37540_D

LS-5 Series | LS-521 V2 (Option K12) Circuit Breaker Control

User Manual

Software Version 1.0203

Manual 37540_D

WARNING

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment. Practice all plant and safety instructions and precautions. Failure to follow instructions can cause personal injury and/or property damage.

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.

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 such unauthorized modifications: (i) constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (ii) invalidate product certifications or listings.

WARNING

Although the application of this device differs from that of the standard LS-5x1, the same safety instructions apply!

Refer to LS-5v2 manual B37649:
http://wwdmanuals.com/ls-5x1_v2

CAUTION

To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts.

- **Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control).**
- **Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.**
- **Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.**

OUT-OF-DATE PUBLICATION

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, be sure to check the Woodward website:

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Important definitions

WARNING

Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation that, if not avoided, could result in damage to equipment.

NOTE

Provides other helpful information that does not fall under the warning or caution categories.

Revision History

Rev.	Date	Editor	Changes
D	2022-04	Lu	**New device features & updates** • New parameters for connecting synchronous networks (refer to page 63) • New command (CAN) to connect synchronous networks (refer to page 119) **Corrections in manual:** • Wiring diagram (refer to page 18): o Relay 5 is fixed to “Close CB A” (not to “Open CB A) o Relay 6 is fixed to “Open CB A if CB A control 0 2 relay (not “Close CB A”) o DI 8 is fixed to “Reply CB A is open (not to CB A is closed) o DI 1 and DI 3 are not assigned by default • CAN message 1, bytes 4; 5 diff. angle is “Sys. B – Sys. A” (not “Sys. A – Sys. B”) (refer to page 117)
C	2017-09	GG	**Manual** Table of content had German wording
B	2017-06-26	GG	**(Same) software version 1.0202 but new hardware version 2** **New device features & updates** • Six current transformers/CT input terminals **Manual** • Hardware related information updated for new version 2; e.g. Front Foil colors and six instead of four CT terminals.
A	2013-03-01	GG	**New device features & updates** • Undesired breaker close for synchronization when one system is configured to 1Ph2Wandthe other system to 3Ph4W: problem solved. **Manual** • New overview table for synchronization matches System A with Sytem B. Refer to “Synchronization Of System A and System B” on page 120 for details.
NEW	2012-08-30	GG	Release

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Figures

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Glossary And List Of Abbreviations

CB	Circuit Breaker
CL	Code Level
CT	Current Transformer
DI	Discrete Input
DO	Discrete (Relay) Output
ECU	Engine Control Unit
FMI	Failure Mode Indicator
GCB	Generator Circuit Breaker
I	Current
IOP	Isolated Operation in Parallel
LDSS	Load-Dependent Start/Stop operation
MCB	Mains Circuit Breaker
MOP	Mains Operation in Parallel
MPU	Magnetic Pickup Unit
N.C.	Normally Closed (break) contact
N.O.	Normally Open (make) contact
OC	Occurrence Count
P	Real power
P/N	Part Number
PF	Power Factor
PF	Power factor
PID	Proportional Integral Derivative controller
PLC	Programmable Logic Control
PT	Potential (Voltage) Transformer
Q	Reactive power
S	Apparent power
S/N	Serial Number
SPN	Suspect Parameter Number
V	Voltage

Chapter 1
General Information

Document Overview

This manual describes the LS-521 V2 (Option K12) circuit breaker control.

	Type		English	German
LS-5				
	LS-521 V2 (Option K12) – User Manual	this manual ⇨	37540	-

Table 1-1: Manual - overview

Intended Use
The unit must only be operated in the manner described by this manual. The prerequisite for a proper and safe operation of the product is correct transportation, storage, and installation as well as careful operation and maintenance.

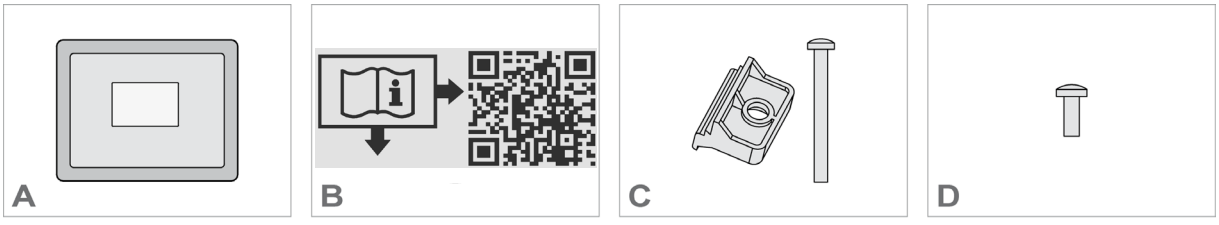
NOTE

This manual has been developed for a unit fitted with all available options. Inputs/outputs, functions, configuration screens, and other details described, which do not exist on your unit, may be ignored.

The present manual has been prepared to enable the installation and commissioning of the unit. Due to the large variety of parameter settings, it is not possible to cover every combination. The manual is therefore only a guide. In case of incorrect entries or a total loss of functions, the default settings may be taken from the Parameter List which can be found in the appendix or from ToolKit and the respective *.SID file.

Scope of delivery

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



http://wwdmanuals.com/ls-5x1_v2

A: LS-5 K12
B: QR code
C: Clamp fastener - 4x
D: Screw kit installation material – 8x

Chapter 2
Installation

Electrostatic Discharge Awareness

All electronic equipment is static-sensitive, some components more than others. To protect these components from static damage, you must take special precautions to minimize or eliminate electrostatic discharges.

Follow these precautions when working with or near the control.

1. Before doing maintenance on the electronic control, discharge the static electricity on your body to ground by touching and holding a grounded metal object (pipes, cabinets, equipment, etc.).

2. Avoid the 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.

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, modules, and work area as much as possible.

4. **Opening the control cover may void the unit warranty.**
   Do not remove the printed circuit board (PCB) from the control cabinet unless absolutely necessary. If you must 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.

CAUTION

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.*

Marine Usage

CAUTION

The following notes are very important for marine usage of the LS-5 circuit breaker control and have to be followed.

Application

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

For marine applications an EMI filter (i.e. SCHAFFNER - FN 2070-3-06) must be connected ahead of the power supply input.

To meet the functional safety requirements of the application, the rules of marine classification independent protective devices must be applied.

Housing Type

The LS-521 V2 (Option K12) control is available with the following housing type.

LS-521 V2 - Plastic housing with LCD display.
Front panel mounting.

Plastic Housing

Panel Cutout

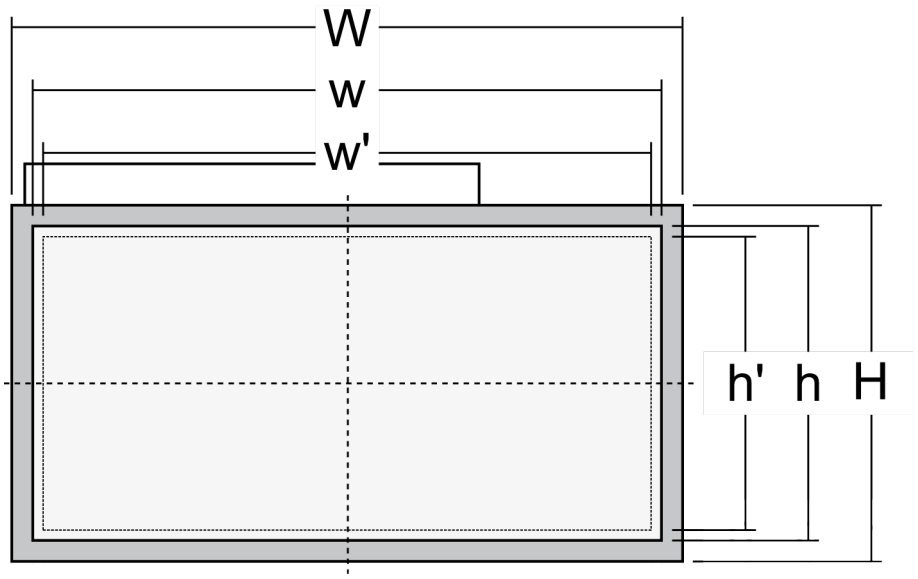


Figure 2-1: Housing - panel-board cutout

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	---

Table 2-1: Plastic housing - panel cutout

The maximum permissible corner radius is 3.5 mm.
Refer to Figure 2-3 on page 17 for a cutout drawing.

Dimensions

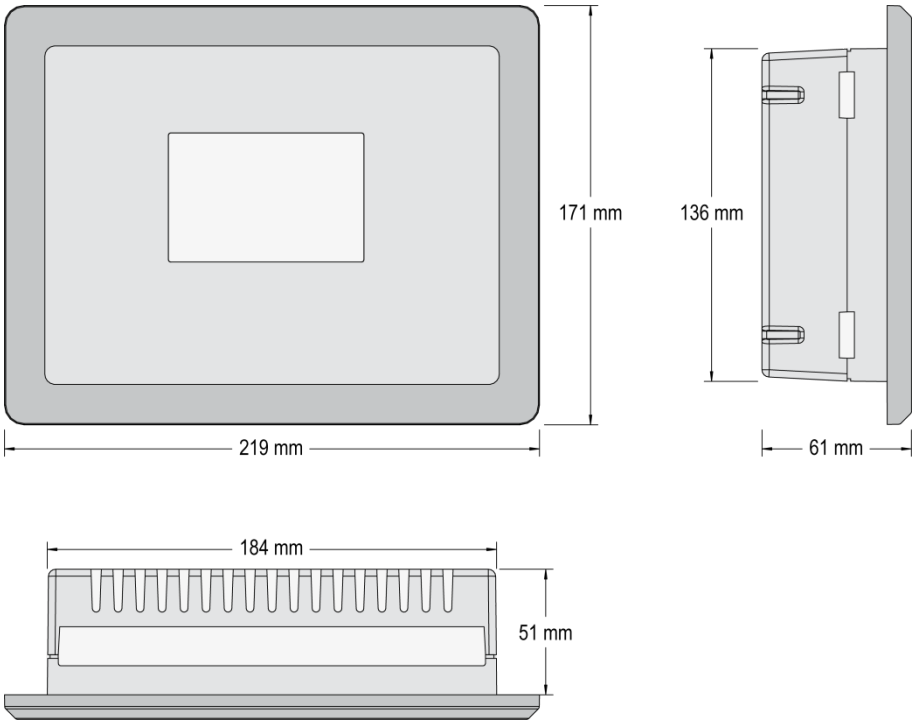


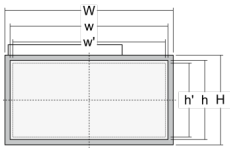
Figure 2-2: Plastic housing LS-521 V2 – dimensions

Clamp Fastener Installation

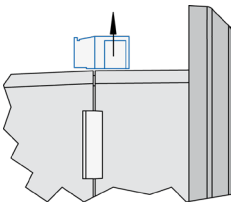
For installation into a panel door with the fastening clamps, please proceed as follows:

1. **Panel cutout**
   Cut out the panel according to the dimensions in Figure 2-1.

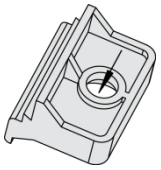
   Note: It is not necessary to drill the holes if the fastening clamps are used.



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

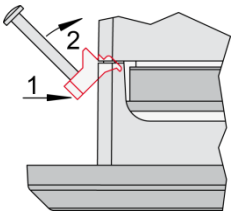


3. **Insert screws in clamps**
   Insert the four clamping screws into the clamp inserts from the shown side (opposite of the nut insert) until they are almost flush. Do not completely insert the screws into the clamp inserts.

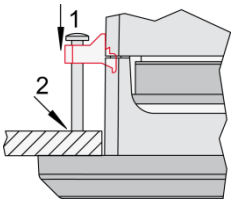


4. **Insert unit into cutout**
   Insert the unit into the panel cutout. Verify that the unit fits correctly in the cutout. If the panel cutout is not big enough, enlarge it accordingly.

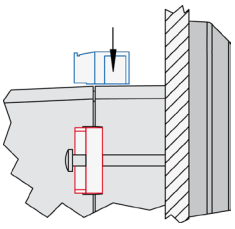
5. **Attach clamp inserts**
   Re-install the clamp inserts by tilting the insert to a 45° angle. (1) Insert the nose of the insert into the slot on the side of the housing. (2) Raise the clamp insert so that it is parallel to the control panel.



6. **Tighten clamping screws**
   Tighten the clamping screws (1) until the control unit is secured to the control panel (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 (0.9 pound-force inches).



7. **Reattach terminals**
   Reattach the wire connection terminal strip (1) and secure them with the side screws.



Screw Kit Installation

In order to enhance the protection of the front to IP 65, it is possible to fasten the unit with a screw kit instead of the clamp fastener hardware.

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 Figure 2-3.
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 cross-wise pattern to ensure even pressure distribution.

NOTE

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

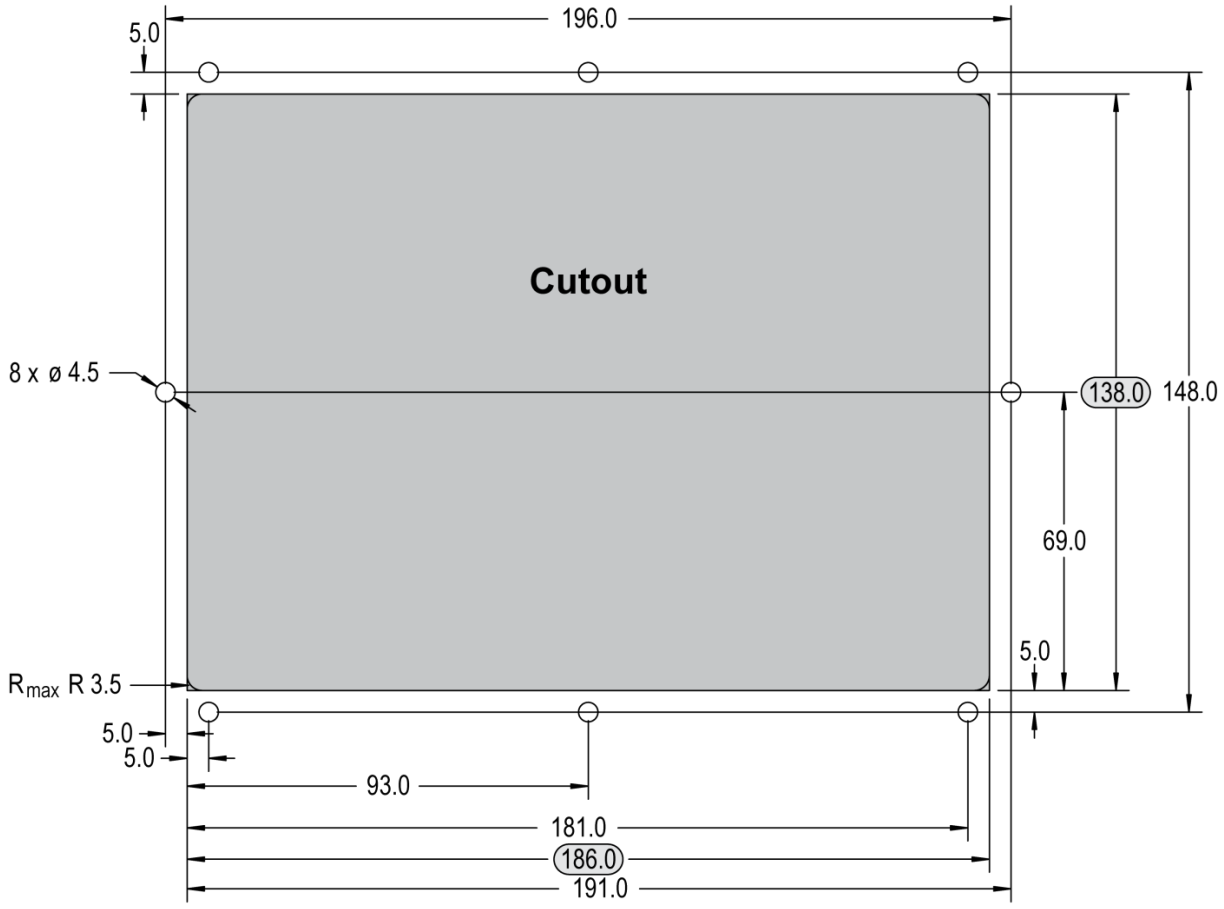


Figure 2-3: Plastic housing - drill plan

Wiring Diagram

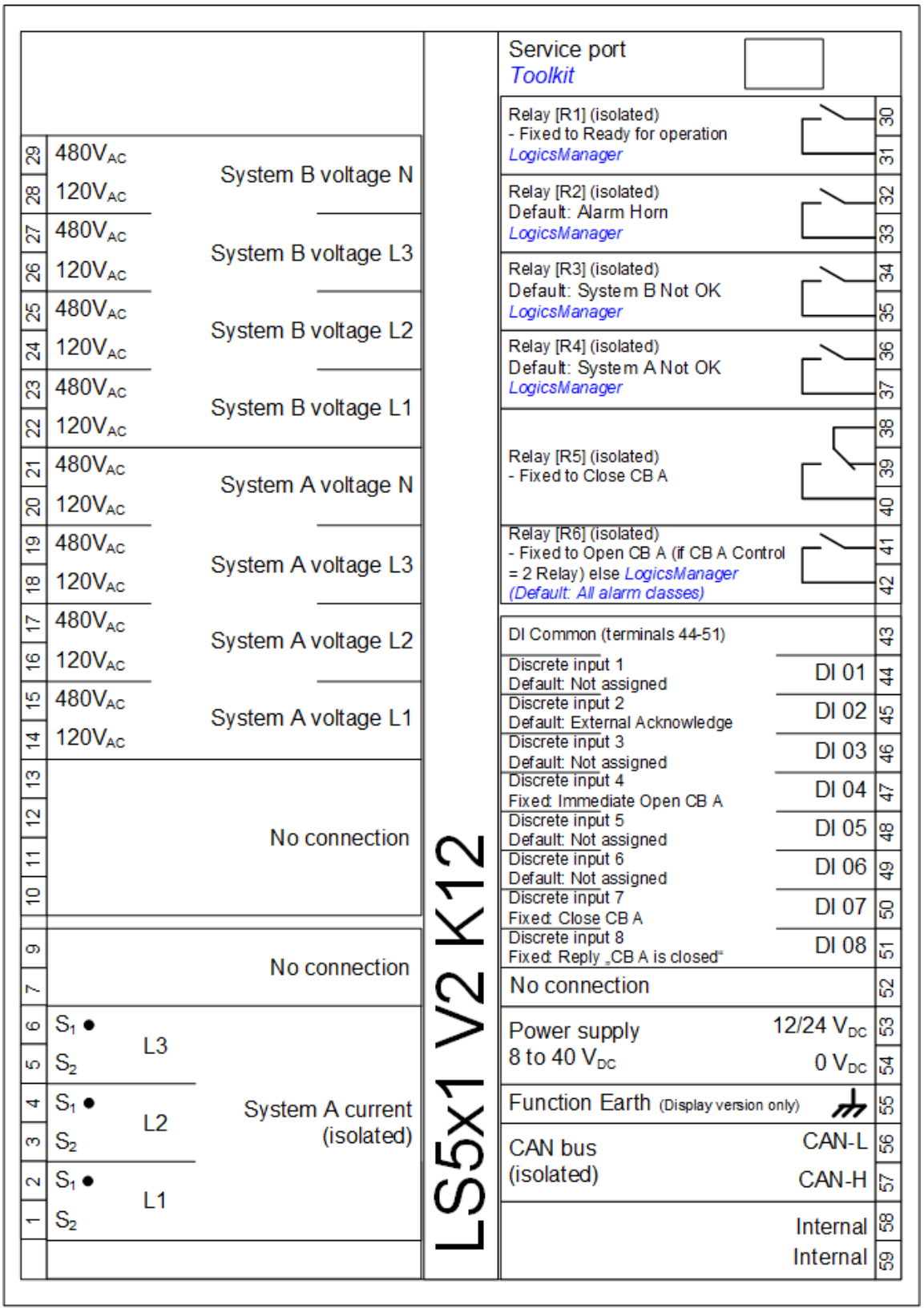


Figure 2-4: LS-521 V2 (Option K12) - wiring diagram

Connections

WARNING

All technical data and ratings indicated in this chapter are not definite! Only the values indicated in Chapter 6: Technical Data on page 98 are valid!

The following chart may be used to convert square millimeters [mm²] to AWG and vice versa:

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

Table 2-2: Conversion chart - wire size

Power Supply

WARNING – Protective Earth / Function Earth

Protective Earth (PE) / Function Earth must be connected to the unit to avoid the risk of electric shock. The conductor providing the connection must have a wire larger than or equal to 2.5 mm² (14 AWG). The connection must be performed properly.

- **This function earth connection will be made using the screw-plug-terminal 55.**

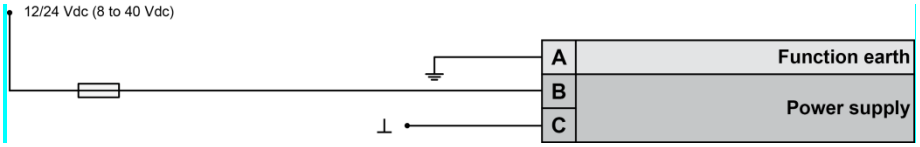


Figure 2-5: Power supply

Figure	Terminal	Description	A_{max}
A	55	Function earth	2.5 mm²
B	53	12/24Vdc (8 to 40.0 Vdc)	2.5 mm²
C	54	0 Vdc	2.5 mm²

Table 2-3: Power supply - terminal assignment

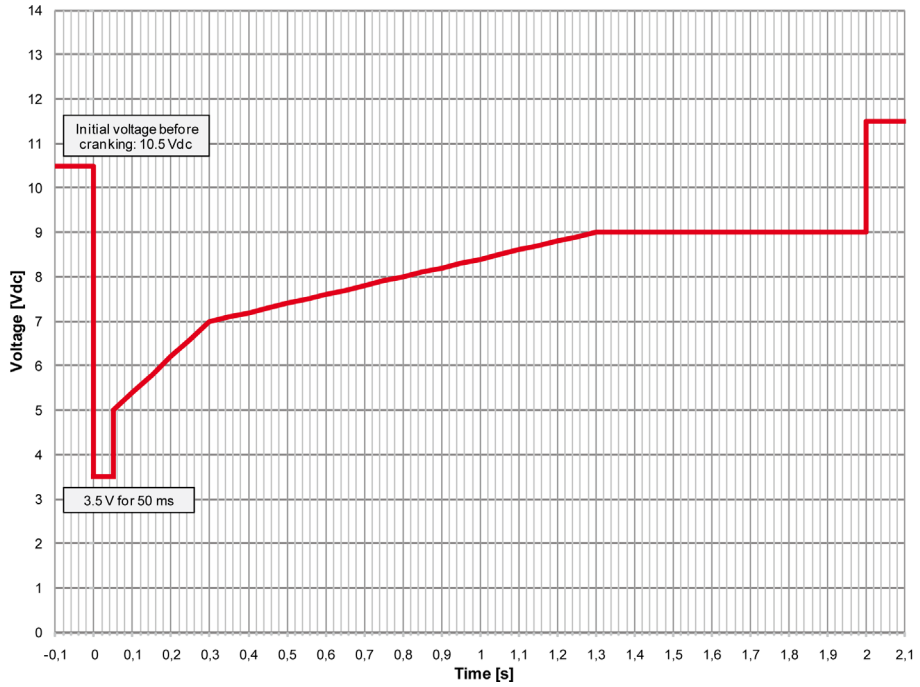


Figure 2-6: Power supply - crank waveform at maximum load

NOTE

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)**

Voltage Measuring

NOTE

DO NOT use both sets of voltage measuring inputs. The control unit will not measure voltage correctly if the 120 V and 480 V inputs are utilized simultaneously.

NOTE

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

Voltage Measuring: System A

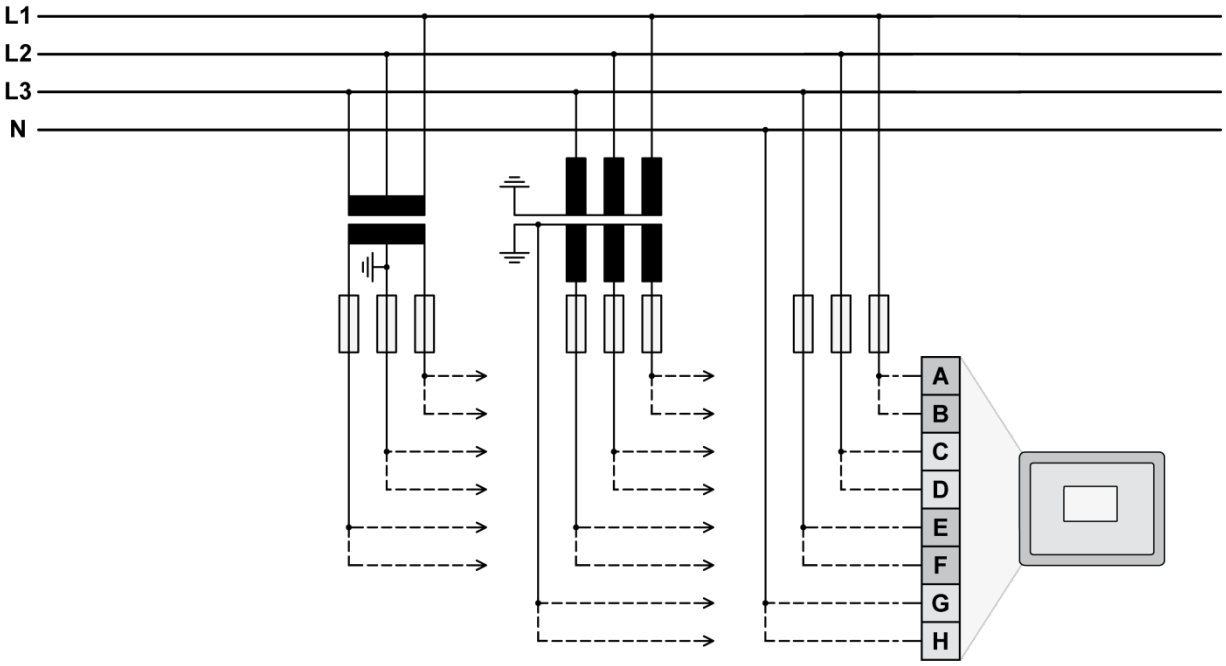


Figure 2-7: Voltage measuring – system A

Figure	Terminal	Description		A_{max}
A	14	System A Voltage L1	120 Vac	2.5 mm²
B	15		480 Vac	2.5 mm²
C	16	System A Voltage L2	120 Vac	2.5 mm²
D	17		480 Vac	2.5 mm²
E	18	System A Voltage L3	120 Vac	2.5 mm²
F	19		480 Vac	2.5 mm²
G	20	System A Voltage N	120 Vac	2.5 mm²
H	21		480 Vac	2.5 mm²

Table 2-4: Voltage measuring - terminal assignment – system A voltage

NOTE

If parameter 1800 ("SyA. PT sec. rated voltage", refer to Chapter 3: Configuration is configured with a value between 50 and 130 V, the 120 V input terminals must be used for proper measurement.

If parameter 1800 ("SyA. PT sec. rated voltage", refer to Chapter 3: Configuration is configured with a value between 131 and 480 V, the 480 V input terminals must be used for proper measurement.

Voltage Measuring: System A, Parameter Setting '3Ph 4W OD' (3-phase, 4-wire, Open delta)

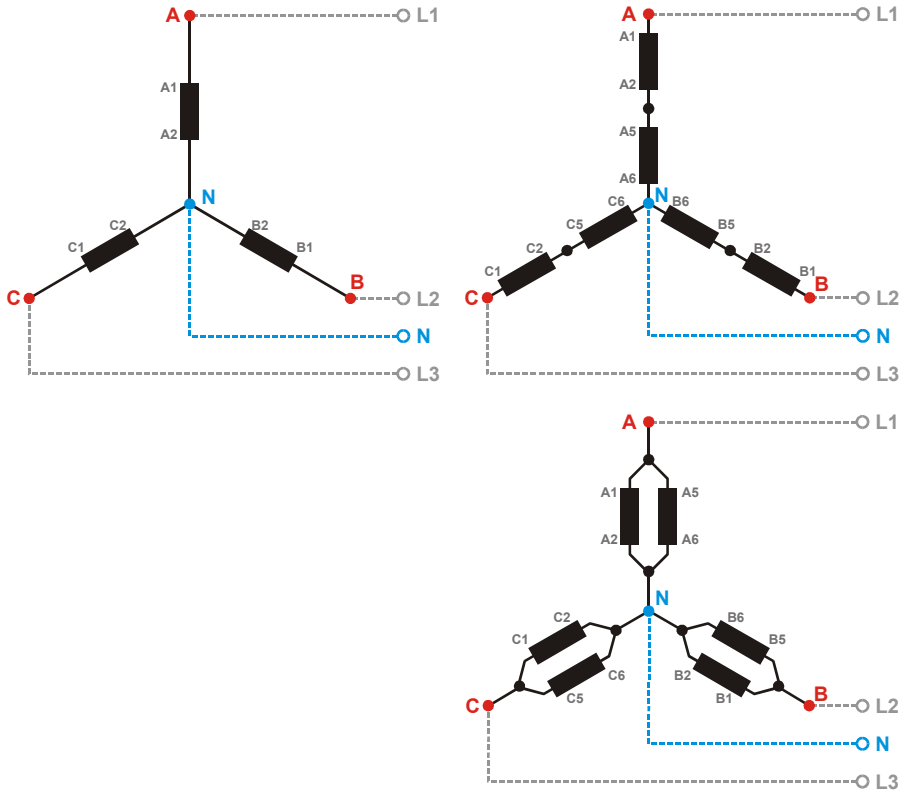


Figure 2-8: Voltage measuring – system A windings, 3Ph 4W OD

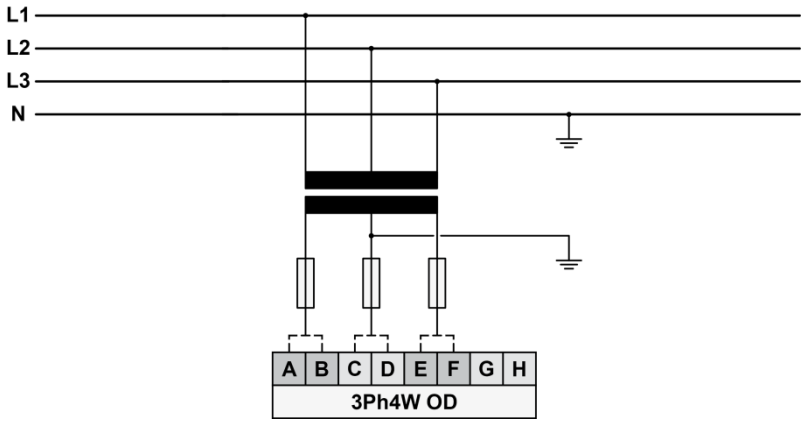


Figure 2-9: Voltage measuring – system A measuring inputs, 3Ph 4W OD

3Ph 4W OD	Wiring terminals								Note
Rated voltage (range)	[1] 120 V (50 to 130 $V_{eff.}$)				[5] 480 V (131 to 480 $V_{eff.}$)				1
Measuring range (max.)	[1] 0 to 150 Vac				[5] 0 to 600 Vac				
Figure	A	C	E	G	B	D	F	H	
Terminal	14	16	18	20	15	17	19	21	
Phase	L1	L2	L3	---	L1	L2	L3	---	

Table 2-5: Voltage measuring - terminal assignment – system A, 3Ph 4W OD

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

Voltage Measuring: System A, Parameter Setting '3Ph 4W' (3-phase, 4-wire)

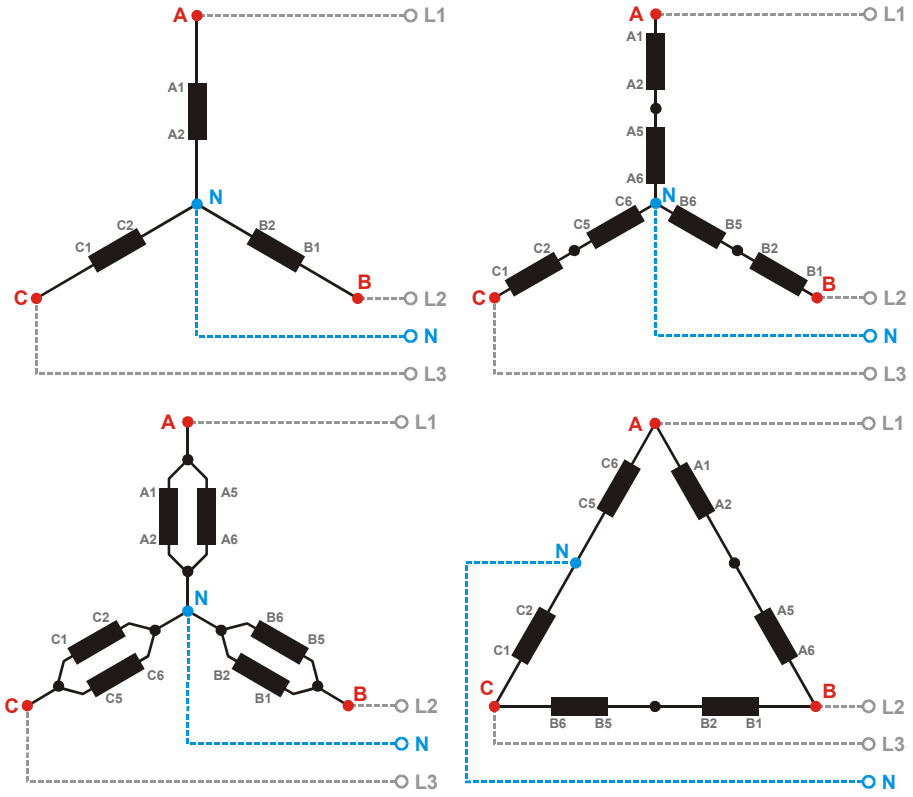


Figure 2-10: Voltage measuring – system A windings, 3Ph 4W

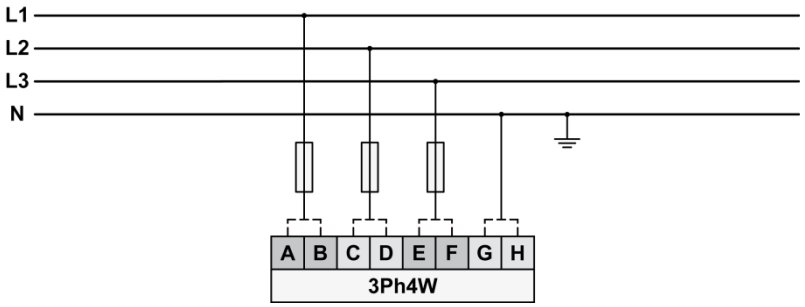


Figure 2-11: Voltage measuring – system A measuring inputs, 3Ph 4W

3Ph 4W	Wiring terminals								Note
Rated voltage (range)	[1] 120 V (50 to 130 $V_{eff.}$)				[5] 480 V (131 to 480 $V_{eff.}$)				2
Measuring range (max.)	[1] 0 to 150 Vac				[5] 0 to 600 Vac				
Figure	A	C	E	G	B	D	F	H	
Terminal	14	16	18	20	15	17	19	21	
Phase	L1	L2	L3	N	L1	L2	L3	N	

Table 2-6: Voltage measuring - terminal assignment – system A, 3Ph 4W

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

Voltage Measuring: System A, Parameter Setting '3Ph 3W' (3-phase, 3-wire)

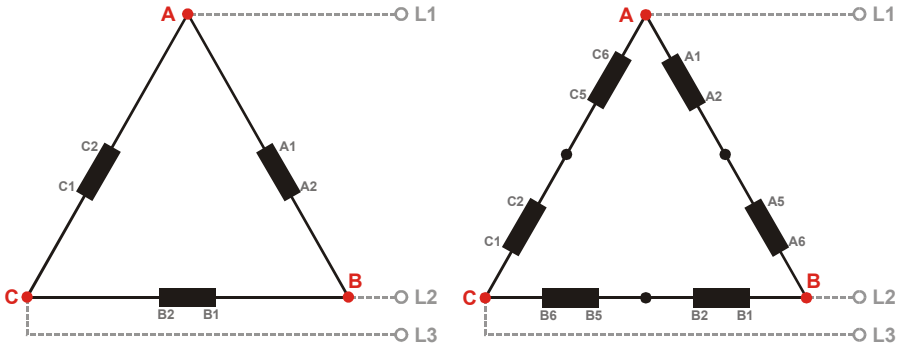


Figure 2-12: Voltage measuring – system A windings, 3Ph 3W

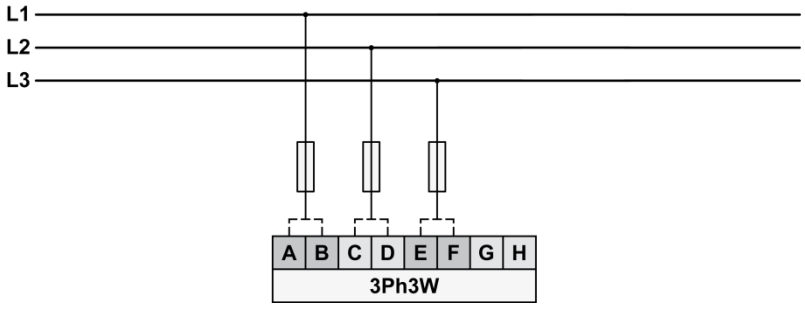


Figure 2-13: Voltage measuring – system A measuring inputs, 3Ph 3W

3Ph 3W	Wiring terminals								Note
Rated voltage (range)	[1] 120 V (50 to 130 $V_{eff.}$)				[5] 480 V (131 to 480 $V_{eff.}$)				3
Measuring range (max.)	[1] 0 to 150 Vac				[5] 0 to 600 Vac				
Figure	A	C	E	G	B	D	F	H	
Terminal	14	16	18	20	15	17	19	21	
Phase	L1	L2	L3	---	L1	L2	L3	---	

Table 2-7: Voltage measuring - terminal assignment – system A, 3Ph 3W

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

Voltage Measuring: System A, Parameter Setting '1Ph 3W' (1-phase, 3-wire)

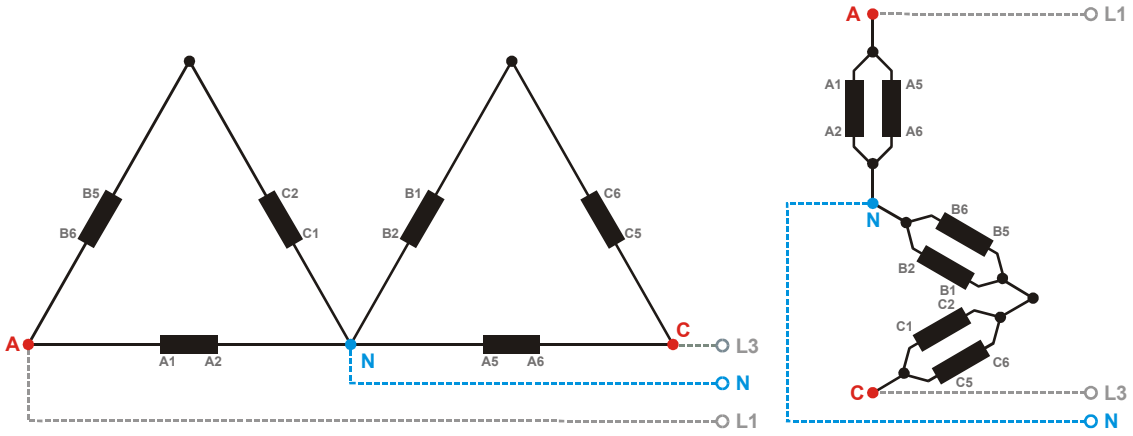


Figure 2-14: Voltage measuring – system A windings, 1Ph 3W

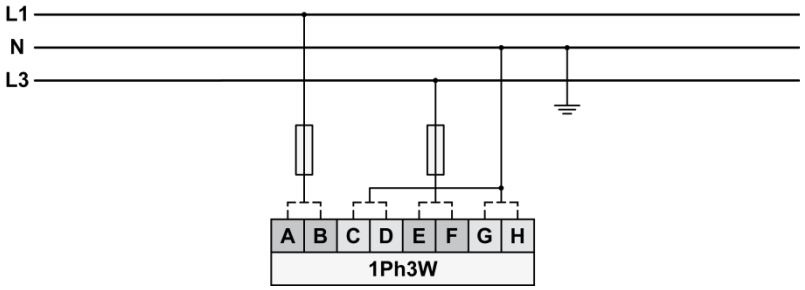


Figure 2-15: Voltage measuring – system A measuring inputs, 1Ph 3W

1Ph 3W	Wiring terminals								Note
Rated voltage (range)	[1] 120 V (50 to 130 $V_{eff.}$)				[5] 480 V (131 to 480 $V_{eff.}$)				4
Measuring range (max.)	[1] 0 to 150 Vac				[5] 0 to 600 Vac				
Figure	A	C	E	G	B	D	F	H	
Terminal	14	16	18	20	15	17	19	21	
Phase	L1	N	L3	N	L1	N	L3	N	

Table 2-8: Voltage measuring - terminal assignment – system A, 1Ph 3W

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

Voltage Measuring: System A, Parameter Setting '1Ph 2W' (1-phase, 2-wire)

NOTE

The 1-phase, 2-wire measurement may be performed phase-neutral or phase-phase. Please note to configure and wire the LS-5 consistently. Refer to the Chapter 3: Configuration for more information.

'1Ph 2W' Phase-Neutral Measuring

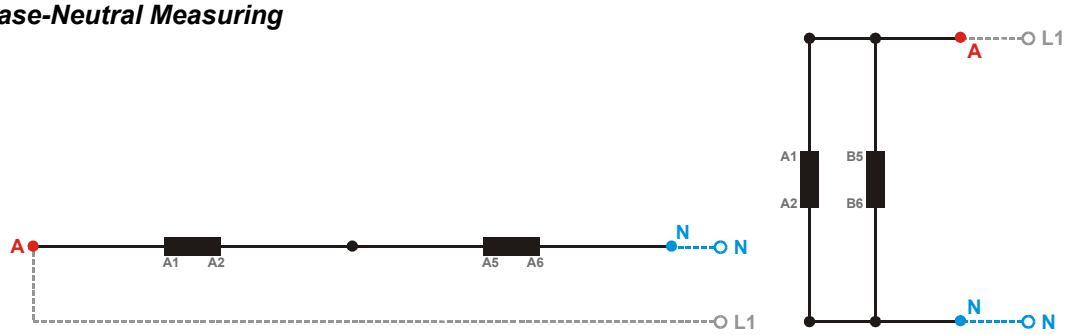


Figure 2-16: Voltage measuring – system A windings, 1Ph 2W (phase-neutral)

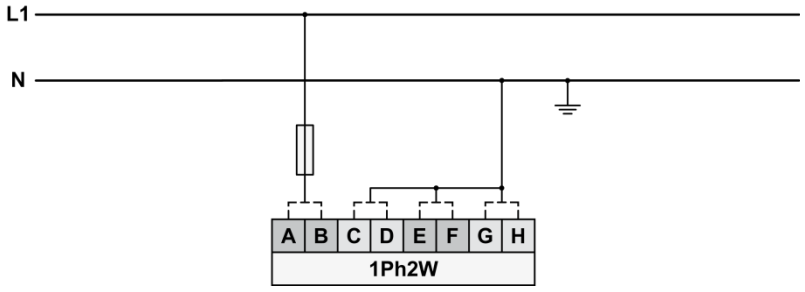


Figure 2-17: Voltage measuring – system A measuring inputs, 1Ph 2W (phase-neutral)

1Ph 2W	Wiring terminals								Note
Rated voltage (range)	[1] 120 V (50 to 130 $V_{eff.}$)				[5] 480 V (131 to 480 $V_{eff.}$)				5
Measuring range (max.)	[1] 0 to 150 Vac				[5] 0 to 600 Vac				
Figure	A	C	E	G	B	D	F	H	
Terminal	14	16	18	20	15	17	19	21	
Phase	L1	N	N	N	L1	N	N	N	

Table 2-9: Voltage measuring - terminal assignment – system A, 1Ph 2W (phase-neutral)

5 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

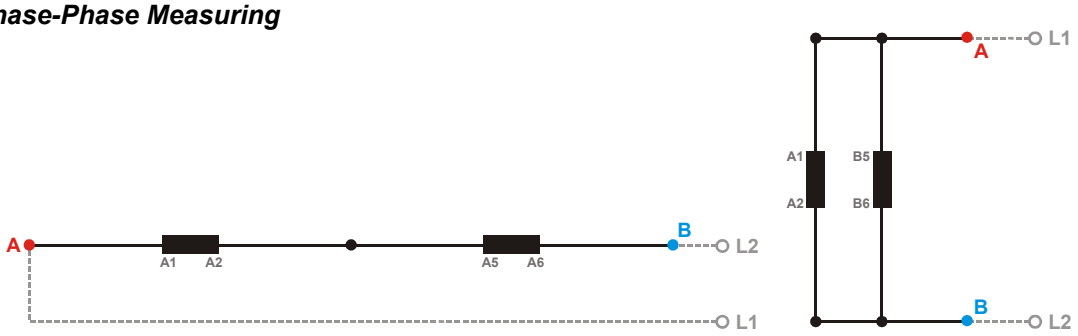


Figure 2-18: Voltage measuring – system A windings, 1Ph 2W (phase-phase)

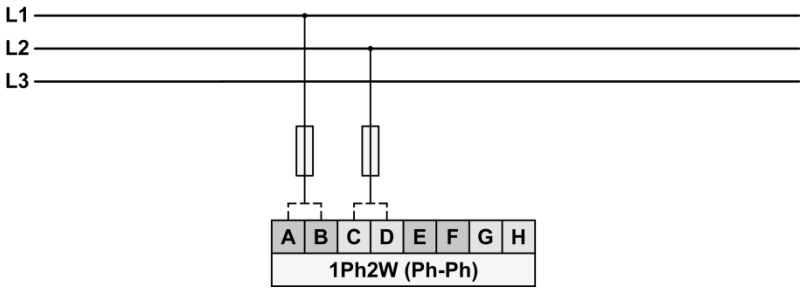


Figure 2-19: Voltage measuring – system A measuring inputs, 1Ph 2W (phase-phase)

1Ph 2W	Wiring terminals								Note
Rated voltage (range)	[1] 120 V (50 to 130 $V_{eff.}$)				[5] 480 V (131 to 480 $V_{eff.}$)				6
Measuring range (max.)	[1] 0 to 150 Vac				[5] 0 to 600 Vac				
Figure	A	C	E	G	B	D	F	H	
Terminal	14	16	18	20	15	17	19	21	
Phase	L1	L2	---	---	L1	L2	---	---	

Table 2-10: Voltage measuring - terminal assignment – system A, 1Ph 2W (phase-phase)

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

Voltage Measuring: System B

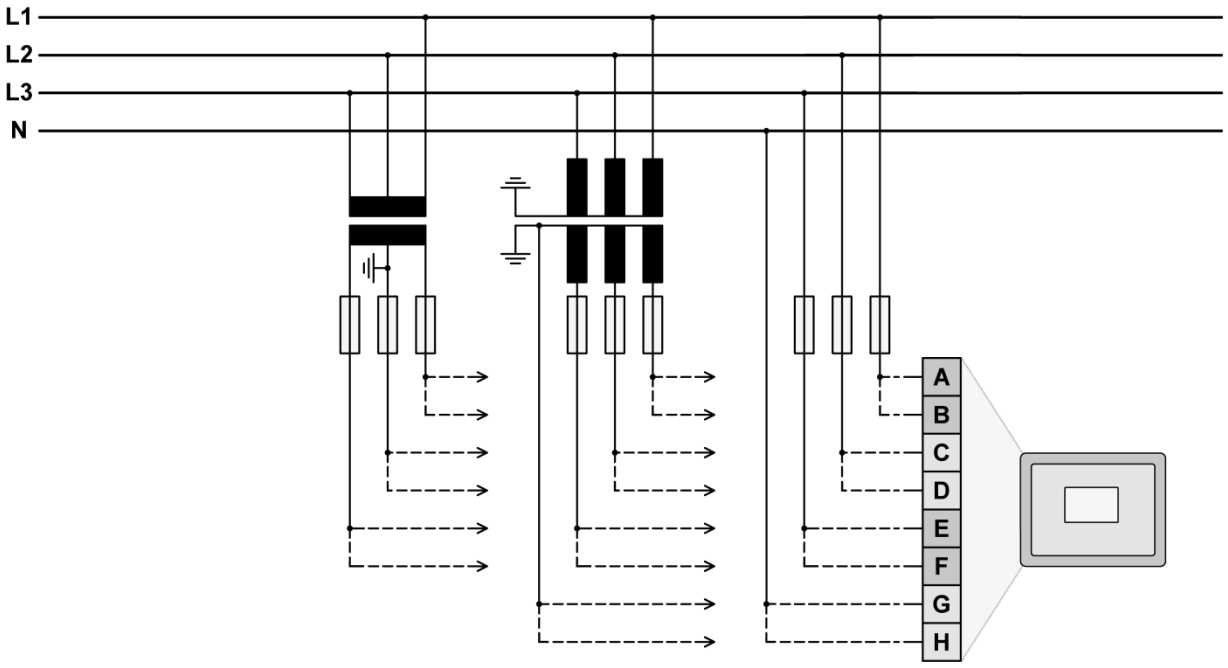


Figure 2-20: Voltage measuring – system B

Figure	Terminal	Description		A_{max}
A	22	System B Voltage L1	120 Vac	2.5 mm²
B	23		480 Vac	2.5 mm²
C	24	System B Voltage L2	120 Vac	2.5 mm²
D	25		480 Vac	2.5 mm²
E	26	System B Voltage L3	120 Vac	2.5 mm²
F	27		480 Vac	2.5 mm²
G	28	System B Voltage N	120 Vac	2.5 mm²
H	29		480 Vac	2.5 mm²

Table 2-11: Voltage measuring - terminal assignment – system B voltage

NOTE

If parameter 1803 ("SyB PT sec. rated voltage", refer to Chapter 3: Configuration) is configured with a value between 50 and 130 V, the 120 V input terminals must be used for proper measurement.

If parameter 1803 ("SyB PT sec. rated voltage", refer to Chapter 3: Configuration) is configured with a value between 131 and 480 V, the 480 V input terminals must be used for proper measurement.

Voltage Measuring: System B, Parameter Setting '3Ph 4W' (3-phase, 4-wire)

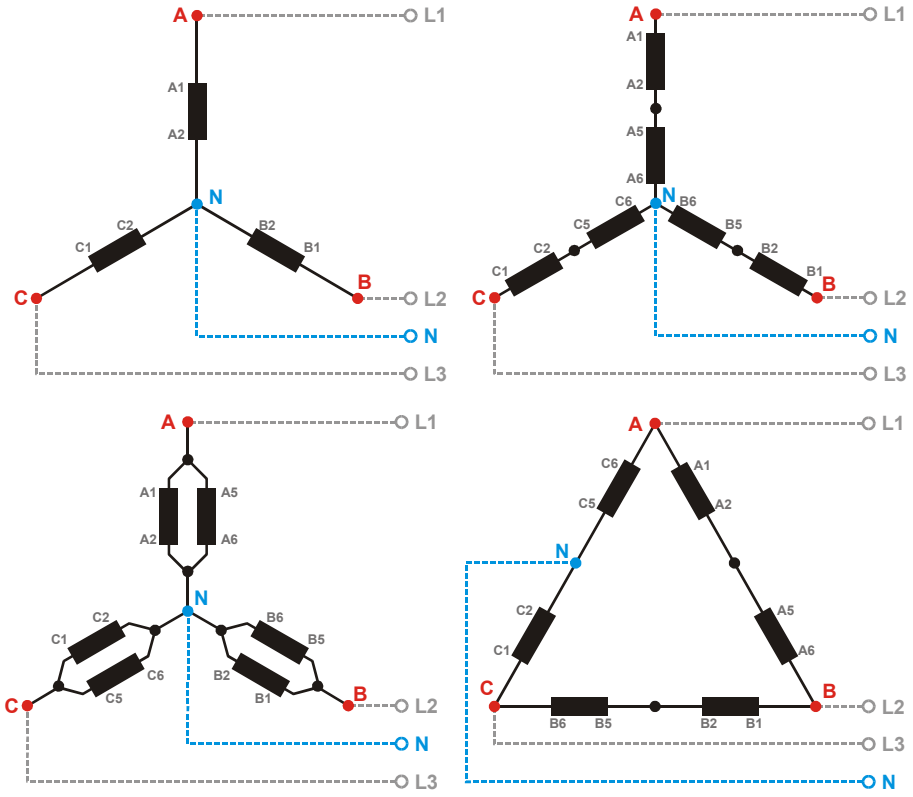


Figure 2-21: Voltage measuring – system B PT windings, 3Ph 4W

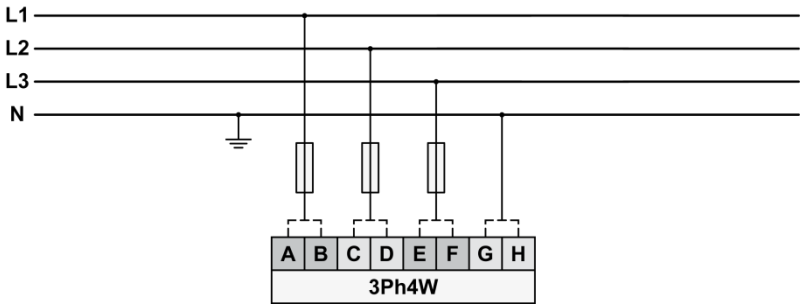


Figure 2-22: Voltage measuring – system B measuring inputs, 3Ph 4W

3Ph 4W	Wiring terminals								Note
Rated voltage (range)	[1] 120 V (50 to 130 $V_{eff.}$)				[5] 480 V (131 to 480 $V_{eff.}$)				7
Measuring range (max.)	[1] 0 to 150 Vac				[5] 0 to 600 Vac				
Figure	A	C	E	G	B	D	F	H	
Terminal	22	24	26	28	23	25	27	29	
Phase	L1	L2	L3	N	L1	L2	L3	N	

Table 2-12: Voltage measuring - terminal assignment – system B, 3Ph 4W

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

Voltage Measuring: System B, Parameter Setting '3Ph 3W' (3-phase, 3-wire)

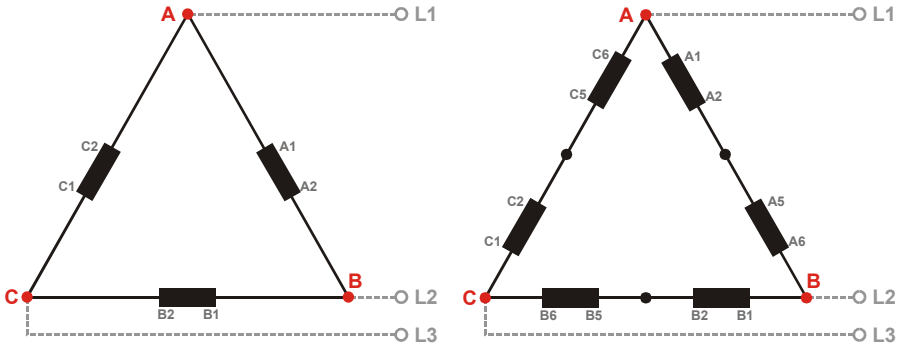


Figure 2-23: Voltage measuring – system B PT windings, 3Ph 3W

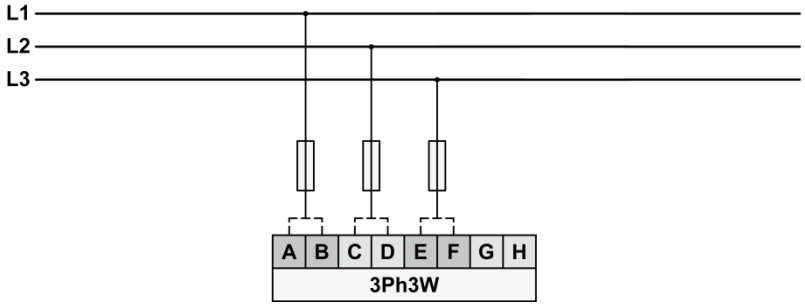


Figure 2-24: Voltage measuring – system B measuring inputs, 3Ph 3W

3Ph 3W	Wiring terminals								Note
Rated voltage (range)	[1] 120 V (50 to 130 $V_{eff.}$)				[5] 480 V (131 to 480 $V_{eff.}$)				8
Measuring range (max.)	[1] 0 to 150 Vac				[5] 0 to 600 Vac				
Figure	A	C	E	G	B	D	F	H	
Terminal	22	24	26	28	23	25	27	29	
Phase	L1	L2	L3	---	L1	L2	L3	---	

Table 2-13: Voltage measuring - terminal assignment – system B, 3Ph 3W

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

Voltage Measuring: System B, Parameter Setting '1Ph 3W' (1-phase, 3-wire)

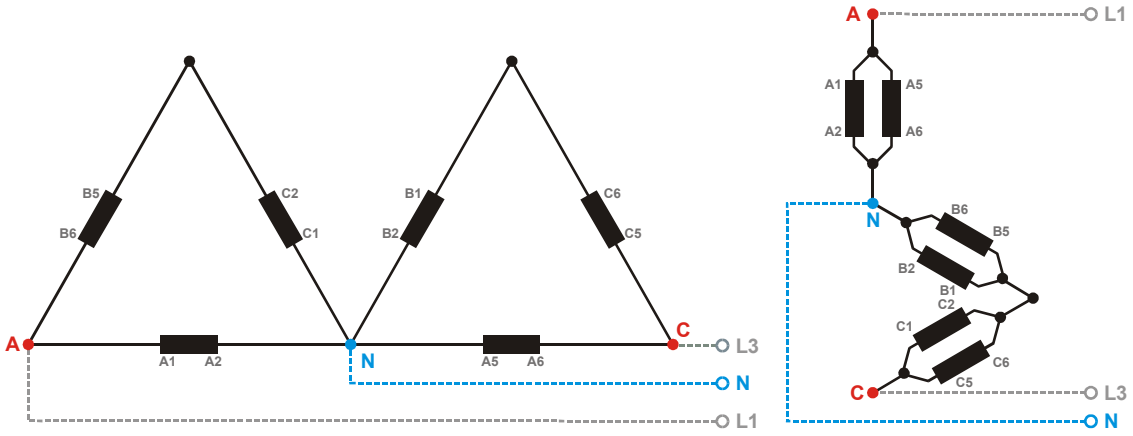


Figure 2-25: Voltage measuring – system B PT windings, 1Ph 3W

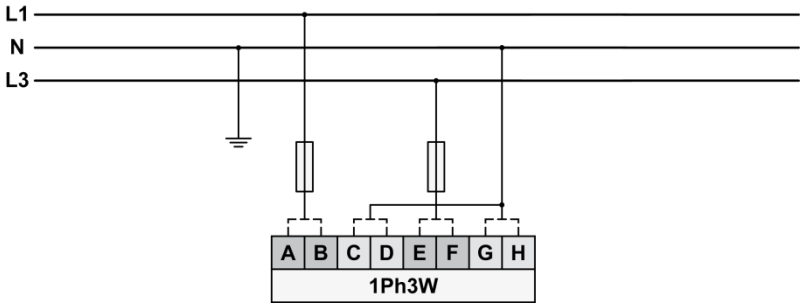


Figure 2-26: Voltage measuring - mains system B measuring inputs, 1Ph 3W

1Ph 3W	Wiring terminals								Note
Rated voltage (range)	[1] 120 V (50 to 130 $V_{eff.}$)				[5] 480 V (131 to 480 $V_{eff.}$)				9
Measuring range (max.)	[1] 0 to 150 Vac				[5] 0 to 600 Vac				
Figure	A	C	E	G	B	D	F	H	
Terminal	22	24	26	28	23	25	27	29	
Phase	L1	N	L3	N	L1	N	L3	N	

Table 2-14: Voltage measuring - terminal assignment – system B, 1Ph 3W

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

Voltage Measuring: System B, Parameter Setting '1Ph 2W' (1-phase, 2-wire)

NOTE

The 1-phase, 2-wire measurement may be performed phase-neutral or phase-phase. Please note to configure and wire the LS-5 consistently. Refer to the Chapter 3: Configuration for more information.

'1Ph 2W' Phase-Neutral Measuring

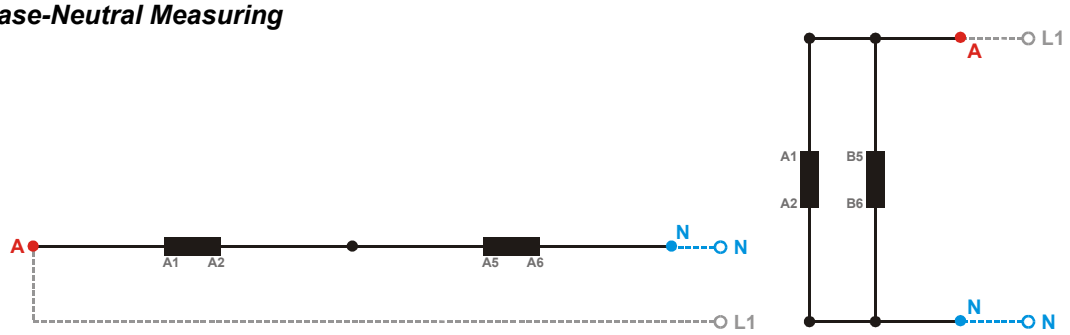


Figure 2-27: Voltage measuring – system B PT windings, 1Ph 2W (phase-neutral)

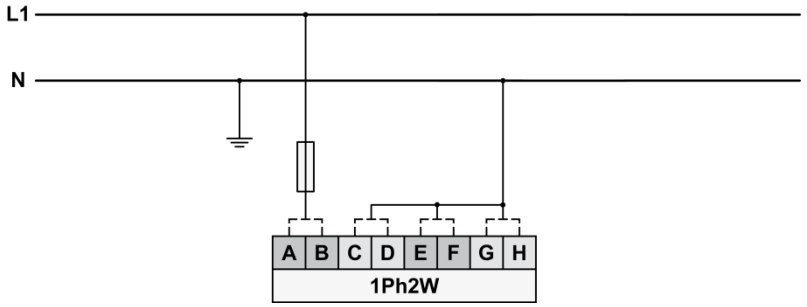


Figure 2-28: Voltage measuring – system B measuring inputs, 1Ph 2W (phase-neutral)

1Ph 2W	Wiring terminals								Note
Rated voltage (range)	[1] 120 V (50 to 130 $V_{eff.}$)				[5] 480 V (131 to 480 $V_{eff.}$)				10
Measuring range (max.)	[1] 0 to 150 Vac				[5] 0 to 600 Vac				
Figure	A	C	E	G	B	D	F	H	
Terminal	22	24	26	28	23	25	27	29	
Phase	L1	N	N	N	L1	N	N	N	

Table 2-15: Voltage measuring - terminal assignment – system B, 1Ph 2W (phase-neutral)

10 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

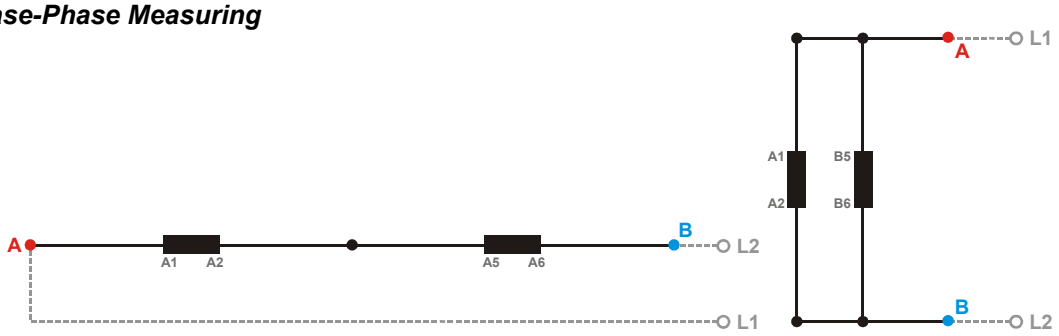


Figure 2-29: Voltage measuring – system B PT windings, 1Ph 2W (phase-phase)

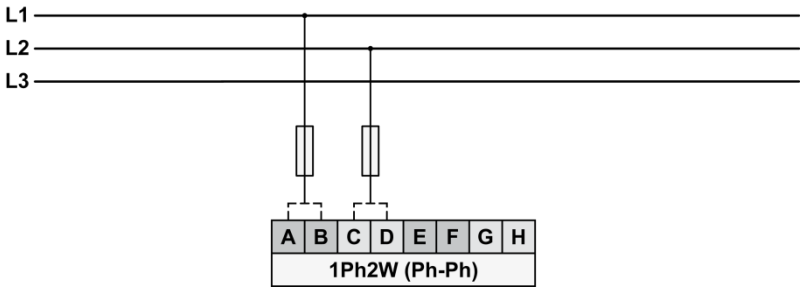


Figure 2-30: Voltage measuring – system B measuring inputs, 1Ph 2W (phase-phase)

1Ph 2W	Wiring terminals								Note
Rated voltage (range)	[1] 120 V (50 to 130 $V_{eff.}$)				[5] 480 V (131 to 480 $V_{eff.}$)				11
Measuring range (max.)	[1] 0 to 150 Vac				[5] 0 to 600 Vac				
Figure	A	C	E	G	B	D	F	H	
Terminal	22	24	26	28	23	25	27	29	
Phase	L1	L2	---	---	L1	L2	---	---	

Table 2-16: Voltage measuring - terminal assignment – system B, 1Ph 2W (phase-phase)

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

Current Measuring

CAUTION

Dangerous voltages due to missing load!
Before disconnecting the device, ensure that the current transformers/CT are short-circuited.

System A Current

NOTE

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

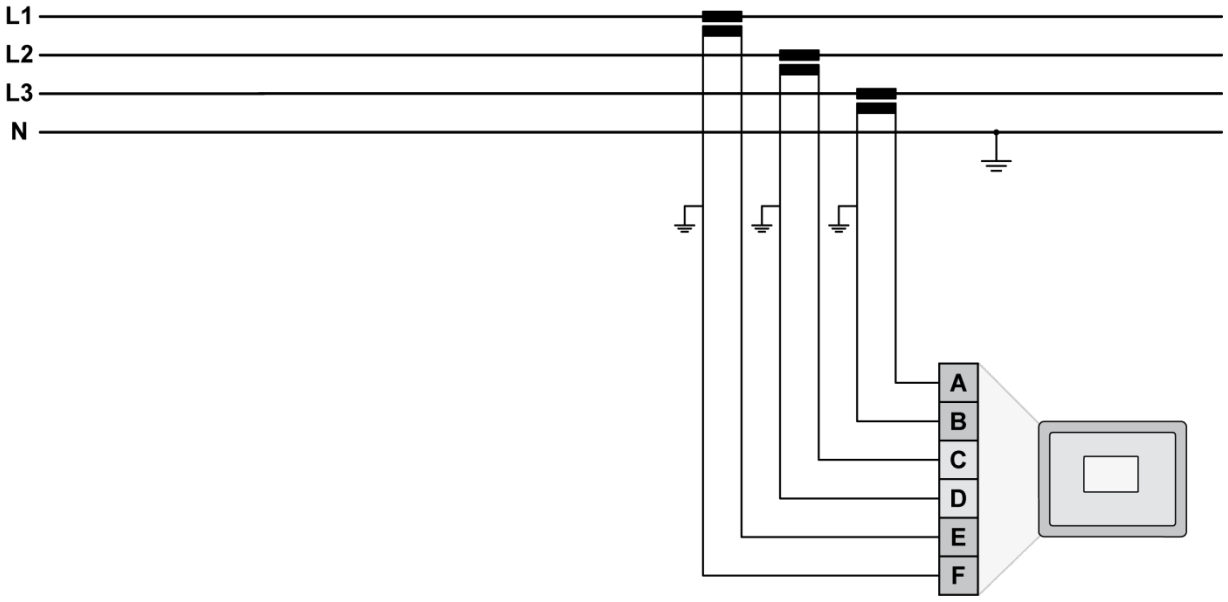


Figure 2-31: Current measuring – System A

Figure	Terminal	Description	A_{max}
A	6	System A Current L3	2.5 mm²
B	5	System A Current L3 (GND)	2.5 mm²
C	4	System A Current L2	2.5 mm²
D	3	System A Current L2 (GND)	2.5 mm²
E	2	System A Current L1	2.5 mm²
F	1	System A Current L1 (GND)	2.5 mm²

Table 2-17: Current measuring - terminal assignment – system A current

Current Measuring: System A, Parameter Setting 'L1 L2 L3'

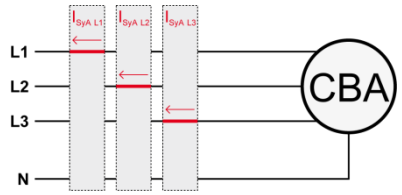


Figure 2-32: Current measuring – system A, L1 L2 L3

L1 L2 L3	Wiring terminals						Notes
Terminal	1	2	3	4	5	6	
Phase	s2 (I) L1	s1 (k) L1	s2 (I) L2	s1 (k) L2	s2 (I) L3	s1 (k) L3	

Figure 2-33: Current measuring – system A, L1 L2 L3

Current Measuring: System A, Parameter Setting 'Phase L1', 'Phase L2' & 'Phase L3'

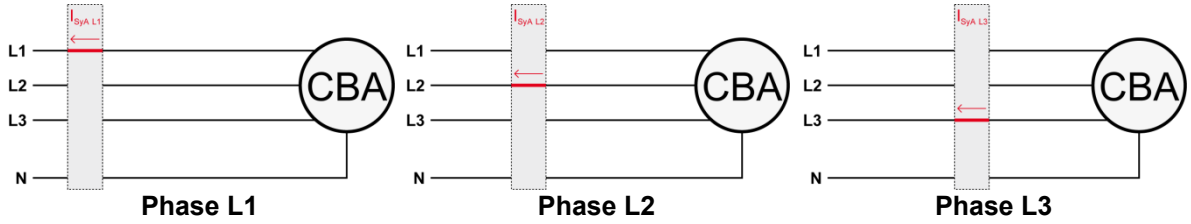


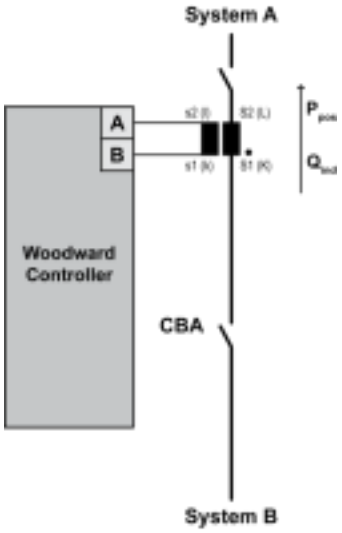
Figure 2-34: Current measuring – system A, phase Lx

	Wiring terminals						Notes
Terminal	1	2	3	4	5	6	
Phase L1	s2 (I) L1	s1 (k) L1	---	---	---	---	
Phase L2	---	---	s2 (I) L2	s1 (k) L2	---	---	
Phase L3	---	---	---	---	s2 (I) L3	s1 (k) L3	
Phase L1 and L3	s2 (I) L1	s1 (k) L1	---	---	s2 (I) L3	s1 (k) L3	

Table 2-18: Current measuring - terminal assignment – system A, phase Lx

Power Measuring

If the unit's current transformers are wired according to the diagram below, the following values are displayed.



Terminal				Description
	L1	L2	L3	
A	1	3	5	System A current
B	2	4	6	

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

Figure 2-35: Power measuring - direction of power

Power Factor Definition

The phasor diagram is used from the System B view. Power factor is defined as follows.

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).

Inductive: 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.	Capacitive: 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 displays at the unit:

i0.91 (inductive) lg.91 (lagging)	c0.93 (capacitive) ld.93 (leading)

Reactive power display at the unit:

70 kvar (positive)	-60 kvar (negative)

Output at the interface:

+ (positive)	- (negative)

In relation to the voltage, the current is

lagging	leading

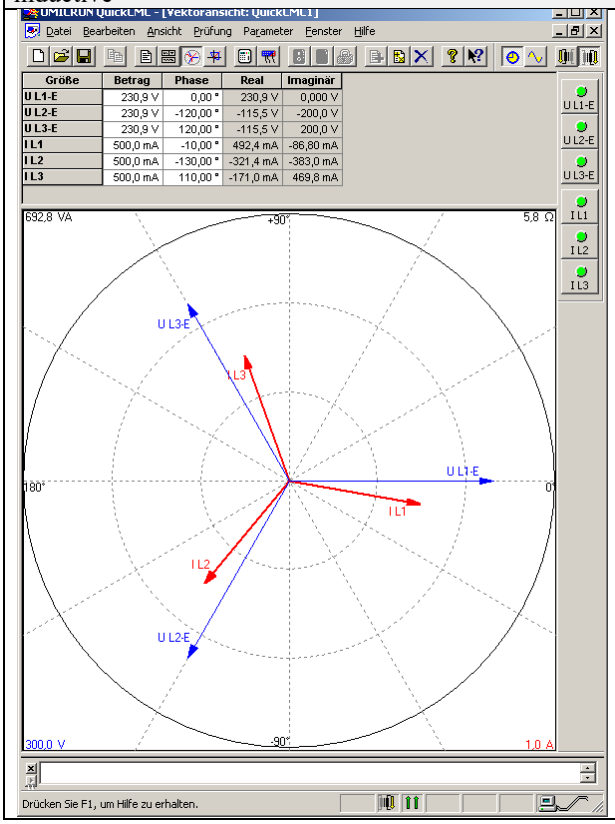
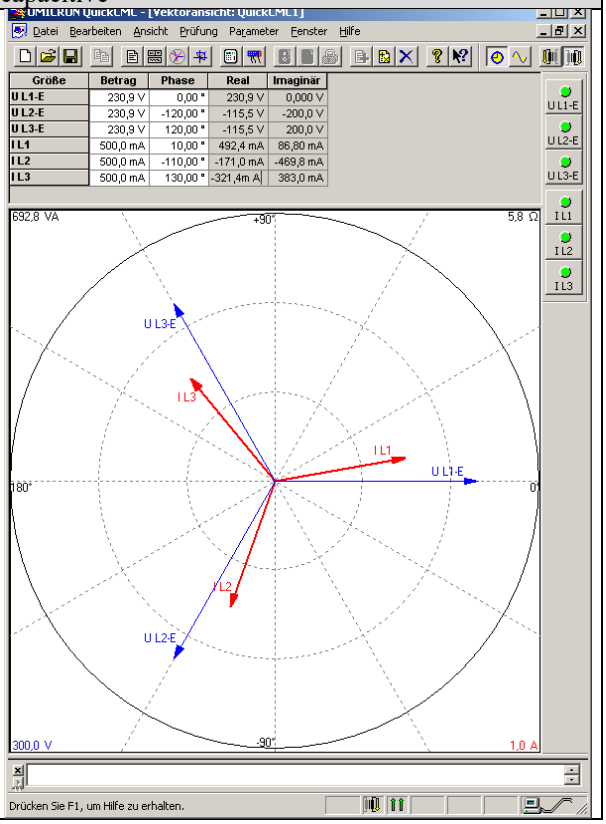
The generator is

over excited	under excited

Control: 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:

inductive	capacitive
	

Discrete Inputs

Discrete Inputs: Signal Polarity

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

NOTE

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

Discrete Inputs: Positive Polarity Signal

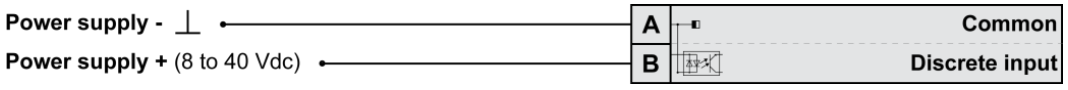


Figure 2-36: Discrete inputs - alarm/control input - positive signal

Discrete Inputs: Negative Polarity Signal

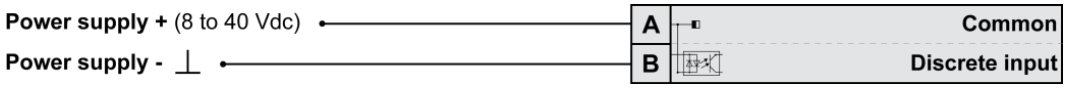


Figure 2-37: Discrete inputs - alarm/control input - negative signal

Terminal Com.	Terminal Term.	Description		A_{max}
A	B			
43 GND common ground	44	Discrete input [DI 01]	*No default value* *1	2.5 mm²
	45	Discrete input [DI 02]	Remote acknowledge *1	2.5 mm²
	46	Discrete input [DI 03]	*No default value* *1	2.5 mm²
	47	Discrete input [DI 04]	Immediate open CBA	2.5 mm²
	48	Discrete input [DI 05]	*No default value* *1	2.5 mm²
	49	Discrete input [DI 06]	*No default value* *1	2.5 mm²
	50	Discrete input [DI 07]	Enable to close CBA	2.5 mm²
	51	Discrete input [DI 08]	Reply: CBA is closed	2.5 mm²

Table 2-19: Discrete input - terminal assignment

*1 = default value / configurable via LogicsManager

Discrete Inputs: Operation Logic

Discrete inputs may be configured to normally open (N.O.) or normally closed (N.C.) states. 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. 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. See previous chapter Discrete Inputs: Signal on page 38 for details.

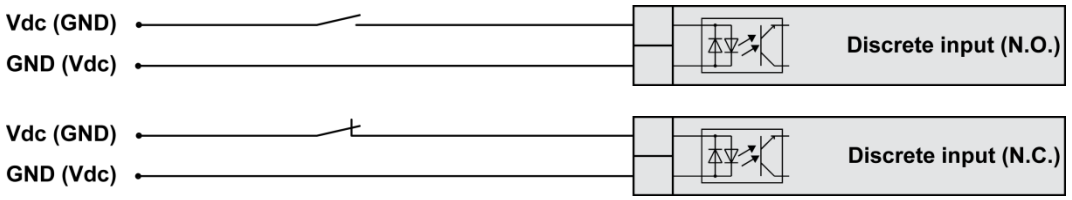


Figure 2-38: Discrete inputs - alarm/control inputs - operation logic

Relay Outputs (*LogicsManager*)

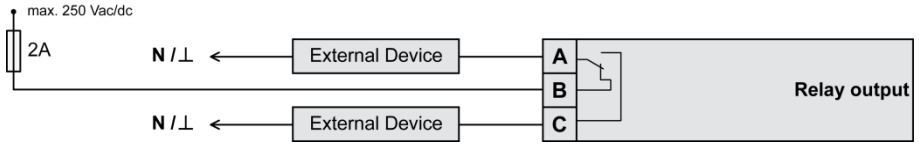


Figure 2-39: Relay outputs

Terminal		Description				A_{max}
A	C	Form A, N.O. make contact		Type ⇩		
30	31	Relay output [R 01]		Fixed to “Ready for operation”	N.O.	2.5 mm²
32	33	Relay output [R 02]		Preconfigured to “Horn”	SW	2.5 mm²
34	35	Relay output [R 03]		Preconfigured to “System B not OK”	SW	2.5 mm²
36	37	Relay output [R 04]		Preconfigured to “System A not OK”	SW	2.5 mm²

Terminal			Description				A_{max}
A	B	C	Form C, N.O. make contact, N.C.		Type ⇩		
38	39	40	Relay output [R 05]		Fixed to “Close CBA”	SW	2.5 mm²

Terminal		Description				A_{max}
A	C	Form A, N.O. make contact		Type ⇩		
41	42	Relay output [R 06]		Fixed to “Open CBA” in [CBA: Two relay] mode otherwise Preconfigured to “All alarm classes”	N.O.	2.5 mm²

LogicsManager.using the function ***LogicsManager*** it is possible to freely program the relays

SW Switchable via software
N.O. Normally open (make) contact

Table 2-20: Relay outputs - terminal assignment

CAUTION

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

NOTE

Refer to Appendix A: Connecting 24 V Relays on page 103 for interference suppressing circuits when connecting 24 V relays.

Interfaces

Service Port

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

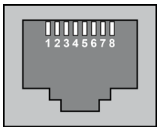


Figure 2-40: Service port connector (RJ-45)

NOTE

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

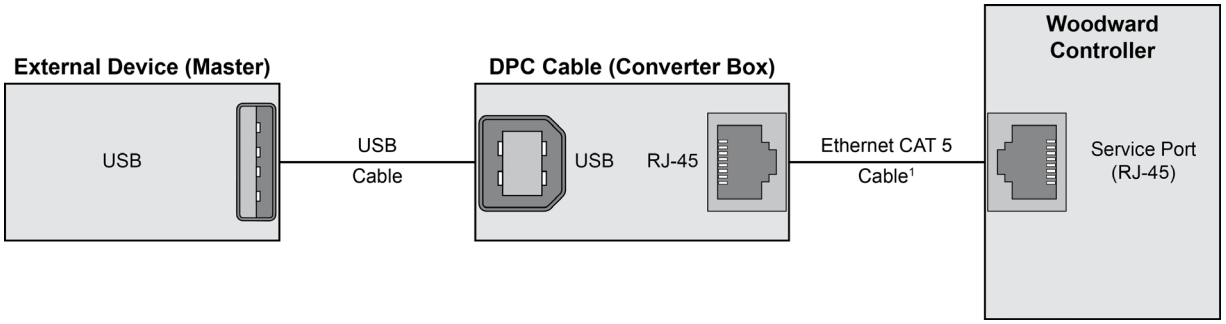


Figure 2-41: DPC-USB wiring - schematic

NOTE

[1] 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

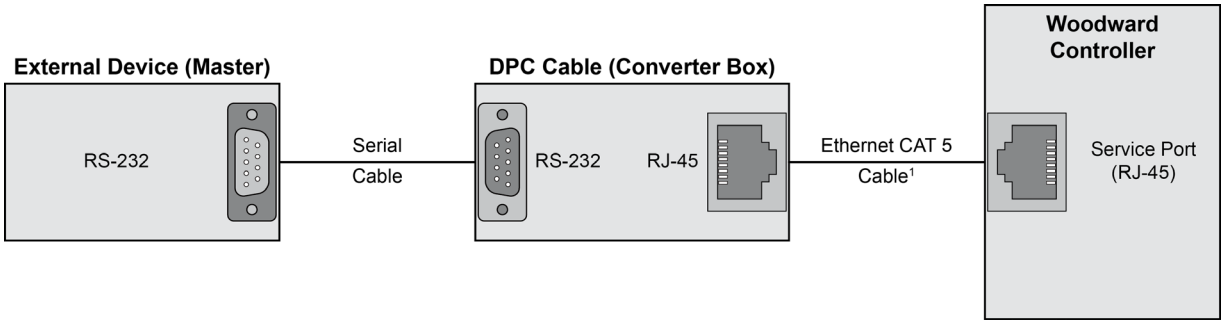


Figure 2-42: DPC-RS-232 wiring - schematic

NOTE

[1] Use the Ethernet CAT 5 cable, which is supplied with the DPC-USB converter. The maximum cable length must not exceed 0.5 m.

NOTE

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.

CAN Bus Interface

Terminal	Description	A_{max}
56	CAN-L	2.5 mm²
57	CAN-H	2.5 mm²

Table 2-21: CAN bus - pin assignment

CAN Bus Topology

NOTE

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.

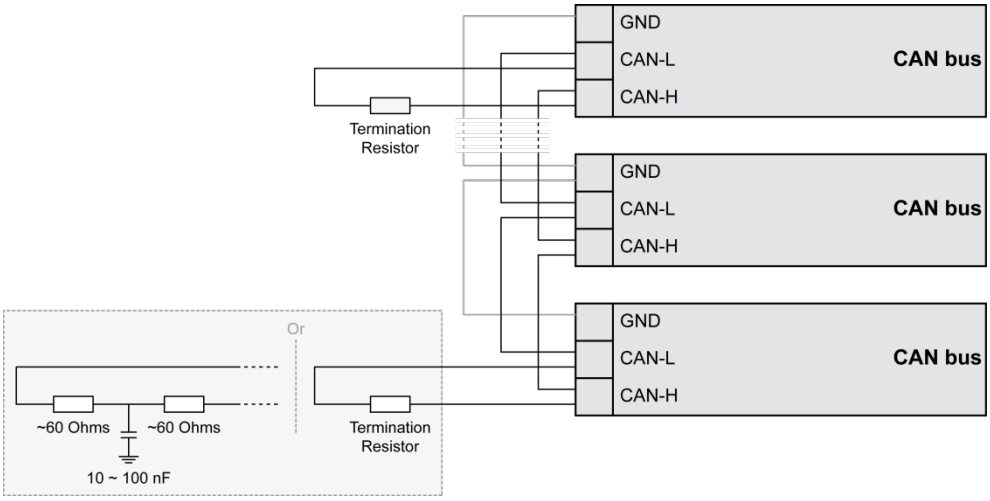


Figure 2-43: Interfaces - CAN bus - termination

Troubleshooting Possible CAN Bus Problems

If data is not transmitting on the CAN bus, check the following for common CAN bus communication problems:

- A T-structure bus is utilized
- CAN-L and CAN-H are interchanged
- Not all devices on the bus are using identical Baud rates
- Terminating resistor(s) missing
- The configured baud rate is too high for bus 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 (i.e.: Lappkabel Unitronic LIYCY (TP) 2×2×0.25, UNITRONIC-Bus LD 2×2×0.22).

Maximum CAN Bus Length

The maximum length of the communication bus wiring is dependent on the configured Baud rate. Refer to Table 2-22 for 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

Table 2-22: Maximum CAN bus length

The maximum specified length for the communication bus wiring might not be achieved if poor quality wire is utilized, there is high contact resistance, or other conditions exist. Reducing the baud rate may overcome these issues.

NOTE

When you are using 20 kbit/s or 50 kbit/s together with Toolkit, we recommend to set Parameter 9921 “Transfer rate fast message” to 0,30 s.

Bus Shielding

The table below gives a detailed overview how the different interfaces needs to be shielded.

Device	Interface	Shielding
LS-5 Series	CAN bus	External RC element

Table 2-23: Bus shielding

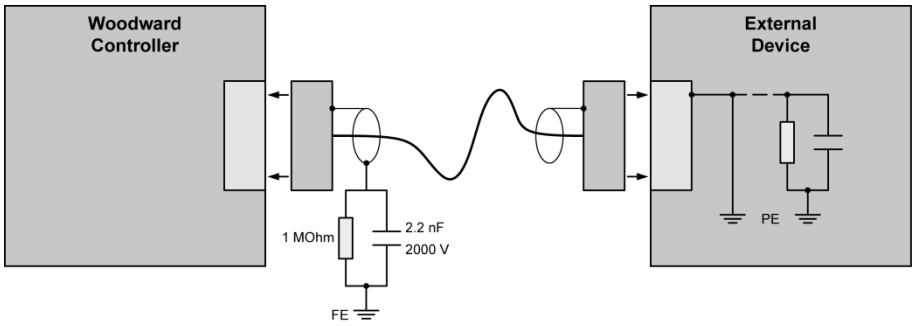


Figure 2-44: Interfaces – shielding (external RC element)

Chapter 3
Configuration

Configuration Via Front Panel

Operation of the unit via the front panel is explained in “Chapter 4: Operation”. This chapter will familiarize you with the unit, the meanings/functions of the buttons, and the display.

Configuration Via PC

Install ToolKit Configuration and Visualization Software

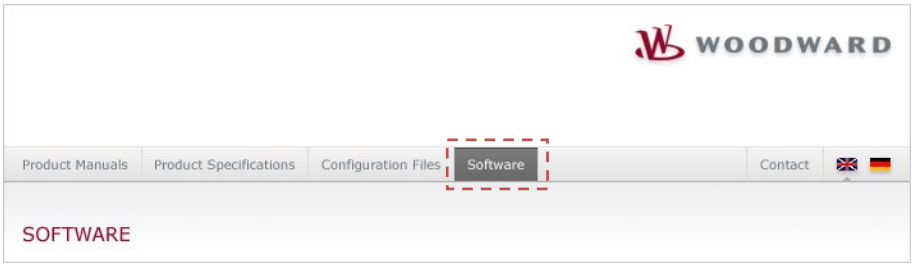
NOTE

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

ToolKit Version 5.5 or higher

Install ToolKit Software

1. Please insert the enclosed Product CD in the CD-ROM drive of your computer
2. The CD is going to start automatically (autostart function needs to be activated)
3. Please go to the section "Software" and follow the instructions described there



Alternatively ToolKit can be downloaded from our Website. Please proceed as follows:

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. Now you need to login with your e-mail address or register first
6. The download will start immediatly

Minimum system requirements for ToolKit:

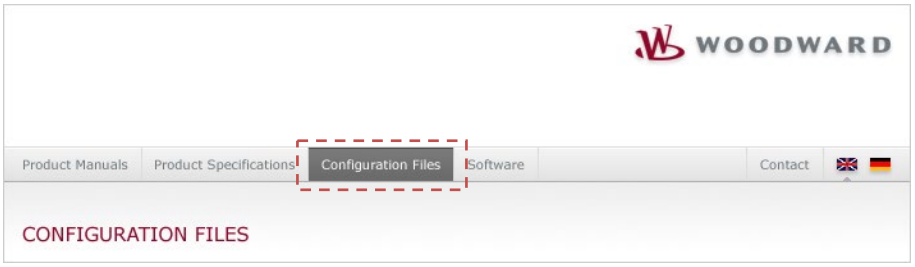
- Microsoft Windows® 10, 8.1, 7, Vista (32- & 64-bit)
- Microsoft .NET Framework 4.5.1
- 1GHz or faster x86 or x64 processor
- 1GB of RAM
- Minimum 1024 by 768 pixel screen resolution at 96 dpi text size
- Serial Port
- Serial Extension Cable
- IXXAT or Kvaser CAN adapter and driver
- CD-ROM drive

NOTE

Microsoft .NET Framework 4.5.1 must be installed on your computer to be able to install ToolKit. If not already installed, Microsoft .NET Framework will be installed automatically. You must be connected to the internet for this. Alternatively you can use the .NET Framework installer which can be found on the Product CD.

Install ToolKit Configuration Files

1. *Please insert the enclosed Product CD in the CD-ROM drive of your computer*
2. *The CD is going to start automatically (autostart function needs to be activated)*
3. Please go to the section “Configuration Files” and follow the instructions described there



Alternatively ToolKit configuration files can be downloaded from our Website. Please proceed as follows:

1. Go to http://www.woodward.com/software/configfiles/
2. Please 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”

NOTE

ToolKit is using the following files:

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

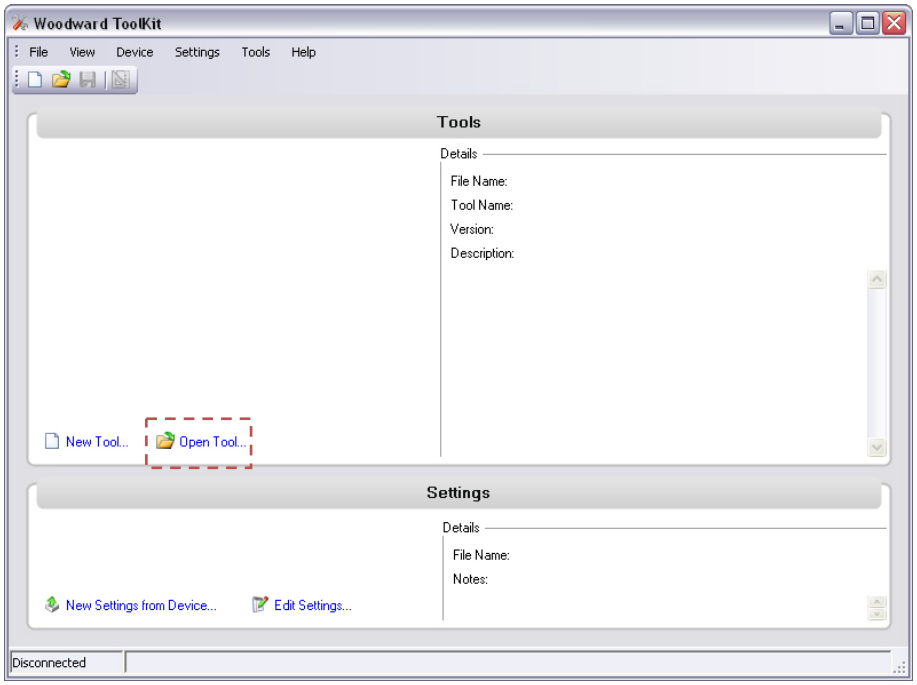
***.SID**
File name composition: [P/N2]*2-[Revision].SID
Example file name: 5418-1234-NEW.SID
Content of the file: All display and configuration parameters available in ToolKit

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

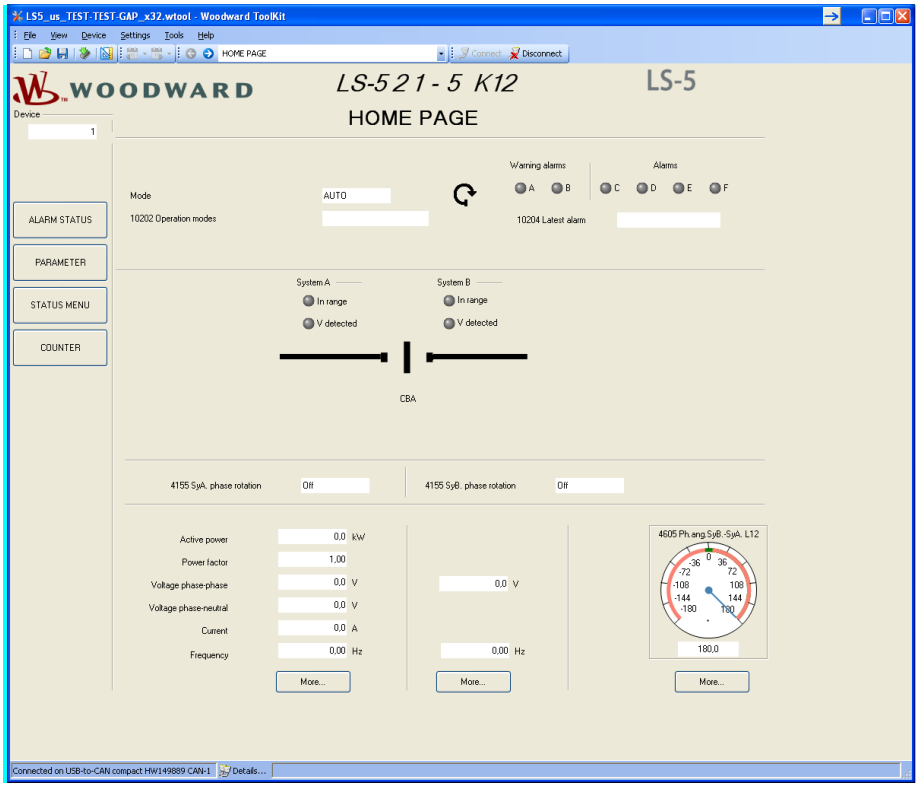
***1 P/N1 = Part number of the unit**
***2 P/N2 = Part number of the software in the unit**

Starting ToolKit Software

1. Start ToolKit via Windows Start menu -> Programs ->Woodward -> ToolKit x.x
2. Please press the button “Open Tool”

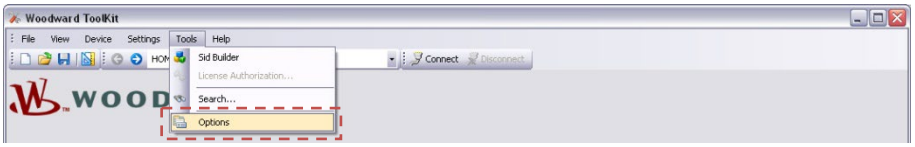


3. Go to the “Application” folder and open then the folder equal to the part number (P/N) of your device (e.g. 8440-1234). Select the wtool file (e.g. 8440-1234-NEW_US_5418-1234-NEW.wtool) and click “Open” to start the configuration file
4. Now the home page of the ToolKit configuration screen appears

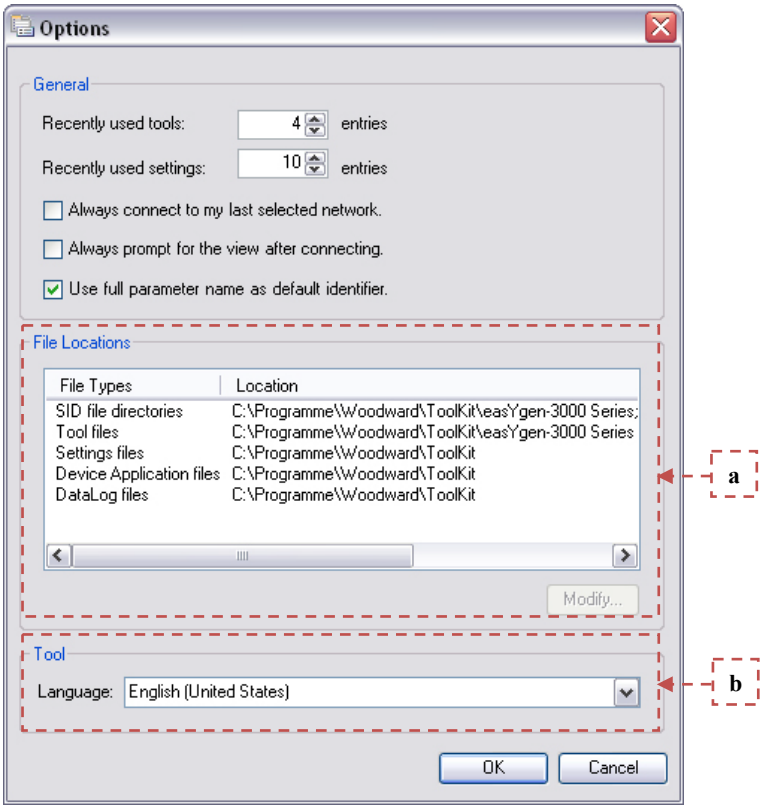


Configure ToolKit Software

1. Start the configuration by using the toolbar. Please go to Tools -> Options



2. The options window will be displayed



   a. Adjust the default locations of the configuration files
   b. The displayed language can be selected here
3. The changes become effective after clicking “OK”

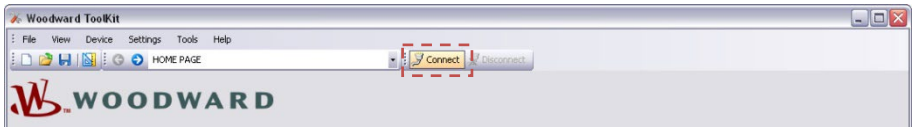
NOTE

Please use the ToolKit online help for further information.

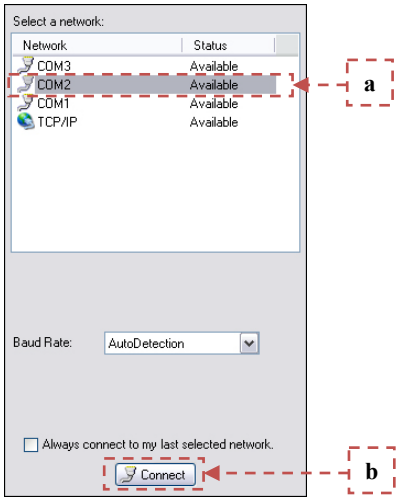
Connect ToolKit and the LS-5 Unit

For configuration of the unit via ToolKit please proceed as follows:

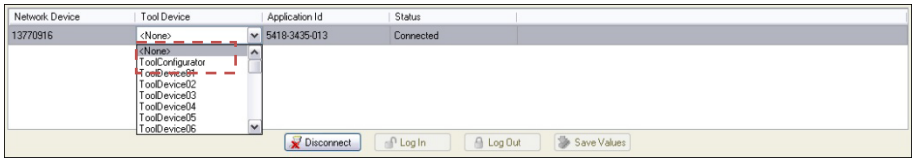
1. Connect the null modem communications cable between your laptop/PC and the DPC cable. Plug the null modem cable into the RS-232 serial port of the DPC cable and the other side to a serial COM port of the laptop/PC. If the laptop/PC does not have a serial port to connect the null modem cable to, use a USB to serial adapter. Now connect the DPC cable to the LS-5.
2. *Open ToolKit via Windows Start menu -> Programs -> Woodward -> ToolKit x.x*
3. *From the main ToolKit window, click File then select "Open Tool"..., or 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.



6. The connect dialog window will open if the option is enabled.



   a. Select the COM port that is connected to the communication cable.
   b. Click the "Connect" button.
7. The identifier of the device that ToolKit is connected to, will display in the status bar.
8. If the Communications window opens, select "ToolConfigurator" under Tool Device and close the Communications window.



9. If the device is security enabled, the Login dialog will appear.
10. Now you are able to edit the LS-5 parameters in the main window. Any changes made are written to the control memory automatically.

SID Files for Using ToolKit on the CAN Bus With Other CANopen Devices

If a PC with ToolKit is connected to the LS-5 via a CAN bus, the baud rate of the LS5 and Toolkit must be at the same value. Additionally the heartbeat time (9120) of the LS5 must be configured greater than 0.

NOTE

Depending on the computer used and the installed operation system, problems with the communication via an infrared connection may occur.

NOTE

If your computer is equipped with a Bluetooth interface please deactivate it temporarily in the Windows system control menu in the case that ToolKit is freezing building up a connection.

NOTE

It is also possible to connect to the unit via CAN bus. If a suitable CAN adapter is used, this may be selected in the Connect window. We recommend to use the IXXAT USB-to-CAN converter using the VCI V3 driver.

Be sure to configure the correct baud rate and timeout in the Properties dialog of the Connect window.

The Password for CAN Interface 1 (parameter 10402 on page 58) must be entered before being able to edit the parameters.

View LS-5 Data with ToolKit

The following figure shows an example visualization screen of ToolKit:

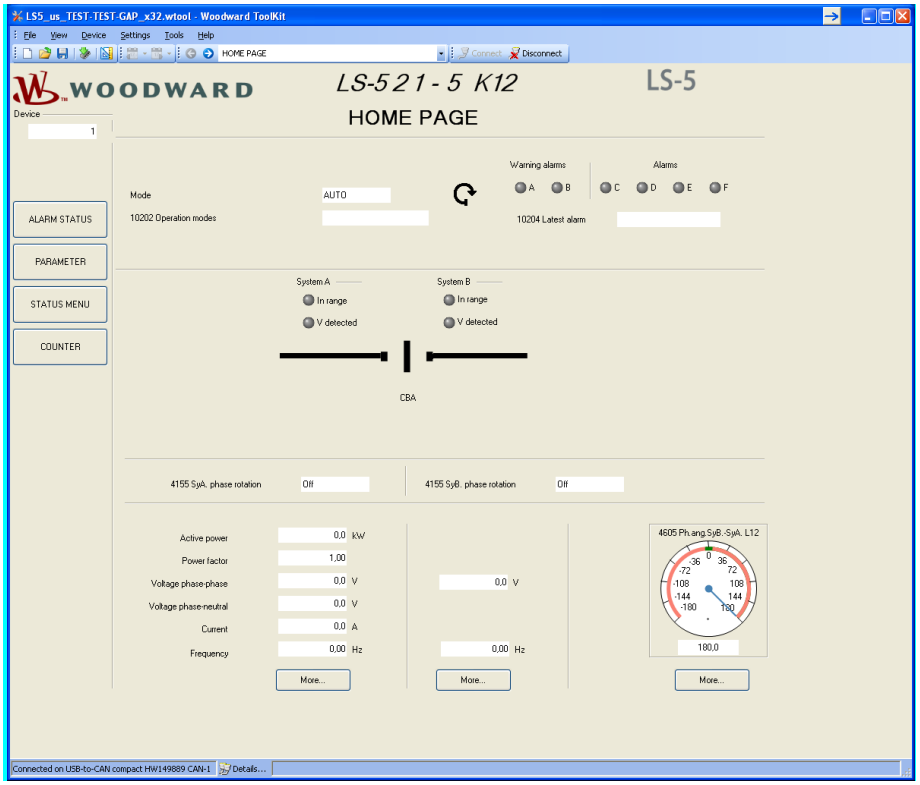


Figure 3-1: ToolKit - visualization screen

Navigation through the various visualization and configuration screens is performed by clicking on the and icons, by selecting a navigation button (e.g. STATUS MENU), or by selecting a screen from the drop-down list to the right of the arrow icons.
It is possible to view a trend chart of up to eight values with the trending tool utility of ToolKit. The following figure shows a trending screen of the measured battery voltage value:

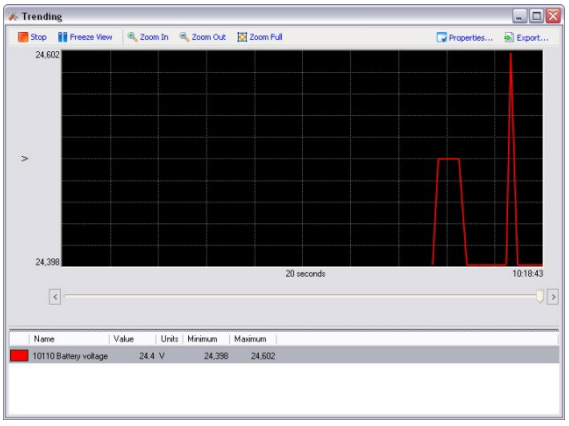


Figure 3-2: ToolKit - analog value trending screen

Each visualization screen provides for trending of monitored values by right-clicking on a value and selecting the "Add to trend" function. Trending is initiated by clicking on the Start button. Clicking the Export… button will save the trend data to a Comma Separated Values (CSV) file for viewing, editing or printing with office software, like Microsoft Excel, etc. The Properties… button is used to define high and low limits of the scale, sample rate, displayed time span and color of the graph.

Configure the LS-5 with ToolKit

The following figure shows an example configuration screen of ToolKit:

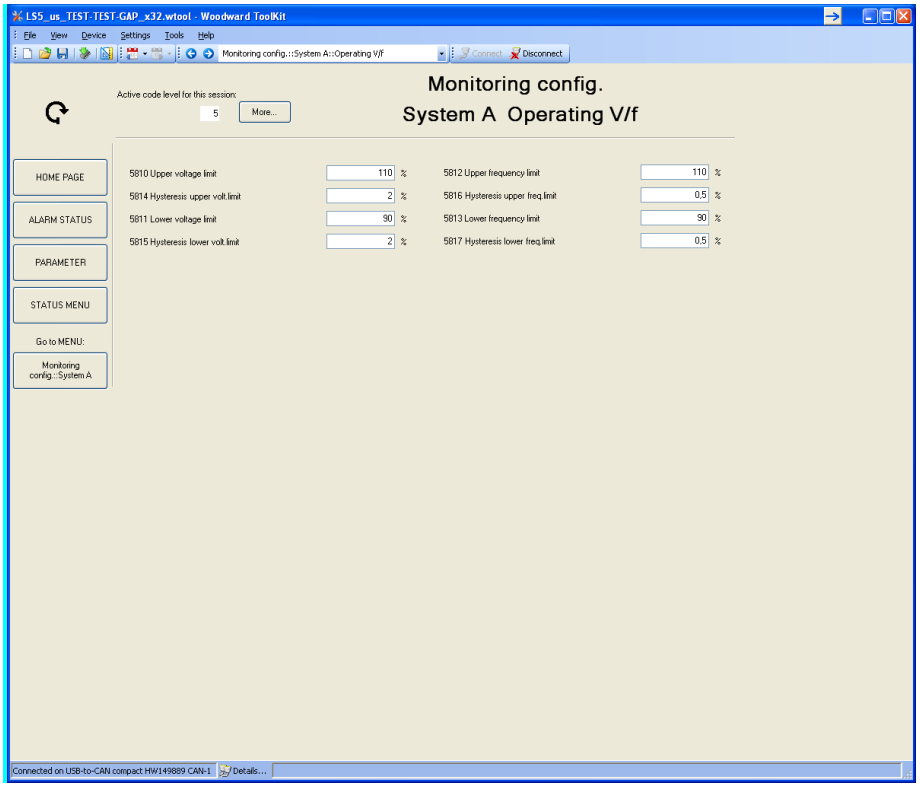


Figure 3-3: ToolKit - configuration screen

Entering a new value or selecting a value from a defined list will change the value in a field. The new value is written to the controller memory by changing to a new field or pressing the Enter key.

Navigation through the various configuration and visualization screens is performed by clicking on the and icons, by selecting a navigation button (e.g. STATUS MENU), or by selecting a screen from the drop-down list to the right of the arrow icons.

Parameters

To all parameters are assigned unique “Parameter Identification Numbers (ID)”. 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.

Language / Clock Configuration

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

NOTE

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	**Language**	0	Deutsch / English / Chinese / Português / Japanese / Russky / Türkçe / Español / Français / Italiano / Polski /	Englisch	The desired language for the unit display text is configured here.
1710	**Hour**	0	0 to 23 h	0	The hour of the clock time is set here. Example: **0:** 0th hour of the day (midnight). **23:** 23rd hour of the day (11 pm).
1709	**Minute**	0	0 to 59 min	-	The minute of the clock time is set here. Example: **0:** 0th minute of the hour. **59:** 59th minute of the hour.
1708	**Second**	0	0 to 59 s	-	The second of the clock time is set here. Example: **0:** 0th second of the minute. **59:** 59th second of the minute.
1698	**Transfer time to clock**	0	Yes / No	No	**Yes:** Adjusted time will be transfered to the unit. **No:** Adjusted time will be not transfered to the unit. ***NOTE:*** *This parameter may only be configured using ToolKit.*
1711	**Day**	0	1 to 31	-	The day of the date is set here. Example: **1:** 1st day of the month. **31:** 31st day of the month.
1712	**Month**	0	1 to 12	-	The month of the date is set here. Example: **1:** 1st month of the year. 1**2:** 12th month of the year.
1713	**Year**	0	0 to 99	-	The year of the date is set here. Example: **0:** Year 2000. **99:** Year 2099.
1699	**Transfer date to clock**	0	Yes / No	No	**Yes:** Adjusted date will be transfered to the unit. **No:** Adjusted date will be not transfered to the unit. ***NOTE:*** *This parameter may only be configured using ToolKit.*

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.

NOTE

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.

NOTE

The following parameters will only be displayed, if Daylight saving time (parameter 4591) has been configured to "On" and the enter button has been pressed.

ID	Parameter	CL	Setting range	Default	Description
4591	**Daylight saving time**	2	On / Off	Off	Enables the daylight saving time. **On:** Daylight saving time is enabled. **Off:** Daylight saving time is disabled.
4594	**DST begin time**	2	0 to 23 h	2	The real-time clock will be advanced by one hour when this time is reached on the DST begin date. Example: **0:** 0th hour of the day (midnight). **23:** 23rd hour of the day (11 pm).
4598	**DST begin weekday**	2	Sunday / Monday / Tuesday / Wednesday / Thursday / Friday / Saturday	Sunday	The weekday for the DST begin date is configured here.
4592	**DST begin nth weekday**	2	1st / 2nd / 3rd / 4th / Last / LastButOne / LastButTwo / LastButThree	Last	The order number of the weekday for the DST begin date is configured here. Example: **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.
4593	**DST begin month**	2	1 to 12	3	The month for the DST begin date is configured here. Example: **1:** 1st month of the year. **12:** 12th month of the year.
4597	**DST end time**	2	0 to 23	3	The real-time clock will fall back by one hour when this time is reached on the DST end date. Example: **0:** 0th hour of the day (midnight). **23:** 23rd hour of the day (11 pm).
4599	**DST end weekday**	2	Sunday / Monday / Tuesday / Wednesday / Thursday / Friday / Saturday	Sunday	The weekday for the DST end date is configured here.

ID	Parameter	CL	Setting range	Default	Description
4595	**DST end nth weekday**	2	1st / 2nd / 3rd / 4th / Last / LastButOne / LastButTwo / LastButThree	Last	The order number of the weekday for the DST end date is configured here. Example: **1st:** DST ends on the 1st configured weekday of the DST end month. **2nd:** DST ends on the 2nd configured weekday of the DST end month. **3rd:** DST ends on the 3rd configured weekday of the DST end month. **4th:** DST ends on the 4th configured weekday of the DST end month. **Last:** DST ends on the last configured weekday of the DST end month. **LastButOne:** DST ends on the last but one configured weekday of the DST end month. **LastButTwo:** DST ends on the last but two configured weekday of the DST end month. **LastButThree:** DST ends on the last but three configured weekday of the DST end month.
4596	**DST end month**	2	1 to 12	10	The month for the DST end date is configured here. Example: **1:** 1st month of the year. **12:** 12th month of the year.

Example:
If daylight saving time starts at 2:00 am on the 2nd Sunday in March and ends at 2:00 am on the 1st Sunday in November, the unit has to be configured like shown in Table 3-1 to enable an automatic change to daylight saving time and back to standard time.

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

Table 3-1: Daylight saving time - configuration example

	USA, Canada		European Union	
Year	DST Begins 2 a.m. (Second Sunday in March)	DST Ends 3 a.m. (First Sunday in November)	DST Begins 1 a.m. UTC=GMT (Last Sunday in March)	DST Ends 2 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, 2010	March 28, 2010	October 31, 2010

Table 3-2: Daylight saving time - examplary dates

Display Configuration

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

Figure 3-4: Configure display

Enter Password

The LS-5 Series 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 CL0 ***(User Level)*** Standard password = none
This code level permits for monitoring of the system and limited access to the parameters. Configuration of the control is not permitted. Only the parameters for setting the language, the date, the time, and the horn reset time are accessible. The unit powers up in this code level.

Code level CL1 ***(Service Level)*** Standard password = "**0 0 0 1**"
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. The user may also change the password for level CL1. Access granted by this password expires two hours after the password has been entered and the user is returned to the CL0 level.

Code level CL2 ***(Temporary Commissioning Level)*** No standard password available
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. 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. 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.

Code level CL3 ***(Commissioning Level)*** Standard password = "**0 0 0 3**"
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. Access granted by this password expires two hours after the password has been entered and the user is returned to the CL0 level.

NOTE

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.

ID	Parameter	CL	Setting range	Default	Description
10400	**Password display**	0	0 to 9999	Random number	The password for configuring the control via the front panel must be entered here.
10405	**Code level display**	0	Info	-	This value displays the code level, which is currently enabled for access via the front panel display.
10402	**Password CAN 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 1**	0	Info	-	This value displays the code level, which is currently enabled for access via the CAN interface #1.
10401	**Password serial 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 1**	0	Info	-	This value displays the code level, which is currently enabled for access via RS-232 serial interface #1.

System Management

ID	Parameter	CL	Setting range	Default	Description
1702	**Device number**	2	1 to 31	1	A unique address is assigned to the control though this parameter. This unique address permits the controller to be correctly identified on the CAN bus. The address assigned to the controller may only be used once. All other bus addresses are calculated on the number entered in this parameter. ***NOTE:*** *The unit must be restarted after changing the device number to ensure proper operation.*
4556	**Configure display backlight**	2	Key actv. / Off / On	Key actv.	**Key actv.:** The display backlight will be dimmed, if no soft key is pressed for the time configured in parameter ID 4557. **Off:** The display backlight is always disabled. **On:** The display backlight is always enabled.
4557	**Time until backlight shutdow**	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. ***NOTE:*** *This parameter is only effective, if parameter ID 4556 is configured to* Key actv..
12978	**Lock keypad**	2	*LogicsManager*	FALSE	**Lock keypad** As long as the conditions of the *LogicsManager* have been fulfilled: **True:** • The buttons "MAN" and "AUTO" are locked. • The softkey "OPEN"/"CLOSE" are locked. • Acknowledge of alarms is blocked. • All parameters with the exception of display relevant parameters are not accessable. **False:** Full access depending on code level.
10417	**Factory default settings**	0	Yes / No	No	**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. ***NOTE:*** *The following parameters will only be displayed, if* Factory default settings *(parameter ID 10417) has been configured to "Yes" and the enter button has been pressed.*
1701	**Set factory default values**	0	Yes / No	No	**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.
10500	**Start bootloader**	2	23130 to 23130	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. ***ATTENTION:*** *This function is used for uploading application software and may only be used by authorized Woodward technicians!*
1706	**Clear event-log**	2	Yes / No	No	**Yes:** The event history will be cleared. **No:** The event history will not be cleared.

System Management: Password System

NOTE

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 interface, and via the CAN bus).

ID	Parameter	CL	Setting range	Default	Description
10415	**Basic code level**	1	0001 to 9999	-	**Password: Service Level (CL1)** The password for the code level "Service" is defined in this parameter. Refer to the display Enter Password section on page 57 for default values.
10413	**Commissioning code level**	3	0001 to 9999	-	**Password: Commission (CL3)** The password for the code level "Commission" is defined in this parameter. Refer to the display Enter Password section on page 57 for default values.
10414	**Temp. commissioning code level**	3	0001 to 9999	-	**Password: Temporary Commission (CL2)** The algorithm for calculating the password for the code level "Temporary Commissioning" is defined in this parameter.
10412	**Temp. supercomm. level code**	5	0001 to 9999	-	**Password: Temporary Supercommissioning (CL4)** The algorithm for calculating the password for the code level "Temporary Supercommissioning" is defined in this parameter.
10411	**Supercommissioning level code**	5	0001 to 9999	-	**Password: Supercommissioning" (CL5)** The password for the code level "Supercommissioning" is defined in this parameter. Refer to the display Enter Password section on page 57 for default values.

Configuration

The configuration screen is accessed pressing the *Configuration* softkey in the parameter screen. The following sub-menus are available to configure the unit:

- Application configuration
- Monitoring configuration
- Measurement configuration
- Interfaces configuration
- *LogicsManager* configuration
- Counters configuration

NOTE

It is absolutely essential that correct rated values to be entered when configuring the controller, as many measurement and monitoring functions refer to these values.

Application Configuration

Breakers Configuration

Configure CBA

ID	Parameter	CL	Setting range	Default	Description
8800	**CBA control**	2	1 Relay / 2 Relays	2 Relays	**1 Relay:**.Relay [R5] (**38**/39/**40**) is fixed for closing CBA. (Relay [R6] (41/42) is free configurable.) **2 Relays:** Relay [R5] (**38**/39/**40**) is fixed for closing CBA. Relay [R6] (41/42) is fixed for opening CBA
3417	**CBA time pulse**	2	0.10 to 0.50 s	0.50 s	**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	**Inherent delay of CBA for synchronization** 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.
5718	**CBA open time pulse**	2	0.10 to 9.90 s	1.00 s	**CBA open time pulse** This time defines the length of the CBA open time pulse, if the automatic switch unblocking CBA is activated.

Synchronization CBA

For synchronization with two systems please see additionally chapter “Synchronization Of System A and System B” on page 120.

ID	Parameter	CL	Setting range	Default	Description
5728	**Synchronization mode**	2	On/Off	On	**Off:** Synchronization is disabled and the following parameters are not visable. **On:** Synchronization is enabled and the following parameters are visable.
5730	**Synchronization CBA**	2	Slip freq / Ph. match	Slip freq	**Slip frequency:** The LS-5 expects the frequency controller to adjust the frequency in a way, that the frequency of the variable system is marginal greater than the target. When the synchronizing conditions are reached, a close command will be issued. **Phase matching:** The LS-5 expects the frequency controller to adjust the phase angle of the variable system to that of the target (cf. parameter 5713, 5714, 5717), in view of turning the phase difference to zero.
5711	**Pos. freq. differential CBA**	2	0.02 to 0.49 Hz	0.18 Hz	**Positive frequency differential CBA** 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	**Neg. freq. differential CBA**	2	-0.49 to 0.00 Hz	-0.18 Hz	**Negative frequency differential CBA** 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	**Voltage differential CBA**	2	0.50 to 20.00 %	5.00 %	The maximum permissible voltage differential for closing CBA is configured here. If the difference between system A and system B voltage does not exceed the value configured here and the system voltages are within the operating voltage windows (parameters 5800/5801/5810/5811 on page 73), the "Command: CBA close" may be issued.
8825	**Phase angle compensation**	2	On / Off	Off	**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. ***NOTE:*** *This parameter defines if the parameter 8824 is valid or not.* ***WARNING:*** *Ensure this parameter is configured correctly to prevent erroneous synchronization settings. Incorrect wiring of the system cannot be compensated for with this parameter.*
8824	**Phase angle compensation**	2	-180 to 180 °	0 °	This parameter compensates phase angle deviations, which can be caused by transformers (e.g. a delta to wye transformer) located within the electrical system. Ensure the following parameters are configured correctly to prevent erroneous synchronization settings. Incorrect wiring of the system cannot be compensated for with this parameter. **Please act as follows:** 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. ***NOTE:*** *Further information can be found in chapter “Commissioning Note” on page 65.* ***WARNING:*** *Ensure this parameter is configured correctly to prevent erroneous synchronization settings. Incorrect wiring of the system cannot be compensated for with this parameter.*

ID	Parameter	CL	Setting range	Default	Description
8821	**Max phase angle**	2	0 to 20°	20°	Maximum admissible angle between both voltage systems in case of connecting synchronous networks.
8823	**Max. voltage differential**	2	0.5 to 20.0 %	5 %	Maximum admissible voltage difference between both voltage systems in case of connecting synchronous networks.
8822	**Delay time phi max**	2	0 to 99 s	1 s	Defines the time how long the phase angle (parameter 8821) and the voltage difference (parameter 8823) between both voltage systems must be below the configured maximum permissible angle before connecting synchronous networks.
					Notes: • Closing of CB A to connect the synchronous networks must be initiated by a command via CAN bus. • If this command is received, state “Syn. netw. close CBA” is indicated. • Networks can only be connected if there is no alarm class C-F active.

Commissioning Note (Phase angle compensation parameter 8824)

a) Interconnection of the mains voltage possible

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). Enter the displayed value into this parameter.

CAUTION

The correct setting must be validated in every control unit with a differential voltage measurement.

b) Interconnection of the mains voltage not possible but the vector group of the transformer is known

The vector group of the transformer is known and states the phase angle deviation in multiplies of 30°. Out of the vector group the phase angle deviation can be calculated as an angle from 0° to 360°. **For this value the voltage of the low voltage side is behind the voltage of the high voltage side ⇨ phase angle deviation α! When calculating the resulting value, the low voltage side of the transformer always lags behind the high voltage side (phase angle deviation α).**

The phase difference is to be calculated as follows:

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

Table 3-3: Calculation of the phase angle deviation

Phase Matching

ID	Parameter	CL	Setting range	Default	Description
5713	**Max. positive phase angle CBA**	2	0.0 to 60.0 °	7.0 °	**Max. permissible positive phase angle CBA** 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 00.0 °	-7.0 °	**Max. permissible negative phase angle CBA** 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	**Phase matching dwell time of CBA** 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.

Deadbus Closure CBA

ID	Parameter	CL	Setting range	Default	Description
8801	**Dead bus closure CBA**	2	On / Off	Off	**On:** Dead bus closure possible according to the conditions defined by parameters 8802, 8803, 8804 and 5820. **Off:** No dead bus closure possible.
8802	**Connect A dead to B dead**	2	On / Off	Off	**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.
8803	**Connect A dead to B alive**	2	On / Off	Off	**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.
8804	**Connect A alive to B dead**	2	On / Off	Off	**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.
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 for at least the time defined here to detect a dead bus condition of a system. ***NOTE:*** *The delay time starts as soon as the measured voltage is below the value configured in parameter 5820 and the command "Enable close CBA" is active.*
5820	**Dead bus detection max. volt.**	2	0 to 30 %	10 %	If system A/B voltage falls below this percentage of system A/B rated voltage for the time configured by parameter 8805, a dead bus condition is detected.

CAUTION

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

Inputs / Outputs Configuration

Discrete Inputs Configuration

NOTE

Please refer to chapter Discrete Inputs on page 38 for details.

ID	Parameter	CL	Setting range	Default	Description
1400	**DI {x} Text**	T	*4 to 16 character text*	*See parameter list*	**Message text** If the discrete input is enabled with alarm class, this text is displayed on the control unit screen. The event history will store this text message as well. The text may have 4 through 16 characters. ***NOTE:*** *This parameter may only be configured using ToolKit.* ***NOTE:*** *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.*
1201	**DI {x} Operation**	2	N.O. / N.C.	N.O.	The discrete inputs may be operated by a normally open (N.O.) or normally closed (N.C.) contact. The idle circuit current input can be used to monitor for a wire break. A positive or negative voltage polarity referred to the reference point of the DI may be applied. **N.O.:** The discrete input is analyzed as "enabled" by energizing the input (normally open). **N.C.:** The discrete input is analyzed as "enabled" by de-energizing the input (normally closed).
1200	**DI {x} Delay**	2	0.08 to 650.00 s	DI 01/04 0.20 s Other DIs 0.50 s	A delay time in seconds can be assigned to each alarm or control input. The discrete input must be enabled without interruption for the delay time before the unit reacts. If the discrete input is used within the *LogicsManager* this delay is taken into account as well.
1202	**DI {x} Alarm class**	2	Class A / Class B / Class C / Class D / Class E / Class F / Control	Control	An alarm class may be assigned to the discrete input. The alarm class is executed when the discrete input is enabled. If "control" has been configured, there will be no entry in the event history and a function out of the *LogicsManager* (description at page 106) can be assigned to the discrete input. ***NOTE:*** *See chapter "Alarm Classes" on page 105.*
1204	**DI {x} Self acknowledge**	2	Yes / No	No	**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). If the DI is configured with the alarm class "Control", self acknowledgement is always active.

The preceding parameters are used to configure the discrete inputs. The parameter IDs refer to DI 1. Refer to Table 3-4 for the parameter IDs of the parameters DIs.

	DI 2	DI 3	DI 4	DI 5	DI 6	DI 7
Text	1410	1420	1430	1440	1450	1460
Operation	1221	1241	1261	1281	1301	1321
Delay	1220	1240	1260	1280	1300	1320
Alarm class	1222	1242	1262	1282	1302	1322
Self acknowledged	1224	1244	1264	1284	1304	1324

Table 3-4: Discrete inputs - parameter IDs

NOTE

DI 4, 7, 8 are always assigned to fixed functions and cannot be configured.

Discrete Outputs Configuration (*LogicsManager*)

The discrete outputs are controlled via the *LogicsManager*.

⇨ **Please note the description of the *LogicsManager* starting on page 106.**

Relay Number	Term.	
Internal relay outputs		
[R1]	30/31	*LogicsManager*; combinated with 'Ready for operation OFF'
[R2]	32/33	*LogicsManager*; pre-assigned with 'Centralized alarm (horn)'
[R3]	34/35	*LogicsManager*; pre-assigned with 'System B not OK'
[R4]	36/37	*LogicsManager*; pre-assigned with 'System A not OK'
[R5]	38/39/40	Fixed to 'Close CBA'
[R6]	41/42	Fixed to 'Open CBA' if CBA is controlled by 2 relays otherwise *LogicsManager* pre-assigned with 'All Alarm classes'

Table 3-5: Relay outputs - assignment

ID	Parameter	CL	Setting range	Default	Description
12580	**Ready for op. Off**	2	*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 "alarm D" or no "AUTO mode" present. The *LogicsManager* and its default settings are explained on page 106 in Appendix C: "LogicsManager". ***CAUTION:*** *The discrete output "Ready for operation OFF" must be wired in series with an emergency function. We recommend to signal this fault independently from the unit if the availability of the plant is important.*
12110	**Relay {x}**	2	*LogicsManager*	-	Once the conditions of the *LogicsManager* have been fulfilled, the relay will be energized. The *LogicsManager* and its default settings are explained on page 106 in Appendix C: "LogicsManager".

Above parameter ID 12110 refers to Relay 2. Refer to Table 3-6 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 3-6: Discrete outputs - parameter IDs

Automatic Run Configuration

ID	Parameter	CL	Setting range	Default	Description
8827	**Startup in mode**	2	AUTO / MAN / Last	AUTO	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.

Monitoring Configuration

System A

ID	Parameter	CL	Setting range	Default	Description
1771	**SyA. voltage monitoring**	2	Phase - phase / Phase - neutral	Phase - phase	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 measured and all subsequent parameters concerning voltage monitoring "System A" are referred to this value (VL-L). **Phase – neutral:** The phase-neutral voltage will be measured and all subsequent parameters concerning voltage monitoring "System A" are referred to this value (VL-N). ***WARNING:*** *This parameter influences the protective functions.*

Operating Voltage / Frequency

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 on page 77) 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 volt. limit**	2	0 to 50 %	2 %	If the system A voltage has exceeded the limit configured in parameter 5810, the voltage must fall below the limit and the value configured here, to be considered as being within the operating limits again.
5811	**Lower voltage limit**	2	50 to 100 %	90 %	The maximum permissible negative deviation of the system A voltage from the system A rated voltage (parameter 1768 on page 77) 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 volt. limit**	2	0 to 50 %	2 %	If the system A voltage has fallen below the limit configured in parameter 5811, the voltage must exceed the limit and the value configured here, to be considered as being within the operating limits again.
5812	**Upper frequency limit**	2	100 to 150 %	110 %	The maximum permissible positive deviation of the system A frequency from the rated system frequency (parameter 1750 on page 77) 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 freq. limit**	2	0 to 50 %	0.5 %	If the system A frequency has exceeded the limit configured in parameter 5812, the frequency must fall below the limit and the value configured here, to be considered as being within the operating limits again.

ID	Parameter	CL	Setting range	Default	Description
5813	**Lower frequency limit**	2	0 to 100 %	90 %	The maximum permissible negative deviation of the system A frequency from the rated system frequency (parameter 1750 on page 77) 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 freq. limit**	2	0 to 50 %	0.5 %	If the system A frequency has fallen below the limit configured in parameter 5813, the frequency must exceed the limit and the value configured here, to be considered as being within the operating limits again.

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).

System A (SyA.) Phase Rotation

CAUTION

Please ensure during installation that all voltages applied to this unit are wired correctly to both sides of the circuit breaker. Failure to do so may result in damage to the control unit and/or generation equipment due to closing the breaker asynchronous or with mismatched phase rotations and phase ro-tation monitoring enabled at all connected components (generator, breakers, cable, busbars, etc.).

This function may block a connection of systems with wrong phases systems only under the following conditions:

- **The voltages being measured are wired correctly with respect to the phase rotation at the measuring points (i.e. the voltage transformer in front and behind the circuit breaker).**
- **The measuring voltages are wired without angular phase shift or interruption from the measuring point to the control unit.**
- **The measuring voltages are wired to the correct terminals of the control unit.**
- **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 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.

NOTE

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

ID	Parameter	CL	Setting range	Default	Description
3970	**Monitoring**	2	On / Off	On	**On:** Phase rotation monitoring is carried out according to the following parameters. **Off:** No monitoring is carried out.
3974	**SyA. Phase rotation**	2	CW / CCW	CW	**CW:** The three-phase measured mains voltage is rotating CW (clock-wise; that means the voltage rotates in L1-L2-L3 direction; standard setting). **CCW:** The three-phase measured mains voltage is rotating CCW (counter clock-wise; that means the voltage rotates in L1-L3-L2 direction).
3971	**Alarm class**	2	Class A / Class B / Class C / Class D / Class E / Class F / Control	Class B	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. ***NOTE:*** *See chapter "Alarm Classes" on page 105.*
3972	**Self acknowledge**	2	Yes / No	No	**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).

System B

ID	Parameter	CL	Setting range	Default	Description
1770	**SyB. Voltage monitoring**	2	Ph – Ph / Phase - N	Ph – Ph	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. **Ph – Ph (Phase – phase):** The phase-phase voltage will be measured and all subsequent parameters concerning voltage monitoring "generator" are referred to this value (V_{L-L}). **Phase – N (Phase – neutral):** The phase-neutral voltage will be measured and all subsequent parameters concerning voltage monitoring "System B" are referred to this value (V_{L-N}). ***WARNING:*** *This parameter defines how the protective functions operate.*

Operating Voltage / Frequency

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 on page 77) 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 on page 77) 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 on page 77) 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 on page 77) 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).

NOTE

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.

System B (SyB.) Phase Rotation

CAUTION

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 mismatched phases only under the following conditions:

- **The voltages being measured are wired correctly with respect to the phase rotation at the measuring points (i.e. the potential transformers in on both sides of the circuit breaker)**
- **The voltages being measured are wired so that angular phase shifts or any interruptions from the measuring point to the control unit do not exist**
- **The voltages being measured are wired to the correct terminals of the control.**
- **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 measured voltages are monitored as counterclockwise, the alarm will be initiated. The direction of configured rotation being monitored by the control unit is displayed on the screen.
If this protective function is triggered, the display indicates "**`SyB.phase rotation`**" and the logical command variable "06.21" will be enabled.

NOTE

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

ID	Parameter	CL	Setting range	Default	Description
3950	**Monitoring**	2	On / Off	Off	**On:** Phase rotation monitoring is carried out according to the following parameters. **Off:** No monitoring is carried out.
3954	**SyB phase rotation**	2	CW / CCW	CW	**CW:** The three-phase measured system B voltage is rotating CW (clock-wise; that means the voltage rotates in L1-L2-L3 direction; standard setting). **CCW:** The three-phase measured system B voltage is rotating CCW (counter clock-wise; that means the voltage rotates in L1-L3-L2 direction).
3951	**Alarm class**	2	Class A / Class B / Class C / Class D / Class E / Class F / Control	Class F	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. ***NOTE:*** *See chapter "Alarm Classes" on page 105.*
3952	**Self acknowledge**	2	Yes / No	No	**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).

System A (SyA.) / System B (SyB.) Phase Rotation

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 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.

NOTE

This monitoring function is only enabled if system A voltage measuring (parameter 1851) and system B voltage measuring (parameter 1853) are configured to "3Ph 4W" or "3Ph 3W" and the measured voltage exceeds 50 % of the rated voltage (parameter 1766) or if Generator voltage measuring (parameter 1851) and Mains voltage measuring (parameter 1853) are configured to "1Ph 2W" (in this case, the phase rotation is not evaluated, but defined by the 1Ph 2W phase rotation (parameter 1859)).

ID	Parameter	CL	Setting range	Default	Description
2940	**Monitoring**	2	On / Off	On	**On:** Phase rotation monitoring is carried out according to the following parameters **Off:** No monitoring is carried out.
2941	**Alarm class**	2	Class A / Class B / Class C / Class D / Class E / Class F / Control	Class B	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. ***NOTE:*** *See chapter "Alarm Classes" on page 105.*
2942	**Self acknowledge**	2	Yes / No	Yes	**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).

Miscellaneous

ID	Parameter	CL	Setting range	Default	Description
1756	**Time until horn reset**	0	0 to 1,000 s	180 s	After each alarm of alarm class B through F occurs, the alarm LED flashes and the horn (command variable 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. ***NOTE:*** *If this parameter is configured to 0, the horn will remain active until it will be acknowledged.*
12490	**Ext. acknowledge**	2	*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. ***NOTE:*** *The first high signal into the discrete input acknowledges the command variable 01.12 (horn). The second high signal acknowledges all inactive alarm messages.* The *LogicsManager* and its default settings are explained on page 106 in Appendix C: "*LogicsManager*".

CAN Interface 1 Monitoring

The CANopen interface 1 is monitored. If the interface does not receive a Receive Process Data Object (RPDO) before the delay expires, an alarm will be initiated.
If this protective function is triggered, the display indicates "**`CANopen interface 1`**" and the logical command variable "08.18" will be enabled.

ID	Parameter	CL	Setting range	Default	Description
3150	**Monitoring**	2	On / Off	On	**On:** CANopen interface 1 monitoring is carried out according to the following parameters. **Off:** Monitoring is disabled.
9121	**Event timer**	2	0 to 65,500	20,000	The maximum receiving break is configured with this parameter. If the interface does not receive an RPDO within this time (in ms), the action specified by the alarm class is initiated. The delay timer is re-initialized after every message is received.
3151	**Alarm class**	2	Class A / Class B / Class C / Class D / Class E / Class F / Control	Class C	Each limit may be assigned an independent alarm class that specifies what action should be taken when the limit is surpassed. ***NOTE:*** *See chapter "Alarm Classes" on page 105.*
3152	**Self acknowledge**	2	Yes / No	No	**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).

Measurement Configuration

ID	Parameter	CL	Setting range	Default	Description
1750	**System rated frequency**	2	50 Hz / 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 650,000 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 650,000 V	400 V	The system 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 system A voltage monitoring, breaker operation windows or the Analog Manager.
1752	**SyA. Rated active power [kW]**	2	0.5 to 99,999.9	200.00	This value specifies the system A real power rating, which is used as a reference figure for related functions.
1758	**SyA. Rated react. Pwr. [kvar]**	2	0.5 to 99999.9	200.00	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 32,000 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 / Phase – neutral	Phase – phase	**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. ***NOTE:*** *Please refer to the comments on measuring principles in the Chapter 1: Installation.*
1859	**1Ph2W phase rotation**	2	CW / CCW	CW	**CW:** A clockwise rotation field is supposed for 1Ph 2W measuring. **CCW:** A counter-clockwise rotation field is supposed for 1Ph 2W measuring. ***NOTE:*** *The measurement of phase rotation with 1Ph 2W is not possible. For this reason montitoring phase rotation mismatch is working with this supposed phase rotation.* ***NOTE:*** *Please refer to the comments on measuring principles in the Chapter 1: Installation.*

ID	Parameter	CL	Setting range	Default	Description
1851	**SyA. Voltage measuring**	2	3Ph 4W OD / 3Ph 4W / 3Ph 3W / 1Ph 2W / 1Ph 3W	3Ph 4W	**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: • V_{L12}, V_{L23}, and V_{L31} **3Ph 4W:** Measurement is performed Line-Neutral (WYE connected system) and Line-Line (Delta connected system). The protection depends on the setting of parameter 1771 on page 70. Phase voltages and the neutral must be connected for proper calculation. Measurement, display and protection are adjusted according to the rules for WYE connected systems. Monitoring refers to the following voltages: • V_{L12}, V_{L23}, and V_{L31} (parameter 1771 configured to “Phase-phase”) • V_{L1N}, V_{L2N}, and V_{L3N} (parameter 1771 configured to “Phase-neutral”) **3Ph 3W:** Measurement is performed Line-Line (Delta connected system). Phase voltages must be connected for proper calculation. Measurement, display and protection are adjusted according to the rules for Delta connected systems. Monitoring refers to the following voltages: • V_{L12}, V_{L23}, V_{L31} **1Ph 2W:** Measurement is performed Line-Neutral (WYE connected system) if parameter 1858 is configured to “Phase – neutral” and Line-Line (Delta connected system) if parameter 1858 is configured to “Phase – phase”. Measurement, display and protection are adjusted according to the rules for phase-phase systems. Monitoring refers to the following voltages: • V_{L1N}, V_{L12} **1Ph 3W:** Measurement is performed Line-Neutral (WYE connected system) and Line-Line (Delta connected system). The protection depends on the setting of parameter 1771 on page 70. Measurement, display, and protection are adjusted according to the rules for single-phase systems. Monitoring refers to the following voltages: • V_{L1N}, V_{L3N} (parameter 1771 configured to “Phase-phase”) • V_{L13} (parameter 1771 configured to “Phase-neutral”) ***NOTE:*** *If this parameter is configured to 1Ph 3W, the system A rated voltages (parameter 1766) must be entered as Line-Line (Delta).* ***NOTE:*** *Please refer to the comments on measuring principles in the Chapter 1: Installation.*
1850	**SyA. Current measuring**		L1 L2 L3 / Phase L1 Phase L2 Phase L3	L1 L2 L3	**L1 L2 L3:** All three phases are monitored. Measurement, display and protection are adjusted according to the rules for 3-phase measurement. Monitoring refers to the following currents: • I_{L1}, I_{L2}, I_{L3} **Phase L{1/2/3}:** Only one phase is monitored. Measurement, display and protection are adjusted according to the rules for single-phase measurement. Monitoring refers to the selected phase.

ID	Parameter	CL	Setting range	Default	Description
1853	**SyB. Voltage measuring**		3Ph 4W / 3Ph 3W / 1Ph 2W / 1Ph 3W	3Ph 4W	**3Ph 4W:** Measurement is performed Line-Neutral (WYE connected system) and Line-Line (Delta connected system). The protection depends on the setting of parameter 1770 on page 73. Phase voltages and the neutral must be connected for proper calculation. Measurement, display and protection are adjusted according to the rules for WYE connected systems. Monitoring refers to the following voltages: • V_{L12}, V_{L23}, and V_{L31} (parameter 1770 configured to "Phase-phase") • V_{L1N}, V_{L2N} and V_{L3N} (parameter 1770 configured to "Phase-neutral") **3Ph 3W:** Measurement is performed Line-Line (Delta connected system). Phase voltages must be connected for proper calculation. Measurement, display and protection are adjusted according to the rules for Delta connected systems. Monitoring refers to the following voltages: • V_{L12}, V_{L23}, V_{L31} **1Ph 2W:** Measurement is performed Line-Neutral (WYE connected system) if parameter 1858 is configured to "Phase – neutral" and Line-Line (Delta connected system) if parameter 1858 is configured to "Phase – phase". Measurement, display and protection are adjusted according to the rules for phase-phase systems. Monitoring refers to the following voltages: • V_{L1N}, V_{L12} **1Ph 3W:** Measurement is performed Line-Neutral (WYE connected system) and Line-Line (Delta connected system). The protection depends on the setting of parameter 1770 on page 73. Measurement, display, and protection are adjusted according to the rules for single-phase systems. Monitoring refers to the following voltages: • V_{L1N}, V_{L3N} (parameter 1770 configured to "Phase-phase") • V_{L13} (parameter 1770 configured to "Phase-neutral") ***NOTE:*** *If this parameter is configured to 1Ph 3W, the system B rated voltages (parameter 1768) must be entered as Line-Line (Delta).* ***NOTE:*** *Please refer to the comments on measuring principles in the Chapter 1: Installation.*

Transformer Configuration

ID	Parameter	CL	Setting range	Default	Description
1801	**SyA. PT prim. Rated voltage**	2	50 to 650,000 V	400 V	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. 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.
1800	**SyA. PT sec. rated voltage**	2	50 to 480 V	400 V	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. 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. • Rated voltage: 100 Vac (this parameter configured between 50 and 130 V) - System A voltage: Terminals 14/16/18/20 • Rated voltage: 400 Vac (this parameter configured between 131 and 480 V) - System A voltage: Terminals 15/17/19/21 ***WARNING:*** *Only connect the measured voltage to either the 100 Vac or the 400 Vac inputs. Do not connect both sets of inputs to the measured system.* ***NOTE:*** *The control is equipped with dual voltage measuring inputs. The voltage range of these measurement inputs is dependent upon input terminals are used (see below). This value refers to the secondary voltages of the potential transformers, which are directly connected to the control.*
1806	**SyA. CT prim. Rated current**	2	1 to 32,000 A/x	500 A/x	The input of the current transformer ratio is necessary for the indication and control of the actual monitored value. The current transformers ratio should be selected so that at least 60% of the secondary current rating can be measured when the monitored system is at 100% of operating capacity (i.e. at 100% of system capacity a 5 A CT should output 3 A). If the current transformers are sized so that the percentage of the output is lower, the loss of resolution may cause inaccuracies in the monitoring and control functions and affect the functionality of the control. ***NOTE:*** *This screen only applies to controls equipped with 5 A CT inputs.*
1804	**SyB. PT prim. Rated voltage**	2	50 to 650,000 V	400 V	Some applications may require the use of potential transformers to facilitate measuring the voltages to be monitored. The rating of the primary side of the potential transformer must be entered into this parameter. If the application does not require potential transformers (i.e. the measured voltage is 480 V or less), then this voltage will be entered into this parameter.

ID	Parameter	CL	Setting range	Default	Description
1803	**SyB. PT sec. rated voltage**	2	50 to 480 V	400 V	Some applications may require the use of potential transformers to facilitate measuring the mains voltages. The rating of the secondary side of the potential transformer must be entered into this parameter. If the application does not require potential transformers (i.e. the measured voltage is 480 V or less), then the this voltage will be entered into this parameter. • Rated voltage: 120 Vac (this parameter configured between 50 and 130 V) - System B voltage: Terminals 22/24/26/28 • Rated voltage: 480 Vac (this parameter configured between 131 and 480 V) - System B Voltage: Terminals 23/25/27/29 ***WARNING:*** *Only connect the measured voltage to either the 100 Vac or the 400 Vac inputs. Do not connect both sets of inputs to the measured system.* ***NOTE:*** *The control is equipped with dual voltage measuring inputs. The voltage range of these measurement inputs is dependent upon input terminals are used (see below). This value refers to the secondary voltages of the potential transformers, which are directly connected to the control.*

Interfaces Configuration

CAN Interface Configuration

NOTE

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.

CAN Interface 1 Configuration

ID	Parameter	CL	Setting range	Default	Description
3156	**Baudrate**	2	20 kBaud / 50 kBaud / 100 kBaud / 125 kBaud / 250 kBaud / 500 kBaud / 800 kBaud / 1,000 kBaud	125 kBaud	This parameter defines the used Baud rate. Please note, that all participants on the CAN bus must use the same Baud rate.
8993	**CANopen Master**	2	Default Master / On / Off	Off	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. **Default Master:** The unit starts up in “operational” mode and sends a “Start_Remote_node” message after a short delay. **On:** The unit is the CANopen Master and automatically changes into operational mode and transmits data. **Off:** The unit is a CANopen Slave. An external Master must change into operational mode. ***NOTE:*** *If CANopen Master (parameter 8993) is configured to “Off”, the Master controller (for example a PLC) must send a “Start_Remote_node” message to initiate the load share message transmission of the easYgen. If no “Start_Remote_node” message would be sent, the complete system would not be operational.*
9120	**Producer heartbeat time**	2	0 to 65,500 ms	0,000 ms	Independent from the CANopen Master configuration, the unit transmits a heartbeat message with this configured heartbeat cycle time. If the producer heartbeat time is equal 0, the heartbeat will only be sent as response to a remote frame request. The time configured here will be rounded up to the next 20 ms step.
8854	**Serial control**	2	On / Off	On	**Off:** The commands and states received by CAN will be ignored. **ON:** The commands and states received by CAN ID 0x200 + device number will be considered.

RS-232 Interface Configuration (Serial 1)

ID	Parameter	CL	Setting range	Default	Description
3163	**Baudrate**	2	2.4 kBd / 4.8 kBd / 9.6 kBd / 14.4 kBd / 19.2 kBd / 38.4 kBd / 56 kBd / 115 kBd	19.2 kBd	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	No / Even / Odd	No	The used parity of the interface is set here.
3162	**Stop bits**	2	One / Two	One	The number of stop bits is set here.

Counters Configuration

CB Close Counter

ID	Parameter	CL	Setting range	Default	Description
2541	**Counter value pre-sent**	2	0 to 65,535	0	**Setpoint value for CBA close counter** 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 on page 83. (The counter is incremented if an rising edge of “reply CBA closed” via DI or CAN is detected.)
2542	**CBA set number of closures**	2	Yes / No	No	**Set CBA close counter** **Yes:** The current value of the CBA close counter is overwritten with the value configured in "Set point value for start counter". After the counter has been (re)set, this parameter changes back to "No" automatically. **No:** The value of this counter is not changed.

Chapter 4
Operation

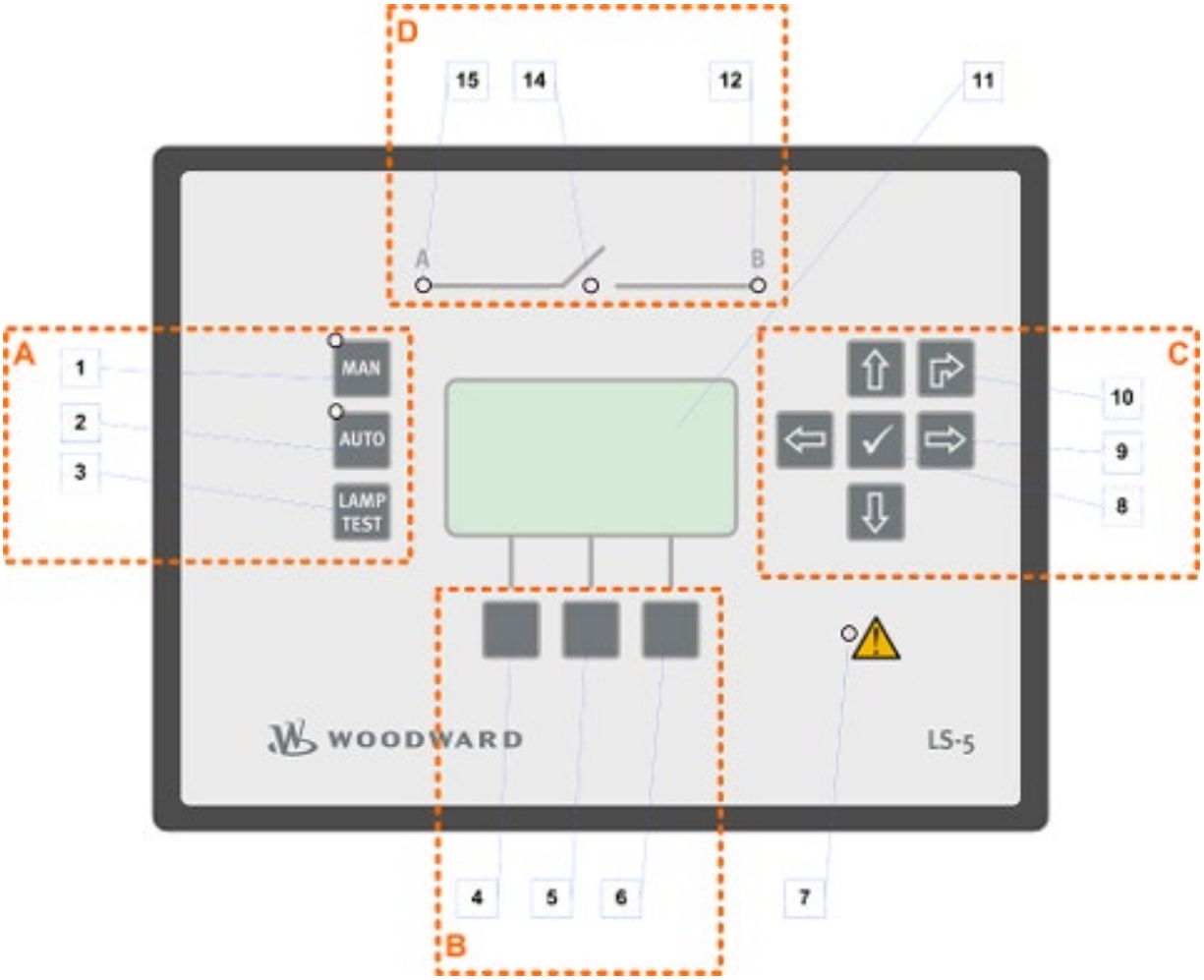


Figure 4-1: Front panel and display

Figure 4-1 illustrates the front panel/display of the LS-52x with push buttons, LEDs and LCD display. A short description of the front panel is given below.

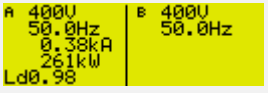
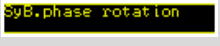
A			
No	**Button**	**Function Main Screen**	**Function Other Screens**
1	MAN	Change into MANUAL operating mode. The LED indicates that the operation mode is active. When MANUAL is selected, the breaker control is performed manually via the push button ■ (No. 5). If the controller is configured to operation mode L-MCB or L-GGB (parameter ID 8840) the button has no function.	
2	AUTO	Change into AUTOMATIC operating mode. The LED indicates that the operation mode is active. When AUTOMATIC is selected, the control unit manages all breaker control functions. These functions are performed in accordance with how the control is configured.	
3	LAMP TEST	Perform lamp test.	

B			
No	**Button**	**Function Main Screen**	**Function Other Screens**
4	■	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. See table Table 4-1 on page 86	The push button has only a function if a graphic icon is assigened (No. 12).

B			
No	**Button**	**Function Main Screen**	**Function Other Screens**
5		AUTOMATIC operating mode – No function. MANUAL operating mode – CLOSE Open / Close Breaker.	The push button has only a function if a graphic icon is assigened (No. 12).
6		No function.	The push button has only a function if a graphic icon is assigened (No. 12).
7		The LED indicates that alarm messages are active / present in the control unit.	

C			
No	**Button**	**Function Main Screen**	**Function Other Screens**
9		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 function.	Scroll left / Enter menu (if graphic icon is assigned)
8		Reset “Horn”.	Enter / Acknowledge
10		No function.	Return to last screen

D			
No	**Button**	**Function Main Screen**	**Function Other Screens**
12		The LED indicates three states: **Off:** Voltage is below dead bus limit (parameter ID 5820). **Blinking:** Voltage higher than dead bus limit (parameter ID 5820) but voltage or frequency are not in range. **On:** Voltage / frequency in operation window.	
14		The LED indicates two states: **Off:** Breaker is opened. **On:** Breaker is closed.	
15		The LED indicates three states: **Off:** Voltage is below dead bus limit (parameter ID 5820). **Blinking:** Voltage higher than dead bus limit (parameter ID 5820) but voltage or frequency are not in range. **On:** Voltage / frequency in operation window.	

Main Screen		
No	**Display**	**Function**
11		**A:** Shows the System A values. **B:** Shows the System B values.
		This display section shows the “Status Messages” and “Alarm Messages”. A detailed list of the messages can be found in paragraph “Display Messages” on page 94.
		The voltage display softkey changes the type of voltage display. The amount of information available from the system depends on how the measuring is configured in the control. Table 4-1 on page 86 illustrates what values are available depending on the configured measurement type.
		This graphic icon is only displayed in the MANUAL operating mode.

NOTE

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

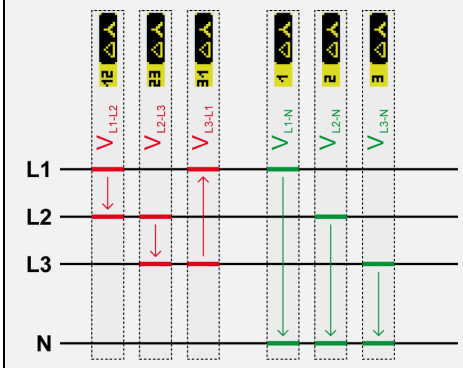
Measuring point	Scroll display		Symbol of the displayed voltage			Displayed at parameter setting			
	Soft key	Press				3Ph 4W	3Ph 3W	1Ph 2W	1Ph 3W
System A / System B 		0× (6×)	12	Delta	L1-L2	yes	yes	Yes *1	---
		1×	23	Delta	L2-L3	yes	yes	---	---
		2×	31	Delta	L3-L1	yes	yes	---	yes
		3×	1	Wye	L1-N	yes	---	Yes *1	yes
		4×	2	Wye	L2-N	yes	---	---	---
		5×	3	Wye	L3-N	yes	---	---	yes

Table 4-1: Measuring values

*1 (depends on setting of parameter 1858)

Screen Structure

The following figure shows the screen structure of the LS-52x control device.

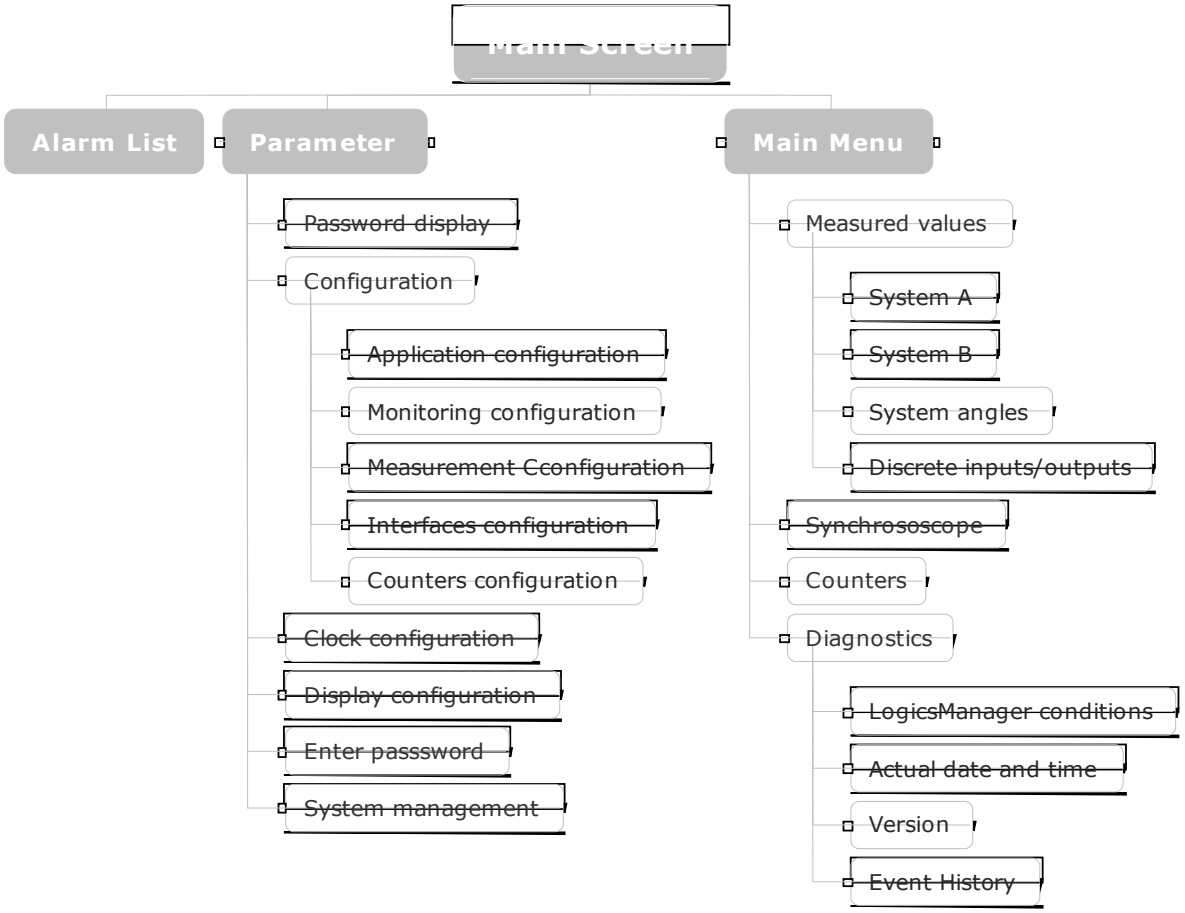


Figure 4-2: Screen structure

Navigation

Alarm List

Screen "Alarm list"

This screen appears after pressing the softkey in the main 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 mon-dd hh:mm:ss.ss. Please note, that self-acknowledging alarm messages get a new timestamp when initializing the unit (switching on). The symbol indicates that this alarm condition is still present. 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.

Return to the main screen.

Scroll up to next alarm message.
Scroll down to next alarm message.
Acknowledge alarm. (can be only performed if alarm condition is not present)

Parameter

The following section shows only some selected screens which have special functions or operation features which extend the standard operation.

Screen "Parameter"

This screen appears after pressing the softkey in the main screen.

Return to the main screen.
Scroll up to next menu item.
Scroll down to next menu item.
Enter menu item.

Password display
Displays the code level.
Configuration
Display the configuration menu screen.
Clock configuration
Display the clock configuration.
Display configuration
Display the display configuration.
Enter password
Display the password entry screen.
System management
Display the system management configuration screen.

Screen "Display configuration"

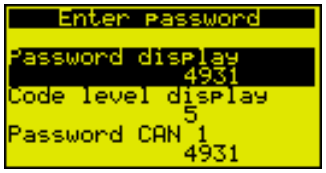
This screen appears after selecting the "Display configuration" menu in the "Parameter" screen. The contrast of the display may be configured here.

Return to the "Parameter" screen.

Increase contrast.

Decrease contrast.

Screen "Enter password"



This screen appears after selecting the "Enter password" menu in the "Parameter" screen. Only the password may be entered using this screen. The code levels are only displayed depending on the entered password.

Return to the "Parameter" screen.

Scroll up one parameter.

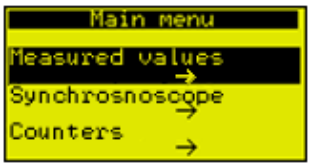
Scroll down one parameter.

Select the parameter to be configured with this button. Change the parameter using the softkeys. Navigate in the screen using the softkeys. Confirm the change with the softkey or exit parameter configuration without any changes using the softkey.

Main Menu

The following section shows only some selected screens which have special functions or operation features which extend the standard operation.

Screen "Main Menu"

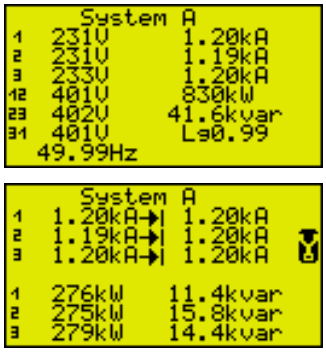


This screen appears after pressing the ⇩ softkey in the main screen.

- ⇨ Return to the main screen.
- ⇧ Scroll up to next menu item.
- ⇩ Scroll down to next menu item.
- ✓ Enter menu item.

Measured Values
Display the measured values screen.
Synchroscope
Display the synchroscope screen.
Counters
Display the counters screen.
Diagnostic
Display the diagonstic screen.

Screen "System A"

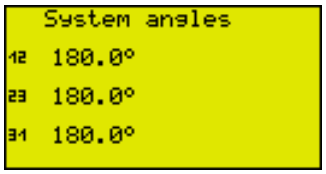


This screen appears after selecting the "System A" menu in the "Measured values" screen. All measured system A values are displayed in this screen.

- ⇨ Return to "Measured values" screen.
- ⇩ Scroll down display screen to additional system A values.
- ⇧ Scroll up display screen to main system A values.
- ⇦ Reset the maximum value display.

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

Screen "System angles"

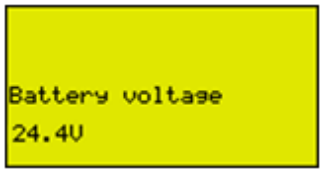


This screen appears after selecting the "System angles" menu in the "Measured values" screen. All measured system angle values are displayed in this screen.

NOTE: *The shown values are the real sytem angles between system A and system B without phase angle compensation (parameter ID 8824).*

Return to "Measured values" screen.

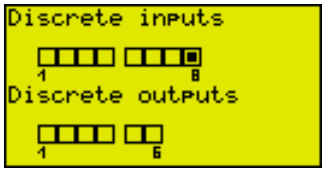
Screen "Analog inputs"



This screen appears after selecting the "Analog inputs" menu in the "Measured values" screen. All measured battery voltagr is displayed in this screen.

Return to "Measured values" screen.

Screen "Discrete inputs/outputs"



This screen appears after selecting the "Discrete inputs/outputs" menu in the "Measured values" screen. Discrete input and discrete output status are displayed.

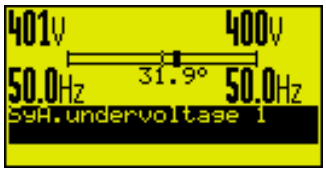
Return to "Measured Values" screen.

Status display of the discrete inputs and discrete outputs. (Note: 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 ( ).

Discrete input: energized
de-energized

Discrete output: relay activated
relay de-activated

Screen "Synchroscope"



This screen appears after selecting the "Synchroscope" menu in the "Main menu" screen. The square symbol indicates the actual phase angle between system A and system B. A complete left position of the square symbol means -180° and complete right position means +180°. The frequency and voltage differences are indicated in the display.

NOTE: *The shown value is not the real angle between system A and system B if the phase angle compensation (parameter ID 8824) is active. The configured phase angle compensation is added to the angle.*

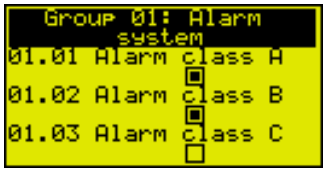
Return to "Main menu" screen.

Screen "LogicsManager conditions"

This screen appears after selecting the "LogicsManager conditions" menu in the "Diagnostic" screen. You are able to display the conditions of all *LogicsManager* command variables, which are located in their respective groups.

Return to "Diagnostic" screen.

Command variables of group 1 (ex.):



Scroll up one group / command variable.

Scroll down one group / command variable.

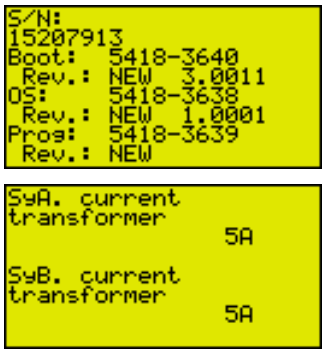
Select the highlighted command variable group and display the state of the command variables in this group.

Status display of the command variables:

The command variables is TRUE

The command variables is FALSE

Screen "Version"



This screen (with your current data) appears after selecting the "Version" menu in the "Diagnostic" screen. This screen displays the serial number of the unit and the firm- and software P/N, version, and revision.

Return to "Diagnostic" screen.

Scroll down display screen.

Scroll up display screen.

Screen "Event History"

This screen (with your current data) appears after selecting the "Event History" menu in the "Diagnostic" screen. A date/time stamp is added to each entry. Additional characters (+ and -) indicate the state of the event. The "+" character indicates a condition that is still active. If the condition is no longer present anymore, it will be displayed again, but with a "-" indication.

Return to "Diagnostic" screen.

Scroll up one event.

Scroll down one event.

Display Messages

Status Messages

Message text and ID	Meaning
CBA dead bus close ID 13210	**Dead bus closing of the CBA** The CBA is closing with at least on system is dead.
CBA open ID 13257	**The CBA is being opened** An CBA open command has been issued.
Synchronization CBA ID 13260	**The CBA will be synchronized** The control tries to synchronize the CBA.
Unloading SyA. ID 13264	**The CBA is unloading** The LS-5 is receiving the “Enable Power Message” via CAN bus.
Synch. OFF ID 13267	**Synchronization mode Off (twinckling)** Synchronization mode is set to Off (parameter 5728)

Alarm Messages

Message text and ID	Meaning
SyB. Phase rotation ID 3955	**System B rotating field** The system A rotating field does not correspond with the configured direction.
SyA. Phase rotation ID 3975	**System A rotating field** The system A rotating field does not correspond with the configured direction.
Ph.rotation mismatch ID 2944	**System A/System B phase rotation different** System A or System B has different rotating fields. A CB closure is blocked.
CANopen Interface1 ID 10087	If the interface does not receive CAN messages within the time of Event timer (parameter 9121) an alarm message will be activated

Discrete input #	1	2	3	4	5	6	7
Message ID	10600	10601	10602	10603	10604	10605	10607

Table 4-2: Message IDs for discrete inputs

Chapter 5
Interface

Interfaces Overview

The LS-521 V2 (Option K12) provides the following interfaces which are supporting different protocols.

LS-521 V2

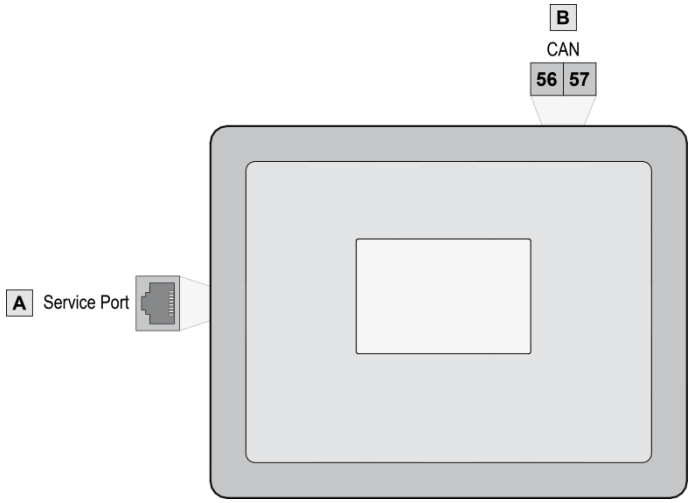


Figure 5-1: Interface ovierview

Figure	Interface	Protocol
A	Service Port (RS-232 – optional Woodward DPC cable required)	ToolKit
B	CAN bus	CANopen

CAN Interface

CAN Interface 1

CAN interface 1 is a CANopen interface with 1 fixed RPDO (receive boxes) and 4 fixed TPDOs (send boxes).

Figure 5-2: CAN interface 1

Serial Interfaces

RS-232 Interface (Serial Interface 1)

A freely configurable RS-232 interface is provided to serve as a local service interface for configuring the unit and visualize measured data. The serial interface 1 is working with the Woodward ToolKit PC software.

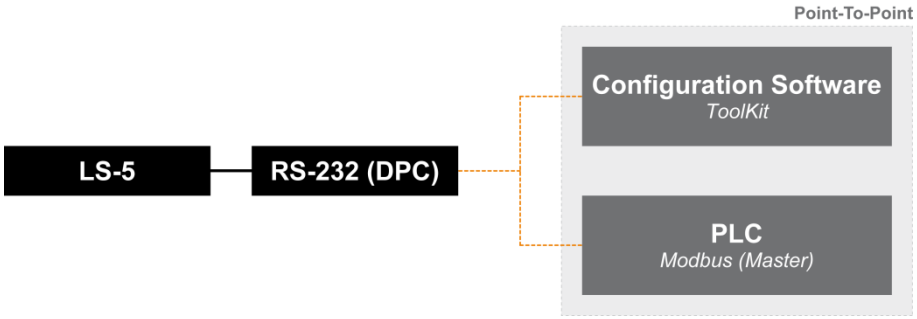


Figure 5-3: RS-232 interface

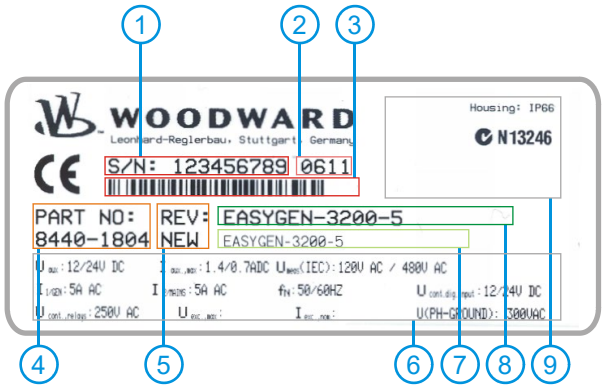
Protocols Overview

CANopen

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.

Chapter 6
Technical Data

Nameplate



1	S/N	Serial number (numerical)
2	S/N	Date of production (YYMM)
3	S/N	Serial number (Barcode)
4	P/N	Item number
5	REV	Item revision number
6	Details	Technical data
7	Type	Description (long)
8	Type	Description (short)
9	Approval	Approvals

Measuring values, voltages ----------Y/Δ

- Measuring voltages

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 ..... 2.5 kV

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 ..... 4.0 kV

- Linear measuring range..... 1.25 × 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

Measuring values, currents ----------galvanically 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 ..... 1.5 × I_{rated}
- Maximum power consumption per path..... < 0.15 VA
- Rated short-time current (1 s) **[1]** ..... 50.0 × I_{rated}
  [5] ..... 10.0 × I_{rated}

Ambient variables ----------

- Power supply..... 12/24 Vdc (8 to 40.0 Vdc)
  Intrinsic consumption ..... ~ 6 W (LS-521 V2)
- Degree of pollution 2
- Overvoltage (≤ 2 min) ..... 80 Vdc
- Reverse voltage protection ..... Full supply range
- Maximum elevation .....2000 m ASL

- Input capacitance ..... 660 µF

Discrete inputs ----------galvanically isolated

- Input range ($V_{cont. dig. input}$).....Rated voltage 12/24 Vdc (8 to 40.0 Vdc)
- Input resistance .....approx. 20 kΩ

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

Interface ----------

Service Port interface .....**not galvanically isolated**

- Proprietary interface .....Connect only with Woodward DPC cable

CAN bus interface ..... **galvanically isolated**

- Insulation voltage (continuously) ..... 100 Vac
- Insulation test voltage (≤ 5s)..... 1000 Vac
- Version .....CAN bus
- Internal line termination ..... Not available

Battery ----------

- Type.....Lithium
- Life span (operation without power supply)..... approx. 5 years
- Battery field replacement.....not allowed

WARNING

Batteries can be harmful to the environment. Damaged or un-usable batteries must be disposed of in a container specially reserved for this purpose.

In general, appropriate local guidelines and regulations must be followed when disposing of electrical devices and batteries

Housing ----------

- Type plastic ..... easYpack
- Dimensions (W × H × D) plastic ..... 219 × 171 × 61 mm
- Front cutout (W × H).....186 [+1.1] × 138 [+1.0] mm
- Wiring..... screw-plug-terminals 2.5 mm²
- Recommended locked torque ..... 4 inch pounds / 0.5 Nm
  use 60/75 °C copper wire only
  use class 1 wire only or equivalent
- Weight ..... approx. 850 g

Protection

- Protection system ..... IP54 from front with clamp fasteners
  IP66 from front with screw kit
  IP20 from back
  Front folio ..... insulating surface
- EMC test (CE)..... tested according to applicable EN guidelines
- Listings.....CE marking; UL / cUL, Ordinary locations, File No.: 231544
- Marine ..... Type approval: Lloyds Register (LR)
  Design Assessment: American Bureau of Shipping (ABS)

Generic note ----------

- Accuracy ..... referred to full scale value

Environmental Data

Vibration
- Frequency Range – Sine Sweep ..... 5Hz to 100Hz
  - Acceleration 4G
- Standards .....
  EN 60255-21-1 (EN 60068-2-6, Fc)
  Lloyd's Register, Vibration Test2
  SAEJ1455 Chassis Data
- Frequency Range - Random ..... 10Hz to 500Hz
  - Power Intensity..... 0.015G²/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..... 40G, Saw tooth pulse, 11ms
- 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, Envt 2,4, DNV Dry heat, Cold Class A,C

Humidity
- Humidity..... 95%, non condensing, max.85% @ ≥ 40°C / 104°F
- Standards ..... MIL-STD 810D, M507.2, PII

Marine Environmental Categories
- Lloyd's Register of Shipping (LRS)..... ENV1, ENV2, ENV3 and ENV4

Accuracy

Measuring value	Display	Accuracy	Measuring start	Notes
Frequency				
System A System B	40.0 to 85.0 Hz	0.1 % (of 85 Hz)	5 % (of PT secondary voltage setting) [1]	
Voltage				
Wye system A / system A	0 to 650 kV	1 % (of 120/480 V) [2]	1.5 % (of PT secondary voltage setting) [1]	
Delta system A / system B			2 % (of PT secondary voltage setting) [1]	
Current				
System A Max. value	0 to 32,000 A	1 % (of 1/5 A) [3]	1 % (of 1/5 A) [3]	
Real power				
Actual total real power value	-2 to 2 GW	2 % (of 120/480 V * 1/5 A) [2/3]	starts with detecting the zero passage of current/voltage	
Reactive power				
Actual value in L1, L2, L3	-2 to 2 Gvar	2 % (of 120/480 V * 1/5 A) [2/3]	starts with detecting the zero passage of current/voltage	
Power factor				
Actual value power factor L1	lagging 0.00 to 1.00 to leading 0.00	2 %	2 % (of 1/5 A) [3]	1.00 is displayed for measuring values below the measuring start
Miscellaneous				
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

[1] Setting of the parameter for the PT secondary rated voltage
[2] depending on the used measuring inputs (120/480 V)
[3] depending on the CT input hardware (1/5 A) of the respective unit

Reference conditions (for measuring the accuracy):

- Input voltage ..... sinusoidal rated voltage
- Input current..... sinusoidal rated current
- Frequency..... rated frequency +/- 2 %
- Power supply..... rated voltage +/- 2 %
- Power factor (cos φ)..... 1.00
- Ambient temperature..... 23 °C +/- 2 K
- Warm-up period..... 20 minutes

Appendix A.
Useful Information

Connecting 24 V Relays

Interferences in the interaction of all components may affect the function of electronic devices.
One interference factor is disabling inductive loads, like coils of electromagnetic switching devices. When disabling such a device, high switch-off induces voltages may occur, which might destroy adjacent electronic devices or result interference voltage pulses, which lead to functional faults, by capacitive coupling mechanisms.
Since an interference-free switch-off is not possible without additional equipment, the relay coil is connected with an interference suppressing circuit.

If 24 V (coupling) relays are used in an application, it is required to connect a protection circuit to avoid interferences. Figure 6-1 shows the exemplary connection of a diode as an interference suppressing circuit.

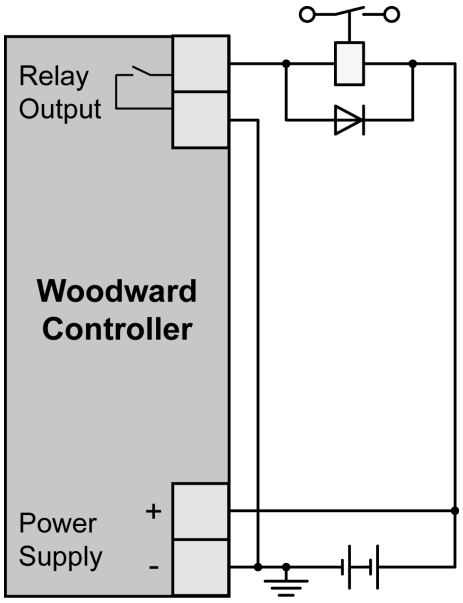


Figure 6-1: Interference suppressing circuit - connection

Advantages and disadvantages of different interference suppressing circuits are described in the following.

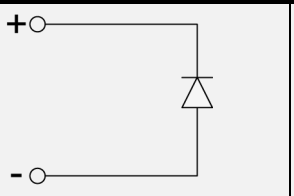
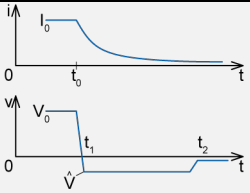
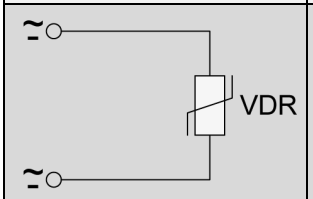
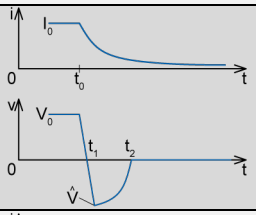
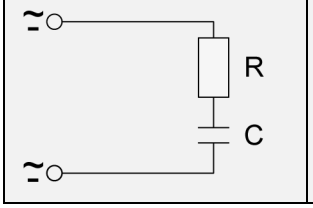
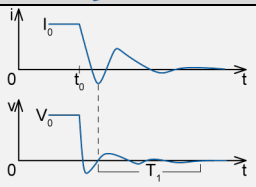
Connection diagram	Load current / voltage curve	Advantages	Disadvantages
		• Uncritical dimensioning • Lowest possible induced voltage • Very simple and reliable	• High release delay
		• Uncritical dimensioning • High energy absorption • Very simple setup • Suitable for AC voltage • Reverse polarity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

Table 6-1: Interference suppressing circuit for relays

Appendix B. Miscellaneous

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**	**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)		
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”.		

Appendix C. LogicsManager

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.

NOTE

Please do not use the output of an equation as input at the same time. Such a configuration could decrease the performace of the interfaces.

Structure and Description of the *LogicsManager*

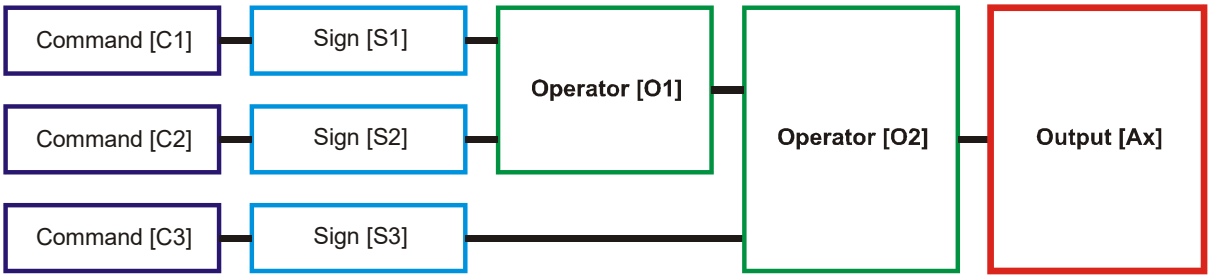


Figure 6-2: *LogicsManager* - function overview

- **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 Logical Command Variables starting on page 110 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.

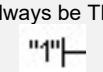
[Cx] - Command {x}	[Sx] - Sign {x}	[Ox] - Operator {x}	[Ax] - Output {x}
The description and the tables of all values, flags, and internal functions that are able to combine via the *LogicsManager* can be found in the Logical Command Variables section starting on page 110.	**Value {[Cx]}** The value [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. 	**AND** Logical AND **NAND** Logical negated AND **OR** Logical OR **NOR** Logical negated OR **XOR** Exclusive OR **NXOR** Exclusive negated OR (See Table 6-3 for symbols)	The description and the tables of all logical outputs, flags, and functions that are able to combine via the *LogicsManager* can be found in the Logical Outputs section starting on page 109.

Table 6-2: *LogicsManager* - command overview

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 [D2]" 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" ⇨

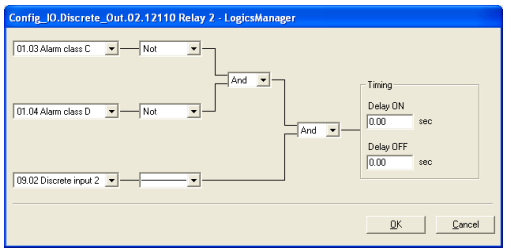


Figure 6-3: *LogicsManager* - display in ToolKit

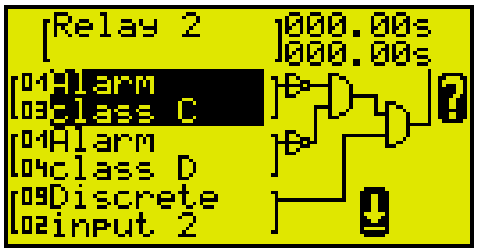


Figure 6-4: *LogicsManager* - display on LCD screen

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.

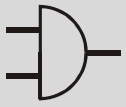
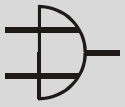
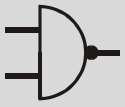
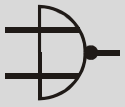
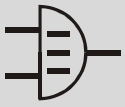
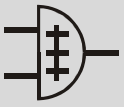
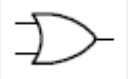
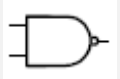
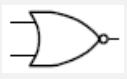
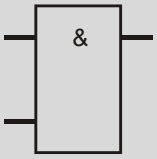
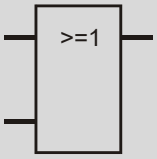
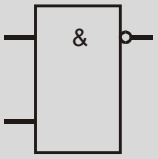
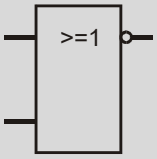
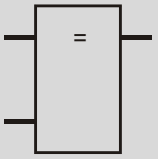
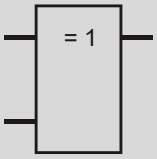
ToolKit	AND			OR			NAND			NOR			NXOR			XOR		
DIN 40 700 (LS-5)																		
ASA US MIL																		
IEC617-12																		
Truth table	x1	x2	y	x1	x2	y	x1	x2	y	x1	x2	y	x1	x2	y	x1	x2	y
	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0
	0	1	0	0	1	1	0	1	1	0	1	0	0	1	0	0	1	1
	1	0	0	1	0	1	1	0	1	1	0	0	1	0	0	1	0	1
	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	0

Table 6-3: *LogicsManager* - logical symbols

Logical Outputs

The logical outputs or combinations may be grouped into three categories:

- Internal functions
- Relay outputs

NOTE

The numbers of the logical outputs in the third column may again be used as input variable for other outputs in the *LogicsManager*.

Logical Outputs: 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 on page 76)	00.15
Lock keypad	Activation of lock keypad (parameter 12978 on page 59)	00.95

Logical Outputs: 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 Close CBA'	---
Relay 6	If this logical output becomes true, the relay output 6 will be activated	00.46

Relay Number	Term.	
Internal relay outputs		
[R1]	30/31	*LogicsManager*; combinated with 'Ready for operation OFF'
[R2]	32/33	*LogicsManager*; pre-assigned with 'Centralized alarm (horn)'
[R3]	34/35	*LogicsManager*; pre-assigned with 'System B not OK'
[R4]	36/37	*LogicsManager*; pre-assigned with 'System A not OK'
[R5]	38/39/40	Fixed to 'Close CBA'
[R6]	41/42	Fixed to 'Open CBA' if CBA is controlled by 2 relays otherwise *LogicsManager* pre-assigned with 'All Alarm classes'

Table 6-4: Relay outputs - terminal assignment

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 13: Discrete outputs

Logical Command Variables: Group 00: Flags Condition 1

Flags condition 1, Logic command variables 00.15-00.95

Flags are internal logic that can be sent to other flags or Command variables.

No.	ID	Name	Function	Note
00.15	15	LM: External acknowledge	The alarm acknowledgement is performed from an external source	
00.41	41	LM: Relay 1		TRUE, if the *LogicsManager* condition driving this relay is fulfilled
00.42	42	LM: Relay 2		
00.43	43	LM: Relay 3		
00.44	44	LM: Relay 4		
00.45	45	Reserved		
00.46	46	LM: Relay 6		
00.95	95	LM: Lock Keypad	Lock keypad is active	

Logical Command Variables: 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 page 105 for a description of the alarm classes.

No.	ID	Name / Function	Note
01.01	101	Alarm class A	TRUE as long as an alarm of this alarm class is active or latched (triggered)
01.02	102	Alarm class B	TRUE as long as an alarm of this alarm class is active or latched (triggered)
01.03	103	Alarm class C	TRUE as long as an alarm of this alarm class is active or latched (triggered)
01.04	104	Alarm class D	TRUE as long as an alarm of this alarm class is active or latched (triggered)
01.05	105	Alarm class E	TRUE as long as an alarm of this alarm class is active or latched (triggered)
01.06	106	Alarm class F	TRUE as long as an alarm of this alarm class is active or latched (triggered)
01.07	107	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	108	Warning alarm	TRUE as long as at least one alarm of the alarm classes A/B is active or latched (triggered)
01.09	109	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	110	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	111	New alarm triggered	TRUE if any alarm has been triggered until it is acknowledged
01.12	112	Horn	True if a new alarm is triggered and time (parameter 1756) for horn reset has not exceeded.

Logical Command Variables: Group 02: Systems Condition

Systems condition, Logic command variables 02.03-02.24

The status of the system may be used as command variable in a logical output to set parameters for customized operations.

No.	ID	Name	Function	Note
02.03	203	SyB. voltage ok	SyB. voltage within operating window	TRUE as long as the SyB. voltage is within the operating window
02.04	204	SyB. frequency ok	SyB. frequency within operating window	TRUE as long as the SyB. frequency is within the operating window
02.05	205	SyB. voltage / frequency ok	SyB. voltage and frequency within operating windows	TRUE as long as the SyB. voltage and frequency are within the operating windows (02.03. and 02.04 are TRUE)
02.09	209	SyA. voltage ok	SyA. voltage within operating window	TRUE as long as the SyA. voltage is within the operating window
02.10	210	SyA. frequency ok	SyA. frequency within operating window	TRUE as long as the SyA. frequency is within the operating window
02.11	211	SyA. voltage / frequency ok	SyA. voltage and frequency within operating windows	TRUE as long as the SyA. voltage and frequency are within the operating windows (02.09. and 02.10 are TRUE)
02.12	212	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	213	SyA. rotation CW	SyA. voltage: rotating direction CW	
02.14	214	SyB. rotation CCW	SyB. voltage: rotating direction CCW	
02.15	215	SyB. rotation CW	SyB. voltage: rotating direction CW	
02.23	223	System A is dead	System A is dead	TRUE as long as system A voltage is below the level defined by parameter 5820.
02.24	224	System B is dead	System B is dead	TRUE as long as system B voltage is below the level defined by parameter 5820.

Logical Command Variables: Group 04: Applications Condition

Applications condition, Logic command variables 4.01-04.62

These operating statuses may be used as command variable in a logical output to set parameters for customized operations.

No.	ID	Name	Function	Note
04.01	401	Auto mode	AUTOMATIC operating mode active	TRUE in AUTOMATIC operating mode
04.03	403	Manual mode	MANUAL operating mode active	TRUE in MANUAL operating mode
04.04	404	Lamp test	A lamp test is being performed	TRUE if the lamp test is active
04.05	405	Acknowledge	"Acknowledge" push button has been pressed or an external acknowledg-ment via *LogicsManager*	This condition is TRUE for approx. 40 ms and must be extended utilizing a delay time
04.07	407	CBA is closed	CBA is closed only	TRUE if DI 8 (Reply CBA) is de-energized
04.14	414	Remote acknowl.	Remote acknowledge	TRUE if a remote acknowledge command is received via CAN and “Serial Control” is on.
04.21	421	Syn. CBA is active	Synchronization CBA is active	TRUE if the CBA shall be synchronized until the CBA is closed
04.22	422	Opening CBA active	Opening CBA is active	TRUE if an CBA open command is issued until DI 8 (Reply CBA) is energized
04.23	423	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)
04.29	429	CBA unloading	CBA unloading	TRUE if “Power Message” command is re-ceived via CAN and “Serial Control” is on.
04.62	462	Dead bus close active	Dead bus closure procedure is active.	TRUE if - Dead bus closure is allowed (parameter 8801 to 8804) and - Dead bus conditions are true (parameter 8801 to 8805, 5820) and - CBA is enabled

Logical Command Variables: Group 05: Device Related Alarms

Device related alarms, Logic command variables 05.15

These device alarm may be used as command variable in a logical output to set parameters for customized operations.

No.	ID	Name / Function	Note
05.15	515	EEprom failure	TRUE = alarm latched (triggered) FALSE = alarm acknowledged

Logical Command Variables: Group 06: System B Related Alarms

System B related alarms, Logic command variables 06.21

These system B alarm may be used as command variable in a logical output to set parameters for customized operations.

No.	ID	Name / Function	Note
06.21	621	SyB. phase rotation	TRUE = alarm latched (triggered) FALSE = alarm acknowledged

Logical Command Variables: Group 07: System A Related Alarms

System A related alarms, Logic command variables 07.05

These system A alarm may be used as command variable in a logical output to set parameters for customized operations.

No.	ID	Name / Function	Note
07.05	705	SyA. phase rotation	TRUE = alarm latched (triggered) FALSE = alarm acknowledged

Logical Command Variables: Group 08: System Related Alarms

System related alarms, Logic command variables 08.18-08.33

These system alarms may be used as command variable in a logical output n to set parameters for customized operations.

No.	ID	Function	Note
08.18	818	CANopen Interface 1	TRUE = alarm latched (triggered) FALSE = alarm acknowledged
08.33	833	Phase rotation mismatch	

Logical Command Variables: 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.	ID	Function	Note
09.01	901	DI 1 (Discrete input [DI 01])	TRUE = logical "1" (delay times and NO/NC 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	902	DI 2 (Discrete input [DI 02])	
09.03	903	DI 3 (Discrete input [DI 03])	
09.04	904	DI 4 (Discrete input [DI 04])	
09.05	905	DI 5 (Discrete input [DI 05])	
09.06	906	DI 6 (Discrete input [DI 06])	
09.07	907	DI 7 (Discrete input [DI 07])	
09.08	908	DI 8 (Discrete input [DI 08])	

Logical Command Variables: Group 13: Discrete Outputs

Discrete outputs, Logic command variables 13.01-13.12

The discrete outputs may be used as command variable in a logical output.

No.	ID	Name / Function	Note
13.01	1301	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	1302	Discrete output DO2 [R02]	
13.03	1303	Discrete output DO3 [R03]	
13.04	1304	Discrete output DO4 [R04]	
13.05	1305	Discrete output DO5 [R05]	
13.06	1306	Discrete output DO6 [R06]	

Appendix D.
Data Protocols

CANopen

Transmitted Data

The LS-521 V2 (Option K12) transmits four fixed CAN messages.

Message 1 (transmitted)
CAN-ID: 180h + Device Number
Transmission rate: 20 ms if "Enable CB A" (via remote control message or DI) is activated, 250 ms if not

Data byte(s)	Description	Multiplier/Mask	Unit	Range/Comment
0, 1	Differential voltage L12 (L1-N if 1Ph 2W, Ph-N measurement) Positive, if SysA higher than SysB (Sys. A – Sys. B)	1	V	± 32,000
2, 3	Differential freq. L12 Positive, if SysA higher than SysB (Sys. A – Sys. B)	0.01	Hz	± 7,000
4, 5	Differential angle L12. Positive, if SysB faster than SysA (Sys. B – Sys. A)	0.1	°	-1,799 to 1,800
6	DI 2	0x01	-	Default: acknowledge
	DI 7	0x02	-	Enable CBA
	DI 8	0x04	-	Reply CBA is closed
	DI 1	0x08	-	State DI 1
	DI 4	0x10	-	Default: Open CBA immediately
	Command "Enable CBA"	0x20	-	State DI 7 or CAN (or Button in manual)
	State CBA (breaker reply)	0x40	-	DI 8 or CAN
	Command "Open CBA"	0x80	-	State DI 4 or CAN (or Button in manual)
7	State Relay R1 (LM)	0x01		Ready for Operation
	State Relay R2 (LM)	0x02		Default: Alarm horn
	State Relay R3 (LM)	0x04		Default: System B not ok.
	State Relay R6 (LM)	0x08		Relay open CBA
	State Relay R4 (LM)	0x10		Default: System A not ok.
	Not used	0x20		= False
	08.18 CANopen Interface1-status	0x40		CAN error indication
	State Relay R5 (LM)	0x80		Relay close CBA

Message 2 (transmitted)
CAN-ID: 280h + Device Number
Transmission rate: 250 ms (at all times)

Data byte(s)	Description	Multiplier/Mask	Unit	Range/Comment
0, 1	Syst. A voltage L1-L2 (L1-N if 1Ph 2W, Ph-N measurement)	1	V	0 to 32,000
2, 3	Syst. B voltage L1-L2 (L1-N if 1Ph 2W, Ph-N measurement)	1	V	0 to 32,000
4, 5	Syst. A frequency L12	0.01	Hz	0 to 7,000
6, 7	Syst. B frequency L12	0.01	Hz	0 to 7,000

Message 3 (transmitted)
CAN-ID: 380h + Device Number
Transmission rate: 20 ms if “Power Message Bit = 1“ (of the remote control message) is received, 250 ms if not

Data byte(s)	Description	Multiplier/Mask	Unit	Range/Comment
0, 1	Real power	1	Scaling cf. below	± 32,000 (Direction of power (+): From A to B)
2, 3	Reactive power	1	Scaling cf. below	± 32,000 (Direction of power (+): From A to B)
4, 5	Power factor	1	-	-99 to 100 0.00 Leading to 1.00 to 0.00 Lagging
6, 7	Average current	1	A	0 to 32,000 (absolute value)

The scaling of real power and reactive power of "Message 3" depends on the configured apparent power S [VA].

S = "SyA PT prim. rated voltage"[V] * "SyA CT prim. rated current"[A] * √3

S < 3 * 10^4 → kW * 10^-1, kvar * 10^-1,
3 * 10^4 < S < 3 * 10^6 → kW, kvar,
3 * 10^6 < S < 6 * 10^6 → MW * 10^-1, Mvar * 10^-1,
60 * 10^6 < S → MW, Mvar

Message 4 (transmitted)
CAN-ID: 480h + Device Number
Transmission rate: 250 ms (at all times)

Data byte(s)	Description	Multiplier/Mask	Unit	Range/Comment
0, 1	Syst. A voltage L2-L3 (= 0 if 1Ph 2W and Ph-N)	1	V	0 to 32,000
2, 3	Syst. B voltage L2-L3 (= 0 if 1Ph 2W and Ph-N)	1	V	0 to 32,000
4, 5	Syst. A voltage L3-L1 (= 0 if 1Ph 2W and Ph-N)	1	V	0 to 32,000
6, 7	Syst. B voltage L3-L1	1	V	0 to 32,000

Received data

The LS-521 V2 (Option K12) expects one fixed CAN message.

Remote control message (received)
CAN-ID: 200h + Device Number

Data byte(s)	Description	Mask	Unit	Comment
0	not used	0x01		
0	not used	0x02		
0	not used	0x04		
0	not used	0x08		
0	not used	0x10		
0	not used	0x20		
0	not used	0x40		
0	not used	0x80		
1	Enable to close CBA	0x01		
	Open CBA immediately	0x02		
	Reply CBA closed	0x04		
	Alarm acknowledge	0x08		
	Enable power message	0x10		
	Enable closing CB A with synchronous networks.	0x20		***WARNING:*** *Ensure that you really want to close synchronous networks before you transmit this command.* **Notes** • If this command is received, state "Syn. netw. close CBA" is indicated, even if the conditions are not met. • Networks can only be connected, if there is no alarm class C-F active.
	not used	0x40		
	not used	0x80		
2 - 7	not used			

Appendix E.
Additional Information

Synchronization Of System A and System B

The table below gives an overview about the synchronization of system 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 vol-tages
Not allowed (*2: These constellations are not applicable

System A \ System B			1Ph2W Ph-Ph left	1Ph2W Ph-Ph right	1Ph2W Ph-N left	1Ph2W Ph-N right	3Ph4W left	3Ph4W right	3Ph3W left	3Ph3W right	1Ph3W (Ph-N)
1Ph2W Ph-Ph	left		Yes	n.a.	n.a.	n.a.	Yes	blocked	Yes	blocked	Not allowed (*2
	right		n.a.	Yes	n.a.	n.a.	blocked	Yes	blocked	Yes	Not allowed (*2
1Ph2W Ph-N	left		n.a.	n.a.	Yes	n.a.	Yes	blocked	Not allowed (*1	blocked	Yes
	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

Table 6-5: Synchronization of two systems

Appendix F.
Event History

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. Refer to Chapter 4: Operation for additional information about the event history.

Resetting the Event History

NOTE

Be sure to be in 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 (refer to the System Management section on page 59 for more information).

The event history can be reset using the parameter "Clear event log" via the front panel.

Resetting the Event History Using the Front Panel

Make sure that you are in code level CL2 or higher (refer to the display

Enter Password section on page 57).
Set the parameter "Clear event log" to Yes (refer to the

System Management section on page 59).
The complete event history is now being cleared.

Event List

Index	Event text	Description
14353	AUTO mode	Auto mode became active
14355	MAN mode	Manual mode became active
14700	Feedback CBA open	Reply CBA open became active
14701	Feedback CBA close	CBA close (reply CBA open became)
14724	System A is ok	System A became ok (Voltage and frequency in range)
14727	System B is ok	System B became ok (Voltage and frequency in range)
14730	Close command CBA	CBA close command became active
14731	Open command CBA	CBA open command became active
14778	Start up power	Power up cycle happened

Table 6-6: Event history - event list

Alarm List

Index	Event text	Description
1714	EEPROM failure	Internal error. EEPROM checksum corrupted
2944	Phase rot. mismatch	Alarm phase rotation mismatch
3955	SyB.phase rotation	Alarm system B phase rotation miswired
3975	SyA.phase rotation	Alarm system A phase rotation miswired
10087	CANopen Interface1	No data received on CAN bus 1
10600	Discrete input 1	Alarm DI1 (configurable)
10601	Discrete input 2	Alarm DI2 (configurable)
10602	Discrete input 3	Alarm DI3 (configurable)
10603	Discrete input 4	Alarm DI4 (configurable)
10604	Discrete input 5	Alarm DI5 (configurable)
10605	Discrete input 6	Alarm DI6 (configurable)
10607	Discrete input 7	Alarm DI7 (configurable)

Service Options

Product Service Options

The following factory options are available for servicing Woodward equipment, based on the standard Woodward Product and Service Warranty (5-01-1205) that is in effect at the time the product is purchased from Woodward or the service is performed. If you are experiencing problems with installation or unsatisfactory performance of an installed system, the following options are available:

- Consult the troubleshooting guide in the manual.
- Contact Woodward technical assistance (see "How to Contact Woodward" later in this chapter) and discuss your problem. In most cases, your problem can be resolved over the phone. If not, you can select which course of action you wish to pursue based on the available services listed in this section.

Returning Equipment For Repair

If a control (or any part of an electronic control) is to be returned to Woodward for repair, please contact Woodward in advance to obtain a Return Authorization Number. When shipping the unit(s), attach a tag with the following information:

- name and location where the control is installed;
- name and phone number of contact person;
- complete Woodward part numbers (P/N) and serial number (S/N);
- description of the problem;
- instructions describing the desired type of repair.

CAUTION

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.*

Packing A Control

Use the following materials when returning a complete control:

- protective caps on any connectors;
- antistatic protective bags on all electronic modules;
- packing materials that will not damage the surface of the unit;
- at least 100 mm (4 inches) of tightly packed, industry-approved packing material;
- a packing carton with double walls;
- a strong tape around the outside of the carton for increased strength.

Return Authorization Number RAN

When returning equipment to Woodward, please telephone and ask for the Customer Service Department in Stuttgart [+49 (0) 711 789 54-510]. They will help expedite the processing of your order through our distributors or local service facility. To expedite the repair process, contact Woodward in advance to obtain a Return Authorization Number, and arrange for issue of a purchase order for the unit(s) to be repaired. No work can be started until a purchase order is received.

NOTE

We highly recommend that you make arrangement in advance for return shipments. Contact a Woodward customer service representative at +49 (0) 711 789 54-510 for instructions and for a Return Authorization Number.

Replacement Parts

When ordering replacement parts for controls, include the following information:

- the part numbers P/N (XXXX-XXX) that is on the enclosure nameplate;
- the unit serial number S/N, which is also on the nameplate.

Engineering Services

Woodward Industrial Controls Engineering Services offers the following after-sales support for Woodward products. For these services, you can contact us by telephone, by e-mail, or through the Woodward website.

- Technical support
- Product training
- Field service during commissioning

How To Contact Woodward

You can contact the Woodward Customer Service Department or consult our worldwide directory on Woodward's website (**www.woodward.com**) for the name of your nearest Woodward distributor or service facility. [For worldwide directory information, go to **www.woodward.com/ic/locations**.]

Technical Assistance

If you need to telephone for technical assistance, you will need to provide the following information. Please write it down here before phoning:

Contact

Your company_____

Your name_____

Phone number _____

Fax number _____

Control (see name plate)

Unit no. and revision: P/N:_____ REV: _____

Unit type LS- _____

Serial number S/N _____

Description of your problem

_____

_____

_____

_____

_____

_____

Please be sure you have a list of all parameters available. You can print this using ToolKit. Additionally you can save the complete set of parameters (standard values) and send them to our Service department via e-mail.

Released

We appreciate your comments about the content of our publications.
Please send comments to: stgt-documentation@woodward.com
Please include the manual number from the front cover of this publication.

Woodward GmbH
Handwerkstrasse 29 - 70565 Stuttgart - Germany
Phone +49 (0) 711 789 54-510 • Fax +49 (0) 711 789 54-101
stgt-info@woodward.com

Homepage

http://www.woodward.com

Woodward has company-owned plants, subsidiaries, and branches, as well as authorized distributors and other authorized service and sales facilities throughout the world.

Complete address/phone/fax/e-mail information for all locations is available on our website (www.woodward.com).

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