

37143A



MFR 15 Protection Relay & Control



Manual

Software Version 1.9xx / 2.0xx / 2.1xx / 3.0xx / 3.1xx

Manual 37143A

**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.

**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.

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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.

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Revision History

Rev.	Date	Editor	Changes
NEW	03-05-08	Tr	Release
A	07-07-17	TP	Update to reflect new format, minor corrections, and language revision, MFR 14 references removed



INACTIVE – FOR REFERENCE ONLY

The information in this publication is no longer current, and may not reflect changes or safety issues that have occurred since the publication was originally released.

Refer to the MFR 15 Packages manual 37354 for more recent information about the MFR 15 unit.

Contents

CHAPTER 1. GENERAL INFORMATION.....	7
Introduction	7
Measurement Value Logging	8
Extent of Functions	9
CHAPTER 2. ELECTROSTATIC DISCHARGE AWARENESS.....	10
CHAPTER 3. INSTALLATION	11
Wiring Diagram up to Version 1.9xx / 2.0xx.....	11
Wiring Diagram from Version 3.0xx / 3.1xx	12
Power Supply (Standard).....	13
Wide Range Power Supply (Option N)	13
Measuring Inputs.....	14
Generator Voltage	14
Synchronizing Voltage (Option Y)	14
Current.....	15
Auxiliary and Control Inputs	16
Discrete Inputs.....	16
Analog Inputs (Options X, B).....	16
Auxiliary and Control Outputs	17
Relay Outputs	17
Pulse Output (Option M).....	17
Analog Outputs (Option A1 to A8)	18
Controller Outputs.....	19
Interface (Options SU/SB/SF).....	20
CAN Bus Shielding	20
CAN Bus Topology	21
DPC - Direct Configuration Interface	22

CHAPTER 4. FUNCTIONAL DESCRIPTION.....	23
Control Inputs	23
General Control Inputs	23
Control Inputs (Option Y).....	24
Control Inputs (Option G [GU/GF]).....	24
Control Outputs.....	25
Functional Table	26
Definition of the Operating Modes (Option Y)	27
No-Load Control.....	27
Isolated Operation.....	27
Synchronization of Circuit Breaker.....	27
Dead Bus Closure of Circuit Breaker (Close CB Without Synchronization)	27
Power Control (Option B) and Power Factor Control (Option C).....	27
Direction of power.....	28
Power Factor Definition	29
Alarms.....	31
Alarm Messages.....	31
Alarm Acknowledgement.....	31
CHAPTER 5. DISPLAY AND OPERATING ELEMENTS	32
Brief Description of LEDs and Push Buttons	32
LEDs	33
Push Buttons	34
LCDisplay	35
Display in Automatic Mode (First Line of the Display: Measured Values)	35
Display in Automatic Mode (Second Line of the Display: Measured Values).....	35
Display in Automatic Mode (Second Line of the Display: Alarm Indication)	36
CHAPTER 6. CONFIGURATION	37
Basic Data	38
Configuration Access.....	38
Sealing (Until Version 1.9xx).....	38
Password (Starting with Version 2.0xx / 3.0xx).....	40
Change Passwords	41
Direct Configuration (from Version 3.0xx)	42
Measurement.....	43
Voltage Measurement	43
Potential Transformer Configuration	43
Current Measurement	44
Rated Values.....	44
Power Measurement	45
Control Functions	46
Synchronization (Option Y)	46
Dead Bus Closure (Option Y).....	48
No-Load Control.....	49
Frequency Controller (Option Y/G/GF)	49
Active Power Controller (Option B).....	51
Voltage Controller (Option Y/G/GU).....	54
Power-Factor Controller (Option C)	56
Shutdown.....	59
Active Power Distribution (Option W).....	60
Reactive Power Distribution (Option O).....	61
Type of Monitoring	62
Protection.....	63
Overvoltage Monitoring (Option U)	63
Undervoltage Monitoring (Option U)	64
Voltage Asymmetry Monitoring (Option U).....	65
Overfrequency Monitoring (Option U)	66
Underfrequency Monitoring (Option U).....	67

Vector / Phase Shift Monitoring (Option V).....	68
df/dt (ROCOF) Monitoring (Option D).....	69
Independent Time-Overcurrent Monitoring (Option IS/IZ).....	70
Overload Monitoring (Option PM).....	72
Reverse/Reduced Power Monitoring (Option PM).....	73
Unbalanced Load Monitoring (Option PS).....	74
Power Factor Monitoring (option ZC).....	75
Reactive Power Monitoring (Option ZQ).....	76
Load Shift Monitoring (Option ZW).....	77
Power Limit Monitoring (Option PZ).....	78
Busbar Voltage Monitoring (Option US).....	79
Busbar Frequency Monitoring (Option US).....	80
Relay Configuration.....	81
Auto Acknowledgement of the Relays.....	82
Auto Acknowledgement of Messages.....	83
Changing the Relay Assignment (Relay Manager).....	83
Pulse Output of the Positive Active Energy (Option M).....	85
Analog Outputs (Options A1/2/3/4/6/8).....	86
Interface (Options SU/SB).....	88
Screens for Protocol DK3964 (Option SU).....	88
Screens for Protocol Profibus DP Slave (Option SU).....	88
Screens for Protocol Modbus RTU Slave (Option SU/SB).....	88
Screens for Protocol CAN Bus (Options SU/SB).....	89
General Screens for All Interfaces (Option SB).....	90
CHAPTER 7. COMMISSIONING.....	91
APPENDIX A. DIMENSIONS.....	93
APPENDIX B. TECHNICAL DATA.....	94
APPENDIX C. MEASURED QUANTITIES AND ACCURACY.....	96
APPENDIX D. INTERFACE TELEGRAM.....	97
Communication Interface Addresses.....	97
Transmission Message.....	97
Receive Message.....	100
Description of the Data Format.....	101
Examples.....	102
Bit Change at Tripping of a Watchdog Function.....	102
Framework Data for the Interfaces.....	103
Framework Data for Procedure 3964 (TTY, RS-232, RS-485).....	103
Framework Data for Hardware Handshaking RTS/CTS (RS-232, RS-422).....	103
Framework Data for Modbus RTU Slave.....	103
Framework Data for CAN Bus.....	104
Framework Data for Profibus DP.....	105
APPENDIX E. LIST OF PARAMETERS.....	106
APPENDIX F. SERVICE OPTIONS.....	114
Product Service Options.....	114
Returning Equipment for Repair.....	114
Packing a Control.....	115
Return Authorization Number RAN.....	115
Replacement Parts.....	115
How to Contact Woodward.....	116
Engineering Services.....	117
Technical Assistance.....	118

Illustrations and Tables

Illustrations

Figure 3-1: Wiring diagram up to version 1.9xx / 2.0xx.....	11
Figure 3-2: Wiring diagram from version 3.0xx / 3.1xx	12
Figure 3-3: Power supply.....	13
Figure 3-4: Wide range power supply.....	13
Figure 3-5: Measuring inputs - voltage.....	14
Figure 3-6: Measuring inputs - synchronizing voltage	14
Figure 3-7: Measuring inputs - current	15
Figure 3-8: Discrete inputs.....	16
Figure 3-9: Relay outputs	17
Figure 3-10: Pulse output.....	17
Figure 3-11: Analog outputs	18
Figure 3-12: Interfaces.....	20
Figure 3-13: Interface - CAN bus shielding.....	20
Figure 3-14: Interfaces - CAN bus topology.....	21
Figure 4-1: 'Direction of power.....	28
Figure 5-1: Front panel	32
Figure 6-1: Diagram for independent time-overcurrent monitoring	70
Figure 7-1: Dimensions.....	93
Figure 7-2: Interface, cosphi scaling.....	101
Figure 7-3: Interface - Modbus connection	103
Figure 7-4: Interface, Profibus DP slave.....	105

Tables

Table 3-1: Conversion chart - wire size.....	13
Table 3-2: Maximum CAN bus length.....	21
Table 4-1: Operating modes - functional table	26
Table 4-2: Operating mode conditions.....	26
Table 4-3: Alarms	31
Table 5-1: Alarms	36
Table 6-1: Release delay of the relays	82
Table 6-2: Protective device output to relay	84
Table 6-3: Analog outputs, table of values	86
Table 7-1: Analog outputs, table of values	113

Chapter 1. General Information

Introduction



The MFR 15 model combines a synchronizer, load (kW) and power factor control via discrete outputs, and generator protection and control into one unit. Different packages offer additional functionality.

The detailed model description for the MFR 15 reads as follows:

MFR1515-h0000B/ABDEF..Z	<p>Options according to list of options. These options can be found in the manual. Each chapter headline points out if the described function is standard or has to be ordered optionally.</p> <p>Mounting [B].. Flush-mounting [M].. DIN-rail/rear panel mounting</p> <p>Hardware variation non-standard models; e.g. additional relays</p> <p>Current transformer, secondary [0] = not available [1] = ../1 A [5] = ../5 A</p> <p>Voltage transformer/PT's, secondary [0] = not available [1] = 100 Vac [4] = 400 Vac</p> <p>Type</p>
-------------------------	---

Example:

- **MFR1541B/A3BCIZMPMPMSUXYZQ** (flush mounted, standard unit with 400 Vac PT and ../1A CT inputs with **Options A3** [3 analog outputs], **B** [constant real power control], **C** [power factor control], **IZ** [independent time-overcurrent monitoring], **M** [pulse output for kWh], **PM** [reverse/reduced load and overload monitoring], **PS** [unbalanced load monitoring], **U** [over-/undervoltage, over-/underfrequency, and voltage asymmetry monitoring], **X** [analog input for external set point], **Y** [synchronisation], and **ZQ** [reactive power monitoring])

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 all available packages. 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 list of parameters enclosed at the rear of this manual.

Measurement Value Logging



Voltage

Voltage is displayed as three-phase r.m.s measurement of the phase-neutral and/or phase-phase voltages.

Option Y utilizes single-phase r.m.s. measurement of the synchronizing voltage V_{L1-L2} .

This device can be ordered with the following measuring voltage input ranges (rated voltages). Please indicate the measuring voltage input required when ordering (refer to Technical Data on page 94):

- 66 V/115 V [1]
- 230 V/400 V [4]

Frequency

Frequency measurement is extracted from the digitally filtered measuring voltages. The frequency is measured three-phase if the measured voltage exceeds 15% of the nominal voltage. This ensures rapid and precise measurement of the frequency. However the frequency is still measured correctly even if voltage is only applied to one phase.

Current

Three-phase measurement of the r.m.s. value.

- ..1 A [1]
- ..5 A [5]

Active power

The active power is measured through real time multiplication of either the three phase-to-neutral voltages and the three-phase conductor currents or single-phase measurement of voltage V_{12} and the current I_1 .

Reactive power

The reactive power is calculated from the measured single-phase voltage V_{12} and the single-phase current I_1 .

Power factor

Power factor is calculated time difference between the digitally filtered voltage V_{12} and current I_1 . The power factor is accurately measured for both clockwise and counter-clockwise phase sequences.

Active energy

Active energy combines a time measurement with the measured positive active load. The counter is incorporated in the non-volatile memory and only computes positive energy. The memory is updated every 3 minutes with a resolution of 0.1 kWh. The unit automatically increases the engineering unit of measure when the maximum value has been reached. This permits a measuring range up to 4,290 GWh. This counter is not Physikalisch-Technische Bundesanstalt (PTB) calibrated.

Extent of Functions



Depending on the model, the unit is equipped with the following functions:

Function	Option	Package		
		SY	SYN	SYN-I
General functions				
2 relay outputs, freely configurable (change-over contacts)	Standard	✓	✓	✓
1 ready for operation relay output (normally open contact)	Standard	✓	✓	✓
Discrete input for blocking or acknowledgment	Standard	✓	✓	✓
Sealing function (software, up to version 1.9xx)	Standard	✓	✓	✓
Password system (software, starting version 2.0xx)	Standard	✓	✓	✓
3 analog outputs - 20/0/4 to +20 mA	A3	✓	✓	
Open-collector pulse output for kWh	M	✓	✓	
Interface, bi-directional	SB			✓ [#]
4-digit maximum control inputs	G/Y	✓	✓	✓
<small>[#] = RS485/MOD-Bus RTU Slave</small>				
Protective functions				
Three phase over / under voltage monitoring (2 levels) V>, V<	U	✓	✓	✓
Three-phase over / under frequency monitoring (2 levels) f>, f<	U	✓	✓	✓
Voltage asymmetry monitoring Vas>	U	✓	✓	✓
Overload monitoring P>	PM	✓	✓	✓
Reverse/reduced power monitoring -P<, P<	PM	✓	✓	✓
Unbalanced load monitoring Ias>	PS	✓	✓	✓
Reactive power monitoring (loss of excitation monitoring) -Q<, Q>	ZQ	✓	✓	✓
Independent time-overcurrent monitoring I>, I>>, I>>>	IZ	✓	✓	✓
Control / synchronization functions				
Synchronization of a power circuit breaker with voltage and frequency balancing	Y	✓	✓	✓
Closing to a de-energized busbar (dead bus start) with a separate release signal	Y	✓	✓	✓
Controlling a separate network at constant voltage and frequency	G/Y	✓	✓	✓
Constant active power controlling	B	✓	✓	✓
Power factor controlling	C	✓	✓	✓
Active power sharing	W	✓	✓	✓
Analog input 0/4 to 20 mA for external set point	X	✓	✓	✓
Packages				
MFR 15 with Options A3-B-C-IZ-M-PM-PS-U-X-Y-ZQ		✓		
MFR 15 with Options A3-B-C-IZ-M-PM-PS-U-W-X-Y-ZQ			✓	
MFR 15 with Options B-C-IZ-PM-PS-SB-U-W-X-Y-ZQ				✓

Chapter 2.

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*.

Chapter 3. Installation

Wiring Diagram up to Version 1.9xx / 2.0xx

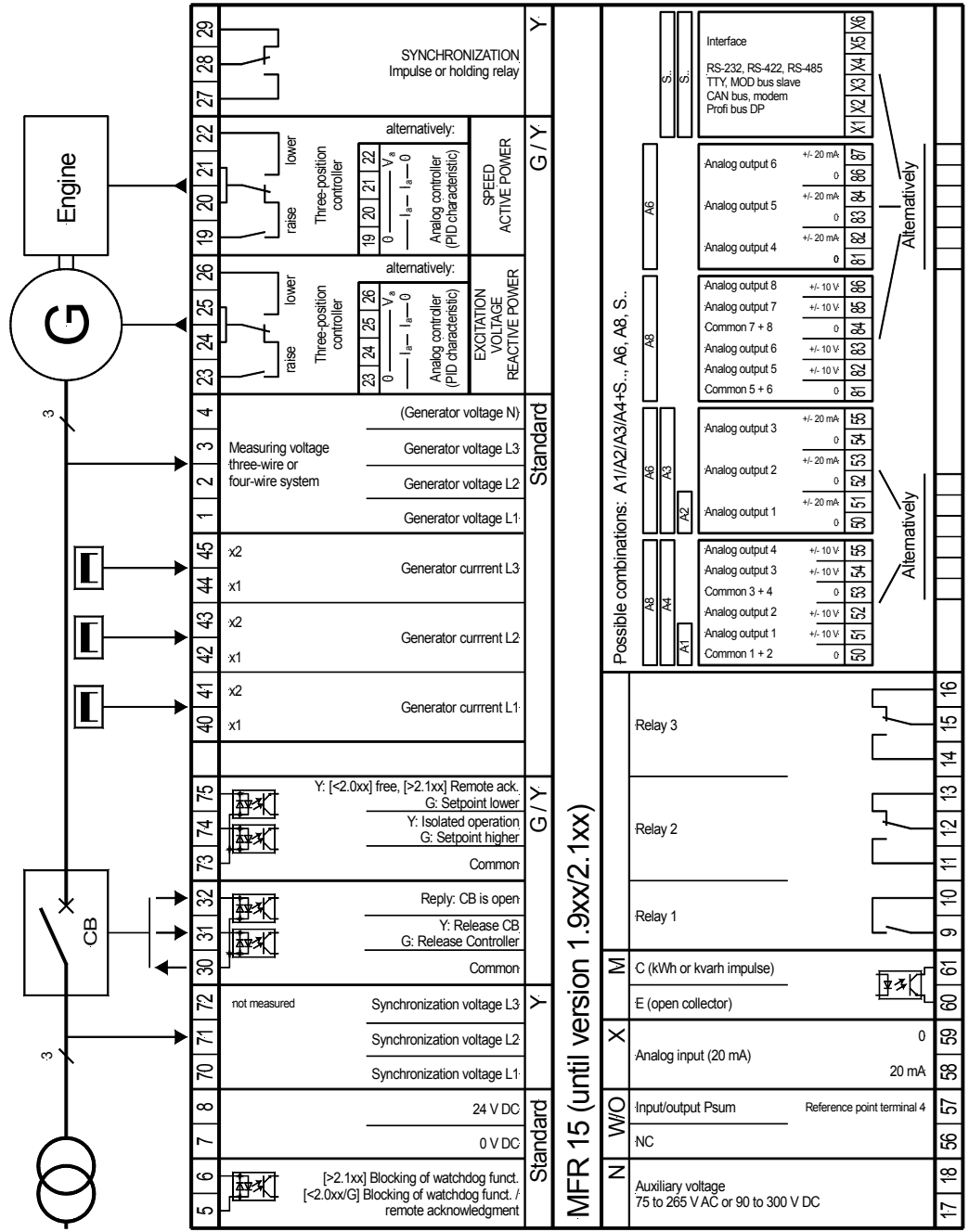
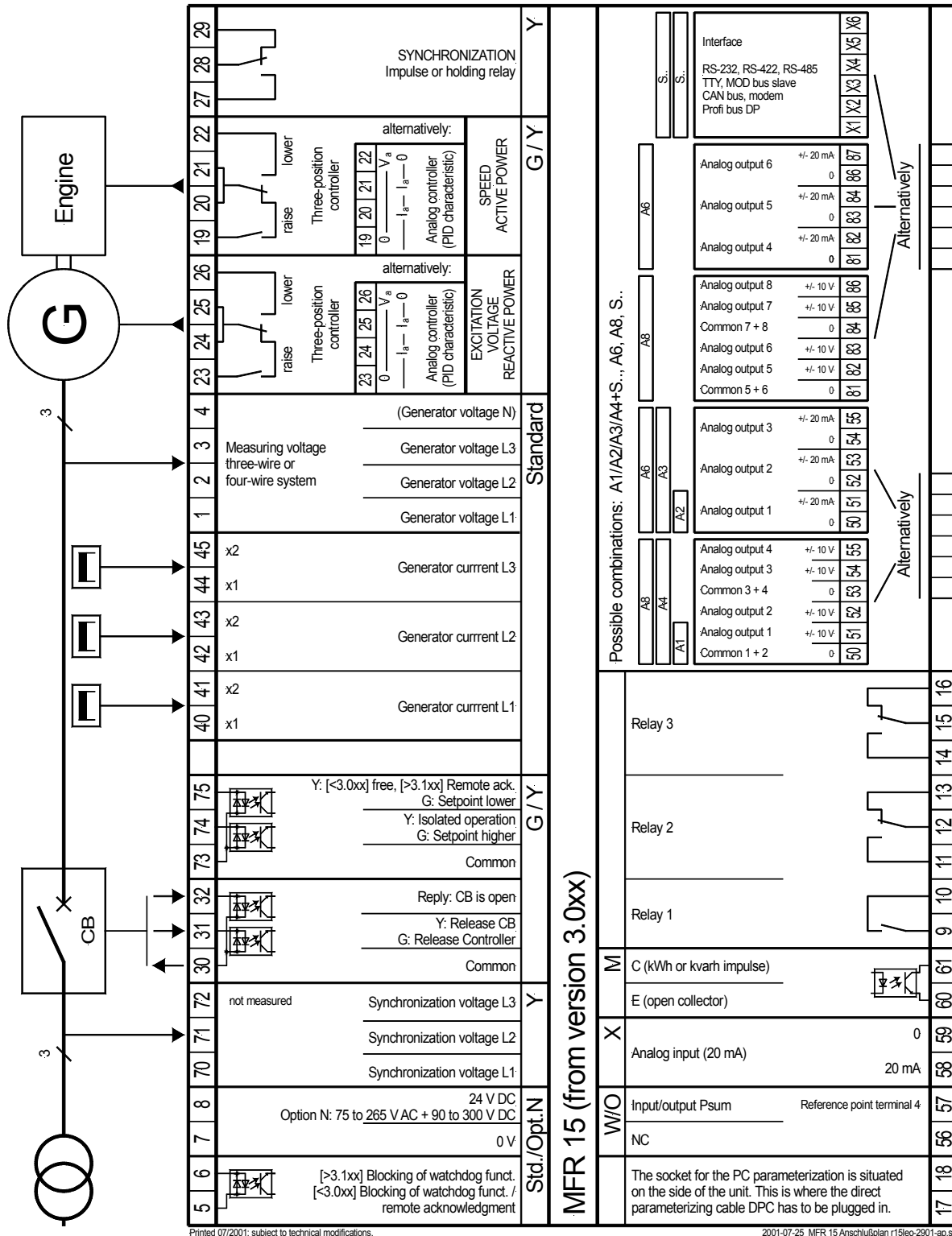


Figure 3-1: Wiring diagram up to version 1.9xx / 2.0xx

Wiring Diagram from Version 3.0xx / 3.1xx



MFR 15 (from version 3.0xx)

Possible combinations: A1/A2/A3/A4+S., A6, A8, S.

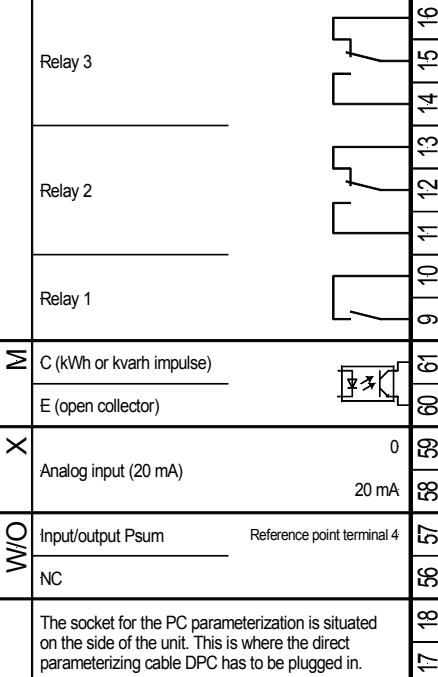


Figure 3-2: Wiring diagram from version 3.0xx / 3.1xx



WARNING

All technical data and ratings indicated in this chapter are not definite! Only the values indicated under Technical Data on page 94 are valid!



CAUTION

A circuit breaker must be provided near to the unit and in a position easily accessible to the operator. This must also bear a sign identifying it as an isolating switch for the unit.



NOTE

Inductive devices connected to the system (such as operating current coils, undervoltage tripping units, or auxiliary/power contacts) must be connected to a suitable interference suppressor.

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

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

Table 3-1: Conversion chart - wire size

Power Supply (Standard)

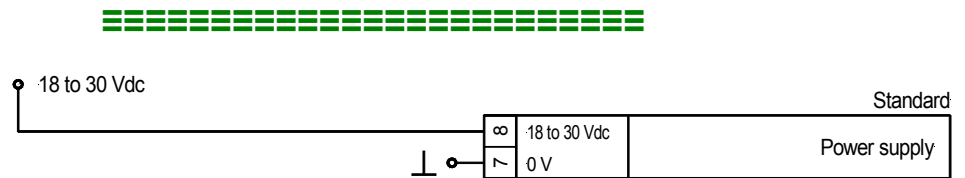


Figure 3-3: Power supply

Terminal	Description	A _{max}
Standard power supply unit (Standard)		
8	18 to 30 Vdc	2.5 mm ²
7	0 V reference point	2.5 mm ²

Wide Range Power Supply (Option N)

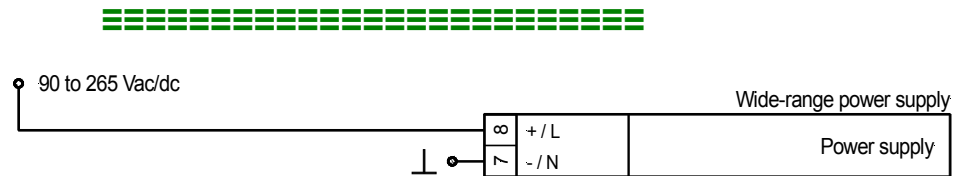


Figure 3-4: Wide range power supply

Terminal	Description	A _{max}
from Version 3.xxx - Wide range power supply unit (Option N)		
8	90 to 265 Vac/dc	2.5 mm ²
7	0 V reference point	2.5 mm ²
up to Version 1.xxx / 2.xxx - Wide range power supply unit (Option N)		
17	90 to 265 Vac/dc	2.5 mm ²
18	0 V reference point	2.5 mm ²

Measuring Inputs



Generator Voltage

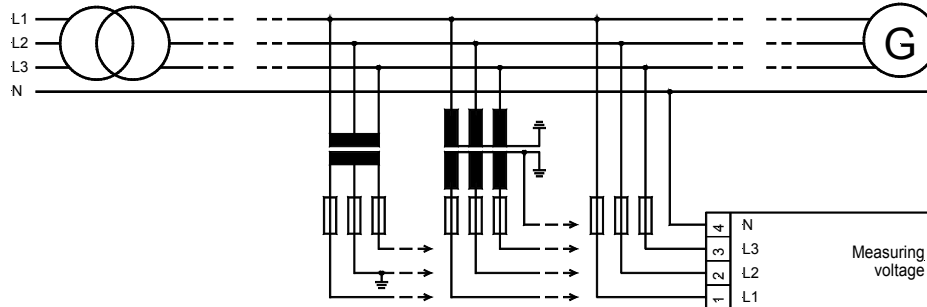


Figure 3-5: Measuring inputs - voltage

Terminal	Measurement	Description	A _{max}
1	400V direct or transformer	Measuring voltage L1	2.5 mm ²
2		Measuring voltage L2	2.5 mm ²
3		Measuring voltage L3	2.5 mm ²
4	.. /100V	Neutral point of the 3-phase system/transformer	2.5 mm ²

Synchronizing Voltage (Option Y)



NOTE

Connection of the phase voltage L3 to terminal 72 (synchronizing voltage) is necessary if

- the generator voltage is connected as a three-wire-system and
- the power measurement of the generator power must be three-phase.

If the input for balancing the measuring system is not connected, minor inaccuracies will occur during the three-phase power measurement. Functionality will not be affected if the voltage L3 is not connected and the power measurement is configured as single-phase.

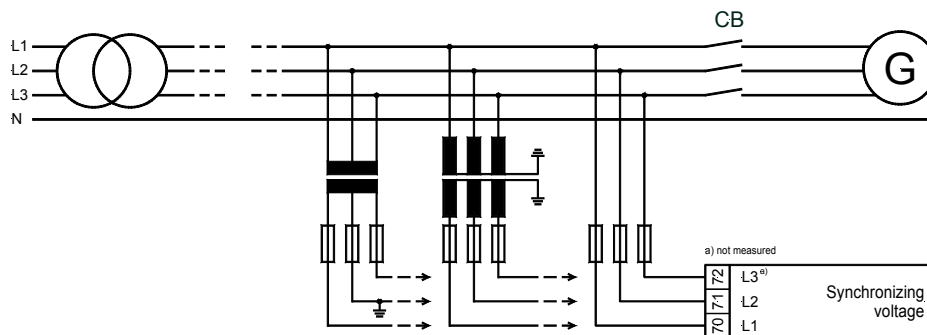


Figure 3-6: Measuring inputs - synchronizing voltage

Terminal	Measurement	Description	A _{max}
70	400V direct or via transf. .. /100V	Synchronizing voltage L1	2.5 mm ²
71		Synchronizing voltage L2	2.5 mm ²
72		Synchronizing voltage L3 (not measured)	2.5 mm ²

Current



WARNING

Prior to disconnecting the current transformer connections or the connections of the transformer which are located at the unit, make sure that the transformer is short-circuited.



NOTE

Grounding of the secondary of a current transformer must always be single-sided.

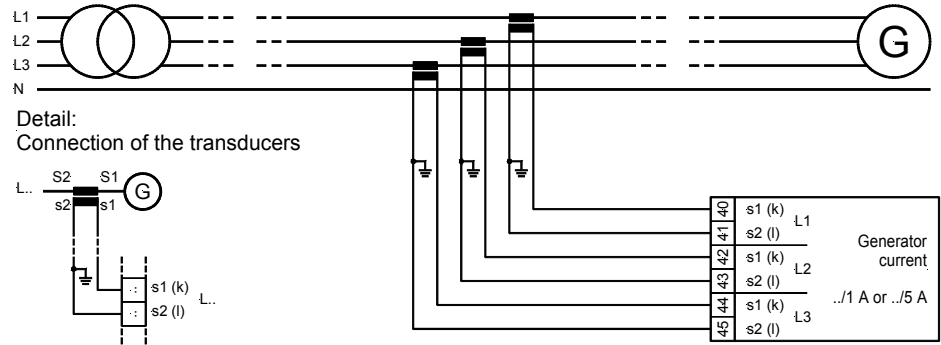


Figure 3-7: Measuring inputs - current

Terminal	Measurement	Description	A _{max}
40	Transformer ..1 A or ..5 A	Generator current L1, transformer terminal s1 (k)	4 mm ²
41		Generator current L1, transformer terminal s2 (l)	4 mm ²
42		Generator current L2, transformer terminal s1 (k)	4 mm ²
43		Generator current L2, transformer terminal s2 (l)	4 mm ²
44		Generator current L3, transformer terminal s1 (k)	4 mm ²
45		Generator current L3, transformer terminal s2 (l)	4 mm ²

Auxiliary and Control Inputs



Discrete Inputs

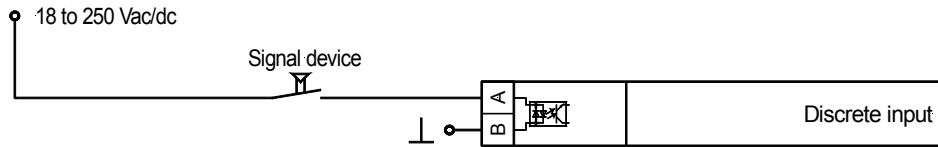
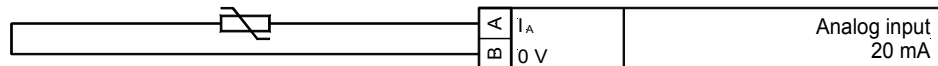


Figure 3-8: Discrete inputs

Terminal	Associated common	Description (according to DIN 40 719 Part 3, 5.8.3)	A _{max}
A	B		
with Option Y			
5	6	up to Version 2.0xx/3.0xx: Blocking of protective device / remote acknowledgement starting with Version 2.1xx/3.1xx: Blocking of protective device	2.5 mm ²
31	30	Enable power circuit breaker	2.5 mm ²
32		Generator power circuit breaker is open	2.5 mm ²
74	73	Isolated operation	2.5 mm ²
75		up to Version 2.0xx/3.0xx: free starting with Version 2.1xx/3.1xx: Remote acknowledgement	2.5 mm ²
with Option G			
5	6	Blocking of protective device / remote acknowledgement	2.5 mm ²
31	30	Enable controller	2.5 mm ²
32		Reply power circuit breaker	2.5 mm ²
74	73	Raise set point value	2.5 mm ²
75		Lower set point value	2.5 mm ²

Analog Inputs (Options X, B)



Terminal	Associated common	Description	A _{max}
A I _A	B 0 V		
58	59	Analog input 0 to 20 mA for power set point value specification Option X	2.5 mm ²
57	-	Input/output P-sum for power distribution (reference point is terminal 4) Option B	2.5 mm ²

Auxiliary and Control Outputs



Relay Outputs

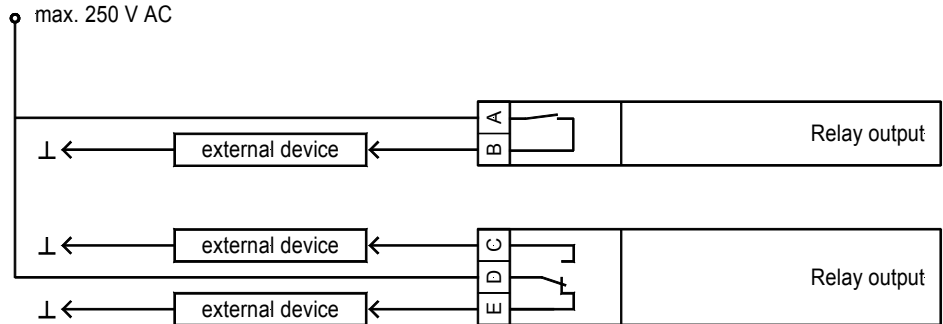


Figure 3-9: Relay outputs

			Description	
Form A contact				A_{max}
main		make		
A		B		
9		10	Relay 1 (ready for operation)	2.5 mm ²
Form C contact				
make	main	break		
C	D	E		
11	12	13	Relay 2	2.5 mm ²
14	15	16	Relay 3	2.5 mm ²
27	28	29	Synchronization (pulse/holding relay) Option Y	2.5 mm ²

Pulse Output (**Option M**)

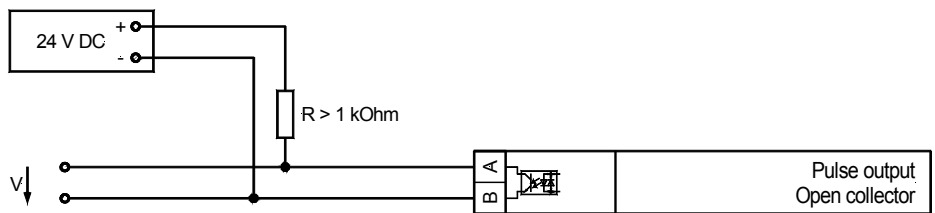


Figure 3-10: Pulse output

Terminal		Description	A_{max}
A	60	Pulse output (Open Collector)	2.5 mm ²
B	61		

Analog Outputs (Option A1 to A8)

Possible combination The analog outputs and the interface may be combined as follows:

Option ...	S	A1 to A4	A6 to A8
simultaneous use of ...	•	•	-
	-	-	•



NOTE

All 20 mA outputs are electrically isolated from each other; the 10 V-outputs 1 to 4 are electrically isolated from outputs 5 to 8.

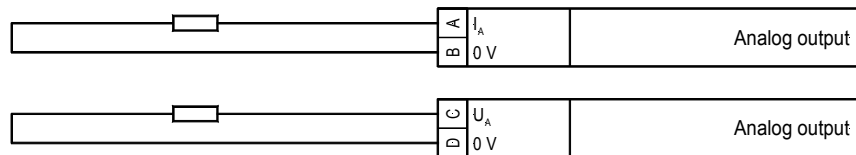


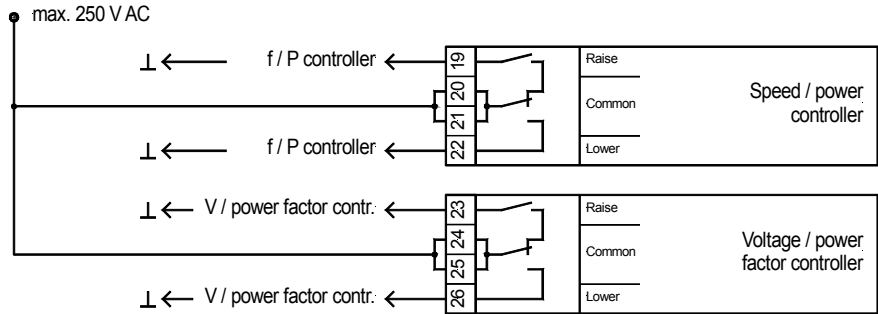
Figure 3-11: Analog outputs

		Description	A _{max}
<i>0 to 20 / 4 to 20 -20 to +20 mA</i>			
<i>I_A</i>	<i>0 V</i>		
<i>A</i>	<i>B</i>		
51	50	Analog output 1 Option A2/3/6	1.5 mm ²
53	52	Analog output 2 Option A3/6	1.5 mm ²
55	54	Analog output 3 Option A3/6	1.5 mm ²
82	81	Analog output 4 Option A6	1.5 mm ²
84	83	Analog output 5 Option A6	1.5 mm ²
87	86	Analog output 6 Option A6	1.5 mm ²
<i>0 to 10 / -10 to +10 V</i>			
<i>V_A</i>	<i>0 V</i>		
<i>C</i>	<i>D</i>		
51	50	Analog output 1 Option A1/4/8	1.5 mm ²
52	50	Analog output 2 Option A4/8	1.5 mm ²
54	53	Analog output 3 Option A4/8	1.5 mm ²
55	53	Analog output 4 Option A4/8	1.5 mm ²
82	81	Analog output 5 Option A8	1.5 mm ²
83	81	Analog output 6 Option A8	1.5 mm ²
85	84	Analog output 7 Option A8	1.5 mm ²
86	84	Analog output 8 Option A8	1.5 mm ²

Controller Outputs

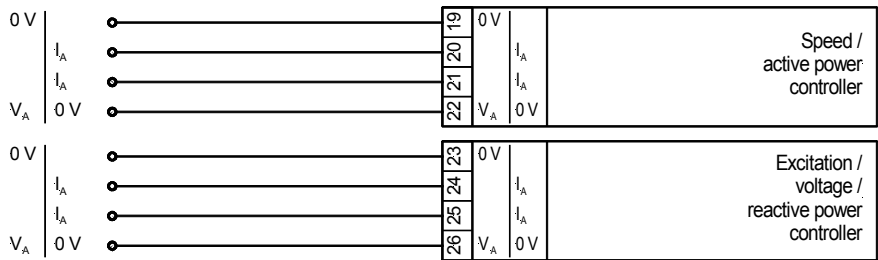
The controllers are configured as three-position controllers in the standard version (made of a form C contact and a form A contact). If the Options QU or QF are equipped, they are configured as a quasi-continuous controller with analog outputs. Refer to the following descriptions of the different controller outputs. Additional parameter screens will be included in the control at apply to the controller outputs.

Three-Position Controller



Terminal	Assignment	Description	A _{max}
19	raise	Speed/active-power controller	2.5 mm ²
20	common		2.5 mm ²
21	common		2.5 mm ²
22	lower		2.5 mm ²
23	raise	Voltage/power-factor φ controller reactive power	2.5 mm ²
24	common		2.5 mm ²
25	common		2.5 mm ²
26	lower		2.5 mm ²

Analog Controller Output (Options QF, QU)



Terminal	Assignment		Description	A _{max}
	I	V		
19	-	0 V	Speed/power controller	2.5 mm ²
20	I	-		2.5 mm ²
21	I	-		2.5 mm ²
22	0 V	V _A		2.5 mm ²
23	-	0 V	Voltage/power-factor φ controller	2.5 mm ²
24	I	-		2.5 mm ²
25	I	-		2.5 mm ²
26	0 V	V _A		2.5 mm ²

Interface (Options SU/SB/SF)

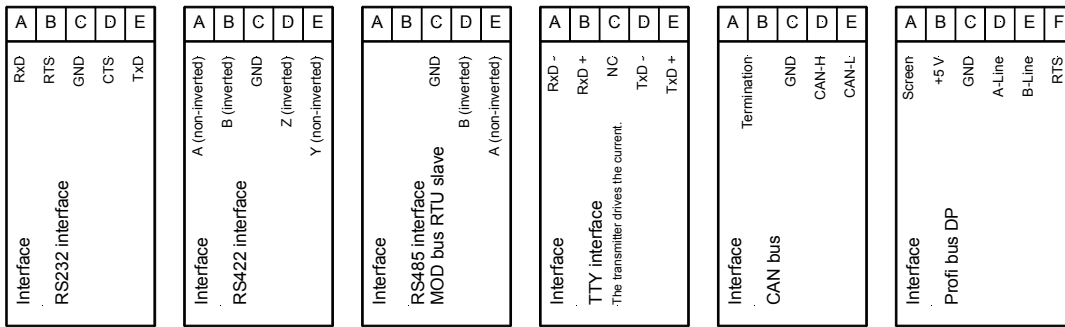


Figure 3-12: Interfaces

Terminal					Description
A (X1)	B (X2)	C (X3)	D (X4)	E (X5)	
RxD	RTS	GND	CTS	TxD	RS-232
A	B	GND	Z		RS-422
		GND	B	A	RS-485, Modbus RTU Slave
RxD-	RxD+	NC	TxD-	TxD+	TTY (transmitter drives current)
		GND	CAN-H	CAN-L	CAN bus
A (X1)	B (X2)	C (X3)	D (X4)	E (X5)	F (X6)
Screen	+5 V	GND	A-Line	B-Line	RTS
<small>Profibus DP (the file LEON00D9.GSD has to be used)</small>					



NOTE

Please note that the CAN bus must be terminated with an impedance which corresponds to the wave impedance of the cable (e.g. 120 Ohm, ¼ W resistor).

CAN Bus Shielding

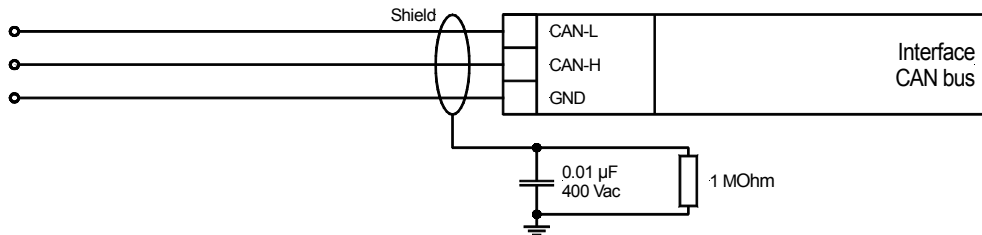


Figure 3-13: Interface - CAN bus shielding

CAN Bus Topology



NOTE

Please note that the CAN bus must be terminated with an impedance which corresponds to the wave impedance of the cable (e.g. 120 Ω). The CAN bus is terminated between CAN-H and CAN-L.

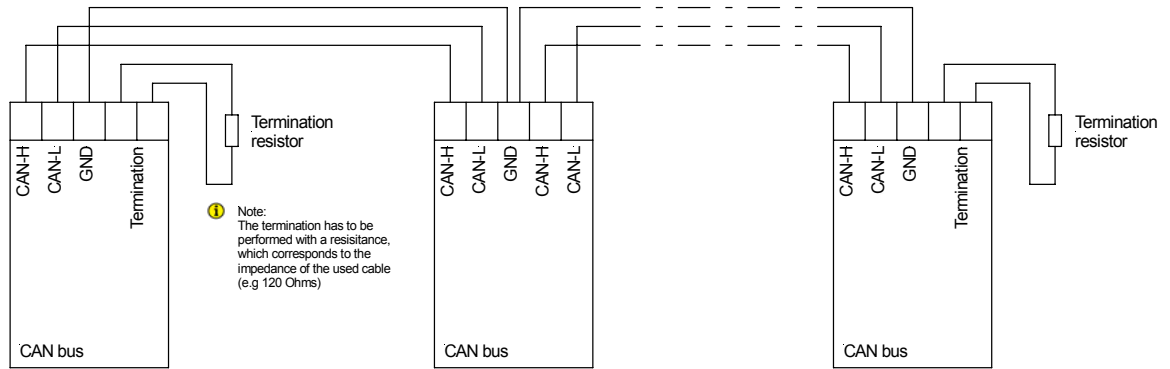


Figure 3-14: Interfaces - CAN bus topology

Possible CAN Bus Problems

If no data is transmitted on the CAN bus, check the following for common CAN bus communication problems:

- T structure bus is utilized (stub-end feeders or branch lines are not recommended)
- CAN-L and CAN-H are interchanged
- Not all devices on the bus are using identical Baud rates
- Terminating resistor(s) is/are missing
- Incorrect baud rate (too high) for length of CAN bus

Maximum CAN Bus Length


The maximum length of the communication bus wiring is dependent on the configured Baud rate. Refer to Table 3-2 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
125 kbit/s	250 m
50 kbits/s	1000 m
20 kbit/s	2500 m


Table 3-2: 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.

DPC - Direct Configuration Interface

 **NOTE**
Configuration with the direct configuration cable DPC (P/N 5417-557) is possible. A laptop/PC, the DPC cable, the program LeoPC1 version 3.1.1 or higher (included on CD Rom with unit), and the proper configuration files are required. Please consult the online help installed when the program is installed for a description of the LeoPC1 program and its setup.

 **WARNING**
Only the DPC cable may be connected to the DPC interface. If other devices or lines are connected, the unit may be destroyed. Especially the connection of live lines (like phone lines) will destroy the unit.

 **CAUTION**
The connection cable delivered with the DPC must be used between DPC and the unit to ensure proper functionality of the unit. An extension or utilization of different cable types for the connection between the unit and DPC may result a malfunction of the unit. This may possibly result in damage to components of the system. If an extension of the data connection line is required, only the serial cable (RS-232) between DPC and laptop/PC may be extended. It is recommended to use an industry standard cable for this.

 **NOTE**
If the parameter "Direct config." is enabled on the control, communication via the CAN bus interface on terminals X1/X5 is disabled.
If the control unit detects that the engine is running (ignition speed exceeded), the direct configuration port is disabled.

Chapter 4. Functional Description

Control Inputs

General Control Inputs



NOTE

Starting with Version 2.1xx/3.1xx the digital input "Remote acknowledgement" is on terminal 75. Starting with this version the double function of the digital input terminal 5/6 described below is being dropped. If the controller has **Option G**, terminal 75 is used as a set point raise output. The following table applies:

	Term.	without Option G		with Option G
		up to V2.0xx/V3.0xx	starting with V2.1xx/V3.1xx	
Watchdog/remote acknowledge	5/6	Yes	-	Yes
Watchdog blocking	5/6	-	Yes	-
Remote acknowledgement	75	-	Yes	-

[up to Version 2.0xx/3.0xx]
Blocking of protective function / Remote acknowledgement
 Terminal 5/6

Energizing this discrete input disables various protective functions. This functionality may be desired if the control is used for generator protection. This keeps the control from recognizing fault conditions (i.e. undervoltage, underfrequency) when the generator is not operating. If blocking of these protective functions is not required, the discrete input should not be connected to any potential source.

[from Version 2.1xx/3.1xx]
Blocking of protective function
 Terminal 5/6

The following protective functions cannot be blocked via this discrete input:

- **Overvoltage monitoring**
- **Overfrequency monitoring**
- **Centralized alarm**

External acknowledgement of the relays via the discrete input ...

If the unit should not automatically reset the relays after the fault is no longer present, the function "**Autoacknowledgement Relays**" must first be configured "**OFF**" (refer to "Auto Acknowledgement of the Relays" on page 82).

[up to Version 2.0xx/3.0xx]
 "Blocking of protective device/remote acknowledgement"
 Terminal 5/6

OFF Alarms that cannot be blocked will not automatically reset after the fault condition is no longer present. Pressing the "Clear" button resets the relays.

[from Version 2.1xx/3.1xx]
 "Remote acknowledgement"
 Terminal 75

ON All alarm messages are reset if terminals 5/6 ("Blocking of protective functions / remote acknowledgement") are energized. Alarms that cannot be blocked are only reset after the fault is no longer present.

External Clearing ON

Control Inputs (Option Y)

Release CB Terminal 30/31 **Energized.....**

- **CB is open**
 - Enables operation of the power circuit breaker (voltage and frequency control may also be enabled).
- **CB is closed**
 - No function.

De-energized

- **CB is open**
 - The control will act in the following manner dependent upon the parameter "Aut.idle running control" in the section titled "No Load Control". If this parameter is configured as:
 - "OFF": Frequency and voltage are not controlled.
 - "ON": Frequency and voltage are controlled if both have surpassed the minimum permissible limits.
- **CB is closed**
 - The control will act in the following manner dependent upon if the parameter "Stop sequence" (refer to page 59) is enabled or disabled. If this parameter is configured as:
 - "OFF": The active power controller and the power factor controller are enabled. The load is not reduced and the circuit breaker remains closed.
 - "ON": The load is reduced according to the ramp rated configured in parameter "Stop sequence ramp" and the circuit breaker is opened when the load level reaches 10% of the configured load rating.

Reply: CB is open Terminal 30/32 This DI is energized to signal the unit that the circuit breaker is open.

Isolated operation Terminal 73/74 **Energized.....**

- Enable voltage/frequency control when circuit breaker is closed.
- Dead bus closure enabled when circuit breaker is open.

De-energized..

- Disable voltage/frequency control when circuit breaker is closed.

Control Inputs (Option G [GU/GF])

Release controller Terminal 30/31 **Set.....**Release for operation of the controller.

- **CB is closed**
 - No function.

Reply

- **CB is open**
 - autom. no load control "OFF": All functions from
 - autom. no load control "ON": Possibly voltage and/or frequency control.

Reply: CB is open Terminal 30/32 This input (logical "1") is used to signal the unit that the power circuit breaker is open.

Set point raise Terminal 73/74 By application of a pulse, the selected set point is increased.

Set point lower Terminal 73/75 By application of a pulse, the selected set point is decreased.

Control Outputs



NOTE

A description of the relay manager may be found in **Changing the Relay Assignment (Relay Manager)** starting on page 83.

Relay 1 Output relay (type: make contact, N.O.)
Terminals 9/10 The "relay manager" controls this relay.



NOTE

The "ready for operation" function is always assigned to relay 1. However, other protective functions may also be assigned to relay 1 additionally. Relay 1 is always configured as Normally Closed (break contact) and will de-energize if the unit is not ready for operation.

Relay 2, 3 Output relay (type: change-over contact)
Terminals 11 through 16 The "relay manager" controls these relays.

Option Y Synchronization relay Output relay (type: make contact, N.O.)
Terminals 27 through 29 This relay is closed at the synchronous point (pulse or holding relay).

Functional Table



Option Y

Input signal			Function	Operation
Discrete input: "Isolated operation"	Discrete input: "Reply: CB is open"	Discrete input: "Enable CB"		
◇	energized	de-energized	No-load operation generator	A
energized	energized	energized	Dead bus start power circuit breaker	B
de-energized	energized	energized	Synchronization power circuit breaker	C
energized	de-energized	◇	Isolated operation	D
de-energized	de-energized	◇	Power control (Option B)	E
de-energized	de-energized	◇	Power-factor control (Option C)	E

**Option G
[GU/GF]**

Input signal		Function	Operation
Discrete input: "Enable controller"	Discrete input: "Reply: CB is open"		
de-energized	◇	All controller functions OFF	
energized	de-energized	Options B+G/GF: Active-power control Options C+G/GU: power-factor control	
energized	energized	Option G/GU: Voltage control Option G/GF: Frequency control	

Table 4-1: Operating modes - functional table

The control functionality is affected by the available discrete input signals. The user must ensure that the "Reply: CB is open" signal is energized only when the circuit breaker is open. The auxiliary contact of the circuit breaker must be a break contact. Table 4-1: Operating Modes illustrates the terminals that must be energized (24 Vdc) to enable specific control functionality. If the input terminal has the "◇" symbol in the provided space, the energizing (24 Vdc) or de-energizing (0 Vdc) the specific input will not affect the functionality of the control.

Conditions

The device functionality is dependent upon the measured voltages in addition to the state of the discrete inputs. If specific functionality of the control is desired, the related parameters must be enabled to permit the desired functionality regardless if the discrete inputs are energized or not.

Condition		
A	No-load operation	- Generator voltage must be greater than 50 % of V_N - Power circuit breaker is open - "Aut.idle running control" is configured as ON
B	Dead bus closure of circuit breaker	- Synchronization voltage must be less than 5 % of parameter "Volt.transformer sec. (MN)" - Generator voltage within the permissible limits
C	Synchronization Power circuit breaker	- Synchronization voltage within the permissible limits - Generator voltage within the permissible limits
D	Isolated operation	- Power circuit breaker must be closed
E	Power control (Option B) Power factor control (Option C)	- If "Stop sequence" is configured as OFF, - The CB must be closed / Reply: CB is open is de-energized - The discrete input "Release CB" must be de-energized

Table 4-2: Operating mode conditions

Definition of the Operating Modes (Option Y)



No-Load Control

The frequency and voltage are controlled at the configured set point levels when the circuit breaker is open. The conditions in Table 4-2: Operating mode conditions on page 26 for No-Load Control must be fulfilled to enable this functionality.

Isolated Operation

The frequency and voltage are controlled at the configured set point levels when the circuit breaker is closed. The conditions in Table 4-2: Operating mode conditions on page 26 for Isolated Operation must be fulfilled to enable this functionality. If the generator is connected to a constant voltage system (i.e. paralleled with another source) the DI "Isolated operation" must be de-energized (0 V DC). This disables the frequency and voltage controllers after synchronization has been accomplished. A droop mode is possible if several generators are operating in parallel in an isolated operation.

Synchronization of Circuit Breaker

The frequency and voltage are raised or lowered to match the system frequency and voltage prior to closing the circuit breaker if the following conditions are fulfilled:

- The parameter "Synchronizing functions" is configured as ON
- The busbar is energized (synchronization voltage)
- The generator voltage and frequency are within the configured permissible limits (all three phases)
- The DI "Reply: CB is open" is energized
- The DI "Enable CB" is energized

Dead Bus Closure of Circuit Breaker (Close CB Without Synchronization)

The power circuit breaker is closed without synchronization if the following conditions are fulfilled:

- The parameter "Dead busbar Operation" is configured as ON
- The busbar is not energized (busbar voltage is less than 5 % of parameter "Volt.transformer sec. (MN)")
- The generator voltage and frequency are within the configured limits (all three phases)
- The DI "Isolated operation" is energized
- The DI "Enable CB" is energized
- The DI "Reply: CB is open" is energized

Power Control (Option B) and Power Factor Control (Option C)

The control real power and power factor are simultaneously controlled if the following conditions are met:

- The circuit breaker is closed and the DI "Reply: CB is open" is de-energized
- The DI "Isolated operation" is de-energized
- The busbar is energized (synchronization voltage)
- The busbar voltage and frequency are within the configured permissible limits
- Terminal 31 (Enable CB) is de-energized and the parameter "Stop sequence" is configured as OFF
- Terminal 31 (Enable CB) is energized and the parameter "Stop sequence" is configured as ON

Direction of power



If the unit's current transformers are wired according to the pin diagram shown, the following values are indicated:

- Positive generator active load** The generator supplies active load.

- Inductive generator power factor** The generator is overexcited and supplies
- Positive reactive power** inductive reactive power.

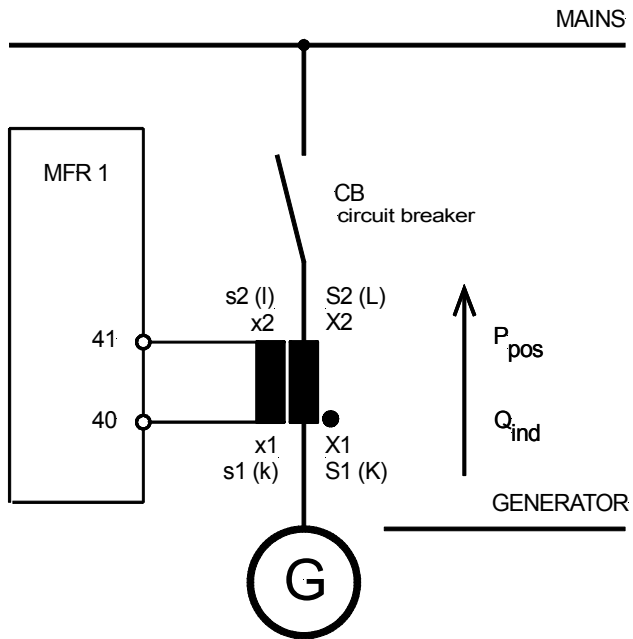


Figure 4-1: 'Direction of power

Power Factor Definition



The phasor diagram is used from the generator's view. This defines the following definitions.

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 in step 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)
--------------	--------------

Compared with the voltage, the current is ...

lagging	leading
---------	---------

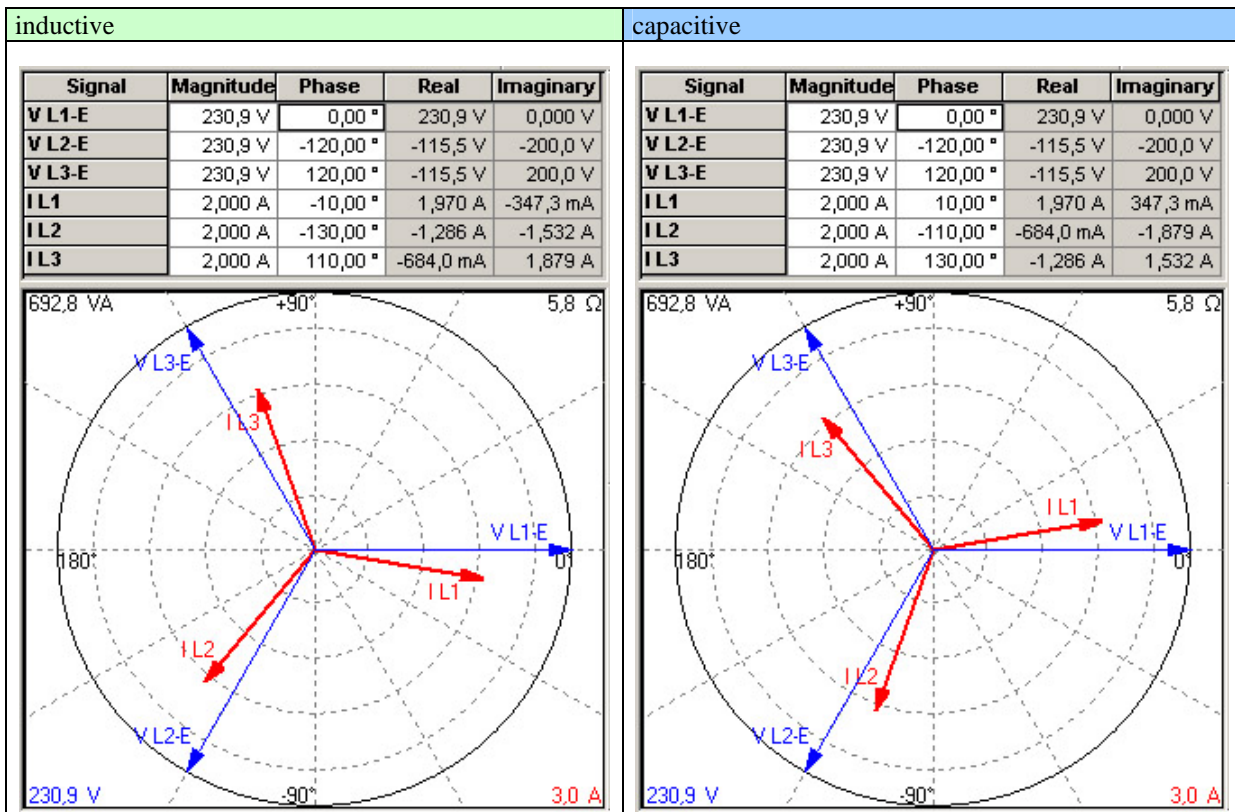
The generator is ...

over excited	under excited
--------------	---------------

Control: If the control unit is equipped with a power factor controller, ...

a voltage lower "-" signal is output as long as the measured value is "more inductive" than the reference set point Example: measured = i0.91; set point = i0.95	a voltage raise "+" signal is output as long as the measured value is "more capacitive" than the reference set point Example: measured = c0.91; set point = c0.95
---	--

Phasor diagram:



Alarms



Alarm Messages

Table 4-3 contains a list of all alarm messages that the control may monitor for depending on how the unit is configured:

Alarm type		Alarm text
Overvoltage, level 1	Option U	Overvolt.1
Overvoltage, level 2	Option U	Overvolt.2
Undervoltage, level 1	Option U	Undervolt.1
Undervoltage, level 2	Option U	Undervolt.2
Asymmetry	Option U	Asymmetry
Overfrequency, level 1	Option U	Overfreq.1
Overfrequency, level 2	Option U	Overfreq.2
Underfrequency, level 1	Option U	Und.freq.1
Underfrequency, level 2	Option U	Und.freq.2
Phase shift	Option V	Phase jmp.
df/dt	Option D	Fault df
Independent time-overcurrent, level 1	Option IZ	Ov.curr. 1
Independent time-overcurrent, level 2	Option IZ	Ov.curr. 2
Independent time-overcurrent, level 3	Option IZ	Ov.curr. 3
Overload	Option PM	Overload
Reverse-/reduced load	Option PM	Rev. power
Unbalanced load	Option PS	Unbalance
Power factor cosphi, level 1	Option ZC	Pow.fact.1
Power factor cosphi, level 2	Option ZC	Pow.fact.2
Reactive power, capacitive	Option ZQ	React.pow-
Reactive power, inductive	Option ZQ	React.pow+
Active power surge positive	Option ZW	Pow.shift+
Active power surge negative	Option ZW	Pow.shift-
Overvoltage busbar	Option US	U> busbar
Undervoltage busbar	Option US	U< busbar
Overfrequency busbar	Option US	f> busbar
Underfrequency busbar	Option US	f< busbar

Table 4-3: Alarms

Alarm Acknowledgement

A fault/alarm is indicated by the "Alarm" LED.

By pressing the "Clear" button, the active faults are acknowledged. The following distinction is made between fault conditions:

The fault ...

- **is still active** As long as the fault is still present, it cannot be acknowledged. The flashing "Alarm" LED on the front panel indicates that the alarm is still active.
- **is no longer active** When the active fault has been eliminated, the flashing "Alarm" LED changes to steady illumination. If the parameter "Auto clearing displays" is configured "ON", the LED extinguishes after the resetting time has expired. If the parameter "Auto clearing displays" is configured "OFF", the LED is extinguished only after pressing the "Clear" button.

Chapter 5. Display and Operating Elements

The pressure-sensitive membrane of the front panel consists of a plastic coating. All keys have been designed as touch-sensitive membrane switch elements. The display is an LC-display, consisting of 2 rows of 16 characters each, with indirect green lighting. The contrast of the display can be infinitely adjusted via a rotary potentiometer positioned on the right side of the control. The configuration plug is located on the right side of the unit as well. Please connect the direct configuration cable there (DPC).

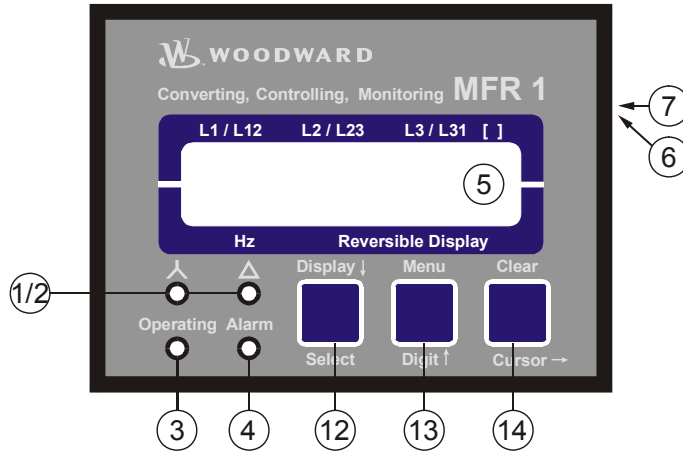


Figure 5-1: Front panel

Brief Description of LEDs and Push Buttons



LEDs

No.	Description	Function
1	"Wye"	Indication of the wye (star) voltages (phase-neutral)
2	"Delta"	Indication of the delta voltages (phase-phase)
3	"Operating"	Automatic mode
4	"Alarm"	Alarm occurred

Push Buttons

No.	Description	Function
12	Display↓	Advance to next screen
12	Select	Confirm selection
13	Menu	Select menu
13	Digit↑	Increase the digit
14	Clear	Acknowledgement of alarm messages
14	Cursor→	Move cursor one position to the right

Miscellaneous

No.	Description	Function
5	LC Display	LC Display
6	Potentiometer	Adjust LCD contrast
7	DPC plug	Configuration plug

LEDs



NOTE

If neither of the "Wye" and "Delta" LEDs is illuminated, the first line of the display indicates the measured currents of the phases.

1	<p>"Wye" Color: Yellow</p>	<p>Indication of the wye voltages</p> <hr/> <p>If this LED is illuminated, the values indicated on the display are the wye (star) voltages (phase-neutral).</p>
2	<p>"Delta" Color: Yellow</p>	<p>Indication of the delta voltages</p> <hr/> <p>If this LED is illuminated, the values indicated on the display are the delta voltages (phase-phase).</p>
3	<p>"Operation " Color: Green</p>	<p>Operation</p> <hr/> <p>This LED is illuminated constantly when the control unit is in the Automatic mode. If this LED is flashing, the control is in the configuration mode.</p>
4	<p>"Alarm" Color: Red</p>	<p>Alarm</p> <hr/> <p>This LED flashes as long as a set point limit is exceeded. When all measuring values are below the configured set point limit again and "Auto clearing display" is configured "OFF", this LED will change to steady illumination.</p>

Push Buttons



In order to facilitate the setting of the parameters the buttons are equipped with an "AUTOSCROLL" function while the controller is in the configuration mode. It permits the user to rapidly advance to the next setting and configuration screens, the digits, or the cursor position. The "AUTOSCROLL" function will only be enabled when the user presses and holds the corresponding buttons.

- 12** **Display↓ / Select** **Display↓ / Select**
Color: none

Automatic mode: Display↓ - By pressing this button, the user advances through the display of operating (wye voltages, delta voltages, wire currents) and alarm messages. The "Wye" and "Delta" LEDs are illuminated accordingly.

Configuration: Select - By pressing this button, the user advances to the next configuration screen. If the value originally displayed has been changed via the "Digit↑" or "Cursor→" push buttons, the newly set value is saved by pressing the "Select" push button once. By pressing the button again, the user causes the system to advance to the next configuration screen.

- 13** **Menu / Digit↑** **Menu / Digit↑**
Color: none

Automatic mode: Menu - By pressing this button, the user advances through the messages displayed on the second line of the display. (Various measured values and any alarm messages that have not been cleared are indicated.)

Configuration: Digit↑ - By pressing this button, the position at which the cursor is presently located is increased by one digit. The increase is restricted by the permissible limits (see list of parameters included in Appendix B). If the highest permissible number has been reached, the number automatically returns to the lowest permissible number.

- 14** **Clear / Cursor →** **Clear / Cursor →**
Color: none

Automatic mode: Clear - Individual alarm messages are deleted by pressing this button provided the fault is no longer present.

Configuration: Cursor→ - This button moves the cursor one position to the right. When the cursor reaches the extreme right position it may be returned to the extreme left position by pressing the Cursor→ button again.

LCDisplay



5 LC Display LC display

Performance values can be monitored from the two-line display, provided that the control is in automatic mode. In configuration mode, the individual parameters are displayed.

Display in Automatic Mode (First Line of the Display: Measured Values)



NOTE

The user can scroll through the first display line with the button "Display ↓".

"Wye" = on, "Delta" = off
Wye voltages

```
230 230 230 V
-----
```

"Wye" = off, "Delta" = on
Delta voltages

```
400 400 400 V
-----
```

"Wye" = off, "Delta" = off
Phase currents

```
314 314 314 A
-----
```

Display in automatic mode, first line: measuring values

The following measured values are displayed (depending on the "Wye" and "Delta" LEDs):

- The "Wye" LED is illuminated, and the "Delta" LED is off.
The wye (star) voltages (V_{L1-N} , V_{L2-N} and V_{L3-N}) of the four-wire system are indicated. If the application is a three-wire system, the configuration screen "volt.-Measuring" must be configured to "phase to phase". The "Wye" LED will not illuminate in this application.
- The "Wye" LED is off and the "Delta" LED is illuminated.
The delta voltages (V_{L1-L2} , V_{L2-L3} and V_{L3-L1}) of the phase-to-phase system/phase-neutral system are indicated.
- The "Wye" LED is off and the "Delta" LED is off.
The phase currents (I_{L1} , I_{L2} and I_{L3}) are displayed

Display in Automatic Mode (Second Line of the Display: Measured Values)



NOTE

The "Menu" button may be used to scroll through the messages shown on the second line of the display.

```
-----
00.00 xxxxxxxxxxxx
```

Display in automatic mode, second line: measured values

The frequency is always indicated in [Hz].

Instead of "xxxxxxxxxx" the following measuring values are indicated:

- | | | |
|-------------------------------------|-------------------------------|---------------|
| • Power P | Unit dynamic in [kW / MW] | |
| • Power factor $\cos \varphi$ | Unit dimensionless | |
| • Reactive power Q | Unit dynamic in [kvar / Mvar] | |
| • Apparent power S | Unit dynamic in [kVA / MVA] | |
| • Active energy W | Unit dynamic in [kWh / MWh] | |
| • Synchronization voltage | Unit dynamic in [V / kV] | Option Y |
| • Synchronization frequency | Unit static in [Hz] | Option Y |
| • Synchronization angle | Unit static in [°] | Option Y |
| • Voltage controller set point | Unit dynamic in [V / kV] | Option GU |
| • Power factor controller set point | Unit dimensionless | Option GU + C |
| • Frequency controller set point | Unit static in [Hz] | Option GF |
| • Power controller set point | Unit dynamic in [kW / MW] | Option GU + C |

Display in Automatic Mode (Second Line of the Display: Alarm Indication)



NOTE

The user may scroll through the alarm messages that have occurred with the "Menu" button.



Display in automatic mode, second line: alarm indication

Alarm messages are shown on the bottom line of the unit display. Table 5-1 contains a list of all alarm messages that the control may monitor for depending on how the unit is configured.

Alarm type		Alarm text
Overvoltage, level 1	Option U	Overvolt.1
Overvoltage, level 2	Option U	Overvolt.2
Undervoltage, level 1	Option U	Undervolt.1
Undervoltage, level 2	Option U	Undervolt.2
Asymmetry	Option U	Asymmetry
Overfrequency, level 1	Option U	Overfreq.1
Overfrequency, level 2	Option U	Overfreq.2
Underfrequency, level 1	Option U	Und.freq.1
Underfrequency, level 2	Option U	Und.freq.2
Phase shift	Option V	Phase jmp.
df/dt	Option D	Fault df
Independent time-overcurrent, level 1	Option IZ	Ov.curr. 1
Independent time-overcurrent, level 2	Option IZ	Ov.curr. 2
Independent time-overcurrent, level 3	Option IZ	Ov.curr. 3
Overload	Option PM	Overload
Reverse-/reduced load	Option PM	Rev. power
Unbalanced load	Option PS	Unbalance
Power factor cosphi, level 1	Option ZC	Pow.fact.1
Power factor cosphi, level 2	Option ZC	Pow.fact.2
Reactive power, capacitive	Option ZQ	React.pow-
Reactive power, inductive	Option ZQ	React.pow+
Active power surge positive	Option ZW	Pow.shift+
Active power surge negative	Option ZW	Pow.shift-
Overvoltage busbar	Option US	U> busbar
Undervoltage busbar	Option US	U< busbar
Overfrequency busbar	Option US	f> busbar
Underfrequency busbar	Option US	f< busbar

Table 5-1: Alarms

Chapter 6. Configuration

Configuration can be performed via the front panel push buttons and the front panel LC display or using a PC and the PC program LeoPC1 via the serial interface. If direct configuration via a PC is selected, the following baud rate is to be used:

- Configuration via direct configuration plug = 9,600 Baud (8 Bit, no parity, 1 stop bit)



CAUTION

Please note that configuration only should be done while the system is not in operation.



NOTE

A list of all parameters may be found in Appendix E of this manual.

You can advance through the individual parameter screens if you are in configuration mode (simultaneously pressing of "Digit↑" and "Cursor→" push buttons permits access to the configuration mode) by using the "Select" button. If you press and hold the "Select" push button, the scroll function will be activated, allowing for the parameter screens to be advanced through more rapidly. The control unit will permit the operator to reverse up to four previous screens (exception: it is not possible to reverse from the first parameter to the last parameter). To perform the reverse function through the parameter screens, the "Select" and "Cursor→" push buttons must be pressed and released simultaneously. The control unit will revert to automatic mode if an entry isn't performed, a change made, or any other action performed for 120 seconds.



NOTE

There are two different hardware versions described in this operating manual: A 100 V version [1] and a 400 V version [4]. The versions vary as far as the configuration screens and the parameter input ranges are concerned. The two types are differentiated by indicating the voltage: ([1] ... or [4] ...).

Adjust Settings: SELECT (ANWAHL)

Configuration mode

Button "Select"

After the configuration mode is enabled, the subsequent screens can be viewed and modified within the preset limits. Please note, that by depressing the "Select" button, the following screens are advanced by one screen each. If a parameter is configured "OFF", the related screens are not displayed or monitored by the control. Pressing the "Select" button will advance the displayed screen to the next parameter.

Basic Data



Software version
x.xxxx

Software version

This screen displays the software version loaded into the control (the last two xx are for software revisions which do not affect the function of the unit).

SPRACHE/LANGUAGE

Language selection

Deutsch/English

The desired language for the controller to operate in is set by this parameter. The screens (configuration and display screens) can be displayed either in German or English.

Configuration Access



Sealing (Until Version 1.9xx)



NOTE

If no protection against modification of the setting values has been ordered, then it is advisable not to turn on the sealing function; Parameters on "OFF". If, on the other hand, a sealing function is necessary, it is advisable to activate it only after setup is complete!

→ SEQUENCE DIAGRAM on the following page!

By entering a five-character code number, the input operation can be protected from unauthorized access, operation and modifications. The function represents the exact software emulation of a mechanical seal.

Encoding
ON

Sealing function

ON/OFF

ONThe input of the following values is protected by a code word. The subsequent screens of this option are being displayed.

OFFThere is no protection through sealing, and the subsequent screens of this option are not shown. (default)

Code no. 000
Code? ?????

Sealing function

00000 to 60000

Correct code If the code number has been correctly entered for the active seal, the values are entered in the sequence of the screens. (default 00100)

Wrong code .If the code number has been incorrectly entered for the active seal, the following seals are indicated.

Wrong Code
SELECT (ANWAHL)

Incorrect code was indicated

Button "Select"

The code number for the active seal was incorrectly entered! Please confirm this message using the button "Select".

Code no. 000
Break? YES

Breaking the seal number XXX

YES/NO

By entering "YES", you can break the seal and release the input mode. However, the sealing number is then increased by 1. Thus, it is possible at any time to check whether modifications have been made without the correct code number having been entered. If you select "NO" the code is inquired again. Leaving the inquiry is only possible by terminating input mode.

Code no. 000
New code: ?????

Code for seal 001 (new entry)

00000 to 60000

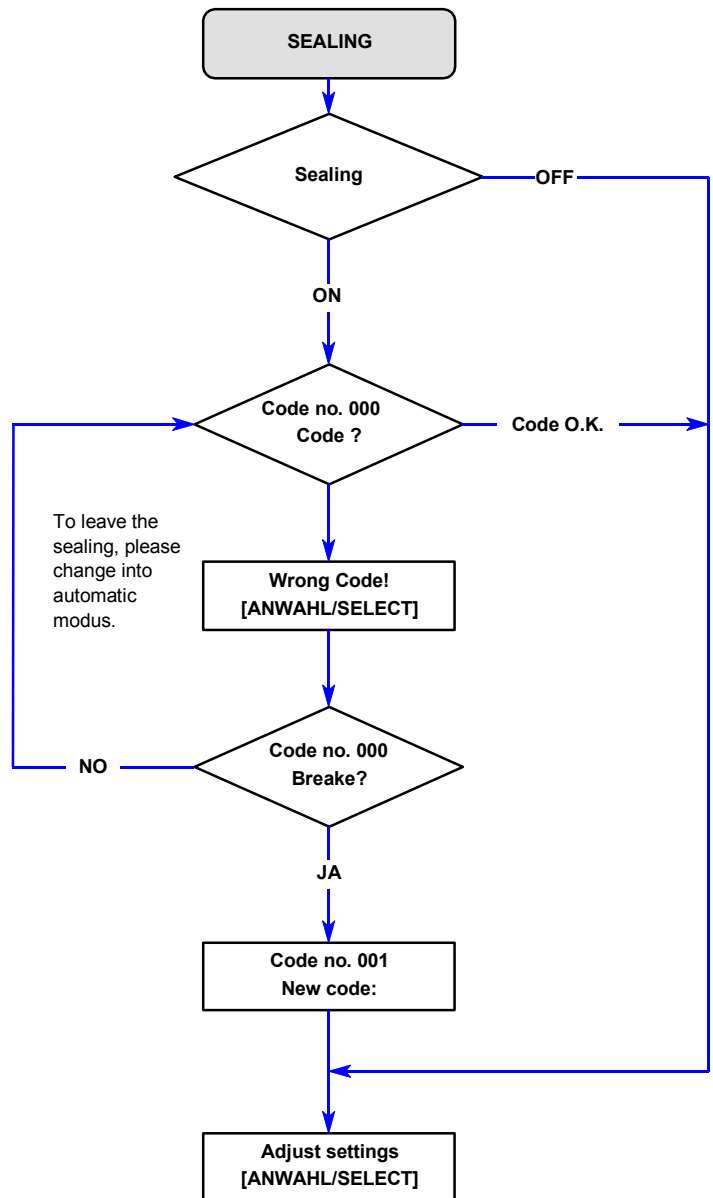
After breaking the old seal, the unit requests the code number for the new seal. Sealing can now be effected with a new code number.

Adjust Settings:
SELECT (ANWAHL)

Enter values

Button "Select"

Press the button "Select" for input.



Password (Starting with Version 2.0xx / 3.0xx)

The unit is equipped with a three-level code and configuration hierarchy, which allows different user access to the control. A distinction is made between:

Code level CS0 (User Level)

Factory password = none

This code level allows for monitoring of the system and does not permit access to the parameters. Configuration is blocked.

Code level CS1 (Basic Service Level)

Factory password = "0 0 0 1"

This code level entitles the user to change selected parameters, like setting Bar/PSI, °C/°F, and clock adjustment. Changing a password is not permitted at this level. This password expires two hours after entering the password and the user is returned to the CS0 level.

Code level CS2 (Commissioning Level)

Factory password = "0 0 0 2"

Allows direct access to all parameters (displaying and changing). In addition, the user may also set the password for levels CS1 and CS2. This password expires two hours after entering the password and the user is returned to the CS0 level.



NOTE

Once the code level is set, it will not be changed even after entering the configuration repeatedly an incorrect code number has been entered, the code level is set to CS0, thus locking the device for external persons.

If for 2 hours uninterruptedly supply voltage is applied, the device automatically switches to code level 0.



NOTE (Starting with Version 2.1xx / 3.1xx)

The following configuration screen "Enter code number" only appears if the parameter "Password Protection" is configured ON (see below).

Enter code number	0000
-------------------	------

Enter code number 0000 to 9999

Upon enabling the configuration mode, the user is required to enter an access code number, which identifies the various users. The displayed number XXXX is a randomly generated number. If the random number is confirmed by pressing the "Select" button without being changed, the current level of access maintained. Upon entering either a level 1 or level 2 access code, the corresponding level of access is granted. If an incorrect access code is entered the control unit changes to code level 0 and all access is blocked until a code level 1 or 2 access code is entered.

Password Protection	ON
---------------------	----

Password protection ON/OFF

ON Password protection is enabled. Configuration access is granted by entering the appropriate password (Code level 1/2). If an incorrect code number has been entered, configuration is blocked.

OFF Password protection is disabled. Access to configuration screens is permanently set to code level 2 and the code number is not queried. This parameter can only be changed if the code number of code level 2 has been entered.

Change Passwords

Define level 1 code 0000

Define level 1 password

0000 to 9999

This screen appears only when the level 2 password has been entered. After entering the digits into this screen, the code level for level 1 (basic service level) is enabled. After entering this code, the user only has the access rights assigned to this code level.

This code level (CS) is preset to **CS1 = 0 0 0 1**

Define level 2 code 0000

Define level 2 password

0000 to 9999

This screen appears only when the level 2 password has been entered. After entering the digits into this screen, the code level for level 2 (commissioning level) is enabled. After entering the code, the user has the access rights assigned to this code level.

This code level (CS) is preset to **CS2 = 0 0 0 2**

Direct Configuration (from Version 3.0xx)



NOTE

A direct configuration cable DPC (P/N 5417-557), the LeoPC1 program (supplied with the cable) and the corresponding configuration files are required to perform direct configuration. After the program has been installed, consult the online help for a description of the PC program and its setup.

For configuration of the unit via PC program please proceed as follows:

- Install the PC program on your laptop/PC according to the installation manual.
- Before the end of the installation you are requested to select the language with which you want to start the PC program. You can change the language at any time. The selection of the language refers only to language with which the menus and subprograms of the PC program works. This setting will not change the language of the control unit being configured.
- After the installation of the PC program reboot your laptop/PC.
- Establish the connection between your laptop/PC and the unit via the DPC. Plug one side to the configuration plug of the unit and the other side to the COM1 port of your laptop/PC (other possibilities are described in the installation manual).
- You may start the PC program as follows:
 - by "Start/Program/Woodward/LeoPC" (starting at version 3.1.xxx), or
 - by a double click on a file ending ".cfg" in the subdirectory "LeoPC".
- After the PC program has been started, establish the communication by pressing the "F2" button. This will establish a data link between the unit and the laptop/PC.
- Start the sub program "Device Parameterization" and adjust the parameter of the unit to your application using this manual.



WARNING

If the following parameter "Direct parametr." is configured to "YES", communication via the interface terminals X1 to X5 is disabled. If communication is to be re-established via the interface terminals X1 to X5 after the unit is configured, the following parameter must be set to "NO"!

Moreover the following restrictions apply:

Option SU: Communication via the interface is locked.

Option A6: The analog outputs 3 to 6 are functionless during configuration.

Option A8 or A82: The analog outputs 5 to 8 are functionless during configuration.

If, after the configuration of the unit, communication via the interface should be re-established and the corresponding analog outputs should function again, the subsequent parameter must be set to "NO"!

Direct parametr. YES

Direct configuration	YES/NO
YES	Configuration via the configuration port is enabled. The following conditions must be met in order to carry out configuration via the direct configuration cable: <ul style="list-style-type: none"> - A connection must be established via the direct configuration cable between the unit and the PC - the Baud rate of the PC program must be set to 9,600 Baud - the corresponding configuration file must be used (file name: "xxxx-xxxx-yyy-zz.asm", initiated by xxxx-xxxx-yyy-zz.cfg)
NO	Configuration via the direct configuration port is disabled.

Measurement



WARNING

The following values must be entered correctly for the generator to be monitored. Failure to do so may lead to incorrect measuring of parameters resulting in damage to or destruction of the generator and/or personal injury or death.

Voltage Measurement

```
Volt.-Measuring
-----
```

This screen only affects the displayed values. The protective functions are defined below.

Voltage measuring

Phase to phase/phase neutral

This parameter determines how the voltage is to be measured. If this parameter is set to "Phase to phase", the configuration screen "Volt.-Monitoring" in section Type of Monitoring on page 62 does not appear.

Potential Transformer Configuration

With Option Y

```
Volt.transformer
sec.(GN) 000V
```

Generator potential transformer secondary

[1] 50 to 125 V; [4] 50 to 480 V

The potential transformer secondary voltage is set here in V. This parameter is utilized to calculate the system voltage in the display. For voltages measured without a potential transformer, secondary and primary voltage must be configured the same.

```
Volt.transformer
prim(GN)00.000kV
```

Generator potential transformer primary

00.100 to 65.000 kV

The potential transformer primary voltage is set here in kV. This entry is used to show the system voltage in the display.

```
Volt.transformer
sec.(MN) 000V
```

Mains potential transformer secondary

[1] 50 to 125 V; [4] 50 to 480 V

The potential transformer secondary voltage is set here in V. This parameter is utilized to calculate the system voltage in the display. For voltages measured without a potential transformer, secondary and primary voltage must be configured the same.

```
Volt.transformer
prim(MN)00.000kV
```

Mains potential transformer primary

00.100 to 65.000 kV

The potential transformer primary voltage is set here in kV. This entry is used to show the system voltage in the display.

Example: If a voltage of 400 V is measured without a potential transformer, the secondary transformer voltage must be configured to **400V** and the primary transformer voltage must be configured to **00.400V**.

With Option G

Volt.transformer secondary 000V

Potential transformer secondary [1] 50 to 125 V; [4] 50 to 480 V

The potential transformer secondary voltage is set here in V. This parameter is utilized to calculate the system voltage in the display. For voltages measured without a potential transformer, secondary and primary voltage must be configured the same.

Volt.transformer primary 00.000kV

Potential transformer primary 00.100 to 65.000 kV

The potential transformer primary voltage is set here in kV. This entry is used to show the system voltage in the display.

Example: If a voltage of 400 V is measured without a potential transformer, the secondary transformer voltage must be configured to 400V and the primary transformer voltage must be configured to 00.400V.

Current Measurement

Current transf. 0000/0

Current transformer 1 to 9,999/{x} A

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 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 5A CT should output 3A). 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 may affect the functionality of the control.

The control may be ordered with either ../1 A or ../5 A current transformer inputs. The CT inputs will dictate how this parameter is displayed on the control. Information about the current transformers inputs may be found on the unit data plate.

{x} = 1.....MFR13x1B/xxx = Current transformer with ../1 A rated current
{x} = 5.....MFR13x5B/xxx = Current transformer with ../5 A rated current

Rated Values

Rated voltage 000V

Rated voltage [1] 5 to 125 V; [4] 10 to 480 V

only available with Option G

This parameter defines the system rated voltage. This will affect the permissible limits for synchronization (refer to Synchronization (Option Y)" on page 46).

Rated frequency 00.0Hz

Rated frequency 40.0 to 70.0 Hz

only available with Option G

Enter the rated frequency of the generator (or the utility mains), which in most cases is 50 Hz or 60 Hz. This will affect the permissible limits for synchronization (refer to Synchronization (Option Y)" on page 46).

Rated current 0000A

Rated current 10 to 9,999 A

The system current rating is defined in this parameter. Percentage values in the protective functions refer to this parameter.

Power Measurement



NOTE

With a positive real power, a positive real current flows in the "k-I" direction in the CT. Positive reactive power means that with a positive effective direction, inductive reactive (lagging) current flows in the effective direction. If the control is connected to the terminals of a generator and if the outgoing circuits of the CT facing the generator are connected to "k", the unit shows a positive real power when the generator supplies real power. Refer to the explanation in the chapter "Direction of power" on page 27.

Rated power 00000kW	Rated power 5 to 32,000 kW <hr/> The rated power is configured here. The exact value of the rated power is absolutely vital. Many measurement, control, and monitoring functions refer to this value (e.g. the percentage input for the power protection).
Power measuring -----	Power measurement one-phase / three-phase <hr/> Power measurement may be configured as one-phase or three-phase. If "one-phase power measurement" is set, the current and the voltage in phase L1 are used for power measurement. If "three-phase power measurement" is set, all three-phase currents and the relevant voltages are used for power measurement. <ul style="list-style-type: none"> • one-phase power measurement: $P = \sqrt{3} \times V_{L12} \times I_{L1} \times P.F (\cos\varphi)$ • threephase power measurement: $P = V_{L1N} \times I_{L1} \times P.F (\cos\varphi) + V_{L2N} \times I_{L2} \times P.F (\cos\varphi) + V_{L3N} \times I_{L3} \times P.F (\cos\varphi)$

Control Functions



Synchronization (Option Y)

The control unit calculates internally the electrical angle of advance to issue the circuit breaker closure command. The corresponding lead-time remains constant due to the inherent delay of the breaker regardless of the frequency differential of the two systems. If the voltage and frequency differential of the two systems are within permissible limits, the breaker closure command may be issued under the following conditions:

- The respective monitored voltages of the two systems must be greater than 75 % and less than 112.5 % of the configured rated voltage.
- The monitored voltage differential of the two systems must fall below the configured maximum permissible voltage differential.
- The monitored frequency differential of the two systems must fall below the configured maximum permissible frequency differential
- The electrical angle between two coincident phases must be smaller than the respective permissible error angle (slip-dependent, max. 8 °elec.).

Configuration Screens

Synchronizing functions	ON
-------------------------	----

Synchronizing functions	ON/OFF
-------------------------	--------

ONSynchronizing functions have been enabled, and the subsequent screens of this function are displayed.

OFFSynchronizing functions have been disabled, and the subsequent screens of this function are not displayed.

Synchronization df max	0.00Hz
------------------------	--------

Maximum permissible positive slip frequency differential for synchr.	0.02 to 0.49 Hz
--	-----------------

This parameter defines the upper permissible frequency differential limit for synchronization. Prior to the control issuing a breaker closure command, the monitored frequency differential of the two systems must be less than the value configured here.

Positive slip refers to the generator frequency being greater than the mains frequency.

Synchronization df min	-0.00Hz
------------------------	---------

Maximum permissible negative slip frequency differential for synchr.	0.00 to -0.49 Hz
--	------------------

This parameter defines the lower permissible frequency differential limit for synchronization. Prior to the control issuing a breaker closure command, the monitored frequency differential of the two systems must be greater than the value configured here.

Negative slip refers to the generator frequency being less than the mains frequency.

Synchronization dV max =	00.0%
--------------------------	-------

Maximum permissible voltage differential	0.1 to 15.0 %
--	---------------

A close command will not be issued until the measured differential voltage of the two systems is less than the value configured here. The percentage configured here is a + or – value.

Signal	CB On
Logic	impulse

Output signal for circuit breaker closure**constant/impulse**

constant The "Synchronization" relay (terminals 27/28/29) can be wired directly into the holding circuit of the circuit breaker. After the CB close command has been issued and the circuit breaker reply has been received, the "Synchronization" relay remains energized. The relay de-energizes as soon as the discrete input "Reply: CB is open" is re-energized. Opening the circuit breaker via this relay is not possible.

impulse The "Synchronization" relay issues a connection pulse. The circuit breaker holding circuit requires an external circuit with self-holding contacts. The CB aux contacts are used to detect the status of the holding circuit contacts.

**NOTE**

Release of holding circuit occurs if:

- the generator voltage drops below 75 % of V_N
- the phase angle between generator and mains voltage exceeds 14 degrees
- the discrete input "Reply: circuit breaker is open" is energized

The "continuous" signal does not release and open the circuit breaker if an alarm condition is detected. The breaker must be opened by an external opening circuit.

Synchronization Time pulse > 000ms

Minimum pulse time of the breaker close relay**50 to 250 ms**

The duration of the breaker closure command is defined by this parameter. The length of the pulse can be adjusted to the requirements of the individual breaker. The configured value defines the minimum on time of the pulse.

Gen.circ.breaker Pick-up t. 000ms

Breaker inherent delay**40 to 300 ms**

All breakers have an inherent delay. This is the time from when the closure command is issued until the breaker contacts are closed. This parameter defines that time. The control unit uses the time value configured here to determine when the breaker closure command is issued independent of the frequency differential. This permits the breaker contacts to close as close as possible to the synchronous point.

Dead Bus Closure (Option Y)

Closing the circuit breaker can be accomplished even if the synchronization voltage is not present. The breaker close command is issued if the following conditions are met:

- The applied generator voltage is within the configured permissible limits
- The applied generator frequency is within the configured permissible limits
- The applied synchronization voltage does not exceed 5 % of the parameter "Volt.transformer sec. (MN)"
- The discrete input "Isolated operation" is energized signaling that the unit is not in parallel with the grid
- The discrete input "Release CB" is energized
- The discrete input " Reply: CB is open " is energized



CAUTION

The measuring voltages are normally protected. If an automatic circuit breaker trips, the unit may perform a dead bus closure. This can cause the generator to operate asynchronously and severely damage the system. To prevent this from happening, the dead bus closure functionality must be disabled through an external circuit if the automatic circuit breaker trips. This may be achieved by de-energizing either the "Isolated operation" discrete input (terminal 74) or "CB enabled" discrete input (terminal 31).



NOTE

If more than one unit is operating in parallel on an isolated system, only one control may have the parameter "Dead busbar Operation" enabled (configured as ON). All other controllers must have this parameter disabled. It is possible to enable the dead bus closure functionality in more than one controller if a higher-level control (i.e. a PLC) is utilized to regulate the breaker functionality of all units in the system. The higher-level control should only enable the circuit breaker in one lower-level controller during a dead bus closure condition by dictating which unit has its "Release CB" digital input energized and de-energizing all other "Release CB" digital inputs to other units.

Dead busbar Operation	ON
--------------------------	----

Dead bus closure of circuit breaker ON/OFF

- ON**A dead bus closure is performed when a de-energized busbar is detected and the isolated operation" discrete input (terminal 74) is energized. All prerequisites for a dead bus closure must be met for this function to be performed. The subsequent screens of this function are displayed.
- OFF**Dead bus closure functionality is disabled. The subsequent screens of this function are not displayed.

Dead busbar op. df max	0.00Hz
---------------------------	--------

Maximum differential frequency for dead bus CB closure 0.05 to 5.00 Hz

The maximum deviation of the generator frequency from the configured frequency controller set point for a breaker closure command to be issued is configured in this parameter.

Dead busbar op. dV max	00.0%
---------------------------	-------

Max. differential voltage for dead bus CB closure 00.1 to 20.0 %

The maximum deviation of the generator voltage from the configured voltage controller set point for a breaker closure command to be issued is configured in this parameter. The value configured is a percentage of the PT secondary voltage.

Example:

If the PT secondary rated voltage is 120 V and 10% is configured for this parameter, the dead bus breaker closure command will be issued when the control monitors the secondary voltage is within +/-12 V of the rated PT secondary voltage (above 108 V or below 132 V).

No-Load Control

Aut.idle running control ON	Automatic no-load control	ON/OFF
	ON	With the power circuit breaker open and terminal 3 de-energized (CB disabled), frequency and voltage is controlled if the minimum permissible generator frequency and voltage have been reached.
	OFF	With the power circuit breaker open, frequency and voltage are controlled according to the following conditions: <ul style="list-style-type: none"> • Terminal 3 energized (CB enabled): Frequency and voltage are controlled • Terminal 3 de-energized (CB disabled): Frequency and voltage are not controlled

Frequency Controller (Option Y/G/GF)

Freq. controller ON	Automatic no-load control	ON/OFF
	ON	The generator frequency may be controlled. The generator frequency is controlled dependent upon the state of the relevant discrete inputs (isolated operation / synchronization). The subsequent screens of this function are displayed.
	OFF	The generator frequency is not controlled. The subsequent screens of this function are not displayed.

Freq. controller Setp. variable <small>(with Option G/GF only)</small>	Presetting for frequency set point	variable/fixed
	Fixed	The set fixed set point is continuously adjusted. An external correction of the set point via actuating signals "higher" or "lower" is not possible.
	Variable	The set point can be externally corrected within certain limits.

Set Point Setting

Freq. controller Setpoint 00,0Hz	Frequency controller – set point	48.0 to 62.0 Hz
	The generator frequency set point is defined in this screen. This value is the reference for the frequency controller when performing isolated and/or no-load operations. Generally 50 Hz or 60 Hz will be the values entered into this parameter. It is possible that a different value may be entered here.	

Freq. controller min.value 00,0Hz <small>Set point "variable" (only with Option G/GF)</small>	Lower limit for variable frequency set point value	48.0 to 62.0 Hz
	The set value indicates the minimum set point that can be reached with an external set point selection via the actuating signal "lower". The smaller frequency set point value should be entered here.	

Freq. controller max.value 00,0Hz <small>Set point "variable" (only with Option G/GF)</small>	Upper limit for variable frequency set point value	48.0 to 62.0 Hz
	The set value indicates the maximum set point that can be reached with an external set point selection via the actuating signal "higher". The larger frequency value should be entered here; otherwise, the assignment of terminals 74 and 75 ("higher" and "lower") is reversed.	

Setpoint voltage Poti f 00.00Hz/s Set point "variable" (only with Option G/GF)	Increase of set point potentiometer frequency	0.10 to 10.00 Hz/s
	The influence of the increase indicates the speed (in Hz per second) at which the set point of the frequency changes with selection via the "higher"/"lower" signal on the digital inputs via an actuating signal.	

Setpoint ramp f set 00.00 Hz/s (only with Option G/GF)	Frequency controller set point ramp	0.10 to 10.00 Hz/s
	The set point ramp indicates how rapidly (in Hz per second) the set point value of the frequency is supposed to approach its limit value. The change is linear.	

Three-Position Controller (Standard)

Freq. controller Insens. 0,00Hz	Frequency controller insensitivity	0.02 to 1.00 Hz
	Isolated operation .. The generator frequency is controlled in such a manner that the measured frequency does not deviate from the configured set point by more than the value configured in this parameter without the controller issuing a frequency raise/lower signal to the speed control. This prevents unneeded wear on the speed control and/or the contacts for terminals 19/20/21/22.	

Synchronization The generator frequency is controlled in such a manner that the measured frequency does not deviate from the monitored busbar frequency by more than the value configured in this parameter without the controller issuing a frequency raise/lower signal to the speed control. This prevents unneeded wear on the speed control and/or the contacts for terminals 19/20/21/22. The value configured for this parameter must be less than half of the value configured for df max (maximum frequency differential) for synchronization.

Freq. controller Time pulse>000ms	Minimum frequency controller ON period	10 to 250 ms
	The minimum duty cycle for the speed raise/lower contacts should be configured so that the speed controller is able to respond reliably to the command issued. It is recommended that the shortest possible time period for this duty cycle be configured to ensure optimum control behavior.	

Freq. controller Gain Kp=00,0	Frequency controller gain	0.1 to 99.9
	The gain factor K_p influences the operating time of the relays. By increasing the gain, the response is increased to permit larger corrections to the frequency. The farther out of tolerance the frequency is the larger the response action is to return the frequency to the tolerance band. Excessive overshoot/undershoot of the desired value will result if the gain is configured too high.	

Analog Controller Outputs (Option QF - Instead of Three-Position Controller)

Pr.-sensitivity Freq. Kpr=000	P gain of the frequency controller	1 to 240
	The proportional coefficient specifies the gain (see analog controller).	

Reset time Freq. Tn=00,0s	Reset time load frequency controller	0.0 to 60.0 s
	The reset time T_n identifies the I part of the PID controller (see analog controller).	

Derivative act. time(freq) 0,00s	Derivative-action time load frequency controller	0.00 to 6.00 s
	The derivative-action time T_v identifies the D part of the PID controller (see analog controller).	

Droop

Freq. controller Droop	00.0%
---------------------------	-------

Controller droop characteristic curve **00.0 to 20.0 %**

If this control is to be operated on a generator in parallel with other generators and frequency control is enabled, a droop characteristic curve must be used. Each generator in the system will require the same value to be configured for the droop characteristic, so that when the system is stable the active power will be distributed proportionally among all generators in relation to their rated power.

Example

Rated power: 500 kW
 Rated frequency set point: 50.0 Hz
 Droop 5.0 %

Active power 0 kW = 0 % of rated power
 Frequency is adjusted to $(50.0 \text{ Hz} - [5.0\% * 0.0]) = 50.0 \text{ Hz}$.

Active power +250 kW = +50 % of rated power
 Frequency is adjusted to $(50.0\text{Hz} - [5 \% * 0.50]) = 48.75 \text{ Hz}$.

Active power +500 kW = +100 % of rated power
 Frequency is adjusted to $(50.0\text{Hz} - [5 \% * 1.00]) = 47.50 \text{ Hz}$.

Active Power Controller (Option B)

Power controller ON

Active power controller **ON/OFF**

ON..... The active power controller is enabled. The active power is automatically adjusted to the configured set point in a mains-parallel operation. The subsequent screens of this function are displayed.
OFF..... The active power controller is disabled. The subsequent screens of this function are not displayed.

External Real Power Control (Option X)

External setp. Adjustment	ON
------------------------------	----

External control of active power set point **ON/OFF**

ON..... External control of the active power set point is enabled. The active power control set point is controlled via the 0/4 to 20mA input. The subsequent screens of this function are displayed.
OFF..... External control of the active power set point is disabled. The active power control set point is controlled via the internal active-power set point. The subsequent screens of this function are not displayed.

External setp. 0 .. 20mA

Analog input range **0 to 20mA / 4 to 20mA**

0 to 20 mA ... The analog input range is scaled from 0 to 20 mA.
4 to 20 mA ... The analog input range is scaled from 4 to 20 mA.

External setp 0/4mA = 00000kW

Minimum value scaling **0 to 32,000 kW**

This parameter is only displayed if the parameter "External setp. Adjustment" has been enabled. The minimum control value for the active power is defined here (e.g. 0 kW). Dependent upon how this parameter is configured, this value will correspond to 0mA or 4mA.

External setp
20mA = 00000kW

Maximum value scaling 0 to 32,000 kW

This parameter is only displayed if the parameter "External setp. Adjustment" has been enabled. The maximum control value for the active power is defined here (e.g. 100 kW). Dependent upon how this parameter is configured, this value will correspond to 20mA.

Internal Real Power Set Point



NOTE

In connection with **Option X**, this setting is only possible if the screen "Setpoint selection external" has been configured "OFF".

Power controller
Setpoint 00000kW

Internal active power controller set point 0 to 32,000 kW

The active power is adjusted to the value defined here.

Power Controller General Set Points

Power controller
Ramp 000%/s

Active power load ramp rate 1 to 100 %/s

The control will increase the load on the generator after the breaker has closed at the rate defined in this parameter. The ramp rate is a percentage of the generator rated power (refer to page 45) per second. The higher the configured percentage, the faster the load reference for the control is increased.

Example:

If the rated load for the generator is 100kW and 10%/s is configured for this parameter. The load ramp for the control is 10kW/s or it will take 10 seconds for the generator to load to 100%.

Power limitation
P max. 000%

Active-power controller maximum power limitation 10 to 120 %

The maximum active power of the generator may be limited by this parameter. The active power limit is defined as a percentage of the generator rated power (refer to page 45). The active power controller is prohibited from permitting the generator load to exceed the load reference point defined here. The active power controller is only functional when the generator is used in parallel with other sources of power. This parameter has no functionality in an isolated application.

Three-Position Controller

Power controller
Dead band 00.0%

Active power controller dead band 0.1 to 25.0 %

The active power is controlled in such a manner that the measured load does not deviate from the active power set point by more than the percentage value of the dead band. The percentage configured here refers to the generator rated power. This prevents unneeded wear on the speed control and the output contacts.

Power controller Sens.red. *0.0	Active power controller dead band reduction	1.0 to 9.9
	The dead band is increased by the factor configured here to further reduce wear on speed control, automatic voltage regulator and the output contacts. The dead band will only be increased by the configured factor after the control has not issued a raise/lower pulse for 5 seconds.	
	Example: If a dead band is configured as 2.5% and the reduction factor is configured as 2.0, the dead band will be increased to 5.0% after 5 seconds. If the load deviates from the configured set point by more than 5.0% of the generator rated power, the dead band is reduced back to 2.5%. This dead band reduction factor can be utilized to reduce wear on the speed controls due to small load changes.	
Power controller Time pulse>000ms	Minimum active power controller duty cycle	20 to 250 ms
	The minimum duty cycle for the active power controller raise/lower contacts should be configured so that the speed controller is able to respond reliably to the command issued. It is recommended that the shortest possible time period for this duty cycle be configured to ensure optimum control behavior.	
Power controller Gain Kp=00.0	Active power controller gain factor	0.1 to 99.9
	The gain factor K_p influences the operating time of the relays. By increasing the gain, the response is increased to permit larger corrections to the active power control. The farther out of tolerance the active power is the larger the response action is to return the active power to the tolerance band. Excessive overshoot/undershoot of the desired value will result if the gain is configured too high.	

Analog Controller Outputs (Option QF – Instead of Three-Position Controller)

Pr.-sensitivity Power Kpr=000	Active-power controller P gain	1 to 240
	The proportional coefficient specifies the gain (see analog controller).	
Reset time Power Tn=00,0s	Active-power controller reset time	0.2 to 60.0 s
	The reset time T_n identifies the I part of the PID controller (see analog controller).	
Deriv. act. time Power Tv=0,00s	Active-power controller derivative-action time	0.0 to 6.0 s
	The derivative-action time T_v identifies the D part of the PID controller (see analog controller).	

Part-Load Warm-Up

Warm up load Setpoint 000%	Warm up partial load limit	5 to 110 %
	If the engine requires a warm-up period, a fixed load value may be entered for the engine warm up period. The setting for the generator load that is to be utilized during this warm-up phase is defined by this parameter. The fixed load is a percentage of the generator rated power (refer to page 45).	
Warm up load Time 000s	Warm up period	0 to 600 s
	The length of the warm-up period with the part-load following the initial closure of the GCB in mains parallel operation is configured here. If an engine warm-up period is not desired, this parameter must be set to zero.	

Voltage Controller (Option Y/G/GU)

Volt. controller ON

Voltage controller **ON/OFF**

ONGenerator voltage control is enabled. The subsequent screens of this function are displayed.
OFFGenerator voltage control is disabled. The subsequent screens of this function are not displayed.

Volt. controller Setp. variable

(with Option G/GU only)

Presetting voltage set point selection **variable/fixe**

Fixed.....The set fixed set point value is continually adjusted. An external correction of the set point value via actuating signals "higher" or "lower" is not possible.
VariableThe set point can be externally corrected within certain limits.

Set Point Setting

Volt. controller Setpoint 000V

Fixed-voltage set point value **[1] 50 to 125 V; [4] 70 to 440 V**

This parameter defines the voltage reference point for the control to use in isolated and no-load operations. The value entered into this parameter refers to the secondary rated voltage of the PTs or the system voltage if PTs are not utilized.

Volt. controller min.value 000V

Set point "variable"
(only with Option G/GU)

Lower limit for variable voltage set point value **[1] 50 to 125 V; [4] 70 to 440 V**

The set value indicates the minimum set point value that can be reached with an external set point selection via that actuating signals "lower". The smaller voltage value should be entered here.

Volt. controller max.value 000V

Set point "variable"
(only with Option G/GU)

Upper limit for variable voltage set point value **[1] 50 to 125 V; [4] 70 to 440 V**

The set value indicates the maximum set point that can be reached with an external selection of the set point via actuating signal "higher". The greater voltage value should be entered here; otherwise, the assignment to terminals 6 and 7 ("higher" and "lower" is reversed).

Setpoint voltage Gradient = 00V/s

Set point "variable"
(only with Option G/GU)

Potentiometer voltage set point increase **1 to 20 V/s**

The effect of the increase indicates the speed (in volts per second) at which the voltage set point value changes when selected using the "higher"/"lower" signals on the digital inputs via an actuating signal.

Setpoint ramp Ramp = 00V/s

(only with Option G/GU)

Voltage controller set point ramp **1 to 20 V/s**

The set point ramp indicates how rapidly (in volts per second) the voltage set point is supposed to approach its limit value. The change is linear.

Three-Position Controller (Standard)

Volt. controller Dead band 00.0V	Voltage controller insensitivity [1] 0.1 to 15.0 V; [4] 0.5 to 60.0 V
	<p>Isolated operation.. The generator voltage is controlled in such a manner that the measured voltage does not deviate from the configured set point by more than the value configured in this parameter without the controller issuing a voltage raise/lower signal to the voltage regulator. This prevents unneeded wear on the voltage regulator and/or the contacts for terminals 23/24/25/26.</p> <p>Synchronization..... The generator voltage is controlled in such a manner that the measured voltage does not deviate from the monitored busbar voltage by more than the value configured in this parameter without the controller issuing a voltage raise/lower signal to the voltage regulator. This prevents unneeded wear on the voltage regulator and/or the contacts for terminals 23/24/25/26. The value configured for this parameter must be less than the value configured for dV max (maximum voltage differential) for synchronization.</p>
Volt. controller Sens.red. *0,0	Voltage controller insensitivity reduction 1.0 to 9.9
	<p>If, following the adjustment of the controller, no further adjusting pulse has been output for at least 5 s the insensitivity is reduced by the input factor.</p> <p>For example: In the case of an insensitivity of 2.5 % and a factor of 2.0, the insensitivity is increased after 5 s to 5.0 %. If the control deviation subsequently exceeds 5.0 %, again, the controller's original sensitivity is automatically reset (2.5 %). This input can be used, in the event of small control deviations, to avoid unnecessarily frequent actuation processes, thereby protecting the adjustment facility.</p>
Volt. controller Time pulse>000ms	Minimum voltage controller duty cycle 20 to 250 ms
	<p>The minimum duty cycle for the voltage raise/lower contacts should be configured so that the voltage regulator is able to respond reliably to the command issued. It is recommended that the shortest possible time period for this duty cycle be configured to ensure optimum control behavior.</p>
Volt. controller Gain Kp=00.0	Voltage controller gain 0.1 to 99.9
	<p>The gain factor K_p influences the operating time of the relays. By increasing the gain, the response is increased to permit larger corrections to the voltage control. The farther out of tolerance the voltage is the larger the response action is to return the voltage to the tolerance band. Excessive overshoot/undershoot of the desired value will result if the gain is configured too high.</p>

Analog Controller Outputs (Option QU - Instead of Three-Position Controller)

Pr.-sensitivity Volt. Kpr=000	P gain of the frequency controller 1 to 240
	<p>The proportional coefficient specifies the gain (see analog controller).</p>
Reset time Volt. Tn=00,0s	Reset time load frequency controller 0.0 to 60.0 s
	<p>The reset time T_n identifies the I part of the PID controller (see analog controller).</p>
Derivative act. time(Volt) 0,00s	Derivative-action time load frequency controller 0.00 to 6.00 s
	<p>The derivative-action time T_v identifies the D part of the PID controller (see analog controller).</p>

Droop

Volt. controller	
Droop	00.0%

Controller droop characteristic curve	00.0 to 20.0 %
---------------------------------------	----------------

If this control is to be operated on a generator in parallel with other generators and voltage control is enabled, a droop characteristic curve must be used. Each generator in the system will require the same value to be configured for the droop characteristic, so that when the system is stable the reactive power will be distributed proportionally among all generators in relation to their rated power.

Example

Rated power: 500 kW
 Rated voltage set point: 400 V
 Droop: 5.0 %

Reactive power 0 kvar = 0% of rated reactive power
 Voltage is adjusted to $(400\text{ V} - [5.0\% * 0.0]) = 400\text{ V}$.

Reactive power +250 kvar (ind) = +50 % of rated reactive power
 Voltage is adjusted to $(400\text{ V} - [5.0\% * 0.50]) = 390\text{ V}$.

Reactive power +500 kvar (ind) = +100 % of rated reactive power
 Voltage is adjusted to $(400\text{ V} - [5.0\% * 1.00]) = 380\text{ V}$.

Power-Factor Controller (Option C)



NOTE

It is vital to ensure that the following variables are properly configured for the controller to operate properly

- Rated power
- Primary current
- Primary voltage

If these variables are not configured properly, the droop controller and/or power factor controller may not operate properly.

Power-factor-controller	ON
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Power factor controller	ON/OFF
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ON.....In a mains parallel operation automatic control of the power factor is enabled. If there are excessively low currents (secondary current less than 5 % of I_{rated}) the power factor cannot be accurately measured. In order to prevent power swings, the controller automatically locks the power factor at a set value. The subsequent screens of this function are displayed.

OFF.....Power factor control is disabled. The subsequent screens of this function are not displayed.

Pow.fact. contr. Setp.	variable
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(with Option G/GU only)

Presetting power factor set point selection	variable/fixd
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Fixed.....The set fixed set point value is continually adjusted. An external correction of the set point value via actuating signals "higher" or "lower" is not possible.

Variable.....The set point can be externally corrected within certain limits.

Power Factor Set Point

Pow.fact. contr. Setpoint 0.00	Power factor controller set point i0.70 to 1.00 to c0.70
Setp. pow. fact. min.value *0,00 Set point "variable" (only with Option G/GU)	Lower limit with variable power-factor set point i0.70 to 1.00 to k0.70 The set value indicates the minimum set point value that can be reached with an external set point selection via that actuating signals "lower". The smaller voltage value should be entered here.
Setp. pow. fact. max.value *0,00 Set point "variable" (only with Option G/GU)	Upper limit with variable power-factor set point i0.70 to 1.00 to k0.70 The set value indicates the maximum set point that can be reached with an external selection of the set point via actuating signal "higher". The greater voltage value should be entered here; otherwise, the assignment to terminals 6 and 7 ("higher" and "lower" is reversed).
Setp. pow. fact. Gradient = 00V/s Set point "variable" (only with Option G/GU)	Slope of the power-factor potentiometer set point 0.01 to 0.30 /s The effect of the increase indicates the speed (in volts per second) at which the power factor set point value changes when selected using the "higher"/"lower" signals on the digital inputs via an actuating signal.
Setp. pow. fact. Ramp = 00V/s (only with Option G/GU)	Power-factor controller set point ramp 0.01 to 0.30 /s The set point ramp indicates how rapidly (in volts per second) the power factor set point is supposed to approach its limit value. The change is linear.

Three-Position Controller (Standard)

Pow.fact. contr. Dead band 00.0%	Power factor controller insensitivity 0.5 to 25.0 %
	The unit automatically calculates the amount of reactive power required to maintain the power factor set point when operating in parallel with the mains. The reactive power is controlled in such a manner that the measured power factor does not deviate from the power factor set point by more than the percentage value of the dead band. The percentage configured here refers to the power factor controller set point. This prevents unneeded wear on the automatic voltage regulator and the output contacts.
Pow.fact. contr. Sens.red. *0,0	Power factor controller insensitivity reduction 1.0 to 9.9
	If, following the adjustment of the controller, no further adjusting pulse has been output for at least 5 s the insensitivity is reduced by the input factor. For example: In the case of an insensitivity of 2.5 % and a factor of 2.0, the insensitivity is increased after 5 s to 5.0 %. If the control deviation subsequently exceeds 5.0 %, again, the controller's original sensitivity is automatically reset (2.5 %). This input can be used, in the event of small control deviations, to avoid unnecessarily frequent actuation processes, thereby protecting the adjustment facility.
Pow.fact. contr. Time pulse>000ms	Minimum power factor controller duty cycle 20 to 250 ms
	The minimum duty cycle for the power factor raise/lower contacts should be configured so that the voltage regulator is able to respond reliably to the command issued. It is recommended that the shortest possible time period for this duty cycle be configured to ensure optimum control behavior.
Pow.fact. contr. Gain Kp=00.0	Power factor controller gain 0.1 to 99.9
	The gain factor K_p influences the operating time of the relays. By increasing the gain, the response is increased to permit larger corrections to the power factor control. The farther out of tolerance the power factor is the larger the response action is to return the power factor to the tolerance band. Excessive overshoot/undershoot of the desired value will result if the gain is configured too high.

Analog Controller Outputs (Option QU - Instead of Three-Position Controller)

Pr.-sensitivity Pow.f. Kpr=000	P gain of the power factor controller 1 to 240
	The proportional coefficient specifies the gain (see analog controller).
Reset time Pow.f. Tn=00,0s	Reset time power factor controller 0.0 to 60.0 s
	The reset time T_n identifies the I part of the PID controller (see analog controller).
Derivative act. time(cos) 0,00s	Derivative-action time power factor controller 0.00 to 6.00 s
	The derivative-action time T_v identifies the D part of the PID controller (see analog controller).

Shutdown

Power Reduction with Shutdown Command

Shutdown in mains parallel operation (only with Option B)

The control must be in a mains parallel operation (the circuit breaker closed and the discrete input "isolated operation" de-energized). If the discrete input "Enable CB" is de-energized, the unit will perform constant power control (Option W) or power factor control (Option C). By de-energizing the discrete input "Enable CB" it is possible to reduce the active power according to the parameter "Stop sequence ramp". When the load reaches 10% of the generator rated load (refer to page 45), the circuit breaker is opened. When the power factor controller is enabled, the power factor is adjusted to 1.00.

Shutdown in isolated parallel operation (only with Option W or O)

The control must be in an isolated operation (the circuit breaker closed and the discrete input "isolated operation" energized). The active (Option W) or reactive (Option O) power is proportionally distributed according the generator rated loads if the discrete input "Enable CB" is energized. When the discrete input "Enable CB" is de-energized, the generator stops participating in the load distribution control and the active load of the generator is reduced according to the parameter "Stop sequence ramp". When the active load reaches 10% of the generator rated load (refer to page 45), the circuit breaker is opened. The remaining generators that are participating in the load distribution control assume the load proportionally.

Message "Shutdown achieved"

Once the measured load of the generator reaches 10% of the generator rated power (refer to page 45), a "Stop order" message may be issued via the relay manager. This message may be used to open the circuit breaker if wired accordingly.

Stop sequence
ON

Power reduction	ON/OFF
ON.....	The load is reduced and the assigned relay energizes after the measured load reaches 10% of the generator load rating (refer to page 45) when the discrete input "Release CB" is de-energized.
OFF.....	The load is not reduced and the circuit breaker remains closed. The active power controller and the power factor controller are enabled if configured as ON in their respective parameters.

Stop sequence
Ramp 000%/s

Shutdown unload ramp rate	1 to 100 %/s
---------------------------	--------------

The control will decrease the load on the generator at the rate defined in this parameter. The ramp rate is a percentage of the generator rated power (refer to page 45) per second. The higher the configured percentage, the faster the load reference for the control is decreased.

Example:

If a 100kW generator is running at full load and 10%/s is configured for this parameter. The load ramp for the control is 10kW/s or it will take 9 seconds for the generator to unload and open the circuit breaker. It takes 9 seconds for the load to be reduced to 10% of the load rating and the breaker is opened when the load reaches 10% of the generator load rating.

Active Power Distribution (Option W)

The control functionality in an isolated parallel operation ensures equal load sharing among the generators. Each MFR-15 participating in the load sharing controls its generator so that the primary control variable (frequency) remains constant. All controls utilize Psum (terminal57) to calculate and correct real load sharing for each unit. The secondary control variable (active power distribution) is utilized to maintain the load sharing. A weighing factor (reference variable) may be adjusted to place emphasis on the primary control variable (frequency) or the secondary control variable (active power distribution). The isolated system in a steady state condition will share the real load proportionally among all participating generators. The load sharing is performed as a percentage (i.e. 20%) of the rated power for the individual generator. The neutral terminal of all generators must be inter-connected since this is used as reference point on terminal 4.



NOTE

This control does not perform reactive load sharing. This requires the voltage controller to be set up for parallel operations (i.e. droop mode).

Prerequisite

The following parameters **must** be configured identically for each unit that will participate in load sharing:

- Frequency controller set point
- Active power load sharing must be enabled
- The discrete input "Isolated operation" is energized on all units participating in load sharing

Active power	
Load share	ON

Active power load sharing ON/OFF

ONLoad sharing is enabled for multiple generators operating in parallel. The generator loads are distributed depending on the configured rated load for each generator. The subsequent screens of this function are displayed.

OFFLoad sharing is disabled The subsequent screens of this function are not displayed.

Act. load share	
Frequency	00%

Active-power load sharing reference variable 0 to 99 %

The frequency and the active load are controlled in isolated operation dependent upon how this parameter is configured. The higher the number configured here, the more emphasis is placed by the control on maintaining the primary control variable (frequency). The lower the number configured here, the more emphasis is placed by the control on maintaining the secondary control variable (active power distribution).

Reactive Power Distribution (Option O)

In isolated operation in parallel with other gensets, the function ensures an even distribution of reactive power to all machines operating in parallel with the busbar. Each controller involved in distribution control influences the machine to which it is assigned in such a manner that the rated voltage (main control variable) which has been set remains constant. All units are interlinked via terminal Psum (terminal 57), via which any deviation in reactive power (generator power) can be determined for each machine. This secondary control variable is taken into consideration on controlling the voltage. The weighting, with which the secondary and the main control variable (= "reference variable") processed, can be set via a factor. In the adjusted state, the isolated system has the set rated power, the total reactive power being divided in equal parts among the machines involved in the distribution control.



NOTE

This control does not perform active load sharing. This requires the speed controller to be set up for parallel operations (i.e. droop mode).

Prerequisite

The following parameters **must** be configured identically for each unit that will participate in load sharing:

- Voltage controller set point
- Reactive power load sharing must be enabled
- The discrete input "Isolated operation" is energized on all units participating in load sharing

Reactive power Load share	ON
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Active power distribution

ON/OFF

- ON**..... Reactive power is distributed to several generators operating in parallel. The generator outputs are distributed depending on the set value. The subsequent screens of this option are displayed.
- OFF**..... No distribution is carried out, and the subsequent screens of this option are not displayed.

React.load share Voltage	= 00%
-----------------------------	-------

Reactive-power distribution reference variable

10 to 99 %

Increasing the weighting factor increases the influence of the main control variable (voltage) on the controlling. The smaller the factor which is set, the greater the influence of the secondary control variable (generator reactive power). The behavior of voltage control (isolated operation) is determined by the main control variable, that of reactive-power distribution by the secondary control variable.

Type of Monitoring



NOTE

The following screen will not be displayed, if the parameter "Volt.-Measuring" is configured to "Phase to phase" power measurement. (refer to Voltage Measurement on page 43).



Monitoring for

Phase-neutral/Phase to phase

The unit can either monitor the phase-neutral voltages (four-wire system) or the phase-phase voltages (three-wire system). Usually, for low-voltage system (400 V version) the phase-neutral voltages are monitored, while for the medium and high-voltage systems (100 V-version), the phase-phase voltages are monitored. The monitoring of the phase-phase voltages is recommended to avoid a phase-earth fault in a compensated or isolated mains resulting in the voltage protection tripping. The only effect on the screen "Voltage measuring" is the one described in the above note. The settings in the screen "**Volt.-Monitoring**" do have the following effects on the configuration screens:

Phase-neutral: The voltage at the terminals 1/2/3/4 is measured as a four-wire installation. All subsequent screens concerning voltage measuring refer to phase-neutral voltage (V_{Ph-N}). This is indicated in the configuration screens by the supplement [**Phase-N**].

Phase to phase: If the voltage system connected to the terminals 1/2/3/4 is a three-wire system, this setting must be selected. All subsequent screens concerning voltage measuring refer to phase-phase voltage (V_{Ph-Ph}). In the configuration screens, this is indicated by the supplement [**V(ph-ph)**].

Protection



Overvoltage Monitoring (Option U)

Function: "Voltage not within permissible limits"

The monitored voltage in at least one phase is not within the configured permissible limits for overvoltage. The alarm message "Overvolt.1" or "Overvolt.2" will be displayed. This message **cannot** be suppressed with the discrete input "Blocking of protective functions / remote acknowledgement".

Overvoltage
Monitoring ON

Overvoltage monitoring **ON/OFF**

ON..... Overvoltage monitoring is enabled. The subsequent screens of this function are displayed.
OFF..... Overvoltage monitoring is disabled. The subsequent screens of this function are not displayed.

Screen for Phase-neutral:
Overvoltage 1
(Phase-N) >000V

Threshold **(Phase-phase) [1] 20 to 150 V; [4] 20 to 520 V**
overvoltage level 1 **(Phase-neutral) [1] 10 to 87 V; [4] 10 to 300 V**

Screen for Phase to phase:
Overvoltage 1
V(ph-ph) >000V

Overvoltage (level 1) is defined by this parameter. If this limit is reached or exceeded, the unit outputs the message "Overvolt.1". If a relay was assigned to this function in the relay manager, that relay will be energized.

Overvoltage 1
Delay 00.00s

Pickup delay, level 1 **0.02 to 99.98 s**

In order to initiate an overvoltage (level 1) alarm, the measured voltage must exceed and remain above the configured threshold without interruption for at least the period of time specified in this screen.

Screen for Phase-neutral:
Overvoltage 2
(Phase-N) >000V

Threshold **(Phase-phase) [1] 20 to 150 V; [4] 20 to 520 V**
overvoltage level 2 **(Phase-neutral) [1] 10 to 87 V; [4] 10 to 300 V**

Screen for Phase to phase:
Overvoltage 2
V(ph-ph) >000V

Overvoltage (level 2) is defined by this parameter. If this limit is reached or exceeded, the unit outputs the message "Overvolt.2". If a relay was assigned to this function in the relay manager, that relay will be energized.

Overvoltage 2
Delay 00.00s

Pickup delay, level 2 **0.02 to 99.98 s**

In order to initiate an overvoltage (level 2) alarm, the measured voltage must exceed and remain above the configured threshold without interruption for at least the period of time specified in this screen.

Overvoltage
Hysteresis 00V

Hysteresis for the overvoltage monitoring, levels 1 + 2 **0 to 99 V**

In order to prevent system fluctuations from continually initiating overvoltage alarms (both levels), a lower release point is defined here. If the control monitors the voltage above the permissible limit, the voltage must drop below that threshold and the voltage level defined here for the fault condition to be recognized as no longer existing.

Example: If a 480 V system has an overvoltage limit of 510 V and a hysteresis of 10 V, the monitored voltage for an overvoltage alarm must drop below 500 V to reset the alarm.

Undervoltage Monitoring (Option U)

Function: "Voltage not within permissible limits"

The monitored voltage in at least one phase is not within the configured permissible limits for undervoltage. The alarm message "Und.volt.1" or "Und.volt.2" will be displayed. This message **cannot** be suppressed with the discrete input "Blocking of protective functions / remote acknowledgement".

Undervoltage Monitoring ON

Undervoltage monitoring **ON/OFF**

ONUndervoltage monitoring is enabled. The subsequent screens of this function are displayed.

OFFUndervoltage monitoring is disabled. The subsequent screens of this function are not displayed.

Screen for Phase-neutral:

Undervoltage 1 (Phase-N) <000V

Screen for Phase to phase:

Undervoltage 1 V(ph-ph) <000V

Threshold undervoltage level 1 **(Phase-phase) [1] 20 to 150 V; [4] 20 to 520 V (Phase-neutral) [1] 10 to 87 V; [4] 10 to 300 V**

Undervoltage (level 1) is defined by this parameter. If this limit is reached or fallen below, the unit outputs the message " **Und.volt.1**". If a relay was assigned to this function in the relay manager, that relay will be energized.

Undervoltage 1 Delay 00.00s

Pickup delay, level 1 **0.02 to 99.98 s**

In order to initiate an undervoltage (level 1) alarm, the measured voltage must fall below and remain below the configured threshold without interruption for at least the period of time specified in this screen.

Screen for Phase-neutral:

Undervoltage 2 (Phase-N) <000V

Screen for Phase to phase:

Undervoltage 2 V(ph-ph) <000V

Threshold undervoltage level 2 **(Phase-phase) [1] 20 to 150 V; [4] 20 to 520 V (Phase-neutral) [1] 10 to 87 V; [4] 10 to 300 V**

Undervoltage (level 2) is defined by this parameter. If this limit is reached or fallen below, the unit outputs the message " **Und.volt.2**". If a relay was assigned to this function in the relay manager, that relay will be energized.

Undervoltage 2 Delay 00.00s

Pickup delay, level 2 **0.02 to 99.98 s**

In order to initiate an undervoltage (level 2) alarm, the measured voltage must fall below and remain below the configured threshold without interruption for at least the period of time specified in this screen.

Undervoltage Hysteresis 00V

Hysteresis for the undervoltage monitoring, level 1 + 2 **0 to 99 V**

In order to prevent system fluctuations from continually initiating undervoltage alarms (both levels), a higher release point is defined here. If the control monitors the voltage below the permissible limit, the voltage must rise above that threshold and the voltage level defined here for the fault condition to be recognized as no longer existing.

Example: If a 480 V system has an undervoltage limit of 440 V and a hysteresis of 10 V, the monitored voltage for an overvoltage alarm must rise above 450 V to reset the alarm.

Voltage Asymmetry Monitoring (Option U)

The phase-phase voltages are monitored.

Function "Voltage asymmetry not within permissible limits"

The monitored phase-phase voltage differential in the three phases is not within the configured permissible limits for asymmetry (asymmetric voltage vectors; the threshold corresponding to the differential value). The alarm message "**Asymmetry**" will be displayed. This message can be suppressed with the discrete input "Blocking of protective functions / remote acknowledgement".

Asymmetry-Monitoring ON

Asymmetry monitoring ON/OFF

ON..... Voltage asymmetry monitoring is enabled. The subsequent screens of this function are displayed.

OFF..... Voltage asymmetry monitoring is disabled. The subsequent screens of this function are not displayed.

Asymmetry Response v. 00V.

Maximum permissible asymmetry 0 to 99 V

The maximum voltage asymmetry is defined by this parameter. If this limit is reached or exceeded, the unit outputs the message "**Asymmetry**". If a relay was assigned to this function in the relay manager, that relay will be energized.

Asymmetry Delay 00.00s

Pickup delay 0.02 to 99.98 s

In order to initiate a voltage asymmetry alarm, the measured voltage differential must rise above and remain above the configured threshold without interruption for at least the period of time specified in this screen.

Asymmetry Hysteresis 00V

Hysteresis for the asymmetry monitoring 0 to 99 V

In order to prevent system fluctuations from continually initiating a voltage asymmetry fault, a lower release point is defined here. If the control monitors the voltage asymmetry beyond the permissible limit, the voltage differential must fall below that threshold plus the voltage level defined here for the fault condition to be recognized as no longer existing.

Overfrequency Monitoring (Option U)

The frequency monitoring is performed on two levels. The frequency measuring is monitored three-phase if all voltages are greater than 15 % of the rated value (100 V or 400 V). This ensures quick and precise measurement of the frequency. The frequency is still monitored correctly even if voltage is only applied to one phase.

Function "Frequency not within permissible limits"

The monitored frequency is not within the configured permissible limits for overfrequency. The alarm message "Overfreq.1" or "Overfreq.2" will be displayed. This message **cannot** be suppressed with the discrete input "Blocking of protective functions / remote acknowledgement".

Overfrequency-Monitoring ON

Overfrequency Monitoring ON/OFF

ONOverfrequency monitoring is enabled. The subsequent screens of this function are indicated.

OFFOverfrequency monitoring is disabled. The subsequent screens of this function are not displayed.

Overfrequency 1
f > 00.00Hz

Threshold overfrequency, level 1 40.00 to 80.00 Hz

Overfrequency (level 1) is defined by this parameter. If this limit is reached or exceeded, the unit outputs the message "Overfreq.1". If a relay was assigned to this function in the relay manager, that relay will be energized.

Overfrequency 1
Delay 00.00s

Pickup delay, level 1 0.02 to 99.98 s

In order to initiate an overfrequency (level 1) alarm, the measured frequency must exceed and remain above the configured threshold without interruption for at least the period of time specified in this screen.

Overfrequency 2
f > 00.00Hz

Threshold overfrequency, level 2 40.00 to 80.00 Hz

Overfrequency (level 2) is defined by this parameter. If this limit is reached or exceeded, the unit outputs the message "Overfreq.2". If a relay was assigned to this function in the relay manager, that relay will be energized.

Overfrequency 2
Delay 00.00s

Pickup delay, level 2 0.02 to 99.98 s

In order to initiate an overfrequency (level 2) alarm, the measured frequency must exceed and remain above the configured threshold without interruption for at least the period of time specified in this screen.

Overfrequency
Hysteres. 0.00Hz

Hysteresis for the overfrequency monitoring, levels 1+2 0.01 to 9.99 Hz

In order to prevent system fluctuations from continually initiating overfrequency alarms (both levels), a lower release point is defined here. If the control monitors the frequency above the permissible limit, the frequency must drop below that threshold and the frequency level defined here for the fault condition to be recognized as no longer existing.

Example: If a 60 Hz system has an overfrequency limit of 70 Hz and a hysteresis of 5 Hz, the monitored frequency for an overfrequency alarm must fall below 65 Hz to reset the alarm.

Underfrequency Monitoring (Option U)

The frequency monitoring is performed on two levels. The frequency measuring is monitored three-phase if all voltages are greater than 15 % of the rated value (100 V or 400 V). This ensures quick and precise measurement of the frequency. The frequency is still monitored correctly even if voltage is only applied to one phase.

Function "Frequency not within permissible limits"

The monitored frequency is not within the configured permissible limits for underfrequency. The alarm message "Und. freq. 1" or "Und. freq. 2" will be displayed. This message can be suppressed with the discrete input "Blocking of protective functions / remote acknowledgement".

Underfrequency-Monitoring ON	Underfrequency monitoring ON/OFF
	<p>ON..... Underfrequency monitoring is enabled. The subsequent screens of this function are indicated.</p> <p>OFF..... Underfrequency monitoring is disabled. The subsequent screens of this function are not displayed.</p>
Underfrequency 1 f < 00.00Hz	Threshold underfrequency, level 1 40.00 to 80.00 Hz
	<p>Underfrequency (level 1) is defined by this parameter. If this limit is reached or fallen below, the unit outputs the message "Und. freq. 1". If a relay was assigned to this function in the relay manager, that relay will be energized.</p>
Underfrequency 1 Delay 00.00s	Pickup delay, level 1 0.02 to 99.98 s
	<p>In order to initiate an underfrequency (level 1) alarm, the measured frequency must fall below and remain below the configured threshold without interruption for at least the period of time specified in this screen.</p>
Underfrequency 2 f < 00.00Hz	Threshold underfrequency, level 2 40.00 to 80.00 Hz
	<p>Underfrequency (level 2) is defined by this parameter. If this limit is reached or fallen below, the unit outputs the message "Und. freq. 2". If a relay was assigned to this function in the relay manager, that relay will be energized.</p>
Underfrequency 2 Delay 00.00s	Pickup delay, level 2 0.02 to 99.98 s
	<p>In order to initiate an underfrequency (level 2) alarm, the measured frequency must fall below and remain below the configured threshold without interruption for at least the period of time specified in this screen.</p>
Underfrequency Hysteres. 0.00Hz	Hysteresis for the underfrequency monitoring, levels 1 + 2 0.01 to 9.99 Hz
	<p>In order to prevent system fluctuations from continually initiating underfrequency alarms (both levels), a higher release point is defined here. If the control monitors the frequency below the permissible limit, the frequency must rise above that threshold and the frequency level defined here for the fault condition to be recognized as no longer existing.</p> <p>Example: If a 60 Hz system has an underfrequency limit of 50 Hz and a hysteresis of 5 Hz, the monitored frequency for an overfrequency alarm must rise above 55 Hz to reset the alarm.</p>

Vector / Phase Shift Monitoring (Option V)

A vector/phase shift is defined as the sudden variation of the voltage curve which may be caused by a major generator load change. The control unit measuring circuit detects the change in the cycle duration. This change in the cycle duration is compared with a mean value calculated from previous measurements. The monitoring may be carried out three-phased or one/three-phased. The threshold in degrees indicates the time difference between the mean value and the instantaneous value, referring to the duration of a full cycle. The monitoring can be configured in different ways. The vector/phase shift monitor can also be used as an additional method to decouple from the mains. Vector/phase shift monitoring is only enabled after the monitored voltage exceeds 70% of the PT secondary rated voltage.

Function: "Cycle duration of the voltage not within permissible limits"

The voltage cycle duration is not within the configured vector/phase shift limits. The alarm message "**Ph. shift**" appears. This message can be suppressed with the discrete input "Blocking of protective functions / remote acknowledgement".

Phase jump monitoring ON

Vector/phase shift monitoring	ON/OFF
-------------------------------	--------

ONVector/phase shift monitoring is enabled. The voltage/frequency cycle duration is being monitored to ensure it does not exceed the defined limits. The subsequent screens of this function are displayed.

OFFVector/phase shift monitoring is disabled, and the subsequent screens of this function are not displayed.

Phase jump monit -----

Vector/phase shift monitoring	one/three phase / 3 phase only
-------------------------------	--------------------------------

one/three phase: An alarm will be issued if the phase angle in any one phase exceeds the configured phase shift phase angle limit. Monitoring of single-phase voltage is exceptionally sensitive and may lead to nuisance tripping if the configured phase angle is too low.

3 phase only: An alarm will be issued if the phase angle in all three phases exceeds the configured phase shift phase angle limit within two waveforms.



NOTE

If the monitoring is configured as "3 phase only", only one of the two subsequent screens will be displayed. If the monitoring is configured as "one/three-phase", both configuration screens will be displayed.

Phase-jump value (One phase) 00°

This screen is only visible if monitoring is configured "one/three phase".

Vector/phase shift monitoring phase angle, single-phase	2 to 90°
---	----------

An alarm will be issued if the phase angle in any one phase exceeds the configured phase shift phase angle limit. If the monitored voltage/frequency reaches or exceeds the phase shift limit, the unit outputs the message "**Ph. shift**". If a relay was assigned to this function in the relay manager, that relay will be energized.

Phase-jump value (3-phase) 00°

Vector/phase shift monitoring phase angle, three-phased	2 to 90°
---	----------

An alarm will be issued if the phase angle in any all three phases exceeds the configured phase shift phase angle limit. If the monitored voltage/frequency reaches or exceeds the phase shift limit, the unit outputs the message "**Ph. shift**". If a relay was assigned to this function in the relay manager, that relay will be energized.

df/dt (ROCOF) Monitoring (Option D)

Function: "Rate Of Change Of Frequency (ROCOF) is not within permissible limits"

Rate of Change Of Frequency (ROCOF) monitoring measures the stability of the frequency. The frequency of a generator will vary due to changing loads and compensation of the fuel system. The rate of these frequency changes due to the load variances is relatively high compared to those of a large network. The control unit calculates the unit of measure per unit of time. The df/dt is measured over 4 sine waves to ensure that it is differentiated from a phase shift. This results in a response time of approximately 100ms. This message can be suppressed with the discrete input "Blocking of protective functions / remote acknowledgement".

df/dt- Monitoring ON

df/dt monitoring **ON/OFF**

ON.....Rate Of Change Of Frequency monitoring is enabled. The subsequent screens of this function are displayed.

OFF.....Rate Of Change Of Frequency monitoring is disabled. The subsequent screens of this function are not displayed.

df/dt Response>0.0Hz/s

Tripping df/dt **1.0 to 9.9 Hz/s**

The Rate Of Change Of Frequency threshold is defined by this parameter. If this limit is reached or exceeded, the unit outputs the message "**Fault df**". If a relay was assigned to this function in the relay manager, that relay will be energized.

df/dt Delay T= 0.0s

Pickup delay **0.1 to 9.9 s**

In order to initiate a Rate Of Change Of Frequency alarm, the measured df/dt must exceed and remain above the configured threshold without interruption for at least the period of time specified in this screen.

Independent Time-Overcurrent Monitoring (Option IS/IZ)



NOTE

All percentage values of the current refer to the rated current (page 44).

Function: Current is monitored depending on parameter "Overcurrent Monitoring". The time-overcurrent alarm contains three limits and can be setup as a step definite time overcurrent alarm as illustrated in the figure below. Monitoring of the maximum phase current is performed in three steps. Every step can be provided with a delay time independent of the other steps.

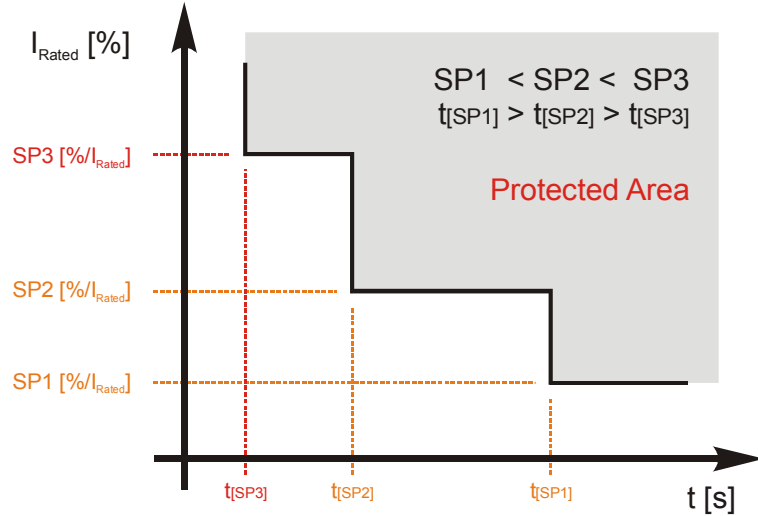


Figure 6-1: Diagram for independent time-overcurrent monitoring

Overcurrent Monitoring ON

Independent time-overcurrent monitoring **ON/OFF**

ONIndependent time-overcurrent monitoring is enabled. The subsequent screens of this function are displayed.

OFFIndependent time-overcurrent monitoring is disabled. The subsequent screens of this function are not displayed.

Overcurrent 1 I > 000%

Threshold independent time-overcurrent, level 1 **0 to 300 %**

Overcurrent (level 1) is defined by this parameter. The percentage configured in this parameter refers to the configured rated system current (refer to page 44). If this limit is reached or exceeded, the unit outputs the message "**overcurrent 1**". If a relay was assigned to this function in the relay manager, that relay will be energized.

Overcurrent 1 Delay 00.00s

Pickup delay, level 1 **0.02 to 99.98 s**

In order to initiate an overcurrent (level 1) alarm, the measured current must exceed and remain above the configured level 1 threshold without interruption for at least the period of time specified in this screen.

Overcurrent 2 I> 100%	Threshold independent time-overcurrent, level 2 0 to 300 %
	<p>Overcurrent (level 2) is defined by this parameter. The percentage configured in this parameter refers to the configured rated system current (refer to page 44). If this limit is reached or exceeded, the unit outputs the message "overcurrent 2". If a relay was assigned to this function in the relay manager, that relay will be energized.</p>
Overcurrent 2 Delay 00.00s	Pickup delay, level 2 0.02 to 99.98 s
	<p>In order to initiate an overcurrent (level 2) alarm, the measured current must exceed and remain above the configured level 2 threshold without interruption for at least the period of time specified in this screen.</p>
Overcurrent 3 I> 100%	Threshold independent time-overcurrent, level 3 0 to 300 %
	<p>Overcurrent (level 3) is defined by this parameter. The percentage configured in this parameter refers to the configured rated system current (refer to page 44). If this limit is reached or exceeded, the unit outputs the message "overcurrent 3". If a relay was assigned to this function in the relay manager, that relay will be energized.</p>
Overcurrent 3 Delay 00.00s	Pickup delay, level 3 0.02 to 99.98 s
	<p>In order to initiate an overcurrent (level 3) alarm, the measured current must exceed and remain above the configured level 3 threshold without interruption for at least the period of time specified in this screen.</p>
Overcurrent Hysteresis 000%	Hysteresis for the independent time-overcurrent monitoring, levels 1, 2 + 3 1 to 300 %
	<p>In order to prevent system fluctuations from continually initiating overcurrent alarms (levels 1, 2 + 3), a lower release point is defined here. If the control monitors the current above the permissible limit, the current must drop below that threshold and the current level defined here for the fault condition to be recognized as no longer existing.</p> <p>Example: If a 1000A system has an overcurrent limit 1 of 110% (1100A) and a hysteresis of 105% (1050A), the monitored current for an overcurrent alarm must drop below 1050A to reset the alarm.</p>

Overload Monitoring (Option PM)



NOTE

All percentage values refer to a percentage of the configured rated power (page 44).

Function: "Positive active load not within the permissible range"

The single-phase or three-phase active load is above the configured limit for overload. The message "overload" is displayed. This message can be suppressed with the discrete input "Blocking of protective device / remote acknowledgement".

Overload
Monitoring ON

Overload monitoring **ON/OFF**

ONOverload monitoring is enabled. The subsequent screens of this function are displayed.

OFFOverload monitoring is disabled. The subsequent screens of this function are not displayed.

Overload
Response v.000%

Threshold overload **0 to 150 %**

The overload threshold is defined by this parameter. The percentage configured here refers to the configured rated power (refer to page 44). If this limit is reached or exceeded, the unit outputs the message "overload ". If a relay was assigned to this function in the relay manager, that relay will be energized.

Overload
Delay time 000s

Pickup delay **0 to 300 s**

In order to initiate an overload alarm, the measured active load must exceed and remain above the configured threshold without interruption for at least the period of time specified in this screen.

Overload
Hysteresis 00%

Hysteresis for the overload monitoring **0 to 99 %**

In order to prevent system fluctuations from continually initiating overload alarms, a lower release point is defined here. If the control monitors the active load above the permissible limit, the load must drop below the percentage of the rated load defined here for the fault condition to be recognized as no longer existing.
Example: If a 100kW rated system has an overload limit of 120% (120kW) and a hysteresis of 95% (95kW), the monitored load for an overload alarm must drop below 95kW to reset the alarm.

Reverse/Reduced Power Monitoring (Option PM)



NOTE

All percentage values refer to a percentage of the configured rated power (page 44).

Function: "Active power not within the permissible range"

The generator power limits may be configured as reduced power or reverse power depending on the threshold value configured in the control. If the single-phase or three-phase measured real power is below the adjusted limit of the reduced load or below the adjusted value of the reverse power, an alarm will be issued. The message "Rev. Power" appears. This message can be suppressed with the discrete input "Blocking of protective device / remote acknowledgement".

Reverse/min.pow. Monitoring ON	Reverse/reduced power monitoring ON/OFF
	<p>ON..... Reverse/reduced power monitoring is enabled. The subsequent screens of this function are displayed.</p> <p>OFF..... Reverse/reduced power monitoring is disabled. The subsequent screens of this function are not displayed.</p>
Reverse/min.pow. -00%	Threshold reverse/reduced power -99 to 99 %
	<p>Reverse power monitoring: If the direction of the active power reverses and the measured power value falls below the configured negative percentage value, the unit issues the message "Rev. Power".</p> <p>Reduced power monitoring: If the measured power falls below the configured positive percentage value, the unit issues the message "Rev. Power".</p> <p>If a relay was assigned to this function in the relay manager, that relay will be energized.</p>
Reverse/min.pow. Delay 00.00s	Pickup delay 0.02 to 99.98 s
	<p>In order to initiate an overload alarm, the measured active load must exceed and remain above the configured threshold without interruption for at least the period of time specified in this screen.</p>
Reverse/min.pow. Hysteresis 00%	Hysteresis for the reverse/reduced power monitoring 0 to 99 %
	<p>In order to prevent system fluctuations from continually initiating reverse/reduced power alarms, a lower release point is defined here. If the control monitors the active load above the permissible limit, the load must drop below the percentage of the rated load defined here for the fault condition to be recognized as no longer existing.</p>

Unbalanced Load Monitoring (Option PS)



NOTE

All percentage values refer to a percentage of the configured rated power (page 44).

Function: "Unbalanced load not within the permissible range"

The percentage threshold value indicates the permissible variation of phase current from the arithmetic mean value of all three-phase currents. If the measured value is greater than the threshold, the message "Unbalance" appears. This message can be suppressed with the discrete input "Blocking of protective device / remote acknowledgement".

Unbalanced load
Monitoring ON

Unbalanced load monitoring ON/OFF

ONUnbalanced load monitoring is enabled. The subsequent screens of this function are displayed.

OFFUnbalanced load monitoring is disabled. The subsequent screens of this function are not displayed.

Unbalanced load
Response v. 000%

Maximum permissible unbalanced load 0 to 100 %

The maximum unbalanced load refers to the measured three-phase currents. If an asymmetrical load causes the phase currents to exceed the configured percentage for the configured time, the unit displays the alarm message "Unbalance". If a relay was assigned to this function in the relay manager, that relay will be energized.

Unbalanced load
Delay 00.00s

Pickup delay 0.02 to 99.98 s

In order to initiate an unbalanced load alarm, the measured active load must exceed and remain above the configured differential threshold without interruption for at least the period of time specified in this screen.

Unbalanced load
Hysteresis 00%

Hysteresis for the unbalanced load monitoring 1 to 20 %

In order to prevent system fluctuations from continually initiating unbalanced load alarms, a lower release point is defined here. If the control monitors the active load above the permissible differential limit, the load must drop below the load differential percentage defined here for the fault condition to be recognized as no longer existing.

Power Factor Monitoring (option ZC)

Function: "Power factor cos phi not within the admissible range"

If the excitation of a generator is regulated by a reactive current governor, operation within the capacitive (underexcited) range could be avoided by interrupting the control signals by means of the φ -monitoring. For the two limiting values both, inductive and capacitive thresholds may be set. It is also possible to set the limiting value 1 to a capacitive and the limiting value 2 to an inductive threshold. The message "**cosphi1**" or "**cosphi2**" appears. This message can be suppressed with the discrete input "Blocking of protective device / remote acknowledgement".

<p>cosphi Monitoring 000</p>	<p>cos φ -monitoring ON/OFF</p>
	<p>ON..... The cos φ (power factor) is being monitored, and the subsequent masks of this function are displayed. OFF..... Monitoring is not carried out, and the subsequent screen masks of this function are not displayed.</p>
<p>cosphi 1 Response v.i0,00</p>	<p>Threshold cos φ level 1 c0.01 to 1.00 to i0.01</p>
	<p>The value of the power factor cos φ (level 1) to be monitored is set in this mask. If the value is either reached or exceeded (inductive) or fallen below (capacitive), the unit issues the message "cosphi 1". If additionally, a relay was configured via the relay manager, an output is also made to this relay.</p>
<p>cosphi 1 Delay 00,00s</p>	<p>Delay cos φ level 1 0.02 to 99.98 s</p>
	<p>For a tripping to occur, the threshold must be exceeded without interruption for at least the period of time specified in this mask.</p>
<p>cosphi 2 Response v.c0,00</p>	<p>Threshold cos φ 2 c0.01 to 1.00 to i0.01</p>
	<p>The value of the power factor cos φ (level 2) to be monitored, is set in this mask. If this value is reached or exceeded (inductive) or fallen below (capacitive), the unit issues the message "cosphi 2". If additionally, a relay was configured via the relay manager, an output is also made to this relay.</p>
<p>cosphi 2 Delay 00,00s</p>	<p>Delay cos φ level 2 0.02 to 99.98 s</p>
	<p>For a tripping to occur, the threshold must be exceeded without interruption for at least the period of time specified in this mask.</p>
<p>cosphi mon. Hysteresis 0,00</p>	<p>Hysteresis cos φ - monitoring 0.01 to 0.50</p>
	<p>In order to avoid that the signal relay keeps picking up and dropping when approaching the preset threshold for the power factor (both levels), the difference between the pickup and the release value (hysteresis) can be entered here as a percentage value.</p>

Reactive Power Monitoring (Option ZQ)



NOTE

All percentage values refer to a percentage of the configured rated power (page 44).

Function: "Reactive power not within the permissible range"

The control may monitor the reactive power and provide protection against excessive inductive (over excitation) or capacitive (under excitation) load conditions. The control will display "React . pow+" or "React . pow-" if the inductive or capacitive load has exceeded the permissible limits. This message can be suppressed with the discrete input "Blocking of protective device / remote acknowledgement".

Reactive power
Monitoring ON

Reactive power monitoring ON/OFF

- ON.....Reactive power monitoring is enabled. The subsequent screens of this function are displayed.
- OFF.....Reactive power monitoring is disabled. The subsequent screens of this function are not displayed.

Cap. react. pow.
Response v.000%

Threshold reactive power, capacitive 0 to 100 %

The capacitive reactive power threshold is defined by this parameter. The percentage configured here refers to the configured rated power (refer to page 44). If this limit is reached or exceeded, the unit outputs the message "React . pow-". If a relay was assigned to this function in the relay manager, that relay will be energized.

Cap. react. pow.
Delay 00.00s

Pickup delay 0.02 to 99.98 s

In order to initiate a capacitive reactive power alarm, the measured capacitive reactive load must exceed and remain above the configured differential threshold without interruption for at least the period of time specified in this screen.

Ind. react. pow.
Response v.000%

Threshold reactive power, inductive 0 to 100 %

The inductive reactive power threshold is defined by this parameter. The percentage configured here refers to the configured rated power (refer to page 44). If this limit is reached or exceeded, the unit outputs the message "React . pow+". If a relay was assigned to this function in the relay manager, that relay will be energized.

Ind. react. pow.
Delay 00.00s

Pickup delay 0.02 to 99.98 s

In order to initiate an inductive reactive power alarm, the measured inductive reactive load must exceed and remain above the configured differential threshold without interruption for at least the period of time specified in this screen.

React. pow. mon.
Hysteresis 00%

Hysteresis for the reactive power monitoring 1 to 20 %

In order to prevent system fluctuations from continually initiating reactive power alarms, a lower release point is defined here. If the control monitors the capacitive or reactive load above the permissible limit, the reactive load must drop below the percentage defined here for the fault condition to reset for the fault condition to be recognized as no longer existing.

Load Shift Monitoring (Option ZW)



NOTE

All percentage values refer to a percentage of the configured nominal power (page 44).

Function: "Active Load Surges not within the admissible range"

The unit logs the three-phase current reactive power by means of the 3 phase voltages and the 3 wire currents. Tripping occurs in case of a sudden variation of the active power, if the variation exceeds a certain settable threshold. Tripping occurs neither for slow variations of the active load, nor for sudden variations of the reactive load. (For a tripping to occur, the active load change must exceed the threshold within 2 measuring periods). If the measured value is greater than the threshold, the message "**Load shift+**" or "**Load shift-**" appears. These message can be separately controlled via the relay manager and can be suppressed with the discrete input "Blocking of protective device / remote acknowledgement".

Act. power shift Monitoring 000

Load Shift Monitoring **ON/OFF**

- ON**..... A load shift is being monitored, and the subsequent masks of this function are displayed.
- OFF**..... Monitoring is not carried out, and the subsequent screen masks of this function are not displayed.

Release value Power shift= 00%

Admissible Active Power Surge **10 to 80 %**

If the value of the active load shifts by a value equal to or greater than the set percentage value (referring to the nominal power; refer to page 44), the unit issues a message. The protective unit differentiates between positive (load) and negative (load reducing) load shifts (the messages issued are therefore either "**Load shift+**" or "**Load shift-**"). If additionally, a relay was configured via the relay manager, an output is also made to this relay.

Power Limit Monitoring (Option PZ)



NOTE

All percentage indications of the power refer to the rated power (page 44).

Function: "Power maximum exceeded" (boost slave genset)"

If the generator active power exceeds the set threshold value "Boost", a message "Boost slave genset" can be output after expiration of the set boost delay time. The message is independently reset if the active power has fallen back below the threshold value taking into consideration the hysteresis and the time delay "Buck" (drop-out delay).

Power max
output ON

Maximum Power Monitoring ON/OFF

ONPower is monitored and the subsequent screens of this option are displayed.

OFFMonitoring is not carried out, and the subsequent screens of this option are not displayed.

Start next gen.
at 000%

Boost command threshold 0 to 120 %

The value of the active power that is to be monitored is set in this screen. If the value is reached or exceeded, the unit outputs the message "Boost" if a relay is configured via the relay manager. The function has no indication in the display.

Start next gen.
Delay 000,0s

Boost command pickup delay 0 to 320.0 s

In order to output the message "Boost", the threshold value must be exceeded uninterruptedly as long as it is indicated on the screen.

Start next gen.
Hysteresis 00%

Boost command hysteresis 01 to 99 %

The boost power of the unit is determined via hysteresis. Hysteresis is used to prevent the unit's continuously starting and shutting down again.

Start next gen.
Rel.delay 000,0s

Boost command drop-out delay 0 to 320.0 s

The message "Boost" is set back if the threshold value minus hysteresis remains fallen below at least as long as it is indicated on the screen.

Busbar Voltage Monitoring (Option US)



NOTE

To monitor busbar voltage, voltage on terminals 70/71 is used. This is designated using synchronization voltage. Monitoring the busbar voltage is carried out single-phase utilizing the phase-to-phase voltage V_{L1-L2} .

Function: "Busbar voltage not within permissible limits"

The monitored busbar voltage in at least one phase is not within the configured permissible limits. The alarm message "**U>busbar**" or "**U<busbar**" will be displayed. This message can be suppressed with the discrete input "Blocking of protective functions / remote acknowledgement".

Busbar voltage Monitoring ON	Busbar voltage monitoring ON/OFF
	ON..... Voltage monitoring is carried out, and the following screens of this option are displayed. OFF..... Monitoring is not carried out, and the subsequent screens of this option are not displayed.
Busbar overvolt. V > 000V	Overvoltage 20 to 130 / 20 to 520 V
	The overvoltage value that is to be monitored is set in this screen. If the value is reached or exceeded, the unit outputs the message " U>busbar ". If a relay is also parameterized via the relay manager, the output still occurs also on this relay.
Busbar overvolt. Delay 00,00s	Pickup delay 0.02 to 99.98 s
	In order to trip monitoring, the threshold value must be exceeded without interruption for at least the period of time specified in this screen.
Busbar undervolt V < 000V	Undervoltage 20 to 130 / 20 to 520 V
	The undervoltage value that is to be monitored is set in this screen. If the value is reached or exceeded, the unit outputs the message " U<busbar ". If a relay is also parameterized via the relay manager, the output still occurs also on this relay.
Busbar undervolt Delay 00,00s	Pickup delay 0.02 to 99.98 s
	In order to trip monitoring, the value must fall below the threshold without interruption for at least the period of time specified in this screen.
Busbar undervolt Hysteresis 00V	Hysteresis for busbar voltage monitoring 0 to 99 V
	In order to prevent a continuous pickup and drop out of the alarm relay in the vicinity of the set threshold value for the overvoltage and undervoltage, an absolute difference between pickup and drop-out values (hysteresis) in relation to the threshold value can be indicated here.

Busbar Frequency Monitoring (Option US)



NOTE

To monitor the busbar frequency, the voltage at terminals 70 to 72 is used. This is called synchronization voltage.

Function "Busbar frequency not within permissible limits"

The monitored busbar frequency is not within the configured permissible limits. The alarm message "**f>busbar**" or "**f<busbar**" will be displayed. This message can be suppressed with the discrete input "Blocking of protective functions / remote acknowledgement".

Busbar frequency Monitoring ON	Busbar frequency monitoring ON/OFF
	ONFrequency monitoring is carried out, and the following screens of this option are displayed. OFFMonitoring is not carried out, and the subsequent screens of this option are not displayed.
Busbar overfreq. f < 00,00Hz	Overfrequency threshold value 40.00 to 80.00 Hz
	The overfrequency value that is to be monitored is set in this screen. If the value is reached or exceeded, the unit outputs the message " f> Busbar ". If a relay is also parameterized via the relay manager, the output still occurs also on this relay.
Busbar overfreq. Delay 00,00s	Pickup delay 0.02 to 99.98 s
	In order to trip monitoring, the threshold value must be exceeded without interruption for at least the period of time specified in this screen.
Busbar underfrq. f > 00,00Hz	Underfrequency threshold value 40.00 to 80.00 Hz
	The underfrequency value that is to be monitored is set in this screen. If the value is reached or exceeded, the unit outputs the message " f< Busbar ". If a relay is also parameterized via the relay manager, the output still occurs also on this relay.
Busbar underfrq. Delay 00,00s	Pickup delay 0.02 to 99.98 s
	In order to trip monitoring, the value must fall below the threshold without interruption for at least the period of time specified in this screen.
Busbar frequency Hysteresis 00V	Hysteresis for busbar frequency monitoring 0.01 to 9.99 Hz
	In order to prevent a continuous pickup and drop out of the alarm relay in the vicinity of the set threshold value for the overfrequency and underfrequency, an absolute difference between pickup and drop-out values (hysteresis) in relation to the threshold value can be indicated here.

Relay Configuration



NOTE

Clearing of faults and fault messages from the control unit will depend on the parameters "External clearing", "Auto-clearing Relays", and "Auto-clearing Display". These three parameters will influence the other depending on how each is configured. This is explained in the following text.



NOTE

Starting with Version 2.1xx/3.1xx (not, if the **Option G** is available) the digital input "Remote acknowledgement" is on terminal 75. Starting with this version the double function of the digital input terminal 5/6 described below is being dropped. The following table applies:

	Term.	without Option G		with Option G
		up to V2.0xx/V3.0xx	starting with V2.1xx/V3.1xx	
Watchdog/remote acknowledge	5/6	Yes	-	Yes
Watchdog blocking	5/6	-	Yes	-
Remote acknowledgement	75	-	Yes	-

External Clearing	ON
-------------------	----

External acknowledgement of the relays via the discrete input "Blocking of protective functions / remote acknowledgement".

Acknowledgement via the discrete input

ON/OFF

"Auto-clearing Relays" configured "OFF" (refer to "Auto Acknowledgement of the Relays" on page 82):

- OFF**..... Alarms that cannot be blocked with discrete input "Blocking of protective functions / remote acknowledgement" will not be reset when the fault condition is no longer present. Pressing the "Clear" button resets the relays.
- ON**..... All alarms are reset when the discrete input "Blocking of protective functions / remote acknowledgement" (terminals 5/6) is energized. Alarms which cannot be blocked with the discrete input "Blocking of protective functions / remote acknowledgement" are only reset after the fault condition is no longer present.

"Auto-clearing Relays" configured "ON" (refer to "Auto Acknowledgement of the Relays" on page 82):

- OFF**..... Pressing the "Clear" button resets the displayed fault messages.
- ON**..... All displayed fault messages are reset when the discrete input "Blocking of protective functions / remote acknowledgement" (terminals 5/6) is energized. Alarms which cannot be blocked with the discrete input "Blocking of protective functions / remote acknowledgement" are only reset after the fault condition is no longer present.

Auto Acknowledgement of the Relays

Auto-clearing Relays	ON
----------------------	----

Relay auto acknowledgment ON/OFF

- ON**Automatic clearing of the relays is enabled. The relays are automatically reset when the fault condition is no longer detected. The alarm message in the display is cleared according to how the parameter "**Auto-clearing Display**" is configured.
- OFF**Automatic clearing of the relays is disabled. Pressing the "Clear" button resets the relays.

The alarm message in the display is cleared according to how the parameter "**Auto-clearing Display**" is configured. The subsequent screens of this function are not indicated.



NOTE

The subsequent screens are only visible if the parameter "Auto-clearing Relays" and the corresponding protective function are enabled and the control unit is equipped with the protective functionality.

Release delay	xxxxxxxx 00.00s
---------------	-----------------

Release delay of the relays 0.02 to 99.98 s

The individual relays will reset if "Auto-clearing relays" has been enabled and the monitored values have returned to the permissible limits plus / minus the hysteresis (depending on monitoring) without interruption for the time specified in this parameter. If the monitored value exceeds / falls below the threshold limit, the delay timer re-initiates its countdown. The following protective functions may have reset delays configured.

Monitoring for ...		Display indication instead of xxxxxxxx	Remark
Overvoltage	Option U	Overvoltage	Level 1 and level 2
Undervoltage	Option U	Undervoltage	Level 1 and level 2
Asymmetry	Option U	Asymmet.	
Overfrequency	Option U	Overfreq.	Level 1 and level 2
Underfrequency	Option U	Underfrq.	Level 1 and level 2
Phase shift	Option V	Pha. shift	
df/dt	Option D	df/dt	
Independent time-overcurrent	Option IZ	Overcurrent	Overcurrent 1, 2 and 3
Overload	Option PM	Overload	
Reverse-/reduced load	Option PM	Reverse power	Reverse and reduced load
Unbalanced load	Option PS	Load unbalance	
Active load surge	Option ZW	Load jump	Positive and negative
Reactive power inductive	Option ZQ	Reactive p. Q-	
Reactive power capacitive	Option ZQ	Reactive power Q+	
Power factor 1	Option ZC	Power factor 1	
Power factor 2	Option ZC	Power factor 2	
Busbar voltage	Option US	V>busbar/V<busbar	
Busbar frequency	Option US	f>busbar/f<busbar	

Table 6-1: Release delay of the relays

Auto Acknowledgement of Messages

Auto-clearing Display ON	Messages auto acknowledgment	ON/OFF
	ON After the alarm condition is no longer detected, the message in the display is deleted.	
	OFF The alarm message remains in the display after the fault condition is no longer detected until manually cleared. The subsequent screen of this function is not displayed.	



NOTE

The subsequent parameter "Clearing display after " is not visible if "Auto-clearing Relays" is configured to "OFF".

Clearing display after 00s	Clear displayed message delay	1 to 99 s
	Alarm messages, which have been enabled, will be acknowledged after this configured delay time expires. This delay will initiate once the measure value exceeds/falls below the threshold limit +/- the hysteresis	

Changing the Relay Assignment (Relay Manager)

Change relay- allocation? YES	Change relay assignment?	YES/NO
	This parameter permits the user to change how the relay outputs are configured. Refer to the list of parameters.	
	YES The relay assignments can be configured and the user may define the relay functionality and assignments. The subsequent screens are displayed.	
	NO The relays are configured with the factory default settings. The subsequent screens are not displayed.	



NOTE

All relay outputs are configured the same. The following is an example showing relays 1 through 3.

Example: Relay 1 to 3

Funct. relay 123 (R=releases) RRR	Function of the relays 1, 2 and 3	EA/R
	The individual relays may be configured as either E= Energizes (Normally Open contacts) or R= Releases (Normally Closed contacts).	
	E The relay is configured as normally open (N.O.) contacts. The relay will energize only if the assigned monitoring function has tripped.	
	R The relay is configured as normally closed (N.C.) contacts. The relay is always energized and will only de-energize (release) if the assigned monitoring function has tripped.	

NOTE Relay 1 is configured as R (release/N.C.) and cannot be modified.



NOTE

The following screen(s) will only be displayed if the unit is equipped with the corresponding protective function(s), the protective function is enabled, and the parameter "Change relay allocation" is enabled.

XXXXXXXXXXXXXXXXXX
to relay 0000

Output of the protective units to the relays

0 to 3

Each digit in this parameter is used to assign one relay to a protective function. Up to four relay outputs may be assigned to a protective function. The control may be configured as follows:

0If the protective function is not assigned to a relay, a "0" must be configured in the display. None of the relay outputs will energize/de-energize when the corresponding protective function trips if all four relay assignments are configured with a "0". A message for the protective function will still be visible in the unit display.

1/2/3Relay 1 (terminals 9/10), relay 2 (terminals 11/12/13), and/or relay 3 (terminals 14/15/16) are available for assignment to protective function on all units.

ExampleA unit has a protective function that is required to output a signal to relays 2 and 3. That protective function relay assignment should be configured as 2300. The sequence of the numbers has no significance in the functionality or operations.

A relay output may be assigned to more than one protective function. This will cause the relay to issue a signal when any of the configured protective functions trip. If a relay should only issue a signal when a specific protective function trips, then the relay must not be assigned to any other protective function.

Monitoring of ... output to relay		Indication on display instead of XXXXXXXXXX
Boost	Option PZ	Start next gen.
Overvoltage, level 1	Option U	Overvoltage 1
Overvoltage, level 2	Option U	Overvoltage 2
Undervoltage, level 1	Option U	Undervoltage 1
Undervoltage, level 2	Option U	Undervoltage 2
Asymmetry	Option U	Asymmetry
Overfrequency, level 1	Option U	Overfrequency 1
Overfrequency, level 2	Option U	Overfrequency 2
Underfrequency, level 1	Option U	Underfrequency 1
Underfrequency, level 2	Option U	Underfrequency 2
Phase shift	Option V	Phase jump
df/dt	Option D	df/dt
Independent time-overcurrent, level 1	Option IZ	Overcurrent 1
Independent time-overcurrent, level 2	Option IZ	Overcurrent 2
Independent time-overcurrent, level 3	Option IZ	Overcurrent 3
Overload	Option PM	Overload
Reverse/reduced power	Option PM	Reverse/min.pow.
Unbalanced load	Option PS	Unbalance load
Load shift, negative	Option ZW	Neg. power shift
Load shift, positive	Option ZW	Pos. power shift
Reactive power, capacitive	Option ZQ	Cap. react. pow.
Reactive power, inductive	Option ZQ	Ind. react. pow.
Power factor cosphi, level 1	Option ZC	cosphi 1
Power factor cosphi, level 2	Option ZC	cosphi 2
Busbar overvoltage	Option US	U> Busbar
Busbar undervoltage	Option US	U< Busbar
Busbar overfrequency	Option US	f> Busbar
Busbar underfrequency	Option US	f< Busbar
Centralized alarm		Collect response
Shutdown	Option W/O/B	Stop order

Table 6-2: Protective device output to relay



NOTE

The "ready for operation" function is always assigned to relay 1. However, other protective functions may also be assigned to relay 1 additionally. Relay 1 is always configured as Normally Closed (break contact) and will de-energize if the unit is not ready for operation.

Pulse Output of the Positive Active Energy (Option M)



NOTE

If the negative active power or the positive and negative reactive power must be logged, use a measuring transducer such as the Woodward UMT 1.

Pulse output p.duration 0.00s

Pulse duration **0.04 to 1.00 s**

The duty cycle of one output pulse is defined here.
Note: The pulse duration must be configured for compatibility to the kWh impulse. It may be possible to configure overlapping impulses that may be recognized as a continuous signal.

Pulse/kWh Logic -----

Output of the kWh-pulse **positive/negative**

The output logic of the kWh-pulse can be either negative (the collector-output [terminal 60/61] is de-energized for each positive kWh-pulse), or positive (the collector-output [terminal 60/61] is energized for each positive kWh-pulse).

Active energy Pulse/kWh 000.0

Pulses per positive kWh **0.1 to 150.0**

The quantity of pulses per measured kWh is defined here. The pulses issued by this controller must be analyzed by an external control.
Example: If this parameter is configured as "**Pulse/kWh 020.00**" and 20 kWh are measured the number of pulses that will be output will be 400 or 20 kWh × 20 pulses/kWh = 400 pulses

RESET kWh ON
--

RESET kWh measuring **ON/OFF**

Enabling this parameter permits the kWh meter to be reset to zero by pressing the "Select" and "Digit↑" buttons while in the automatic operating mode.



NOTE

The kWh-counter is reset by:

1. Verify the control is in automatic mode.
2. Verify that the kWh-counter is displayed in the lower line of the display.
3. Press and hold the "Select" and "Digit↑" buttons for at least 5 seconds.

After the counter has been successfully reset, the screens will display "0000.0 kWh".

Analog Outputs (Options A1/2/3/4/6/8)



NOTE

The common use of the analog outputs, the interfaces and the discrete inputs depends on their respective combinations. Please pay attention to the combinations possible as described in the introduction.



CAUTION

The function of the analog outputs is restricted during configuration via the side connector (version 3.xxx). The parameter "Direct parametr." must be set to "NO" in order to make all analog outputs available (also see chapter "Direct Configuration (from Version 3.0xx)" on page 42).

It is possible to configure a linear measuring range for each analog output and assign it to a specific measured value (refer to Table 6-3). The -20/0/4 to 20 mA analog outputs may be configured as a -20 to 20 mA, 0 to 20 mA, or 4 to 20 mA output. The -10/0 to 10 V analog outputs may be configured as a -10 to +10 V or 0 to +10 V output. The user may define the upper and lower limits of the analog input measuring range. Text may be assigned to the input as well.

Value	Lower and upper setting value	
	0 V, -10 V 0 mA, 4 mA, -20 mA	10 V, 20 mA
Vol 1	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Vol 2	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Vol 3	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Vol ph-N AV	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Vol ph-N max.	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Vol ph-N min.	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Vol 1-2	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Vol 2-3	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Vol 3-1	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Vol ph-ph AV	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Vol ph-ph max.	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Vol ph-ph min.	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Frequency	40.00 to 80.00 Hz	
Current L1	0 to 9,999 A	
Current L2	0 to 9,999 A	
Current L3	0 to 9,999 A	
Current AV	0 to 9,999 A	
Current max.	0 to 9,999 A	
Current min.	0 to 9,999 A	
Direct Cur. 1 ¹	-9,999 to +9,999 A	
Direct Cur. 2 ¹	-9,999 to +9,999 A	
Direct Cur. 3 ¹	-9,999 to +9,999 A	
Dir. Current AV ¹	-9,999 to +9,999 A	
Dir. Current max. ¹	-9,999 to +9,999 A	
Dir. Current min. ¹	-9,999 to +9,999 A	
Active power	-32,000 to +32,000 kW	
Reactive power	-32,000 to +32,000 kvar	
Apparent power	0 to 32,000 kVA	
cosphi	i0.00 to 1.00 to c0.00 [LeoPC1: -70 = k0.70; +70 = i0.70]	

¹... The sign of the current values is defined by the polarity of the active component.

Table 6-3: Analog outputs, table of values

Example: analog output 2 (-10/0 to 10 V: terminals 50/52, -20/0/4 to 20 mA: terminals 52/53)
 Output of the phase-to-phase voltage V_{L1-L2} :

20 mA output
Analog output 2
 0 .. 20 mA

Output range of the analog output 2 (20 mA) -20..+20 / 0..20 / 4..20 mA / OFF
 (10 V) -10..+10 / 0..10 V / OFF

10 V output
Analog output 2
 0 .. 10 V

The only variable that may be changed for this parameter is the lower value for this analog output. The upper limit is always +20 mA.
-20..20mA -20 mA is the configured low limit for the analog output
0..20mA 0 mA is the configured low limit for the analog output
4..20mA 4 mA is the configured low limit for the analog output
OFF..... The analog output is not enabled. The subsequent screens of this function are not displayed.

The only variable that may be changed for this parameter is the lower value for this analog output. The upper limit is always +10 V.
-10..+10 V -10 V is the configured low limit for the analog output
0..10 V 0 V is the configured low limit for the analog output
OFF..... The analog output is not enabled. The subsequent screens of this function are not displayed.

Analog output 2

Output value of the analog output 2 see Table 6-3

The parameter that is to be assigned to the output is selected here (refer to Table 6-3).

Analog output
 0mA = 00000V

Example for 20 mA-output

Scaling of the lower output value see Table 6-3

Defines the lower limit of the output.

Analog output
 20mA = 00000V

Example for 20 mA-output

Scaling of the upper output value see Table 6-3

Defines the upper limit of the output.

Interface (Options SU/SB)



CAUTION

The communications bus interface functionality is disabled when the direct configuration port is enabled. The parameter "Direct parametr." must be set to "NO" to re-enable the communication bus interface (refer to "Direct Configuration (from Version 3.0xx)" on page 42).



NOTE

These screens and all related screens are only displayed if the particular communication option is included on the control unit. If the individual communication protocol is not included, the related screens will not be displayed.



NOTE

A description of the communication protocols may be found in Appendix E.

Screens for Protocol DK3964 (Option SU)

Data block RK512 000	Data block RK512 0 to 255
	Data block address in receiver (e. g. PLC).
Data word RK512 000	Data word RK512 0 to 255
	Data word address in receiver (e.. g. PLC).

Screens for Protocol Profibus DP Slave (Option SU)

Device number Profibus 000	Device number profi-bus DP slave 0 to 126
	Device number for the profi-bus DP slave.

Screens for Protocol Modbus RTU Slave (Option SU/SB)

Device number MOD-Bus 000	Device number Modbus RTU Slave 1 to 255
	Device number for the Modbus RTU Slave.
Baudrate 0000	Baud rate Modbus RTU Slave 1,200 / 2,400 / 4,800 / 9,600 / 19,200 Baud
	The baud rate of the Modbus RTU Slave is defined here.
Parity none	Parity Modbus RTU Slave none / even / odd
	The parity of the Modbus RTU Slave is defined here.
Stopbits one	Stop bits Modbus RTU Slave one / two
	The number of stop bits of the Modbus RTU Slave is defined here.
Delay to send MOD-Bus 00.0ms	Waiting time transmission after read request 0.2 to 50.0 ms
	After the read request by the master, the minimum waiting time before transmitting the answer is configured here. This allows the controller to adjust the response time to the master so that it can process the answer.

Screens for Protocol CAN Bus (Options SU/SB)

**NOTE**

Please note that IDs must not be allocated twice. This applies to all units linked to the bus system. Moreover, all IDs adjusted at the unit must be set to different values.

Procedure for transmission-IDs: The same "Basic-ID Transmission" is allocated to all units existing within the bus system. This allows a grouping of the various types of information. (Example: The same "Basic-ID Transmission" = 800 is allocated to all units. By means of the different unit numbers, the individual IDs are then allocated; unit number 1: ID = 801; unit number 2: ID = 802; etc.)

Device number CAN-Bus 0	Device number CAN-bus 1 to 8
The device number at CAN-bus is entered here. The device number affects the calculation of the transmitting- and controlling IDs.	
Baudrate 0000	Baudrate CAN-Bus 125/250/500kBaud
Setting the baudrate.	
Base-ID (send) 0000	Basic - ID Transmission 0 to 2015
The ID, from which the device is transmitting its operating data, is calculated from the Basic-ID Transmission + Device Number CAN-Bus.	
Base-ID (remote) 0000	Basic - ID control 0 to 2015
The ID, at which the device receives control data, is calculated from the Basic-ID-Control + Device Number CAN-Bus.	
ID (parametriz.) 0000	ID for remote parameterization 0 to 2015
Here the ID is entered on which the unit receives parameterization data. If the remote parameterization occurs via a system GW 4, these ID's must always be set to the value 831.	

General Screens for All Interfaces (Option SB)

Serial control
ON

Control via interface ON/OFF

- ONControl via the serial interface is enabled and control orders received via the interface are processed.
- OFFControl via the serial interface is disabled and control orders received via the interface are ignored.

Serial interface
Monitoring ON

Interface monitoring ON/OFF

- ONThe interface monitoring is enabled. The control expects to receive bits 2 and 3 to be written to "00" in the control word by the master control within 15 seconds after receiving the last message. If these bits are not read within the prescribed time, and unsuccessful data exchange is detected, and the alarm message "**Interface**" is issued.
- OFFThe interface monitoring is disabled.

Interface fault
to relay 0000

Relay assignment for interface error 0 to 3 / 0 to 8

Relays may be configured to energize when an interface fault is detected. The desired relays that to energize are configured here. The relays will only energize if the parameter "**Serial interface monitoring**" is configured as "ON".

Inhibit via
Interface ON

Blocking via the interface ON/OFF

- ONThe protective functions messages (i.e. underfrequency) may be suppress via the interface. This operates in the same manner as terminals 5/6 "Blocking of protective functions / remote acknowledgement".
- OFFThe protective functions messages (i.e. underfrequency) cannot be suppress via the interface.

Chapter 7.

Commissioning



DANGER - HIGH VOLTAGE

When commissioning the control, please observe all safety rules that apply to the handling of live equipment. Ensure that you know how to provide first aid in the event of an uncontrolled release of energy and that you know where the first aid kit and the nearest telephone are. Never touch any live components of the system or on the back of the system:

LIFE THREATENING



CAUTION

Only a qualified technician may commission unit. The "EMERGENCY-STOP" function must be operational prior to commissioning of the system, and must not depend on the unit for its operation.



CAUTION

Prior to commissioning ensure that all measuring devices are connected in correct phase sequence. The connect command for the unit circuit breaker must be disconnected at the unit circuit breaker. The field rotation must be monitored for proper rotation. Any absence of or incorrect connection of voltage measuring devices or other signals may lead to malfunctions and damage the unit, the engine, and/or components connected to the unit!

Procedure

1. After wiring the unit and ensuring all voltage-measuring devices are phased correctly, apply the control system voltage (i.e. 24 Vdc). The "Operation" LED will illuminate.
2. After applying the measured variables, the unit indicates the various measuring values which can be verified with a measuring instrument.
3. By simultaneously pressing the two push buttons "Digit↑" and "Cursor→", the configuration mode is accessed. After entering the access code number, the unit may be configured according to the application requirements (see the chapter regarding the parameters).
4. Check the synchronization (only with Option Y):
 - a.) Interrupt the "Connect" signal for the power circuit breaker.
 - b.) The mains voltage (synchronization voltage) must be within the permissible limits.
 - c.) Apply the "Release CB" signal. The synchronization will then be started.
 - d.) If the generator voltage is above 50 % of the set rated value, the frequency controller begins to control. The voltage controller inserts at 45 Hz. The control parameter should be selected so that the set value is optimally adjusted.
 - e.) In the moment a connection command is output, the differential voltage between the corresponding conductors must be equal to zero. This check must be carried out for all three phases, in order to check the correctness of the rotating field.
 - f.) After a successful check, the "Connect" signal can be connected again.
5. Check the dead bus start function
Prior to checking the dead bus start function, the output of the "Connect" signal must be interrupted.

6. Now, proceed as follows to change the code level:

until version 1.9xx:

Encoding	ON
----------	----

Sealing function

Enter: "ON" select and confirm using the "Select" button

Code no. 000	
Code? ?????	

Code input

Enter: Button "Select".

Wrong Code:	
SELECT (ANWAHL)	

Incorrect input

Enter: Button "Select".

Code no. 000	
Break? NO	

Break seal

Enter: "YES" Select and confirm using "Select" button

Code no. 000	
New code: ?????	

Enter new code

Enter: Enter new code number and confirm using "Select" button

from version 2.0xx:

Enter code number	0000
-------------------	------

Enter code number

0 to 9999

On accessing the parameterization mode, a code number, which identifies the various users, is first requested. The indicated number XXXX is a random number (ZU) and is confirmed using the "Select" button. If the random number was confirmed without modification using "Select", the code level remains as it was. Two four-digit code numbers (0000 to 9999) exist for changing the code level and setting up new code words for the users. No assignment is required for the "third party" user level, as the user does not usually receive access to the parameterization level (protected via the code).

7. After entering and checking the parameters of the unit, return to automatic mode by simultaneously depressing the two buttons "Digit↑" and "Cursor→".

Appendix A. Dimensions

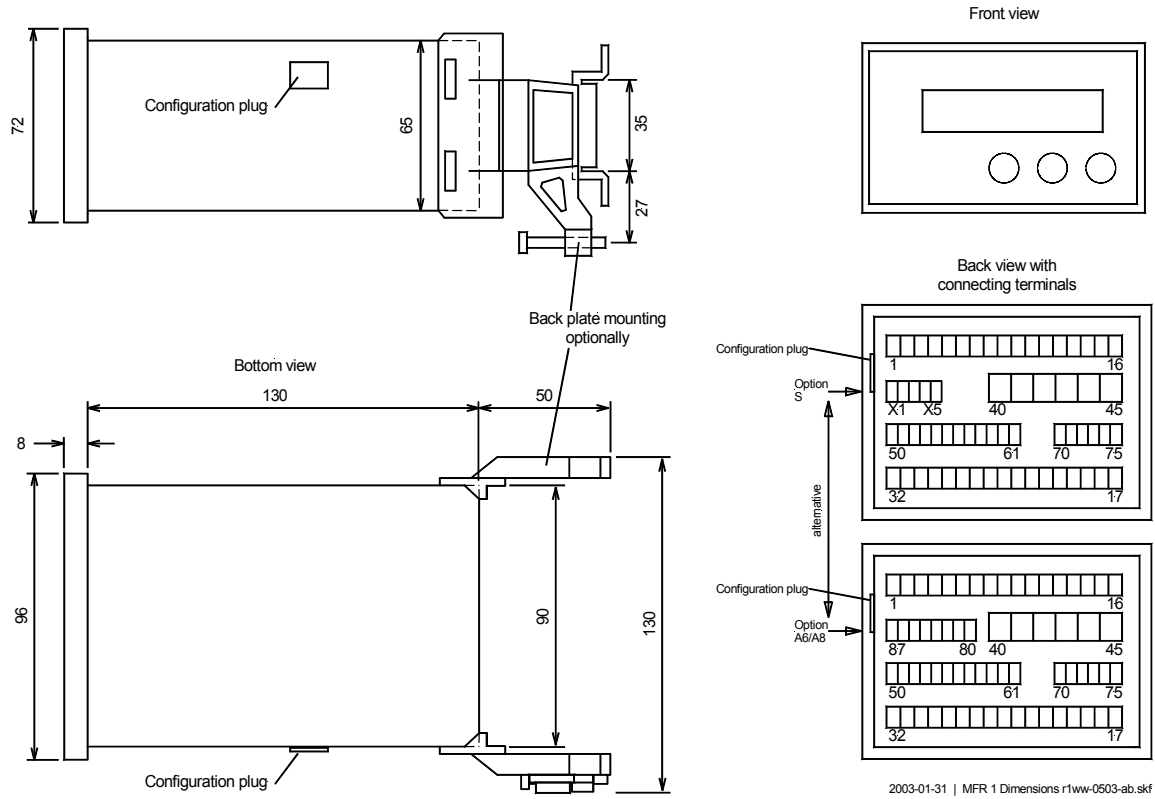
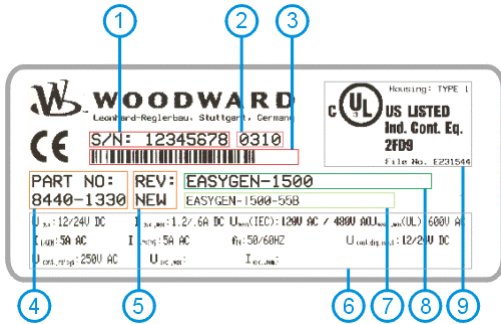


Figure 7-1: Dimensions

Appendix B. Technical Data

Nameplate -----



- | |
|--|
| <p>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 UL UL sign</p> |
|--|

Measuring voltage -----

- Measuring voltage Standard (V_{rated}) \sphericalangle/Δ [1] 66/115 Vac
 [4] 230/400 Vac
- Maximum value V_{ph-ph} max. (UL/cUL)..... [1] max. 150 Vac
 [4] max. 300 Vac
- Rated voltage $V_{ph-ground}$ [1] 150 Vac
 [4] 300 Vac
- Rated surge voltage..... [1] 2.5 kV
 [4] 4.0 kV
- Measuring frequency 40.0 to 80.0 Hz
- Accuracy Class 1
- Resistance 0.1 %
- Linear measuring range..... $1.3 \times V_{rated}$
- Input resistance [1] 0.21 M Ω
 [4] 0.7 M Ω
- Maximum power consumption per path 0.15 W

Measuring current-----isolated

- Measuring current I_{rated}[1] ..1 A
 [5] ..5 A
- Accuracy Class 1
- Linear measuring range..... $3.0 \times I_{rated}$
- Power consumption..... < 0.15 VA
- Rated short-time current (1 s) [1] $100.0 \times I_{rated}$
 [5] $20.0 \times I_{rated}$

Ambient variables -----

- Power supply Standard..... 24 Vdc (18 to 30 Vdc)
- Wide range power supply (Option N)..... 90 to 265 Vac/dc
- Intrinsic consumption.....max. 12 W
- Ambient temperature Storage -40 to 85 °C / -40 to 185 °F
 Operational -20 to 70 °C / -4 to 158 °F
- Ambient humidity95 %, not condensing
- Maximum altitude 2000 m
- Degree of pollution 2

Discrete inputs -----	isolated
- Input range ($V_{Cont, discrete input}$)	Rated voltage 18 to 250 Vac/dc
- Input resistance	approx. 68 k Ω
Relay outputs -----	potential free
- Contact material.....	AgCdO
- General purpose (GP) ($V_{Cont, relay output}$)	
	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) ($V_{Cont, relay output}$)	
	AC
	DC 1.00 Adc@24 Vdc
	0.22 Adc@125 Vdc
	0.10 Adc@250 Vdc
Analog outputs -----	isolated
- At rated value	freely scaleable
- Insulation voltage	3000 Vdc
- Resolution PWM	12 Bit
- -20/0/4 to +20 mA output	Maximum load 400 Ω
- -10/0 to 10 Vdc output.....	Internal resistance \leq 1 k Ω
Interface -----	isolated
- Insulation voltage	3000 Vdc
- Version	variable
Housing -----	
- Type.....	APRANORM DIN 43 700
- Dimensions (W \times H \times D)	96 \times 72 \times 130 mm
- Front cutout (W \times H).....	91 [+1.0] \times 67 [+0.7] mm
- Wiring.....	Screw-type terminals depending on connector 1.5 mm ² , 2.5 mm ² , or 4 mm ²
- Recommended tightening torque	[1.5 mm ² / 2.5 mm ²] 0.5 Nm, [4 mm ²] 0.6 Nm
	use 60/75 °C copper wire only
	use class 1 wire only or equivalent
- Weight	approx. 800 g
Protection -----	
- Protection system.....	IP42 from front with correct mounting
	IP54 from front with gasket (gasket: P/N 8923-1036)
	IP21 from back
- Front foil.....	insulating surface
- EMC test (CE)	tested according to applicable EN guidelines
- Listings	CE marking; UL listing for ordinary locations
	UL/cUL listed, Ordinary Locations, File No.: E231544
	(Option N not UL/cUL listed)
- Marine-Approval	GL

Appendix C.

Measured Quantities and Accuracy

Measuring value	Display/range	Accuracy	Note
Frequency			
f_{L1}, f_{L2}, f_{L3}	40.0 to 80.0 Hz	0.05 Hz	
Voltage			
$V_{L1}, V_{L2}, V_{L3}, V_{L12}, V_{L23}, V_{L31}$	0 to 520 V/0 to 65 kV	1 %	Accuracy depending on the configured transformer ratio
Current			
I_{L1}, I_{L2}, I_{L3}	0 to 9,999 A	1 %	Accuracy depending on the configured transformer ratio
Real power			
Total real actual power	-32.0 to 32.0 MW	2 %	Accuracy depending on the configured transformer ratio
Re-active power			
Actual value in L1, L2, L3	-32.0 to 32.0 Mvar	2 %	Accuracy depending on the configured transformer ratio
Apparent power			
Actual value in L1, L2, L3	0 to 45.0 MVA	2 %	Accuracy depending on the configured transformer ratio
Power factor (cos ϕ)			
Actual value (cos ϕ_{L1})	c0.00 to 1.00 to i0.00	1.5 °	-
Miscellaneous			
Active energy	0 to 4200 GWh		-

Reference conditions: The data apply to the following reference conditions:

- Input voltage = sinusoidal rated voltage
- Input current = sinusoidal rated current
- Frequency = rated frequency ± 2 %
- Power supply = rated voltage ± 2 %
- Power factor $\cos \phi = 1$
- Ambient temperature $23\text{ °C} \pm 2\text{ K}$
- Warm-up period = 20 minutes.

Appendix D. Interface Telegram

Communication Interface Addresses



Transmission Message

Number				Content (words)	Unit	Remark	
3964	Modbus	CAN bus	Profibus				
00	01	1 (02, 03)	MUX=1, 1	0	Telegram header	"302"	Telegram type
02	03	2 (04, 05)	MUX=1, 2	1	Voltage L12	V	
04	05	3 (06, 07)	MUX=1, 3	2	Voltage L23	V	
06	07	4 (08, 09)	MUX=2, 1	3	Voltage L31	V	
08	09	5 (10, 11)	MUX=2, 2	4	Voltage L1N	V	
10	11	6 (12, 13)	MUX=2, 3	5	Voltage L2N	V	
12	13	7 (14, 15)	MUX=3, 1	6	Voltage L3N	V	
14	15	8 (16, 17)	MUX=3, 2	7	Frequency L12	Hz × 100	
16	17	9 (18, 19)	MUX=3, 3	8	Current L1	A	
18	19	10 (20, 21)	MUX=4, 1	9	Current L2	A	
20	21	11 (22, 23)	MUX=4, 2	10	Current L3	A	
22	23	12 (24, 25)	MUX=4, 3	11	Power factor cosphi	dim.less × 100	
24	25	13 (26, 27)	MUX=5, 1	12	Real power	kW	
26	27	14 (28, 29)	MUX=5, 2	13	Reactive power	kvar	
28	29	15 (30, 31)	MUX=5, 3	14	Busbar voltage L12	V	
30	31	16 (32, 33)	MUX=6, 1	15	Busbar voltage L12	Hz × 100	
32	17	34	MUX=6, 2	16	Exponent	dim.less	VGN
33	17	35	MUX=6, 2	16		dim.less	IGN
34	18	36	MUX=6, 3	17	Exponent	dim.less	PGN/QGN
35	18	37	MUX=6, 3	17		dim.less	VSS
36	37	19 (38, 39)	MUX=7, 1	18	Generator real energy	kWh	High Word
38	39	20 (40, 41)	MUX=7, 2	19		kWh	Low Word
40	41	21 (42, 43)	MUX=7, 3	20	Internal alarms 1 Note (example bit 15/14): 0/1 = alarm not triggered 1/0 = alarm triggered	Bit 15 = 1 \	Overfrequency level 2
						Bit 14 = 0 /	
						Bit 13 = 1 \	Underfrequency level 2
						Bit 12 = 0 /	
						Bit 11 = 1 \	Overvoltage level 2
						Bit 10 = 0 /	
						Bit 9 = 1 \	Overvoltage level 2
						Bit 8 = 0 /	
					Bit 7 = 1 \	Unbalanced load	
					Bit 6 = 0 /		
					Bit 5 = 1 \	Overcurrent level 1	
					Bit 4 = 0 /		
					Bit 3 = 1 \	Overload	
					Bit 2 = 0 /		
					Bit 1 = 1 \	Reverse/reduced power	
					Bit 0 = 0 /		

Number				Content (words)	Unit	Remark		
3964	Modbus	CAN bus	Profibus					
42	43	22 (44, 45)	MUX=8, 1	21	Internal alarms 2	Bit 15 = 1 \	Overfrequency level 1	
						Bit 14 = 0 /		
						Bit 13 = 1 \		Underfrequency level 1
						Bit 12 = 0 /		
						Bit 11 = 1 \		Overvoltage level 1
						Bit 10 = 0 /		
						Bit 9 = 1 \		Undervoltage level 1
						Bit 8 = 0 /		
Bit 7 = 1 \	Overcurrent level 3							
Bit 6 = 0 /								
Bit 5 = 1 \	df/dt alarm							
Bit 4 = 0 /								
Bit 3 = 1 \	Asymmetry (voltage)							
Bit 2 = 0 /								
Bit 1 = 1 \	Vector/phase jump							
Bit 0 = 0 /								
44	45	23 (46, 47)	MUX=8, 2	22	Internal alarms 3	Bit 15 = 1 \	Power factor level 1	
						Bit 14 = 0 /		
						Bit 13 = 1 \		Power factor level 2
						Bit 12 = 0 /		
						Bit 11 = 1 \		Inductive reactive power
						Bit 10 = 0 /		
						Bit 9 = 1 \		Capacitive reactive power
						Bit 8 = 0 /		
Bit 7 = 1 \	Positive real power surge							
Bit 6 = 0 /								
Bit 5 = 1 \	Negative real power surge							
Bit 4 = 0 /								
Bit 3 = 1 \	Overcurrent level 2							
Bit 2 = 0 /								
Bit 1 = 1 \	Interface fault							
Bit 0 = 0 /								
46	47	24 (48, 49)	MUX=8, 3	23	Internal alarms 4	Bit 15 = 1 \	Busbar : Overfrequency	
						Bit 14 = 0 /		
						Bit 13 = 1 \	Busbar : Underfrequency	
						Bit 12 = 0 /		
						Bit 11 = 1 \	Busbar : Overvoltage	
						Bit 10 = 0 /		
						Bit 9 = 1 \	Busbar : Undervoltage	
						Bit 8 = 0 /		
Bit 7 = 1 \	Internal							
Bit 6 = 0 /								
Bit 5 = 1 \	Internal							
Bit 4 = 0 /								
Bit 3 = 1 \	Internal							
Bit 2 = 0 /								
Bit 1 = 1 \	Internal							
Bit 0 = 0 /								

Note (example bit 15/14):
0/1 = alarm not triggered
1/0 = alarm triggered

Note (example bit 15/14):
0/1 = alarm not triggered
1/0 = alarm triggered

Note (example bit 15/14):
0/1 = alarm not triggered
1/0 = alarm triggered

Number				Content (words)	Unit	Remark		
3964	Modbus	CAN bus	Profibus					
48	49	25 (50, 51)	MUX=9, 1	24	Internal alarms 5	Bit 15 = 1 \	Internal	
						Bit 14 = 0 /		
						Bit 13 = 1 \		Internal
						Bit 12 = 0 /		
						Bit 11 = 1 \		Internal
						Bit 10 = 0 /		
						Bit 9 = 1 \		Internal
						Bit 8 = 0 /		
						Bit 7 = 1 \		Internal
						Bit 6 = 0 /		
Bit 5 = 1 \	Internal							
Bit 4 = 0 /								
Bit 3 = 1 \	Zero voltage							
Bit 2 = 0 /								
Bit 1 = 1 \	Power level reached							
Bit 0 = 0 /								
50	51	26 (52, 53)	MUX=9, 2	25	Internal alarms 6	Bit 15 = 1 \	Ground fault Ue, level 1	
						Bit 14 = 0 /		
						Bit 13 = 1 \	Internal	
						Bit 12 = 0 /		
						Bit 11 = 1 \	Internal	
						Bit 10 = 0 /		
						Bit 9 = 1 \	Internal	
						Bit 8 = 0 /		
						Bit 7 = 1 \	Internal	
						Bit 6 = 0 /		
Bit 5 = 1 \	Ground fault Ue, level 2							
Bit 4 = 0 /								
Bit 3 = 1 \	Internal							
Bit 2 = 0 /								
Bit 1 = 1 \	Internal							
Bit 0 = 0 /								
Note (example bit 15/14): 0/1 = alarm not triggered 1/0 = alarm triggered								
Note (example bit 15/14): 0/1 = alarm not triggered 1/0 = alarm triggered								

Receive Message

Number		Content (words)	Unit	Remark
3964	Modbus			
00 01	1 (02, 03)	Set point value active power $P_{Setpoint}$	kW	0 to 32000
02 03	2 (04, 05)	Set point value Power factor $\varphi_{Setpoint}$	Power factor \times 100	-99 to 100 ¹
04 05	3 (06, 07)	Control word	Bit 15 = 1	Blocking of watchdog active ²
			Bit 14 = 1	free
			Bit 13 = 1	free
			Bit 12 = 1	free
			Bit 11 = 1	free
			Bit 10 = 1	Release isolated operation ³
			Bit 9 = 1	free
			Bit 8 = 1	Y : Release power circuit breaker / G : Release controller ⁴
			Bit 7 = 1	free
			Bit 6 = 1	free
			Bit 5 = 1	free
			Bit 4 = 1	Acknowledge ⁵
Bit 3 = 1	Transmission watchdog bit 1 ⁶			
Bit 2 = 1	Transmission watchdog bits 0 ⁶			
Bit 1 = 1	free			
Bit 0 = 1	free			
06 07	4 (08, 09)	Setpoint frequency $f_{Setpoint}$	Hz \times 100	3200 to 6800 ⁷
08 09	5 (10, 11)	Setpoint voltage $V_{Setpoint}$	V	0 to 480 ⁸
10 11	6 (12, 13)	free		

¹ The transmitted number has a sign (When connected correctly - = capacitive, + = inductive; 100 means power factor = 1)

² This control bit is ignored, if the screen "Blocking via interface" is set to "OFF".

³ Corresponds to the digital input "Release isolated operation" (terminal 73/74).

⁴ **Option Y/G**: Corresponds to the digital input "Release CB"/"Release controller" (terminal 30/31).

⁵ Corresponds to the button "Acknowledge" (edge).

⁶ Here, a "00" must always be sent. If these bits are not set to "00", no later than 15 seconds after the alarm "Interface triggered" is sent (only if the screen "Interface monitoring" is set to "ON").

⁷ Example: 4856 = 48.56 Hz

⁸ The voltage set point relates to the set secondary voltage.

For voltage transformers 10.0 kV/100 V a voltage set point value of 100 V must be set (corresponds to $V_{Setpoint} = 10.0$ kV)

Description of the Data Format



NOTE

Certain addresses have two parts, the measured value and the exponent multiplier!

Voltage and current	0 to 9999 without sign	measured in [V, A], no exponent
Real power	0 to 9999 with sign	measured in [W]; data format: two's complement positive = positive power negative = negative power (reverse power)
Reactive power	0 to 9999 with sign	measured in [var]; data format: two's complement positive = inductive negative = capacitive
Frequency		measured in [Hz × 100]
Real energy	32 Bit	measured in [kWh]; data format: two's complement positive = exported real energy negative = imported real energy
power factor	-99 to +100	measured in [cos phi × 100] positive = inductive, generator over-excited negative = capacitive, generator under-excited

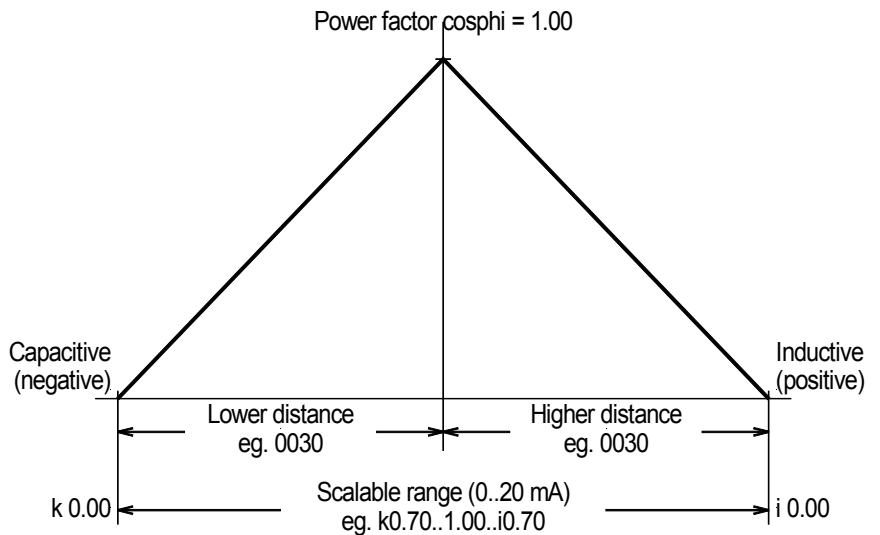


Figure 7-2: Interface, cosphi scaling

Examples

$$V_{G12} = 103, \text{ exponent} = 2 \\ 103 \times 10^2 \text{ [V]} = 1,030 \text{ [V]} = 10.3 \text{ kV}$$

$$I_{G1} = 80, \text{ exponent} = -1 \\ 80 \times 10^{-1} \text{ [A]} = 8.0 \text{ [A]} = 8.0 \text{ A}$$

$$P_{GN} = 123, \text{ exponent} = 4 \\ 123 \times 10^4 \text{ [W]} = 1,230,000 \text{ [W]} = 1.23 \text{ MW}$$

$$P_{GN} = 803, \text{ exponent} = 2 \\ 803 \times 10^2 \text{ [W]} = 80,300 \text{ [W]} = 80.3 \text{ kW}$$

$$f_{GN} = 5230 \\ 5230 \text{ [Hz} \times 100] = 52.30 \text{ [Hz]} = 52.3 \text{ Hz}$$

$$\cos \phi = 87 \\ 87 \text{ [Cos } \phi \times 100] = 0.87 \text{ [Cos } \phi] = 0.87$$

Bit Change at Tripping of a Watchdog Function

If one of the watchdog functions (protective alarms) trips, the corresponding bits (for example bit 15/14 = over-frequency limit 2) will change from not tripped (= 0/1) to tripped (= 1/0).

Framework Data for the Interfaces



Framework Data for Procedure 3964 (TTY, RS-232, RS-485)

String length.....8 bit
 Stop bit.....1 bit
 Parity bit.....1 bit with even parity
 Idle state.....This corresponds to the state log. "1" (20 mA with TTY)
 Data format.....16 bit binary value
 Transmission rate.....9,600 Baud.
 Other baud rates on request. The records are transferred cyclically.

RK 512 interpreter procedure: See Siemens documentation on procedure 3,964.

Framework Data for Hardware Handshaking RTS/CTS (RS-232, RS-422)

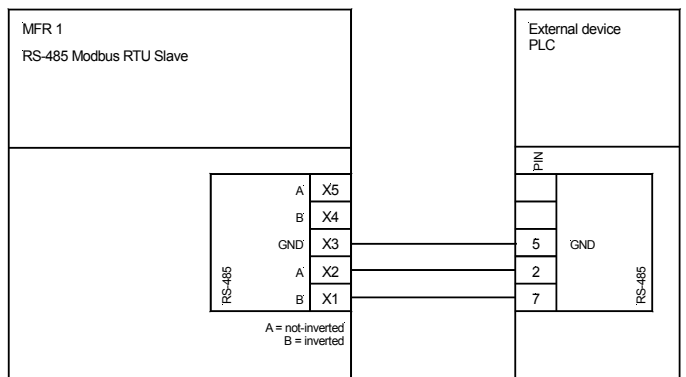
String length.....8 bit
 Stop bit.....1 bit
 Parity bit.....1 bit with even parity
 Idle state.....This corresponds to the state log. "1" (20 mA with TTY)
 Data format.....16 bit binary value
 Transmission rate.....9,600 Baud.
 Other baud rates on request. The records are transferred cyclically.

Procedure: When the transmitter is ready for data transmission, it notifies the receiver of this by switching its control line RTS to "ON". The prerequisite of this is that no data are received (CTS = "OFF"). The receiver registers this status and indicates its readiness to receive by switching its RTS line to "ON". The transmitter can then begin transmitting when it detects this "ON" status on its CTS line. As soon as the receiver withdraws its RTS signal (RTS = "OFF"), the transmitter interrupts its transmission and waits until the receiver is ready to receive again. The initialization conflict (both subscribers set the RTS line simultaneously) and timeout (one subscriber waits in vain for a reply) must be taken into consideration.

Framework Data for Modbus RTU Slave

Transmitting protocol.....MOD bus RTU slave
 Hardware.....Interface RS-485
 Transmission rate.....adjustable
 Slave address.....adjustable
 Parity.....adjustable

A maximum of 10 words can be read or 4 words written with one command. Modbus function codes 03, 04, 06 and 16 are supported.



2005-08-31 | Data coupling 2005-08-31.skf

Figure 7-3: Interface - Modbus connection

Framework Data for CAN Bus

Transmitting protocol CAN (CiA)
 Hardware CAN bus
 Transmission rate..... adjustable
 Special characteristic Bt0 = 03, Bt1 = 1C

Every 200 ms a data telegram of 8 bytes is sent, which is structured as follows (all word variables are in the high byte / low byte format):

Transmission Data

ID Base ID sending + CAN number

Byte 1 Multiplexer [1 to 9]
 Byte 2 always 221
 Byte 3/4 1. data word (note table, no. 1), multiplexed (MUX = 1, 1)
 Byte 5/6 2. data word (note table, no. 2), multiplexed (MUX = 1, 2)
 Byte 7/8 3. data word (note table, no. 3), multiplexed (MUX = 1, 3)
 etc.

Control Data (Option SB)

ID Base ID control + CAN number

A data telegram of 7 Bytes is expected, which is structured as follows (all word variables are in the high byte / low byte format):

Byte 1 Multiplexer
 Byte 2/3 1. data word (note table, no. 1), multiplexed (MUX = 1, 1)
 Byte 4/5 2. data word (note table, no. 2), multiplexed (MUX = 1, 2)
 Byte 6/7 3. data word (note table, no. 3), multiplexed (MUX = 1, 3)
 etc.

Configuration Data (Option SF)

ID ID configure (default value: 831)

No ID's can be assigned twice in the system. This applies for all devices coupled to the bus system. Likewise all ID's set on the unit must be set to different values.

Procedure for base-ID transmission: All units available in the bus system are assigned to the same "Base ID transmission". The types of information are grouped in this way.

Example: The base ID transmission = 800 is used with all units. The individual ID's are assigned to the various unit numbers.

Unit number 1: ID = 801
 Unit number 2: ID = 802
 etc.

Procedure for base ID control: The same procedure applies for base-ID control. (Standard value 224)

Framework Data for Profibus DP

Receiving Range

Byte 0 and the followingTelegram according to description

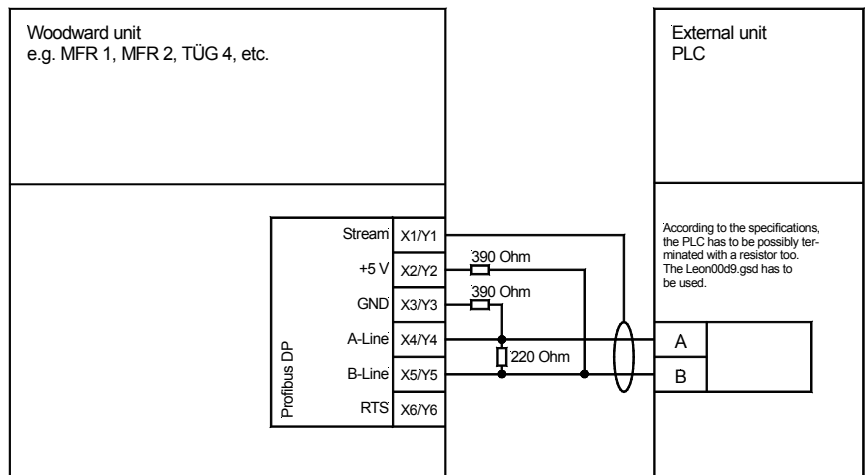
Example:No. 1 - Byte 0/1 = telegram header "302"
 No. 2 - Byte 2/3 = voltage L12
 No. 3 - Byte 4/5 = voltage L23
 No. 4 - Byte 6/7 = voltage L31
 etc.

Byte 185The bit 0 toggles every 2.5 seconds. This can be used for control if the interface still functions flawlessly.

Transmitting Range (Option SB)

Byte 0Block pre-selection (is not taken into account)
 Byte 1The bit 0 is used as a watchdog. If monitoring is switched ON in the configuration screen, this bit must be toggle every 4 seconds. The unit monitors this and possibly triggers a fault and reinitializes the interface.
 Byte 8/9Control word 1
 Byte 10/11Control word 2
 Byte 12/13Control word 3

Connection Example



2003-01-24 | Datenkopplung 2003-01-24.skf

Figure 7-4: Interface, Profibus DP slave

Appendix E. List of Parameters

Product number P/N _____ Rev _____
 Version MFR 15 _____
 Project _____
 Serial number S/N _____ Date _____

Option	Parameter	Setting range	Default setting	Customer setting
BASIC DATA				
	Software version	-	-	
	SPRACHE/LANGUAGE	German/English	English	<input type="checkbox"/> G <input type="checkbox"/> E <input type="checkbox"/> G <input type="checkbox"/> E
	Enter code	0000 to 9999	-	
	Password Protection	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 0
	Define level 1 code	0000 to 9999	0001	
	Define level 2 code	0000 to 9999	0002	
	Direct parametr.	YES/NO	NO	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> Y <input type="checkbox"/> N
MEASUREMENT				
	Volt.-Measuring	Phase to phase / Phase-neutral	Phase-neutral	<input type="checkbox"/> pn <input type="checkbox"/> pp <input type="checkbox"/> pn <input type="checkbox"/> pp
	Volt.transformer secondary	50 to 125/50 to 480 V	100/400 V	
	Volt.transformer primary	00.100 to 65.000 kV	00.400 kV	
	Volt.transformer sec.(GN)	50 to 125/50 to 480 V	100/400 V	
	Volt.transformer prim(GN)	00.100 to 65.000 kV	00.400 kV	
	Volt.transformer sec.(MN)	50 to 125/50 to 480 V	100/400 V	
	Volt.transformer prim(MN)	00.100 to 65.000 kV	00.400 kV	
	Current transf.	1,999/{x} A	1,000/{x} A	
G/GU	Rated voltage	5 to 125/10 to 480 V	100/400 V	
G/GF	Rated frequency	40.0 to 70.0 Hz	50.0 Hz	
	Rated current	1 to 9,999 A	1,000 A	
	Rated power	5 to 32,000 kW	500 kW	
	Power measuring	one-phase/three-phase	three-phase	<input type="checkbox"/> s <input type="checkbox"/> t <input type="checkbox"/> s <input type="checkbox"/> t
CONTROL FUNCTIONS				
Y	Synchronizing	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 0
..	Synchronization df max	0.02 to 0.49 Hz	0.18 Hz	
..	Synchronization df min	0.00 to -0.49 Hz	-0.10 Hz	
..	Synchronization dV max	0.1 to 15.0 %	6.0 %	
..	Signal CB On Logic	constant / impulse	impulse	<input type="checkbox"/> c <input type="checkbox"/> i <input type="checkbox"/> c <input type="checkbox"/> i
..	Synchronization Time pulse>	50 to 250 ms	200 ms	
..	Gen.circ.breaker Pick-up t.	40 to 300 ms	80 ms	
..	Dead busbar Operation	ON/OFF	OFF	<input type="checkbox"/> 1 <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 0
..	Dead busbar op. df max	0.05 to 5.00 Hz	0.25 Hz	
Y	Dead busbar op. dV max	0.0 to 20.0 %	10.0 %	
CONTROLLER CONFIGURATION				
	Aut.idle running control	ON/OFF	OFF	<input type="checkbox"/> 1 <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 0
G/GF/Y	Freq. controller	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 0
G/GF	Freq. controller Setp.	variable / fixed	fixed	<input type="checkbox"/> v <input type="checkbox"/> f <input type="checkbox"/> v <input type="checkbox"/> f
G/GF/Y	Freq. controller Setpoint	48.0 to 62.0 Hz	50.0 Hz	
G/GF..	Freq. controller min.value	48.0 to 62.0 Hz	48.0 Hz	
....	Freq. controller max.value	48.0 to 62.0 Hz	52.0 Hz	
..	Setpoint voltage Poti f	0.10 to 10.00 Hz/s	0.10 Hz/s	
G/GF	Setpoint Ramp	0.10 to 10.00 Hz/s	1.00 Hz/s	

Option	Parameter	Setting range	Default setting	Customer setting
G/GF/Y	Freq. controller Dead band	0.02 to 1.00 Hz	0.10 Hz	
..	Freq. controller Time pulse>	10 to 250 ms	80 ms	
G/GF/Y	Freq. controller gain	0.1 to 99.9	10.0	
G/Y _{QF}	Pr-sensitivity Freq.	1 to 240	30	
..	Reset time Freq.	0.0 to 60.0 s	2.5 s	
G/Y _{QF}	Derivative act. time (freq)	0.00 to 6.00 s	0.20 s	
G/Y	Freq. controller Droop	0.0 to 20.0 %	5.0 %	
B	Power controller	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0
B+X..	External setp. Adjustment	ON/OFF	OFF	<input type="checkbox"/> 1 <input type="checkbox"/> 0
..	Analog input	0 to 20 mA / 4 to 20 mA	0 to 20 mA	<input type="checkbox"/> 0 <input type="checkbox"/> 4
..	External setp. 0 mA	0 to 32000 kW	000 kW	
B+X	External setp. 20 mA	0 to 32000 kW	500 kW	
B	Power controller Setpoint	0 to 32000 kW	500 kW	
..	Power controller Ramp	0 to 100 %	50 %	
..	Power limitation P. max	10 to 120 %	100 %	
..	Power controller Dead band	0.1 to 25.0 %	2.5 %	
..	Power controller Sens.red.	1.0 to 9.9	2.0	
..	Power controller T.impuls >	10 to 250 ms	80 ms	
..	Power controller Gain	0.1 to 99.9	5.0	
B	Power controller Sens.red.	1.0 to 9.9	2.0	
B _{QF}	Pr.-sensitivity Power	1 to 240	30	
..	Reset time Power Tn	0.2 to 60 s	2.5 s	
B _{QF}	Deriv. act.time Power Tv	0.0 to 6.0 s	0.20 s	
B	Power reduction Setpoint	5 to 110 %	15 %	
B	Power reduction Time	0 to 600 s	5 s	
G/GU/Y	Volt. controller	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0
G/GU	Volt. controller Setp.	variable / fixed	fixed	<input type="checkbox"/> v <input type="checkbox"/> f
G/GU/Y	Volt. controller Setpoint	50 to 125 V / 70 to 440 V	100 / 400 V	
G/GU	Setpoint voltage min. value	50 to 125 V / 70 to 440 V	90 / 360 V	
..	Setpoint voltage max. value	50 to 125 V / 70 to 440 V	1190 / 440 V	
..	Setpoint voltage Gradient	1 to 20 V/S	2 V/S	
G/GU	Setpoint voltage Ramp	1 to 20 V/S	2 V/S	
G/GU/Y	Volt. controller Dead band	0.1 to 15.0 V / 0.5 to 60.0 V	3.0 V	
..	Volt. controller Sens.red.	1.0 to 9.9	2.0	
..	Volt. controller Time pulse >	20 to 250 ms	80 ms	
G/GU/Y	Volt. controller Gain	0.1 to 99.9	10.0	
G/Y _{QU}	Pr-sensitivity Volt.	1 to 240	30	
..	Reset time Volt.	0.0 to 60.0 s	2.5 s	
G/Y _{QU}	Derivative act. time (Volt)	0.00 to 6.00 s	0.20 s	
G/GU/Y	Volt. controller Droop	0.0 to 20.0 %	5.0 %	
C	Power-factor controller	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0
C _G GU	Pow.fact.contr. Setp.	variable / fixed	fixed	<input type="checkbox"/> v <input type="checkbox"/> f
C	Pow.fact.contr. Setpoint	i0.70 to 1.00 to c0.70	1.00	
C _G GU	Setp. pow.fact. min. value	i0.70 to 1.00 to c0.70	c0.80	
..	Setp. pow.fact. max. value	i0.70 to 1.00 to c0.70	i0.80	
..	Setp. pow.fact. Gradient	0.01 to 0.30 /s	0.05 /s	
C _G GU	Setp. pow.fact. Ramp	0.01 to 0.30 /s	0.05 /s	
C	Pow.fact.contr. Dead band	0.5 to 25.0 %	2.5 %	
..	Pow.fact.contr. Sens.red.	1.0 to 9.9	2.0	
..	Pow.fact.contr. Time pulse >	20 to 250 ms	80 ms	
C	Pow.fact.contr. Gain	0.1 to 99.9	5.0	
C _{QU}	Pr.-sensitivity Pow.f.	1 to 240	30	
..	Reset time Pow.f.	0.2 to 60 s	2.5 s	
C _{QU}	Derivative act. time (cos)	0.0 to 6.0 s	0.20 s	
B/W/O	Stop sequence	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0
B/W/O	Stop sequence Ramp	1 to 100 %/s	5 %/s	
W	Active power Load share	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0
W	Act. load share Frequency	10 to 99 %/s	50 %	
O	Reactive power Load share	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0
O	React.load share Voltage	10 to 99 %/s	50 %	

Option	Parameter	Setting range	Default setting	Customer setting
PROTECTION				
U	Volt. Monitoring	Phase-neutral / Phase to phase	Phase to phase	<input type="checkbox"/> pp <input type="checkbox"/> pn <input type="checkbox"/> pp <input type="checkbox"/> pn
..	Overvoltage Monitoring	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 0
..	Overvoltage 1 V(ph-ph)>	20 to 130 / 520 V	110/440 V	
..	(Phase-N)>	10 to 75 / 300 V	64/254 V	
..	Overvoltage 1 Delay	0.02 to 99.98 s	0.10 s	
..	Overvoltage 2 V(ph-ph)>	20 to 130 / 520 V	120/480 V	
..	(Phase-N)>	10 to 75 / 300 V V	64/254 V	
..	Overvoltage 2 Delay	0.02 to 99.98 s	0.04	
..	Overvoltage Hysteresis	0 to 99 V	1/4 V	
..	Undervoltage Monitoring	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 0
..	Undervoltage 1 V(ph-ph)<	20 to 130 / 520 V	90/360 V	
..	(Phase-N)<	10 to 75 / 300 V	51/207 V	
..	Undervoltage 1 Delay	0.02 to 99.98 s	0.10 s	
..	Undervoltage 2 V(ph-ph)<	20 to 130 / 520 V	80/320 V	
..	(Phase-N)<	10 to 75 / 300 V	46/184 V	
..	Undervoltage 2 Delay	0.02 to 99.98 s	0.04 s	
..	Undervoltage Hysteresis	0 to 99 V	1/4 V	
..	Asymmetry- Monitoring	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 0
..	Asymmetry Response v.	0 to 99 V	10/40/69 V	
..	Asymmetry Delay	0.02 to 99.98 s	2.00 s	
..	Asymmetry Hysteresis	0 to 99 V	1/4 V	
..	Overfrequency- Monitoring	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 0
..	Overfrequency 1 f>	40.00 to 80.00 Hz	50.2 Hz	
..	Overfrequency 1 Delay	0.02 to 99.98 s	0.10 s	
..	Overfrequency 2 f>	40.00 to 80.00 Hz	51.0 Hz	
..	Overfrequency 2 Delay	0.02 to 99.98 s	0.04 s	
..	Overfrequency Hysteresis	0.01 to 9.99 Hz	0.05 Hz	
..	Underfrequency- Monitoring	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 0
..	Underfrequency 1 f<	40.00 to 80.00 Hz	49.8 Hz	
..	Underfrequency 1 Delay	0.02 to 99.98 s	0.10 s	
..	Underfrequency 2 f<	40.00 to 80.00 Hz	49.0 Hz	
..	Underfrequency 2 Delay	0.02 to 99.98 s	0.04 s	
U	Underfrequency Hysteresis	0.01 to 9.99 Hz	0.05 Hz	
V	Phase jump monitoring	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 0
..	Phase jump mon.	one/three-phase / 3 phase only	3 phase only	<input type="checkbox"/> 1/3 <input type="checkbox"/> 3 <input type="checkbox"/> 1/3 <input type="checkbox"/> 3
..	Phase-jump value (one phase)	3 to 90 °	30 °	
V	Phase-jump value (3-phase)	3 to 90 °	8 °	
D	df/dt- Monitoring	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 0
..	df/dt Response>	1.0 to 9.9 Hz/s	2.5 Hz/s	
D	df/dt Delay	0.1 to 9.9 s	0.1 s	
IZ	Overcurrent Monitoring	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 0
..	Overcurrent 1 I>	0 to 300 %	120 %	
..	Overcurrent 1 Delay	0.02 to 99.98 s	0.1 s	
..	Overcurrent 2 I>	0 to 300 %	160 %	
..	Overcurrent 2 Delay	0.02 to 99.98 s	0.04 s	
..	Overcurrent 3 I>	0 to 300 %		
..	Overcurrent 3 Delay	0.02 to 99.98 s		
IZ	Overcurrent Hysteresis	1 to 300 %	5 %	
PM	Overload Monitoring	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 0
..	Overload Response v.	0 to 150 %	120 %	
..	Overload Delay	0 to 300 s	20 s	
..	Overload Hysteresis	1 to 99 %	2 %	
..	Reverse/min.pow. Monitoring	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 0
..	Reverse/min.pow.	-99 to 99 %	-10 %	
..	Reverse/min.pow. Delay	0.02 to 99.98 s	3.0 s	
PM	Reverse/min.pow. Hysteresis	1 to 99 %	2 %	
PS	Unbalanced load Monitoring	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 0
..	Unbalanced load Response v.	0 to 100 %	20 %	
..	Unbalanced load Delay	0.02 to 99.98 s	0.25 s	
PS	Unbalanced load Hysteresis	1 to 20 %	5 %	

Option	Parameter	Setting range	Default setting	Customer setting
PROTECTION				
ZQ	Reactive power Monitoring	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0
..	Cap. react. pow. Response v.	0 to 100 %	30 %	<input type="checkbox"/> 1 <input type="checkbox"/> 0
..	Cap. react. pow. Delay	0.02 to 99.98 s	0.10 s	
..	Ind. react. pow. Response v.	0 to 100 %	30 %	
..	Ind. react. pow. Delay	0.02 to 99.98 s	0.10 s	
ZQ	React. pow. mon. Hysteresis	1 to 20 %	2 %	
ZC	cos-phi Moniotring	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0
..	cos-phi 1 Response v.	c0.01 to 1.00 to i0.01	i0.80	
..	cos-phi 1 Delay	0.02 to 99.98 s	0.10 s	
..	cos-phi 2 Response v.	c0.01 to 1.00 to i0.01	c0.80	
..	cos-phi 2 Delay	0.02 to 99.98 s	0.10 s	
ZC	cos-phi mon. Hysteresis	0.01 to 0.50	0.01	
ZW	Act. power shift Monitoring	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0
ZW	Release value Power shift	10 to 80 %	10 %	
PZ	Power max output	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0
..	Start next gen. at	0 to 120 %	80 %	
..	Start next gen. Delay	0.0 to 320.0 s	1.0 s	
..	Start next gen. Hysteresis	1 to 99 %	2 %	
PZ	Start next gen. Rel. delay	0.0 to 320.0 s	0.1 s	
US	Busbar voltage Monitoring	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0
..	Busbar overvolt. V >	20 to 130 V / 20 to 520 V	110/440 V	
..	Busbar overvolt. Delay	0.02 to 99.98 s	0.10 s	
..	Busbar undervolt. V <	20 to 130 V / 20 to 520 V	90/360 V	
..	Busbar undervolt. Delay	0.02 to 99.98 s	0.104	
..	Busbar voltage Hysteresis	0 to 99 V	1/4 V	
..	Busbar frequency Monitoring	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0
..	Busbar overfreq. f >	40.00 to 80.00 Hz	50.2 Hz	
..	Busbar overfreq. Delay	0.02 to 99.98 s	0.10 s	
..	Busbar underfrq. f <	40.00 to 80.00 Hz	51.0 Hz	
..	Busbar underfrq. Delay	0.02 to 99.98 s	0.10 s	
US	Busbar frequency Hysteresis	0.01 to 9.99 Hz	0.05 Hz	
RELAY CONFIGURATION				
	External Clearing	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0
	Auto-clearing Relays	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0
U	Release delay Overvoltage	0.02 to 99.98 s	0.10 s	
U	Release delay Undervoltage	0.02 to 99.98 s	0.10 s	
U	Release delay Asymmet.	0.02 to 99.98 s	0.10 s	
U	Release delay Overfreq.	0.02 to 99.98 s	0.10 s	
U	Release delay Underfrq.	0.02 to 99.98 s	0.10 s	
V	Release delay Pha.shift	0.02 to 99.98 s	0.10 s	
D	Release delay df/dt	0.02 to 99.98 s	0.20 s	
IZ	Release delay Overcurrent	0.02 to 99.98 s	0.20 s	
PM	Release delay Overload	0.02 to 99.98 s	0.10 s	
PM	Release delay Reverse load	0.02 to 99.98 s	0.10 s	
PS	Release delay Load unbalance	0.02 to 99.98 s	0.25 s	
ZW	Release delay Load jump	0.02 to 99.98 s	0.10 s	
ZQ	Release delay Reactive p. Q-	0.02 to 99.98 s	0.10 s	
ZQ	Release delay Reactive p. Q+	0.02 to 99.98 s	0.10 s	
ZC	Release delay Power factor 1	0.02 to 99.98 s	0.10 s	
ZC	Release delay Power factor 2	0.02 to 99.98 s	0.10 s	
US	Release delay U>busbar/U<busbar	0.02 to 99.98 s	0.10 s	
US	Release delay f>busbar/f<busbar	0.02 to 99.98 s	0.10 s	
	Auto-clearing Display	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0
	Clearing display after	1 to 99 s	1 s	

Option	Parameter	Setting range	Default setting	Customer setting
RELAY CONFIGURATION				
	Change relay- allocation	YES/NO	YES	<input type="checkbox"/> Y <input type="checkbox"/> N
	Funct. relay 123 (R=release)	R/A	RRR	<input type="checkbox"/> Y <input type="checkbox"/> N
PZ	Boost command to relay	0 to 3	0000	
U	Overvoltage L 1 to relay	0 to 3	0002	
U	Overvoltage L 2 to relay	0 to 3	0002	
U	Undervoltage L 1 to relay	0 to 3	0002	
U	Undervoltage L 2 to relay	0 to 3	0002	
U	Asymmetry to relay	0 to 3	0002	
U	Overfreq. L 1 to relay	0 to 3	0003	
U	Overfreq. L 2 to relay	0 to 3	0003	
U	Underfreq. L 1 to relay	0 to 3	0003	
U	Underfreq. L 2 to relay	0 to 3	0003	
V	Phase shift to relay	0 to 3	0003	
D	df/dt to relay	0 to 3	0003	
IZ	Overcurrent 1 to relay	0 to 3	0002	
IZ	Overcurrent 2 to relay	0 to 3	0002	
PM	Overload to relay	0 to 3	0003	
PM	Reverse power to relay	0 to 3	0003	
PS	Load unbalance to relay	0 to 3	0002	
ZW	Neg. load jump to relay	0 to 3	0002	
ZW	Pos. load jump to relay	0 to 3	0002	
ZQ	cap. Reactive power to relay	0 to 3	0002	
ZQ	ind. Reactive power to relay	0 to 3	0002	
ZC	Power factor 1 to relay	0 to 3	0002	
ZC	Power factor 2 to relay	0 to 3	0002	
US	Busbar overvolt. to relay	0 to 3	0002	
US	Busbar undervolt. to relay	0 to 3	0002	
US	Busbar overfreq. to relay	0 to 3	0002	
US	Busbar underfreq. to relay	0 to 3	0002	
	Centralized fault to relay	0 to 3	0000	
B/W/O	Stoppage to relay	0 to 3	0000	
PULSE OUTPUT CONFIGURATION				
M	Pulse/kWh Logic	positive/negative	negative	
..	Active energy Pulse/kWh	0.10 to 150.00	1.00	
M	RESET kWh	ON/OFF	OFF	<input type="checkbox"/> 1 <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 0

Option	Parameter	Setting range	Default setting	Customer setting
ANALOG OUTPUT CONFIGURATION				
A6/8	Analog output 6	OFF -20 to +20mA 0 to 20 mA 4 to 20 mA	-20 to +20mA	<input type="checkbox"/> OFF <input type="checkbox"/> -/+20mA <input type="checkbox"/> 0-20mA <input type="checkbox"/> 4-20mA
..		OFF -10 to +10 V 0 to 10 V	-10 to +10V	<input type="checkbox"/> OFF <input type="checkbox"/> -/+10V <input type="checkbox"/> 0-10V
..	Analog output 6	see table at the end of this parameter list	Frequency	
..	Analog output 0/-10 mA 0/4/-20 mA		45.00 Hz	
A6/8	Analog output 10 V 20 mA		55.00 Hz	
A8	Analog output 7	OFF -20 to +20mA 0 to 20 mA 4 to 20 mA	-20 to +20mA	<input type="checkbox"/> OFF <input type="checkbox"/> -/+20mA <input type="checkbox"/> 0-20mA <input type="checkbox"/> 4-20mA
..		OFF -10 to +10 V 0 to 10 V	-10 to +10V	<input type="checkbox"/> OFF <input type="checkbox"/> -/+10V <input type="checkbox"/> 0-10V
..	Analog output 7	see table at the end of this parameter list	Reactive power	
..	Analog output 0/-10 mA 0/4/-20 mA		0 kvar	
A8	Analog output 10 V 20 mA		500 kvar	
A8	Analog output 8	OFF -20 to +20mA 0 to 20 mA 4 to 20 mA	-20 to +20mA	<input type="checkbox"/> OFF <input type="checkbox"/> -/+20mA <input type="checkbox"/> 0-20mA <input type="checkbox"/> 4-20mA
..		OFF -10 to +10 V 0 to 10 V	-10 to +10V	<input type="checkbox"/> OFF <input type="checkbox"/> -/+10V <input type="checkbox"/> 0-10V
..	Analog output 8	see table at the end of this parameter list	Apparent power	
..	Analog output 0/-10 mA 0/4/-20 mA		0 kVA	
A8	Analog output 10 V 20 mA		500 kVA	
INTERFACE CONFIGURATION				
S3964	Data block RK512	0 to 255	0	
S3964	Data word RK512	0 to 255	0	
SPRO	Device number Profibus	0 to 126	1	
SMOD	Device number MOD-Bus	0 to 255	1	
..	Baudrate	1200 / 2400 / 4800 / 9600 / 19200 Baud	9600 Baud	
..	Parity	none/even/odd	none	
..	Stopbits	one/two	one	
SMOD	Delay to send MOD-Bus	0.2 to 50.0 ms	0.0 ms	
SCAN	Device number CAN-Bus	1 to 8	1	
..	Baudrate	125 / 250 / 500 kBaud	125 kBaud	
..	Base-ID (send)	0 to 2,015	800	
..	Base-ID (remote)	0 to 2,015	224	
SCAN	ID (parameteriz.)	0 to 2,015	831	
SB	Serial control	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 0
..	Serial interface Monitoring	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 0
..	Interface fault to relay	0 to 3	0003	
SB	Inhibit via Interface	ON/OFF	ON	<input type="checkbox"/> 1 <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 0

Value	Lower and upper setting value	
	0 V, -10 V 0 mA, 4 mA, -20 mA	10 V, 20 mA
Vol 1	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Vol 2	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Vol 3	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Vol ph-N AV	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Vol ph-N max.	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Vol ph-N min.	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Vol 1-2	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Vol 2-3	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Vol 3-1	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Vol ph-ph AV	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Vol ph-ph max.	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Vol ph-ph min.	0 to 65,000 V [LeoPC1: 0 to 32,000 V]	
Frequency	40.00 to 80.00 Hz	
Current L1	0 to 9,999 A	
Current L2	0 to 9,999 A	
Current L3	0 to 9,999 A	
Current AV	0 to 9,999 A	
Current max.	0 to 9,999 A	
Current min.	0 to 9,999 A	
Direct Cur. 11	-9,999 to +9,999 A	
Direct Cur. 21	-9,999 to +9,999 A	
Direct Cur. 31	-9,999 to +9,999 A	
Dir. Current AV1	-9,999 to +9,999 A	
Dir. Current max. ¹	-9,999 to +9,999 A	
Dir. Current min. ¹	-9,999 to +9,999 A	
Active power	-32,000 to +32,000 kW	
Reactive power	-32,000 to +32,000 kvar	
Apparent power	0 to 32,000 kVA	
cosphi	i0.00 to 1.00 to c0.00 [LeoPC1: -70 = k0.70; +70 = i0.70]	

¹..... The sign of the current values is defined by the polarity of the active component.

Table 7-1: Analog outputs, table of values

Appendix F. 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 (refer to "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 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 (711) 789 54-0]. 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 (711) 789 54-0 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.

How to Contact Woodward



Please contact following address if you have questions or if you want to send a product for repair:

Woodward GmbH
Handwerkstrasse 29
70565 Stuttgart - Germany

Phone: +49 (711) 789 54-0 (8.00 - 16.30 German time)
Fax: +49 (711) 789 54-100
e-mail: stgt-info@woodward.com

For assistance outside Germany, call one of the following international Woodward facilities to obtain the address and phone number of the facility nearest your location where you will be able to get information and service.

Facility	Phone number
USA	+1 (970) 482 5881
India	+91 (129) 409 7100
Brazil	+55 (19) 3708 4800
Japan	+81 (476) 93 4661
The Netherlands	+31 (23) 566 1111

You can also 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.]

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

Technical Support is available through our many worldwide locations, through our authorized distributors, or through GE Global Controls Services, depending on the product. This service can assist you with technical questions or problem solving during normal business hours. Emergency assistance is also available during non-business hours by phoning our toll-free number and stating the urgency of your problem. For technical engineering support, please contact us via our toll-free or local phone numbers, e-mail us, or use our website and reference technical support.

Product Training is available on-site from several of our worldwide facilities, at your location, or from GE Global Controls Services, depending on the product. This training, conducted by experienced personnel, will assure that you will be able to maintain system reliability and availability. For information concerning training, please contact us via our toll-free or local phone numbers, e-mail us, or use our website and reference *customer training*.

Field Service engineering on-site support is available, depending on the product and location, from our facility in Colorado, or from one of many worldwide Woodward offices or authorized distributors. Field engineers are experienced on both Woodward products as well as on much of the non-Woodward equipment with which our products interface. For field service engineering assistance, please contact us via our toll-free or local phone numbers, e-mail us, or use our website and reference *field service*.

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 MFR 15 _____

Serial number S/N _____

Description of your problem

Please be sure you have a list of all parameters available.

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.



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