easYprotec-1000 Series

Manual | Multifunction Relay

easYprotec-1410

Software Version 1.0301

37541A

This is no translation but the original Technical Manual.

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Brief Overview

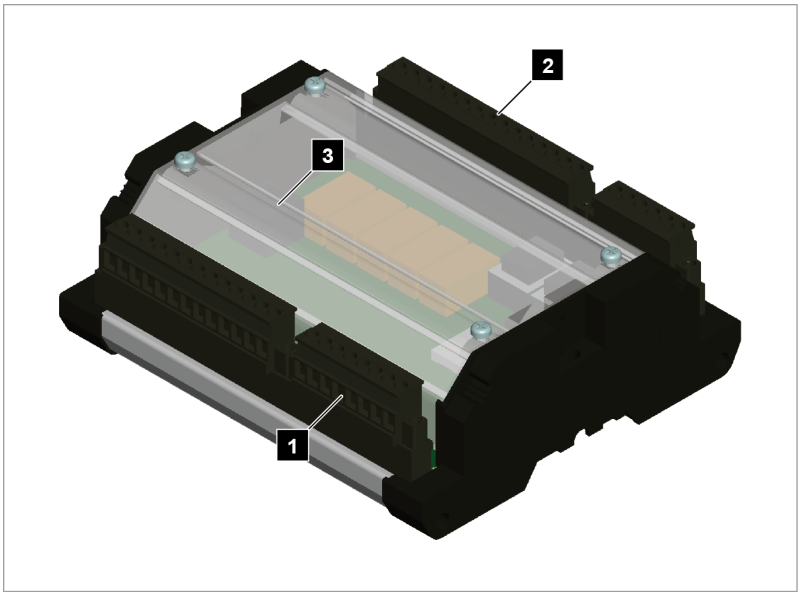


Fig. 1: easYprotec-1000 Series (housing)

1 Voltage PT terminal
2 Relay outputs terminal
3 Service port connector (USB/RS-232)[1]

[1] Optional configuration cable for ToolKit configuration software and external extensions/applications required:

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

The easYprotec-1000 Series are multifunction relays which combine measuring and protection capabilities into one single system.

Sample application setup

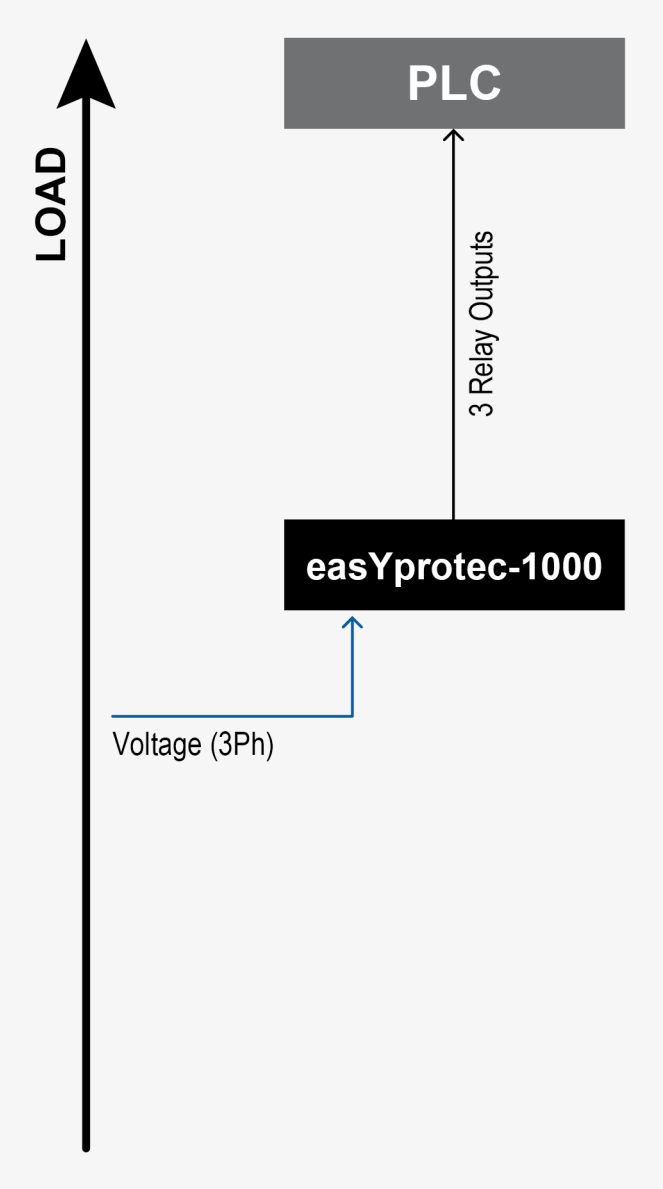


Fig. 2: Sample application setup

A typical application for the control unit is to use it as a power transducer for a PLC.

For a listing of additional applications and setups please refer to chapter ↳ Chapter 6 “Application” on page 71.

Versions

The easYprotec-1000 Series multifunction relays are available in different versions. The differences are listed below.

easYprotec-1000 Series	easYprotec-1410	
	1	**7**
easYprotec-1410-**[x]** Measuring voltage	**[1]** = 120 Vac	**[7]** = 690 Vac

Scope of delivery

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

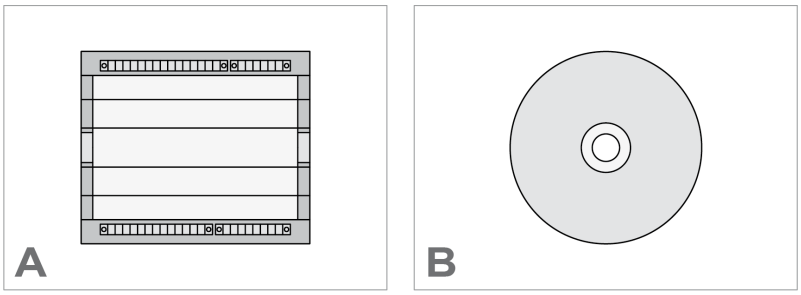


Fig. 3: Scope of delivery - schematic

A easYprotec-1410 multifunction relay
B Product CD (configuration software and manual)

Table of contents

1 General Information

1.1 About This Manual

1.1.1 Revision History

Rev.	Date	Editor	Changes
A	2015-08-03	GG	Describing software version 1.0301. **New Features** ■ New parameter 2415 *[Startup delay]*. Backward compatible by default, it is possible now to configure a time all relays/alarms being activated with first start of the device. For details see *Chapter 4.2.4 "Start-up delay" on page 37*. **Manual** ■ Updated according change described above. ■ Typos corrected.
NEW	2012-04-17	TE	**Manual** ■ Release

1.1.2 Depiction Of Notes And Instructions

Safety instructions

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

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

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

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

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

Tips and recommendations

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

Additional markings

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

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

1.2 Copyright And Disclaimer

Disclaimer

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

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

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

Copyright

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

1.3 Service And Warranty

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

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

Warranty terms

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

1.4 Safety

1.4.1 Intended Use

The multifunction relay unit has been designed and constructed solely for the intended use described in this manual.

The multifunction relay unit must be used exclusively for power measurement applications.

- Intended use requires operation of the control unit within the specifications listed in *Chapter 8.1 "Technical Data" on page 75*.
- All permissible applications are outlined in *Chapter 6 "Application" on page 71*.
- Intended use also includes compliance with all instructions and safety notes presented in this manual.
- Any use which exceeds or differs from the intended use shall be considered improper use.
- No claims of any kind for damage will be entertained if such claims result from improper use.

NOTICE!

Damage due to improper use!

Improper use of the multifunction relay unit may cause damage to the control unit as well as connected components.

Improper use includes, but is not limited to:

– Operation outside the specified operation conditions.

1.4.2 Personnel

WARNING!

Hazards due to insufficiently qualified personnel!

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

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

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

The workforce must only consist of persons who can be expected to carry out their work reliably. Persons with impaired reactions due to, for example, the consumption of drugs, alcohol, or medication are prohibited.

When selecting personnel, the age-related and occupation-related regulations governing the usage location must be observed.

1.4.3 General Safety Notes

Electrical hazards

DANGER!

Life-threatening hazard from electric shock!

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

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

Modifications

WARNING!

Hazards due to unauthorized modifications

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment.

Any unauthorized modifications:

- constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage
- invalidate product certifications or listings.

Electrostatic discharge

Protective equipment: ■ ESD wrist band

NOTICE!

Damage from electrostatic discharge

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

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

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

2. Before any maintenance work on the control unit, ground yourself by touching and holding a grounded metal object (pipes, cabinets, equipment, etc.) to discharge any static electricity.

   Alternatively wear an ESD wrist band connected to ground.

3. Keep plastic, vinyl, and Styrofoam materials (such as plastic or Styrofoam cups, cigarette packages, cellophane wrappers, vinyl books or folders, plastic bottles, etc.) away from the control unit, modules and work area.

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

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

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

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

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

1.4.4 Protective Equipment And Tools

Protective gear

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

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

The cumulative required personal protective equipment is detailed below:

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

Tools

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

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

The cumulative required tools are detailed below:

2 System Overview

This chapter provides a basic overview of the control unit.

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

- *Chapter 3 “Installation” on page 21* provides information on how to mount the unit and setup connections.
- *Chapter 4 “Configuration” on page 33* provides information on basic setup and reference information on all configurable parameters.
- *Chapter 5 “Operation” on page 63* provides information on how to access the unit remotely using the ToolKit software provided by Woodward.
- *Chapter 6 “Application” on page 71* provides application examples as well as instructions for the corresponding required configuration.
- *Chapter 7 “Interfaces And Protocols” on page 73* provides reference information on the usage of the interfaces and protocols provided by the control unit.

2.1 Status Indicators

easYprotec-1410 LED

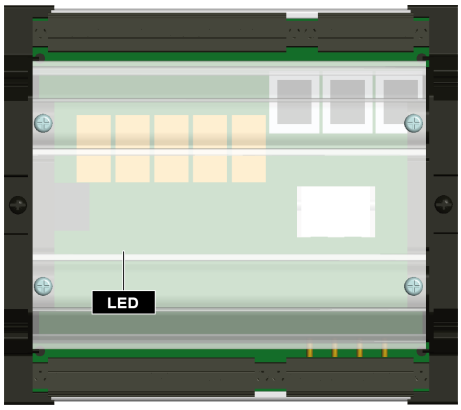


Fig. 4: Position of LED

The easYprotec-1410 unit features a LED (Fig. 4) on the front plate.

The LED indicates the following states:

State		Indication
	Illuminated green	Unit is ready for operation.

Table 1: LED (Ready for operation)

2.2 Hardware Interfaces (Terminals)

The easYprotec-1410 (Fig. 5) provides the following terminals.

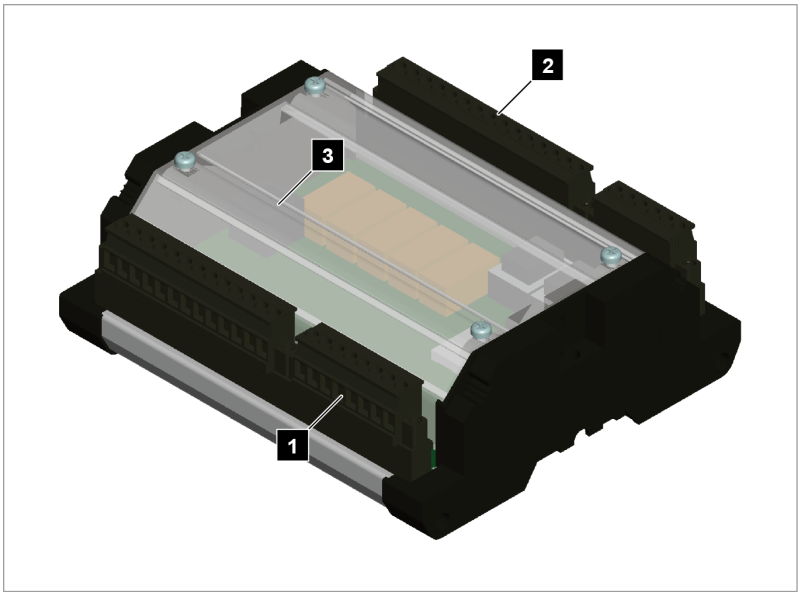


Fig. 5: easYprotec-1000 Series (housing)

1 Voltage PT terminal
2 Relay outputs terminal
3 Service port connector (USB/RS-232)[1]

[1] Optional configuration cable for ToolKit configuration software and external extensions/applications required:

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

For information on how to setup connections refer to *Chapter 3.2 “Setup Connections” on page 21.*

For information on the interfaces and protocols refer to *Chapter 7 “Interfaces And Protocols” on page 73.*

2.3 Measuring Values

Measuring principle

The device measures alternating voltage utilizing a sampling measuring method. All values are sampled for each phase with a rate of 5 kHz, integrated over one period, and the RMS value is calculated. The frequency is established from the time intervals of the voltage passing through zero.

Measuring values

Measuring value	Definition
Voltage	Three-phase RMS value measuring of the wye and delta voltages.
Frequency	Frequency measurement is extracted from the digitally filtered measuring voltages. The frequency is measured if the measured voltage exceeds 5 % of the rated voltage (120 V or 690 V). If the system is configured for three phases, all three phases are used for measurement. However the frequency is still measured correctly even if voltage is only applied to one phase.
Phase angle	Measuring of the phase angle between the single wye voltages.

3 Installation

3.1 Mount Unit

Dimensions

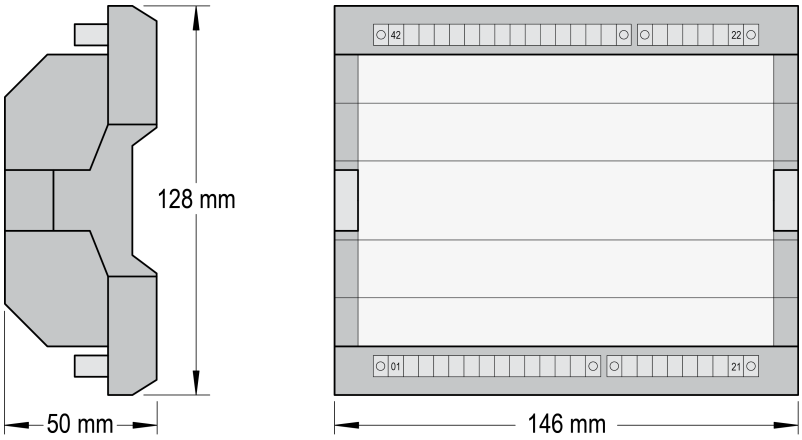


Fig. 6: Housing - dimensions

3.2 Setup Connections

General notes

NOTICE!

Malfunctions due to literal use of example values

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

– For definite values please refer to chapter ↳ *Chapter 8.1 “Technical Data” on page 75*.
– Connected inductances (e.g. operating current coils, undervoltage tripping devices, auxiliary contactors, and/or power contactors) must be wired with an appropriate interference protection.

Wire sizes

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

Table 2: Conversion chart - wire sizes

3.2.1 Terminal Allocation

General notes

The device terminals are allocated as follows:

- Plastic housing - shown in Fig. 7

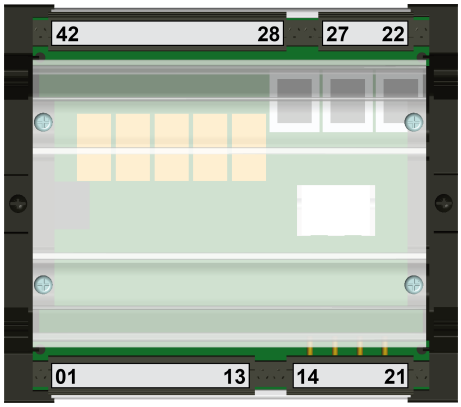


Fig. 7: Plastic housing

3.2.2 Wiring Diagram

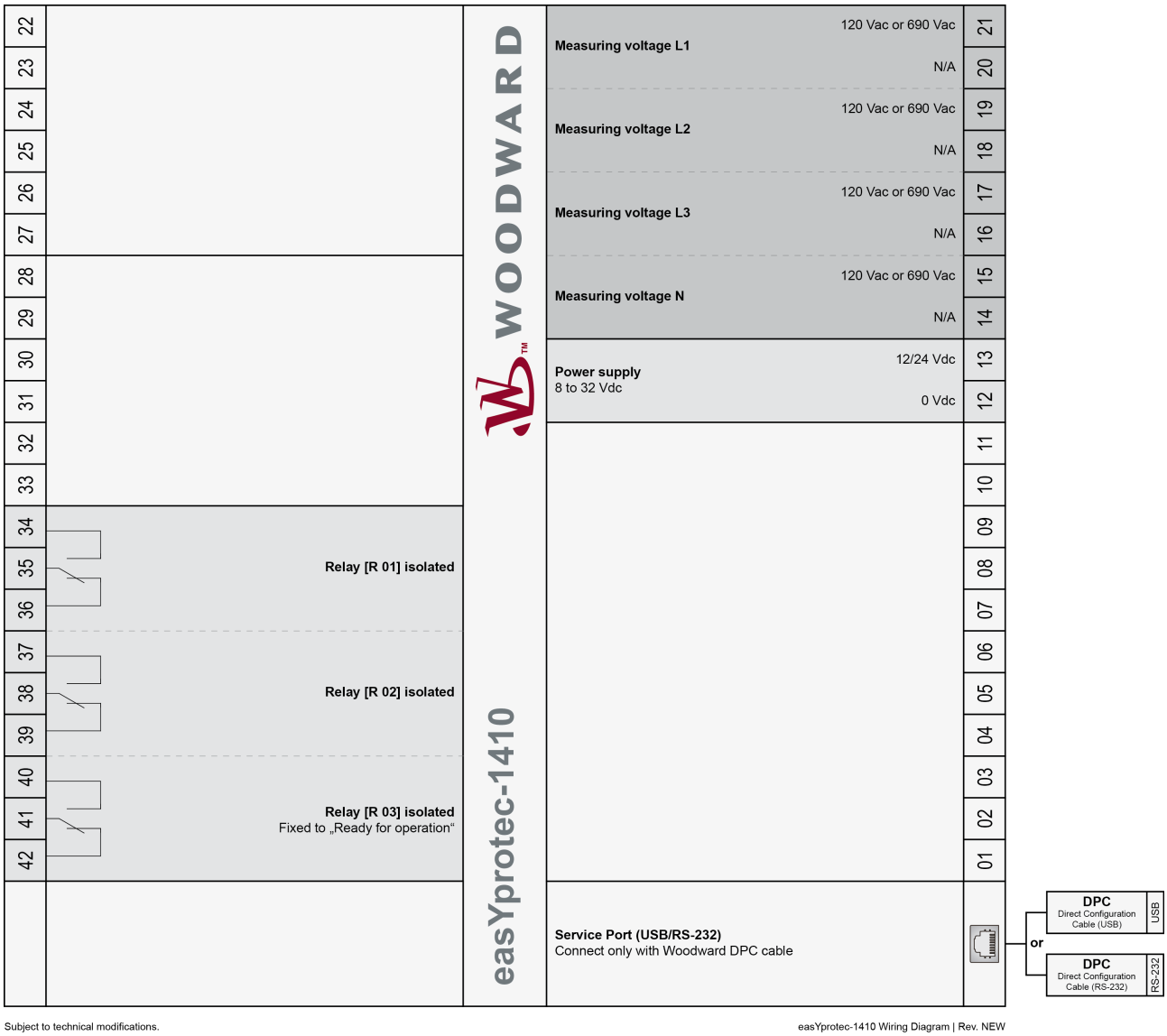


Fig. 8: Wiring diagram

3.2.3 Power Supply

Schematic and terminals

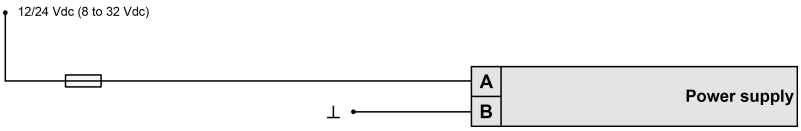


Fig. 9: Power supply - wiring

Terminal		Description	A_{max}
A	13	12/24Vdc (8 to 32.0 Vdc)	2.5 mm²
B	12	0 Vdc	2.5 mm²

Table 3: Power supply - terminal assignment

3.2.4 Voltage Measuring

General notes

NOTICE!

Versions

The easYprotec-1000 Series multifunction relays are available in different versions. Please make sure to use the description which is valid for your device.

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

Schematic and terminals

The following description is only valid for units with 690 Vac voltage.

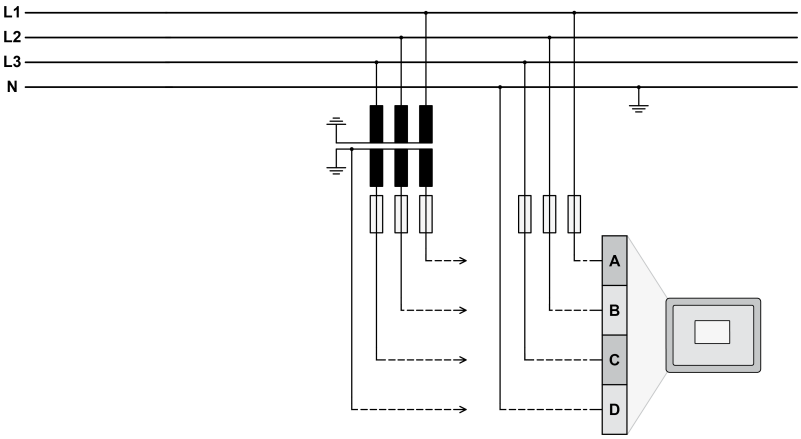


Fig. 10: Voltage measuring - 690 Vac - wiring

Terminal		Description		A_{max}
A	21	Measuring voltage L1	690 Vac	2.5 mm²
B	19	Measuring voltage L2	690 Vac	2.5 mm²
C	17	Measuring voltage L3	690 Vac	2.5 mm²
D	15	Measuring voltage N	690 Vac	2.5 mm²

Table 4: Voltage measuring - 690 Vac - terminal assignment

Schematic and terminals

The following description is only valid for units with 120 Vac voltage.

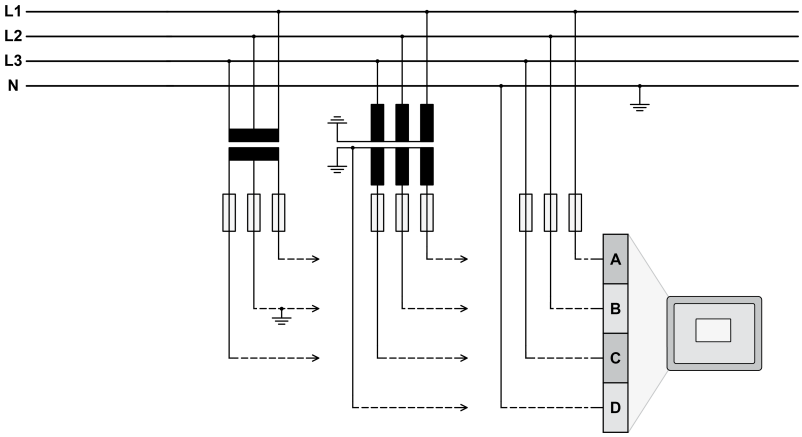


Fig. 11: Voltage measuring - 120 Vac - wiring

Terminal		Description		A_{max}
A	21	Measuring voltage L1	120 Vac	2.5 mm²
B	19	Measuring voltage L2	120 Vac	2.5 mm²
C	17	Measuring voltage L3	120 Vac	2.5 mm²
D	15	Measuring voltage N	120 Vac	2.5 mm²

Table 5: Voltage measuring - 120 Vac - terminal assignment

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

Generator windings

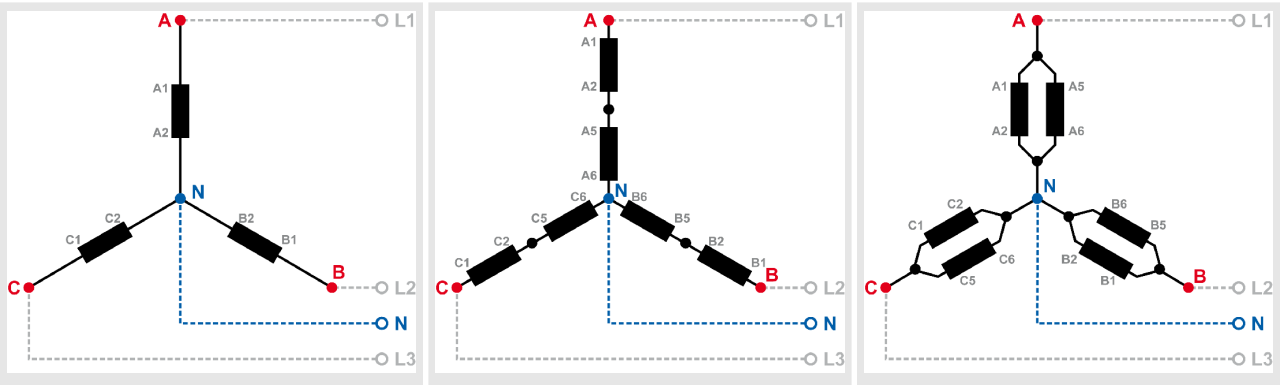


Table 6: Generator windings - 3Ph 4W

Measuring inputs

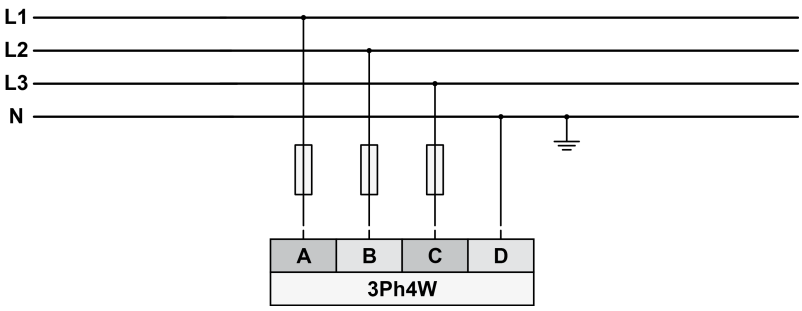


Fig. 12: Measuring inputs - 3Ph 4W

Terminal assignment

3Ph 4W	Wiring terminals							
Rated voltage (range)	120 V (50 to 130 $V_{eff.}$)				690 V (131 to 690 $V_{eff.}$)			
Measuring range (max.)	0 to 150 Vac				0 to 800 Vac			
Terminal	A	C	E	G	B	D	F	H
	21	19	17	15	21	19	17	15
Phase	L1	L2	L3	N	L1	L2	L3	N

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

Generator windings

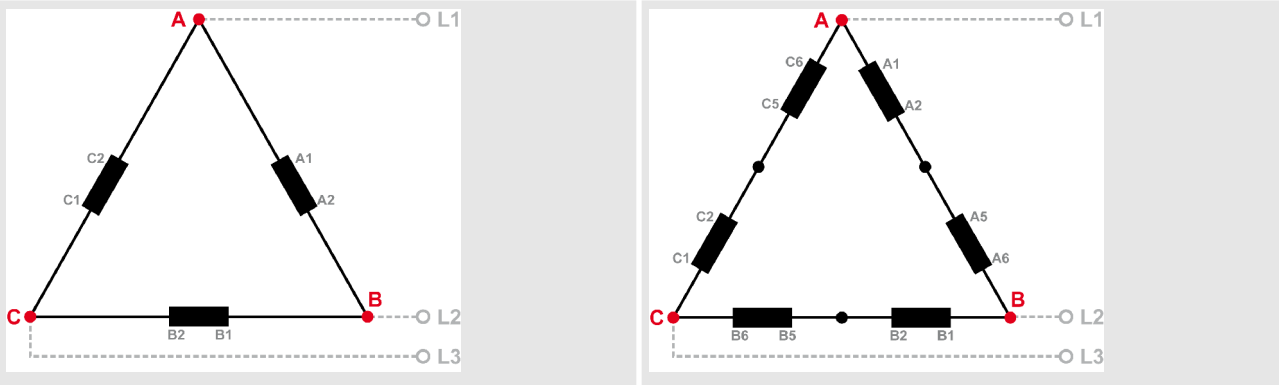


Table 7: Generator windings - 3Ph 3W

Measuring inputs

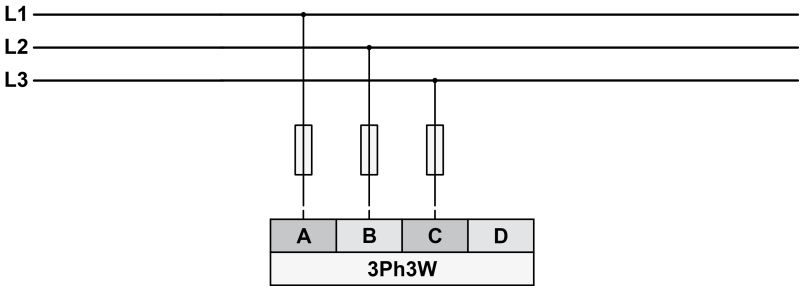


Fig. 13: Measuring inputs - 3Ph 3W

Terminal assignment

3Ph 3W	Wiring terminals							
Rated voltage (range)	120 V (50 to 130 $V_{eff.}$)				690 V (131 to 690 $V_{eff.}$)			
Measuring range (max.)	0 to 150 Vac				0 to 800 Vac			
Terminal	A	C	E	G	B	D	F	H
	21	19	17	15	21	19	17	15
Phase	L1	L2	L3	---	L1	L2	L3	---

If L1, L2 or L3 are connected to PE or N the single reactive powers VL1-I1, VL2-I2 and VL3-I3 cannot be calculated correctly. So the overall reactive power does not fit. The apparent power is calculated out of the reactive power and cannot be correct too.

The at all active power and the single currents are calculated all the time correct.

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

Generator windings

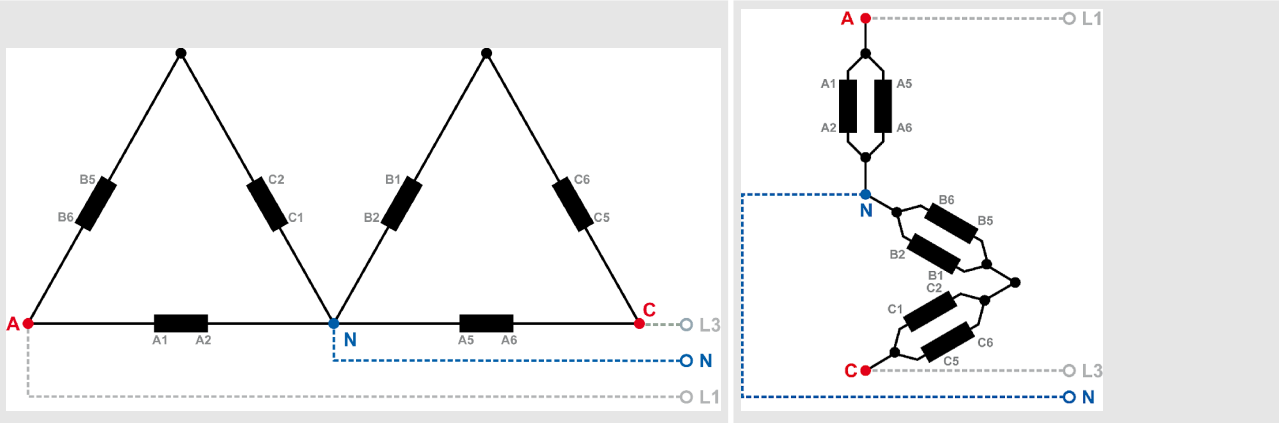


Table 8: Generator windings - 1Ph 3W

Measuring inputs

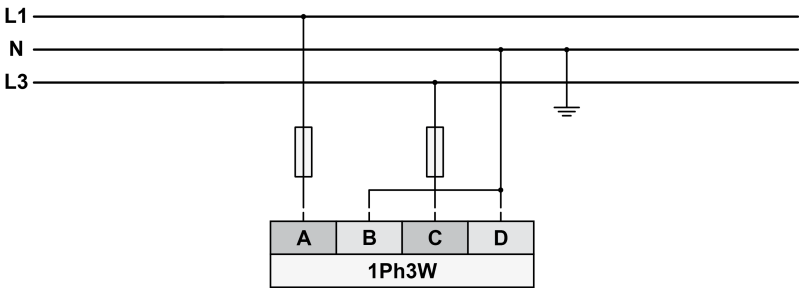


Fig. 14: Measuring inputs - 1Ph 3W

Terminal assignment

1Ph 3W	Wiring terminals							
Rated voltage (range)	120 V (50 to 130 $V_{eff.}$)				690 V (131 to 690 $V_{eff.}$)			
Measuring range (max.)	0 to 150 Vac				0 to 800 Vac			
Terminal	A	C	E	G	B	D	F	H
	21	19	17	15	21	19	17	15
Phase	L1	N	L3	N	L1	N	L3	N

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

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

– *Please note to configure and wire the device consistently.*

3.2.4.4.1 '1Ph 2W' Phase-Neutral Measuring

Generator windings

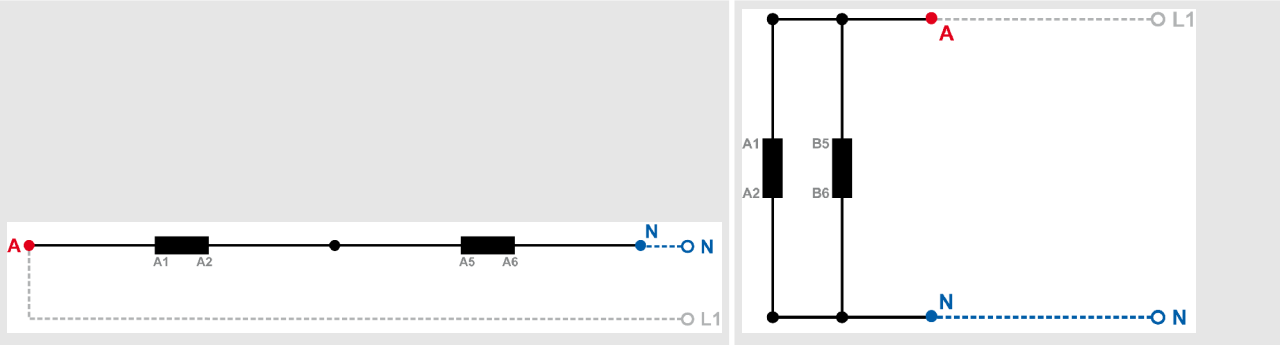


Table 9: Generator windings - 1Ph 2W (phase neutral)

Measuring inputs

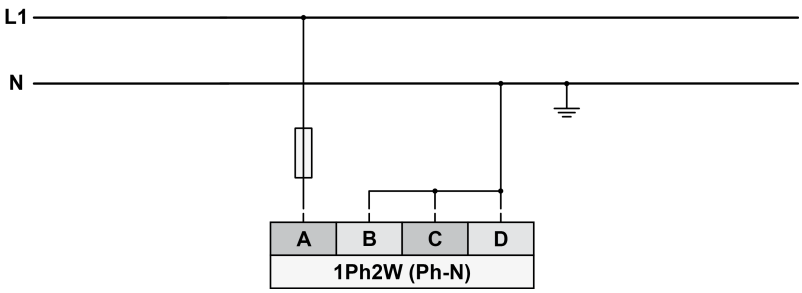


Fig. 15: Measuring inputs - 1Ph 2W (phase neutral)

Terminal assignment

1Ph 2W	Wiring terminals							
Rated voltage (range)	120 V (50 to 130 $V_{eff.}$)				690 V (131 to 690 $V_{eff.}$)			
Measuring range (max.)	0 to 150 Vac				0 to 800 Vac			
Terminal	A	C	E	G	B	D	F	H
	21	19	17	15	21	19	17	15
Phase	L1	N	N	N	L1	N	N	N

3.2.4.4.2 '1Ph 2W' Phase-Phase Measuring

Generator windings

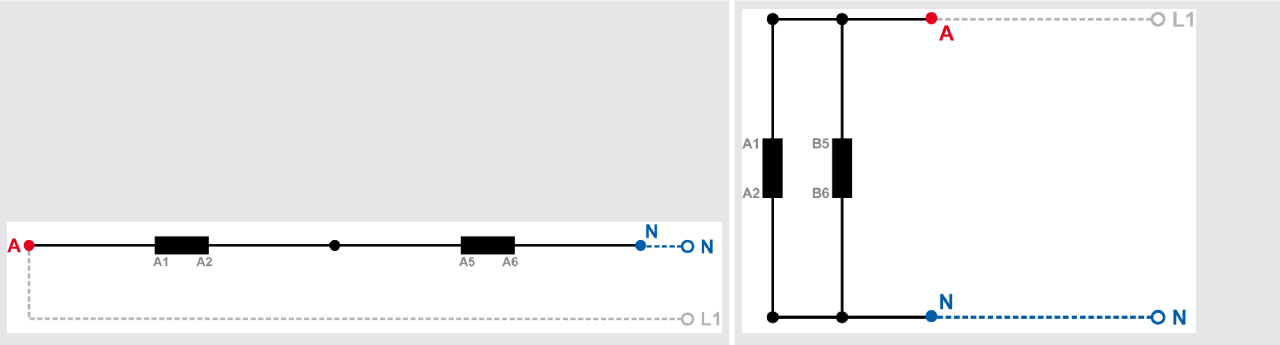


Table 10: Generator windings - 1Ph 2W (phase-phase)

Measuring inputs

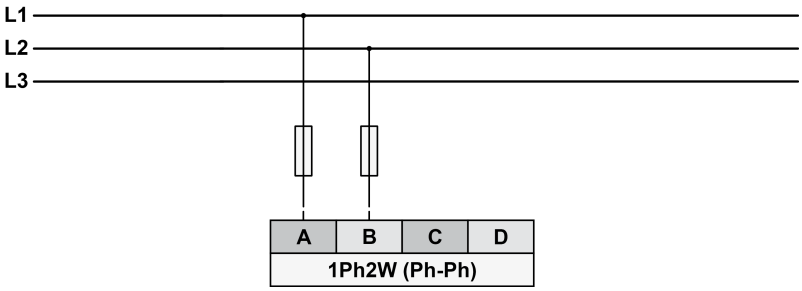


Fig. 16: Measuring inputs - 1Ph 2W (phase-phase)

Terminal assignment

1Ph 2W	Wiring terminals							
Rated voltage (range)	120 V (50 to 130 $V_{eff.}$)				690 V (131 to 690 $V_{eff.}$)			
Measuring range (max.)	0 to 150 Vac				0 to 800 Vac			
Terminal	A	C	E	G	B	D	F	H
	21	19	17	15	21	19	17	15
Phase	L1	L2	---	---	L1	L2	---	---

3.2.5 Relay Outputs

General notes

CAUTION!
The discrete output "Ready for operation" may be wired in series with an emergency stop function and used in conjunction with an alarm function to ensure that the proper actions are initiated upon activation of this output, i.e. a failure of the unit.

Schematic and terminals

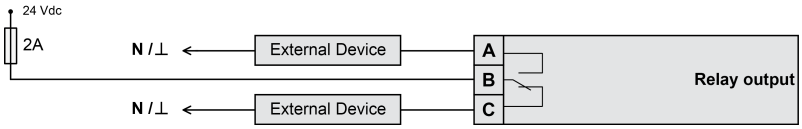


Fig. 17: Relay outputs - schematic

Terminal			Description		A_{max}
N.O.	Common	N.C.			
A	B	C	Form C		
34	35	36	Relay output [R 01]	---	2.5 mm²
37	38	39	Relay output [R 02]	---	2.5 mm²
40	41	42	Relay output [R 03]	Fixed to "Ready for operation"	2.5 mm²

Notes
***N.O.**: normally open (make) contact*
***N.C.**: normally closed (break) contact*

3.2.6 Service Port

Service port connector

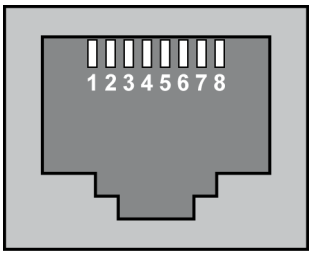


Fig. 18: Service port connector (RJ-45)

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

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

Direct configuration cable (DPC)

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

There are two versions available:

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

DPC-USB direct configuration cable

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

Order item number:

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

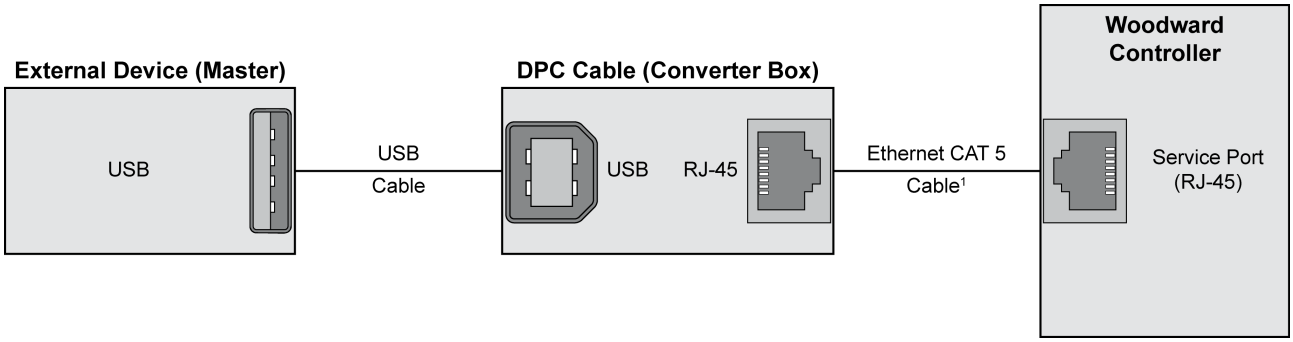


Fig. 19: DPC-USB wiring - schematic

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

DPC-RS-232 direct configuration cable

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

Order item number:

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

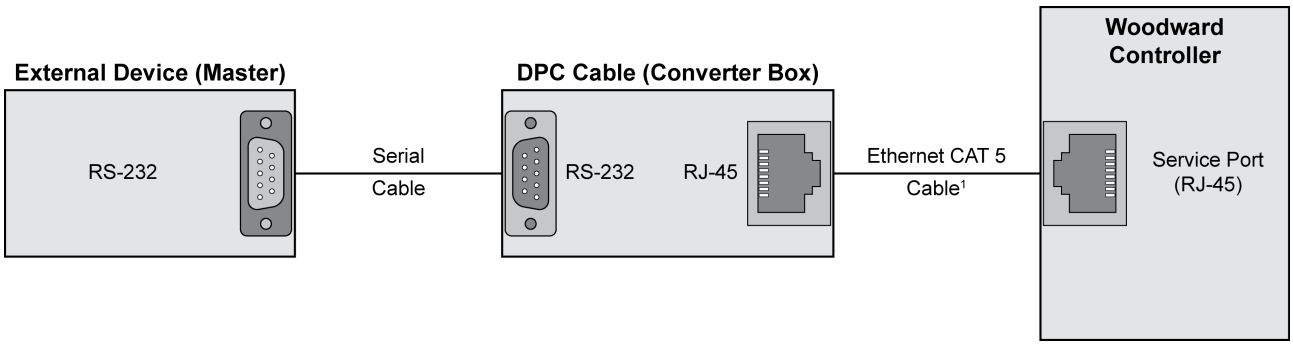


Fig. 20: DPC-RS-232 wiring - schematic

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

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

4 Configuration

All parameters are assigned a unique parameter identification number.

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

This parameter identification number is also displayed in the ToolKit configuration screens next to the respective parameter.

4.1 Homepage

General notes

The ToolKit “Homepage” gives an overview of all measured values, the state of the relays and the state of the monitoring.

The “Homepage” is only used to display values. The values cannot be adjusted here. The configuration of the parameters is done in the other menu sections on the left hand side. The following chapters describe all menus in detail.

Please refer to Chapter 5.1 “Access Via PC (ToolKit)” on page 63 for details about the operation of the device via ToolKit.

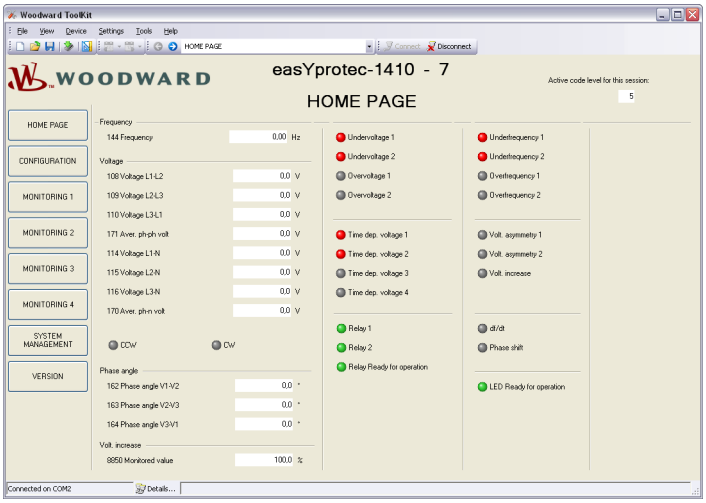


Fig. 21: Homepage

4.2 Configuration

4.2.1 Measurement

General notes

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

Dependencies

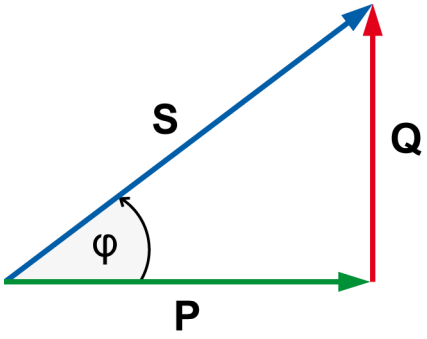


Fig. 22: AC power triangle

PF Power Factor
P Active Power [kW]
S Apparent power [kVA]
Q Reactive Power [kvar]

The AC power triangle illustrates the dependencies between active power, apparent power, reactive power and power factor.

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

ID	Parameter	CL	Setting range [Default]	Description
1750	**System rated frequency**	4	50 / 60 Hz **[50 Hz]**	The rated frequency of the system is used as a reference figure for all frequency related functions, which use a percentage value, like frequency monitoring.
1766	**Rated voltage**	4	50 to 650000 V **[690 V]**	This value refers to the rated voltage of the source and is the voltage measured on the potential transformer primary. The rated voltage is used as a reference figure for all voltage related functions, which use a percentage value, like voltage monitoring.
1851	**Voltage measuring**	4	**[3Ph 4W]**	Measurement is performed Line-Neutral (WYE connected system) and Line-Line (Delta connected system). The protection depends on the setting of parameter 1770 ↳ p. 35. Phase voltages and the neutral must be connected for proper calculation. Measurement, display and protection are adjusted according to the rules for WYE connected systems. Monitoring refers to the following voltages: ■ VL12, VL23, and VL31 (parameter 1770 ↳ p. 35 configured to "Phase-phase") ■ VL1N, VL2N and VL3N (parameter 1770 ↳ p. 35 configured to "Phase-neutral") ■ VL12, VL23, VL31, VL1N, VL2N and VL3N (parameter 1770 ↳ p. 35 configured to "All")
			3Ph 3W	Measurement is performed Line-Line (Delta connected system). Phase voltages must be connected for proper calculation. Measurement, display and protection are adjusted according to the rules for Delta connected systems. Monitoring refers to the following voltages: ■ VL12, VL23, VL31
			1Ph 2W	Measurement is performed Line-Neutral (WYE connected system) if parameter 1858 ↳ p. 35 is configured to "Phase - neutral" and Line-Line (Delta connected system) if parameter 1858 ↳ p. 35 is configured to "Phase - phase". Measurement, display and protection are adjusted according to the rules for phase-phase systems. Monitoring refers to the following voltages: ■ VL1N, VL12

ID	Parameter	CL	Setting range [Default]	Description
			1Ph 3W	Measurement is performed Line-Neutral (WYE connected system) and Line-Line (Delta connected system). The protection depends on the setting of parameter 1770 ↳ p. 35. Measurement, display, and protection are adjusted according to the rules for single-phase systems. Monitoring refers to the following voltages: ■ VL13 (parameter 1770 ↳ p. 35 configured to "Phase-phase") ■ VL1N, VL3N (parameter 1770 ↳ p. 35 configured to "Phase-neutral") ■ VL1N, VL3N (parameter 1770 ↳ p. 35 configured to "All")
				Notes If this parameter is configured to 1Ph 3W, the rated voltage (parameter 1766 ↳ p. 34) must be entered as Line-Line (Delta).
3954	**Phase rotation**	4	**[CW]**	The three-phase measured voltage is rotating CW (clock-wise; that means the voltage rotates in L1-L2-L3 direction; standard setting).
			CCW	The three-phase measured voltage is rotating CCW (counter clock-wise; that means the voltage rotates in L1-L3-L2 direction).
1858	**1Ph2W voltage measuring**	4	**[Phase - phase]**	The unit is configured for measuring phase-phase voltages if 1Ph 2W measuring is selected.
			Phase - neutral	The unit is configured for measuring phase-neutral voltages if 1Ph 2W measuring is selected.
				Notes For information on measuring principles refer to ↳ *Chapter 3.2.4 “Voltage Measuring” on page 23*
1859	**1Ph2W phase rotation**	4	**[CW]**	A clockwise rotation field is considered for 1Ph 2W measuring .
			CCW	A counter-clockwise rotation field is considered for 1Ph 2W measuring.
				Notes For information on measuring principles refer to ↳ *Chapter 3.2.4 “Voltage Measuring” on page 23* This parameter is important for power factor and reactive power calculation.
1770	**Voltage monitoring**	4		The unit can either monitor the wye voltages (phase-neutral) or the delta voltages (phase-phase). The monitoring of the wye voltage is above all necessary to avoid earth-faults in a compensated or isolated network resulting in the tripping of the voltage protection.
			[Phase - phase]	The phase-phase voltage will be monitored and all subsequent parameters concerning voltage monitoring are referred to this value (VL-L).
			Phase - neutral	The phase-neutral voltage will be monitored and all subsequent parameters concerning voltage monitoring are referred to this value (VL-N).
			All	The phase-phase **and** phase-neutral voltage will be monitored and all subsequent parameters concerning voltage monitoring are referred to this value (VL-L & VL-N). This setting is only effective if "Voltage measuring" (parameter 1851 ↳ p. 34) is configured to "3Ph 4W".

ID	Parameter	CL	Setting range [Default]	Description
				Notes WARNING: This parameter influences the protective functions. Please be aware that if "Voltage monitoring" (parameter 1770 p. 35) is configured to "All" and the function *Chapter 4.3.8 "Voltage Increase" on page 49* is used, that this function only monitors "Phase - neutral".
1788	**Disable underfrequency monitoring with low voltage**	4		Blocks the underfrequency monitoring, if the voltage is below 12.5% of nominal to avoid an alarm if the voltage drops to zero. This affects both underfrequency monitoring thresholds.
			Yes	Underfrequency monitoring with low voltage is disabled.
			[No]	Underfrequency monitoring with low voltage is enabled.
1801	**PT primary rated voltage** (Potential transformer primary voltage rating)	4	50 to 650000 V **[690 V]**	The primary source voltage in V. The control utilizes the value entered in this parameter along with the measured voltage of the PT secondaries to calculate the voltage.
1800	**PT secondary rated volt.** (Potential transformer secondary voltage rating)	4	50 to 800 V **[690 V]**	The secondary source voltage in V, which is used as a reference figure for related functions.

4.2.2 Discrete Outputs

General notes

The discrete outputs of this control device have a "Normally Open" (N.O.) as well as a "Normally Closed" (N.C.) function.

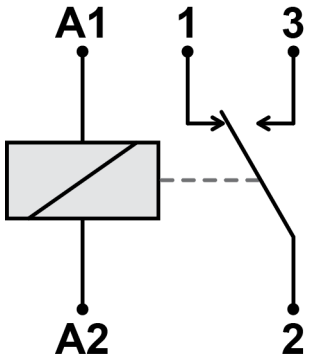


Fig. 23: Normally Open/Closed contacts - schematic

Normally Open (N.O.) contacts

– *The relay (discrete output) must be energized to close the contact.*

Normally Closed (N.C.) contacts

– *The relay (discrete output) must be de-energized to open the contact.*

ID	Parameter	CL	Setting range [Default]	Description
6920 6921	**Relay {x} function** [x = 1 to 2]	4	**[N.O.]**	The relay will be energized when an alarm occurs.
			N.C	The relay will be de-energized when an alarm occurs.
				Notes The fallback delay of the relays can be configured with parameter 8855 ↳ p. 37.

4.2.3 Monitoring

ID	Parameter	CL	Setting range [Default]	Description
8855	**Monitoring fallback delay**	0	0.0 to 500.0 s **[0.2 s]**	This parameter defines the fallback time of all alarms and hence the fallback time of the relays.

4.2.4 Start-up delay

ID	Parameter	CL	Setting range [Default]	Description
2415	**Startup delay**	0	0.0 to 180.0 s **[0 s]**	This parameter defines the time all alarms/relays will be active at the first startup of the device.
				Notes Depending on configuration relays will close or open as defined. This can be used e.g., to ensure alarm behavior and is backward compatible by default (0 s).

4.3 Monitoring

4.3.1 Overvoltage (Level 1 & 2) ANSI# 59

General notes

Voltage is monitored according to how the parameter "Voltage measuring" (parameter 1851 ↳ p. 34) is configured. This controller provides the user with two alarm levels for overvoltage. Both alarms are definite time alarms.

Monitoring for overvoltage faults is performed in two steps.

The diagram listed below shows a frequency trend and the associated pickup times and length of the alarms.

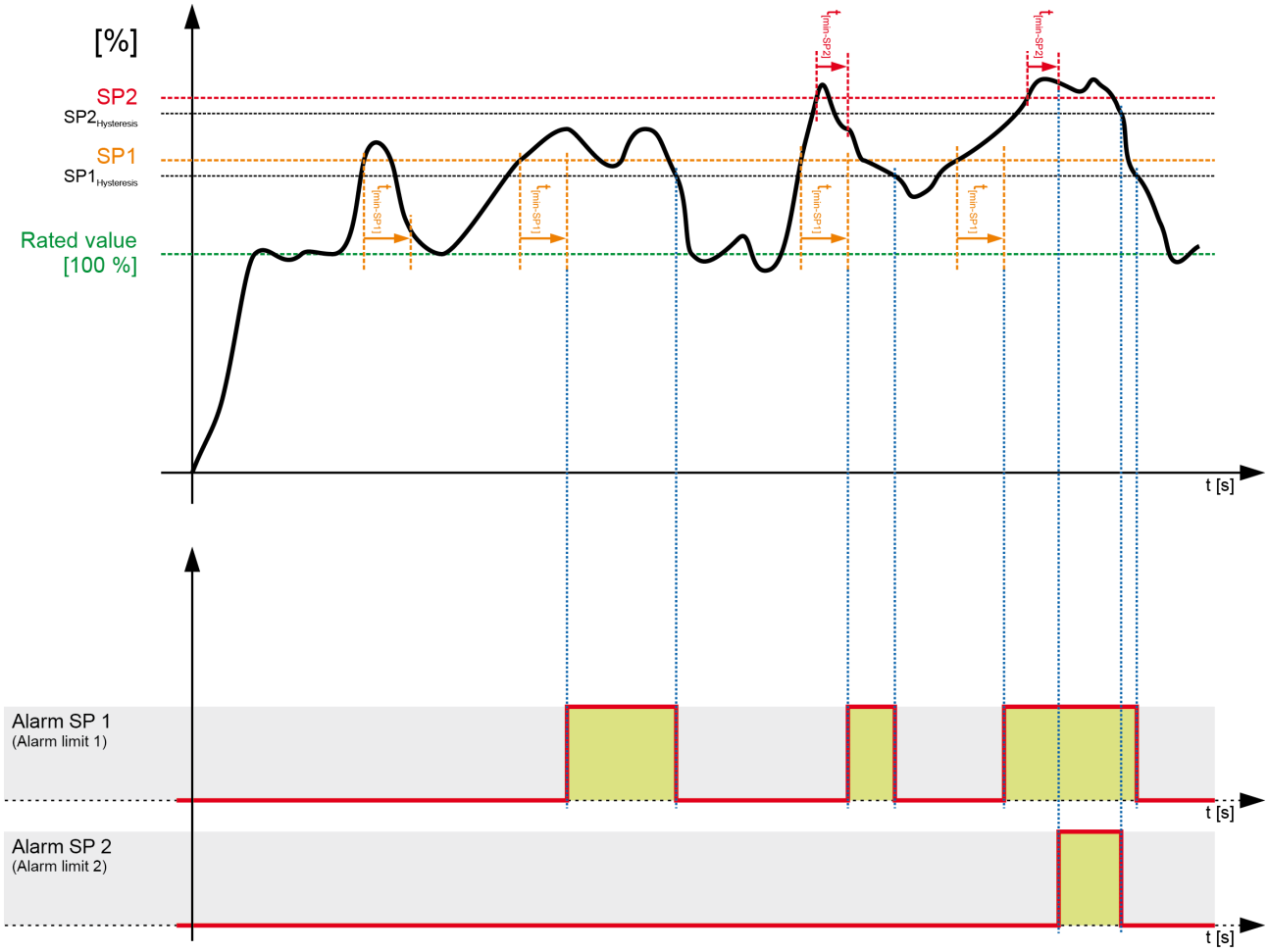


Fig. 24: Overvoltage monitoring

The hysteresis is 0.7 % of the primary transformer delta voltage.

The parameter limits listed below have identical setting ranges. Each parameter may be configured with different settings to create unique trip characteristics for specific thresholds.

ID	Parameter	CL	Setting range [Default]	Description
2000 2006	**Monitoring**	2	**[On]**	Overvoltage monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: Level 1 limit < limit 2).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.

ID	Parameter	CL	Setting range [Default]	Description
2004 2010	**Limit**	2	50.0 to 150.0 % 2004: **[108.0 %]** 2010: **[112.0 %]**	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or exceeded for at least the delay time without interruption, the specified relay will be energized.
				Notes This value refers to the "Rated voltage" (parameter 1766 ↳ p. 34).
2005 2011	**Delay**	2	0.02 to 300.00 s 2005: **[5.00 s]** 2011: **[0.30 s]**	If the monitored voltage exceeds the threshold value for the delay time configured here, an alarm will be issued.
				Notes If the monitored voltage falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.
2014 2015	**AND characteristics**	2	On	Each phase has to be over the threshold for tripping.
			[Off]	At least one phase has to be over the threshold for tripping.
2001 2007	**Relay**	2	None / Relay 1 / Relay 2 2001: **[Relay 1]** 2007: **[Relay 2]**	The relay configured here is activated if the respective monitoring functions triggers. If "None" is configured here, no relay is activated in this case.
				Notes Whether the relay is energized or de-energized depends on the configuration of the relay function (parameter 6920 ↳ p. 37 and 6921 ↳ p. 37).

4.3.2 Undervoltage (Level 1 & 2) ANSI# 27

General notes

Voltage is monitored according to how the parameter "Voltage measuring" (parameter 1851 ↳ p. 34) is configured. This controller provides the user with two alarm levels for undervoltage. Both alarms are definite time alarms.

Monitoring for undervoltage faults is performed in two steps.

The diagram listed below shows a frequency trend and the associated pickup times and length of the alarms.

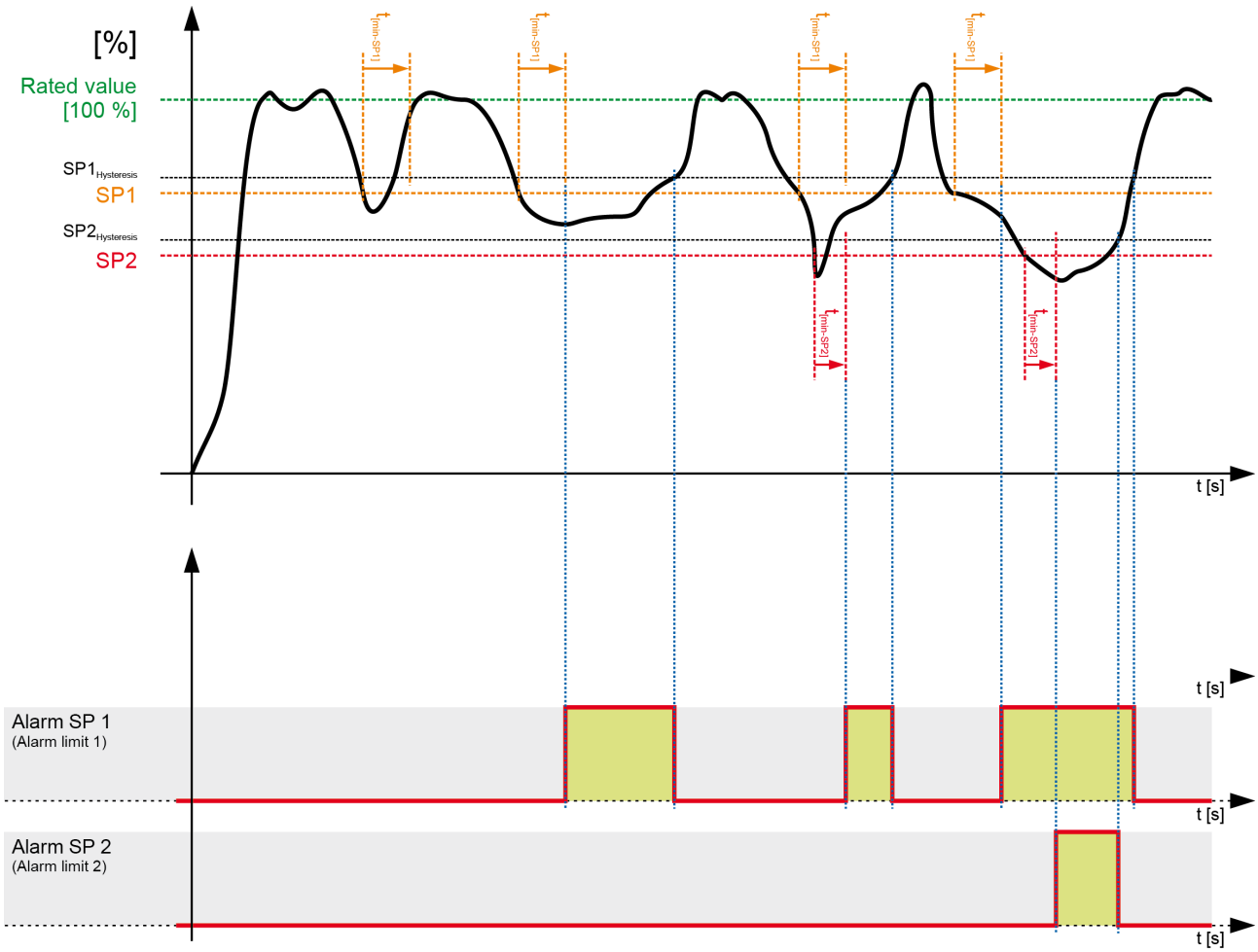


Fig. 25: Undervoltage monitoring

The hysteresis is 0.7 % of the primary transformer delta voltage.

The parameter limits listed below have identical setting ranges. Each parameter may be configured with different settings to create unique trip characteristics for specific thresholds.

ID	Parameter	CL	Setting range [Default]	Description
2050 2056	**Monitoring**	2	**[On]**	Undervoltage monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: Level 1 limit > limit 2).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.

ID	Parameter	CL	Setting range [Default]	Description
2054 2060	**Limit**	2	5.0 to 150.0 % 2054: **[92.0 %]** 2060: **[88.0 %]**	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or fallen below for at least the delay time without interruption, the specified relay will be energized.
				Notes This value refers to the "Rated voltage" (parameter 1766 ↳ p. 34).
2055 2061	**Delay**	2	0.02 to 300.00 s 2055: **[5.00 s]** 2061: **[0.30 s]**	If the monitored voltage falls below the threshold value for the delay time configured here, an alarm will be issued.
				Notes If the monitored voltage exceeds the threshold (plus the hysteresis) again before the delay expires the time will be reset.
2064 2065	**AND characteristics**	2	On	Each phase has to be under the threshold for tripping.
			[Off]	At least one phase has to be under the threshold for tripping.
2051 2057	**Relay**	2	None / Relay 1 / Relay 2 2051: **[Relay 1]** 2057: **[Relay 2]**	The relay configured here is activated if the respective monitoring functions triggers. If "None" is configured here, no relay is activated in this case.
				Notes Whether the relay is energized or de-energized depends on the configuration of the relay function (parameter 6920 ↳ p. 37 and 6921 ↳ p. 37).

4.3.3 Overfrequency (Level 1 & 2) ANSI# 81O

General notes

This controller provides the user with two alarm levels for overfrequency. Both alarms are definite time alarms.

Monitoring for overfrequency faults is performed in two steps.

The diagram listed below shows a frequency trend and the associated pickup times and length of the alarms.

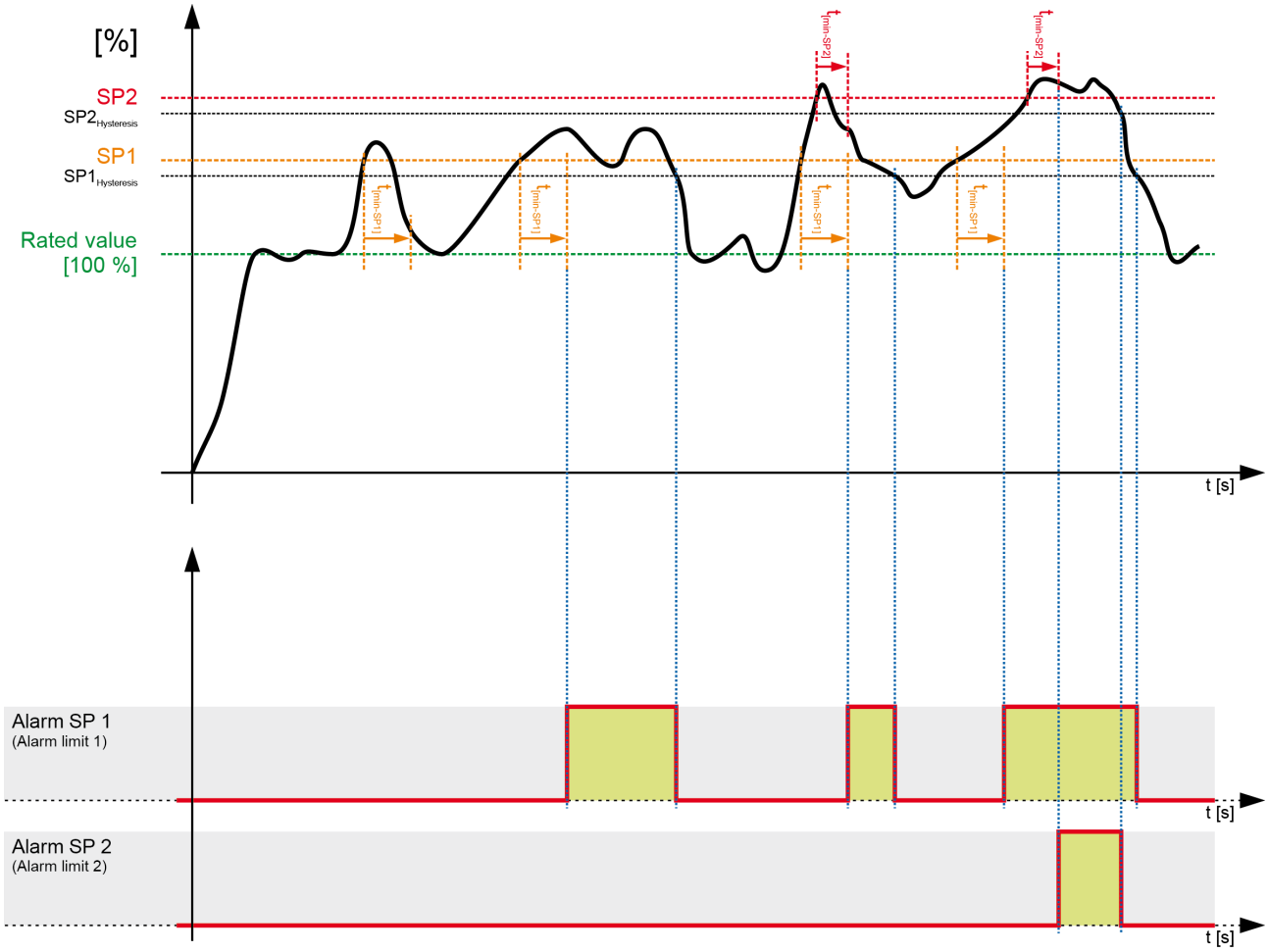


Fig. 26: Overfrequency monitoring

The hysteresis is 0.05 Hz.

The parameter limits listed below have identical setting ranges. Each parameter may be configured with different settings to create unique trip characteristics for specific thresholds.

ID	Parameter	CL	Setting range [Default]	Description
1900 1906	**Monitoring**	2	**[On]**	Overfrequency monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: Level 1 limit < limit 2).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.

ID	Parameter	CL	Setting range [Default]	Description
1904 1910	**Limit**	2	50.0 to 140.0 % 1904: **[110.0 %]** 1910: **[115.0 %]**	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or exceeded for at least the delay time without interruption, the specified relay will be energized.
				Notes This value refers to the "Rated system frequency" (parameter 1750 ↳ p. 34).
1905 1911	**Delay**	2	0.02 to 300.00 s 1905: **[1.50 s]** 1911: **[0.30 s]**	If the monitored frequency value exceeds the threshold value for the delay time configured here, an alarm will be issued.
				Notes If the monitored frequency falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.
1901 1907	**Relay**	2	None / Relay 1 / Relay 2 1901: **[Relay 1]** 1907: **[Relay 2]**	The relay configured here is activated if the respective monitoring functions triggers. If "None" is configured here, no relay is activated in this case.
				Notes Whether the relay is energized or de-energized depends on the configuration of the relay function (parameter 6920 ↳ p. 37 and 6921 ↳ p. 37).

4.3.4 Underfrequency (Level 1 & 2) ANSI# 81U

General notes

This controller provides the user with two alarm levels for underfrequency. Both alarms are definite time alarms.

Monitoring for underfrequency faults is performed in two steps.

The diagram listed below shows a frequency trend and the associated pickup times and length of the alarms.

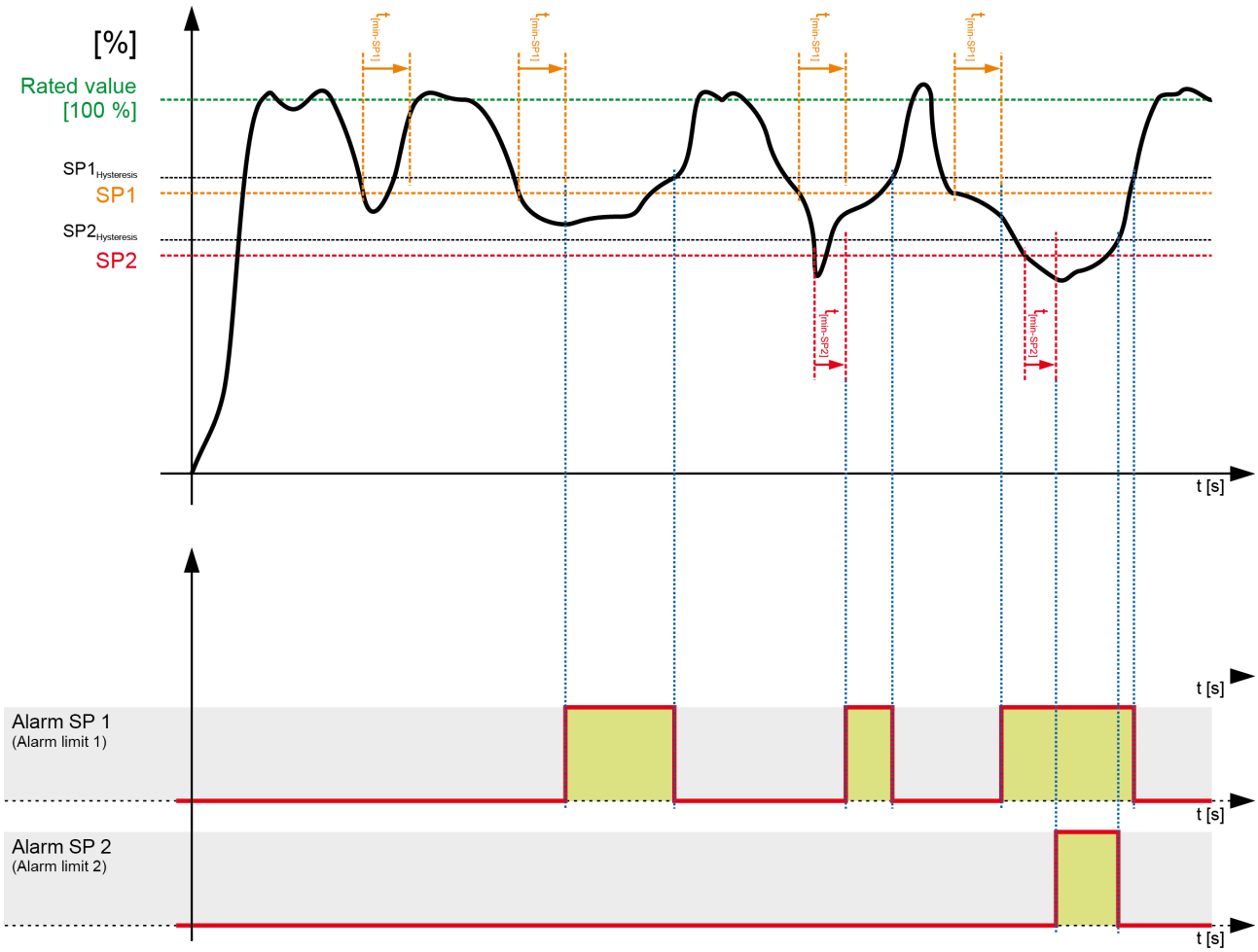


Fig. 27: Underfrequency monitoring

The hysteresis is 0.05 Hz.

The parameter limits listed below have identical setting ranges. Each parameter may be configured with different settings to create unique trip characteristics for specific thresholds.

ID	Parameter	CL	Setting range [Default]	Description
1950 1956	**Monitoring**	2	**[On]**	Underfrequency monitoring is carried out according to the following parameters. Monitoring is performed at two levels. Both values may be configured independent from each other (prerequisite: Level 1 limit > limit 2).
			Off	Monitoring is disabled for Level 1 limit and/or Level 2 limit.

ID	Parameter	CL	Setting range [Default]	Description
1954 1960	**Limit**	2	50.0 to 140.0 % 1954: **[90.0 %]** 1960: **[84.0 %]**	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or fallen below for at least the delay time without interruption, the specified relay will be energized.
				Notes This value refers to the "Rated system frequency" (parameter 1750 ↳ p. 34).
1955 1961	**Delay**	2	0.02 to 300.00 s 1955: **[5.00 s]** 1961: **[0.30 s]**	If the monitored frequency value falls below the threshold value for the delay time configured here, an alarm will be issued.
				Notes If the monitored frequency exceeds the threshold (plus the hysteresis) again before the delay expires the time will be reset.
1951 1957	**Relay**	2	None / Relay 1 / Relay 2 1951: **[Relay 1]** 1957: **[Relay 2]**	The relay configured here is activated if the respective monitoring functions triggers. If "None" is configured here, no relay is activated in this case.
				Notes Whether the relay is energized or de-energized depends on the configuration of the relay function (parameter 6920 ↳ p. 37 and 6921 ↳ p. 37).

4.3.5 Voltage Asymmetry (Level 1 & 2)

General notes

Voltage asymmetry is determined by calculating the negative sequence component of a three-phase system. This value is derived from the three delta voltages (phase-phase). Voltage asymmetry monitoring is only active if "Voltage measuring" (parameter 1851 ↳ p. 34) is configured to "3Ph 4W" or "3Ph 3W". The threshold is defined as the percentage of that value relative to the nominal delta voltage. The protective function is triggered if this percentage value is exceeded.

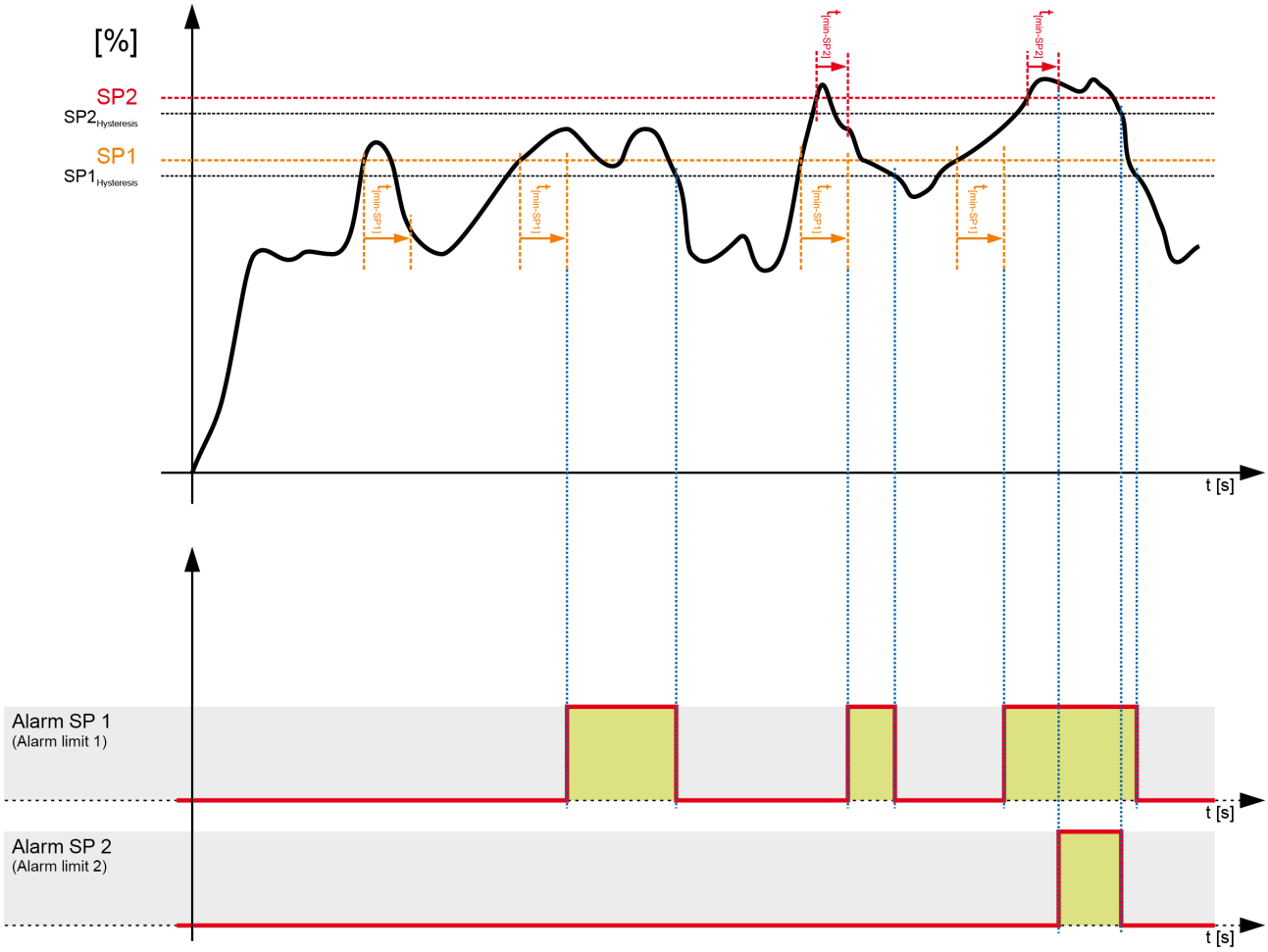


Fig. 28: Voltage asymmetry monitoring

The hysteresis is 0.5 % of the primary transformer delta voltage.

This monitoring function is only enabled if "Voltage measuring" (parameter 1851 ↳ p. 34) is configured to "3Ph 4W" or "3Ph 3W".

ID	Parameter	CL	Setting range [Default]	Description
3900 3931	**Monitoring**	2	3900: **[On]**	Voltage asymmetry monitoring is carried out according to the following parameters.
			3931: **[Off]**	No monitoring is carried out.

ID	Parameter	CL	Setting range [Default]	Description
3903 3934	**Limit**	2	0.5 to 99.9 % 3903: **[10.0 %]** 3934: **[15.0 %]**	The percentage values that are to be monitored for each threshold limit are defined here. If this value is reached or exceeded for at least the delay time without interruption, the specified relay will be energized.
				Notes This value refers to the "Rated voltage" (parameter 1766 ↳ p. 34).
3904 3935	**Delay**	2	0.02 to 300.00 s 3904: **[5.00 s]** 3935: **[3.00 s]**	If the monitored voltage asymmetry exceeds the threshold value for the delay time configured here, an alarm will be issued.
				Notes If the monitored voltage asymmetry falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.
3901 3932	**Relay**	2	None / Relay 1 / Relay 2 3901: **[Relay 1]** 3932: **[Relay 2]**	The relay configured here is activated if the respective monitoring functions triggers. If "None" is configured here, no relay is activated in this case.
				Notes Whether the relay is energized or de-energized depends on the configuration of the relay function (parameter 6920 ↳ p. 37 and 6921 ↳ p. 37).

4.3.6 Phase Shift

General notes

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

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

A vector/phase shift as shown in Fig. 29 causes a premature or delayed zero passage. The determined cycle duration difference corresponds with the occurring phase shift angle.

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

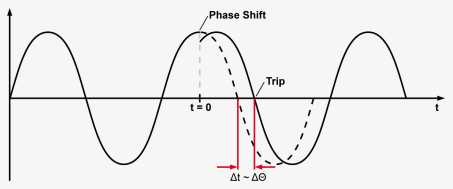


Fig. 29: Phase shift

Function "Voltage cycle duration not within the permissible range"
The voltage cycle duration exceeds the configured limit value for the phase/vector shift.

3-phase - phase shift monitoring is only enabled if "Voltage measuring" (parameter 1851 ↳ p. 34) is configured to "3Ph 4W" or "3Ph 3W".

ID	Parameter	CL	Setting range [Default]	Description
3050	**Monitoring**	4	**[On]**	Phase shift monitoring is carried out according to the following parameters.
			Off	No monitoring is carried out.
3053	**Monitoring**	4	**[1- and 3-phase]**	During single-phase voltage phase/vector shift monitoring, tripping occurs if the phase/vector shift exceeds the configured threshold value (parameter 3054 ↳ p. 48) in at least one of the three phases.
			3-phase	During three-phase voltage phase/vector shift monitoring, tripping occurs only if the phase/vector shift exceeds the specified threshold value (parameter 3055 ↳ p. 48) in all three phases within 2 cycles.
				Notes If a phase/vector shift occurs in one or two phases, the single-phase threshold value (parameter 3054 ↳ p. 48) is taken into consideration; if a phase/vector shift occurs in all three phases, the three-phase threshold value (parameter 3055 ↳ p. 48) is taken into consideration. Single phase monitoring is very sensitive and may lead to nuisance tripping if the selected phase angle settings are too small.
3054	**Limit 1-phase**	4	3 to 30° **[20°]**	If the electrical angle of the voltage shifts more than this configured value in any single phase, the relay configured in parameter 3051 ↳ p. 48 energizes.
				Notes This parameter is only active, if phase shift "Monitoring" (parameter 3053 ↳ p. 48) is configured to "1- and 3-phase". Since one phase monitoring is more sensible than three phase monitoring, it should be always be configured to a significantly higher threshold than phase shift "Limit 3-phase" (parameter 3055 ↳ p. 48).
3055	**Limit 3-phase**	4	3 to 30° **[8°]**	If the electrical angle of the voltage shifts more than this configured value in all three phases, the relay configured in parameter 3051 ↳ p. 48 energizes.
3051	**Relay**	4	None / Relay 1 / Relay 2 **[Relay 1]**	The relay configured here is activated if the respective monitoring functions triggers. If "None" is configured here, no relay is activated in this case.
				Notes Whether the relay is energized or de-energized depends on the configuration of the relay function (parameter 6920 ↳ p. 37 and 6921 ↳ p. 37).

4.3.7 df/dt (ROCOF)

General notes

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

Function "Rate of change of frequency not within permissible limits"

The control unit calculates the unit of measure per unit of time. The df/dt is measured over 4 sine waves to ensure that it is differentiated from a phase shift. This results in a minimum response time of approximately 100ms (at 50 Hz).

The hysteresis is 0.1 Hz/s.

ID	Parameter	CL	Setting range [Default]	Description
3100	**Monitoring**	4	On	df/dt monitoring is carried out according to the following parameters.
			[Off]	No monitoring is carried out.
3104	**Limit**	4	0.1 to 9.9 Hz/s **[2.6 Hz/s]**	The df/dt threshold is defined here. If this value is reached or exceeded for at least the delay time without interruption, the relay configured in parameter 3101 ↳ p. 49 will be energized.
3105	**Delay**	4	0.10 to 2.00 s **[0.10 s]**	If the monitored rate of df/dt exceeds the threshold value for the delay time configured here, the relay configured in parameter 3101 ↳ p. 49 will be energized. If the monitored df/dt falls below the threshold (minus the hysteresis) before the delay expires the time will be reset.
3101	**Relay**	4	None / Relay 1 / Relay 2 **[Relay 1]**	The relay configured here is activated if the respective monitoring functions triggers. If "None" is configured here, no relay is activated in this case.
				Notes Whether the relay is energized or de-energized depends on the configuration of the relay function (parameter 6920 ↳ p. 37 and 6921 ↳ p. 37).

4.3.8 Voltage Increase

General notes

Voltage is monitored depending on parameter "Monitoring" (parameter 8806 ↳ p. 50). This function allows the monitoring of the voltage quality over a longer time period. It is realized as a 10 minute moving average. The function is only active, if the frequency is larger than 60 % of the nominal frequency. If "Voltage measuring" (parameter 1851 ↳ p. 34) is configured to a three-phase measurement, the slow voltage increase alarm is monitoring the individual three-phase voltages according to parameter “AND characteristics” (parameter 8849 ↳ p. 50).

If this protective function is triggered, the configured relay is energized (parameter 8831 ↳ p. 50).

The average is set to "Rated voltage" (parameter 1766 ↳ p. 34) if:

- *Frequency is smaller than 60 % nominal frequency OR*
- *Monitoring (parameter 8806 ↳ p. 50) is "Off" OR*
- *Monitoring is tripped AND the measured voltage is again below the limit*

The relay is de-energized, if:

- *The 10 minute average value is smaller than the defined limit AND*
- *The actual measured value frequency is smaller than 60 % of nominal frequency*
- *After a tripping has occurred AND the voltage falls below the threshold*

The hysteresis is 0.7 % of the primary transformer delta voltage.

Please be aware that if "Voltage monitoring" (parameter 1770 ↳ p. 35) is configured to "All" and the voltage increase monitoring (parameter 8806 ↳ p. 50) is used, that this function only monitors "Phase - neutral".

ID	Parameter	CL	Setting range [Default]	Description
8806	**Monitoring**	4	On	Voltage increase monitoring is carried out according to the following parameters.
			[Off]	No monitoring is carried out.
8807	**Limit**	4	100 to 150 % **[110 %]**	The percentage voltage value that is to be monitored is defined here. If the average voltage over 10 minutes is higher, the specified relay will be energized.
				Notes This value refers to the "Rated voltage" (parameter 1766 ↳ p. 34).
8849	**AND characteristics**	4	On	If the 10 minute voltage averages of **all** phases exceed the limit, the monitoring is tripping.
			[Off]	If the 10 minute voltage average of **at least one** phase exceeds the limit, the monitoring is tripping.
8831	**Relay**	4	None / Relay 1 / Relay 2 **[Relay 1]**	The relay configured here is activated if the respective monitoring functions triggers. If "None" is configured here, no relay is activated in this case.
				Notes Whether the relay is energized or de-energized depends on the configuration of the relay function (parameter 6920 ↳ p. 37 and 6921 ↳ p. 37).

4.3.9 Time-Dependent Voltage 1

General notes

Voltage is monitored depending on parameter "Voltage measuring" (parameter 1851 p. 34). It can be configured either as undervoltage or overvoltage monitoring (parameter 4953 p. 52). If the measured voltage of at least one phase falls below/exceeds the configured "Initial threshold" (parameter 4970 p. 52), the time-dependent voltage monitoring sequence starts and the voltage threshold will change in time according to the configured threshold curve points. If the measured voltage falls below/exceeds this curve, the monitoring function triggers and the configured relay will energize. If the measured voltage falls below/exceeds the configured "Fallback threshold" (parameter 4978 p. 52) for at least the configured "Fallback time" (parameter 4968 p. 52), the time-dependent voltage monitoring sequence will be reset.

The threshold curve results from seven configurable points and a linear interpolation between these points. Fig. 30 shows a threshold curve with standard values for time-dependent voltage monitoring 1. These standard values form an FRT (fault ride-through) monitoring function according to the grid code requirements for wind turbines. The time points should always have an ascending order. The fallback threshold should always be configured to a value higher/lower than the init threshold.

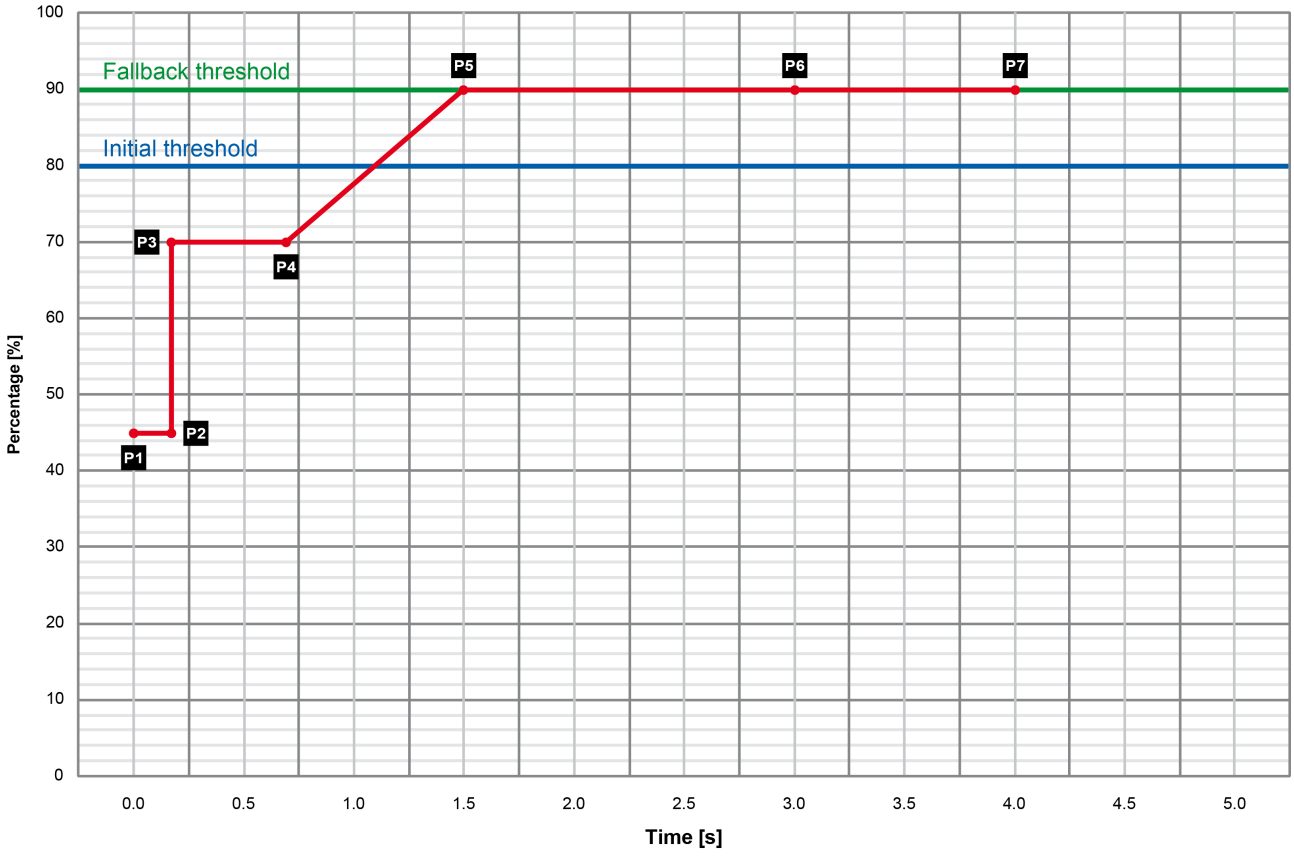


Fig. 30: Time-dependent voltage monitoring 1

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

ID	Parameter	CL	Setting range [Default]	Description
4950	**Monitoring**	2	**[On]**	Time-dependent voltage monitoring 1 is carried out according to the following parameters.
			Off	No monitoring is carried out.
4952	**AND characteristics**	2	On	Each phase falls below/exceeds the threshold for tripping.
			[Off]	At least one phase falls below/exceeds the threshold for tripping.
4953	**Monitoring at**	2		Selects whether the system shall do over- or undervoltage monitoring.
			[Underrun]	The undervoltage monitoring is carried out.
			Overrun	The overvoltage monitoring is carried out.
4970	**Init threshold**	2	0.0 to 200.0 % **[80.0 %]**	The time-dependent voltage monitoring initial threshold is configured here. If the measured voltage of at least one phase falls below/exceeds this threshold, the monitoring sequence starts and the voltage threshold will change in time according to the configured threshold curve points. If the measured voltage falls below/exceeds this curve, the monitoring function triggers and the configured relay will energize.
4968	**Fallback time**	2	0.00 to 320.00 s **[1.00 s]**	The time-dependent voltage monitoring fallback time is configured here. If the measured voltage falls below/exceeds the configured "Fallback threshold" (parameter 4978 p. 52) for at least the time configured here, the monitoring sequence will be reset.
4978	**Fallback threshold**	2	0.0 to 200.0 % **[90.0 %]**	The time-dependent voltage monitoring fallback voltage is configured here. If the measured voltage falls below/exceeds the voltage configured here for at least the configured "Fallback time" (parameter 4968 p. 52), the monitoring sequence will be reset.
				Notes This parameter should always be configured to a value higher/lower than the "Init threshold" (parameter 4970 p. 52) for proper operation.
4961 4962 4963 4964 4965 4966 4967	**Time point {x}** [x = 1 to 7]	2	0.00 to 320.00 s 4961: **[0.00 s]** 4962: **[0.15 s]** 4963: **[0.15 s]** 4964: **[0.70 s]** 4965: **[1.50 s]** 4966: **[3.00 s]** 4967: **[4.00 s]**	The time values of time-dependent voltage monitoring time points are configured here.
4971 4972 4973 4974 4975 4976 4977	**Voltage point {x}** [x = 1 to 7]	2	0.0 to 200.0 % 4971: **[45.0 %]** 4972: **[45.0 %]** 4973: **[70.0 %]** 4974: **[70.0 %]** 4975: **[90.0 %]** 4976: **[90.0 %]** 4977: **[90.0 %]**	The voltage values of time-dependent voltage monitoring voltage points are configured here.

ID	Parameter	CL	Setting range [Default]	Description
4951	**Relay**	2	None / Relay 1 / Relay 2 **[Relay 1]**	The relay configured here is activated if the respective monitoring functions triggers. If "None" is configured here, no relay is activated in this case.
				Notes Whether the relay is energized or de-energized depends on the configuration of the relay function (parameter 6920 ↳ p. 37 and 6921 ↳ p. 37).

4.3.10 Time-Dependent Voltage 2

General notes

Voltage is monitored depending on parameter "Voltage measuring" (parameter 1851 ↳ p. 34). It can be configured either as undervoltage or overvoltage monitoring (parameter 4957 ↳ p. 54). If the measured voltage of at least one phase falls below/exceeds the configured "Initial threshold" (parameter 4990 ↳ p. 54), the time-dependent voltage monitoring sequence starts and the voltage threshold will change in time according to the configured threshold curve points. If the measured voltage falls below/exceeds this curve, the monitoring function triggers and the configured relay will energize. If the measured voltage falls below/exceeds the configured "Fallback threshold" (parameter 4998 ↳ p. 55) for at least the configured "Fallback time" (parameter 4988 ↳ p. 55), the time-dependent voltage monitoring sequence will be reset.

The threshold curve results from seven configurable points and a linear interpolation between these points. Fig. 31 shows a threshold curve with standard values for time-dependent voltage monitoring 2. These standard values form an STI (short-term interruption) monitoring function according to the grid code requirements for wind turbines. The time points should always have an ascending order. The fallback threshold should always be configured to a value higher/lower than the init threshold.

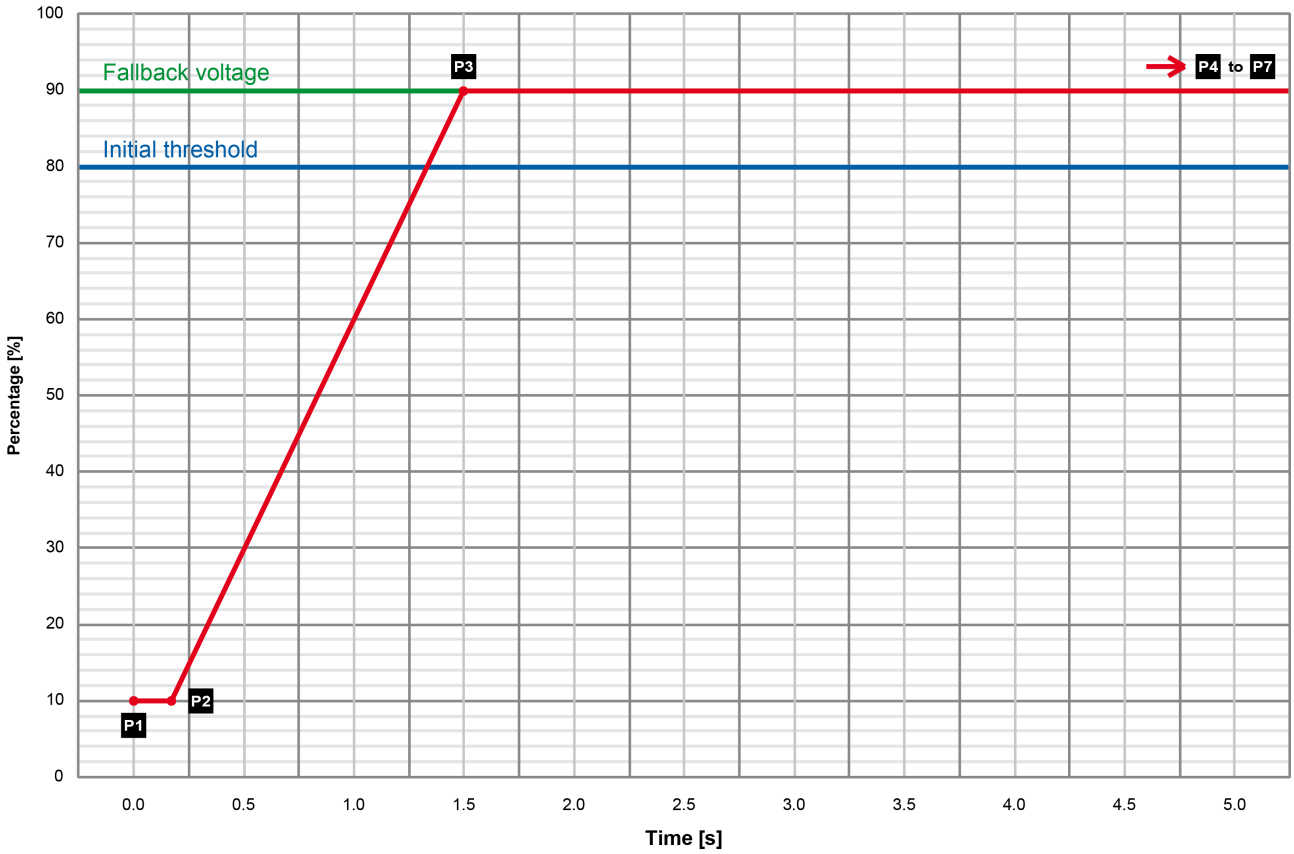


Fig. 31: Time-dependent voltage monitoring 2

P1	0.00 s → 10.0 %	P6	30.00 s → 90.0 %
P2	0.15 s → 10.0 %	P7	40.00 s → 90.0 %
P3	1.50 s → 90.0 %	Fallback voltage	90.0 %
P4	10.00 s → 90.0 %	Initial threshold	80.0 %
P5	20.00 s → 90.0 %	Fallback time	1.00 s

ID	Parameter	CL	Setting range [Default]	Description
4954	**Monitoring**	2	**[On]**	Time-dependent voltage monitoring 2 is carried out according to the following parameters.
			Off	No monitoring is carried out.
4956	**AND characteristics**	2	On	Each phase falls below/exceeds the threshold for tripping.
			[Off]	At least one phase falls below/exceeds the threshold for tripping.
4957	**Monitoring at**	2		Selects whether the system shall do over- or undervoltage monitoring.
			[Underrun]	The undervoltage monitoring is carried out.
			Overrun	The overvoltage monitoring is carried out.
4990	**Init threshold**	2	0.0 to 200.0 % **[80.0 %]**	The time-dependent voltage monitoring initial threshold is configured here. If the measured voltage of at least one phase falls below/exceeds this threshold, the monitoring sequence starts and the voltage threshold will change in time according to the configured threshold curve points. If the measured voltage falls below/exceeds this curve, the monitoring function triggers and the configured relay will energize.

ID	Parameter	CL	Setting range [Default]	Description
4988	**Fallback time**	2	0.00 to 320.00 s **[1.00 s]**	The time-dependent voltage monitoring fallback time is configured here. If the measured voltage falls below/exceeds the configured "Fallback threshold" (parameter 4998 ↳ p. 55) for at least the time configured here, the monitoring sequence will be reset.
4998	**Fallback threshold**	2	0.0 to 200.0 % **[90.0 %]**	The time-dependent voltage monitoring fallback voltage is configured here. If the measured voltage falls below/exceeds the voltage configured here for at least the configured "Fallback time" (parameter 4988 ↳ p. 55), the monitoring sequence will be reset.
				Notes This parameter should always be configured to a value higher/lower than the "Init threshold" (parameter 4990 ↳ p. 54) for proper operation.
4981 4982 4983 4984 4985 4986 4987	**Time point {x}** [x = 1 to 7]	2	0.00 to 320.00 s 4981: **[0.00 s]** 4982: **[0.15 s]** 4983: **[1.50 s]** 4984: **[10.00 s]** 4985: **[20.00 s]** 4986: **[30.00 s]** 4987: **[40.00 s]**	The time values of time-dependent voltage monitoring time points are configured here.
4991 4992 4993 4994 4995 4996 4997	**Voltage point {x}** [x = 1 to 7]	2	0.0 to 200.0 % 4991: **[10.0 %]** 4992: **[10.0 %]** 4993: **[90.0 %]** 4994: **[90.0 %]** 4995: **[90.0 %]** 4996: **[90.0 %]** 4997: **[90.0 %]**	The voltage values of time-dependent voltage monitoring voltage points are configured here.
4955	**Relay**	2	None / Relay 1 / Relay 2 **[Relay 2]**	The relay configured here is activated if the respective monitoring functions triggers. If "None" is configured here, no relay is activated in this case.
				Notes Whether the relay is energized or de-energized depends on the configuration of the relay function (parameter 6920 ↳ p. 37 and 6921 ↳ p. 37).

4.3.11 Time-Dependent Voltage 3

General notes

Voltage is monitored depending on parameter "Voltage measuring" (parameter 1851 ↳ p. 34). It can be configured either as undervoltage or overvoltage monitoring (parameter 9133 ↳ p. 57). If the measured voltage of at least one phase falls below/exceeds the configured "Initial threshold" (parameter 9148 ↳ p. 57), the time-dependent voltage monitoring sequence starts and the voltage threshold will change in time according to the configured threshold curve points. If the measured voltage falls below/exceeds this

curve, the monitoring function triggers and the configured relay will energize. If the measured voltage falls below/exceeds the configured "Fallback threshold" (parameter 9156 ↳ p. 57) for at least the configured "Fallback time" (parameter 9147 ↳ p. 57), the time-dependent voltage monitoring sequence will be reset.

The threshold curve results from seven configurable points and a linear interpolation between these points. Fig. 32 shows a threshold curve with standard values for time-dependent voltage monitoring 3. These standard values form an FRT (fault ride-through) monitoring function according to the grid code requirements for wind turbines. The time points should always have an ascending order. The fallback threshold should always be configured to a value higher/lower than the init threshold.

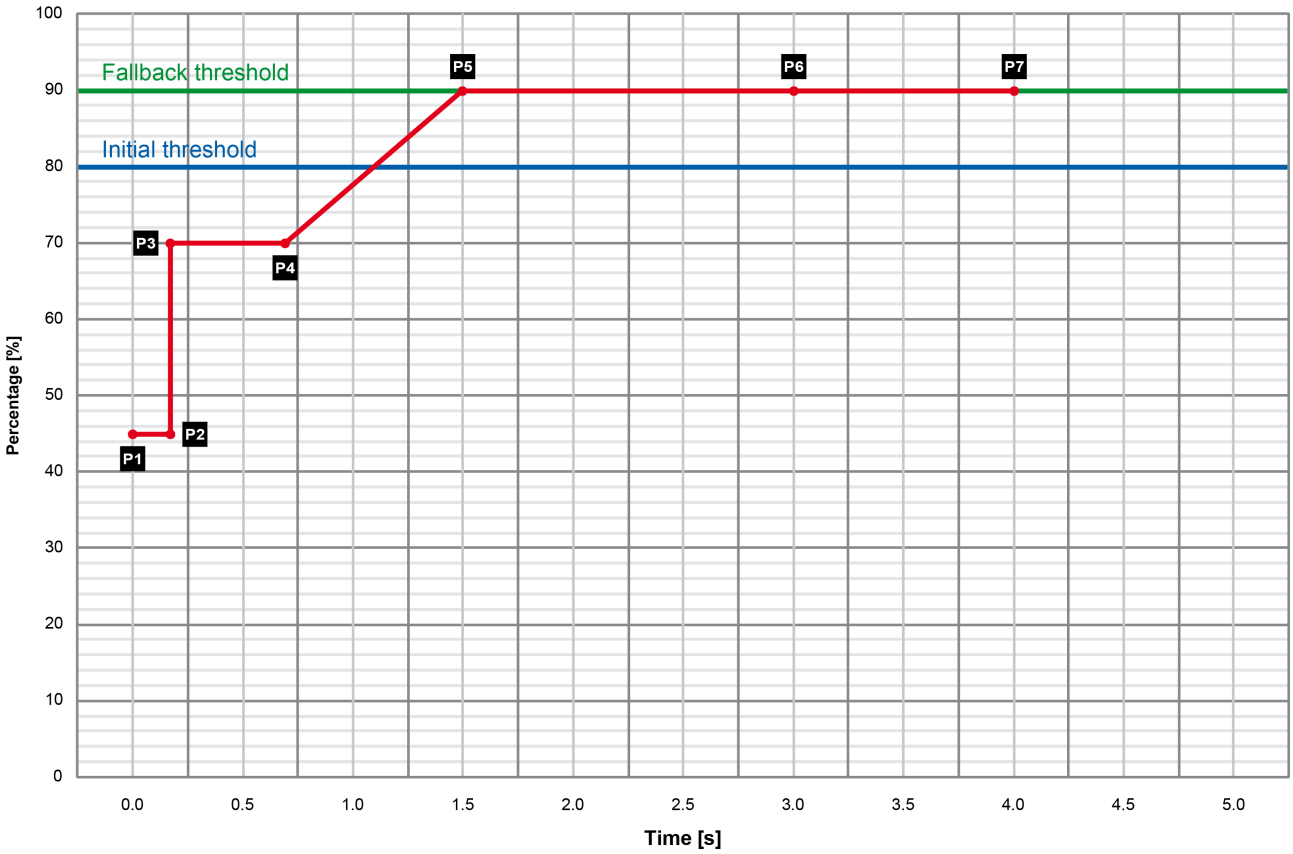


Fig. 32: Time-dependent voltage monitoring 3

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

ID	Parameter	CL	Setting range [Default]	Description
9130	**Monitoring**	2	On	Time-dependent voltage monitoring 3 is carried out according to the following parameters.
			[Off]	No monitoring is carried out.
9132	**AND characteristics**	2	On	Each phase falls below/exceeds the threshold for tripping.
			[Off]	At least one phase falls below/exceeds the threshold for tripping.

ID	Parameter	CL	Setting range [Default]	Description
9133	**Monitoring at**	2		Selects whether the system shall do over- or undervoltage monitoring.
			[Underrun]	The undervoltage monitoring is carried out.
			Overrun	The overvoltage monitoring is carried out.
9148	**Init threshold**	2	0.0 to 200.0 % **[80.0 %]**	The time-dependent voltage monitoring initial threshold is configured here. If the measured voltage of at least one phase falls below/exceeds this threshold, the monitoring sequence starts and the voltage threshold will change in time according to the configured threshold curve points. If the measured voltage falls below/exceeds this curve, the monitoring function triggers and the configured relay will energize.
9147	**Fallback time**	2	0.00 to 320.00 s **[1.00 s]**	The time-dependent voltage monitoring fallback time is configured here. If the measured voltage falls below/exceeds the configured "Fallback threshold" (parameter 9156 ↳ p. 57) for at least the time configured here, the monitoring sequence will be reset.
9156	**Fallback threshold**	2	0.0 to 200.0 % **[90.0 %]**	The time-dependent voltage monitoring fallback voltage is configured here. If the measured voltage falls below/exceeds the voltage configured here for at least the configured "Fallback time" (parameter 9147 ↳ p. 57), the monitoring sequence will be reset.
				Notes This parameter should always be configured to a value higher/lower than the "Init threshold" (parameter 9148 ↳ p. 57) for proper operation.
9140 9141 9142 9143 9144 9145 9146	**Time point {x}** [x = 1 to 7]	2	0.00 to 320.00 s 9140: **[0.00 s]** 9141: **[0.15 s]** 9142: **[0.15 s]** 9143: **[0.70 s]** 9144: **[1.50 s]** 9145: **[3.00 s]** 9146: **[4.00 s]**	The time values of time-dependent voltage monitoring time points are configured here.
9149 9150 9151 9152 9153 9154 9155	**Voltage point {x}** [x = 1 to 7]	2	0.0 to 200.0 % 9149: **[45.0 %]** 9150: **[45.0 %]** 9151: **[70.0 %]** 9152: **[70.0 %]** 9153: **[90.0 %]** 9154: **[90.0 %]** 9155: **[90.0 %]**	The voltage values of time-dependent voltage monitoring voltage points are configured here.
9131	**Relay**	2	None / Relay 1 / Relay 2 **[Relay 1]**	The relay configured here is activated if the respective monitoring functions triggers. If "None" is configured here, no relay is activated in this case.
				Notes Whether the relay is energized or de-energized depends on the configuration of the relay function (parameter 6920 ↳ p. 37 and 6921 ↳ p. 37).

4.3.12 Time-Dependent Voltage 4

General notes

Voltage is monitored depending on parameter "Voltage measuring" (parameter 1851 p. 34). It can be configured either as undervoltage or overvoltage monitoring (parameter 9137 p. 59). If the measured voltage of at least one phase falls below/exceeds the configured "Initial threshold" (parameter 9165 p. 59), the time-dependent voltage monitoring sequence starts and the voltage threshold will change in time according to the configured threshold curve points. If the measured voltage falls below/exceeds this curve, the monitoring function triggers and the configured relay will energize. If the measured voltage falls below/exceeds the configured "Fallback threshold" (parameter 9173 p. 59) for at least the configured "Fallback time" (parameter 9164 p. 59), the time-dependent voltage monitoring sequence will be reset.

The threshold curve results from seven configurable points and a linear interpolation between these points. Fig. 33 shows a threshold curve with standard values for time-dependent voltage monitoring 4. These standard values form an STI (short-term interruption) monitoring function according to the grid code requirements for wind turbines. The time points should always have an ascending order. The fallback threshold should always be configured to a value higher/lower than the init threshold.

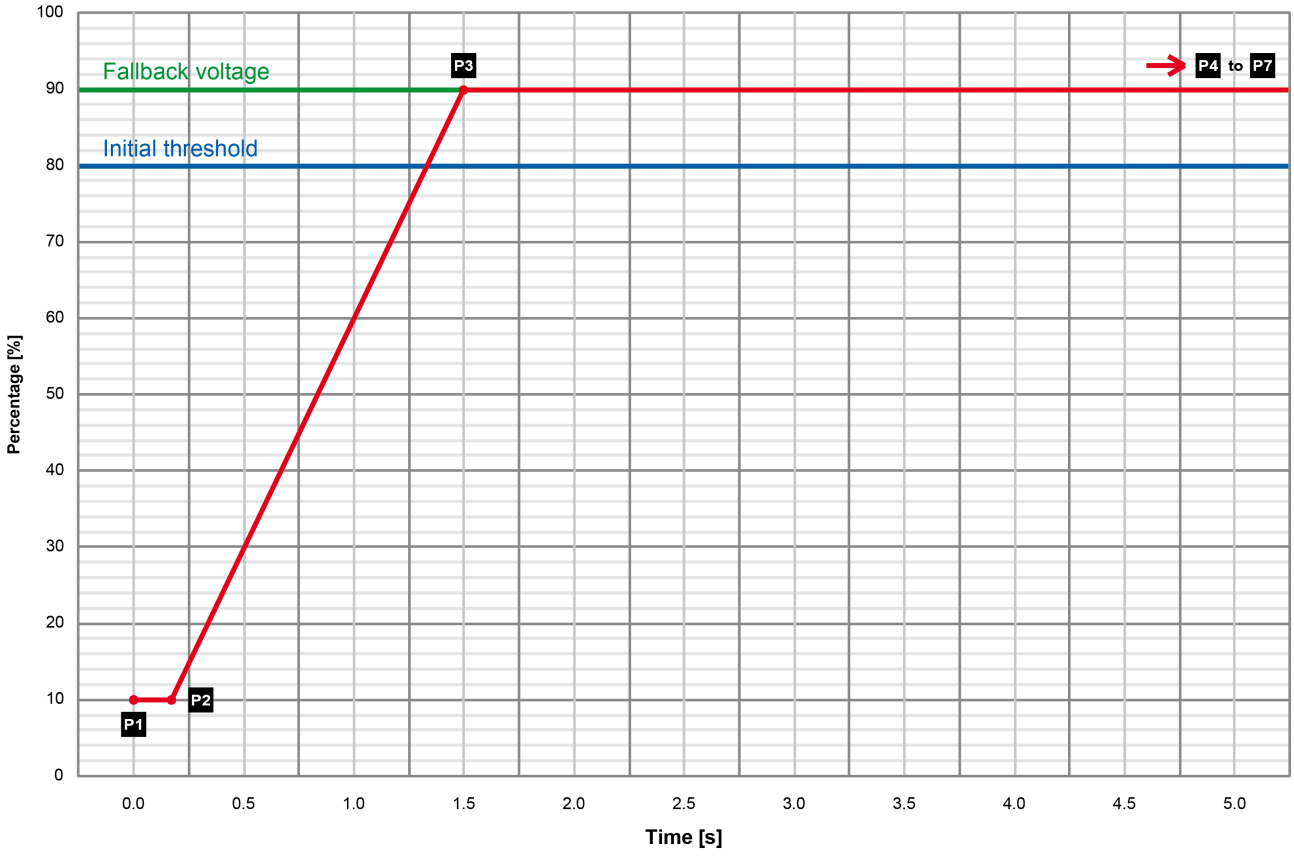


Fig. 33: Time-dependent voltage monitoring 4

P1	0.00 s → 10.0 %	P6	30.00 s → 90.0 %
P2	0.15 s → 10.0 %	P7	40.00 s → 90.0 %
P3	1.50 s → 90.0 %	Fallback voltage	90.0 %
P4	10.00 s → 90.0 %	Initial threshold	80.0 %
P5	20.00 s → 90.0 %	Fallback time	1.00 s

ID	Parameter	CL	Setting range [Default]	Description
9134	**Monitoring**	2	On	Time-dependent voltage monitoring 4 is carried out according to the following parameters.
			[Off]	No monitoring is carried out.
9136	**AND characteristics**	2	On	Each phase falls below/exceeds the threshold for tripping.
			[Off]	At least one phase falls below/exceeds the threshold for tripping.
9137	**Monitoring at**	2		Selects whether the system shall do over- or undervoltage monitoring.
			[Underrun]	The undervoltage monitoring is carried out.
			Overrun	The overvoltage monitoring is carried out.
9165	**Init threshold**	2	0.0 to 200.0 % **[80.0 %]**	The time-dependent voltage monitoring initial threshold is configured here. If the measured voltage of at least one phase falls below/exceeds this threshold, the monitoring sequence starts and the voltage threshold will change in time according to the configured threshold curve points. If the measured voltage falls below/exceeds this curve, the monitoring function triggers and the configured relay will energize.
9164	**Fallback time**	2	0.00 to 320.00 s **[1.00 s]**	The time-dependent voltage monitoring fallback time is configured here. If the measured voltage falls below/exceeds the configured "Fallback threshold" (parameter 9173 ↳ p. 59) for at least the time configured here, the monitoring sequence will be reset.
9173	**Fallback threshold**	2	0.0 to 200.0 % **[90.0 %]**	The time-dependent voltage monitoring fallback voltage is configured here. If the measured voltage falls below/exceeds the voltage configured here for at least the configured "Fallback time" (parameter 9164 ↳ p. 59), the monitoring sequence will be reset.
				Notes This parameter should always be configured to a value higher/lower than the "Init threshold" (parameter 9165 ↳ p. 59) for proper operation.
9157 9158 9159 9160 9161 9162 9163	**Time point {x}** [x = 1 to 7]	2	0.00 to 320.00 s 9157: **[0.00 s]** 9158: **[0.15 s]** 9159: **[1.50 s]** 9160: **[10.00 s]** 9161: **[20.00 s]** 9162: **[30.00 s]** 9163: **[40.00 s]**	The time values of time-dependent voltage monitoring time points are configured here.
9166 9167 9168 9169 9170 9171 9172	**Voltage point {x}** [x = 1 to 7]	2	0.0 to 200.0 % 9166: **[10.0 %]** 9167: **[10.0 %]** 9168: **[90.0 %]** 9169: **[90.0 %]** 9170: **[90.0 %]** 9171: **[90.0 %]** 9172: **[90.0 %]**	The voltage values of time-dependent voltage monitoring voltage points are configured here.

ID	Parameter	CL	Setting range [Default]	Description
9135	**Relay**	2	None / Relay 1 / Relay 2 **[Relay 2]**	The relay configured here is activated if the respective monitoring functions triggers. If "None" is configured here, no relay is activated in this case.
				Notes Whether the relay is energized or de-energized depends on the configuration of the relay function (parameter 6920 ↳ p. 37 and 6921 ↳ p. 37).

4.4 System Management

4.4.1 Factory Settings

ID	Parameter	CL	Setting range [Default]	Description
1704	**Factory default settings**	0	Yes	Enables the parameter "Reset factory default values" (parameter 1701 ↳ p. 60).
			[No]	Disables the parameter "Reset factory default values" (parameter 1701 ↳ p. 60).
1701	**Reset factory default values**	0	Yes	All parameters, which the enabled access code grants privileges to, will be restored to factory default values.
			[No]	All parameters will remain as currently configured.
				Notes The function will only be executed if parameter 1704 ↳ p. 60 is configured to “Yes”. It will reset itself automatically.

4.4.2 Password System

General notes

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

A distinction is made between the access levels as follows:

Code level	
Code level CL0 (User Level) Standard password = none	This code level permits for monitoring of the system. Configuration of the control is not permitted. The unit powers up in this code level.
Code level CL1 (Service Level) Standard password = "0 0 0 1"	This code level entitles the user to change selected non-critical parameters. The user may also change the password for level CL1. Access granted by this password expires two hours after the password has been entered and the user is returned to the CL0 level.

Code level	
Code level CL2 (Temporary Commissioning Level) No standard password available	This code level grants temporary access to most of the parameters. The password is calculated from the random number generated when the password is initially accessed. It is designed to grant a user one-time access to a parameter without having to give him a reusable password. The user may also change the password for level CL1. Access granted by this password expires two hours after the password has been entered and the user is returned to the CL0 level. The password for the temporary commissioning level may be obtained from the vendor.
Code level CL3 (Commissioning Level) Standard password = "0 0 0 3"	This code level grants complete and total access to most of the parameters. In addition, the user may also change the passwords for levels CL1, CL2 and CL3. Access granted by this password expires two hours after the password has been entered and the user is returned to the CL0 level.

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

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

4.4.3 Password Entry

ID	Parameter	CL	Setting range [Default]	Description
10418	**Password system**	4	On	The standard password system is used.
			[Off]	The password system is set permanently to code level CL5 (Supercommissioning level).
10406	**Actual code level**	---	Info **[-]**	This value displays the code level which is currently enabled for the access via ToolKit.
10401	**Password**	0	0 to 9999 **[0]**	The password to configure the device needs to be entered here.

4.4.4 Passwords

General notes

The values from parameter 10411 ↳ p. 62 to parameter 10415 ↳ p. 62 are not readable in ToolKit if the actual code level is lower than the parameters code level.

ID	Parameter	CL	Setting range [Default]	Description
10415	**Basic code level**	1	0 to 9999 **[-]**	The password for the code level "Service" is defined in this parameter. Refer to ↳ *Chapter 4.4.2 "Password System" on page 60* for default values.
10414	**Temp. commissioning code level**	3	0 to 9999 **[-]**	The algorithm for calculating the password for the code level "Temporary Commissioning" is defined in this parameter.
10413	**Commissioning code level**	3	0 to 9999 **[-]**	The password for the code level "Commission" is defined in this parameter. Refer to ↳ *Chapter 4.4.2 "Password System" on page 60* for default values.
10412	**Temp. supercomm. level code**	5	0 to 9999 **[-]**	The algorithm for calculating the password for the code level "Temporary Supercommissioning" is defined in this parameter.
10411	**Supercommissioning level code**	5	0 to 9999 **[-]**	The password for the code level "Supercommissioning" is defined in this parameter. Refer to ↳ *Chapter 4.4.2 "Password System" on page 60* for default values.

5 Operation

The easYprotec-1410 can be operated, monitored and configured using the following access methods:

- External access with a PC using the ToolKit configuration software.
  ↳ *Chapter 5.1.1 “Install ToolKit” on page 63*

5.1 Access Via PC (ToolKit)

Version

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

– *Required version: 4.7.3 or higher*
– *For information on how to obtain the latest version see ↳ “Load from the website” on page 63.*

5.1.1 Install ToolKit

Load from CD

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

   ⇨ The HTML menu is opened automatically in a browser.

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

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

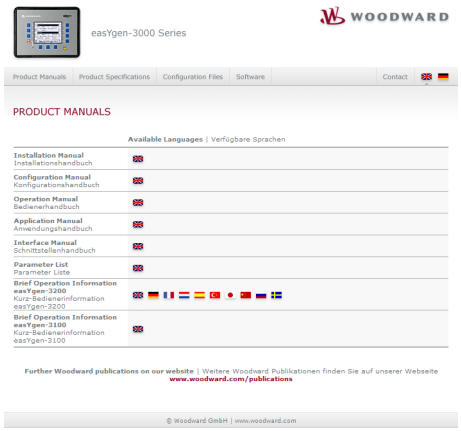


Fig. 34: Product CD - HTML menu

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

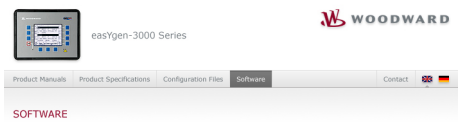


Fig. 35: HTML menu section 'Software'

Load from the website

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

To get the software from the website:

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

Minimum system requirements

- Microsoft Windows® 7, Vista, XP (32- & 64-bit)
- Microsoft .NET Framework Ver. 3.5
- 600 MHz Pentium® CPU
- 96 MB of RAM
- Screen
  – Resolution: 800 by 600 pixels
  – Colors: 256
- Serial Port
- CD-ROM drive

Microsoft .NET Framework 3.5 must be installed on your computer to be able to install ToolKit.

– *If not already installed, Microsoft .NET Framework 3.5 will be installed automatically (internet conection required).*
– *Alternatively use the .NET Framework 3.5 installer found on the Product CD.*

Installation

To install ToolKit:

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

5.1.2 Install ToolKit Configuration Files

Load from CD

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

   ⇨ The HTML menu is opened automatically in a browser.

> *The 'autostart' function of your operating system needs to be activated.*
>
> *Alternately open the document "start.html" in the root directory of the CD in a browser.*

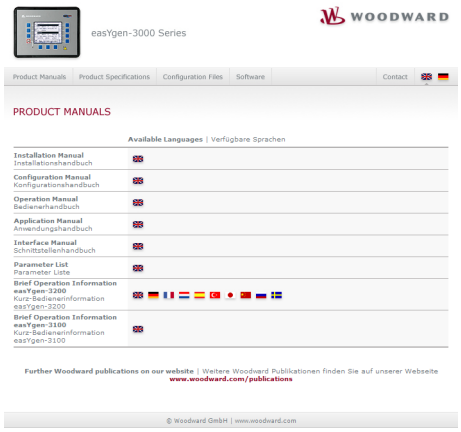


Fig. 36: Product CD - HTML menu

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

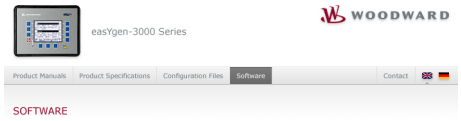


Fig. 37: HTML menu section 'Software'

Load from the website

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

To get the software from the website:

1. Go to *http://www.woodward.com/software/configfiles*
2. Insert the part number (P/N) and revision of your device into the corresponding fields.
3. Select "ToolKit" in the *"application type"* list.
4. Click *"Search"*.
5. Download the file displayed in the search result.

   ⇨ The file is a ZIP archive which must be extracted for use in ToolKit.

ToolKit files

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

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

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

- [1] P/N1 = Part number of the unit
- [2] P/N2 = Part number of the software in the unit

5.1.3 Configure ToolKit

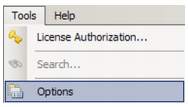


Fig. 38: Tools menu

To change ToolKit settings:

1. Select *"Tools ➔ Options"*.

⇨ The *"Options"* windows is displayed.

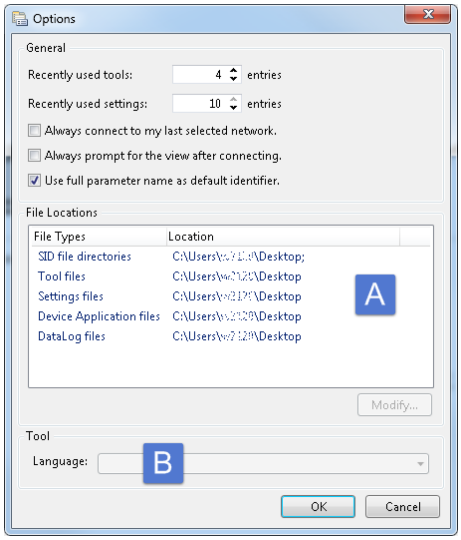


Fig. 39: ToolKit Options window

A File locations
B Language setting for tools

2. Adjust settings as required.

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

⇨ Changes take effect after clicking *"OK"*.

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

5.1.4 Connect ToolKit

Standard connection

To connect ToolKit and the easYprotec unit:

1.

> *The USB/RS-232 serial interface is only provided via the optional Woodward DPC (direct configuration cable), which must be connected to the service port.*
>
> – *For additional information refer to ↯ Chapter 3.2.6 "Service Port" on page 30.*

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

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

2. Open ToolKit from the Windows Start Menu path *"Programs ➔ Woodward ➔ ToolKit X.x"*.
3. From the main ToolKit window, select *"File ➔ Open Tool..."* click the *"Open Tool"* icon on the tool bar.
4. Locate and select the desired tool file (`*.WTOOL`) in the ToolKit data file directory and click *"Open"*.

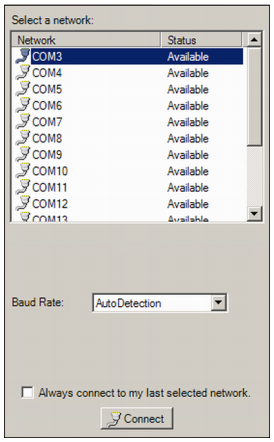


Fig. 40: Connect dialog

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

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

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

7. Click the *“Connect”* button.

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

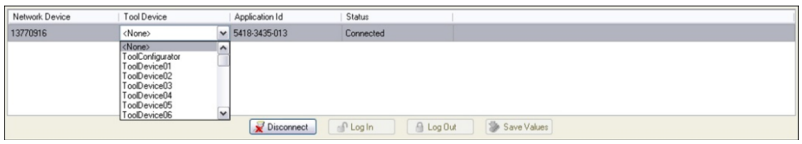


Fig. 41: Communications window

8. If the communications window opens, select *“ToolConfigurator”* from the *“Tool Device”* list and close the communications window.

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

9. Enter the login data if required.

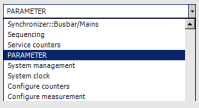
⇨ Now you are able to edit the device parameters in the main window.

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

5.1.5 View And Set Values In ToolKit

Basic navigation

ToolKit offers the following graphical elements for basic navigation:

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

Value and status fields

Graphical element	Caption	Description
300 h	Value field	To directly input (alpha)numeric values
No	Option field	To select from a preset list of options
Connected on COM2	Connection status field	Displays active port and unit connection status

To change the value of a value or option field:

1. Enter the value or select an option from the drop-down list.
2. Press *[Enter]* to confirm.
   ⇨ The new value is written directly to the unit.

Visualization

Values displayed by visualization graphical elements cannot be changed.

Graphical element	Caption	Description
	Status indicator	Displays status [**on**/off]
	Error indicator	Displays error [**on**/off]

Search

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

To find a parameter/setting/monitoring value:

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

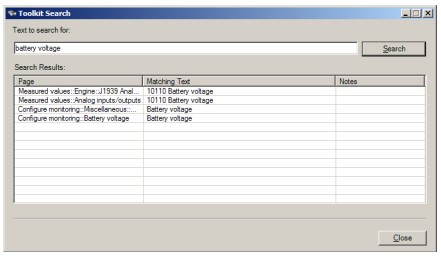


Fig. 42: Search dialog

Value trending

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

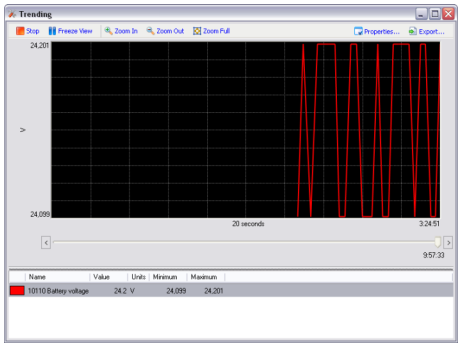


Fig. 43: Trending screen

To select values for trending screen:

1. Right-click an analog value field on any configuration/visualisation page and select *"Add to trend"* from the context-menu.
2. Select *"Tools* ➔ *Trending"* from the menu.
   ⇨ The trending screen opens.
3. Click the *"Start"* button to initiate charting.
4. Click the *"Stop"* button to stop charting the values.
5. To store the tracked data select *"Export"*
   ⇨ The tracked data is exported to a `.CSV` (comma separated values) file which can be viewed/edited/analysed in external applications (e.g. MS Excel/OpenOffice.org Calc).

Graphical element	Caption	Description
Start	*"Start"*	Start value charting
Stop	*"Stop"*	Stop value charting
Zoom In Zoom Out Zoom Full	Zoom controls	Adjust detail of value chart
Export...	*"Export"*	Export to `.CSV`
Properties...	*"Properties"*	Change scale limits, sample rate, time span, colors

6 Application

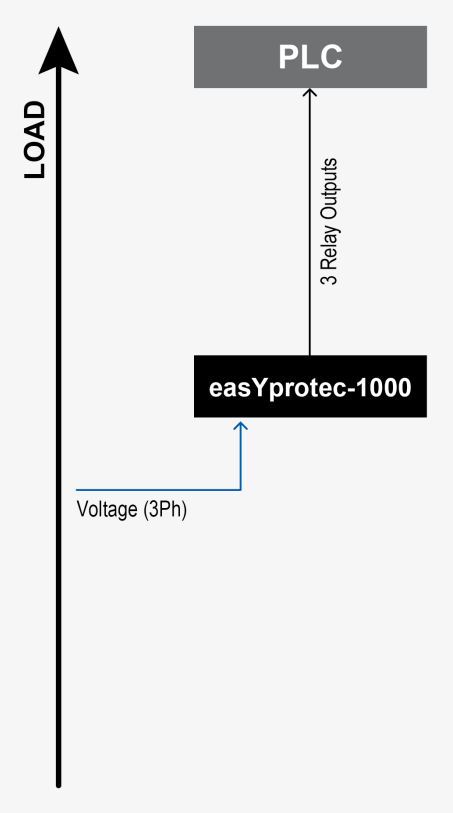


Fig. 44: Generator application

In this general application the device is used as a transducer with monitoring functions. The control does not operate any breaker.

- PLC measuring data V, f
- Monitoring V, f

7 Interfaces And Protocols

7.1 Interfaces Overview

Interfaces and protocols

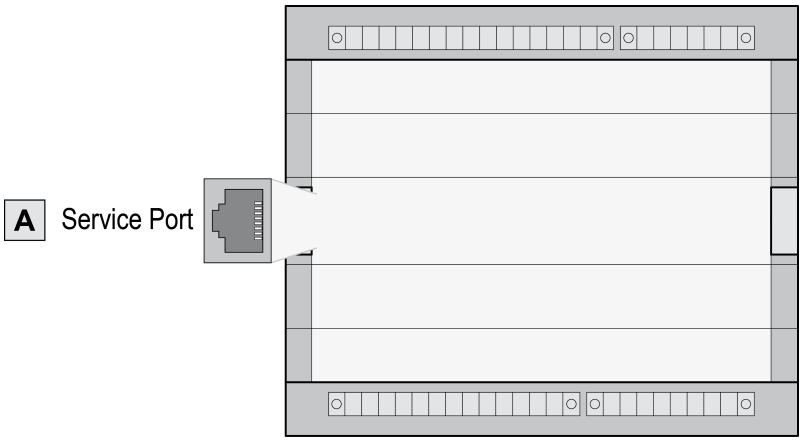


Fig. 45: easYprotec-1410 interfaces

The easYprotec-1410 (Fig. 45) provides the following interface.

Figure	Interface	Protocol
A	Service Port (USB/RS-232)[1]	ToolKit

[1] Please refer to ↳ Chapter 3.2.6 “Service Port” on page 30.

7.2 Serial Interfaces

7.2.1 Service Port (RS-232/USB)

The Woodward specific service port can be used to extend the interfaces of the controller.

In conjunction with the direct configuration cable the service port allows service access for configuring the unit and visualize measured data.

Fig. 46: Service Port

*[1] The service port can be **only** used in combination with an optional Woodward direct configuration cable (DPC), which includcdes a converter box to provide either an USB or a RS-232 interface.*

– *For additional information refer to ↳ Chapter 3.2.6 “Service Port” on page 30.*

8 Technical Specifications

8.1 Technical Data

Product label

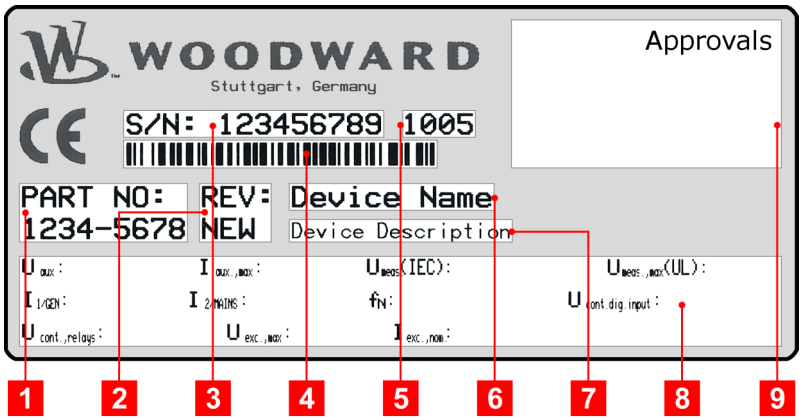


Fig. 47: Product label

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

8.1.1 Measuring Values

Voltages

Measuring voltage ⅄ / Δ	**120 V**	
Rated value (V_{rated})		69/120 Vac
Maximum value (V_{max})		max. 86/150 Vac
Rated voltage phase – ground		150 Vac
Rated surge voltage (V_{surge})		2.5 kV
Measuring voltage ⅄ / Δ	**690 V**	
Rated value (V_{rated})		400/690 Vac
Maximum value (V_{max})		max. 500/862 Vac
Rated value UL (V_{rated})		600/600 Vac
Rated voltage phase – ground		600 Vac
Rated surge voltage (V_{surge})		6.0 kV
Linear measuring range		1.25 × V_{rated}

Measuring frequency		50/60 Hz (45.0 to 65.0 Hz)
Accuracy		Class 0.5
Input resistance per path	**120 V**	0.522 MΩ
	690V	2.0 MΩ
Maximum power consumption per path		< 0.15 W

8.1.2 Ambient Variables

Power supply	12/24 Vdc (8 to 32.0 Vdc)
Intrinsic consumption	max. 5 W
Degree of pollution	2
Maximum elevation	2,000 m ASL
Reverse voltage protection	Fully supply range
Input capacitance	440 uF

8.1.3 Inputs/Outputs

Discrete outputs

Discrete outputs		Potential free
Contact material		AgCdO

8.1.4 Interface

Service Port interface

Service Port interface	Not isolated
Proprietary interface	Connect only with Woodward DPC cable

8.1.5 Housing

Housing type

Type		Extrusion Profile UM122 Plastic - DIN rail mounting
Dimensions (W × H × D)		146 × 128 × 50 mm
Wiring	Screw-plug-terminals	2.5 mm²
Recommended locked torque	4 inch pounds / 0.5 Nm Use 60/75 °C copper wire only Use class 1 wire only or equivalent	
Weight		approx. 300 g

Protection

Protection system		IP20

8.1.6 Approvals

EMC test (CE)	Tested according to applicable EN guidelines
Listings	CE marking

8.1.7 Generic Note

Accuracy	Referred to full scale value

8.2 Environmental Data

Vibration

Frequency range - sine sweep	5 Hz to 100 Hz
Acceleration	4 G
Standards	EN 60255-21-1 (EN 60068-2-6, Fc)
	Lloyd’s Register, Vibration Test2
Frequency range - random	10 Hz to 500 Hz
Power intensity	0.015 G²/Hz
RMS value	1.04 Grms
Standards	MIL-STD 810F, M514.5A, Cat.4,
	Truck/Trailer tracked-restrained
	Cargo, Fig. 514.5-C1

Shock

Shock	40 G, Saw tooth pulse, 11 ms
Standards	EN 60255-21-2
	MIL-STD 810F, M516.5, Procedure 1

Temperature

Cold, Dry Heat (storage)	-40 °C (-40 °F) / 85 °C (185 °F)
Cold, Dry Heat (operating)	-20 °C (-4 °F) / 70 °C (158 °F)
Standards	IEC 60068-2-2, Test Bb and Bd
	IEC 60068-2-1, Test Ab and Ad

Humidity

Humidity	95 %, not condensing
Standards	IEC 60068-2-30, Test Db

8.3 Accuracy

Measuring value	Range	Accuracy	Measuring start	Notes
Frequency	40.0 to 80.0 Hz	0.1 % (of 80 Hz)	5 % (of PT secondary voltage setting)[1]	
Voltage				
Wye generator / mains / busbar	0 to 650 kV	1 % (of 150/600 V)[2]	1.5 % (of PT secondary voltage setting)[1]	
Delta generator / mains / busbar			2 % (of PT secondary voltage setting)[1]	
Miscellaneous				
Phase angle	-180 to 180°		2.00 % (of PT secondary volt. setting)	180° is displayed for measuring values below measuring start

[1] Setting of the parameter for the PT secondary rated voltage

[2] Depending on the used measuring inputs (120/690 V)

Reference conditions

The reference conditions for measuring the accuracy are listed below.

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

9 Glossary And List Of Abbreviations

CB	Circuit Breaker
CL	Code Level
CT	Current Transformer
DI	Discrete Input
DO	Discrete (Relay) Output
GCB	Generator Circuit Breaker
I	Current
MCB	Mains Circuit Breaker
N.C.	Normally Closed (break) contact
N.O.	Normally Open (make) contact
P	Real power
P/N	Part Number
PF	Power Factor
PLC	Programmable Logic Control
PT	Potential (Voltage) Transformer
Q	Reactive power
S	Apparent power
S/N	Serial Number
V	Voltage

10 Index

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