open) initiated by the easYgen.</li> <li>■ Measuring and monitoring of system A values (load voltage, load frequency, load phase rotation).</li> <li>■ Measuring of system B values (generator busbar voltage, -frequency, -phase rotation).</li> <li>■ Automatic configuration of the relevant parameters.</li> </ul>

### 6.1.3 easYgen-3400/3500 & LS-5: Common Application Modes (easYgen-3400/3500 View)

easYgen-3400/3500		LS-511/521		
Mode	Symbol	Mode	Symbol	Function
GCB/LS5	<b>A07</b>	LS5	<b>A02</b>	<p>One or more easYgen in combination with an open LS-5 system, individually configurable for different application. Multiple isolated and/or mains parallel operation. (max. 16 LS-5).</p> <p>This application mode provides the following functions:</p> <ul style="list-style-type: none"> <li>■ Handling of the GCB (dead bus closure, synchronization, open) initiated by start command in AUTO or individually in MAN mode.</li> <li>■ Measuring and monitoring of generator values (voltage, frequency, phase rotation, current and power).</li> <li>■ Measuring of generator busbar values (voltage, frequency).</li> <li>■ Indicating of mains values (voltage, frequency) sent from 'Mains'-LS-5 with the smallest ID in the own segment.</li> <li>■ Indicating the sum of active and reactive power sent from all 'Mains'-LS-5 in the own segment.</li> <li>■ Regulating Import/Export power with the sum of active and reactive power sent from all 'Mains'-LS-5 in the own segment.</li> <li>■ The easYgen recognizes through the LS-5 system the active segment number.</li> <li>■ Connection to mains (MCB is closed) is recognized via the LS-5 system, if one or more "Mains"-LS-5 are available.</li> <li>■ The close and open commands for the single LS-5 breakers are usually not generated in the easYgen.</li> <li>■ Mains voltage and current is usually not connected at the easYgen.</li> <li>■ Run-up synchronization, acting on the GCB, is possible.</li> </ul>
GCB/L-MCB	<b>A08</b>	L-MCB	<b>A03</b>	<p>One or more easYgen in combination with one LS-5 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 LS5.</p> <p>This application mode provides the following functions:</p> <ul style="list-style-type: none"> <li>■ Handling of the GCB (dead bus closure, synchronization, open) initiated by start command in AUTO or individually in MAN mode.</li> <li>■ Handling of the MCB (dead bus closure, synchronization, open) in AUTO and MANUAL according to the rules of the GCB/MCB mode.</li> <li>■ Measuring and monitoring of generator values (voltage, frequency, phase rotation, current and power)</li> <li>■ Measuring of generator busbar values (voltage, frequency)</li> <li>■ Indicating of mains values (voltage, frequency, phase angle) sent from the LS-5.</li> <li>■ Indicating of active and reactive power at the interchange point sent from LS-5.</li> <li>■ Regulating Import/Export power with active and reactive power sent from LS-5.</li> <li>■ Mains voltage and current is usually not connected at the easYgen.</li> <li>■ The breaker transition mode is considered.</li> <li>■ Connection to mains (MCB is closed) is recognized via the LS-5.</li> <li>■ Run-up synchronization, acting on the GCB, is possible.</li> </ul>

easYgen-3400/3500		LS-511/521		
Mode	Symbol	Mode	Symbol	Function
GCB/GGB/ L-MCB	<b>A09</b>	L-MCB	<b>A03</b>	<p>One or more easYgen, one generator group breaker (GGB) in combination with one LS-5 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 LS-5.</p> <p>This application mode provides the following functions:</p> <ul style="list-style-type: none"> <li>■ Handling of the GCB (dead bus closure, synchronization, open) initiated by start command in AUTO or individually in MAN mode.</li> <li>■ Handling of the GGB (dead bus closure, synchronization, open) initiated by start command in AUTO or individually in MAN mode.</li> <li>■ Handling of the MCB (dead bus closure, synchronization, open) in AUTO and MANUAL according to the rules of the GCB/GGB/MCB mode.</li> <li>■ Measuring and monitoring of generator values (voltage, frequency, phase rotation, current and power).</li> <li>■ Measuring of generator busbar values (voltage, frequency).</li> <li>■ Measuring and monitoring of load busbar values (voltage, frequency, phase rotation, current and power)</li> <li>■ Indicating of mains values (voltage, frequency, phase angle) sent from the LS-5.</li> <li>■ Indicating of active and reactive power at the interchange point sent from LS-5.</li> <li>■ Regulating Import/Export power with active and reactive power sent from LS-5.</li> <li>■ Run-up synchronization, acting on the GCB or GCB/GGB, is possible.</li> <li>■ The breaker transition mode is considered.</li> <li>■ Connection to mains (MCB is closed) is recognized via the LS-5.</li> </ul>
GCB/L-GGB	<b>A10</b>	L-GGB	<b>A04</b>	<p>One or more easYgen with one LS-5 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 LS-5.</p> <p>This application mode provides the following functions:</p> <ul style="list-style-type: none"> <li>■ Handling of the GCB (dead bus closure, synchronization, open) initiated by start command in AUTO or individually in MAN mode.</li> <li>■ 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.</li> <li>■ Measuring and monitoring of generator values (voltage, frequency, phase rotation, current and power).</li> <li>■ Measuring of generator busbar values (voltage, frequency).</li> <li>■ Run-up synchronization, acting on the GCB or GCB/GGB, is possible.</li> </ul>

easYgen-3400/3500		LS-511/521		
Mode	Symbol	Mode	Symbol	Function
GCB/L-GGB/L-MCB	A11	L-MCB	A03	<p>One or more easYgen with one LS-5 unit, acting on the GGB and another LS-5 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 is operated through the LS-5.</p> <p>This application mode provides the following functions:</p> <ul style="list-style-type: none"> <li>■ Handling of the GCB (dead bus closure, synchronization, open) initiated by start command in AUTO or individually in MAN mode.</li> <li>■ 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.</li> <li>■ Handling of the MCB (dead bus closure, synchronization, open) in AUTO and MANUAL according to the rules of the GCB/GGB/MCB mode.</li> <li>■ Measuring and monitoring of generator values (voltage, frequency, phase rotation, current and power).</li> <li>■ Measuring of generator busbar values (voltage, frequency)</li> <li>■ Indicating of mains values (voltage, frequency, phase angle) sent from the LS-5.</li> <li>■ Indicating of active and reactive power at the interchange point sent from LS-5.</li> <li>■ Regulating Import/Export power with active and reactive power sent from LS-5.</li> <li>■ Run-up synchronization, acting on the GCB or GCB/GGB, is possible.</li> </ul>
		L-GGB	A04	

## 6.2 Setup Stand-Alone Applications (Mode A01)

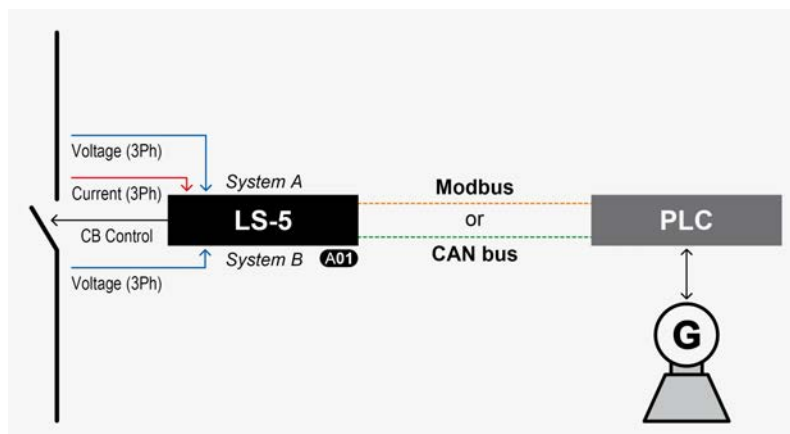
### Overview

The LS-5, configured to application mode **A01** ('single LS-5'), runs as an independent unit and does not expect any other unit on the CAN bus.

The idea of this mode is to use the LS-5 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-5 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. 87: Application mode **A01**

## General notes



### NOTICE!

#### Dead bus interlocking due to incorrect setup

No other LS-5 or easYgen device is expected on the CAN bus. After power-up the LS-5 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-5 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-5 acts as if there is no other LS-5 in the system.*

## Prerequisites

Personnel: ■ Qualified electrician

Ensure the following prerequisites are met:

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-5

Personnel: ■ User

Configure the following parameters:

1. ➤ Set the application mode (parameter 8840 ↗ p. 108) of the LS-5 device to **A01**.
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 ➔ Application config ➔ Breakers config.  
 ➔ Configure CBA ➔ Synchronization CBA  
 ➔ Phase angle compensation"*

**NOTICE!****Component damage**

Incorrect settings may cause erratic system behaviour 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 ( *Chapter 3.3.2 "Wiring Diagram" on page 32*).

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 *Chapter 7 "Interfaces And Protocols" on page 225*.

6. ➤

To configure the close command, the LogicsManager equation "Enable close CBA" can be modified.

Navigate to *"Configuration ➔ Application config  
 ➔ Breakers config. ➔ Configure CBA ➔ Enable close CBA"*  
 and enter the desired arguments.

7. ➤

To configure the open command, the LogicsManager equation "Open CBA immedi." can be modified.

Navigate to *"Configuration ➔ Application config  
 ➔ Breakers config. ➔ Configure CBA ➔ Open CBA immedi."*  
 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, the two LogicsManager equations "Open CBA in manual" and "Close CBA in manual" can be used.

Set the equation "Open CBA in manual" (*"Immediate  
 ➔ With unl."* to "Immediate".

9. ➤ The LS-5 can be adjusted for different kinds of breaker closure.

Navigate to “Configuration ➔ Application config.

➔ Configure CBA” to configure specific kinds of breaker closure.

Configure "Dead bus closure CBA" to generally handle any kind of dead busbar closure.

## 6.3 Setup easYgen & Slave LS-5 Applications (Mode A03 & A04)

### 6.3.1 Introduction

In application modes **A03** and **A04** the LS-5 runs as a slave unit. In these modes the LS-5 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-5 is not supported.

Manual control is provided by the easYgen(s). The isolation switch input of the LS-5 is ignored. The LS-5 sends measuring values and flags to the CAN 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-5 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-5 is expecting at least one easYgen device in the system.*



*Complex applications may require external close and open logic (via PLC).*



*In application mode **A04** and **A04** the operating mode MANUAL is not supported in the LS-5.*

#### Predefined applications

The following chapters provide step by step instructions on how to set up the following predefined applications:

- Chapter 6.3.2 "Single Or Multiple easYgen With One Externally Operated MCB" on page 172
- Chapter 6.3.3 "Multiple easYgen With One GGB And One Externally Operated MCB" on page 176
- Chapter 6.3.4 "Multiple easYgen With One Externally Operated GGB In Isolated Operation" on page 181
- Chapter 6.3.5 "Multiple easYgen With One Externally Operated GGB And One Externally Operated MCB" on page 184

## 6.3.2 Single Or Multiple easYgen With One Externally Operated MCB

### Overview

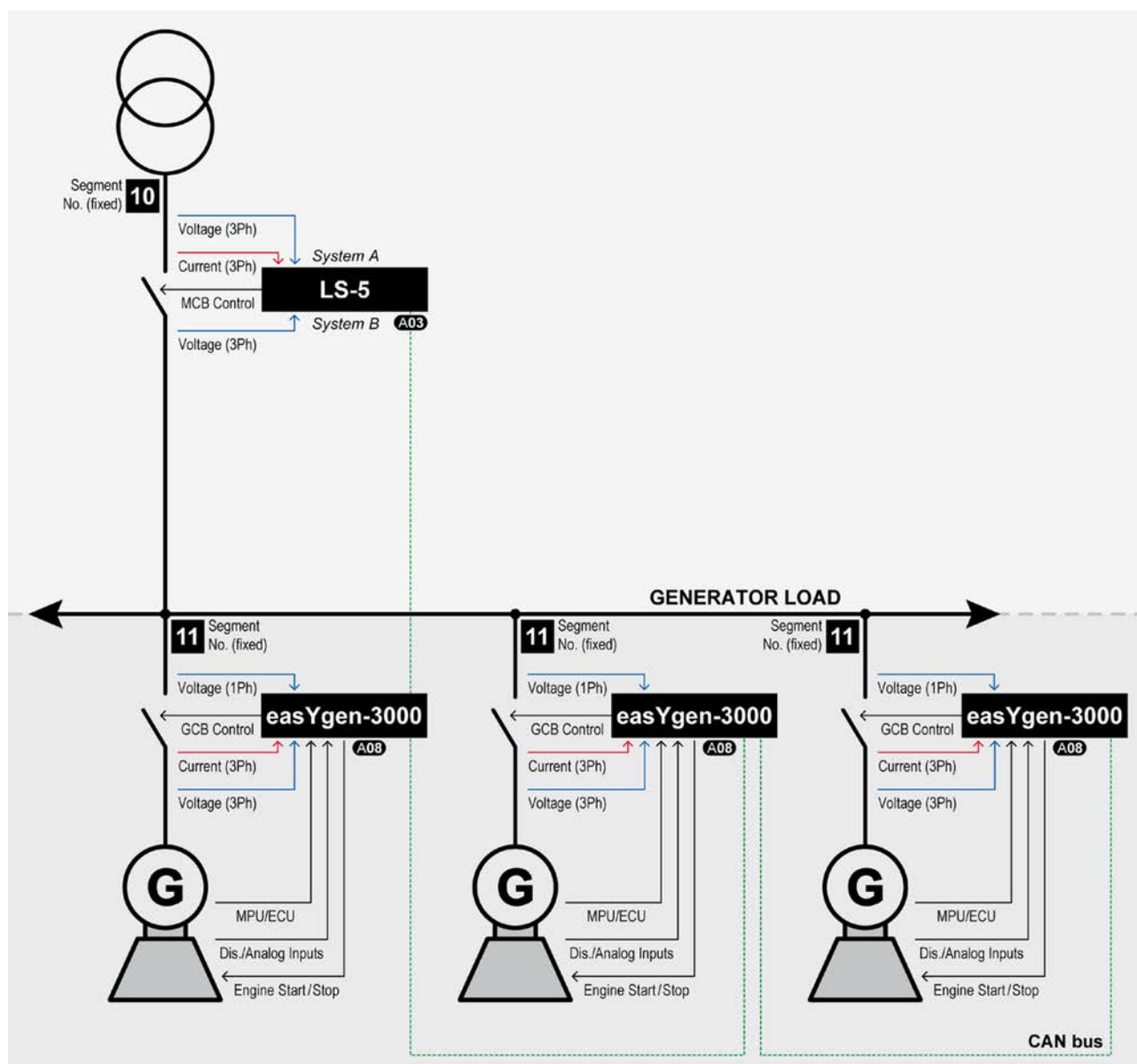


Fig. 88: Single or multiple easYgen with one externally operated MCB

One or more gensets feed on a load busbar. The easYgen(s) close and open their own generator breaker. The LS-5 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-5 is taking over that part.

The decision when to close or open the MCB is coming from the easYgen(s) via CAN 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-5.

Required application modes:

- easYgen-3400/3500: **A08**
- LS-5: **A03**

## 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-3000 driven generators (up to 32).*

- *Check whether your application is compatible with the prerequisites listed below.*

## Prerequisites LS-5

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 busbar.
3. ➤ The MCB breaker feedback is connected to the LS-5 only.
4. ➤ The MCB breaker command(s) are connected to the LS-5 only.
5. ➤ The LS-5 CAN bus is connected to the CAN bus #3 of the easYgen(s).

### 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 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. ➤ The easYgen CAN bus #3 is connected to the CAN bus of the LS-5.

### Configure LS-5

Personnel: ■ User

Configure the following parameters:

1. ➤ Configure the application mode (parameter 8840 ↗ p. 108) of the LS-5 device to **A03**.
2. ➤ Configure the measurement system A and B.
3. ➤



*When tapping voltages over power transformer, phase angle compensation may be required.*

If a phase angle compensation is required, navigate to  
"Configuration ➔ Application config ➔ Breakers config.  
➔ Configure CBA ➔ Synchronization CBA  
➔ Phase angle compensation"



#### NOTICE!

##### Component damage

Incorrect settings may cause erratic system behaviour 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

Configure the following parameters:

1. ➤ Configure the application mode (parameter 3444) of each easYgen device to **A08**.
2. ➤ Configure the measurement for generator and busbar according to the easYgen manual.
3. ➤ The mains measurement is not used in this application mode. A couple of settings should be configured as follows.

☒ Switch off the following parameters:

Parameter	ID
Mains decoupling	3110
Change of frequency	3058
Overfrequency level 1	2850
Underfrequency level 1	2900
Overfrequency level 2	2856
Underfrequency level 2	2906
Overvoltage level 1	2950
Undervoltage level 1	3000
Overvoltage level 2	2956
Undervoltage level 2	3006
Mains voltage increase	8806

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 behaviour 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-5 on the main screen, navigate to parameter "Show mains data" (parameter 4103) and switch to "LS5".

6.



*In this setup each easYgen device provides four control bits for sending information to the LS-5. These bits can be used as command variables in the LS-5.*

*One of the bits could for example be used to initiate alarms acknowledgement in the LS-5 or to release the mains decoupling.*

Navigate to "Parameter → Configuration

→ Configure LogicsManager → Configure LS5" to configure the command variables.

### 6.3.3 Multiple easYgen With One GGB And One Externally Operated MCB

#### Overview

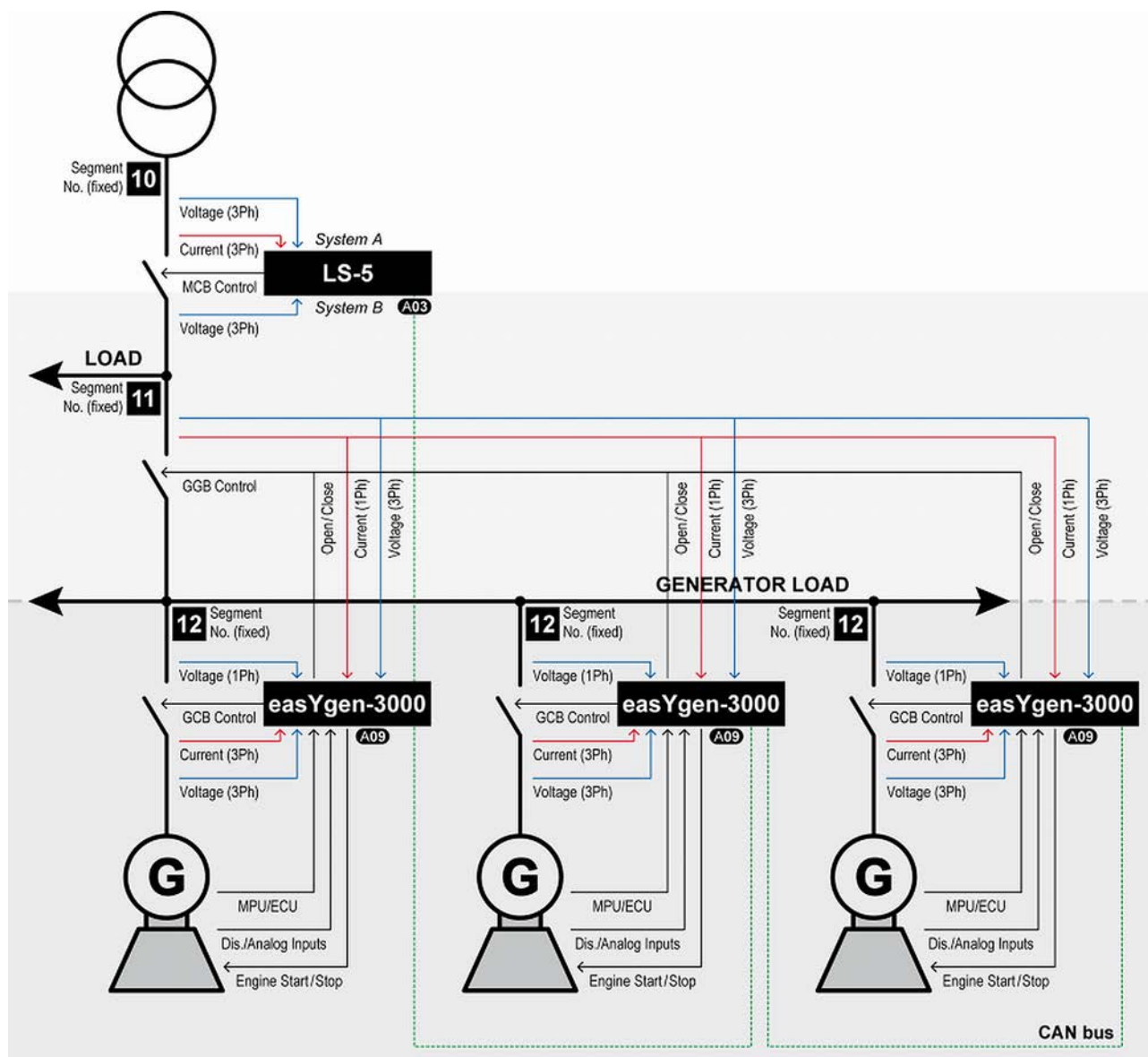


Fig. 89: Multiple easYgen with one GGB and one externally operated MCB



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-5 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-5 controls the MCB.

The decision when to close or open the MCB is coming from the easYgen(s) over the CAN 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-5.

Required application modes:

- easYgen-3400/3500: **A09**
- LS-5: **A03**

## 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 driven generators (up to 32).

– Check whether your application is compatible with the prerequisites listed below.

## Prerequisites LS-5

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-5 only.
4. ➤ The MCB breaker command(s) are connected to the LS-5 only.
5. ➤ The LS-5 CAN bus is connected to the CAN bus #3 of the easYgen(s).

### 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 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. ➤ The easYgen CAN bus #3 is connected to the CAN bus of the LS-5.

### Configure LS-5

Personnel: ■ User

Configure the following parameters:

1. ➤ Configure the application mode (parameter 8840 ↗ p. 108) of the LS-5 device to **A03**.
2. ➤ Configure the measurement system A and B.
3. ➤



*When tapping voltages over power transformer, phase angle compensation may be required.*

If a phase angle compensation is required, navigate to  
"Configuration ➔ Application config ➔ Breakers config.  
➔ Configure CBA ➔ Synchronization CBA  
➔ Phase angle compensation"



#### NOTICE!

##### Component damage

Incorrect settings may cause erratic system behaviour 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

Configure the following parameters:

1. ➤ Configure the application mode (parameter 3444) of each easYgen device to **A09**.
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. A couple of settings should be configured as follows.

■ Switch off the following parameters:

Parameter	ID
Mains decoupling	3110
Change of frequency	3058
Overfrequency level 1	2850
Underfrequency level 1	2900
Overfrequency level 2	2856
Underfrequency level 2	2906
Overvoltage level 1	2950
Undervoltage level 1	3000
Overvoltage level 2	2956
Undervoltage level 2	3006
Mains voltage increase	8806

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 behaviour 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 behaviour 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-5 on the main screen, navigate to "Show mains data" (parameter 4103) and switch to "LS5".

7. ➤



*In this setup each easYgen device provides four control bits for sending information to the LS-5. These bits can be used as command variables in the LS-5.*

*One of the bits could for example be used to initiate alarms acknowledgement in the LS-5.*

Navigate to "Parameter ➔ Configuration

➔ Configure LogicsManager ➔ Configure LS5" to configure the command variables.

### 6.3.4 Multiple easYgen With One Externally Operated GGB In Isolated Operation

#### Overview

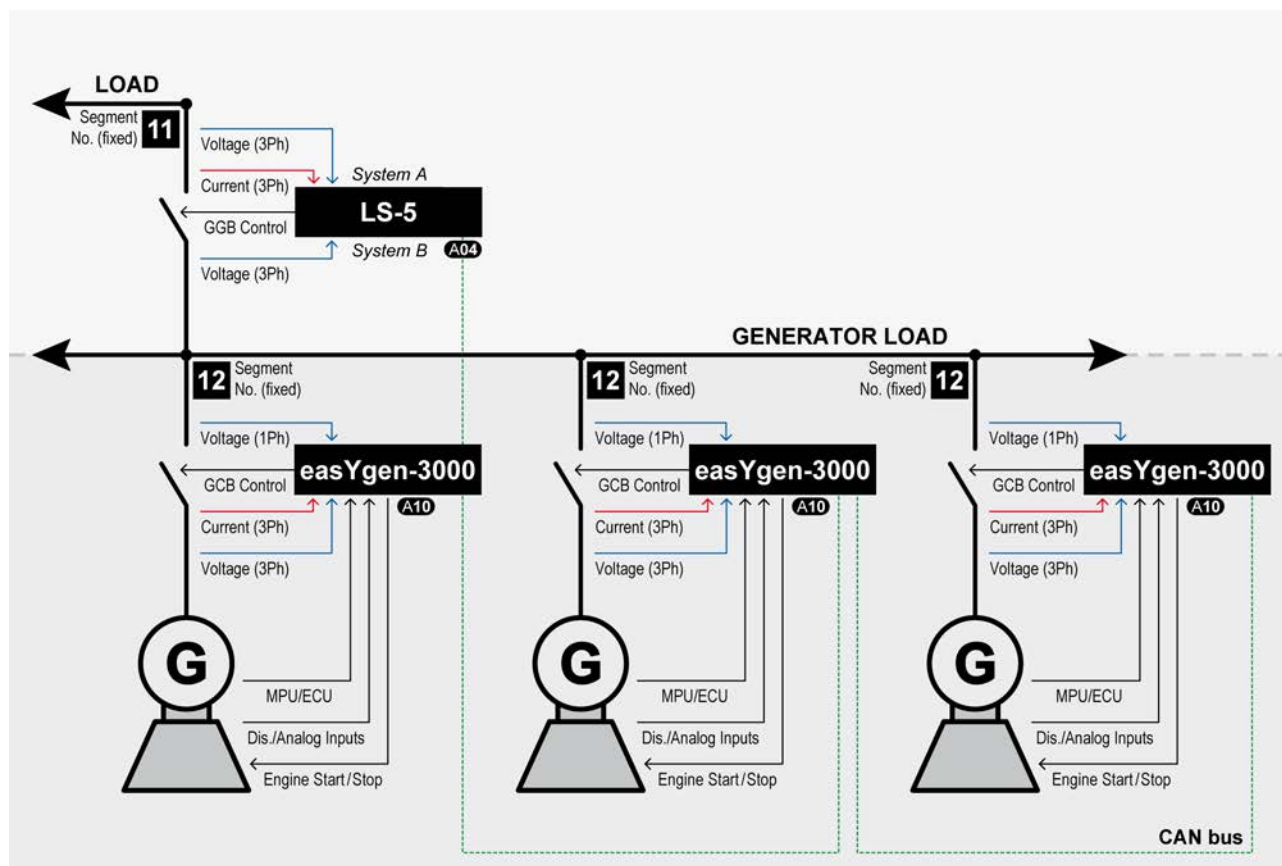


Fig. 90: Multiple easYgen with one externally operated GGB in isolated operation

One or more gensets feed on a generator busbar. The easYgen(s) close and open their own generator breaker. The easYgens close and open the common generator group breaker (GGB). The LS-5 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-5 controls the GGB.

The decision when to close or open the GGB is coming from the easYgen(s) over the CAN 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-3400/3500: A10
- LS-5: A04

#### General notes



*This application setup is predefined and allows for no variations, except the amount of easYgen-3000 driven generators (up to 32).*

- *Check whether your application is compatible with the prerequisites listed below.*

### Prerequisites LS-5

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-5 only.
4. ➤ The GGB breaker command(s) are connected to the LS-5 only.
5. ➤ The LS-5 CAN bus is connected to the CAN bus #3 of the easYgen(s).

### 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 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. ➤ The easYgen CAN bus #3 is connected to the CAN bus of the LS-5.

### Configure LS-5

Personnel: ■ User

Configure the following parameters:

1. ➤ Configure the application mode (parameter 8840 ↗ p. 108) of the LS-5 device to **A04**.
2. ➤ Configure the measurement system A and B.
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**.
2. ➤ Configure the measurement for generator and busbar according to the easYgen manual.

3. ➤ The mains measurement is not used in this application mode. A couple of settings should be configured as follows.

■ Switch off the following parameters:

Parameter	ID
Mains decoupling	3110
Change of frequency	3058
Overfrequency level 1	2850
Underfrequency level 1	2900
Overfrequency level 2	2856
Underfrequency level 2	2906
Overvoltage level 1	2950
Undervoltage level 1	3000
Overvoltage level 2	2956
Undervoltage level 2	3006
Mains voltage increase	8806

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 behaviour and damage to the involved components .

- Set the values carefully and double check with a voltmeter at the according breaker.

5. ➤



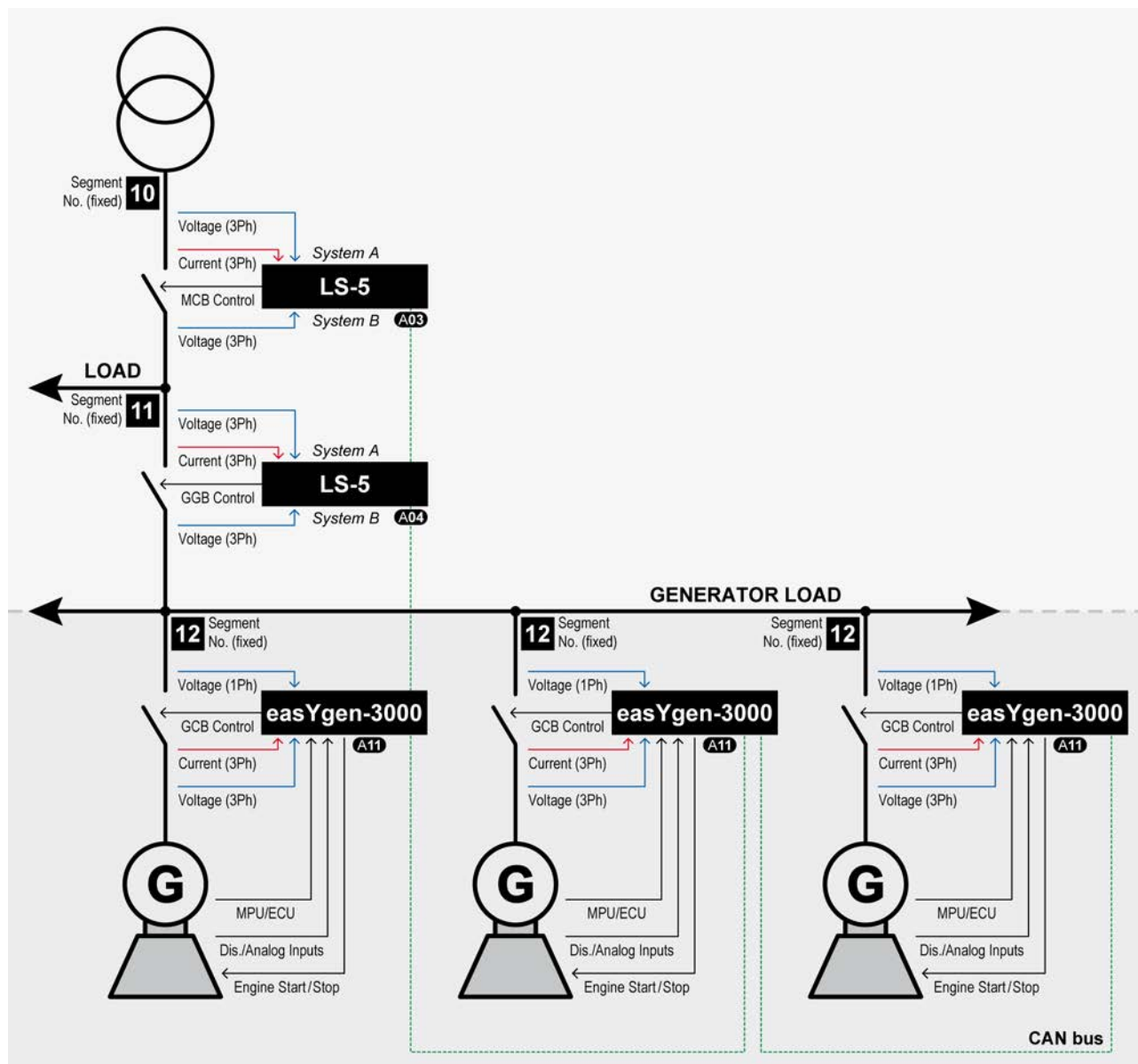
*In this setup each easYgen device provides four control bits for sending information to the LS-5. These bits can be used as command variables in the LS-5.*

*One of the bits could for example be used to initiate alarms acknowledgement in the LS-5.*

Navigate to “Parameter ➔ Configuration

➔ Configure LogicsManager ➔ Configure LS5” to configure the command variables.

## Overview



The decision when to close or open the MCB and GGB is coming from the easYgen(s) over the CAN 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-5.



Required application modes:

- easYgen-3400/3500: **A11**
- LS-5: **A03**
- LS-5: **A04**

## 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 driven generators (up to 32).*

- *Check whether your application is compatible with the prerequisites listed below.*

## Prerequisites LS-5 (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-5 only.
4. ➤ The MCB breaker command(s) are connected to the LS-5 only.
5. ➤ The LS-5 CAN bus is connected to the CAN bus #3 of the easYgen(s).

## Prerequisites LS-5 (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-5 only.
4. ➤ The GGB breaker command(s) are connected to the LS-5 only.
5. ➤ The LS-5 CAN bus is connected to the CAN bus #3 of the easYgen(s).

### 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. ➤ The easYgen CAN bus #3 is connected to the CAN bus of the LS-5.

### Configure LS-5 (MCB)

Personnel: ■ User

Configure the following parameters:

1. ➤ Configure the application mode (parameter 8840 ↗ p. 108) of the LS-5 device to **A03**.
2. ➤ Configure the measurement system A and B.
3. ➤



*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 CBA* ➔ *Synchronization CBA* ➔ *Phase angle compensation*”



#### **NOTICE!**

##### **Component damage**

Incorrect settings may cause erratic system behaviour 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-5 (GGB)

Personnel: ☒ User

Configure the following parameters:

1. ➤ Configure the application mode (parameter 8840 ↗ p. 108) of the LS-5 device to **A04**.
2. ➤ Configure the measurement system A and B.

3. ➤



*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 behaviour 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**.
2. ➤ Configure the measurement for generator and busbar according to the easYgen manual.

3. ➤ The mains measurement is not used in this application mode. A couple of settings should be configured as follows.

■ Switch off the following parameters:

Parameter	ID
Mains decoupling	3110
Change of frequency	3058
Overfrequency level 1	2850
Underfrequency level 1	2900
Overfrequency level 2	2856
Underfrequency level 2	2906
Overvoltage level 1	2950
Undervoltage level 1	3000
Overvoltage level 2	2956
Undervoltage level 2	3006
Mains voltage increase	8806

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 behaviour 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-5 on the main screen, navigate to "Show mains data" (parameter 4103) and switch to "LS5".

6. ➤



*In this setup each easYgen device provides two control bits for sending information to the LS-5. These bits can be used as command variables in the LS-5.*

*One of the bits could for example be used to initiate alarms acknowledgement in the LS-5 or to release the mains decoupling.*

Navigate to "Parameter ➔ Configuration

➔ Configure LogicsManager ➔ Configure LS5" to configure the command variables.

## 6.4 Setup easYgen & Independent LS-5 Applications (Mode A02)

### 6.4.1 Introduction

In application mode **A02** the LS-5 runs as an independent unit. The free LS-5 setup allows up to 32 easYgen-3400/3500 and up to 16 LS-5 devices. The easYgen(s) are only operating their GCBs. The other breakers have to be operated by the LS-5.

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 bits or CB control bits coming from the easYgen(s).

The operating mode MANUAL in the LS-5 is supported and provides the operator with the option to manually force a close or open of the breaker. For this purpose the LS-5 provides an operating mode button and a softkey to close and open the breaker.

#### General notes



*The LS-5 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-5 application mode **A02** opens a wide range of applications and requires more effort to configure the whole easYgen – LS-5 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 LS-5.

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.

#### 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-5 unit in application mode **A02** can handle max.1 isolation switch. Located at the isolation switch, the LS-5 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-5 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-5 (parameter 1702 ↗ p. 65).

### 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 ↗ p. 124). 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-5 and the easYgen. Once an easYgen is enabled for a dead bus connection, it has priority over all LS-5s (any CB controlled by an LS-5 cannot be closed).

If multiple LS-5s are enabled to close a circuit breaker at the same time the LS-5 with the lowest CAN identification number receives the master status (all other LS-5s are inactive).

When a closure failure occurs (↗ *Chapter 4.3.3 "Breaker" on page 97*), this LS-5 is no longer considered for dead bus closure. The next prioritized LS-5 takes over.

### Predefined applications

The following chapters provide step by step instructions on how to set up the following predefined applications:

- ↗ *Chapter 6.4.3 "H-Configuration With Two easYgen And Two Incoming Mains And Tie-breaker" on page 199*
- ↗ *Chapter 6.4.4 "Multiple Mains/Generators With Four easYgen Units, Two Incoming Mains And Different Tie-breakers" on page 210*

## 6.4.2 General Functions

### 6.4.2.1 General Preparation

Prepare the easYgen – LS-5 system for configuration as follows:

1. ➤ Draw a single line diagram that only contains essential equipment.

The schematic should contain all used easYgens, all transformers, all breaker elements (such as circuit breakers and isolation switches), all elements to be controlled, and all LS-5s.

2. ➤ Assign numbered addresses for each component of the system in accordance with the methods described in [Chapter 6.4.1 "Introduction" on page 189](#).
3. ➤ Number all easYgen control units from 1 to 32 (order is user-defined and depends on your application).
4. ➤ Number all system LS-5s from 33 to 48 (order is user-defined and depends on your application).
5. ➤ Number all CAN Node-IDs (usually the same as the device number).
6. ➤ Number all segments according to the definitions in [Chapter 6.4.1 "Introduction" on page 189](#).



*Unless special numbering conventions are required, count up continuously from left to right or right to left.*

7. ➤ Draw the measurement system A and B of the single LS-5 into the single line diagram according to the definitions in [Chapter 6.4.1 "Introduction" on page 189](#).

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.

### 6.4.2.2 Setup Mains Measurement With easYgen

#### Overview

In easYgen application mode **A07** mains measurement of the easYgen is not required. This measurement is provided by the LS-5 unit.



**Exception: mains decoupling acting on GCB**

*When using the mains decoupling function mains measurement of the easYgen is required.*

- For information on this setup refer to [Chapter 6.4.2.3 "Setup Mains Decoupling With easYgen" on page 192](#).

#### Prerequisites easYgen

Personnel: ■ User

- The application uses the easYgen in mode **A07** (configured in parameter 8840).

## Configure easYgen

Personnel: ☒ User

To prevent the easYgen measurement from causing alarms, it must be configured as follows.

➔ ☒ Switch off the following parameters:

Parameter	ID
Mains decoupling	3110
Change of frequency	3058
Overfrequency level 1	2850
Underfrequency level 1	2900
Overfrequency level 2	2856
Underfrequency level 2	2906
Overvoltage level 1	2950
Undervoltage level 1	3000
Overvoltage level 2	2956
Undervoltage level 2	3006
Mains voltage increase	8806



*The mains current and power measurement is never used in the application mode **A07**.*

### 6.4.2.3 Setup Mains Decoupling With easYgen

#### Overview

To provide mains decoupling, acting on the GCB, the mains decoupling function of the easYgen must be used.

#### Prerequisites easYgen

Personnel: ☒ Qualified electrician

Ensure the following prerequisites are met:

➔ The mains measurement is connected together with the busbar measurement on the generator busbar.

## Configure easYgen



*For detailed information on the easYgen configuration, refer to the easYgen-3400/3500 manual.*



### 6.4.2.4 Setup Mains Decoupling With LS-5

#### Overview

In this setup the mains decoupling is provided by the LS-5 for the MCB.



*When the mains decoupling over GCB is required, refer to ↗ Chapter 6.4.2.3 "Setup Mains Decoupling With easYgen" on page 192.*

The LS-5(s) which are responsible for the mains breakers take over the mains monitoring and execute the decoupling function.

#### Prerequisites LS-5

Personnel: ■ Qualified electrician

Ensure the following prerequisites are met:

1. ➤ The mains monitoring is set up with the measurement system A.
2. ➤ The measurement system A is connected on the mains side.

#### Configure LS-5

Configure the following parameters:

1. ➤ Navigate to "Configuration ➔ Monitoring config. ➔ System A" and configure parameter 1771 ↗ p. 72 to "Phase-Phase (Ph-Ph)" or "Phase-Neutral (Ph-N)".
2. ➤ Navigate to "Operating voltage" and configure the operating range for voltage.



– *Make sure not configure the range smaller than the decoupling threshold (see below).*

3. ➤ Navigate to "Operating frequency" and configure the operating range for frequency.



– *Make sure not configure the range smaller than the decoupling threshold (see below).*

4. ➤ Configure the mains settling time (parameter 2801 ↗ p. 73).

The mains settling time determines for how long the mains stay continuously stable, before the MCB is closed again.



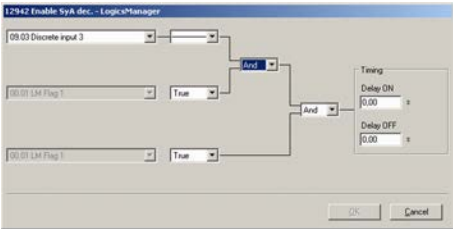
*Multiple LS-5s on different mains incoming points should have the same setting.*

5. ➤ Navigate to “SyA. Decoupling” and configure the LogicsManager equation “Enable SyA dec.”.



*The following steps show two different configuration examples.*

**LogicsManager configuration example 1**



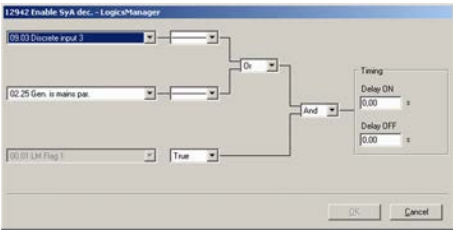
*Fig. 92: LogicsManager configuration example 1*

6. ➤ The mains decoupling function is only enabled, if an external release is given (Discrete Input 3).



*In this case a PLC is required.*

**LogicsManager configuration example 2**



*Fig. 93: LogicsManager configuration example 2*

7. ➤ The mains decoupling function is enabled, if a "Test" key switch is activated.



*This helps to perform a mains decoupling test without any generator running.*

**OR**

The mains decoupling function is enabled, if any generator is running parallel to mains.

8. ➤ Configure the corresponding mains decoupling thresholds:

Parameter	ID
Overvoltage level 2	2956
Undervoltage level 2	3006
Overfrequency level 2	2856
Underfrequency level 2	2906
Change of frequency	3058

9. ➤ Configure the alarm class and self-acknowledgement.

**6.4.2.5 Setup Run-Up Synchronization In LS-5 Mode**

**Configure easYgen**

The LS-5 mode allows the run-up synchronization only for the GCB. The mode GCB/GGB is not supported.



*The easYgen will only close its breaker in a run-up situation, if the LS-5 system detects no connection to mains for the corresponding easYgen segment.*

## Configure LS-5



*Regarding run-up synchronization there is nothing to configure in the LS-5.*

### 6.4.2.6 Setup AMF Start In LS-5 Mode

#### Overview

The AMF start of the easYgen(s) is controlled by segments. The design engineer has to consider, which segments should be monitored and cause an AMF start.

For this case the easYgen provides a special setting, where the procedure runs as follows:

1. ➤ The easYgen(s) monitors the configured segment(s) on being not in operation range.
2. ➤ If only one segment is recognized as not within operating range, the generator starts after the emergency run delay time.
3. ➤ After a successful start, all generator breakers are closed.



*To avoid the LS-5 of the MCB staying closed during emergency run, the according LS-5 has to open its own breaker.*

*The example below shows a solution where the "System A Not-OK" flag opens the MCB automatically after the emergency delay time.*

*The system A condition flags are generated out of the operating ranges for system A.*

- For additional information refer to  
 Chapter 6.4.2.3 "Setup Mains Decoupling With easYgen" on page 192.

The easYgen feeds its own segment during emergency run. The AMF mode is only stopped, if all monitored segments are OK for the mains settling time and have reestablished the connection to mains.



*The operating ranges and the main settling time are configured in the LS-5s.*

## Configure LS-5

Personnel: ■ User

Configure the following parameters for the LS-5 unit over the MCB:

1. ➤ Navigate to "Configuration ➔ Monitoring config. ➔ System A".
2. ➤ Navigate to "Operating voltage" and configure the operating range for voltage.

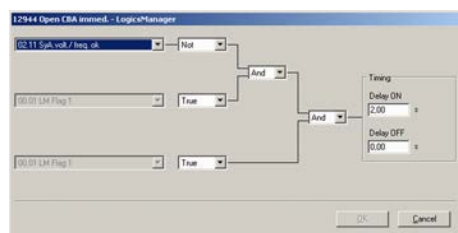


Fig. 94: LogicsManager configuration

3. ➤ Navigate to “Operating frequency” and configure the operating range for frequency.
4. ➤ Navigate to “Configuration ➔ Application config. ➔ Breakers config. ➔ Configure CBA” and configure "Open CBA immmed." as shown in the screenshot.

LS-5 over the MCB:

- The LS-5 issues an MCB open command, if the mains (system A) is not in operating range.
- To avoid flicker trouble, the open command is delayed.



*There may other solutions exist to open the MCB. The LogicsManager system provides a wide range of flags and conditions to take from.*

*So another example could be to incorporate a flag coming from easYgen, which signals successful start.*

## Configure easYgen(s)

Personnel: ■ User

Configure the following parameters:

1. ➤ Configure the application mode of the easYgen device to **A07**.
2. ➤ Navigate to “Parameter ➔ Configuration ➔ Configure emergency run” and configure "Mains fail delay time", "LM inhibit emerg.run", "Break emerg. in crital mode" according to your application.
3. ➤ Configure the emergency run segments in each easYgen. They can differ between easYgens or easYgen groups.

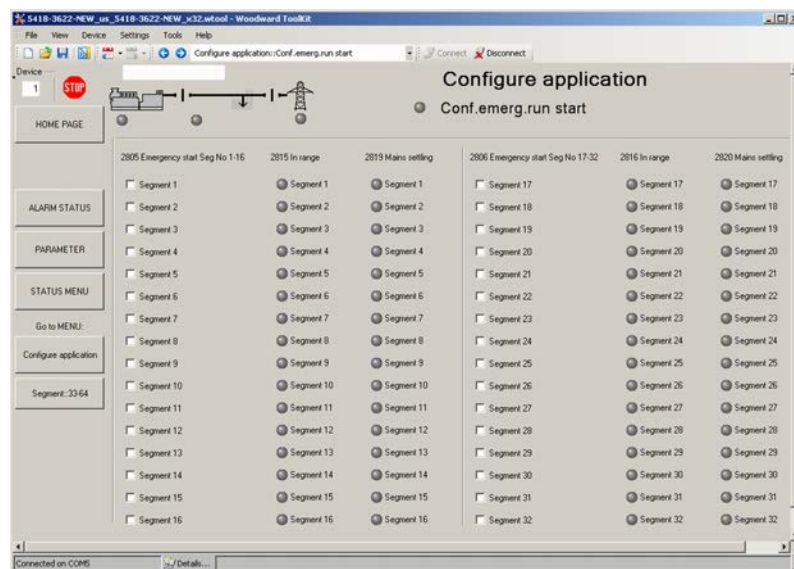


Fig. 95: Segment configuration in ToolKit

- ⇒ The example shows the segment configuration according to [Chapter 6.4.3 “H-Configuration With Two easYgen And Two Incoming Mains And Tie-breaker”](#) on page 199.

### 6.4.2.7 Setup Manual Breaker Control In LS-5 Mode

#### Overview

The LS-5 mode provides manual closing and opening of the circuit breaker at the particular LS-5.

This can be configured via LogicsManager equations. The display variant provides additionally soft keys in the display. The soft keys take part of the key lock function for security reasons or unintended operations.



*The easYgen(s) have no direct influence on the manual control of the LS-5(s).*

### 6.4.2.8 Setup LS-5 Command Bits From easYgen To LS-5

#### Overview

The easYgen provides six LS-5 command bits in this application mode. The command bits are transported via CAN interface to each LS-5.

The design engineer can decide, if he wants to take the OR'ed LS-5 command flags coming from all easYgens or if he wants to take the individual command flag coming from a special easYgen.

In the example an 'acknowledge' alarm command could be a general flag which would be taken from the OR'ed source.

A special close command in the example could come from a specific easYgen and must be therefore not taken from the OR'ed list.

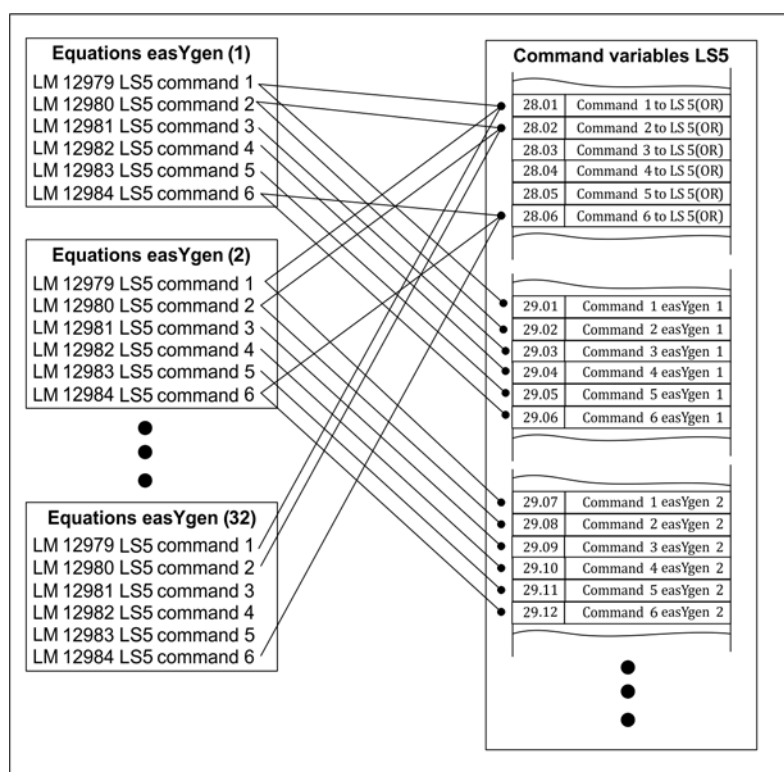


Fig. 96: easYgen information transport to LS-5

6.4.2.9 Setup LS-5 Flags From LS-5 To LS-5 And easYgen

Overview

The LS-5 flags generated in the LS-5 device with LogicsManager equations can be used from connected LS-5 and easYgen devices. Each LS-5 sends five flags over the CAN interface.

The system allows to inform or to command something to other units. In the example the 'acknowledge' command can be sent to all other units to reset alarms. All bits are individual.

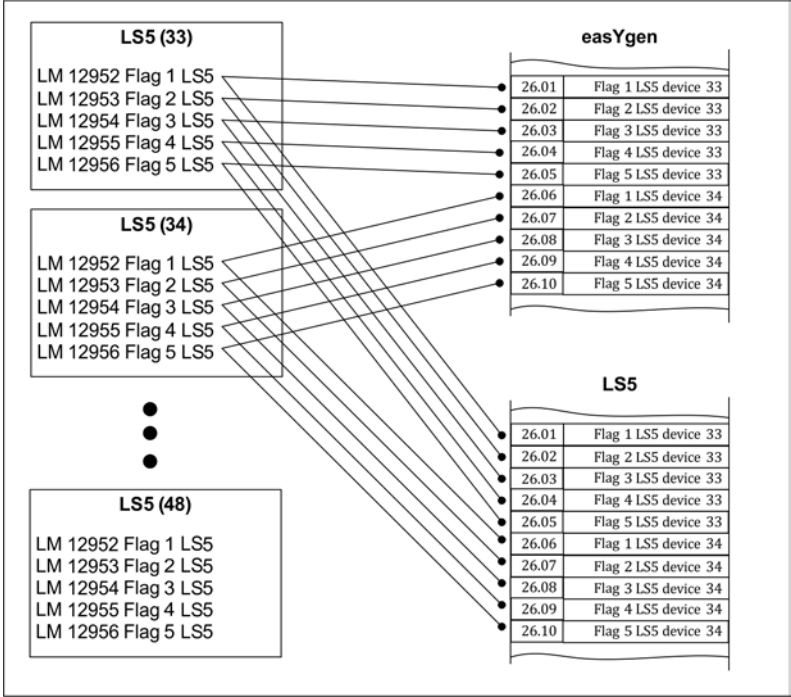


Fig. 97: LS-5 information transport to LS-5 and easYgen

### 6.4.3 H-Configuration With Two easYgen And Two Incoming Mains And Tie-breaker

#### Overview

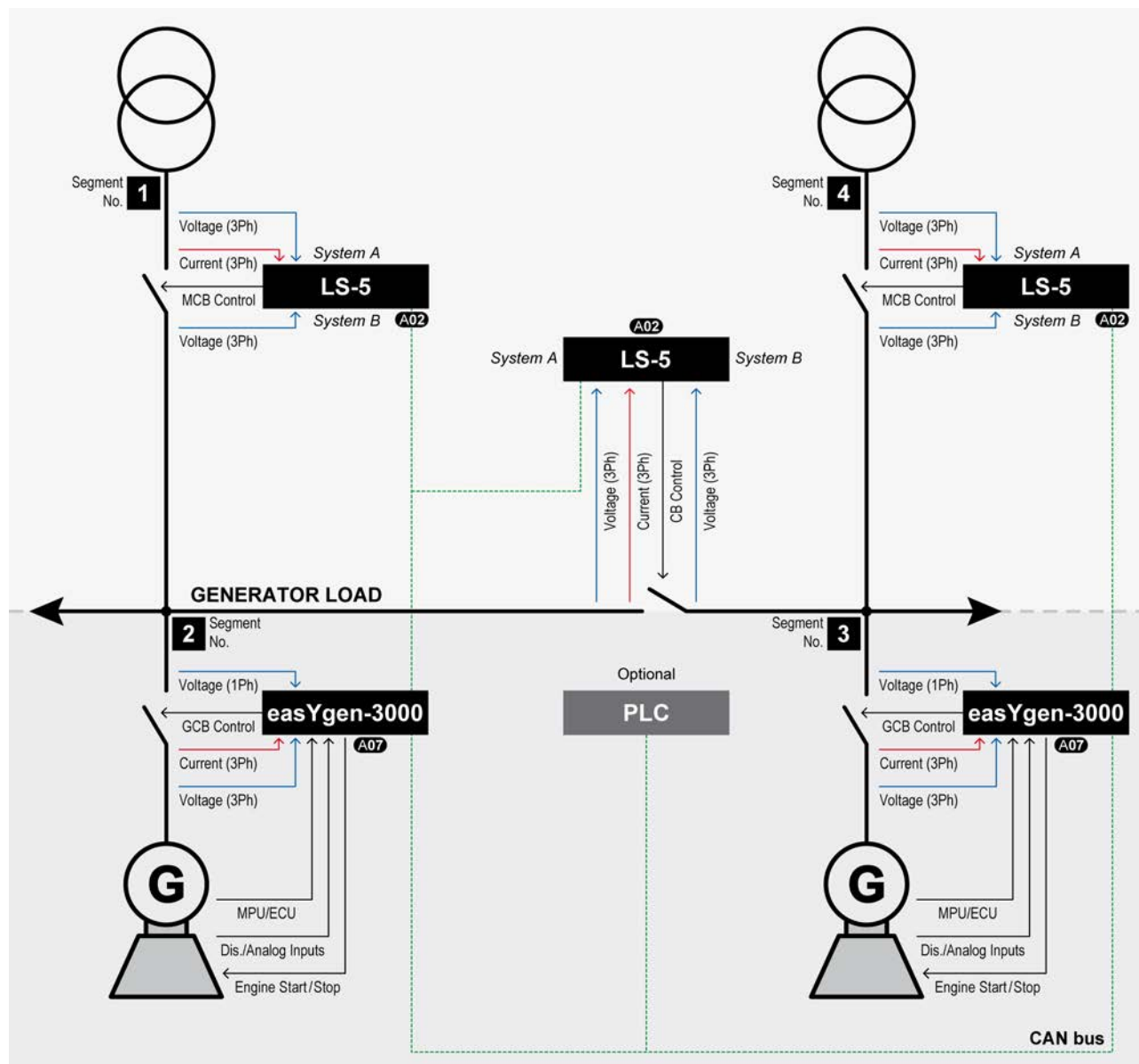


Fig. 98: H-Configuration with two easYgen and two incoming mains and tie-breaker

One or more genset(s) feed on a generator/load busbar (Fig. 98/ Segment No. 2). One or more genset(s) feed on a generator/load busbar (Fig. 98/Segment No. 3). A tie-breaker is located between the both generator/load busbars. Each generator/load busbar has its own incoming mains breaker (Fig. 98/ 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-5, 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. Serial Modbus can also be used to send orders or read information from all members.



*For additional information refer to [Chapter 7 “Interfaces And Protocols”](#) on page 225.*

Amongst others, the breaker feedbacks of the single LS-5 are sent via the CAN 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-3400/3500: **A07**
- LS-5: **A02**

## General notes



*Please note that the measured power of all LS-5s in the same segment are accumulated if there are 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 [Chapter 6.4.1 “Introduction”](#) on page 189.*

*The following example does not contain any isolation switches, which could divide the segments.*

## Single line diagram

Prepare the easYgen – LS-5 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 segment, and all breakers (tie-breaker, GCB, MCB).
2. ➤ Number all easYgen control units from 1 to 32.
3. ➤ Number all system LS-5s 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 in [“Segment number”](#) on page 189.



*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-5 into the single line diagram according to the definitions in *Chapter 6.4.1 "Introduction" on page 189*.

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-5 (incoming mains)

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 generator/load busbar.
3. ➤ The MCB breaker feedback is connected to the LS-5 only.
4. ➤ The MCB breaker commands are connected to the LS-5 only.
5. ➤ The LS-5 CAN bus is connected to the CAN bus #3 of the easYgen(s).

#### Prerequisites LS-5 (tie-breaker)

Personnel: ■ Qualified electrician

Ensure the following prerequisites are met:

1. ➤ The system A voltage and current measurement is connected to the generator/load busbar segment (Fig. 98/Segment No. 2).
2. ➤ The system B voltage measurement is connected to the generator/load busbar segment (Fig. 98/Segment No. 3).
3. ➤ The tie-breaker feedback is connected to the LS-5 only.
4. ➤ The tie-breaker commands are connected to the LS-5 only.
5. ➤ The LS-5 CAN bus is connected to the CAN bus #3 of the easYgen(s).

#### Prerequisites easYgen(s)

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/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. ➤ The easYgen CAN bus #3 is connected to the CAN bus of the LS-5.

**Configure LS-5 (incoming mains)**

Personnel: ■ User

Configure the following parameters:

1. ➤ Configure the application mode (parameter 8840 ↗ p. 108) of the LS-5 device to **A02**.
2. ➤ Enter the device ID 33 for the LS-5, incoming mains on the left side and ID 35 for the LS-5, incoming mains on the right.
3. ➤ Enter the Node-IDs (usually the same like device ID).
4. ➤ For the following two steps navigate to *“Configuration ➔ Application config ➔ Segment config.”* on each respective LS-5.
5. ➤ Configure the following parameters for the LS-5 ID 33, incoming mains on the left side:

Parameter	ID	Value
Segment No. Sy.A	8810 ↗ p. 116	1
Segment No. Sy.B	8811 ↗ p. 116	2
Segment No. isol. Switch	8812 ↗ p. 116	N/A
Mains pow. Measurement	8813 ↗ p. 116	Valid
Mains connection	8814 ↗ p. 116	System A
Isol. Switch Para	8815 ↗ p. 116	None
Variable system	8816 ↗ p. 117	System B

6. ➤ Configure the following parameters for the LS-5 ID 35, incoming mains on the right side:

Parameter	ID	Value
Segment No. Sy.A	8810 ↗ p. 116	4
Segment No. Sy.B	8811 ↗ p. 116	3
Segment No. isol. Switch	8812 ↗ p. 116	N/A
Mains pow. Measurement	8813 ↗ p. 116	Valid
Mains connection	8814 ↗ p. 116	System A
Isol. Switch Para	8815 ↗ p. 116	None
Variable system	8816 ↗ p. 117	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 ➔ Application config ➔ Breakers config. ➔ Configure CBA ➔ Synchronization CBA ➔ Phase angle compensation*”

**NOTICE!****Component damage**

Incorrect settings may cause erratic system behaviour 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 ➔ Application config ➔ Breakers config. ➔ Configure CBA ➔ Dead bus closure CBA*” and set the following parameters:

Parameter	ID	Value
Dead bus closure CBA	8801 ↗ p. 114	On
Connect A dead to B dead	8802 ↗ p. 114	Off
Connect A dead to B alive	8803 ↗ p. 114	Off
Connect A alive to B dead	8804 ↗ p. 114	Off
Dead bus closure delay time	8805 ↗ p. 114	As required
Dead bus detection max. volt	5820 ↗ p. 114	As required

11. ➤ Navigate to “*Configuration ➔ Application config ➔ Breakers config. ➔ Configure CBA ➔ Connect synchronous mains*” and set the following parameters:

Parameter	ID	Value
Connect synchronous mains	8820 ↗ p. 109	Yes
Max. phase angle	8821 ↗ p. 110	20°
Delay time phi max.	8822 ↗ p. 110	1 s

12. ➤ To configure the LogicsManager in regards to close and open commands for the MCB navigate to “*Configuration ➔ Application config ➔ Breakers config. ➔ Configure CBA*”.

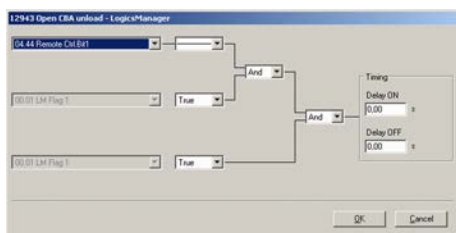


Fig. 99: LogicsManager configuration 'Open CBA unload'

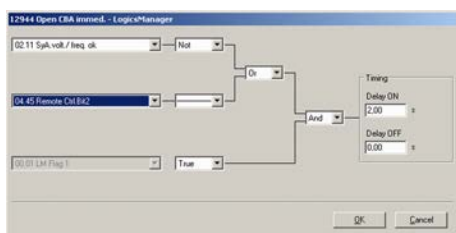


Fig. 100: LogicsManager configuration 'Open CBA immed.'

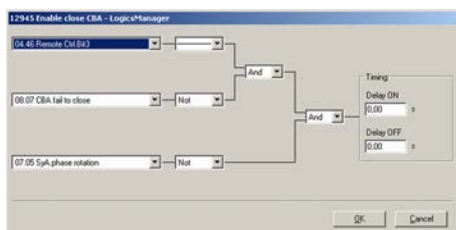


Fig. 101: LogicsManager configuration 'Enable close CBA.'

13. Select "Open CBA unload → LogicsManager" (parameter 12943 ↗ p. 110) and configure the equation as follows:

- The LM equation opens the MCB with unloading, if the remote control bit 1 is sent by the PLC.

14. Select "Open CBA immed. → LogicsManager" (parameter 12944 ↗ p. 110) 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 ↗ Chapter 4.3.1.1 "System A Operating Voltage / Frequency" on page 73) **OR** the remote control bit 2 sent by the PLC.

15. Select "Enable close CBA → LogicsManager" (parameter 12945 ↗ p. 111) and configure the equation as follows:

- The LM equation gives the release for close MCB, 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-5 receives its own control bits. The different device and Node-ID separates the control bits from each other.

## Configure LS-5 (tie-breaker)

Personnel: ■ User

Configure the following parameters:

1. Configure the application mode (parameter 8840 ↗ p. 108) of the LS-5 device to **A02**.
2. Enter the device ID 34 for the LS-5.
3. Enter the Node-IDs (usually the same like device ID).

4. ➤ Navigate to “*Configuration ➔ Application config ➔ Segment config.*” and configure the following parameters:

Parameter	ID	Value
Segment No. Sy.A	8810 ↗ p. 116	2
Segment No. Sy.B	8811 ↗ p. 116	3
Segment No. isol. Switch	8812 ↗ p. 116	N/A
Mains pow. Measurement (Actually system A measurement)	8813 ↗ p. 116	Invalid
Mains connection	8814 ↗ p. 116	None
Isol. Switch Para	8815 ↗ p. 116	None
Variable system	8816 ↗ p. 117	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 ➔ Application config ➔ Breakers config. ➔ Configure CBA ➔ Synchronization CBA ➔ Phase angle compensation*”



#### NOTICE!

##### Component damage

Incorrect settings may cause erratic system behaviour 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 ➔ Application config ➔ Breakers config. ➔ Configure CBA ➔ Dead bus closure CBA*” and set the following parameters:

Parameter	ID	Value
Dead bus closure CBA	8801 ↗ p. 114	On
Connect A dead to B dead	8802 ↗ p. 114	On
Connect A dead to B alive	8803 ↗ p. 114	On
Connect A alive to B dead	8804 ↗ p. 114	On
Dead bus closure delay time	8805 ↗ p. 114	As required
Dead bus detection max. volt	5820 ↗ p. 114	As required

10. Navigate to “Configuration → Application config → Breakers config. → Configure CBA → Connect synchronous mains” and set the following parameters:

Parameter	ID	Value
Connect synchronous mains	8820 ↗ p. 109	Yes
Max. phase angle	8821 ↗ p. 110	20°
Delay time phi max.	8822 ↗ p. 110	1 s

11. To configure the LogicsManager in regards to close and open commands for the tie-breaker navigate to “Configuration → Application config → Breakers config. → Configure CBA”.

12. Select “Open CBA unload → LogicsManager” (parameter 12943 ↗ p. 110) 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.

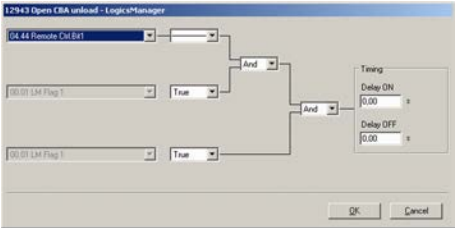


Fig. 102: LogicsManager configuration 'Open CBA unload'



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. Select “Open CBA immmed. → LogicsManager” (parameter 12944 ↗ p. 110) and configure the equation as follows:

- The LM equation opens the tie-breaker immediately, if the remote control bit 2 sent by the PLC.

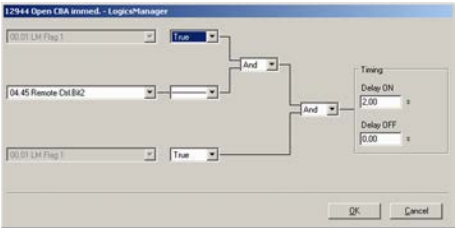


Fig. 103: LogicsManager configuration 'Open CBA immmed.'

14. Select “Enable close CBA → LogicsManager” (parameter 12945 ↗ p. 111) 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.

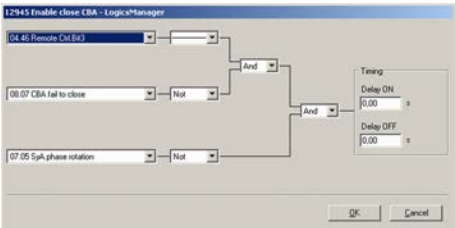


Fig. 104: LogicsManager configuration 'Enable close CBA.'



The same remote control bits can be used in the upper example, because each LS-5 receives its own control bits. The different device and Node-ID separates the control bits from each other.

**Configure easYgen(s)**

Personnel: ☒ User

Configure the following parameters:

1. ➤ Configure the application mode (parameter 3444) of each easYgen device to **A07**.
2. ➤ Enter the device ID 1 for the easYgen (usually from left to right).
3. ➤ Enter the Node-IDs (usually the same like device ID).
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 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. A couple of settings should be configured as follows.

☒ Switch off the following parameters:

Parameter	ID
Mains decoupling	3110
Change of frequency	3058
Overfrequency level 1	2850
Underfrequency level 1	2900
Overfrequency level 2	2856
Underfrequency level 2	2906
Overvoltage level 1	2950
Undervoltage level 1	3000
Overvoltage level 2	2956
Undervoltage level 2	3006
Mains voltage increase	8806

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 behaviour 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-5 on the main screen, navigate to *“Parameter ➔ Configuration*

*➔ Configure measurement”* and set *“Show mains data”* (parameter 4103) to "LS5".



9. ➤



*For the AMF mode the emergency run segments have to be configured (🔗 Chapter 6.4.2.6 "Setup AMF Start In LS-5 Mode" on page 195).*

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.  
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 control bits for sending information to the LS-5.  
These bits can be used as command variables in the LS-5 to initiate i.e. an alarm acknowledgement or to release the mains decoupling.*

To configure these control bits navigate to "Parameter  
➔ Configuration ➔ Configure LogicsManager  
➔ Configure LS5".

## 6.4.4 Multiple Mains/Generators With Four easYgen Units, Two Incoming Mains And Different Tie-breakers

### Overview

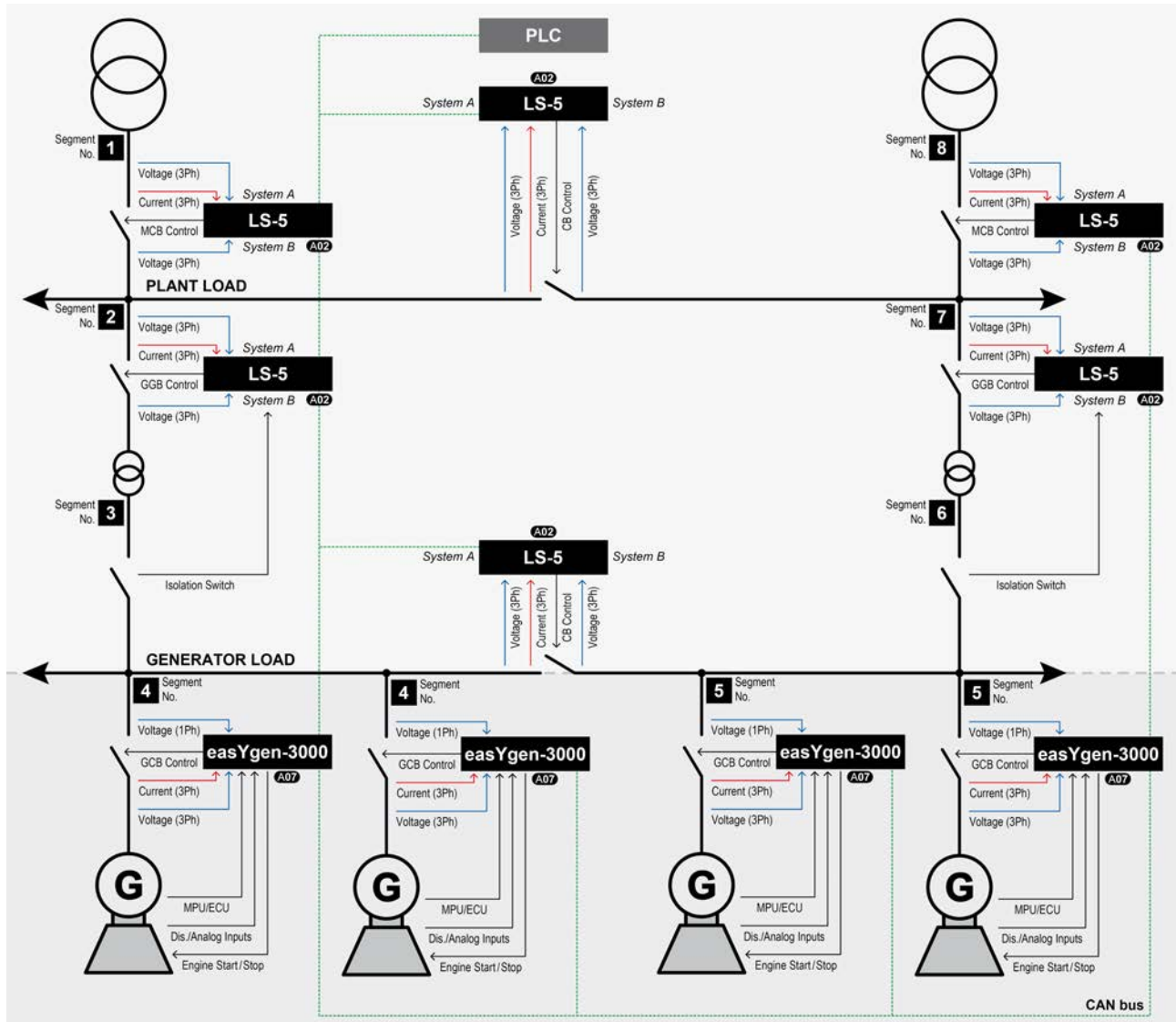


Fig. 105: Multiple Mains/Generators with four easYgen units, two incoming mains and different tie-breakers

One or more genset(s) feed on a generator/load busbar (Fig. 105/ Segment No. 4). One or more genset(s) feed on a generator/load busbar (Fig. 105/Segment No. 5).

A tie-breaker is located between the both generator/load busbars. Each generator/load busbar has its own generator group breaker (Fig. 105/Segment No. 2/3 respectively Segment No. 6/7). The application contains two mains interchange points with mains breakers (Fig. 105/Segment No. 1/2 respectively Segment No. 7/8).

Another tie-breaker can connect directly the both plant/load busbars (Fig. 105/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-5 controls its own breaker. The LS-5s 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-5, 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 protocol. Serial Modbus can also be used to send orders or read information from all members.



*For additional information refer to ↗ Chapter 7 “Interfaces And Protocols” on page 225.*

Amongst others the breaker feedbacks of the single LS-5 are sent via CAN 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-3400/3500: **A07**
- LS-5: **A02**

## General notes



*All units must be configured according to the requirements listed in ↗ Chapter 6.4.1 “Introduction” on page 189.*

*In the following example the isolation switch condition represents an important part of the segmenting.*

## Single line diagram

Prepare the easYgen – LS-5 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-5s 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 in ↗ “Segment number” on page 189.



*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-5 into the single line diagram according to the definitions in [Chapter 6.4.1 "Introduction" on page 189](#).

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-5 (incoming mains)

Personnel: ■ Qualified electrician

Ensure the following prerequisites are met:

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-5 only.
4. ➤ The MCB breaker commands are connected to the LS-5 only.
5. ➤ The LS-5 CAN bus is connected to the CAN bus #3 of the easYgen(s).

### Prerequisites LS-5 (GGBs)

Personnel: ■ Qualified electrician

Ensure the following prerequisites are met:

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-5 only.
4. ➤ The GGB command(s) are connected to the LS-5 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-5 only.
6. ➤ The LS-5 CAN bus is connected to the CAN bus #3 of the easYgen(s).

### Prerequisites LS-5 (tie-breaker generator/load busbar)

Personnel: ■ Qualified electrician

Ensure the following prerequisites are met:

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-5 only.
4. ➤ The tie-breaker command(s) are connected to the LS-5 only.
5. ➤ The LS-5 CAN bus is connected to the CAN bus #3 of the easYgen(s).

**Prerequisites LS-5 (tie-breaker plant/load busbar)**

Personnel: ■ Qualified electrician

Ensure the following prerequisites are met:

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-5 only.
4. ➤ The tie-breaker command(s) are connected to the LS-5 only.
5. ➤ The LS-5 CAN bus is connected to the CAN bus #3 of the easYgen(s).

**Prerequisites easYgen(s)**

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/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. ➤ The easYgen CAN bus #3 is connected to the CAN bus of the LS-5.

**Configure LS-5 (incoming mains)**

Personnel: ■ User

Configure the following parameters:

1. ➤ Configure the application mode (parameter 8840 ↗ p. 108) of the LS-5 device to **A02**.
2. ➤ Enter the device ID 33 for the LS-5, incoming mains on the left side and ID 37 for the LS-5, incoming mains on the right.
3. ➤ Enter the Node-IDs (usually the same like device ID).
4. ➤ For the following two steps navigate to *“Configuration ➔ Application config ➔ Segment config.”* on each respective LS-5.

5. ➤ Configure the following parameters for the LS-5 ID 33, incoming mains on the left side:

Parameter	ID	Value
Segment No. Sy.A	8810 ↗ p. 116	1
Segment No. Sy.B	8811 ↗ p. 116	2
Segment No. isol. Switch	8812 ↗ p. 116	N/A
Mains pow. Measurement	8813 ↗ p. 116	Valid
Mains connection	8814 ↗ p. 116	System A
Isol. Switch Para	8815 ↗ p. 116	None
Variable system	8816 ↗ p. 117	System B

6. ➤ Configure the following parameters for the LS-5 ID 37, incoming mains on the right side:

Parameter	ID	Value
Segment No. Sy.A	8810 ↗ p. 116	8
Segment No. Sy.B	8811 ↗ p. 116	7
Segment No. isol. Switch	8812 ↗ p. 116	N/A
Mains pow. Measurement	8813 ↗ p. 116	Valid
Mains connection	8814 ↗ p. 116	System A
Isol. Switch Para	8815 ↗ p. 116	None
Variable system	8816 ↗ p. 117	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 ➔ Application config ➔ Breakers config. ➔ Configure CBA ➔ Dead bus closure CBA*” and set the following parameters:

Parameter	ID	Value
Dead bus closure CBA	8801 ↗ p. 114	On
Connect A dead to B dead	8802 ↗ p. 114	Off
Connect A dead to B alive	8803 ↗ p. 114	Off
Connect A alive to B dead	8804 ↗ p. 114	On
Dead bus closure delay time	8805 ↗ p. 114	As required
Dead bus detection max. volt	5820 ↗ p. 114	As required

11. ➤ Navigate to “*Configuration ➔ Application config ➔ Breakers config. ➔ Configure CBA ➔ Connect synchronous mains*” and set the following parameters:

Parameter	ID	Value
Connect synchronous mains	8820 ➔ p. 109	Yes
Max. phase angle	8821 ➔ p. 110	20°
Delay time phi max.	8822 ➔ p. 110	1 s

12. ➤ To configure the LogicsManager in regards to close and open commands for the MCB navigate to “*Configuration ➔ Application config ➔ Breakers config. ➔ Configure CBA*”.

13. ➤ Select “*Open CBA unload ➔ LogicsManager*” (parameter 12943 ➔ p. 110) and configure the equation as follows:

- The LM equation opens the MCB with unloading, if the remote control bit 1 is sent by the PLC.

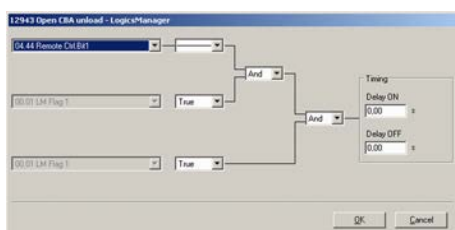


Fig. 106: LogicsManager configuration 'Open CBA unload'

14. ➤ Select “*Open CBA immed. ➔ LogicsManager*” (parameter 12944 ➔ p. 110) 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 ➔ Chapter 4.3.1.1 “*System A Operating Voltage / Frequency*” on page 73) **OR** the remote control bit 2 sent by the PLC.

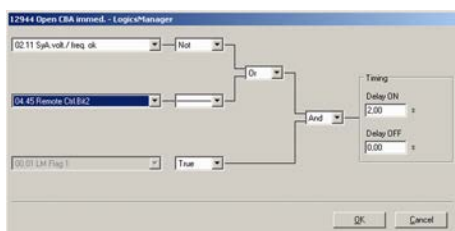


Fig. 107: LogicsManager configuration 'Open CBA immed.'

15. ➤ Select “*Enable close CBA ➔ LogicsManager*” (parameter 12945 ➔ p. 111) and configure the equation as follows:

- The LM equation gives the release for close MCB, 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.

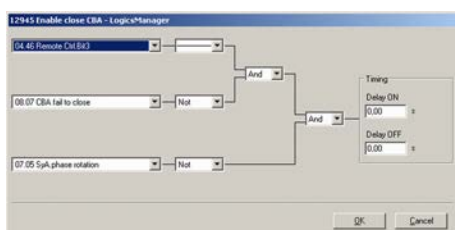


Fig. 108: LogicsManager configuration 'Enable close CBA.'



The same remote control bits can be used in the upper example, because each LS-5 receives its own control bits. The different device and Node-ID separates the control bits from each other.

## Configure LS-5 (GGBs)

Personnel: ■ User

Configure the following parameters:

- Configure the application mode (parameter 8840 ➔ p. 108) of the LS-5 device to **A02**.
- Enter the device ID 34 for the LS-5, set up as GGB on the left and ID 36 for the LS-5, set up as GGB on the right.

3. ➤ Enter the Node-IDs (usually the same like device ID).
4. ➤ For the following two steps navigate to “*Configuration ➔ Application config ➔ Segment config.*” on each respective LS-5.
5. ➤ Configure the following parameters for the LS-5 ID 34, set up as GGB on the left:

Parameter	ID	Value
Segment No. Sy.A	8810 ↗ p. 116	2
Segment No. Sy.B	8811 ↗ p. 116	3
Segment No. isol. Switch	8812 ↗ p. 116	4
Mains pow. Measurement (Actually system A measurement)	8813 ↗ p. 116	Invalid
Mains connection	8814 ↗ p. 116	None
Isol. Switch Para	8815 ↗ p. 116	System B
Variable system	8816 ↗ p. 117	System B

6. ➤ Configure the following parameters for the LS-5 ID 36, set up as GGB on the right:

Parameter	ID	Value
Segment No. Sy.A	8810 ↗ p. 116	7
Segment No. Sy.B	8811 ↗ p. 116	6
Segment No. isol. Switch	8812 ↗ p. 116	5
Mains pow. Measurement (Actually system A measurement)	8813 ↗ p. 116	Invalid
Mains connection	8814 ↗ p. 116	None
Isol. Switch Para	8815 ↗ p. 116	System B
Variable system	8816 ↗ p. 117	System B

7. ➤ Navigate to “*Configuration ➔ Application config ➔ Breakers config.*” 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 → Application config → Breakers config. → Configure CBA → Dead bus closure CBA*” and set the following parameters:

Parameter	ID	Value
Dead bus closure CBA	8801 ↗ p. 114	On
Connect A dead to B dead	8802 ↗ p. 114	On
Connect A dead to B alive	8803 ↗ p. 114	On
Connect A alive to B dead	8804 ↗ p. 114	On
Dead bus closure delay time	8805 ↗ p. 114	As required
Dead bus detection max. volt	5820 ↗ p. 114	As required

12. Navigate to “*Configuration → Application config → Breakers config. → Configure CBA → Connect synchronous mains*” and set the following parameters:

Parameter	ID	Value
Connect synchronous mains	8820 ↗ p. 109	Yes
Max. phase angle	8821 ↗ p. 110	20°
Delay time phi max.	8822 ↗ p. 110	1 s

13. To configure the LogicsManager in regards to close and open commands for the GGB navigate to “*Configuration → Application config → Breakers config. → Configure CBA*”.

14. Select “*Open CBA unload → LogicsManager*” (parameter 12943 ↗ p. 110) and configure the equation as follows:

- The LM equation opens the GGB with unloading, if the remote control bit 1 is sent by the PLC.

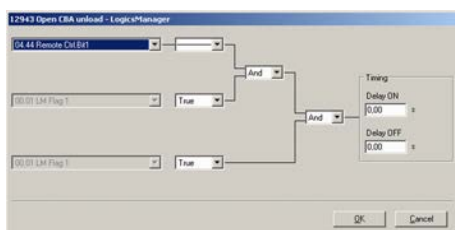


Fig. 109: LogicsManager configuration 'Open CBA unload'

15. Select “*Open CBA immmed. → LogicsManager*” (parameter 12944 ↗ p. 110) and configure the equation as follows:

- The LM equation opens the GGB immediately, if the remote control bit 2 sent by the PLC.

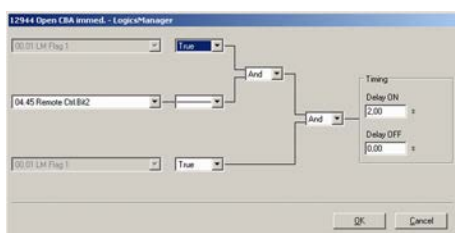


Fig. 110: LogicsManager configuration 'Open CBA immmed.'

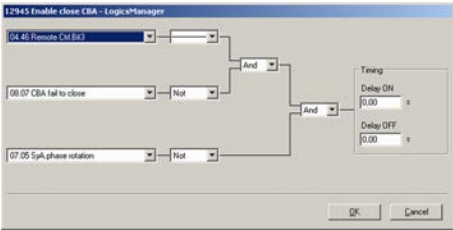


Fig. 111: LogicsManager configuration 'Enable close CBA.'

16. Select “Enable close CBA → LogicsManager” (parameter 12945 ↗ p. 111) and configure the equation as follows:
- The LM equation gives the release for close GGB, 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-5 receives its own control bits. The different device and Node-ID separates the control bits from each other.

Configure LS-5 (tie-breaker generator/load busbar)

Personnel: ■ User

Configure the following parameters:

1. Configure the application mode (parameter 8840 ↗ p. 108) of the LS-5 device to **A02**.
2. Enter the device ID 35 for the LS-5.
3. Enter the Node-ID (usually the same like device ID).
4. Navigate to “Configuration → Application config → Segment config.” and configure the following parameters:

Parameter	ID	Value
Segment No. Sy.A	8810 ↗ p. 116	4
Segment No. Sy.B	8811 ↗ p. 116	5
Segment No. isol. Switch	8812 ↗ p. 116	N/A
Mains pow. Measurement (Actually system A measurement)	8813 ↗ p. 116	Invalid
Mains connection	8814 ↗ p. 116	None
Isol. Switch Para	8815 ↗ p. 116	None
Variable system	8816 ↗ p. 117	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 ➔ Application config ➔ Breakers config. ➔ Configure CBA ➔ Dead bus closure CBA*” and set the following parameters:

Parameter	ID	Value
Dead bus closure CBA	8801 ↗ p. 114	On
Connect A dead to B dead	8802 ↗ p. 114	On
Connect A dead to B alive	8803 ↗ p. 114	On
Connect A alive to B dead	8804 ↗ p. 114	On
Dead bus closure delay time	8805 ↗ p. 114	As required
Dead bus detection max. volt	5820 ↗ p. 114	As required

9. ➤ Navigate to “*Configuration ➔ Application config ➔ Breakers config. ➔ Configure CBA ➔ Connect synchronous mains*” and set the following parameters:

Parameter	ID	Value
Connect synchronous mains	8820 ↗ p. 109	Yes
Max. phase angle	8821 ↗ p. 110	20°
Delay time phi max.	8822 ↗ p. 110	1 s

10. ➤ To configure the LogicsManager in regards to close and open commands for the tie-breaker navigate to “*Configuration ➔ Application config ➔ Breakers config. ➔ Configure CBA*”.

11. ➤ Select “*Open CBA unload ➔ LogicsManager*” (parameter 12943 ↗ p. 110) 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.

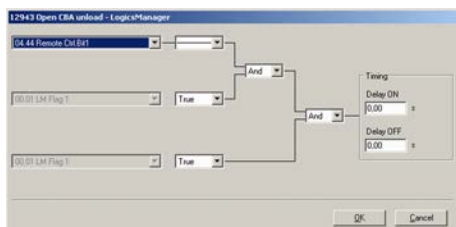


Fig. 112: LogicsManager configuration 'Open CBA unload'



*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. ➤ Select “*Open CBA immed. ➔ LogicsManager*” (parameter 12944 ↗ p. 110) and configure the equation as follows:

- The LM equation opens the tie-breaker immediately, if the remote control bit 2 sent by the PLC.

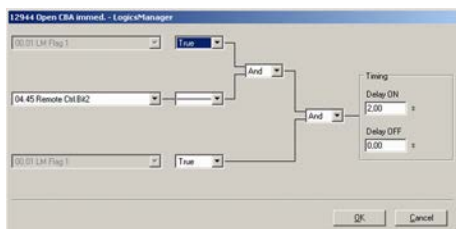


Fig. 113: LogicsManager configuration 'Open CBA immed.'

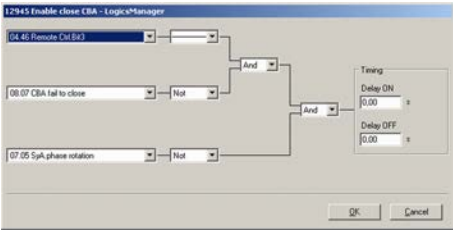


Fig. 114: LogicsManager configuration 'Enable close CBA.'

13. Select “Enable close CBA → LogicsManager” (parameter 12945 ↗ p. 111) 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-5 receives its own control bits. The different device and node-ID separates the control bits from each other.

Configure LS-5 (tie-breaker plant/ load busbar)

Personnel: ■ User

Configure the following parameters:

1. Configure the application mode (parameter 8840 ↗ p. 108) of the LS-5 device to **A02**.
2. Enter the device ID 38 for the LS-5.
3. Enter the Node-ID (usually the same like device ID).
4. Navigate to “Configuration → Application config → Segment config.” and configure the following parameters:

Parameter	ID	Value
Segment No. Sy.A	8810 ↗ p. 116	2
Segment No. Sy.B	8811 ↗ p. 116	7
Segment No. isol. Switch	8812 ↗ p. 116	N/A
Mains pow. Measurement (Actually system A measurement)	8813 ↗ p. 116	Invalid
Mains connection	8814 ↗ p. 116	None
Isol. Switch Para	8815 ↗ p. 116	None
Variable system	8816 ↗ p. 117	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 ➔ Application config ➔ Breakers config. ➔ Configure CBA ➔ Dead bus closure CBA*” and set the following parameters:

Parameter	ID	Value
Dead bus closure CBA	8801 ↗ p. 114	On
Connect A dead to B dead	8802 ↗ p. 114	On
Connect A dead to B alive	8803 ↗ p. 114	On
Connect A alive to B dead	8804 ↗ p. 114	On
Dead bus closure delay time	8805 ↗ p. 114	As required
Dead bus detection max. volt	5820 ↗ p. 114	As required

9. ➤ Navigate to “*Configuration ➔ Application config ➔ Breakers config. ➔ Configure CBA ➔ Connect synchronous mains*” and set the following parameters:

Parameter	ID	Value
Connect synchronous mains	8820 ↗ p. 109	Yes
Max. phase angle	8821 ↗ p. 110	20°
Delay time phi max.	8822 ↗ p. 110	1 s

10. ➤ To configure the LogicsManager in regards to close and open commands for the tie-breaker navigate to “*Configuration ➔ Application config ➔ Breakers config. ➔ Configure CBA*”.

11. ➤ Select “*Open CBA unload ➔ LogicsManager*” (parameter 12943 ↗ p. 110) 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.

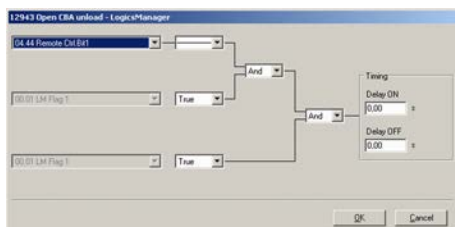


Fig. 115: LogicsManager configuration 'Open CBA unload'



*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. ➤ Select “*Open CBA immmed. ➔ LogicsManager*” (parameter 12944 ↗ p. 110) and configure the equation as follows:

- The LM equation opens the tie-breaker immediately, if the remote control bit 2 sent by the PLC.

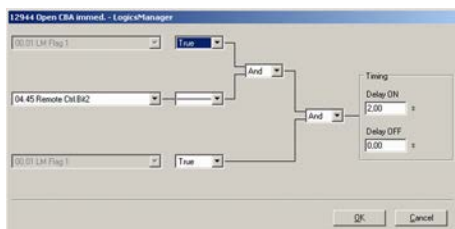


Fig. 116: LogicsManager configuration 'Open CBA immmed.'

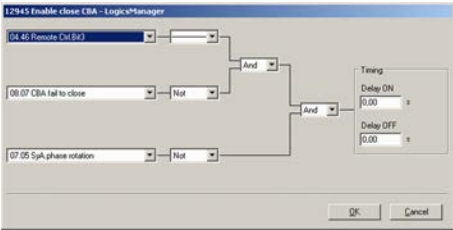


Fig. 117: LogicsManager configuration 'Enable close CBA.'

13. Select “Enable close CBA → LogicsManager” (parameter 12945 p. 111) 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-5 receives its own control bits. The different device and Node-ID separates the control bits from each other.*

Configure easYgen(s)

Personnel: ■ User

Configure the following parameters:

1. Configure the application mode (parameter 3444) of each easYgen device to **A07**.
2. Enter the device ID 1 for the easYgen (usually from left to right).
3. Enter the Node-IDs (usually the same like device ID).
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 Right side	Segment number	1723	5

5. Configure the measurement for generator and busbar according to the easYgen manual.

6. ➤ The mains measurement is not used in this application mode. A couple of settings should be configured as follows.

■ Switch off the following parameters:

Parameter	ID
Mains decoupling	3110
Change of frequency	3058
Overfrequency level 1	2850
Underfrequency level 1	2900
Overfrequency level 2	2856
Underfrequency level 2	2906
Overvoltage level 1	2950
Undervoltage level 1	3000
Overvoltage level 2	2956
Undervoltage level 2	3006
Mains voltage increase	8806

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 behaviour 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-5 on the main screen, navigate to *“Parameter ➔ Configuration ➔ Configure measurement”* and set *“Show mains data”* (parameter 4103) to “LS5”.

9. ➔



*For the AMF mode the emergency run segments have to be configured (☞ Chapter 6.4.2.6 "Setup AMF Start In LS-5 Mode" on page 195).*

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.  
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.

10. ➔



*In this setup each easYgen device provides six control bits for sending information to the LS-5.  
These bits can be used as command variables in the LS-5 to initiate i.e. an alarm acknowledgement or to release the mains decoupling.*

To configure these control bits navigate to "Parameter  
➔ Configuration ➔ Configure LogicsManager  
➔ Configure LS5".



7 Interfaces And Protocols

7.1 Interfaces Overview

LS-511

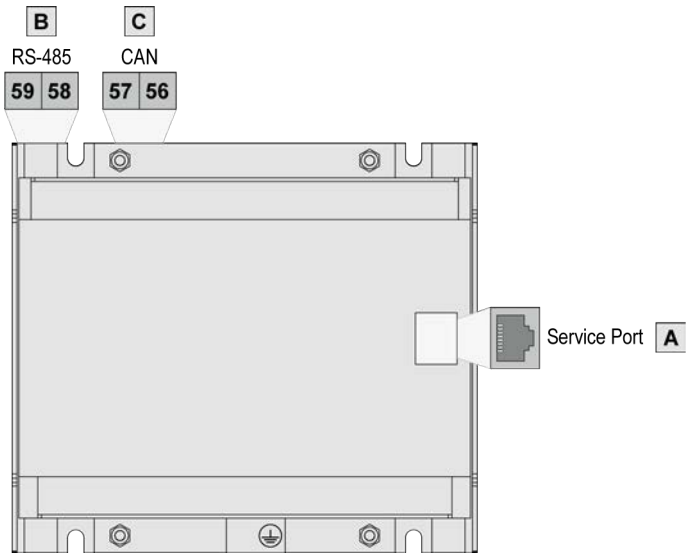


Fig. 118: LS-511 interfaces

LS-521

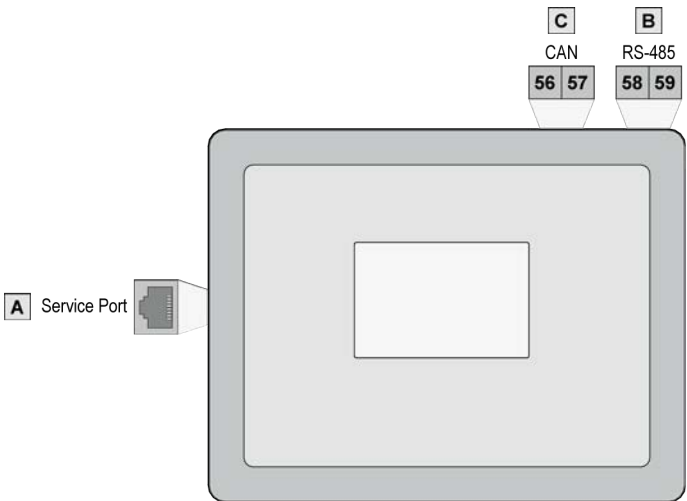


Fig. 119: LS-521 interfaces

The LS-511/521 (Fig. 118/Fig. 119) provides the following inter-  
faces, which are supporting different protocols.

Figure	Interface	Protocol
A	Service Port (USB/RS-232) <sup>1</sup>	Modbus, ToolKit
B	RS-485	Modbus
C	CAN bus	CANopen



<sup>1</sup> Please refer to Chapter 3.3.11 “Service Port” on page 54.

## 7.2 CAN Interfaces

### 7.2.1 CAN Interface 1 (Guidance level)

CAN interface 1 is a freely configurable CANopen interface with 2 RPDOs (receive boxes), 3 TPDOs (send boxes), and 4 additional Server SDOs.

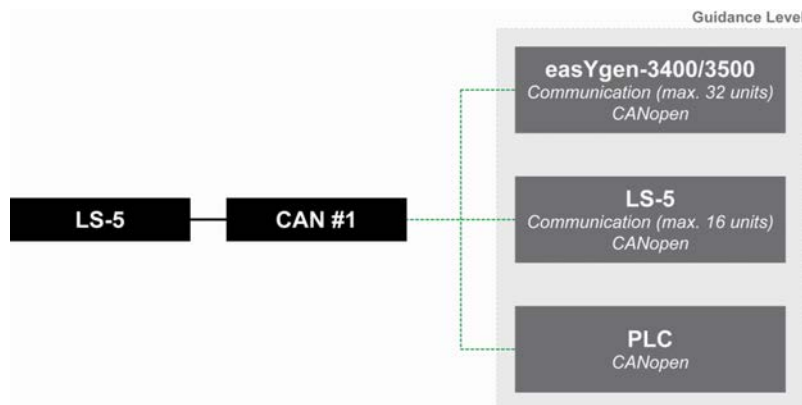


Fig. 120: CAN interface 1

## 7.3 Serial Interfaces

### 7.3.1 Service Port (RS-232/USB)

The Woodward specific service port can be used to extend the interfaces of the controller.

In conjunction with the direct configuration cable the service port allows service access for configuring the unit and visualize measured data. It is possible to connect a modem for remote control and alarm signaling.

The extended serial interface provides a Modbus as well as the Woodward ToolKit protocol.

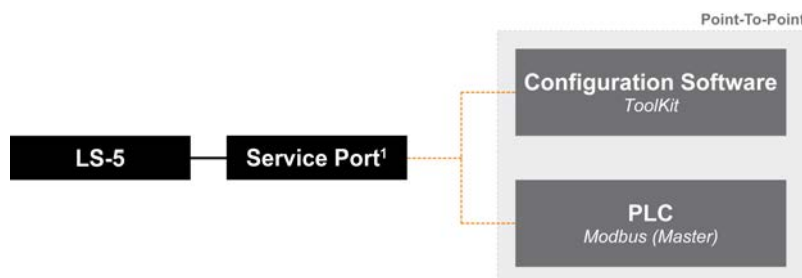


Fig. 121: Service Port



<sup>1</sup> The service port can be **only** used in combination with an optional Woodward direct configuration cable (DPC), which includes a converter box to provide either an USB or a RS-232 interface.

- For additional information refer to [Chapter 3.3.11 “Service Port”](#) on page 54.

7.3.2 RS-485 Interface

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. 122: RS-485 interface

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/desegmentation.

Protocol description

If a data protocol is used, a CAN message looks like this:

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
MUX	Data byte	Data byte	Data byte	Data byte	Data byte	Data byte	Internal

The MUX byte is counted up, the meaning of the data byte changes according to the value of the MUX byte.

In the protocol tables is listed which parameter at which MUX on which position is transmitted. The meaning of the parameter can be taken by means of the number of the parameter description ("CANopen Mapping parameter").

Example

MUX	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
1	118				147		Internal

In MUX 1 (byte 1 has got value 1) the value of parameter 118 is included in the byte 2 up to byte 5 (mains voltage 1-2). In byte 6 up to byte 7 the value of parameter 147 is included (mains frequency). Byte 8 includes internal definitions and can be ignored.

Data format "Unsigned Integer"

UNSIGNED type data has positive integers as values. The range is between 0 and 2<sup>n</sup>-1. The data is shown by the bit sequence of length n.

- Bit sequence:  
b = b<sub>0</sub> to b<sub>n-1</sub>
- Value shown:  
$$\text{UNSIGNED}_n(b) = b_{n-1} * 2^{n-1} + \dots + b_1 * 2^1 + b_0 * 2^0$$



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 <sub>7</sub> to b <sub>0</sub>							
UNSIGNED16	b <sub>7</sub> to b <sub>0</sub>	b <sub>15</sub> to b <sub>8</sub>						
UNSIGNED24	b <sub>7</sub> to b <sub>0</sub>	b <sub>15</sub> to b <sub>8</sub>	b <sub>23</sub> to b <sub>16</sub>					
UNSIGNED32	b <sub>7</sub> to b <sub>0</sub>	b <sub>15</sub> to b <sub>8</sub>	b <sub>23</sub> to b <sub>16</sub>	b <sub>31</sub> to b <sub>24</sub>				
UNSIGNED40	b <sub>7</sub> to b <sub>0</sub>	b <sub>15</sub> to b <sub>8</sub>	b <sub>23</sub> to b <sub>16</sub>	b <sub>31</sub> to b <sub>24</sub>	b <sub>39</sub> to b <sub>32</sub>			
UNSIGNED48	b <sub>7</sub> to b <sub>0</sub>	b <sub>15</sub> to b <sub>8</sub>	b <sub>23</sub> to b <sub>16</sub>	b <sub>31</sub> to b <sub>24</sub>	b <sub>39</sub> to b <sub>32</sub>	b <sub>47</sub> to b <sub>40</sub>		
UNSIGNED56	b <sub>7</sub> to b <sub>0</sub>	b <sub>15</sub> to b <sub>8</sub>	b <sub>23</sub> to b <sub>16</sub>	b <sub>31</sub> to b <sub>24</sub>	b <sub>39</sub> to b <sub>32</sub>	b <sub>47</sub> to b <sub>40</sub>	b <sub>55</sub> to b <sub>48</sub>	
UNSIGNED64	b <sub>7</sub> to b <sub>0</sub>	b <sub>15</sub> to b <sub>8</sub>	b <sub>23</sub> to b <sub>16</sub>	b <sub>31</sub> to b <sub>24</sub>	b <sub>39</sub> to b <sub>32</sub>	b <sub>47</sub> to b <sub>40</sub>	b <sub>55</sub> to b <sub>48</sub>	b <sub>63</sub> to b <sub>56</sub>

Table 37: Transfer syntax for data type UNSIGNEDn

### Data format "Signed Integer"

SIGNED type data has integers as values. The range is between 0 and  $2^{n-1}$ . The data is shown by the bit sequence of length n.

- Bit sequence:  
b = b<sub>0</sub> to b<sub>n-1</sub>
- Value shown:  

$$\text{SIGNED}_n(b) = b_{n-2} * 2^{n-2} + \dots + b_1 * 2^1 + b_0 * 2^0$$
 if b<sub>n-1</sub> = 0
- And with two's complement:  

$$\text{SIGNED}_n(b) = \text{SIGNED}_n(b) - 1$$
 if b<sub>n-1</sub> = 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 <sub>7</sub> to b <sub>0</sub>							
SIGNED16	b <sub>7</sub> to b <sub>0</sub>	b <sub>15</sub> to b <sub>8</sub>						
SIGNED24	b <sub>7</sub> to b <sub>0</sub>	b <sub>15</sub> to b <sub>8</sub>	b <sub>23</sub> to b <sub>16</sub>					
SIGNED32	b <sub>7</sub> to b <sub>0</sub>	b <sub>15</sub> to b <sub>8</sub>	b <sub>23</sub> to b <sub>16</sub>	b <sub>31</sub> to b <sub>24</sub>				

Octet Number	1.	2.	3.	4.	5.	6.	7.	8.
SIGNED40	b <sub>7</sub> to b <sub>0</sub>	b <sub>15</sub> to b <sub>8</sub>	b <sub>23</sub> to b <sub>16</sub>	b <sub>31</sub> to b <sub>24</sub>	b <sub>39</sub> to b <sub>32</sub>			
SIGNED48	b <sub>7</sub> to b <sub>0</sub>	b <sub>15</sub> to b <sub>8</sub>	b <sub>23</sub> to b <sub>16</sub>	b <sub>31</sub> to b <sub>24</sub>	b <sub>39</sub> to b <sub>32</sub>	b <sub>47</sub> to b <sub>40</sub>		
SIGNED56	b <sub>7</sub> to b <sub>0</sub>	b <sub>15</sub> to b <sub>8</sub>	b <sub>23</sub> to b <sub>16</sub>	b <sub>31</sub> to b <sub>24</sub>	b <sub>39</sub> to b <sub>32</sub>	b <sub>47</sub> to b <sub>40</sub>	b <sub>55</sub> to b <sub>48</sub>	
SIGNED64	b <sub>7</sub> to b <sub>0</sub>	b <sub>15</sub> to b <sub>8</sub>	b <sub>23</sub> to b <sub>16</sub>	b <sub>31</sub> to b <sub>24</sub>	b <sub>39</sub> to b <sub>32</sub>	b <sub>47</sub> to b <sub>40</sub>	b <sub>55</sub> to b <sub>48</sub>	b <sub>63</sub> to b <sub>56</sub>

Table 38: 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. This means that a Master node needs to poll 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.

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. 123)

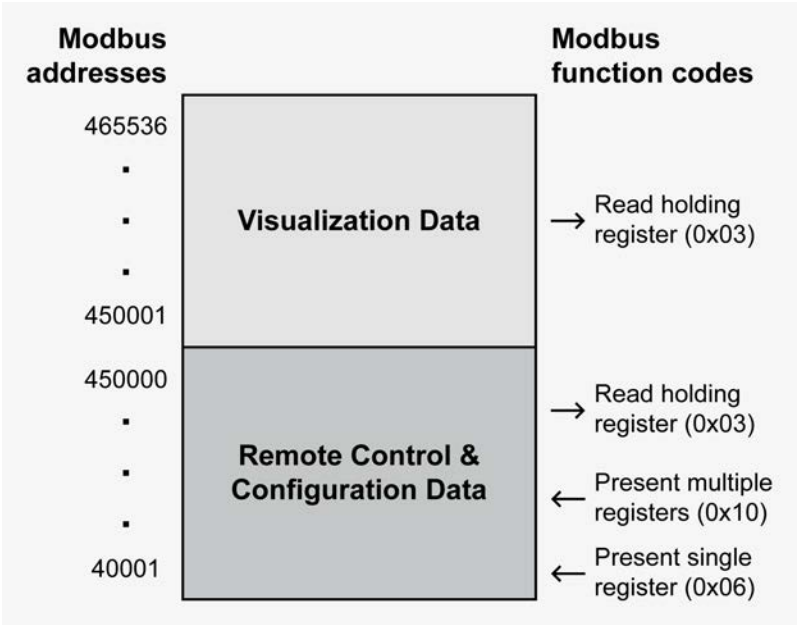


Fig. 123: Address range



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 informations 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		--
450002	Scaling Power (16 bits) Exponent 10x W (5;4;3;2)		
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....

Modbus read addresses	Description	Multiplier	Units
.....	.....	.....	.....
450250	System B voltage L3-N	0.1	V

Table 39: Address range block read



“Address range block read” Table on page 230 is only an excerpt of the data protocol. It conforms to the data protocol 5300 that is also used by CAN bus.

Refer to Chapter 9.2.3.1 “Data Protocol 5300 (Basic Visualization)” on page 263 for the complete protocol.

The following ModScan32 screenshot shows the configurations made to read the visualization protocol with a block read of 128 registers.

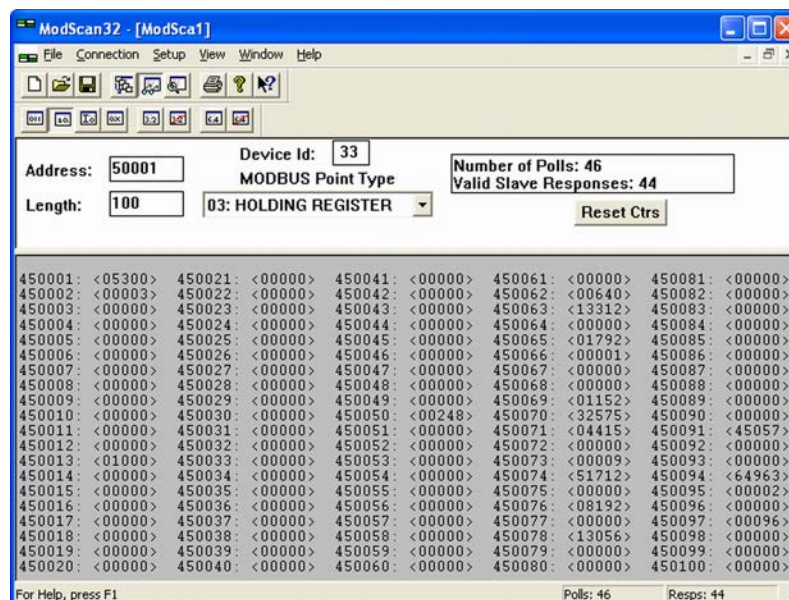


Fig. 124: Visualization configurations


## 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 < 10000	Parameter ID >= 10000
Modbus address =	40000 + (Par. ID+1)	400000 + (Par. ID+1)

Table 40: 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  “Data types” Table on page 232 for more information.

Types	Modbus registers
UNSIGNED 8	1
UNSIGNED 16	1
INTEGER 16	1
UNSIGNED 32	2
INTEGER 32	2
LOGMAN	7
TEXT/X	X/2

Table 41: Data types



## 8 Technical Specifications

### 8.1 Technical Data

#### Product label

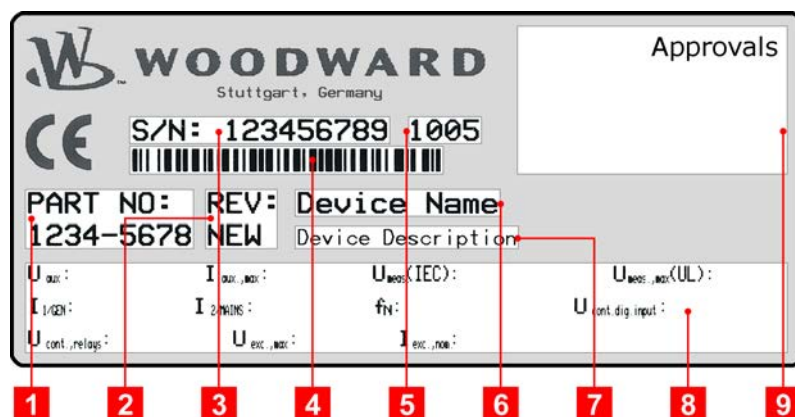


Fig. 125: Product label

1	P/N	Item number
2	REV	Item revision number
3	S/N	Serial number (numerical)
4	S/N	Serial number (barcode)
5	S/N	Date of production (year-month)
6	Type	Description (short)
7	Type	Description (long)
8	Details	Technical data
9	Approval	Approvals

#### 8.1.1 Measuring Values

##### Voltages

Measuring voltage $\Delta$ / $\Delta$	120 V	
Rated value ( $V_{rated}$ )		69/120 Vac
Maximum value ( $V_{max}$ )		max. 86/150 Vac
Rated voltage phase – ground		150 Vac
Rated surge voltage ( $V_{surge}$ )		2.5 kV
Measuring voltage $\Delta$ / $\Delta$	480 V	
Rated value ( $V_{rated}$ )		277/480 Vac
Maximum value ( $V_{max}$ )		max. 346/600 Vac
Rated voltage phase – ground		300 Vac
Rated surge voltage ( $V_{surge}$ )		4.0 kV
Linear measuring range		$1.25 \times V_{rated}$

Measuring frequency		50/60 Hz (30.0 to 85.0 Hz)
Accuracy		Class 1
Input resistance per path	120 V	0.498 MΩ
	480 V	2.0 MΩ
Maximum power consumption per path		< 0.15 W

### Currents

Measuring inputs		Isolated
Measuring current	[1] Rated value ( $I_{rated}$ )	../1 A
	[5] Rated value ( $I_{rated}$ )	../5 A
Accuracy	Class 1	
Linear measuring range	System A	approx. $1.5 \times I_{rated}$
Maximum power consumption per path	< 0.15 VA	
Rated short-time current (1 s)	[1]	$50.0 \times I_{rated}$
	[5]	$10.0 \times I_{rated}$

### 8.1.2 Ambient Variables

Power supply	12/24 Vdc (8 to 40.0 Vdc)
Intrinsic consumption	LS-511: ~ 5 W
	LS-521: ~ 6 W
Degree of pollution	2
Maximum elevation	2,000 m ASL
Overvoltage ( $\leq 2$ min)	80 Vdc
Reverse voltage protection	Full supply range
Input capacitance	LS-511: 660 μF
	LS-521: 660 μF

### 8.1.3 Inputs/Outputs

#### Discrete inputs

Discrete inputs	Isolated
Input range (Vcont. dig. input)	Rated voltage
	12/24 Vdc (8 to 40.0 Vdc)
Input resistance	approx. 20 kΩ

#### Discrete outputs

Discrete outputs	Potential free
Contact material	AgCdO

General purpose (GP) ( $V_{cont, relays}$ )	AC	2.00 Aac@250 Vac
	DC	2.00 Adc@24 Vdc
		0.36 Adc@125 Vdc
		0.18 Adc@250 Vdc
Pilot duty (PD) ( $V_{cont, relays}$ )	AC	B300
	DC	1.00 Adc@24 Vdc
		0.22 Adc@125 Vdc
		0.10 Adc@250 Vdc

## 8.1.4 Interface

### Service Port interface

Service Port interface	Not isolated
Proprietary interface	Connect only with Woodward DPC cable

### RS-485 interface

RS-485 interface	Isolated
Insulation voltage (continuously)	100 Vac
Insulation test voltage ( $\leq 5$ s)	1000 Vac
Version	RS-485 Standard
Operation	Half-duplex

### CAN bus interface

CAN bus interface	Isolated
Insulation voltage (continuously)	100 Vac
Insulation test voltage ( $\leq 5$ s)	1000 Vac
Version	CAN bus
Internal line termination	Not available

## 8.1.5 Battery

Type	Lithium
Life span (operation without power supply)	approx. 5 years
Battery field replacement	Not allowed

## 8.1.6 Housing

### Housing type

Type	Plastic	easYpack
	Sheet metal	Custom

## Technical Specifications

### Environmental Data

Dimensions (W × H × D)	Plastic	219 × 171 × 61 mm
	Sheet metal	190 × 167 × 47 mm
Front cutout (W × H)	Plastic	186 [+1.1] × 138 [+1.0] mm
Wiring	Screw-plug-terminals	2.5 mm <sup>2</sup>
Recommended locked torque	4 inch pounds / 0.5 Nm Use 60/75 °C copper wire only Use class 1 wire only or equivalent	
Weight	Plastic	approx. 850 g
	Sheet metal	approx. 840 g

### Protection

Protection system	Plastic	IP54 from front with clamp fasteners
		IP66 from front with screw kit
		IP20 from back
	Sheet metal	IP20
Front foil (plastic housing)		Insulating surface

### 8.1.7 Approvals

EMC test (CE)	Tested according to applicable EN guidelines	
Listings	CE marking	
	UL / cUL, Ordinary Locations, File No.: 231544 GOST-R	
Marine	Type approval	Lloyds Register (LR) Det Norske Veritas (DNV) German Lloyd (GL) Bureau Veritas (BV)
	Design assessment	American Bureau of Shipping (ABS)

### 8.1.8 Generic Note

Accuracy	Referred to full scale value
----------	------------------------------

## 8.2 Environmental Data

### Vibration

Frequency range - sine sweep	5 Hz to 100 Hz
Acceleration	4 G
Standards	EN 60255-21-1 (EN 60068-2-6, Fc)

	Lloyd's Register, Vibration Test2
	SAEJ1455 Chassis Data
Frequency range - random	10 Hz to 500 Hz
Power intensity	0.015 G <sup>2</sup> /Hz
RMS value	1.04 Grms
Standards	MIL-STD 810F, M514.5A, Cat.4,
	Truck/Trailer tracked-restrained
	Cargo, Fig. 514.5-C1

## Shock

Shock	40 G, Saw tooth pulse, 11 ms
Standards	EN 60255-21-2
	MIL-STD 810F, M516.5, Procedure 1

## Temperature

Cold, Dry Heat (storage)	-30 °C (-22 °F) / 80 °C (176 °F)
Cold, Dry Heat (operating)	-20 °C (-4 °F) / 70 °C (158 °F)
Standards	IEC 60068-2-2, Test Bb and Bd
	IEC 60068-2-1, Test Ab and Ad
	MILSTD -810D, M501.2 Induced, M502.2 Cold
	LR Dry Heat, Cold, Env't 2,4, DNV Dry heat, Cold Class A,C

## Humidity

Humidity	95%, non condensing
Standards	MIL-STD 810D, M507.2, PII

## Marine environmental categories

Marine environmental categories	Lloyd's Register of Shipping (LRS): ENV1, ENV2, ENV3 and ENV4
---------------------------------	--

## 8.3 Accuracy

Measuring value	Display	Accuracy	Measuring start	Notes
Frequency				
System A	40.0 to 85.0 Hz	0.1 % (of 85 Hz)	5 % (of PT secondary voltage setting) <sup>1</sup>	
System B				
Voltage				

## Technical Specifications

### Accuracy

Measuring value	Display	Accuracy	Measuring start	Notes
Wye system A / system A	0 to 650 kV	1 % (of 120/480 V) <sup>2</sup>	1.5 % (of PT secondary voltage setting) <sup>1</sup>	
Delta system A / system B			2 % (of PT secondary voltage setting) <sup>1</sup>	
<b>Current</b>				
System A	0 to 32,000 A	1 % (of 1/5 A) <sup>3</sup>	1 % (of 1/5 A) <sup>3</sup>	
Max. value				
<b>Real power</b>				
Actual total real power value	-2 to 2 GW	2 % (of 120/480 V * 1/5 A) <sup>2/3</sup>	Measuring starts when voltage is recognized	
<b>Reactive power</b>				
Actual value in L1, L2, L3	-2 to 2 Gvar	2 % (of 120/480 V * 1/5 A) <sup>2/3</sup>	Measuring starts when voltage is recognized	
<b>Power factor</b>				
Actual value power factor L1	lagging 0.00 to 1.00 to leading 0.00	2 %	2 % (of 1/5 A) <sup>3</sup>	1.00 is displayed for measuring values below the measuring start
<b>Miscellaneous</b>				
Battery voltage	8 to 40 V	1 % (of 24 V)		
Phase angle	-180 to 180 °		1.25 % (of PT secondary volt. setting)	180 ° is displayed for measuring values below measuring start



<sup>1</sup> Setting of the parameter for the PT secondary rated voltage

<sup>2</sup> Depending on the used measuring inputs (120/480 V)

<sup>3</sup> Depending on the CT input hardware (1/5 A) of the respective unit

### 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 +/- 2 %
Power supply	Rated voltage +/- 2 %
Power factor (cos $\varphi$ )	1.00
Ambient temperature	23 °C +/- 2 K
Warm-up period	20 minutes

Accuracy



## 9 Appendix

### 9.1 Characteristics

#### 9.1.1 Triggering Characteristics

##### Two-level overshoot monitoring

This triggering characteristic is used for system A, system B and battery overvoltage, system A and system B overfrequency.

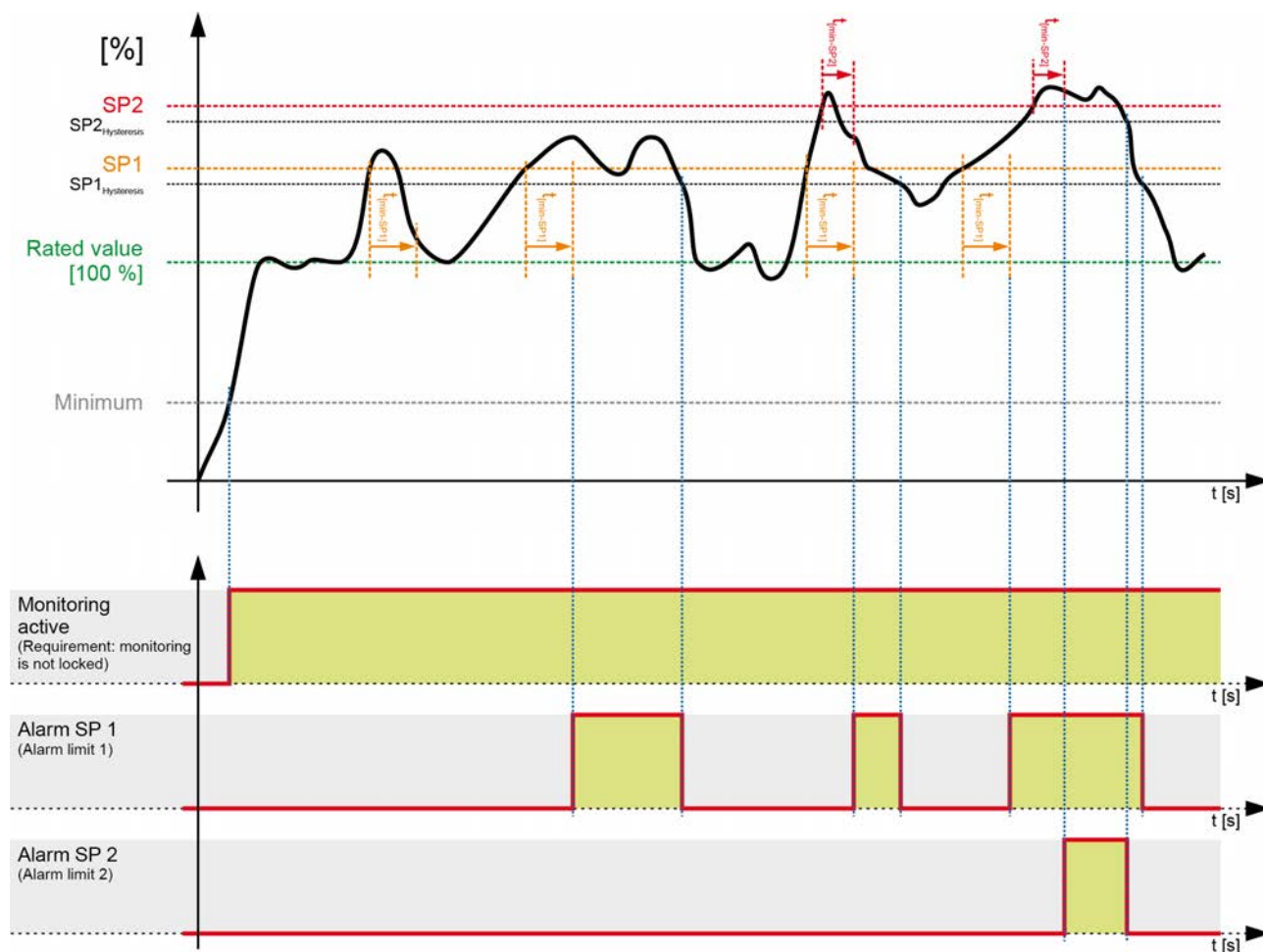


Fig. 126: Two-level overshoot monitoring

**Two-level undershoot monitoring**

This triggering characteristic is used for system A, system B and battery undervoltage, system A and system B underfrequency.

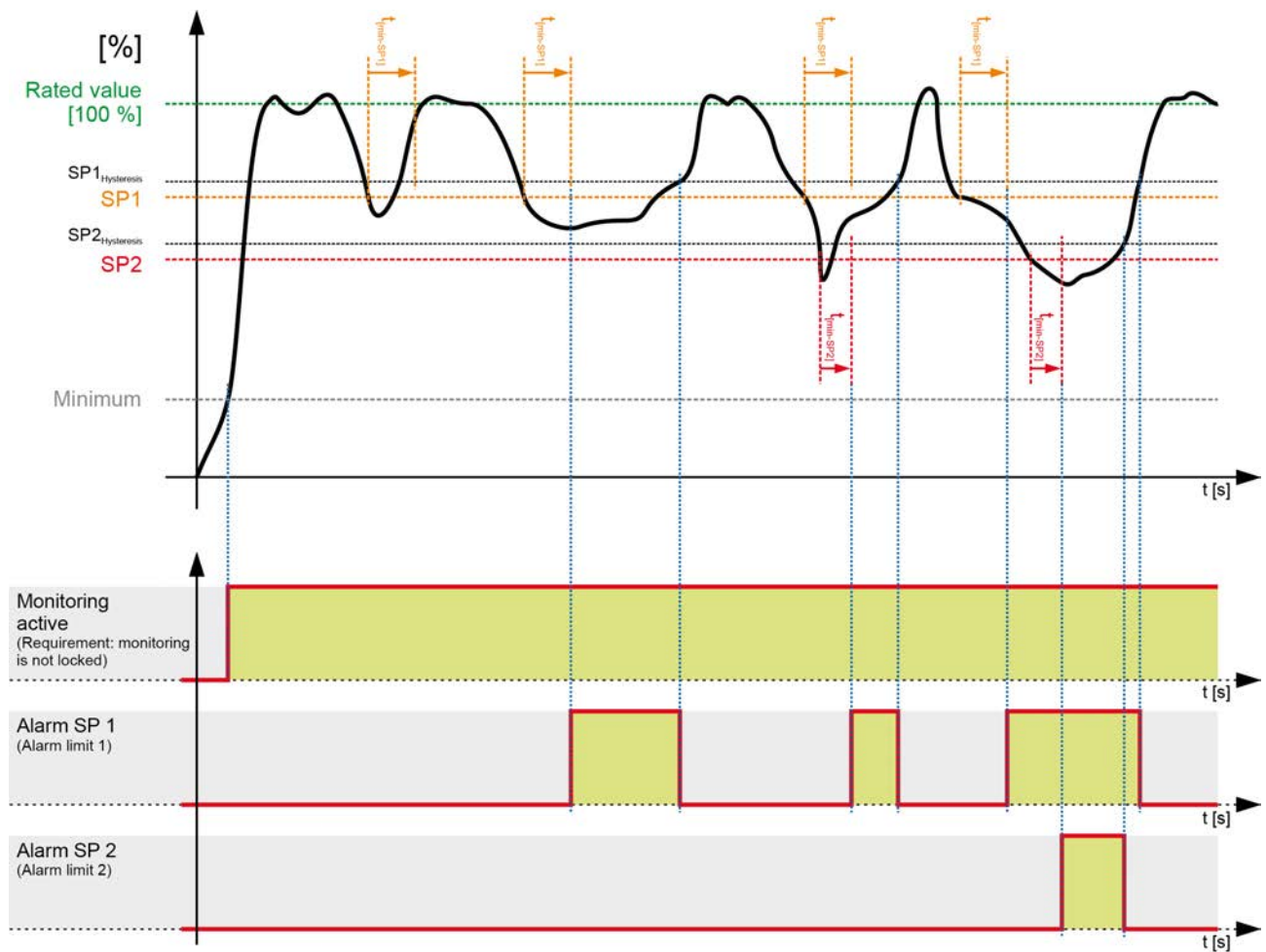


Fig. 127: Two-level undershoot monitoring

**One-level asymmetry monitoring**

This triggering characteristic is used for system A voltage asymmetry monitoring.

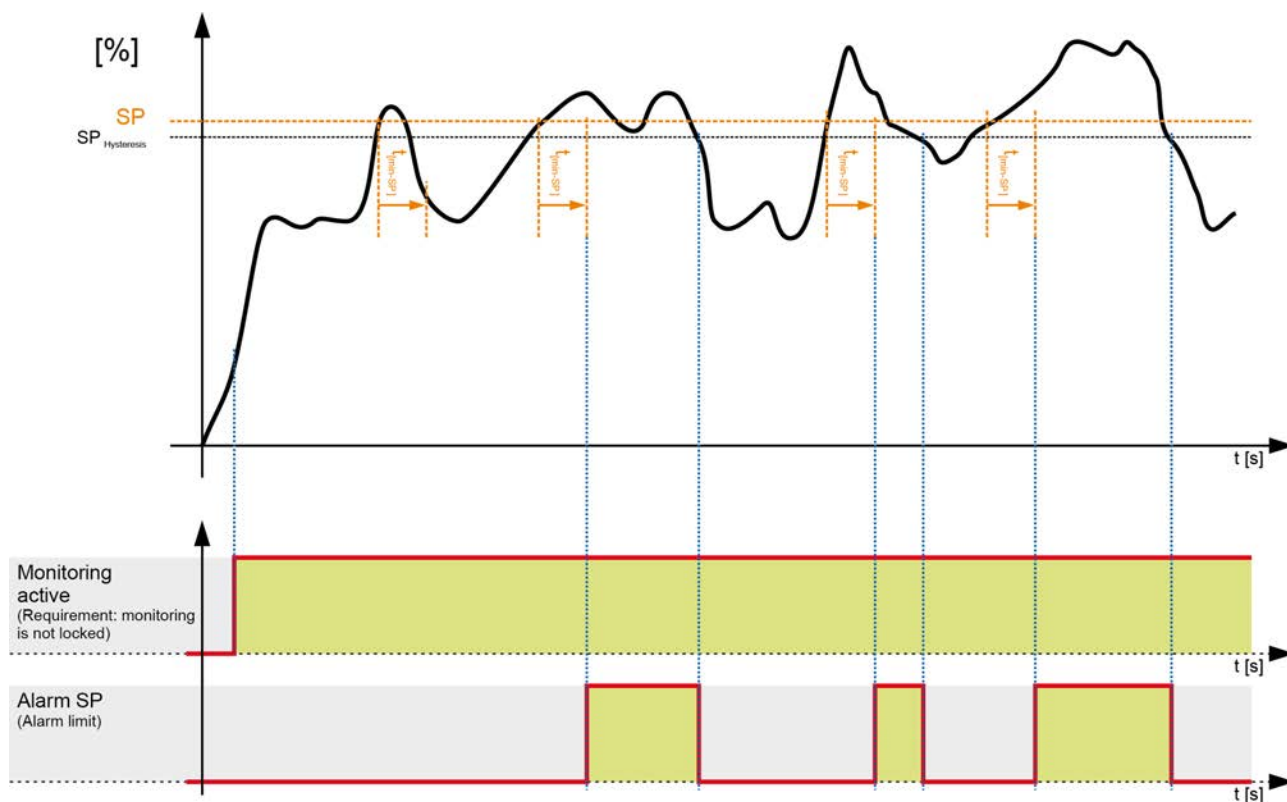


Fig. 128: One-level asymmetry monitoring

## 9.2 Data Protocols

### 9.2.1 CANopen/Modbus

#### 9.2.1.1 Data Protocol 5301 (Basic Visualization)

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
50001	50000	0	1,2		Protocol ID, always 5301		
50002	50001	0	3,4,5,6	136	System A total reactive power	1	Var
50004	50003	1	1,2	160	System A power factor (cos.phi)	0.001	
50005	50004	1	3,4,5,6	170	System A average wye voltage	0.1	V
50007	50006	2	1,2	144	System A frequency	0.01	Hz
50008	50007	2	3,4,5,6	171	System A average delta voltage	0.1	V

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
50010	50009	3	1,2	10202	Operation modes 13280 = CB A request 13264 = Unloading CB A 13210 = CB A Dead bus closure 13260 = Synchronization CB A 13205 = Mains settling time running 13257 = Open CB A 13279 = Synchronization network close CB A 13265 = Synchronization PERMISSIVE 13266 = Synchronization CHECK 13267 = Synchronization OFF 13286 = Synchronization segments close CB A		
50011	50010	3	3,4,5,6	135	System A total active power	1	W
50013	50012	4	1,2	10107	Discrete outputs 1 to 6		
					Relay-Output 1 (inverted)	Mask: 8000h	Bit
					Relay-Output 2	Mask: 4000h	Bit
					Relay-Output 3	Mask: 2000h	Bit
					Relay-Output 4	Mask: 1000h	Bit
					Relay-Output 5	Mask: 0800h	Bit
					Relay-Output 6	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
					internal	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
50014	50013	4	3,4,5,6	185	System A current average	0.001	A
50016	50015	5	1,2	8018	internal	Mask: 0001h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0004h	Bit
					internal	Mask: 0008h	Bit

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
					internal	Mask: 0010h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0040h	Bit
					internal	Mask: 0080h	Bit
					28.01 Command to CB-control 1 (OR'ed)	Mask: 0100h	Bit
					28.02 Command to CB-control 2 (OR'ed)	Mask: 0200h	Bit
					28.03 Command to CB-control 3 (OR'ed)	Mask: 0400h	Bit
					28.04 Command to CB-control 4 (OR'ed)	Mask: 0800h	Bit
					28.05 Command to CB-control 5 (OR'ed)	Mask: 1000h	Bit
					28.06 Command to CB-control 6 (OR'ed)	Mask: 2000h	Bit
					internal	Mask: 4000h	Bit
					internal	Mask: 8000h	Bit
50017	50016	5	3,4,5,6	111	System A current 1	0.001	A
50019	50018	6	1,2	10110	Battery voltage	0.1	V
50020	50019	6	3,4,5,6	112	System A current 2	0.001	A
50022	50021	7	1,2	10146	internal	Mask: 0001h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0004h	Bit
					11.07 Active second	Mask: 0008h	Bit
					11.06 Active minute	Mask: 0010h	Bit
					11.05 Active hour	Mask: 0020h	Bit
					11.04 Active day in month	Mask: 0040h	Bit
					11.03 Active weekday	Mask: 0080h	Bit
					11.02 Time 2 overrun	Mask: 0100h	Bit
					11.01 Time 1 overrun	Mask: 0200h	Bit
					internal	Mask: 0400h	Bit
					04.05 Acknowledge was executed	Mask: 0800h	Bit
					01.09 Shutdown alarm active (alarm C-F)	Mask: 1000h	Bit
					internal	Mask: 2000h	Bit
					internal	Mask: 4000h	Bit
					internal	Mask: 8000h	Bit
50023	50022	7	3,4,5,6	113	System A current 3	0.001	A
50025	50024	8	1,2	10107	00.41 LM Relay 1	Mask: 8000h	Bit
					00.42 LM Relay 2	Mask: 4000h	Bit

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
					00.43 LM Relay 3	Mask: 2000h	Bit
					00.44 LM Relay 4	Mask: 1000h	Bit
					00.45 LM Relay 5	Mask: 0800h	Bit
					00.46 LM Relay 6	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
					internal	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
50026	50025	8	3,4,5,6	108	System A voltage L1-L2	0.1	V
50028	50027	9	1,2	10140	00.01 LM Internal flag 1	Mask: 8000h	Bit
					00.02 LM Internal flag 2	Mask: 4000h	Bit
					00.03 LM Internal flag 3	Mask: 2000h	Bit
					00.04 LM Internal flag 4	Mask: 1000h	Bit
					00.05 LM Internal flag 5	Mask: 0800h	Bit
					00.06 LM Internal flag 6	Mask: 0400h	Bit
					00.07 LM Internal flag 7	Mask: 0200h	Bit
					00.08 LM Internal flag 8	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					00.15 LM External acknowledge	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
					00.16 LM Operation mode AUTOMATIC	Mask: 0004h	Bit
					00.17 LM Operation mode MANUAL	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
50029	50028	9	3,4,5,6	114	System A voltage L1-N	0.1	V
50031	50030	10	1,2	10148	internal	Mask: 8000h	Bit
					internal	Mask: 4000h	Bit

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
					internal	Mask: 2000h	Bit
					internal	Mask: 1000h	Bit
					04.04 Lamp test	Mask: 0800h	Bit
					01.10 Centralized alarms active (alarm B-F)	Mask: 0400h	Bit
					01.07 All alarm classes are active	Mask: 0200h	Bit
					01.08 Warning alarms active (alarm A, B)	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
					internal	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
50032	50031	10	3,4,5,6	109	System A voltage L2-L3	0.1	V
50034	50033	11	1,2	10150	internal	Mask: 8000h	Bit
					internal	Mask: 4000h	Bit
					internal	Mask: 2000h	Bit
					internal	Mask: 1000h	Bit
					internal	Mask: 0800h	Bit
					internal	Mask: 0400h	Bit
					00.30 LM Internal flag 9	Mask: 0200h	Bit
					00.31 LM Internal flag 10	Mask: 0100h	Bit
					00.32 LM Internal flag 11	Mask: 0080h	Bit
					00.33 LM Internal flag 12	Mask: 0040h	Bit
					00.34 LM Internal flag 13	Mask: 0020h	Bit
					00.35 LM Internal flag 14	Mask: 0010h	Bit
					00.36 LM Internal flag 15	Mask: 0008h	Bit
					00.37 LM Internal flag 16	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
50035	50034	11	3,4,5,6	115	System A voltage L2-N	0.1	V
50037	50036	12	1,2	10160	internal	Mask: 8000h	Bit
					internal	Mask: 4000h	Bit

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
					internal	Mask: 2000h	Bit
					internal	Mask: 1000h	Bit
					internal	Mask: 0800h	Bit
					internal	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
					internal	Mask: 0004h	Bit
					01.11 New alarm triggered	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
50038	50037	12	3,4,5,6	110	System A voltage L3-L1	0.1	V
50040	50039	13	1,2	10162	internal	Mask: 8000h	Bit
					internal	Mask: 4000h	Bit
					internal	Mask: 2000h	Bit
					internal	Mask: 1000h	Bit
					internal	Mask: 0800h	Bit
					internal	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
					00.38 LM Synchronization mode CHECK	Mask: 0004h	Bit
					00.39 LM Synchronization mode PERMISSIVE	Mask: 0002h	Bit
					00.40 LM Synchronization mode RUN	Mask: 0001h	Bit
50041	50040	13	3,4,5,6	116	System A voltage L3-N	0.1	V
50043	50042	14	1,2	10131	internal	Mask: 8000h	Bit
					internal	Mask: 4000h	Bit



Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
					internal	Mask: 2000h	Bit
					internal	Mask: 1000h	Bit
					internal	Mask: 0800h	Bit
					internal	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit
					Alarm class F latched	Mask: 0020h	Bit
					Alarm class E latched	Mask: 0010h	Bit
					Alarm class D latched	Mask: 0008h	Bit
					Alarm class C latched	Mask: 0004h	Bit
					Alarm class B latched	Mask: 0002h	Bit
					Alarm class A latched	Mask: 0001h	Bit
50044	50043	14	3,4,5,6	-	reserved	-	-
50046	50045	15	1,2	10132	State Discrete Input 8 latched	Mask: 8000h	Bit
					State Discrete Input 7 latched	Mask: 4000h	Bit
					State Discrete Input 6 latched	Mask: 2000h	Bit
					State Discrete Input 5 latched	Mask: 1000h	Bit
					State Discrete Input 4 latched	Mask: 0800h	Bit
					State Discrete Input 3 latched	Mask: 0400h	Bit
					State Discrete Input 2 latched	Mask: 0200h	Bit
					State Discrete Input 1 latched	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
					internal	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
50047	50046	15	3,4,5,6	173	System B average wye voltage	0.1	V
50049	50048	16	1,2	147	System B frequency	0.01	Hz
50050	50049	16	3,4,5,6	174	System B average delta voltage	0.1	V

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
50052	50051	17	1,2	-	reserved	-	-
50053	50052	17	3,4,5,6	-	reserved	-	-
50055	50054	18	1,2	-	reserved	-	-
50056	50055	18	3,4,5,6	-	reserved	-	-
50058	50057	19	1,2	10132	internal	Mask: 8000h	Bit
					internal	Mask: 4000h	Bit
					internal	Mask: 2000h	Bit
					internal	Mask: 1000h	Bit
					internal	Mask: 0800h	Bit
					internal	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
					internal	Mask: 0004h	Bit
					reserved	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
50059	50058	19	3,4,5,6	-	reserved	-	-
50061	50060	20	1,2	534	04.59 Remote control bit 16	Mask: 8000h	Bit
					04.58 Remote control bit 15	Mask: 4000h	Bit
					04.57 Remote control bit 14	Mask: 2000h	Bit
					04.56 Remote control bit 13	Mask: 1000h	Bit
					04.55 Remote control bit 12	Mask: 0800h	Bit
					04.54 Remote control bit 11	Mask: 0400h	Bit
					04.53 Remote control bit 10	Mask: 0200h	Bit
					04.52 Remote control bit 9	Mask: 0100h	Bit
					04.51 Remote control bit 8	Mask: 0080h	Bit
					04.50 Remote control bit 7	Mask: 0040h	Bit
					04.49 Remote control bit 6	Mask: 0020h	Bit
					04.48 Remote control bit 5	Mask: 0010h	Bit
					04.47 Remote control bit 4	Mask: 0008h	Bit

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
					04.46 Remote control bit 3	Mask: 0004h	Bit
					04.45 Remote control bit 2	Mask: 0002h	Bit
					04.44 Remote control bit 1	Mask: 0001h	Bit
50062	50061	20	3,4,5,6	-	reserved	-	-
50064	50063	21	1,2	10136	internal	Mask: 8000h	Bit
					internal	Mask: 4000h	Bit
					internal	Mask: 2000h	Bit
					internal	Mask: 1000h	Bit
					internal	Mask: 0800h	Bit
					internal	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					08.02 Battery overvoltage threshold 2	Mask: 0008h	Bit
					08.04 Battery undervoltage threshold 2	Mask: 0004h	Bit
					08.01 Battery overvoltage threshold 1	Mask: 0002h	Bit
					08.03 Battery undervoltage threshold 1	Mask: 0001h	Bit
50065	50064	21	3,4,5,6	118	System B voltage L1-L2	0.1	V
50067	50066	22	1,2	4139	02.03 System B voltage in range (Based on system B operating voltage window)	Mask: 8000h	Bit
					02.04 System B frequency in range (Based on system B operating frequency window)	Mask: 4000h	Bit
					02.05 System B voltage and frequency in range (Ready for operation, 02.03 AND 02.04 are TRUE)	Mask: 2000h	Bit
					02.09 Sytem A voltage in range (Based on system A voltage window)	Mask: 1000h	Bit
					internal	Mask: 0800h	Bit
					internal	Mask: 0400h	Bit
					02.10 System A frequency in range (Based on system A frequency window)	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
					internal	Mask: 0080h	Bit
					02.11 System A voltage and frequency in range (Ready for operation, 02.09 AND 02.10 are TRUE)	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
					internal	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
50068	50067	22	3,4,5,6	121	System B voltage L1-N	0.1	V
50070	50069	23	1,2	1791	internal	Mask: 8000h	Bit
					internal	Mask: 4000h	Bit
					internal	Mask: 2000h	Bit
					internal	Mask: 1000h	Bit
					internal	Mask: 0800h	Bit
					internal	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit
					02.12 System A phase rotation Counter Clock Wise (CCW, reverse, left turn)	Mask: 0080h	Bit
					02.13 System A phase rotation Clock Wise (CW, forward, right turn)	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
					internal	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
50071	50070	23	3,4,5,6	119	System B voltage L2-L3	0.1	V
50073	50072	24	1,2	1792	internal	Mask: 8000h	Bit
					internal	Mask: 4000h	Bit
					internal	Mask: 2000h	Bit
					internal	Mask: 1000h	Bit
					internal	Mask: 0800h	Bit

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
					internal	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit
					02.14 System B phase rotation Counter Clock Wise (CCW, reverse, left turn)	Mask: 0080h	Bit
					02.15 System B phase rotation Clock Wise (CW, forward, right turn)	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
					internal	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
50074	50073	24	3,4,5,6	122	System B voltage L2-N	0.1	V
50076	50075	25	1,2		internal	Mask: 8000h	Bit
					04.63 Synchr. Segm Closure Pr. is act	Mask: 4000h	Bit
					internal	Mask: 2000h	Bit
					02.28 Synch. Check Relay	Mask: 1000h	Bit
					02.29 Synch. Condition	Mask: 0800h	Bit
					02.30 Dead Bus Closure Condition	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
					internal	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
50077	50076	25	3,4,5,6	120	System B voltage L3-L1	0.1	V
50079	50078	26	1,2	10149	reserved	Mask: 8000h	Bit
					08.31 Timeout synchronization CB A	Mask: 4000h	Bit
					internal	Mask: 2000h	Bit

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
					internal	Mask: 1000h	Bit
					08.33 System A / System B phase rotation mismatch	Mask: 0800h	Bit
					reserved	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					08.17 Number of member mismatch	Mask: 0008h	Bit
					05.15 EEPROM corrupted	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
50080	50079	26	3,4,5,6	123	System B voltage L3-N	0.1	V
50082	50081	27	1,2	4153	reserved	Mask: 8000h	Bit
					reserved	Mask: 4000h	Bit
					04.29 Unloading CB A is active	Mask: 2000h	Bit
					reserved	Mask: 1000h	Bit
					04.23 Close command CB A is active	Mask: 0800h	Bit
					04.22 Open command CB A is active	Mask: 0400h	Bit
					04.21 Synchronization CB A procedure is active	Mask: 0200h	Bit
					reserved	Mask: 0100h	Bit
					reserved	Mask: 0080h	Bit
					reserved	Mask: 0040h	Bit
					04.11 Mains settling is active	Mask: 0020h	Bit
					24.39 Isolation switch is open	Mask: 0010h	Bit
					04.07 CB A is closed	Mask: 0008h	Bit
					04.04 Lamp test request	Mask: 0004h	Bit
					04.03 Operating mode MANUAL	Mask: 0002h	Bit
					04.01 Operating mode AUTOMATIC	Mask: 0001h	Bit
50083	50082	27	3,4	4154	02.23 System A is dead	Mask: 8000h	Bit
					02.24 System B is dead	Mask: 4000h	Bit
					02.25 Mains parallel operation	Mask: 2000h	Bit

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
					System B mains connected	Mask: 1000h	Bit
					System A mains connected	Mask: 0800h	Bit
					internal	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
					04.61 Synchronous mains closure procedure is active	Mask: 0004h	Bit
					04.62 Dead bus closure procedure is active	Mask: 0002h	Bit
					Increment close counter CB A	Mask: 0001h	Bit
50084	50083	27	5,6	4155	System B phase rotation CCW (ToolKit)	Mask: 8000h	Bit
					System B phase rotation CW (ToolKit)	Mask: 4000h	Bit
					System A phase rotation CCW (ToolKit)	Mask: 2000h	Bit
					System A phase rotation CW (ToolKit)	Mask: 1000h	Bit
					internal	Mask: 0800h	Bit
					internal	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					Syst. A phase rotation CW (for ToolKit)	Mask: 0008h	Bit
					Syst. A phase rotation CCW (for ToolKit)	Mask: 0004h	Bit
50085	50084	28	1,2	10133	internal	Mask: 8000h	Bit
					internal	Mask: 4000h	Bit
					internal	Mask: 2000h	Bit
					internal	Mask: 1000h	Bit

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
					internal	Mask: 0800h	Bit
					internal	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					reserved	Mask: 0100h	Bit
					reserved	Mask: 0080h	Bit
					08.07 CB A close not successful	Mask: 0040h	Bit
					08.08 CB A open not successful	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
					internal	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					08.18 CANopen error interface 1	Mask: 0001h	Bit
50086	50085	28	3,4	10191	internal	Mask: 8000h	Bit
					internal	Mask: 4000h	Bit
					internal	Mask: 2000h	Bit
					24.45 Flag 5 LS 5	Mask: 1000h	Bit
					24.44 Flag 4 LS 5	Mask: 0800h	Bit
					24.43 Flag 3 LS 5	Mask: 0400h	Bit
					24.42 Flag 2 LS 5	Mask: 0200h	Bit
					24.41 Flag 1 LS 5	Mask: 0100h	Bit
					24.38 Load transfer to system B	Mask: 0080h	Bit
					24.37 Load transfer to system A	Mask: 0040h	Bit
					reserved	Mask: 0020h	Bit
					reserved	Mask: 0010h	Bit
					24.34 Enable to close CB A	Mask: 0008h	Bit
					24.33 Immediate open CB A	Mask: 0004h	Bit
					24.32 Open CB A	Mask: 0002h	Bit
					24.31 Enable mains decoupling	Mask: 0001h	Bit
50087	50086	28	5,6	10138	internal	Mask: 8000h	Bit
					internal	Mask: 4000h	Bit
					internal	Mask: 2000h	Bit
					internal	Mask: 1000h	Bit
					internal	Mask: 0800h	Bit
					06.21 System B phase rotation	Mask: 0400h	Bit



Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
					internal	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
					internal	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
50088	50087	29	1,2	10135	07.06 System A overfrequency threshold 1	Mask: 8000h	Bit
					07.07 System A overfrequency threshold 2	Mask: 4000h	Bit
					07.08 System A underfrequency threshold 1	Mask: 2000h	Bit
					07.09 System A underfrequency threshold 2	Mask: 1000h	Bit
					07.10 System A overvoltage threshold 1	Mask: 0800h	Bit
					07.11 System A overvoltage threshold 2	Mask: 0400h	Bit
					07.12 System A undervoltage threshold 1	Mask: 0200h	Bit
					07.13 System A undervoltage threshold 2	Mask: 0100h	Bit
					07.14 System A phase shift	Mask: 0080h	Bit
					07.25 System A decoupling	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					07.26 System A voltage asymmetry (with negative sequence)	Mask: 0008h	Bit
					07.05 System A phase rotation	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
50089	50088	29	3,4	4138	internal	Mask: 8000h	Bit
					internal	Mask: 4000h	Bit
					internal	Mask: 2000h	Bit
					internal	Mask: 1000h	Bit
					internal	Mask: 0800h	Bit
					internal	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit


Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
					internal	Mask: 0100h	Bit
					07.15 df/dt (ROCOF)	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit
					07.28 System A time-dependent voltage	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					07.27 System A voltage increase	Mask: 0008h	Bit
					08.36 CB A unload mismatch	Mask: 0004h	Bit
					07.29 QV Monitoring step 1 tripped	Mask: 0002h	Bit
					07.30 QV Monitoring step 2 tripped	Mask: 0001h	Bit
50090	50089	29	5,6	-	internal	Mask: 8000h	Bit
					internal	Mask: 4000h	Bit
					internal	Mask: 2000h	Bit
					internal	Mask: 1000h	Bit
					internal	Mask: 0800h	Bit
					internal	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
					internal	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit

## 9.2.2 CANopen

### 9.2.2.1 Protocol 6003 (LS-5 Communication)

#### General information

The LS-5 communication message contains all data, which is required to operate the LS-5 system. This communication protocol works parallel to the load share communication.

In order to lower the bus load, the messages are divided into "fast", "normal", and "slow" refreshed data. The mux is identified accordingly with "F", "N", and "S" (refer to the following tables). The load share message contains one fast, two normal, and four slow messages, which are made up as in  "Load share bus communication" on page 260.

**Timing**

The time interval between two fast messages ( $T_{Fast}$ , i.e. the time for refreshing a fast message) is configured with the parameter "Transfer rate LS fast message" (parameter 9921 ↗ p. 122). The time intervals between refreshing a normal or slow messages depend on this parameter as well according to the following sequence:

- $S0 - F - N0 - F - N1 - F - S1 - F - N0 - F - N1 - F - S2 - F - N0 - F - N1 - F - S3 - F - N0 - F - N1 - F$
- $T_{Fast}$  = time interval between refreshing the fast message
- $T_{Normal}$  = time interval between refreshing a normal message =  $3 \times T_{Fast}$
- $T_{Slow}$  = time interval between refreshing a slow message =  $12 \times T_{Fast}$

**Example**

- The parameter "Transfer rate LS fast message" (parameter 9921 ↗ p. 122) is configured to "0.10 s".
- The sequence of the sent messages for  $T_{Fast} = 100$  ms (i.e. 0.10 s) is shown in ↗ "Load share bus communication" on page 260.
- This means that a new message is sent every 50 ms.

Time [ms]	0	50	100	150	200	250	300	350	400	450	500	550
Sent message	S0	F	N0	F	N1	F	S1	F	N0	F	N1	F
Mux #	0	3	1	3	2	3	4	3	1	3	2	3

Time [ms]	600	650	700	750	800	850	900	950	1000	1050	1100	1150
Sent message	S2	F	N0	F	N1	F	S3	F	N0	F	N1	F
Mux #	5	3	1	3	2	3	6	3	1	3	2	3

**CAN bus load share line**

The maximum length of the CAN bus load share line depends on this parameter as well. The values in ↗ "Load share line - max. length (32 participants)" Table on page 259 are valid for 32 participants and a bus load of approximately 40 %<sup>1</sup>.

$T_{Fast}$ [ms]	$T_{Normal}$ [ms]	$T_{Slow}$ [ms]	Baud rate [kBaud]	Distance [m]
100	300	1200	250	250
200	600	2400	125	500
300	900	3800	50	1000

Table 42: Load share line - max. length (32 participants)

The maximum length of the CAN bus load share line depends on this parameter as well. The values in ↗ "Load share line - max. length (48 participants)" Table on page 260 are valid for 48 participants and a bus load of approx. 40 %<sup>1</sup>.

$T_{Fast}$ [ms]	$T_{Normal}$ [ms]	$T_{Slow}$ [ms]	Baud rate [kBaud]	Distance [m]
100	300	1200	250	250
200	600	2400	125	500

Table 43: Load share line - max. length (48 participants)



<sup>1</sup> This approach incorporates two transmit PDO (remote control bits) by a PLC on CAN interface 3 with a refresh time same as the configured  $T_{Fast}$  - setting in the easYgen / LS-5.

## Correlation of protocols

Parallel to the load share message protocol the easYgen also handles the LS-5 communication protocol.

	easYgen	LS-5
Load Share Message (protocol 6000)	Transmit / Receive	Receive
LS-5 Communication (protocol 6003)	Receive	Transmit / Receive

## Load share bus communication

Load share bus communication - "fast" refreshed data				
Mux	Byte	Bit	Function	Remark
F	0		3	Mux identifier
	1		Frequency of connected mains or frequency to which is to synchronize	Frequency in 00.00 Hz
	2			
	3		Phase angle between system A and B	Phase angle [1/10°]
	4			Phase angle compensation is incorporated
	5	0	System A in range	
		1	System B in range	
		2	System A is black	
		3	System B is black	
		4	Breaker 1 closed	
		5	Isolation switch or breaker 2 closed	
		6	Synchronous networks detected	Between system A and B
		7	Not used	
	6	1	Wish to open the breaker	
		2	Wish to close the breaker	

Load share bus communication - "fast" refreshed data				
Mux	Byte	Bit	Function	Remark
		3	Wish is for breaker 0 = Breaker 1 1 = Breaker 2	
		4	Execution of wish	
		5	Variable system 0 = System A 1 = System B	
		6	Synchronizing mode 0 = Slip frequency 1 = Phase matching	
		7	Not used	
	7		Not used	

Load share bus communication - "normal" refreshed data				
Mux	Byte	Bit	Function	Remark
N0	0		1	Mux identifier
	1		Voltage setpoint	Voltage of the fixed system in the percentage format (000.00 %) of the rated voltage setting
	2			
	3		Active power system A	Long [W]
	4			
	5			
	6			
	7		Not used	

Load share bus communication - "normal" refreshed data				
Mux	Byte	Bit	Function	Remark
N1	0		2	Mux identifier
	1		Not used	
	2	0	Logic bit 1	
		1	Logic bit 2	
		2	Logic bit 3	
		3	Logic bit 4	
		4	Logic bit 5	
		5	Mains settling active	
		6-7	Not used	

## Load share bus communication - "normal" refreshed data

Mux	Byte	Bit	Function	Remark
	3		Reactive power system A	Long [var]
	4			
	5			
	6			
	7		Not used	

## Load share bus communication - "slow" refreshed data

Mux	Byte	Bit	Function	Remark
S0	0		0	Mux identifier
	1		Protocol-Identifier	6003
	2			
	3		Not used	
	4			
	5			
	6			
	7		Not used	
S1	0		4	Mux identifier
	1	0-1	Mains wiring 0 = No mains wiring 1 = Mains wiring at system A 2 = Mains wiring at system B 3 = Mains wiring at isolation switch	
		2-3	Isolation switch wiring 0 = Off 1 = System A 2 = System B 3 = Not used	
		4-6	Visualization message definition 0 = No valid information 1 = Average delta voltage of mains (visualization message 1) and average wye voltage of mains (visualization message 2)	
		7	Mains power measurement valid	This means the power of system A is used for mains import/export control
	2	0-4	Segment number isolation switch	Max. 32 nodes possible
		5	Extended bit for segment number isolation switch	Max. 64 nodes possible
		6-7	Not used	

Load share bus communication - "slow" refreshed data				
Mux	Byte	Bit	Function	Remark
	3		Not used	
	4			
	5			
	6			
	7		Not used	
S2	0		5	Mux identifier
	1	0-4	Segment number system A	1 to 32
		5	Extended bit for segment number system A	Max. 64 nodes possible
		6-7	Not used	
	2	0-4	Segment number system B	Max. 32 nodes possible
		5	Extended bit for segment number system B	Max. 64 nodes possible
		6-7	Not used	
	3		Visualization message 1	Dependent on visualization message defined in mux "S1"
	4			
	5			
	6			
	7		Not used	
S3	0		6	Mux identifier
	1		Not used	
	2		Not used	
	3		Visualization message 2	Dependent of visualization message defined in "Slow 1"
	4			
	5			
	6			
	7		Not used	

## 9.2.3 Modbus

### 9.2.3.1 Data Protocol 5300 (Basic Visualization)

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
450001	450000		Protocol-ID, always 5300		--
450002	450001	3181	Scaling Power (16 bits) Exponent 10x W (5;4;3;2)		

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
450003	450002	3182	Scaling Volts (16 bits) Exponent 10x V (2;1;0;-1)		
450004	450003	3183	Scaling Amps (16 bits) Exponent 10x A (0;-1)		
450005	450004		reserved		
450006	450005		reserved		
450007	450006		reserved		
450008	450007		reserved		
450009	450008		reserved		
<b>AC System A Values</b>					
450010	450009	144	System A frequency	0.01	Hz
450011	450010	246	Total system A active power	scaled defined by index 3181 (modicon Address 450002)	W
450012	450011	247	Total system A reactive power	scaled defined by index 3181 (modicon Address 450002)	var
450013	450012	160	System A power factor	0.001	
450014	450013	248	System A voltage L1-L2	scaled defined by index 3182 (modicon Address 450003)	V
450015	450014	249	System A voltage L2-L3	scaled defined by index 3182 (modicon Address 450003)	V
450016	450015	250	System A voltage L3-L1	scaled defined by index 3182 (modicon Address 450003)	V
450017	450016	251	System A voltage L1-N	scaled defined by index 3182 (modicon Address 450003)	V
450018	450017	252	System A voltage L2-N	scaled defined by index 3182 (modicon Address 450003)	V
450019	450018	253	System A voltage L3-N	scaled defined by index 3182 (modicon Address 450003)	V
450020	450019	255	System A current 1	scaled defined by index 3183 (modicon Address 450004)	A
450021	450020	256	System A current 2	scaled defined by index 3183 (modicon Address 450004)	A
450022	450021	257	System A current 3	scaled defined by index 3183 (modicon Address 450004)	A



Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
450023	450022		reserved		
450024	450023		reserved		
450025	450024		reserved		
450026	450025		reserved		
450027	450026		reserved		
450028	450027		reserved		
450029	450028		reserved		
<b>AC System B Values</b>					
450030	450029	147	System B frequency	0.01	Hz
450031	450030	258	Total system B active power	scaled defined by index 3181 (modicon Address 450002)	W
450032	450031	259	Total system B reactive power	scaled defined by index 3181 (modicon Address 450002)	var
450033	450032	208	System B power factor	0.001	
450034	450033	260	System B voltage L1-L2	scaled defined by index 3182 (modicon Address 450003)	V
450035	450034	261	System B voltage L2-L3	scaled defined by index 3182 (modicon Address 450003)	V
450036	450035	262	System B voltage L3-L1	scaled defined by index 3182 (modicon Address 450003)	V
450037	450036	263	System B voltage L1-N	scaled defined by index 3182 (modicon Address 450003)	V
450038	450037	264	System B voltage L2-N	scaled defined by index 3182 (modicon Address 450003)	V
450039	450038	265	System B voltage L3-N	scaled defined by index 3182 (modicon Address 450003)	V
450040	450039		reserved		
450041	450040		reserved		
450042	450041		reserved		
450043	450042		reserved		
450044	450043		reserved		
<b>AC System Values</b>					
450045	450044		reserved		

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
450046	450045		reserved		
450047	450046		reserved		
450048	450047		reserved		
450049	450048		reserved		
DC Analogue Values					
450050	450049	10110	Battery voltage	0.1	V
450051	450050		reserved		
450052	450051		reserved		
450053	450052		reserved		
450054	450053		reserved		
450055	450054		reserved		
450056	450055		reserved		
450057	450056		reserved		
450058	450057		reserved		
450059	450058		reserved		
Control And Status					
450060	450059	10202	State display	Please refer to ❧ Chapter 9.4.2 “Status Messages” on page 329 for an ID description.	(enum.)
450061	450060	8018	Visualization remote and CB-Control		
			internal	Mask: 0001h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			28.01 Command to CB-control 1 (OR'ed)	Mask: 0100h	Bit
			28.02 Command to CB-control 2 (OR'ed)	Mask: 0200h	Bit
			28.03 Command to CB-control 3 (OR'ed)	Mask: 0400h	Bit
			28.04 Command to CB-control 4 (OR'ed)	Mask: 0800h	Bit
			28.05 Command to CB-control 5 (OR'ed)	Mask: 1000h	Bit
			28.06 Command to CB-control 6 (OR'ed)	Mask: 2000h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450062	450061	10146	LogicManagerBits		
			internal	Mask: 0001h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0004h	Bit
			11.07 Active second	Mask: 0008h	Bit
			11.06 Active minute	Mask: 0010h	Bit
			11.05 Active hour	Mask: 0020h	Bit
			11.04 Active day in month	Mask: 0040h	Bit
			11.03 Active weekday	Mask: 0080h	Bit
			11.02 Time 2 overrun	Mask: 0100h	Bit
			11.01 Time 1 overrun	Mask: 0200h	Bit
			internal	Mask: 0400h	Bit
			04.05 Acknowledge was executed	Mask: 0800h	Bit
			01.09 Shutdown alarms are active (alarm class C-F)	Mask: 1000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450063	450062	10147	LogicManagerBits1		
			internal	Mask: 0001h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0200h	Bit
			00.46 LM Relay 6	Mask: 0400h	Bit
			internal	Mask: 0800h	Bit
			00.44 LM Relay 4	Mask: 1000h	Bit
			00.43 LM Relay 3	Mask: 2000h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			00.42 LM Relay 2	Mask: 4000h	Bit
			00.41 LM Relay 1	Mask: 8000h	Bit
450064	450063	10140	LogicManagerBits2		
			internal	Mask: 0001h	Bit
			00.17 LM Operation mode MANUAL	Mask: 0002h	Bit
			00.16 LM Operation mode AUTOMATIC	Mask: 0004h	Bit
			internal	Mask: 0008h	Bit
			00.15 LM External acknowledge	Mask: 0010h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			00.08 LM Internal flag 8	Mask: 0100h	Bit
			00.07 LM Internal flag 7	Mask: 0200h	Bit
			00.06 LM Internal flag 6	Mask: 0400h	Bit
			00.05 LM Internal flag 5	Mask: 0800h	Bit
			00.04 LM Internal flag 4	Mask: 1000h	Bit
			00.03 LM Internal flag 3	Mask: 2000h	Bit
			00.02 LM Internal flag 2	Mask: 4000h	Bit
			00.01 LM Internal flag 1	Mask: 8000h	Bit
450065	450064	10148	LogicManagerBits3		
			internal	Mask: 0001h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			01.08 Warning alarms are active (alarm class A, B)	Mask: 0100h	Bit
			01.07 All alarm classes are active	Mask: 0200h	Bit
			01.10 Centralized alarms are active (alarm class B-F)	Mask: 0400h	Bit
			04.04 Lamp test	Mask: 0800h	Bit
			internal	Mask: 1000h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			internal	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450066	450065	10150	LogicManagerBits4		
			internal	Mask: 0001h	Bit
			internal	Mask: 0002h	Bit
			00.37 LM Internal flag 16	Mask: 0004h	Bit
			00.36 LM Internal flag 15	Mask: 0008h	Bit
			00.35 LM Internal flag 14	Mask: 0010h	Bit
			00.34 LM Internal flag 13	Mask: 0020h	Bit
			00.33 LM Internal flag 12	Mask: 0040h	Bit
			00.32 LM Internal flag 11	Mask: 0080h	Bit
			00.31 LM Internal flag 10	Mask: 0100h	Bit
			00.30 LM Internal flag 9	Mask: 0200h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450067	450066	10162	LogicManagerBits6		
			00.40 LM Synchronization mode RUN	Mask: 0001h	Bit
			00.39 LM Synchronization mode PERMISSIVE	Mask: 0002h	Bit
			00.38 LM Synchronization mode CHECK	Mask: 0004h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 2000h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450068	450067	10136	Monitoring analog inputs		
			08.03 Battery undervoltage threshold 1	Mask: 0001h	Bit
			08.01 Battery overvoltage threshold 1	Mask: 0002h	Bit
			08.04 Battery undervoltage threshold 2	Mask: 0004h	Bit
			08.02 Battery overvoltage threshold 2	Mask: 0008h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450069	450068	4139	Monitoring operation windows		
			internal	Mask: 0001h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0020h	Bit
			02.11 System A voltage and frequency in range (Ready for operation, 02.09 AND 02.10 are TRUE)	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0100h	Bit
			02.10 System A frequency in range (Based on System B frequency window)	Mask: 0200h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0800h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			02.09 Sytem A voltage in range (Based on System B voltage window)	Mask: 1000h	Bit
			02.05 System B voltage and frequency in range (Ready for operation, 02.03 AND 02.04 are TRUE)	Mask: 2000h	Bit
			02.04 System B frequency in range (Based on System A Operating frequency window)	Mask: 4000h	Bit
			02.03 System B voltage in range (Based on System A Operating voltage window)	Mask: 8000h	Bit
450070	450069	1791	Monitoring System A		
			internal	Mask: 0001h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0020h	Bit
			02.13 System A phase rotation Clock Wise (CW, forward, right turn)	Mask: 0040h	Bit
			02.12 System A phase rotation Counter Clock Wise (CCW, reverse, left turn)	Mask: 0080h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450071	450070	1792	Monitoring System B		
			internal	Mask: 0001h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0010h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			internal	Mask: 0020h	Bit
			02.15 System B phase rotation Clock Wise (CW, forward, right turn)	Mask: 0040h	Bit
			02.14 System B phase rotation Counter Clock Wise (CCW, reverse, left turn)	Mask: 0080h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450072	450071		reserved		
450073	450072	4153	ControlBits1		
			04.01 Operating mode AUTOMATIC	Mask: 0001h	Bit
			04.03 Operating mode MANUAL	Mask: 0002h	Bit
			04.04 Lamp test request	Mask: 0004h	Bit
			04.07 CB A is closed	Mask: 0008h	Bit
			24.39 Isolation switch is open	Mask: 0010h	Bit
			04.11 Mains settling is active	Mask: 0020h	Bit
			reserved	Mask: 0040h	Bit
			reserved	Mask: 0080h	Bit
			reserved	Mask: 0100h	Bit
			04.21 Synchronization CB A procedure is active	Mask: 0200h	Bit
			04.22 Open command CB A is active	Mask: 0400h	Bit
			04.23 Close command CB A is active	Mask: 0800h	Bit
			reserved	Mask: 1000h	Bit
			04.29 Unloading CB A is active	Mask: 2000h	Bit
			reserved	Mask: 4000h	Bit
			reserved	Mask: 8000h	Bit
450074	450073	4154	ControlBits2		
			internal	Mask: 0001h	Bit
			04.62 Dead bus closure procedure is active	Mask: 0002h	Bit



Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			04.61 Synchronous mains closure procedure is active	Mask: 0004h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0400h	Bit
			System A mains connected	Mask: 0800h	Bit
			System B mains connected	Mask: 1000h	Bit
			02.25 Mains parallel operation	Mask: 2000h	Bit
			02.24 System B is dead	Mask: 4000h	Bit
			02.23 System A is dead	Mask: 8000h	Bit
450075	450074	4155	ControlBits3		
			internal	Mask: 0001h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0800h	Bit
			System A Phase rotation CW (ToolKit)	Mask: 1000h	Bit
			System A Phase rotation CCW (ToolKit)	Mask: 2000h	Bit
450076	450075	10191	LogicManagerBits10		
			24.31 Enable mains decoupling	Mask: 0001h	Bit
			24.32 Open CB A	Mask: 0002h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			24.33 Immediate open CB A	Mask: 0004h	Bit
			24.34 Enable to close CB A	Mask: 0008h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0020h	Bit
			24.37 Load transfer to system A	Mask: 0040h	Bit
			24.38 Load transfer to system B	Mask: 0080h	Bit
			24.41 Flag 1 LS 5	Mask: 0100h	Bit
			24.42 Flag 2 LS 5	Mask: 0200h	Bit
			24.43 Flag 3 LS 5	Mask: 0400h	Bit
			24.44 Flag 4 LS 5	Mask: 0800h	Bit
			24.45 Flag 5 LS 5	Mask: 1000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450077	450076	10138	Monitoring System B		
			internal	Mask: 0001h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0200h	Bit
			06.21 System B phase rotation	Mask: 0400h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450078	450077	10135	Monitoring System A		
			internal	Mask: 0001h	Bit
			internal	Mask: 0002h	Bit
			07.05 System A phase rotation	Mask: 0004h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			07.26 System A voltage asymmetry (with negative sequence)	Mask: 0008h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0020h	Bit
			07.25 System A decoupling	Mask: 0040h	Bit
			07.14 System A phase shift	Mask: 0080h	Bit
			07.13 System A undervoltage threshold 2	Mask: 0100h	Bit
			07.12 System A undervoltage threshold 1	Mask: 0200h	Bit
			07.11 System A overvoltage threshold 2	Mask: 0400h	Bit
			07.10 System A overvoltage threshold 1	Mask: 0800h	Bit
			07.09 System A underfrequency threshold 2	Mask: 1000h	Bit
			07.08 System A underfrequency threshold 1	Mask: 2000h	Bit
			07.07 System A overfrequency threshold 2	Mask: 4000h	Bit
			07.06 System A overfrequency threshold 1	Mask: 8000h	Bit
450079	450078	4138	Monitoring System A		
			07.30 QV Monitoring step 2 tripped	Mask: 0001h	Bit
			07.29 QV Monitoring step 1 tripped	Mask: 0002h	Bit
			08.36 CB A unload mismatch	Mask: 0004h	Bit
			07.27 System A voltage increase	Mask: 0008h	Bit
			internal	Mask: 0010h	Bit
			07.28 System A time-dependent voltage	Mask: 0020h	Bit
			intern	Mask: 0040h	Bit
			07.15 df/dt (ROCOF)	Mask: 0080h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450080	450079	534	Visualization remote and CB-Control with CAN input		
			04.44 Remote control bit 1	Mask: 0001h	Bit
			04.45 Remote control bit 2	Mask: 0002h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			04.46 Remote control bit 3	Mask: 0004h	Bit
			04.47 Remote control bit 4	Mask: 0008h	Bit
			04.48 Remote control bit 5	Mask: 0010h	Bit
			04.49 Remote control bit 6	Mask: 0020h	Bit
			04.50 Remote control bit 7	Mask: 0040h	Bit
			04.51 Remote control bit 8	Mask: 0080h	Bit
			04.52 Remote control bit 9	Mask: 0100h	Bit
			04.53 Remote control bit 10	Mask: 0200h	Bit
			04.54 Remote control bit 11	Mask: 0400h	Bit
			04.55 Remote control bit 12	Mask: 0800h	Bit
			04.56 Remote control bit 13	Mask: 1000h	Bit
			04.57 Remote control bit 14	Mask: 2000h	Bit
			04.58 Remote control bit 15	Mask: 4000h	Bit
			04.59 Remote control bit 16	Mask: 8000h	Bit
450081	450080	4150	internal	Mask: 0001h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0200h	Bit
			02.30 Dead Bus closure condition	Mask: 0400h	Bit
			02.29 Sync. condition	Mask: 0800h	Bit
			02.28 Sync. check relay	Mask: 1000h	Bit
			internal	Mask: 2000h	Bit
			04.63 Synchronous segment closure procedure is active	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450082	450081		reserved		
450083	450082		reserved		
450084	450083		reserved		
450085	450084		reserved		

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
450086	450085		reserved		
450087	450086		reserved		
450088	450087		reserved		
450089	450088		reserved		
450090	450089		reserved		
<b>Discrete Outputs</b>					
450091	450090	10107	Discrete outputs 1 to 6		
			Relay-Output 1 (inverted)	Mask: 8000h	Bit
			Relay-Output 2	Mask: 4000h	Bit
			Relay-Output 3	Mask: 2000h	Bit
			Relay-Output 4	Mask: 1000h	Bit
			Relay-Output 5	Mask: 0800h	Bit
			Relay-Output 6	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450092	450091		reserved		
450093	450092		reserved		
<b>Alarm Management</b>					
450094	450093	10131	Alarm class latched		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			Alarm class F latched	Mask: 0020h	Bit
			Alarm class E latched	Mask: 0010h	Bit
			Alarm class D latched	Mask: 0008h	Bit
			Alarm class C latched	Mask: 0004h	Bit
			Alarm class B latched	Mask: 0002h	Bit
			Alarm class A latched	Mask: 0001h	Bit
450095	450094	10160	LogicManagerBits5		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			01.11 New alarm triggered	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450096	450095	10149	Alarm2		
			reserved	Mask: 8000h	Bit
			08.31 Timeout synchronization CB A	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			08.33 System A / System B phase rotation mismatch	Mask: 0800h	Bit
			reserved	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0100h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			08.17 Number of member mismatch	Mask: 0008h	Bit
			05.15 EEPROM corrupted	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450097	450096	10133	Alarm1		
			internal	Mask: 8000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0200h	Bit
			reserved	Mask: 0100h	Bit
			reserved	Mask: 0080h	Bit
			08.07 CB A close not successful	Mask: 0040h	Bit
			08.08 CB A open not successful	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			08.18 CANopen error interface 1	Mask: 0001h	Bit
450098	450097		reserved		
450099	450098		reserved		
450100	450099		reserved		
450101	450100		reserved		
450102	450101		reserved		
450103	450102		reserved		
450104	450103		reserved		
450105	450104		reserved		
450106	450105		reserved		
450107	450106		reserved		

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
450108	450107		reserved		
<b>System A</b>					
450109	450108		reserved		
450110	450109		reserved		
<b>System B</b>					
450111	450110		reserved		
450112	450111		reserved		
<b>Discrete Inputs</b>					
450113	450112	10132	Alarms discrete inputs 1 latched (unacknowledged)		
		10608	State Discrete Input 8	Mask: 8000h	Bit
		10607	State Discrete Input 7	Mask: 4000h	Bit
		10605	State Discrete Input 6	Mask: 2000h	Bit
		10604	State Discrete Input 5	Mask: 1000h	Bit
		10603	State Discrete Input 4	Mask: 0800h	Bit
		10602	State Discrete Input 3	Mask: 0400h	Bit
		10601	State Discrete Input 2	Mask: 0200h	Bit
		10600	State Discrete Input 1	Mask: 0100h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0004h	Bit
			internal	Mask: 0002h	Bit
			internal	Mask: 0001h	Bit
450114	450113		reserved		
450115	450114		reserved		
450116	450115		reserved		
450117	450116		reserved		
<b>DC Analogue Values Wirebreak</b>					
450118	450117	10137	Alarms analog inputs wire break latched (unacknowledged)		
			internal	Mask: 0001h	Bit
			internal	Mask: 0002h	Bit



Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			internal	Mask: 0004h	Bit
			internal	Mask: 0008h	Bit
			internal	Mask: 0010h	Bit
			internal	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			internal	Mask: 0100h	Bit
			internal	Mask: 0200h	Bit
			internal	Mask: 0400h	Bit
			internal	Mask: 0800h	Bit
			internal	Mask: 1000h	Bit
			internal	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450119	450118		reserved		
450120	450119		reserved		
<b>easYgen-3000 Controls</b>					
450121	450120		Status of Device 1		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450122	450121		Status of Device 2		

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450123	450122		Status of Device 3		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450124	450123		Status of Device 4		
			Generator voltage and frequency ok	Mask: 0001h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450125	450124		Status of Device 5		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450126	450125		Status of Device 6		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450127	450126		Status of Device 7		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
450128	450127		internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
			Status of Device 8		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450129	450128		Status of Device 9		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450130	450129		Status of Device 10		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450131	450130		Status of Device 11		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450132	450131		Status of Device 12		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450133	450132		Status of Device 13		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450134	450133		Status of Device 14		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450135	450134		Status of Device 15		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450136	450135		Status of Device 16		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit



Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450137	450136		Status of Device 17		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450138	450137		Status of Device 18		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450139	450138		Status of Device 19		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450140	450139		Status of Device 20		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450141	450140		Status of Device 21		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450142	450141		Status of Device 22		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450143	450142		Status of Device 23		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450144	450143		Status of Device 24		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450145	450144		Status of Device 25		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450146	450145		Status of Device 26		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450147	450146		Status of Device 27		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450148	450147		Status of Device 28		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450149	450148		Status of Device 29		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450150	450149		Status of Device 30		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450151	450150		Status of Device 31		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit
			internal	Mask: 8000h	Bit
450152	450151		Status of Device 32		
			Generator voltage and frequency ok	Mask: 0001h	Bit
			Busbar voltage and frequency ok	Mask: 0002h	Bit
			Mains voltage and frequency ok	Mask: 0004h	Bit
			4th system voltage and frequency ok	Mask: 0008h	Bit
			Busbar 1 dead busbar detection	Mask: 0010h	Bit
			Busbar 2 dead busbar detection	Mask: 0020h	Bit
			internal	Mask: 0040h	Bit
			internal	Mask: 0080h	Bit
			29.01 Command to CB-control 1	Mask: 0100h	Bit
			29.02 Command to CB-control 2	Mask: 0200h	Bit
			29.03 Command to CB-control 3	Mask: 0400h	Bit
			29.04 Command to CB-control 4	Mask: 0800h	Bit
			29.05 Command to CB-control 5	Mask: 1000h	Bit
			29.06 Command to CB-control 6	Mask: 2000h	Bit
			internal	Mask: 4000h	Bit



Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
			internal	Mask: 8000h	Bit
450153	450152		reserved		
450154	450153		reserved		
450155	450154		reserved		
450156	450155		reserved		
450157	450156		reserved		
450158	450157		reserved		
450159	450158		reserved		
450160	450159		reserved		
450161	450160		reserved		
450162	450161		reserved		
450163	450162		reserved		
450164	450163		reserved		
450165	450164		reserved		
450166	450165		reserved		
450167	450166		reserved		
450168	450167		reserved		
450169	450168		reserved		
450170	450169		reserved		
450171	450170		reserved		
450172	450171		reserved		
450173	450172		reserved		
450174	450173		reserved		
450175	450174		reserved		
450176	450175		reserved		
450177	450176		reserved		
450178	450177		reserved		
450179	450178		reserved		
450180	450179		reserved		
450181	450180		reserved		
450182	450181		reserved		
450183	450182		reserved		
450184	450183		reserved		
AC System A (Long - 32 bits)					
450185	450184	135	Total system A active power	1	W

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
450187	450186	136	Total system A reactive power	1	var
450189	450188	137	Total system A apparent power	1	VA
450191	450190	170	Av. system A wye-voltage	0.1	V
450193	450192	171	Av. system A delta-voltage	0.1	V
450195	450194	185	Av. system A current	0.001	A
450197	450196	111	System A current 1	0.001	A
450199	450198	112	System A current 2	0.001	A
450201	450200	113	System A current 3	0.001	A
450203	450202	108	System A voltage L1-L2	0.1	V
450205	450204	109	System A voltage L2-L3	0.1	V
450207	450206	110	System A voltage L3-L1	0.1	V
450209	450208	114	System A voltage L1-N	0.1	V
450211	450210	115	System A voltage L2-N	0.1	V
450213	450212	116	System A voltage L3-N	0.1	V
450215	450214	125	System A active power L1-N	1	W
450217	450216	126	System A active power L2-N	1	W
450219	450218	127	System A active power L3-N	1	W
450221	450220		reserved		
450223	450222		reserved		
450225	450224		reserved		
450227	450226		reserved		
450229	450228		reserved		
<b>AC System B (Long - 32 bits)</b>					
450231	450230	140	Total system B active power	1	W
450233	450232	150	Total system B reactive power	1	var
450235	450234	173	Av. system B wye-voltage	0.1	V
450237	450236	174	Av. system B delta-voltage	0.1	V
450239	450238	207	Av. system B current	0.001	A
450241	450240		reserved		
450243	450242	118	System B voltage L1-L2	0.1	V
450245	450244	119	System B voltage L2-L3	0.1	V
450247	450246	120	System B voltage L3-L1	0.1	V
450249	450248	121	System B voltage L1-N	0.1	V
450251	450250	122	System B voltage L2-N	0.1	V
450253	450252	123	System B voltage L3-N	0.1	V

Modbus		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)				
450255	450254		reserved		
450257	450256		reserved		
<b>AC System Values (Long - 32 bits)</b>					
450259	450258		reserved		
450261	450260		reserved		
450263	450262		reserved		
450265	450264		reserved		
450267	450266		reserved		
450269	450268		reserved		

## 9.3 LogicsManager Reference

### 9.3.1 LogicsManager Overview

The LogicsManager is used to customize the sequence of events in the control unit such as the start command of the engine or the operation of control unit relay outputs. For example, the start routine may be programmed so that it requires the closing of a discrete input or a preset time of day.

Depending on the application mode of the unit, the number of available relays that may be programmed with the LogicsManager will vary.

Two independent time delays are provided for the configured action to take place and be reset.



*Please do not use the output of an equation as input at the same time. Such a configuration could decrease the performance of the interfaces.*

#### Structure and description of the LogicsManager

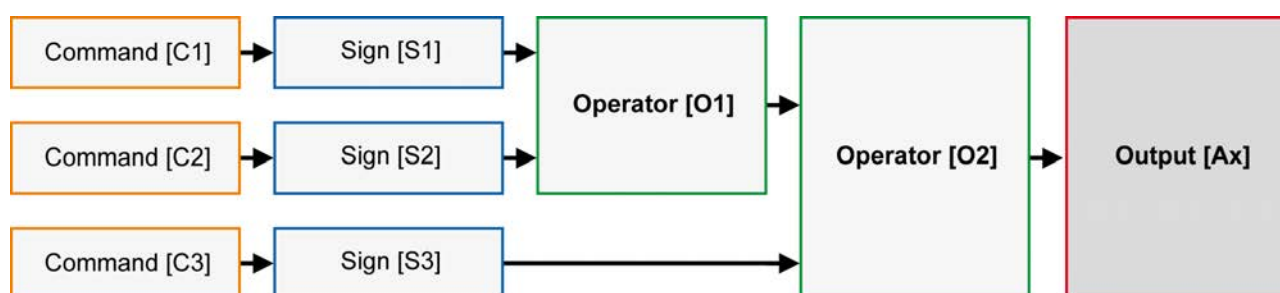


Fig. 129: LogicsManager - function overview

### ■ Command (variable)

A list of parameters and functions is provided for the command inputs.

Examples of the parameters that may be configured into these commands are generator undervoltage thresholds 1 and 2, start fail, and cool down.

These command variables are used to control the output function or relay.

Refer to [❧ Chapter 9.3.4 “Logical Command Variables” on page 304](#) for a complete list of all command variables.

### ■ Sign

The sign field can be used to invert the state of the command or to fix its output to a logical true or false if the command is not needed. Setting the sign to the NOT state changes the output of the command variable from true to false or vice versa.

### ■ Operator

A logical device such as AND or OR.

### ■ (Logical) output

The action or control sequence that occurs when all parameters set into the LogicsManager are met.

For a complete list of all logical outputs refer to [❧ Chapter 9.3.3 “Logical Outputs” on page 302](#).





[Sx] - Sign {x}		
	Value {[Cx]}	The value [Cx] is passed 1:1.
	NOT Value {[Cx]}	The opposite of the value [Cx] is passed.
	0 [False; always "0"]	The value [Cx] is ignored and this logic path will always be FALSE.
	1 [True; always "1"]	The value [Cx] is ignored and this logic path will always be TRUE.

Table 44: 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 45: Operators



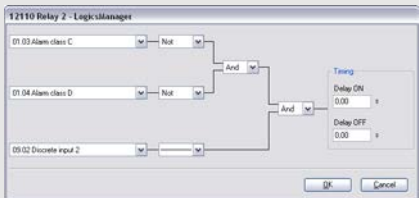
For the various display formats of the corresponding logical symbols refer to [❧ Chapter 9.3.2 “Logical Symbols” on page 301](#).

### 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



- 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"

Fig. 130: Programming example (ToolKit)

### 9.3.2 Logical Symbols

The following symbols are used for the graphical programming of the LogicsManager. The LS-5 displays symbols according to the DIN 40 700 standard by default.

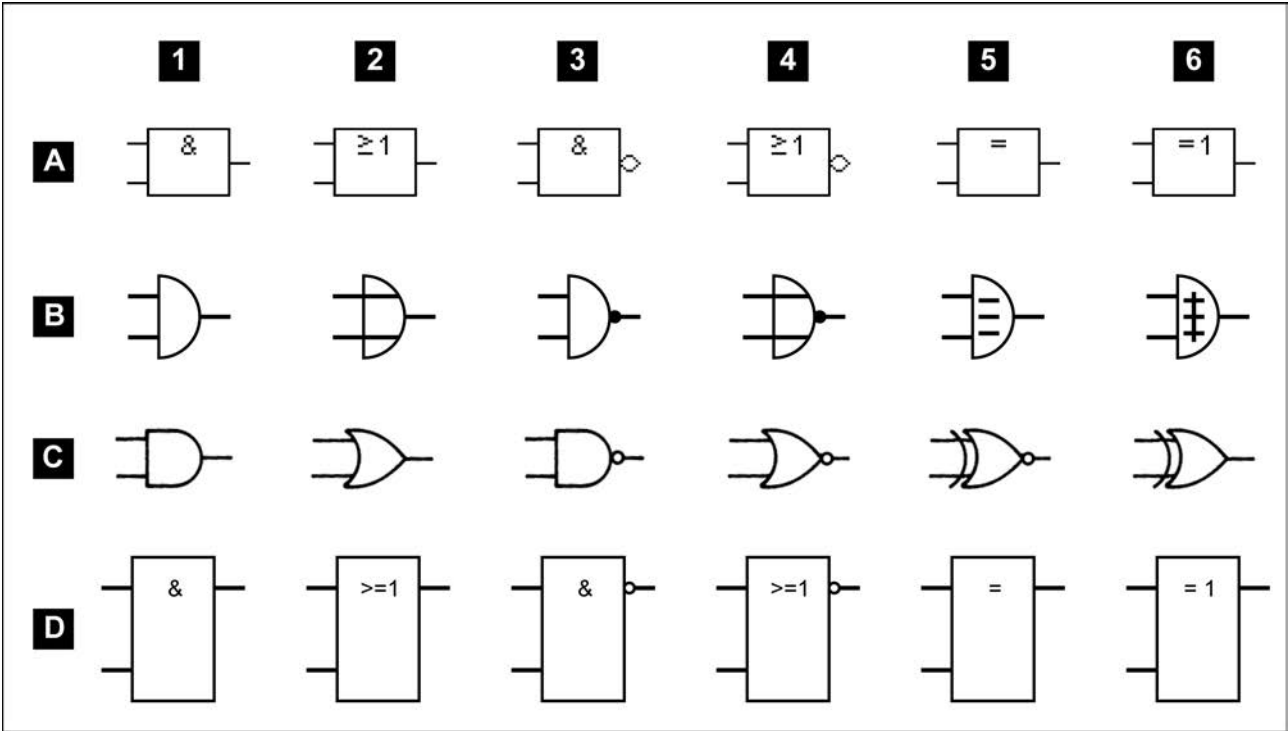


Fig. 131: Logical symbols

Row	... according to standard:
A	IEC
B	LS-5 (default: DIN 40 700)
C	ASA US MIL
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 46: Truth table

### 9.3.3 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

16 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
Flag 1	Internal flag 1	00.01
Flag 2	Internal flag 2	00.02
Flag 3	Internal flag 3	00.03

Name	Function	Number
Flag 4	Internal flag 4	00.04
Flag 5	Internal flag 5	00.05
Flag 6	Internal flag 6	00.06
Flag 7	Internal flag 7	00.07
Flag 8	Internal flag 8	00.08
Flag 9	Internal flag 9	00.30
Flag 10	Internal flag 10	00.31
Flag 11	Internal flag 11	00.32
Flag 12	Internal flag 12	00.33
Flag 13	Internal flag 13	00.34
Flag 14	Internal flag 14	00.35
Flag 15	Internal flag 15	00.36
Flag 16	Internal flag 16	00.37

**LS-5 flags**

5 internal logical LS-5 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 LS-5 are received (as 26.01 to 27.80) by the LS-5 and the easYgen. They can be used as inputs for the LogicsManager.

Name	Function	Number
Flag 1 LS5	LS5 flag 1	24.41
Flag 2 LS5	LS5 flag 2	24.42
Flag 3 LS5	LS5 flag 3	24.43
Flag 4 LS5	LS5 flag 4	24.44
Flag 5 LS5	LS5 flag 5	24.45

**Internal functions**

The following logical functions may be used to activate/deactivate functions.

Name	Function	Number
External acknowledge	The alarm acknowledgement is performed from an external source (parameter 12490 ↗ p. 102)	00.15
Operation mode AUTO	Activation of the AUTOMATIC operating mode (parameter 12510 ↗ p. 121)	00.16
Operation mode MAN	Activation of the MANUAL operating mode (parameter 12520 ↗ p. 121)	00.17
Synchronization 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 5728 ↗ p. 115)	00.38

Name	Function	Number
Synchronization mode PERMISSIVE	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 5728 ↗ p. 115)	00.39
Synchronization mode RUN	Normal operating mode. The system actively synchronizes and issues breaker closure commands. (parameter 5728 ↗ p. 115)	00.40
Lock keypad	Activation of lock keypad (parameter 12978 ↗ p. 66)	00.95

### Relay outputs

All relays may be controlled directly by the LogicsManager depending on the respective application mode.

Name	Function	Number
Relay 1 (Ready for operation OFF)	If this logical output becomes true, the relay output 1 will be activated	00.41
Relay 2	If this logical output becomes true, the relay output 2 will be activated	00.42
Relay 3	If this logical output becomes true, the relay output 3 will be activated	00.43
Relay 4	If this logical output becomes true, the relay output 4 will be activated	00.44
Relay 5	Fixed to 'Open CBA'	---
Relay 6	If this logical output becomes true, the relay output 6 will be activated	00.46

Relay Number	Terminal	
Internal relay outputs		
[R1]	30/31	LogicsManager; combined with 'Ready for operation OFF'
[R2]	32/33	LogicsManager; pre-assigned with 'Common CBA failure'
[R3]	34/35	LogicsManager; pre-assigned with 'Missing LS5'
[R4]	36/37	LogicsManager; pre-assigned with 'System A or B not OK'
[R5]	38/39/40	Fixed to 'Open CBA'
[R6]	41/42	Fixed to 'Close CBA' if CBA is controlled by 2 relays otherwise LogicsManager pre-assigned with 'All alarm classes'

### 9.3.4 Logical Command Variables

The logical command variables are grouped into different categories

- Group 00: Flags condition 1
- Group 01: Alarm system
- Group 02: Systems condition
- Group 04: Applications condition
- Group 05: Device related alarms
- Group 06: System B (SyB.) related alarms



- Group 07: System A (SyA.) related alarms
- Group 08: System related alarms
- Group 09: Discrete inputs
- Group 11: Clock and timer
- Group 13: Discrete outputs
- Group 24: Flags condition 2
- Group 26: Flags of LS5 (33 to 48)
- Group 27: Flags of LS5 (49 to 64)
- Group 28: LS5 system conditions
- Group 29: Commands of EG (1 to 16)
- Group 29: Commands of EG (17 to 32)

#### 9.3.4.1 Group 00: Flags Condition 1

- Flags condition 1
- Logic command variables 00.01-00.95

Internal Flags are the result of the output of the logic ladders from Flag 1 to 16. Flags are internal logic that can be sent to other flags or Command variables.

No.	Name	Function	Note
00.01	LM: Flag 1	Internal flag 1	Internal calculation; refer to ☞ “ <i>Internal flags</i> ” on page 302
00.02	LM: Flag 2	Internal flag 2	Internal calculation; refer to ☞ “ <i>Internal flags</i> ” on page 302
00.03	LM: Flag 3	Internal flag 3	Internal calculation; refer to ☞ “ <i>Internal flags</i> ” on page 302
00.04	LM: Flag 4	Internal flag 4	Internal calculation; refer to ☞ “ <i>Internal flags</i> ” on page 302
00.05	LM: Flag 5	Internal flag 5	Internal calculation; refer to ☞ “ <i>Internal flags</i> ” on page 302
00.06	LM: Flag 6	Internal flag 6	Internal calculation; refer to ☞ “ <i>Internal flags</i> ” on page 302
00.07	LM: Flag 7	Internal flag 7	Internal calculation; refer to ☞ “ <i>Internal flags</i> ” on page 302
00.08	LM: Flag 8	Internal flag 8	Internal calculation; refer to ☞ “ <i>Internal flags</i> ” on page 302
00.15	LM: External acknowledge	The alarm acknowledgement is performed from an external source	
00.16	LM: Operation mode AUTO	Activation of the AUTOMATIC operating mode	
00.17	LM: Operation mode MAN	Activation of the MANUAL op. mode	
00.30	LM: Flag 9	Internal flag 9	Internal calculation; refer to ☞ “ <i>Internal flags</i> ” on page 302
00.31	LM: Flag 10	Internal flag 10	Internal calculation; refer to ☞ “ <i>Internal flags</i> ” on page 302

No.	Name	Function	Note
00.32	LM: Flag 11	Internal flag 11	Internal calculation; refer to <a href="#">☞ “Internal flags” on page 302</a>
00.33	LM: Flag 12	Internal flag 12	Internal calculation; refer to <a href="#">☞ “Internal flags” on page 302</a>
00.34	LM: Flag 13	Internal flag 13	Internal calculation; refer to <a href="#">☞ “Internal flags” on page 302</a>
00.35	LM: Flag 14	Internal flag 14	Internal calculation; refer to <a href="#">☞ “Internal flags” on page 302</a>
00.36	LM: Flag 15	Internal flag 15	Internal calculation; refer to <a href="#">☞ “Internal flags” on page 302</a>
00.37	LM: Flag 16	Internal flag 16	Internal calculation; refer to <a href="#">☞ “Internal flags” on page 302</a>
00.38	LM: Syn. Mode CHECK	Synchronisation mode check is active	
00.39	LM: Syn. Mode PERM	Synchronisation mode permissive is active	
00.40	LM: Syn. Mode RUN	Synchronisation mode run is active	
00.41	LM: Relay 1		TRUE, if the LogicsManager condition driving this relay is fulfilled
00.42	LM: Relay 2		
00.43	LM: Relay 3		
00.44	LM: Relay 4		
00.45	Reserved		
00.46	LM: Relay 6		
00.95	LM: Lock Keypad	Lock keypad is active	

#### 9.3.4.2 Group 01: Alarm System

- Alarm system
- Logic command variables 01.01-01.12

Alarm classes may be configured as command variables for all logical outputs in the LogicsManager. Refer to [☞ Chapter 9.4.1 “Alarm Classes” on page 328](#) for a description of the alarm classes.

No.	Name / Function	Note
01.01	Alarm class A	TRUE as long as an alarm of this alarm class is active or latched (triggered)
01.02	Alarm class B	TRUE as long as an alarm of this alarm class is active or latched (triggered)
01.03	Alarm class C	TRUE as long as an alarm of this alarm class is active or latched (triggered)
01.04	Alarm class D	TRUE as long as an alarm of this alarm class is active or latched (triggered)

No.	Name / Function	Note
01.05	Alarm class E	TRUE as long as an alarm of this alarm class is active or latched (triggered)
01.06	Alarm class F	TRUE as long as an alarm of this alarm class is active or latched (triggered)
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 (triggered)
01.08	Warning alarm	TRUE as long as at least one alarm of the alarm classes A/B is active or latched (triggered)
01.09	Shutdown alarm	TRUE as long as at least one alarm of the alarm classes C/D/E/F is active or latched (triggered)
01.10	Centralized alarm	TRUE as long as at least one alarm of the alarm classes B/C/D/E/F is active or latched (triggered)
01.11	New alarm triggered	TRUE if any alarm has been triggered until it is acknowledged
01.12	Horn	True if a new alarm is triggered and time (parameter 1756 ↗ p. 102) for horn reset has not exceeded.

### 9.3.4.3 Group 02: Systems Condition

- Systems condition
- Logic command variables 02.03-02.25

The status of the system may be used as command variable in a logical output to set parameters for customized operations.

No.	Name	Function	Note
02.03	SyB. voltage ok	SyB. voltage within operating range	TRUE as long as the SyB. voltage is within the operating range
02.04	SyB. frequency ok	SyB. frequency within operating range	TRUE as long as the SyB. frequency is within the operating range
02.05	SyB. voltage / frequency ok	SyB. voltage and frequency within operating ranges	TRUE as long as the SyB. voltage and frequency are within the operating ranges (02.03. and 02.04 are TRUE)
02.09	SyA. voltage ok	SyA. voltage within operating range	TRUE as long as the SyA. voltage is within the operating range
02.10	SyA. frequency ok	SyA. frequency within operating range	TRUE as long as the SyA. frequency is within the operating range
02.11	SyA. voltage / frequency ok	SyA. voltage and frequency within operating ranges	TRUE as long as the SyA. voltage and frequency are within the operating ranges (02.09. and 02.10 are TRUE)
02.12	SyA. rotation CCW	SyA. voltage: rotating direction CCW	TRUE as long as the respective rotation field is detected in case of a three-phase voltage measurement at the respective measuring location
02.13	SyA. rotation CW	SyA. voltage: rotating direction CW	
02.14	SyB. rotation CCW	SyB. voltage: rotating direction CCW	
02.15	SyB. rotation CW	SyB. voltage: rotating direction CW	

No.	Name	Function	Note
02.23	System A is dead	System A is dead	TRUE as long as system A voltage is below the level defined by parameter 5820 ↗ p. 114.
02.24	System B is dead	System B is dead	TRUE as long as system B voltage is below the level defined by parameter 5820 ↗ p. 114.
02.25	Gen. is mains par.	Indicates generator is in mains parallel operation	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	<p>TRUE if synchronization conditions are TRUE defined by parameters 5711 ↗ p. 112, 5712 ↗ p. 112, 5710 ↗ p. 112, 8825 ↗ p. 113, 8824 ↗ p. 113, 5712 ↗ p. 112, 5714 ↗ p. 113 and 5717 ↗ p. 113</p> <p>OR if Dead Bus conditions are TRUE defined by parameters 8801 ↗ p. 114, 5820 ↗ p. 114, 8805 ↗ p. 114, 8802 ↗ p. 114, 8803 ↗ p. 114 and 8804 ↗ p. 114.</p> <p><b>Warning</b></p> <p>No deadbus interlocking.</p>
02.29	Sync. condition	Indicates phase matching conditions met	TRUE if synchronization conditions are TRUE defined by parameters 5711 ↗ p. 112, 5712 ↗ p. 112, 5710 ↗ p. 112, 8825 ↗ p. 113, 8824 ↗ p. 113, 5712 ↗ p. 112, 5714 ↗ p. 113 and 5717 ↗ p. 113.
02.30	Dead bus cl. condition	Indicates Dead Bus conditions met	<p>TRUE if Dead Bus conditions are TRUE defined by parameters 8801 ↗ p. 114, 5820 ↗ p. 114, 8805 ↗ p. 114, 8802 ↗ p. 114, 8803 ↗ p. 114 and 8804 ↗ p. 114.</p> <p><b>Warning</b></p> <p>No deadbus interlocking.</p>

#### 9.3.4.4 Group 04: Applications Condition

- Applications condition
- Logic command variables 4.01-04.63

These operating statuses may be used as command variable in a logical output to set parameters for customized operations.

No.	Name	Function	Note
04.01	Auto mode	AUTOMATIC operating mode active	TRUE in AUTOMATIC operating mode
04.03	Manual mode	MANUAL operating mode active	TRUE in MANUAL operating mode
04.04	Lamp test	A lamp test is being performed	TRUE if the lamp test is active
04.05	Acknowledge	"Acknowledge" push button has been pressed or an external acknowledgment via LogicsManager	This condition is TRUE for approx. 40 ms and must be extended utilizing a delay time
04.07	CBA is closed	CBA is closed only	TRUE if DI 8 (Reply CBA) is de-energized
04.11	Mains settling	Mains settling time active	TRUE in LS5 or single LS5 mode while mains settling time is running.
04.21	Syn. CBA is active	Synchronization CBA is active	TRUE if the CBA shall be synchronized until the CBA is closed
04.22	Opening CBA active	Opening CBA is active	TRUE if an CBA open command is issued until DI 8 (Reply CBA) is energized
04.23	Closing CBA active	Closing CBA is active	TRUE if an CBA close command is issued; same function as relay 5 or 6 (cf. parameter 8800 ↗ p. 108)
04.29	CBA unloading	CBA unloading sequence is active	TRUE if CBA open with unloading is active.
04.44	Remote control Bit 1	Free control bit 1 is activated	Refer to ↗ <i>Chapter 7 "Interfaces And Protocols"</i> on page 225
04.45	Remote control Bit 2	Free control bit 2 is activated	
04.46	Remote control Bit 3	Free control bit 3 is activated	
04.47	Remote control Bit 4	Free control bit 4 is activated	
04.48	Remote control Bit 5	Free control bit 5 is activated	
04.49	Remote control Bit 6	Free control bit 6 is activated	
04.50	Remote control Bit 7	Free control bit 7 is activated	
04.51	Remote control Bit 8	Free control bit 8 is activated	
04.52	Remote control Bit 9	Free control bit 9 is activated	
04.53	Remote control Bit 10	Free control bit 10 is activated	
04.54	Remote control Bit 11	Free control bit 11 is activated	
04.55	Remote control Bit 12	Free control bit 12 is activated	
04.56	Remote control Bit 13	Free control bit 13 is activated	
04.57	Remote control Bit 14	Free control bit 14 is activated	
04.58	Remote control Bit 15	Free control bit 15 is activated	
04.59	Remote control Bit 16	Free control bit 16 is activated	

No.	Name	Function	Note
04.61	Syn. mains close active	Synchronous mains closure procedure is active.	TRUE if <ul style="list-style-type: none"> <li>■ System A detected as mains connected <b>and</b></li> <li>■ System B detected as mains connected <b>and</b></li> <li>■ Angle is in range (parameter 8821 ↗ p. 110, 8822 ↗ p. 110) <b>and</b></li> <li>■ Parameter "Connect synchr. mains (8820 ↗ p. 109) is "Yes" <b>and</b></li> <li>■ CBA is enabled <b>and</b></li> <li>■ System A is ok <b>and</b></li> <li>■ System B is ok.</li> </ul>
04.62	Dead bus close active	Dead bus closure procedure is active.	TRUE if <ul style="list-style-type: none"> <li>■ Dead bus closure is allowed (parameter 8801 ↗ p. 114 to 8804 ↗ p. 114) <b>and</b></li> <li>■ Dead bus conditions are true (parameter 8801 ↗ p. 114 to 8805 ↗ p. 114, 5820 ↗ p. 114) <b>and</b></li> <li>■ CBA is enabled.</li> </ul>
04.63	Syn.segm. close act.	Synchronous segments closure procedure is active.	TRUE if <ul style="list-style-type: none"> <li>■ System A and B are already connected <b>and</b></li> <li>■ Angle is in range (parameter 8821 ↗ p. 110, 8822 ↗ p. 110) <b>and</b></li> <li>■ Parameter "Connect synchr. segments (8852 ↗ p. 109) is "Yes" <b>and</b></li> <li>■ CBA is enabled <b>and</b></li> <li>■ System A is ok <b>and</b></li> <li>■ System B is ok.</li> </ul>

#### 9.3.4.5 Group 05: Device Related Alarms

- Device related alarms
- Logic command variables 05.15

These device alarms may be used as command variable in a logical output to set parameters for customized operations.

No.	Name / Function	Note
05.15	EEprom failure	TRUE = alarm latched (triggered) FALSE = alarm acknowledged

**9.3.4.6 Group 06: System B Related Alarms**

- System B related alarms
- Logic command variables 06.21

These system B alarms may be used as command variable in a logical output to set parameters for customized operations.

No.	Name / Function	Note
06.21	SyB. phase rotation	TRUE = alarm latched (triggered) FALSE = alarm acknowledged

**9.3.4.7 Group 07: System A Related Alarms**

- System A related alarms
- Logic command variables 07.05-07.30

These system A alarms may be used as command variable in a logical output to set parameters for customized operations.

No.	Function	Note
07.05	SyA. phase rotation	TRUE = alarm latched (triggered) FALSE = alarm acknowledged
07.06	SyA. overfrequency (limit) 1	
07.07	SyA. overfrequency (limit) 2	
07.08	SyA. underfrequency (limit) 1	
07.09	SyA. underfrequency (limit) 2	
07.10	SyA. overvoltage (limit) 1	
07.11	SyA. overvoltage (limit) 2	
07.12	SyA. undervoltage (limit) 1	
07.13	SyA. undervoltage (limit) 2	
07.14	SyA. phase shift	
07.15	SyA. df/dt	
07.25	SyA. decoupling	
07.26	SyA. voltage asymmetry	
07.27	SyA. voltage increase.	
07.28	Time-dep. voltage	
07.29	SyA. QV mon. (limit) 1	
07.30	SyA. QV mon. (limit) 2	

**9.3.4.8 Group 08: System Related Alarms**

- System related alarms
- Logic command variables 08.01-08.36

These system alarms may be used as command variable in a logical output n to set parameters for customized operations.

No.	Function	Note
08.01	Battery overvoltage (limit) 1	TRUE = alarm latched (triggered) FALSE = alarm acknowledged
08.02	Battery overvoltage (limit) 2	
08.03	Battery undervoltage (limit) 1	
08.04	Battery undervoltage (limit) 2	
08.07	CBA fail to close	
08.08	CBA fail to open	
08.17	Missing LS5	
08.18	CANopen Interface 1	
08.31	Synchronization time CBA	
08.33	Phase rotation mismatch	
08.36	CBA unload mismatch	

#### 9.3.4.9 Group 09: Discrete Inputs

- Discrete inputs
- Logic command variables 09.01-09.08

The discrete inputs may be used as command variable in a logical output to set parameters for customized operations.

No.	Function	Note
09.01	DI 1 (Discrete input [DI 01])	TRUE = logical "1" (delay times and N.O./N.C. parameters are ignored) FALSE = logical "0" (alarm has been acknowledged or immediately after TRUE condition is not present anymore, if Control is configured as alarm class)
09.02	DI 2 (Discrete input [DI 02])	
09.03	DI 3 (Discrete input [DI 03])	
09.04	DI 4 (Discrete input [DI 04])	
09.05	DI 5 (Discrete input [DI 05])	
09.06	DI 6 (Discrete input [DI 06])	
09.07	DI 7 (Discrete input [DI 07])	
09.08	DI 8 (Discrete input [DI 08])	

#### 9.3.4.10 Group 11: Clock And Timer

- Clock and timer
- Logic command variables 11.01-11.07



Time functions may be used as command variable in a logical output.

No.	Name / Function	Note
11.01	Timer 1 (exceeded)	Refer to <a href="#">Chapter 4.1.1 "Configure Language/Clock" on page 59.</a>
11.02	Timer 2 (exceeded)	Refer to <a href="#">Chapter 4.1.1 "Configure Language/Clock" on page 59.</a>
11.03	Active weekday (equal to setting)	Refer to <a href="#">Chapter 4.1.1 "Configure Language/Clock" on page 59.</a>
11.04	Active day (equal to setting)	Refer to <a href="#">Chapter 4.1.1 "Configure Language/Clock" on page 59.</a>
11.05	Active hour (equal to setting)	Refer to <a href="#">Chapter 4.1.1 "Configure Language/Clock" on page 59.</a>
11.06	Active minute (equal to setting)	Refer to <a href="#">Chapter 4.1.1 "Configure Language/Clock" on page 59.</a>
11.07	Active second (equal to setting)	Refer to <a href="#">Chapter 4.1.1 "Configure Language/Clock" on page 59.</a>

#### 9.3.4.11 Group 13: Discrete Outputs

- Discrete outputs
- Logic command variables 13.01-13.12

The discrete outputs may be used as command variable in a logical output.

No.	Name / Function	Note
13.01	Discrete output DO1 [R01]	TRUE = logical "1" (this condition indicates the logical status of the internal relays)  FALSE = logical "0" (this condition indicates the logical status of the internal relays)
13.02	Discrete output DO2 [R02]	
13.03	Discrete output DO3 [R03]	
13.04	Discrete output DO4 [R04]	
13.05	Discrete output DO5 [R05]	
13.06	Discrete output DO6 [R06]	

#### 9.3.4.12 Group 24: Flags Condition 2

- Flags condition 2
- Logic command variables 24.31-24.58

The discrete outputs may be used as command variable in a logical output.

No.	Name / Function	Note
24.31	LM: Enable SyA dec.	
24.32	LM: Open CBA	
24.33	LM: Immediate open CBA	
24.34	LM: Enable to close CBA	
24.39	LM: Isol. swi. open	
24.40	LM: Lock Monitoring	
24.41	LM: Flag 1 LS5	
24.42	LM: Flag 2 LS5	
24.43	LM: Flag 3 LS5	
24.44	LM: Flag 4 LS5	
24.45	LM: Flag 5 LS5	
24.46	LM: Open CBA in MAN	
24.47	LM: Close CBA in MAN	
24.51	LM: LED 1 (System A in range)	These command variables and the corresponding equations are available in the display version in ToolKit and the HMI, even if the LEDs are not available. In the display version the variables can be used as additional internal flags and are located there.
24.52	LM: LED 2 (System B in range)	
24.53	LM: LED 3 (Breaker is closed)	
24.54	LM: LED 4 (Synchronization is active)	
24.55	LM: LED 5 (Breaker close command)	
24.56	LM: LED 6 (Breaker open failure)	
24.57	LM: LED 7 (Breaker close failure)	
24.58	LM: LED 8 (Communication failure)  <b>Note:</b> Indicates that the multi-unit missing members monitoring function (parameter 4060 ↗ p. 106) has tripped. See also LogicsManager "LED 8" (parameter 12969 ↗ p. 134).	

#### 9.3.4.13 Group 26: Flags Of LS5 (33 to 48)

- Flags of LS5 (33 to 48)
- Logic command variables 26.01-26.80

No.	Name / Function	Note
26.01	Flag 1 LS5 device 33	TRUE if LogicsManager 12952 in LS-5 device no. {x} is activated [x = 33 to 48]
26.02	Flag 2 LS5 device 33	TRUE if LogicsManager 12953 in LS-5 device no. {x} is activated [x = 33 to 48]

No.	Name / Function	Note
26.03	Flag 3 LS5 device 33	TRUE if LogicsManager 12954 in LS-5 device no. {x} is activated [x = 33 to 48]
26.04	Flag 4 LS5 device 33	TRUE if LogicsManager 12955 in LS-5 device no. {x} is activated [x = 33 to 48]
26.05	Flag 5 LS5 device 33	TRUE if LogicsManager 12956 in LS-5 device no. {x} is activated [x = 33 to 48]
26.06	Flag 1 LS5 device 34	
26.07	Flag 2 LS5 device 34	
26.08	Flag 3 LS5 device 34	
26.09	Flag 4 LS5 device 34	
26.10	Flag 5 LS5 device 34	
26.11	Flag 1 LS5 device 35	
26.12	Flag 2 LS5 device 35	
26.13	Flag 3 LS5 device 35	
26.14	Flag 4 LS5 device 35	
26.15	Flag 5 LS5 device 35	
26.16	Flag 1 LS5 device 36	
26.17	Flag 2 LS5 device 36	
26.18	Flag 3 LS5 device 36	
26.19	Flag 4 LS5 device 36	
26.20	Flag 5 LS5 device 36	
26.21	Flag 1 LS5 device 37	
26.22	Flag 2 LS5 device 37	
26.23	Flag 3 LS5 device 37	
26.24	Flag 4 LS5 device 37	
26.25	Flag 5 LS5 device 37	
26.26	Flag 1 LS5 device 38	
26.27	Flag 2 LS5 device 38	
26.28	Flag 3 LS5 device 38	
26.29	Flag 4 LS5 device 38	
26.30	Flag 5 LS5 device 38	
26.31	Flag 1 LS5 device 39	
26.32	Flag 2 LS5 device 39	
26.33	Flag 3 LS5 device 39	
26.34	Flag 4 LS5 device 39	
26.35	Flag 5 LS5 device 39	
26.36	Flag 1 LS5 device 40	
26.37	Flag 2 LS5 device 40	

No.	Name / Function	Note
26.38	Flag 3 LS5 device 40	
26.39	Flag 4 LS5 device 40	
26.40	Flag 5 LS5 device 40	
26.41	Flag 1 LS5 device 41	
26.42	Flag 2 LS5 device 41	
26.43	Flag 3 LS5 device 41	
26.44	Flag 4 LS5 device 41	
26.45	Flag 5 LS5 device 41	
26.46	Flag 1 LS5 device 42	
26.47	Flag 2 LS5 device 42	
26.48	Flag 3 LS5 device 42	
26.49	Flag 4 LS5 device 42	
26.50	Flag 5 LS5 device 42	
26.51	Flag 1 LS5 device 43	
26.52	Flag 2 LS5 device 43	
26.53	Flag 3 LS5 device 43	
26.54	Flag 4 LS5 device 43	
26.55	Flag 5 LS5 device 43	
26.56	Flag 1 LS5 device 44	
26.57	Flag 2 LS5 device 44	
26.58	Flag 3 LS5 device 44	
26.59	Flag 4 LS5 device 44	
26.60	Flag 5 LS5 device 44	
26.61	Flag 1 LS5 device 45	
26.62	Flag 2 LS5 device 45	
26.63	Flag 3 LS5 device 45	
26.64	Flag 4 LS5 device 45	
26.65	Flag 5 LS5 device 45	
26.66	Flag 1 LS5 device 46	
26.67	Flag 2 LS5 device 46	
26.68	Flag 3 LS5 device 46	
26.69	Flag 4 LS5 device 46	
26.70	Flag 5 LS5 device 46	
26.71	Flag 1 LS5 device 47	
26.72	Flag 2 LS5 device 47	
26.73	Flag 3 LS5 device 47	
26.74	Flag 4 LS5 device 47	

No.	Name / Function	Note
26.75	Flag 5 LS5 device 47	
26.76	Flag 1 LS5 device 48	
26.77	Flag 2 LS5 device 48	
26.78	Flag 3 LS5 device 48	
26.79	Flag 4 LS5 device 48	
26.80	Flag 5 LS5 device 48	

#### 9.3.4.14 Group 27: Flags Of LS5 (49 to 64)

- Flags of LS5 (49 to 64)
- Logic command variables 27.01-27.80

No.	Name / Function	Note
27.01	Flag 1 LS5 device 49	TRUE if LogicsManager 12952 in LS-5 device no. {x} is activated [x = 49 to 64]
27.02	Flag 2 LS5 device 49	TRUE if LogicsManager 12953 in LS-5 device no. {x} is activated [x = 49 to 64]
27.03	Flag 3 LS5 device 49	TRUE if LogicsManager 12954 in LS-5 device no. {x} is activated [x = 49 to 64]
27.04	Flag 4 LS5 device 49	TRUE if LogicsManager 12955 in LS-5 device no. {x} is activated [x = 49 to 64]
27.05	Flag 5 LS5 device 49	TRUE if LogicsManager 12956 in LS-5 device no. {x} is activated [x = 49 to 64]
27.06	Flag 1 LS5 device 50	
27.07	Flag 2 LS5 device 50	
27.08	Flag 3 LS5 device 50	
27.09	Flag 4 LS5 device 50	
27.10	Flag 5 LS5 device 50	
27.11	Flag 1 LS5 device 51	
27.12	Flag 2 LS5 device 51	
27.13	Flag 3 LS5 device 51	
27.14	Flag 4 LS5 device 51	
27.15	Flag 5 LS5 device 51	
27.16	Flag 1 LS5 device 52	
27.17	Flag 2 LS5 device 52	
27.18	Flag 3 LS5 device 52	
27.19	Flag 4 LS5 device 52	
27.20	Flag 5 LS5 device 52	
27.21	Flag 1 LS5 device 53	

No.	Name / Function	Note
27.22	Flag 2 LS5 device 53	
27.23	Flag 3 LS5 device 53	
27.24	Flag 4 LS5 device 53	
27.25	Flag 5 LS5 device 53	
27.26	Flag 1 LS5 device 54	
27.27	Flag 2 LS5 device 54	
27.28	Flag 3 LS5 device 54	
27.29	Flag 4 LS5 device 54	
27.30	Flag 5 LS5 device 54	
27.31	Flag 1 LS5 device 55	
27.32	Flag 2 LS5 device 55	
27.33	Flag 3 LS5 device 55	
27.34	Flag 4 LS5 device 55	
27.35	Flag 5 LS5 device 55	
27.36	Flag 1 LS5 device 56	
27.37	Flag 2 LS5 device 56	
27.38	Flag 3 LS5 device 56	
27.39	Flag 4 LS5 device 56	
27.40	Flag 5 LS5 device 56	
27.41	Flag 1 LS5 device 57	
27.42	Flag 2 LS5 device 57	
27.43	Flag 3 LS5 device 57	
27.44	Flag 4 LS5 device 57	
27.45	Flag 5 LS5 device 57	
27.46	Flag 1 LS5 device 58	
27.47	Flag 2 LS5 device 58	
27.48	Flag 3 LS5 device 58	
27.49	Flag 4 LS5 device 58	
27.50	Flag 5 LS5 device 58	
27.51	Flag 1 LS5 device 59	
27.52	Flag 2 LS5 device 59	
27.53	Flag 3 LS5 device 59	
27.54	Flag 4 LS5 device 59	
27.55	Flag 5 LS5 device 59	
27.56	Flag 1 LS5 device 60	
27.57	Flag 2 LS5 device 60	
27.58	Flag 3 LS5 device 60	

No.	Name / Function	Note
27.59	Flag 4 LS5 device 60	
27.60	Flag 5 LS5 device 60	
27.61	Flag 1 LS5 device 61	
27.62	Flag 2 LS5 device 61	
27.63	Flag 3 LS5 device 61	
27.64	Flag 4 LS5 device 61	
27.65	Flag 5 LS5 device 61	
27.66	Flag 1 LS5 device 62	
27.67	Flag 2 LS5 device 62	
27.68	Flag 3 LS5 device 62	
27.69	Flag 4 LS5 device 62	
27.70	Flag 5 LS5 device 62	
27.71	Flag 1 LS5 device 63	
27.72	Flag 2 LS5 device 63	
27.73	Flag 3 LS5 device 63	
27.74	Flag 4 LS5 device 63	
27.75	Flag 5 LS5 device 63	
27.76	Flag 1 LS5 device 64	
27.77	Flag 2 LS5 device 64	
27.78	Flag 3 LS5 device 64	
27.79	Flag 4 LS5 device 64	
27.80	Flag 5 LS5 device 64	

#### 9.3.4.15 Group 28: LS5 System Conditions

- LS5 system conditions
- Logic command variables 28.01-28.06

No.	Name / Function	Note
28.01	Command 1 to LS5 easYgen (OR)	TRUE if at least one easYgen sets the command variable to TRUE (OR operation)
28.02	Command 2 to LS5 easYgen (OR)	
28.03	Command 3 to LS5 easYgen (OR)	
28.04	Command 4 to LS5 easYgen (OR)	
28.05	Command 5 to LS5 easYgen (OR)	
28.06	Command 6 to LS5 easYgen (OR)	

**9.3.4.16 Group 29: Commands Of EG (1 to 16)**

- Commands of EG (1 to 16)
- Logic command variables 29.01-29.96

No.	Name / Function	Note
29.01	Command 1 easYgen 1	
29.02	Command 2 easYgen 1	
29.03	Command 3 easYgen 1	
29.04	Command 4 easYgen 1	
29.05	Command 5 easYgen 1	
29.06	Command 6 easYgen 1	
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	



No.	Name / Function	Note
29.34	Command 4 easYgen 6	
29.35	Command 5 easYgen 6	
29.36	Command 6 easYgen 6	
29.37	Command 1 easYgen 7	
29.38	Command 2 easYgen 7	
29.39	Command 3 easYgen 7	
29.40	Command 4 easYgen 7	
29.41	Command 5 easYgen 7	
29.42	Command 6 easYgen 7	
29.43	Command 1 easYgen 8	
29.44	Command 2 easYgen 8	
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	

No.	Name / Function	Note
29.71	Command 5 easYgen 12	
29.72	Command 6 easYgen 12	
29.73	Command 1 easYgen 13	
29.74	Command 2 easYgen 13	
29.75	Command 3 easYgen 13	
29.76	Command 4 easYgen 13	
29.77	Command 5 easYgen 13	
29.78	Command 6 easYgen 13	
29.79	Command 1 easYgen 14	
29.80	Command 2 easYgen 14	
29.81	Command 3 easYgen 14	
29.82	Command 4 easYgen 14	
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	

#### 9.3.4.17 Group 30: Commands Of EG (17 to 32)

- Commands of EG (17 to 32)
- Logic command variables 30.01-30.96

No.	Name / Function	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	

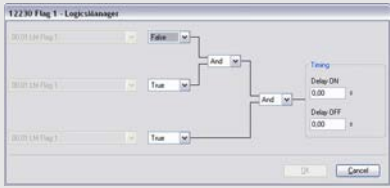
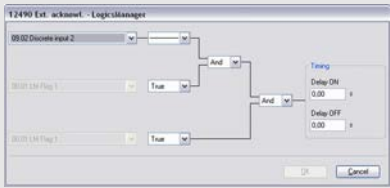
No.	Name / Function	Note
30.05	Command 5 easYgen 17	
30.06	Command 6 easYgen 17	
30.07	Command 1 easYgen 18	
30.08	Command 2 easYgen 18	
30.09	Command 3 easYgen 18	
30.10	Command 4 easYgen 18	
30.11	Command 5 easYgen 18	
30.12	Command 6 easYgen 18	
30.13	Command 1 easYgen 19	
30.14	Command 2 easYgen 19	
30.15	Command 3 easYgen 19	
30.16	Command 4 easYgen 19	
30.17	Command 5 easYgen 19	
30.18	Command 6 easYgen 19	
30.19	Command 1 easYgen 20	
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	

No.	Name / Function	Note
30.42	Command 6 easYgen 23	
30.43	Command 1 easYgen 24	
30.44	Command 2 easYgen 24	
30.45	Command 3 easYgen 24	
30.46	Command 4 easYgen 24	
30.47	Command 5 easYgen 24	
30.48	Command 6 easYgen 24	
30.49	Command 1 easYgen 25	
30.50	Command 2 easYgen 25	
30.51	Command 3 easYgen 25	
30.52	Command 4 easYgen 25	
30.53	Command 5 easYgen 25	
30.54	Command 6 easYgen 25	
30.55	Command 1 easYgen 26	
30.56	Command 2 easYgen 26	
30.57	Command 3 easYgen 26	
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	

No.	Name / Function	Note
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	
30.93	Command 3 easYgen 32	
30.94	Command 4 easYgen 32	
30.95	Command 5 easYgen 32	
30.96	Command 6 easYgen 32	

### 9.3.5 Factory Settings

#### Functions

Simple (function)	Extended (configuration)	Result
<b>[00.0x] Flag {x}; {x} = 1 to 8</b>		
<p>If TRUE, flag {x} becomes TRUE.</p> <p>Deactivated by default.</p>		FALSE
<b>[00.15] External acknowledgment</b>		
<p>If TRUE, all alarms are acknowledged from an external source.</p> <p>TRUE once discrete input [DI 2] is energized.</p>		dependent on discrete input [DI 2]
<b>[00.16] Operation mode AUTOMATIC</b>		

Simple (function)	Extended (configuration)	Result
<p>If TRUE the unit changes into AUTOMATIC operating mode.</p> <p>Deactivated by default.</p> <p>Only available in operating mode "MAN" and application mode <b>A01</b> to <b>A02</b>.</p>		FALSE
<b>[00.17] Operation mode MANUAL</b>		
<p>If TRUE the unit changes into MANUAL operating mode.</p> <p>Deactivated by default.</p> <p>Only available in operating mode "AUTO" and application mode <b>A01</b> to <b>A02</b>.</p>		FALSE
<b>[00.3x] Flag {y}; {x} = 0 to 7, {y} = 9 to 16</b>		
<p>If TRUE, flag {y} becomes TRUE.</p> <p>Deactivated by default.</p>		FALSE
<b>[00.38] Synchronization Mode CHECK</b>		
<p>If TRUE, synchronization mode CHECK is enabled.</p> <p>Deactivated by default.</p> <p>Only available in application mode <b>A01</b> to <b>A02</b>.</p>		FALSE
<b>[00.39] Synchronization Mode PERM</b>		
<p>If TRUE, synchronization mode PERMISSIVE is enabled.</p> <p>Deactivated by default.</p> <p>Only available in application mode <b>A01</b> to <b>A02</b>.</p>		FALSE
<b>[00.40] Synchronization Mode RUN</b>		
<p>If TRUE, synchronization mode RUN is enabled.</p> <p>Deactivated by default.</p> <p>Only available in application mode <b>A01</b> to <b>A02</b>.</p>		FALSE
<b>[00.95] Lock keypad</b>		
<p>If TRUE, the Lock keypad function is activated.</p> <p>Deactivated by default.</p>		FALSE

## Relay outputs

Simple (function)	Extended (configuration)	Result
<b>[00.41] Relay 1 [R01] - Ready for operation OFF</b>		
Relay will be de-energized if unit is not ready for operation or the logics manager output is TRUE.  LM output is deactivated by default  The unit is only ready for operation after a start-up delay following the power supply connection.		FALSE
<b>[00.42] Relay 2 [R02] - Common CBA failure / freely configurable</b>		
Relay energizes if at least one of the internal conditions "CBA fail to close" or "Synchron. time CBA" or "Feedback CBA mism." is TRUE		dependent on Logics Command Variable [08.07], [08.31] or [08.23]
<b>[00.43] Relay 3 [R03] - Missing LS5 / freely configurable</b>		
Relay energizes if the internal condition "Missing LS5" is TRUE		dependent on Logics Command Variable [08.17]
<b>[00.44] Relay 4 [R04] - System A or B voltage/frequency not OK / freely configurable</b>		
Relay energizes if at least one of the internal conditions "SyA volt/freq. ok" or "SyB volt/freq. ok" is FALSE		dependent on Logics Command Variable [02.11] or [02.05]
<b>[00.45] Relay 5 [R05] - Command: open CBA</b>		
Fixed function to open CBA	Not configurable	
<b>[00.46] Relay 6 [R06] – Close CBA (in CBA: two relay mode) / All alarm classes</b>		
In two relay mode fixed to "close CBA". Otherwise the relay energizes if "All alarm classes" is TRUE		FALSE

## Discrete inputs

DI	Alarm class		Pre-assigned to
1		freely configurable	LogicsManager 'Lock monitoring'
2	CONTROL	freely configurable	LogicsManager 'Remote acknowledge'
3		freely configurable	LogicsManager 'Reply CBA closed'
4		freely configurable	LogicsManager) 'Immediate open CBA'

DI	Alarm class		Pre-assigned to
5	CONTROL	freely configurable	LogicsManager 'Reply: Isolation switch is open'
6	CONTROL	freely configurable	LogicsManager 'Open CBA (with unloading)'
7	CONTROL	freely configurable	LogicsManager 'Enable to close CBA'
8		fixed	Reply CBA open

## 9.4 Event And Alarm Reference

### 9.4.1 Alarm Classes



*The control functions are structured in the following alarm classes:*

Alarm class	Visible in the display	LED "Alarm" & horn	Relay "Command: open 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".		



## 9.4.2 Status Messages

Message text ID	Meaning
Mains settling 13205	<b>Mains settling time is active</b> When the control unit detects that a mains (system A) fault is in range again the mains settling timer begins counting down. The mains (system A) is assumed as stable after the expiration of this timer. If the timer is running a synchronization of CBA is not possible.
CBA dead bus close 13210	<b>Dead bus closing of the CBA</b> The CBA is closing with at least on system is dead.
CBA open 13257	<b>The CBA is being opened</b> An CBA open command has been issued.
Synchronization CBA 13260	<b>The CBA will be synchronized</b> The control tries to synchronize the CBA.
Unloading SyA. 13264	<b>The CBA will open with unloading</b> The LS-5 wants to open the CBA with unloading and is waiting until the power reaches the value defined by parameter 8819 ↗ p. 99.
Synch. PERMISSIVE 13265	<b>Synchronization mode Permissive (twinkling)</b> Synchronization mode is set to Permissive (parameter 5728 ↗ p. 115)
Synch. CHECK 13266	<b>Synchronization mode Check (twinkling)</b> Synchronization mode is set to Check (parameter 5728 ↗ p. 115)
Synch. OFF 13267	<b>Synchronization mode Off (twinkling)</b> Synchronization mode is set to Off (parameter 5728 ↗ p. 115)
Syn. mains close CBA 13279	<b>Synchronous mains close CBA</b> The LS-5 has detected that System A and System B are connected to mains and is closing the CBA according to parameters 8820 ↗ p. 109, 8821 ↗ p. 110 and 8822 ↗ p. 110.
Syn. segm. close CBA 13286	<b>Synchronous segment close CBA</b> The LS-5 has detected that System A and System B are already alternatively connected and is closing the CBA according to parameters 8852 ↗ p. 109, 8821 ↗ p. 110 and 8822 ↗ p. 110.
CBA request 13280	<b>CBA request</b> There is a command to open or close the CBA, but the execution is already blocked by the priority of a breaker command off another LS-5/GCB or the LS-5 is still arbitrating the priority.

## 9.4.3 Event History

### General notes

The event history is a 300 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 300 events have occurred.

For additional information refer to ↗ *Chapter 5 "Operation" on page 139.*

**Resetting event history****1.** ➔

*Make sure to have set the appropriate code level to reset the event history.*

*If you have not entered the correct password for the required code level, the parameters for resetting the event history are not available (for additional information refer to [Chapter 4.1.5 "Password System"](#) on page 67).*

**2.** ➔

Reset the event history by setting the parameter "Clear eventlog" (parameter 1706 [p. 67](#)) to "Yes" via the front panel.

⇒ The complete event history is now being cleared.

**9.4.3.1 Event Messages**

Message text ID	Meaning
AUTO mode 14353	Auto mode became active
MAN mode 14355	Manual mode became active
Feedback CBA open 14700	Reply CBA open became active
Feedback CBA close 14701	CBA close (reply CBA open became )
14724 System A is ok	System A became ok (Voltage and frequency in range)
System B is ok 14727	System B became ok (Voltage and frequency in range)
Close command CBA 14730	CBA close command became active
Open command CBA 14731	CBA open command became active
Start up power 14778	Power up cycle happened


## 9.4.3.2 Alarm Messages



*For a detailed description of the monitoring functions, which trigger the alarm messages, refer to [Chapter 4.3 “Configure Monitoring” on page 72](#).*

Message text ID	Meaning
Bat. overvoltage 1 10007	<b>Battery overvoltage, limit value 1</b> The battery voltage has exceeded the limit value 1 for battery overvoltage for at least the configured time and did not fall below the value of the hysteresis.
Bat. overvoltage 2 10008	<b>Battery overvoltage, limit value 2</b> The battery voltage has exceeded the limit value 2 for battery overvoltage for at least the configured time and did not fall below the value of the hysteresis.
Bat. undervoltage 1 10005	<b>Battery undervoltage, limit value 1</b> The battery voltage has fallen below the limit value 1 for battery undervoltage for at least the configured time and has not exceeded the value of the hysteresis.
Bat. undervoltage 2 10006	<b>Battery undervoltage, limit value 2</b> The battery voltage has fallen below the limit value 2 for battery undervoltage for at least the configured time and has not exceeded the value of the hysteresis.
CANopen Interface 1 10087	<b>Interface alarm CANopen on CAN bus 1</b> No Receive Process Data Object (RPDO) is received within the configured time.
EEPROM failure 1714	<b>The EEPROM checksum is corrupted</b> The EEPROM check at startup has resulted a defective EEPROM.
SyB. phase rotation 3955	<b>System B rotating field</b> The system A rotating field does not correspond with the configured direction.
SyA. decoupling 3114	<b>System A decoupling is initiated</b> One or more monitoring function(s) considered for the system A decoupling functionality has triggered.
SyA. overfreq. 1 2862	<b>System A overfrequency, limit value 1</b> The system A frequency has exceeded the limit value 1 for system A overfrequency for at least the configured time and did not fall below the value of the hysteresis.
SyA. overfreq. 2 2863	<b>System A overfrequency, limit value 2</b> The system A frequency has exceeded the limit value 2 for system A overfrequency for at least the configured time and did not fall below the value of the hysteresis. Triggering this monitoring function causes the mains decoupling function to trigger.
SyA. overvoltage 1 2962	<b>System A overvoltage, limit value 1</b> The system A voltage has exceeded the limit value 1 for system A overvoltage for at least the configured time and did not fall below the value of the hysteresis.
SyA. overvoltage 2 2963	<b>System A overvoltage, limit value 2</b> The system A voltage has exceeded the limit value 2 for system A overvoltage for at least the configured time and did not fall below the value of the hysteresis. Triggering this monitoring function causes the mains decoupling function to trigger.

Message text ID	Meaning
SyA. phase shift 3057	<b>System A phase shift</b> A system A phase shift, which has exceeded the configured limit, has occurred. Triggering this monitoring function causes the system A decoupling function to trigger.
SyA. underfreq. 1 2912	<b>System A underfrequency, limit value 1</b> The system A frequency has fallen below the limit value 1 for system A underfrequency for at least the configured time and has not exceeded the value of the hysteresis.
SyA underfreq. 2 2913	<b>System A underfrequency, limit value 2</b> The system A frequency has fallen below the limit value 2 for system A underfrequency for at least the configured time and has not exceeded the value of the hysteresis. Triggering this monitoring function causes the mains decoupling function to trigger.
SyA. undervoltage 1 3012	<b>System A undervoltage, limit value 1</b> The system A voltage has fallen below the limit value 1 for system A undervoltage for at least the configured time and has not exceeded the value of the hysteresis.
SyA. undervoltage 2 3013	<b>System A undervoltage, limit value 2</b> The system A voltage has fallen below the limit value 2 for system A undervoltage for at least the configured time and has not exceeded the value of the hysteresis. Triggering this monitoring function causes the mains decoupling function to trigger.
CBA fail to close 2623	<b>CBA failed to close</b> The LS-5 has attempted to close the CBA the configured maximum number of attempts and failed. The LS-5 will continue to attempt to close the CBA as long as the conditions for closing the CBA are fulfilled.
CBA fail to open 2624	<b>Failed CBA open</b> The LS-5 is still receiving the reply CBA closed after the CBA open monitoring timer has expired.
CBA syn. timeout 3074	<b>CBA synchronization time exceeded</b> The LS-5 has failed to synchronize the CBA within the configured synchronization time.
Missing LS5 4064	<b>Missing LS-5 members detected</b> The LS-5 has detected that the number of available units at CAN does not correspond with the configured application mode.
SyA. phase rotation 3975	<b>System A rotating field</b> The system A rotating field does not correspond with the configured direction.
Ph.rotation mismatch 2944	<b>System A/System B phase rotation different</b> System A or System B has different rotating fields. A CB closure is blocked.
SyA. df/dt 3106	<b>System A df/dt (ROCOF)</b> A system A df/dt, which has exceeded the configured limit, has occurred. Triggering this monitoring function causes the system A decoupling function to trigger.
SyA. volt. asymmetry 3928	<b>System A voltage asymmetry</b> For at least the delay time without interruption.
SyA. volt. incr. 8834	<b>System A voltage increase</b> The limit for voltage increase is reached or exceeded.
SyA. time-dep. voltage 4958	<b>System A time-dependent voltage</b> The measured voltage falls below/exceeds the configured criteria.

Message text ID	Meaning
QV monitoring 1 3288	<b>QV monitoring, delay time 1</b> The system A reactive power has exceeded the limit for at least the configured delay time 1.
QV monitoring 2 3289	<b>QV monitoring, delay time 2</b> The system A reactive power has exceeded the limit for at least the configured delay time 2.
CBA unload mismatch 8838	<b>CBA unloading mismatch</b> While unloading CBA the defined limit of load is not reached in the defined time.
Discrete input {x}	<b>Discrete input {x}, energized / de-energized</b> The actual state of the monitored discrete input is energized / de-energized (depending on the configuration) for at least the configured time. This text may be assigned customer defined. The text in angular brackets is the default text.  Refer to  “Message IDs for discrete inputs” on page 333.

### Message IDs for discrete inputs

Discrete input #	1	2	3	4	5	6	7
Message ID	10600	10601	10602	10603	10604	10605	10607

## 9.5 Additional Information

### 9.5.1 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				3Ph4W		3Ph3W		1Ph3W	
		Ph-Ph		Ph-N		left	right	left	right	(Ph-N)	
		left	right	left	right						
1Ph2W	Ph-Ph	left	Yes	n.a.	n.a.	n.a.	Yes	blocked	Yes	blocked	Not allowed (*2
		right	n.a.	Yes	n.a.	n.a.	blocked	Yes	blocked	Yes	Not allowed (*2
	Ph-N	left	n.a.	n.a.	Yes	n.a.	Yes	blocked	Not allowed (*1	blocked	Yes
		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	
	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	
	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. 132: Synchronization Table - Two Systems A-B

## 10 Glossary And List Of Abbreviations

<b>CB</b>	Circuit Breaker
<b>CL</b>	Code Level
<b>CT</b>	Current Transformer
<b>DI</b>	Discrete Input
<b>DO</b>	Discrete (Relay) Output
<b>ECU</b>	Engine Control Unit
<b>FMI</b>	Failure Mode Indicator
<b>GCB</b>	Generator Circuit Breaker
<b>GGB</b>	Generator Group Breaker
<b>I</b>	Current
<b>IOP</b>	Isolated Operation in Parallel
<b>LDSS</b>	Load-Dependent Start/Stop operation
<b>MCB</b>	Mains Circuit Breaker
<b>MOP</b>	Mains Operation in Parallel
<b>MPU</b>	Magnetic Pickup Unit
<b>N.C.</b>	Normally Closed (break) contact
<b>N.O.</b>	Normally Open (make) contact
<b>OC</b>	Occurrence Count
<b>P</b>	Real power
<b>P/N</b>	Part Number
<b>PF</b>	Power Factor
<b>PID</b>	Proportional Integral Derivative controller
<b>PLC</b>	Programmable Logic Control
<b>PT</b>	Potential (Voltage) Transformer
<b>Q</b>	Reactive power
<b>S</b>	Apparent power
<b>S/N</b>	Serial Number
<b>SPN</b>	Suspect Parameter Number
<b>V</b>	Voltage





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### A

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### B

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