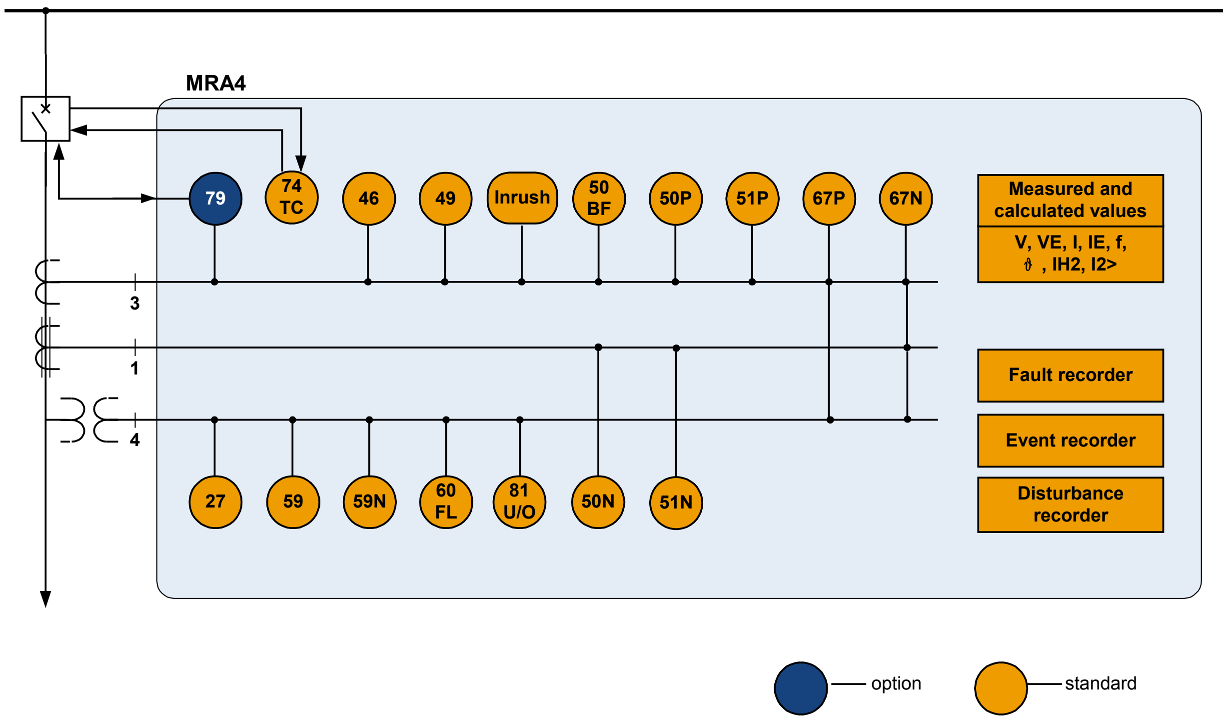
MRA4
HighPROTEC

Feeder Protection

Device Manual

MRA4 Functional Overview



Build: 4326

Version 1.1.d

Comments on the Manual

This manual explains in general the tasks of device planning, parameter setting, installation, commissioning, operation and maintenance of the HighPROTEC devices.

The manual serves as working basis for:

- Engineers in the protection field,
- commissioning engineers,
- people dealing with setting, testing and maintenance of protection and control devices,
- as well as trained personnel for electrical installations and power stations.

All functions concerning the type code will be defined. Should there be a description of any functions, parameters or inputs/outputs which do not apply to the device in use, please ignore that information.

All details and references are explained to the best of our knowledge and are based on our experience and observations.
This manual describes the (optionally) full featured versions of the devices.

All technical information and data included in this manual reflect their state at the time this document was issued. We reserve the right to carry out technical modifications in line with further development without changing this manual and without previous notice. Hence no claim can be brought based on the information and descriptions this manual includes.

Text, graphic and formulae do not always apply to the actual delivery scope. The drawings and graphics are not true to scale. We do not accept any liability for damage and operational failures caused by operating errors or disregarding the directions of this manual.

No part of this manual is allowed to be reproduced or passed on to others in any form, unless *Woodward SEG GmbH & Co. KG* have approved in writing.

This user manual is part of the delivery scope when purchasing the device. In case the device is passed on (sold) to a third party, the manual has to be handed over as well.

Any repair work carried out on the device requires skilled and competent personnel who need to be well aware especially of the local safety regulations and have the necessary experience for working on electronic protection devices and power installations (provided by evidence).

Information Concerning Liability and Warranty

Woodward SEG does not accept any liability for damage resulting from conversions or changes carried out on the device or planning (projecting) work, parameter setting or adjustment changes done by the customer.

The warranty expires after a device has been opened by others than *Woodward SEG* specialists.

Warranty and liability conditions stated in *Woodward SEG's* General Terms and Conditions are not supplemented by the above mentioned explanations.

IMPORTANT DEFINITIONS

The signal definitions shown below serve the safety of life and limb as well as for the appropriate operating life of the device.

⚠ DANGER	**DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.**
⚠ WARNING	**WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.**
⚠ CAUTION	**CAUTION, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.**
NOTICE	**NOTICE is used to address practices not related to personal injury.**
CAUTION	**CAUTION, without the safety alert symbol, is used to address practices not related to personal injury.**

WARNING

FOLLOW INSTRUCTIONS

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

WARNING

PROPER USE

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (1) constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (2) invalidate product certifications or listings.

The progamable devices subject to this manual are designed for protection and also control of power installations and operational devices. The devices are further designed for installation in low-voltage (LV) compartments of medium voltage (MV) switchgear panels or in de-centralized protection panels. The programing and parameterization has to meet all requirements of the protection concept (of the equipment that is to be protected). You must ensure that the device will properly recognize and manage (e.g. switch off the circuit breaker) on the basis of your progaming and parameterization all operational conditions (failures). Before starting any operation and after any modification of the programming (parameterization) test make a documentary proof that your programing and parameterization meets the requirements of your protection concept.

Typical applications for this product family/device line are for instance:

- **Feeder protection**
- **Mains protection**
- **Machine protection**

Any usage beyond these applications the devices are not designed for. The manufacturer cannot be held liable for any resulting damage, the user alone bears the risk for this. As to the appropriate use of the device: The technical data specified by *Woodward SEG* have to be met.

WARNING

OUT-OF-DATE PUBLICATION

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

doc.seg-pp.com

The latest version of most publications is available at: doc.seg-pp.com

If your publication is not there, please contact your customer service representative to get the latest copy.

CAUTION

Electrostatic Discharge Awareness

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

Follow these precautions when working with or near the control.

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

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

3. **Keep plastic, vinyl, and Styrofoam materials (such as plastic or Styrofoam cups, cup holders, cigarette packages, cellophane wrappers, vinyl books or folders, plastic bottles, and plastic ash trays) away from the control, the modules, and the work area as much as possible.**

4. **Do not remove any printed circuit board (PCB) from the control cabinet unless absolutely necessary. If you must remove the PCB from the control cabinet, follow these precautions:**

   - **Do not touch any part of the PCB except the edges.**

   - **Do not touch the electrical conductors, the connectors, or the components with conductive devices or with your 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.**

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.

Scope of Delivery

The delivery scope does not include the fastening material, but includes all connection terminals, except communication connectors. Please check the consignment for completeness on arrival (delivery note).

Please ascertain whether the type plate, connection diagram, type code and description of the device tally.
If you have any doubts please contact our Service Department (contact address to be found on the reverse of the manual).

Storage

The devices must not be stored outdoors. The storing facilities have to be sufficiently ventilated and must be dry (see Technical Data).

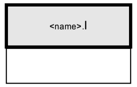
Important Information

WARNING

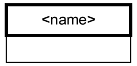
In line with the customer's requirement the devices are combined in a modular way (in compliance with the order code). The terminal assignment of the device can be found on the top of the device (wiring diagram). In addition to that it can be found within the appendix (wiring diagrams).

Symbols

setting value:

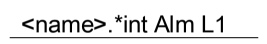


Device Planning:

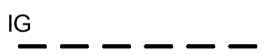


Signal:

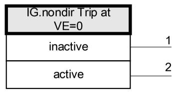
internal message



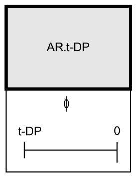
Measured values:



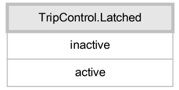
Functional description: If the setting value "IE.Block at VE=0" is set to "inactive" the output 1 is active and output 2 is inactive. If the setting value "IE.Block at VE=0" is set to "active" the output 2 is active and the output 1 is inactive.



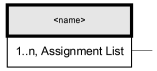
"ϕ"=Elements with complex functions "gray-box".



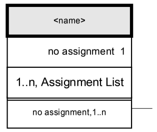
option/features to be realised in the future



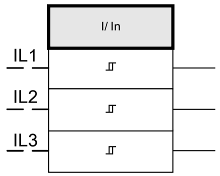
Parameter of a Module-Input with a SelectionList/DropDown. An (1..n) signal/output from the list or a pre-defined value can be selcted.

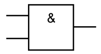


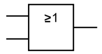
Parameter of a Module-Input (with special values): An (1..n) output from the list will be assigned to the input "<name>.identifier". If the parameter is set to "ItemNull", an "active"-signal will be given out.

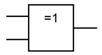


Limit value monitoring with three analogue input values. Compares 3 analogue values with the set limit; output values are three different binary values as a result of the comparision. If the analogue signal exceeds the limit I/In the corresponding output signal becomes "1".



and 

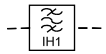
or 

exclusive-OR 

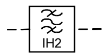
negated input 

negated output 

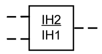
band-pass (filter)
IH1



band-pass (filter)
IH2



Quotient of analogue values

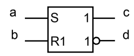


analogue values

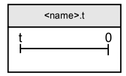
Analogue values comparator 

RS flip-flop

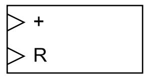
a	b	c	d
0	0	unchanged	
0	1	0	1
1	0	1	0
1	1	0	1



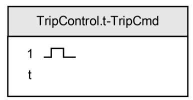
Time stage: A "1" at the input starts the stage. If the time <name>.t is expired the output becomes "1" too. The time stage will be reseted by "0" at the input. Thus the output will be set to "0" at the same time.



edge triggered counter
+ increment
R Reset



Time stage minimum pulse width: The pulse width <name>.t will be started if a "1" is feed to the input. By starting <name>.t the output becomes "1". If the time is expired, the output becomes "0" independent from the input signal.



Device

MRA4

Device Planning

Planning of a device means to reduce the functional range to a degree that suits the protection task to be fulfilled, i.e. the device shows only those functions you really need. If you, for example, deactivate the voltage protection function, all parameter branches related to this function do not appear in the parameter tree any more. All corresponding events, signals etc. will be deactivated too. By this the parameter trees become very transparent. Planning also involves adjustment of all basic system data (frequency etc.).

WARNING

But it has to be taken into account that by deactivating, for instance, protective functions, you also change the functionality of the device. If you cancel the directional feature of the overcurrent protections then the device no longer trips in a directional way but merely in a non-directional way.

The manufacturer does not accept liability for any personal or material damage as a result of wrong planning.

A planning service is also offered by *Woodward SEG*.

WARNING

Beware of inadvertent deactivating protective functions/modules

If you are deactivating modules within the device planning all parameters of those modules will be set on default.
If you are activating one of these modules again all parameters of those reactivated modules will be set on default.

Device Planning Parameters of the Device

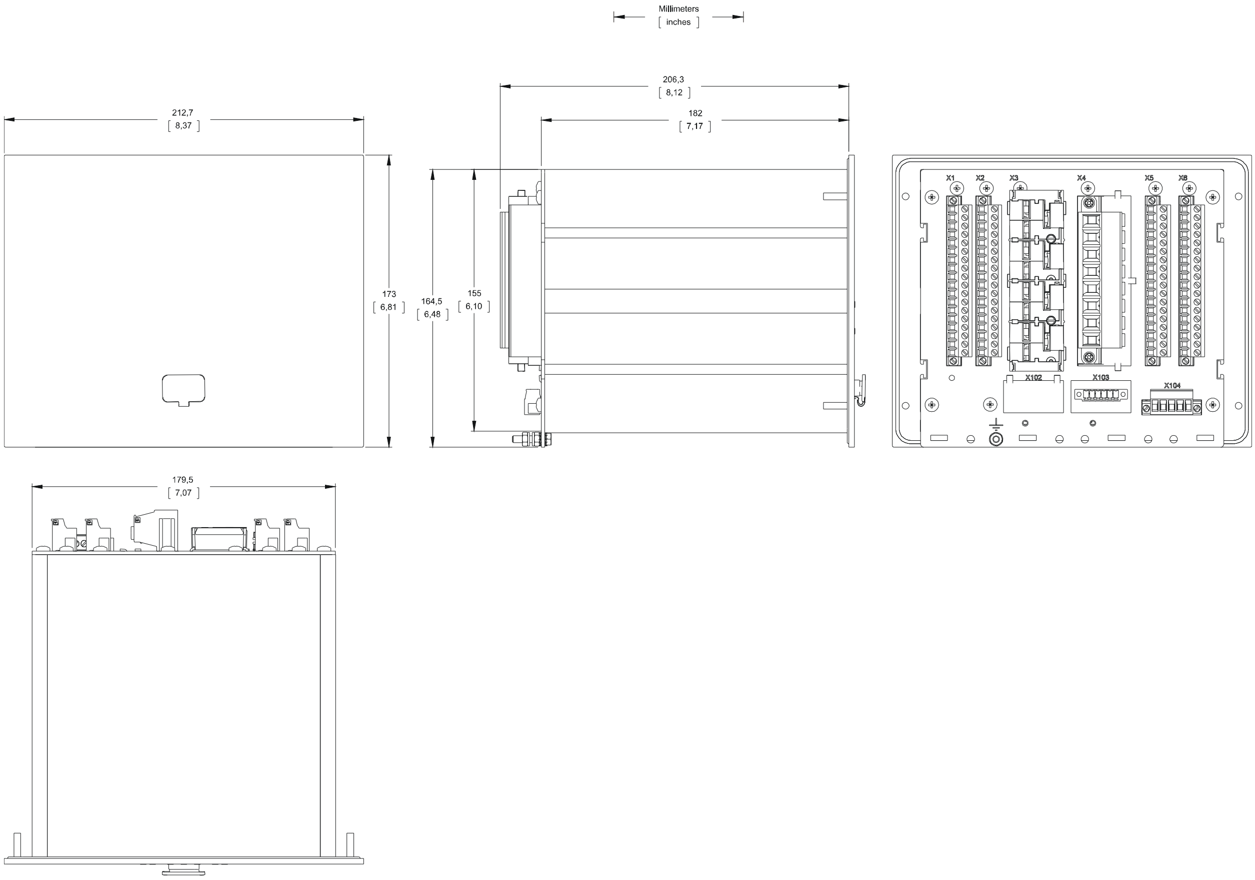
Parameter	*Description*	*Options*	*Default*	*Menu path*
Hardware variant 1	Optional hardware extension	»A« 8 digital inputs | 6 binary output relays, »B« 16 digital inputs | 6 binary output relays, »C« 8 digital inputs | 12 binary output relays, »D« 16 digital inputs | 12 binary output relays	8 digital inputs | 6 binary output relays	[MRA4]
Hardware variant 2	Optional hardware extension	»0« standard	standard	[MRA4]
Housing	Mounting form	»A« Flush mounting	Flush mounting	[MRA4]
Protection extension 1	Optional protection extension	»0« without, »1« AR	without	[MRA4]
Protection extension 2	Optional protection extension	»A« without	without	[MRA4]
Protection extension 3	Optional protection extension	»0« without	without	[MRA4]
Protection extension 4	Optional protection extension	»A« without	without	[MRA4]
Disturbance recorder	Disturbance recorder	»0« standard	standard	[MRA4]
Communication	Communication	»A« without, »G« Modbus RS485 D-Sub, »H« Modbus RS485 terminal	without	[MRA4]
Language package	Language package	»0« English-English, »1« English-German	English-English	[MRA4]

Installation and Connection

Three-Side-View

NOTICE

Dependent on the connection method of the SCADA system used the needed space (depth) differs. If, for instance, a D-Sub-Plug is used, it has to be added to the depth dimension.



3-Side-View B2 Housing

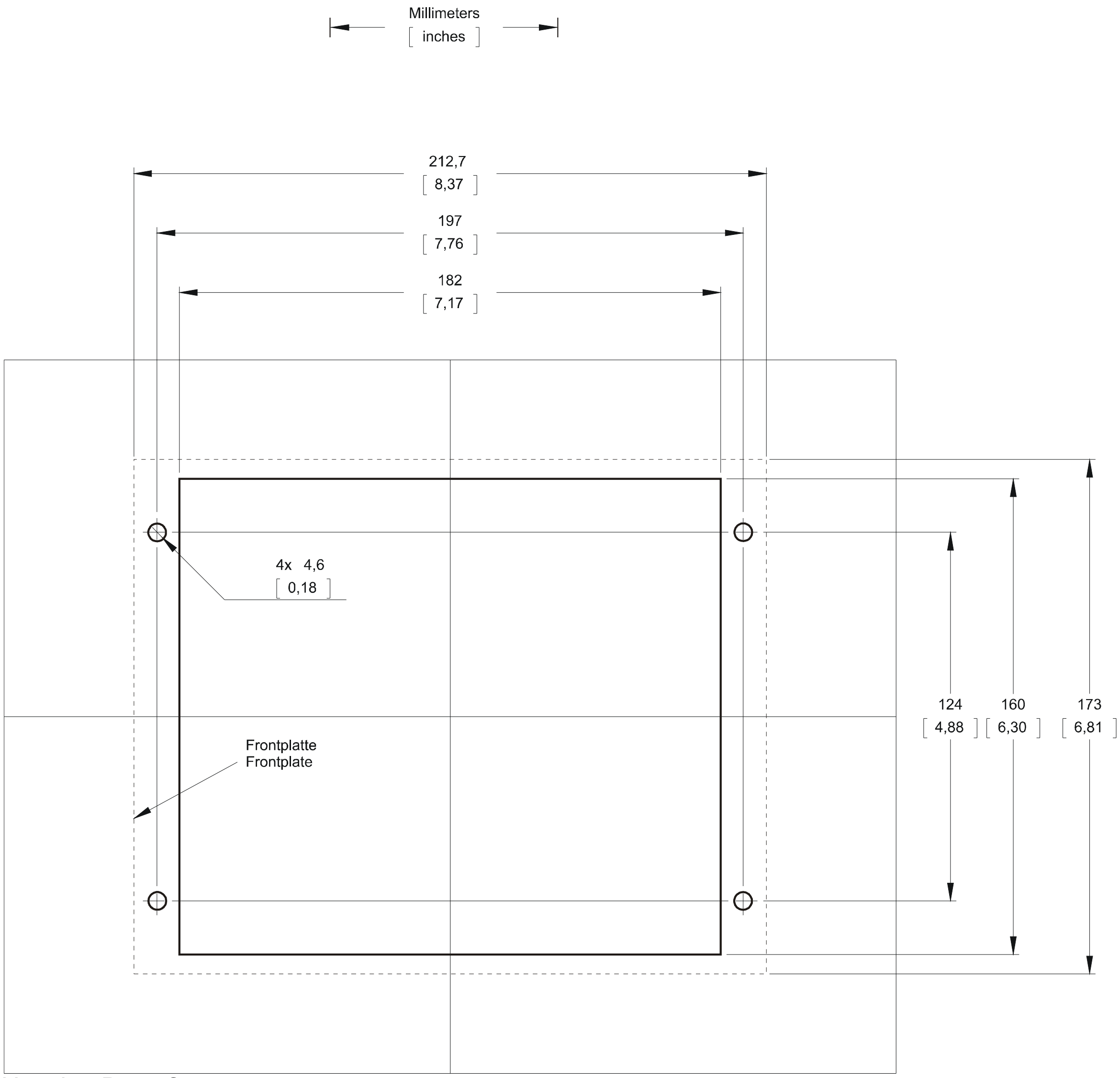
WARNING

The housing must be carefully earthed. Connect a ground cable (4 to 6 mm^2 (AWG 12-10) / 1.7 Nm (15 lb-in)) to the housing, using the screw, which is marked with the ground symbol (at the rear side of the device).

The power supply card needs a separate ground connection (2.5 mm^2 (AWG 14) at terminal X1 (0.55 Nm/4.9 lb-in).

Installation Diagram

WARNING **Even when the auxiliary voltage is switched-off, unsafe voltages might remain at the device connections.**



B2 Housing Door Cut-out

WARNING **The housing must be carefully earthed. Connect a ground cable (4 to 6 mm^2 (AWG 12-10) / 1.7 Nm (15 lb-in)) to the housing, using the screw, which is marked with the ground symbol (at the rear side of the device).**

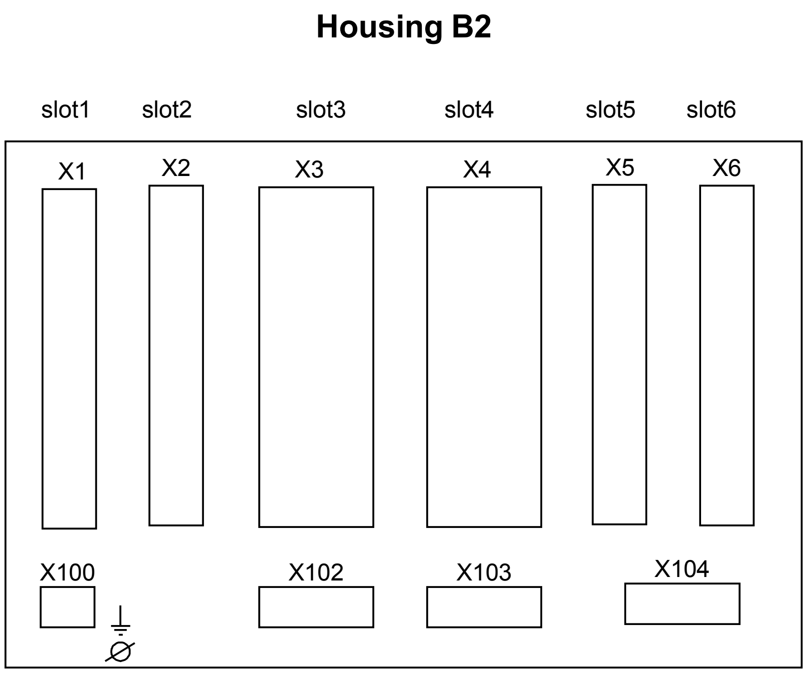
The power supply card needs a separate ground connection (2.5 mm^2 (AWG 14) at terminal X1 (0.55 Nm/4.9 lb-in).

CAUTION **Be careful. Do not overtighten the mountings nuts of the relay (M4 metric 4 mm). Check the torque by means of a torque wrench (1.7 Nm / 15 lb-in). Overtightening the mounting nuts could due to personal injury or damage the relay.**

Assembly Groups

WARNING **In line with the customer's requirement the devices are combined in a modular way (in compliance with the order code). In each of the slots an assembly-group may be integrated. In the following the terminal assignment of the individual assembly-groups are shown. The exact installation place of the individual modules can be learned from the connection diagram fixed at the top of your device.**

Middle Housing B2 *for the following device:MRA4*



WARNING **The housing must be carefully grounded. Connect a ground cable (4 to 6 mm^2 (AWG 12-10) / 1.7 Nm (15 lb-in)) to the housing, using the screw, which is marked with the ground symbol (at the rear side of the device).**

The power supply card needs a separate ground connection (2.5 mm^2 (AWG 14) at terminal X1 (0.55 Nm/4.9 lb-in).

Grounding

WARNING

The housing must be carefully grounded. Connect a ground cable (4 to 6 mm^2 (AWG 12-10) / 1.7 Nm (15 lb-in)) to the housing, using the screw, which is marked with the ground symbol (at the rear side of the device).

The power supply card needs a separate ground connection (2.5 mm^2 (AWG 14) at terminal X1 (0.55 Nm/4.9 lb-in).

CAUTION

The devices are very sensitive to electro-static discharges.

Power Supply and Digital Inputs

WARNING **Make sure, that the tightening torque is 0.55 Nm (4.9 lb-in).**

This assembly group comprises:

- a wide-range power supply unit
- 6 digital inputs, grouped
- 2 digital inputs, non-grouped
- 24V DC (for options with *Woodward SEG* Devices only)

Auxiliary voltage supply

- The aux. voltage inputs (wide-range power supply unit) is non-polarized. The device could be provided with AC or DC voltage.

Digital inputs

CAUTION **For each digital input group the related voltage input range has to be parameterized. Wrong switching thresholds can result in malfunctions/wrong signal transfer times.**

The digital inputs are provided with different switching thresholds (can be parameterized) (two AC and five DC input ranges). For the six grouped (connected to common potential) inputs and the two non-grouped inputs the following switching levels can be defined:

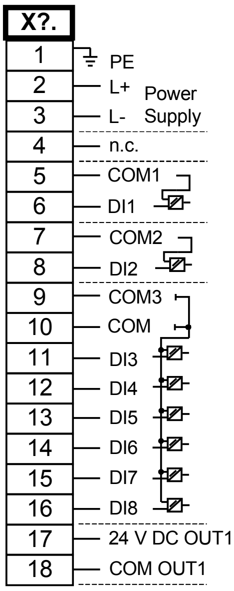
- 24V DC
- 48V DC / 60V DC
- 110 V AC/DC
- 230 V AC/DC

If a voltage >80% of the set switching threshold is applied at the digital input, the state change is recognized (physically "1"). If the voltage is below 40% of the set switching threshold, the device detects physically "0".

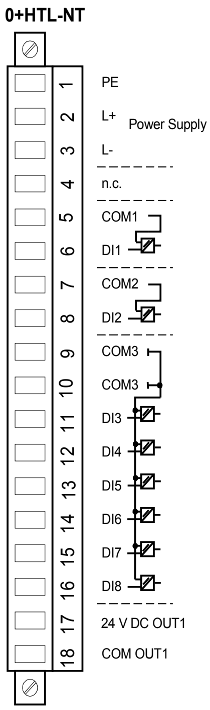
CAUTION **The ground terminal has to be connected to the »-pole« when using DC supply.**

CAUTION **Use of the 24 V DC Output is prohibited. This output is exclusively for factory testing and commissioning.**

MRA4, MRU4, MRI4 Terminal Marking => X1



Electro-mechanical assignment

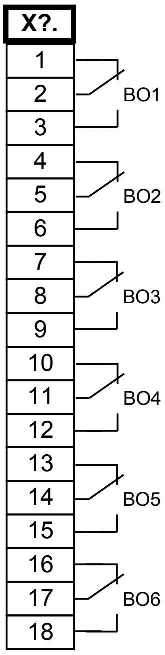
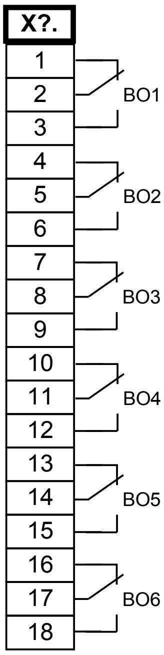


Binary Output Relays

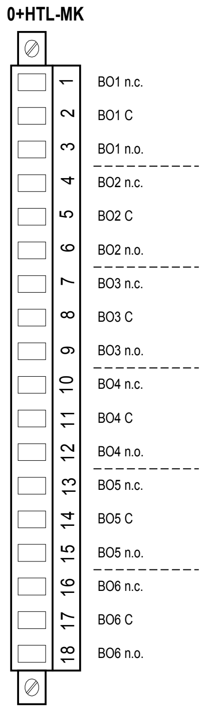
The number of the binary output relay contacts is related to the type of the device or type code. The binary output relays are potential-free change-over contacts. In chapter [Assignment/binary outputs] the assignment of the binary output relays is specified. The changeable signals are listed in the »assignment list« which can be found in the appendix.

WARNING **Make sure that the tightening torque is 0.55 Nm (4.9 lb-in).**

CAUTION **Please duly consider the current carrying capacity of the binary output relays. Please refer to the Technical Data.**

Terminal Marking X2 *for device: MRA4*	***Terminal Marking X5*** *for device: MRA4*
	

Electro-mechanical assignment for device: MRA4



Digital Inputs

This module is provided with 8 grouped digital inputs.
In chapter [Device parameter/Digital Inputs] the assignment of the digital inputs is specified.

WARNING **Make sure that the tightening torque is 0.55 Nm (4.9 lb-in).**

CAUTION **The ground terminal has to be connected to the »-pole« when using DC supply.**

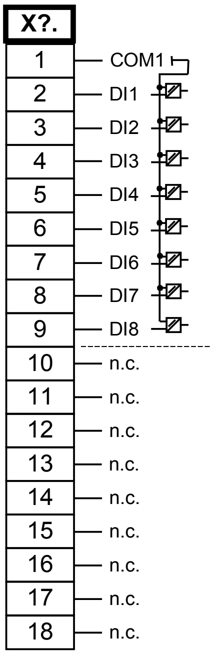
CAUTION **For each digital input group the related voltage input range has to be parameterized. Wrong switching thresholds can result in malfunctions/wrong signal transfer times.**

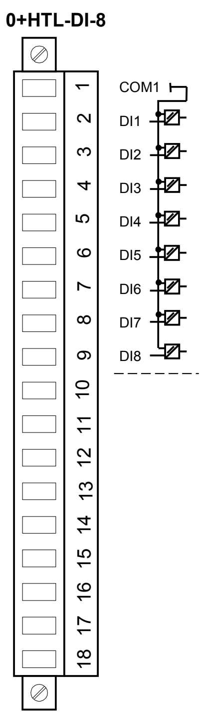
NOTICE **Via the »assignment list« the states of the digital inputs are assigned to the module inputs (e.g. I[1]).**

The digital inputs are provided with different switching thresholds (can be parameterized) (two AC and five DC input ranges). For each group the following switching thresholds can be defined:

- 24V DC
- 48V DC / 60V DC
- 110 V AC/DC
- 230 V AC/DC

If a voltage >80% of the set switching threshold is applied at the digital input, the state change is recognized (physically “1”). If the voltage is below 40% of the set switching threshold, the device detects physically “0”.

Terminal Marking X6 *for device:* MRA4


Electro-mechanical assignment for device: MRA4


Voltage Measuring Inputs

The device is provided with 4 voltage measuring inputs: three for measuring the phase-to-phase voltages (*»V12«, »V23« , »V31«*) or phase-to-neutral voltages (*»VL1«, »VL2«, »VL3«*) and one for the measuring of the residual voltage »*VE*«. With the field parameters the correct connection of the voltage measuring inputs has to be set:

- phase-to-neutral (star)
- phase-to-phase (Delta respectively V-Connection)

⚠WARNING **Make sure that the tightening torque is 1 Nm (8.85 lb-in).**

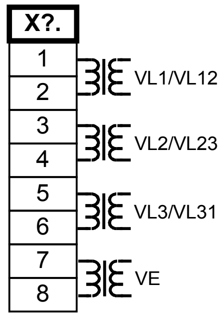
CAUTION **The rotating field of your power supply system has to be taken in to account. Make sure that the transformer is wired correctly.**

For the V-connection the parameter »VT con« has to be set to »phase-to-phase«.

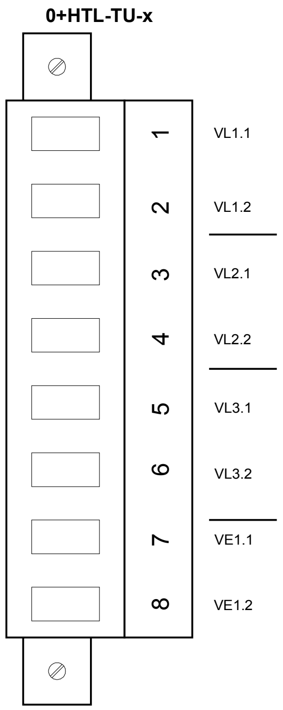
Please refer to the Technical Data.

MRA4 Terminal Marking => X4

MRU4 Terminal Marking => X3



Electro-mechanical assignment



Current Measuring Inputs and Ground Current Measuring Input

The device is provided with 4 current measuring inputs: three for measuring the phase currents and one for measuring of the earth current. Each of the current measuring inputs has a measuring input for 1 A and 5 A.

The input for earth current measuring either can be connected to a cable-type current transformer or alternatively it is possible to connect the summation current path of the phase current transformer to this input (Holmgreen connection).

DANGER **Current transformers have to be earthed on their secondary side.**

DANGER **Interrupting the secondary circuits of current transformers causes hazardous voltages.**

The secondary side of the current transformers have to be short circuited before the current circuit to the device is opened.

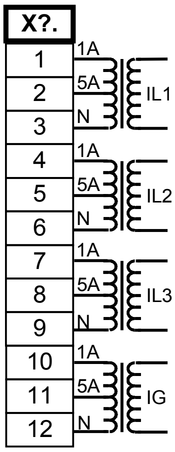
WARNING **The current measuring inputs may exclusively be connected to current measuring transformers.**

WARNING

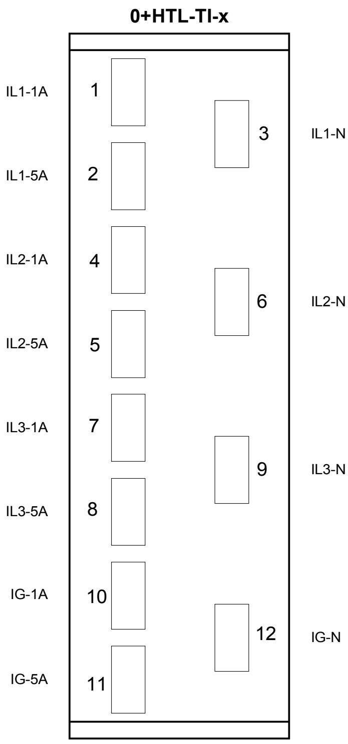
- **Do not interchange the inputs (1 A/5 A)**
- **Make sure the transformation ratios and the power of the CTs are correctly rated. If the rating of the CTs is not right (overrated), then the normal operational conditions may not be recognized. The pickup value of the measuring unit amounts approx. 3% of the rated current of the device. Also the CTs need a current greater than approx 3% of the rated current to ensure sufficient accuracy. Example: For a 600 A CT (primary current) any currents below 18 A cannot be detected any more.**
- **Overloading can result in destruction of the measuring inputs or faulty signals. Overloading means that in case of a short-circuit the current-carrying capacity of the measuring inputs could be exceeded.**

WARNING **Make sure, that the tightening torque is 1 Nm (11.94 lb-in).**

MRA4, MRI4 Terminal Marking => X3



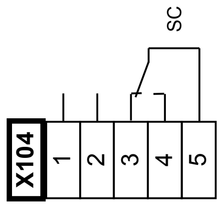
Electro-mechanical assignment



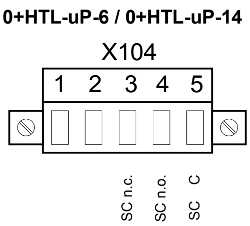
Supervision Contact (SC)

WARNING **Make sure that the tightening torque is 0.55 Nm (4.9 lb-in).**

Terminal markings X104 *for device:* MRA4



Electro-mechanical assignment for device: MRA4



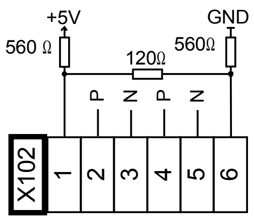
This contact closes after the boot phase of the device if the protection is working.
This contact will open if an internal device error has occurred (please refer to chapter Self Supervision).

Communication Interfaces

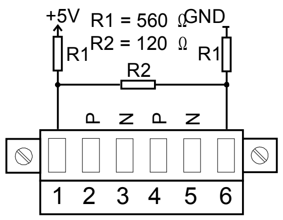
Modbus® RTU via Terminals

WARNING **Make sure that the tightening torque is 0.23 Nm (2.03 lb-in).**

Terminal Marking X103 *for the device:* MRA4

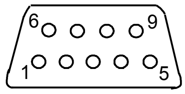


Electro-mechanical assignment for device: MRA4



NOTICE **The Modbus® connection cable must be shielded. The shielding has to be fixed at the screw which is marked with the ground symbol at the rear side of the device.**

Modbus® RTU via D-SUB-plug

Terminal marking X103 *for the device:* MRA4


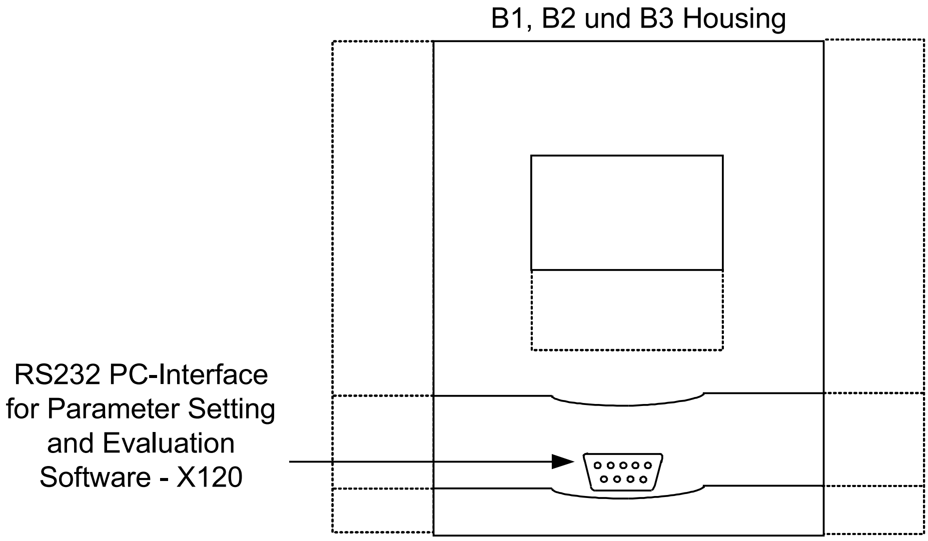
Electro-mechanical assignment for device: MRA4
D-SUB assignment - bushing 1 Earthing/shielding 3 RxD TxD - P: High-Level 4 RTS-signal 5 DGND: Ground, neg. Potential of aux voltage supply 6 VP: pos. Potential of the aux voltage supply 8 RxD TxD - N: Low-Level

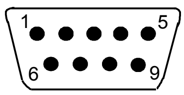
NOTICE

The Modbus® connection cable must be shielded. The shielding has to be fixed at the screw which is marked with the ground symbol at the back side of the device.

PC Interface

X120 9-pole D-Sub at all device fronts



Electro-mechanical assignment for all device types
 1 DCD 2 RxD 3 TxD 4 DTR 5 GND 6 DSR 7 RTS 8 CTS 9 RI housing shielded

Assignment of the Zero Modem Cable

Assignment of the fully wired zero modem cable

Dsub -9 (female)	*Signal*	*Dsub -9 (female)*	*Signal*
2	RxD	3	TxD
3	TxD	2	RxD
4	DTR	6,1	DSR, DCD
6,1	DSR, DCD	4	DTR
7	RTS	8	CTS
8	CTS	7	RTS
5	GND (Ground)	5	GND (Ground)
9	Ring signal	9	Ring signal

NOTICE **The connection cable must be shielded.**

Current Transformers (CT)

Check the installation direction.

DANGER **It is imperative that the secondary sides of measuring transformers be grounded.**

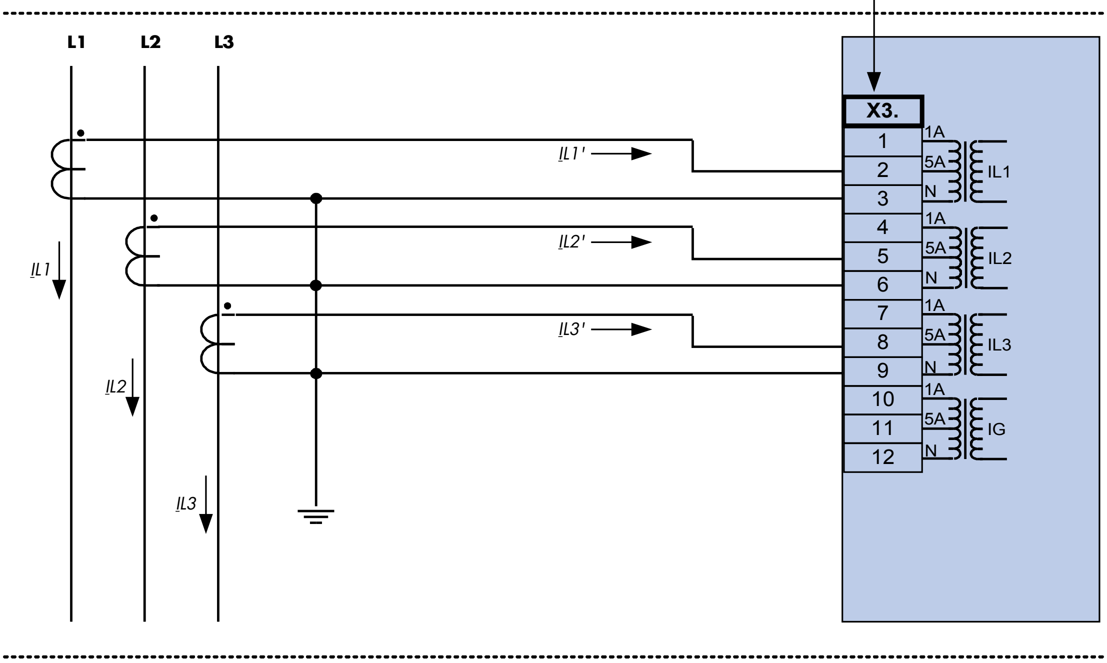
WARNING **CT secondary circuits must always to be low burdend or short-circuited during operation.**

NOTICE **All current measuring inputs can be provided with 1 A or 5 A nominal. Make sure that the wiring is correct.**

Current Transformer Connection Examples

Connection example Clockwise Rotating Field

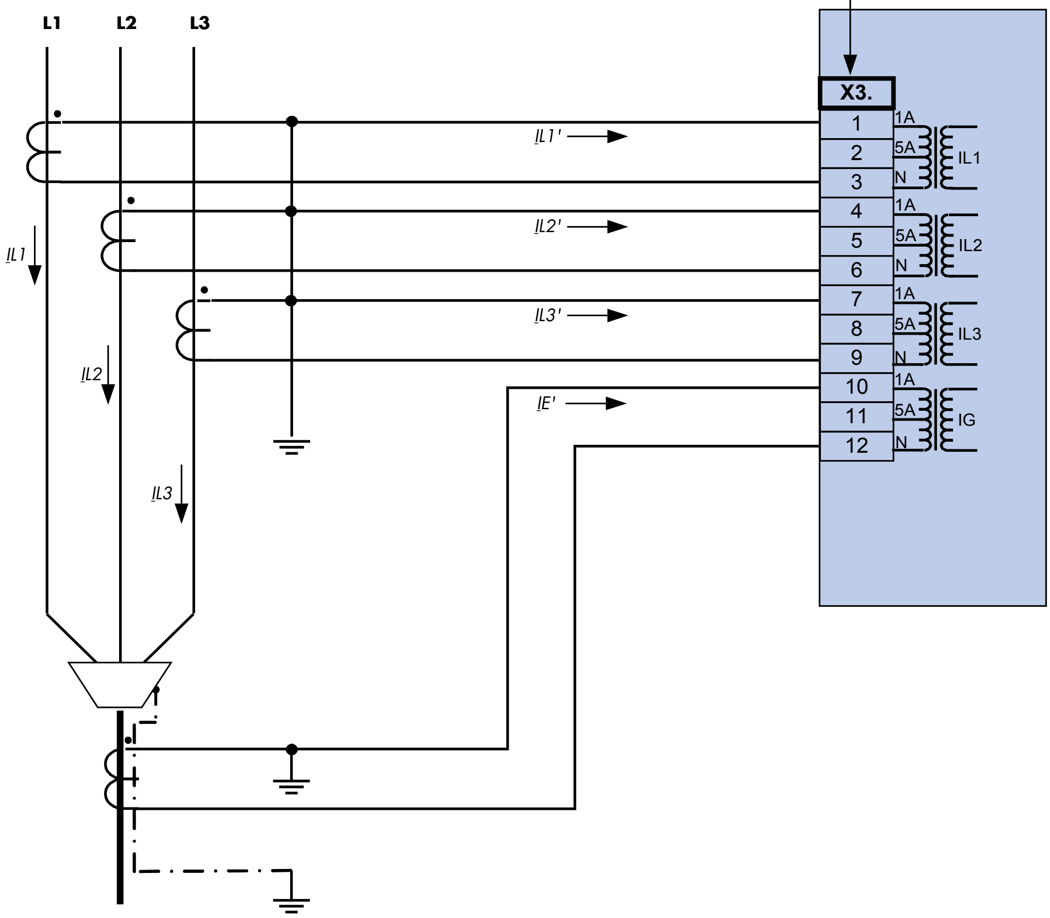
MRI4, MCI4, MRA4, MCA4 => teminal marking X3.



Three phase current measurement; In secondary = 5 A

Notice!
Calculation of IE is possible

Connection example Clockwise Rotating Field
MRI4, MCI4, MRA4, MCA4 => teminal marking X3.

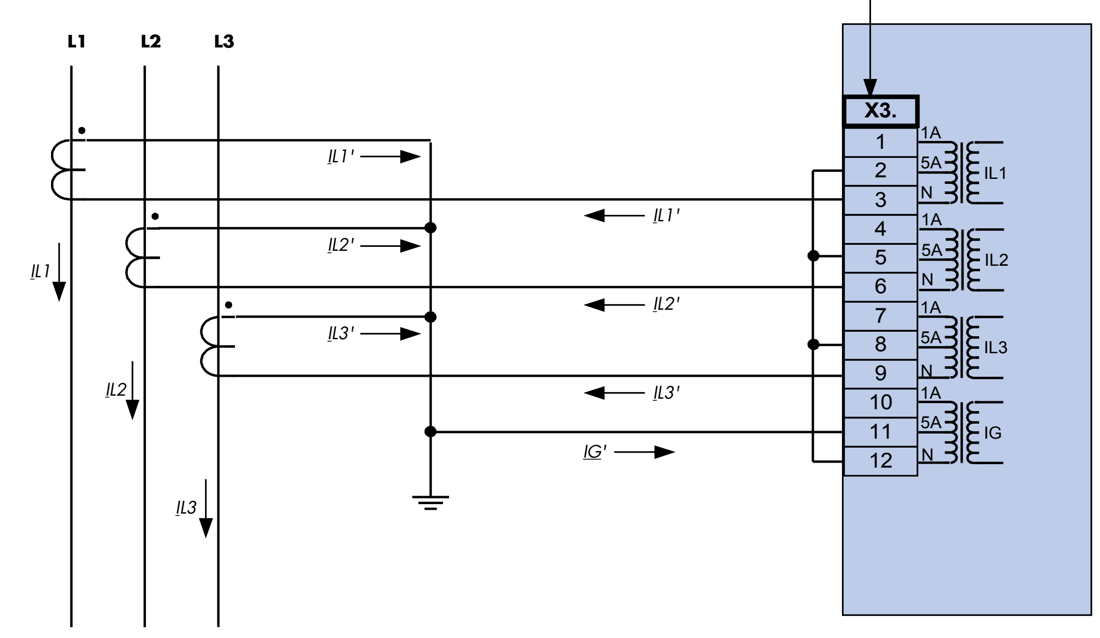


Three phase current measurement; In secondary = 1 A;
Earth-current measuring via cable-type current transformer ; IEn secondary = 1 A

Warning!
The shielding at the dismantled end of the line has to be put through the cable-type current transformer and has to be grounded at the cable side.

Notice!
Recommendated for isolated or compensated networks

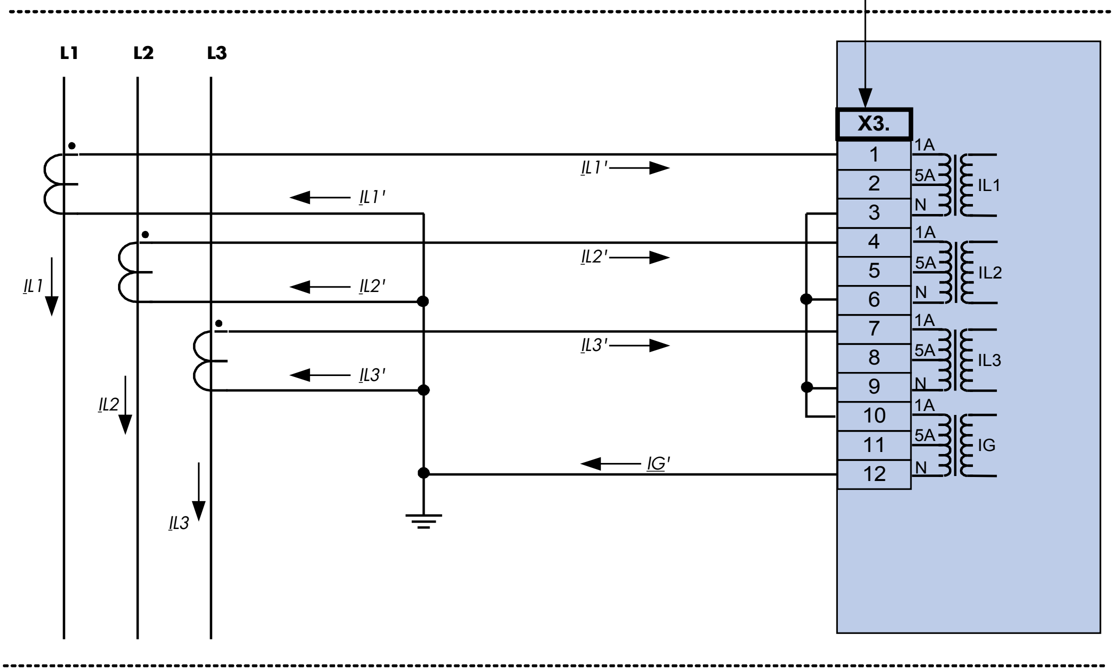
Connection example Clockwise Rotating Field
MRI4, MCI4, MRA4, MCA4 => teminal marking X3.



Three phase current measurement; In secondary = 5 A
Earth-current measuring via Holmgreen-connection; IEn secondary = 5A

Notice!
Not recommendated for isolated and compensated networks

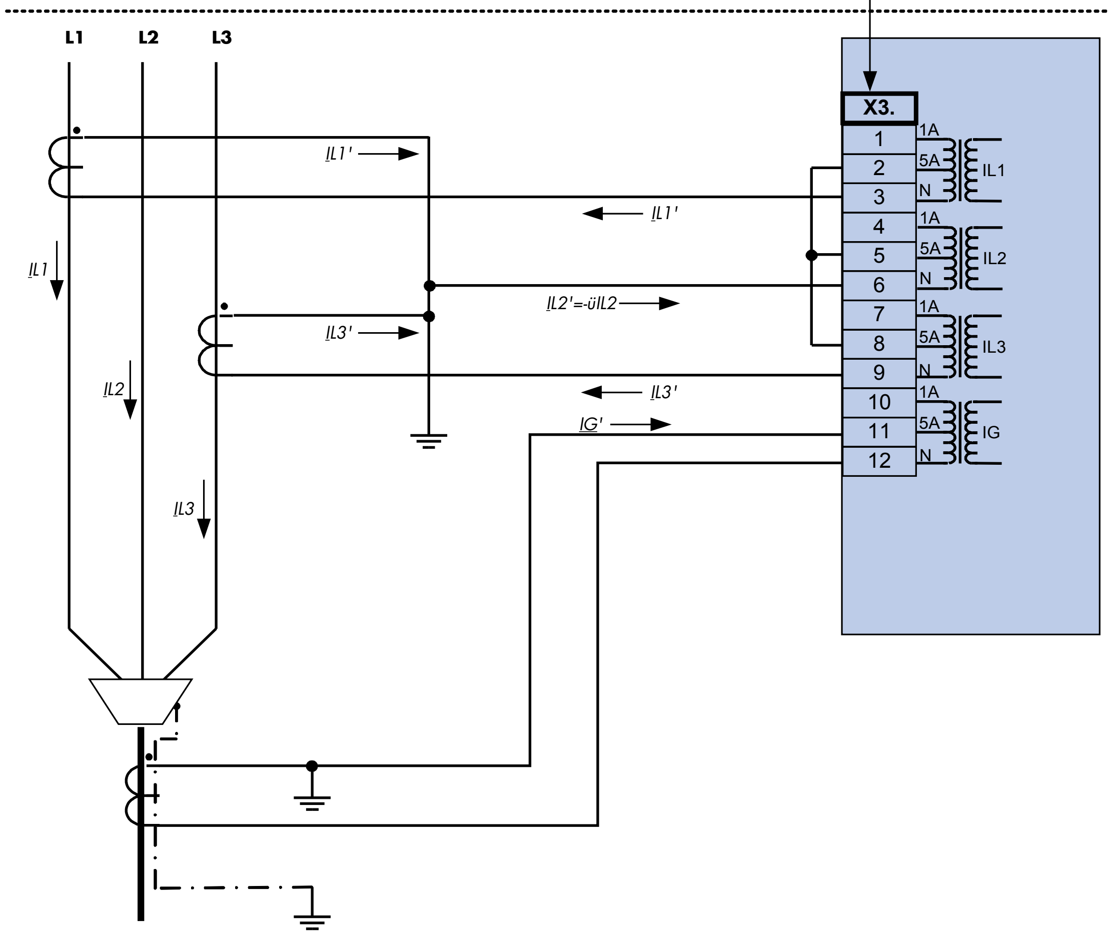
Connection example Clockwise Rotating Field
MRI4, MCI4, MRA4, MCA4 => teminal marking X3.



Three phase current measurement; In secondary = 1 A
Earth-current measuring via Holmgreen-connection; IEn secondary = 1 A

Notice!
Not recommendated for isolated and compensated networks

Connection example Clockwise Rotating Field
MRI4, MCI4, MRA4, MCA4 => teminal marking X3.



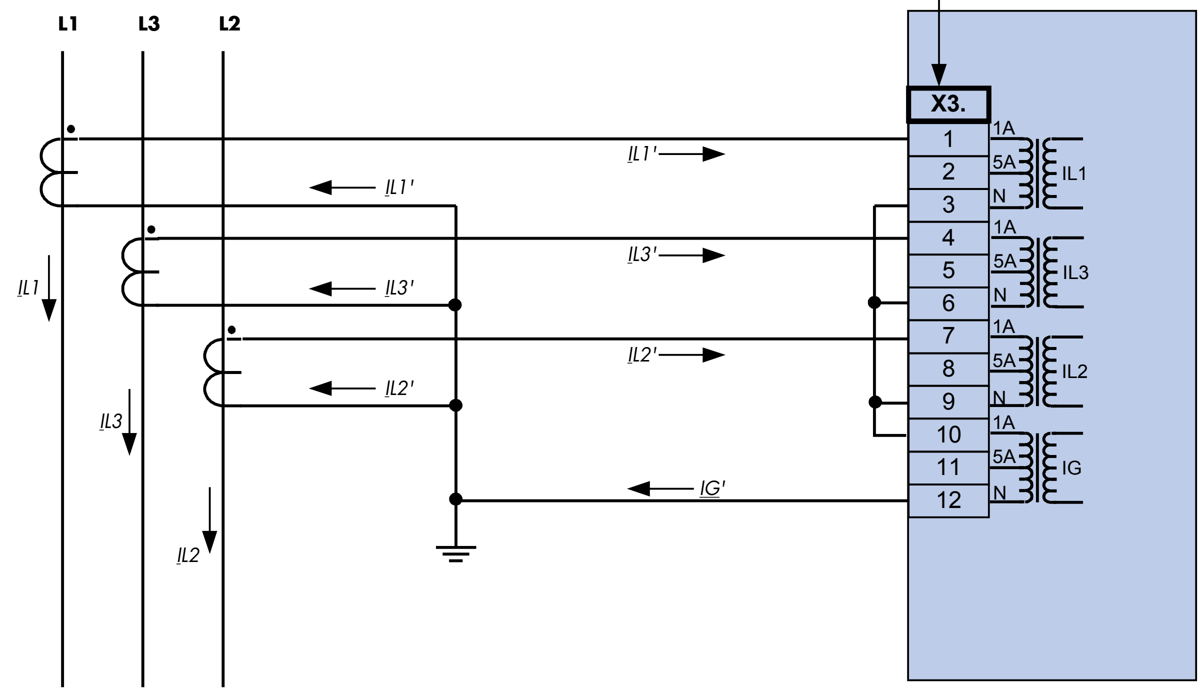
Two phase current measurement (V-connection); In secondary = 5 A
Earth-current measuring via cable-type current transformer ; IEn secondary = 5 A

Warning!
The shielding at the dismantled end of the line has to be put through the cable-type current transformer and has to be grounded at the cable side.

Notice!
Recommendated for isolated or compensated networks

Connection example Anti-Clockwise Rotating Field

MRI4, MCI4, MRA4, MCA4 => teminal marking X3.



Three phase current measurement; In secondary = 1 A
Earth-current measuring via Holmgreen-connection; IEn secondary = 1 A

Notice!
Not recommendated for isolated and compensated networks

Voltage Transformers

Check the installation direction of the VTs.

DANGER **It is imperative that the secondary sides of measuring transformers be grounded.**

Check of the Voltage Measuring Values

Connect a three-phase measuring voltage equal to the rated voltage to the relay.

NOTICE **Take connection of the measuring transformers (star connection/delta connection) duly into account.**

Now adjust voltage values in the nominal voltage range with the corresponding nominal frequency which are not likely to cause overvoltage- or undervoltage trips.

Compare the values shown in the device display with the readings of the measuring instruments. The deviation must be according to the technical data.

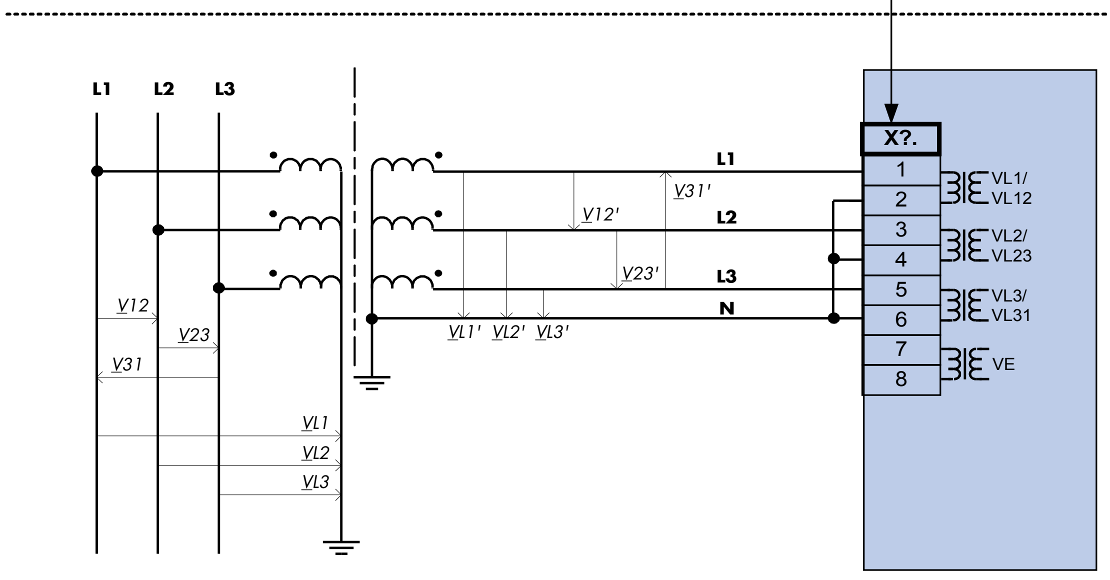
NOTICE **When r.m.s. value measuring instruments are used, higher deviations can arise if the fed voltage has a very high harmonic content. Since the device is provided with a filter for the harmonics, only the fundamental oscillation is evaluated (exception: thermal protection functions). If, however, a r.m.s. value forming measuring instrument is used, the harmonics are also measured.**

Wiring Examples of the Voltage Transformers

Connection example Clockwise Rotating Field

MRA, MCA => teminal marking X4.

MRN4, MRU4, MRF4 => teminal marking X3.



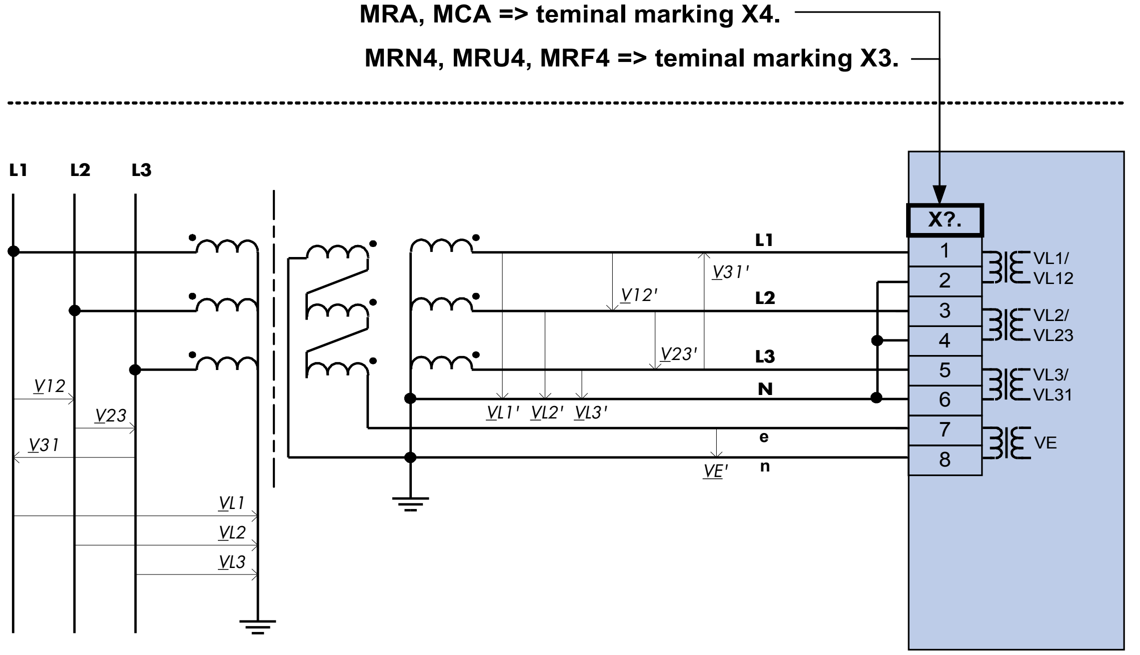
Three-phase voltage measurement - wiring of the measurement inputs: "star-connection"

Notice!
Calculation of the residual voltage VE is possible

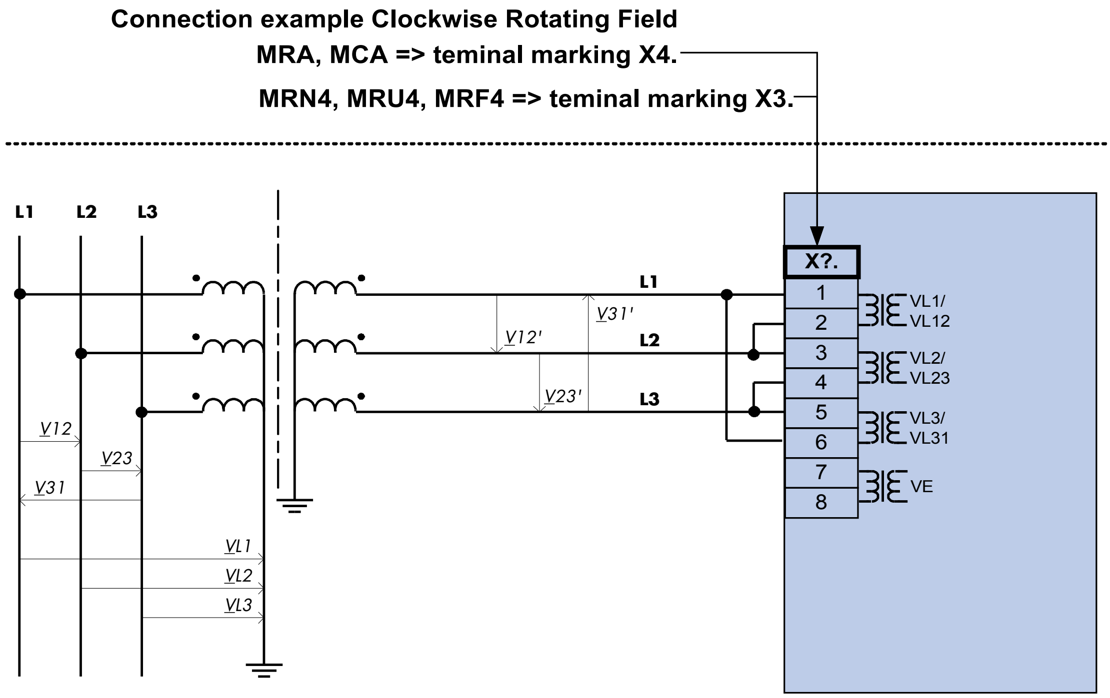
Connection example Clockwise Rotating Field

MRA, MCA => teminal marking X4.

MRN4, MRU4, MRF4 => teminal marking X3.



Three-phase voltage measurement - wiring of the measurement inputs: "star-connection"
Measurement of the residual voltage VE via auxilliary windings (e-n) "open delta"



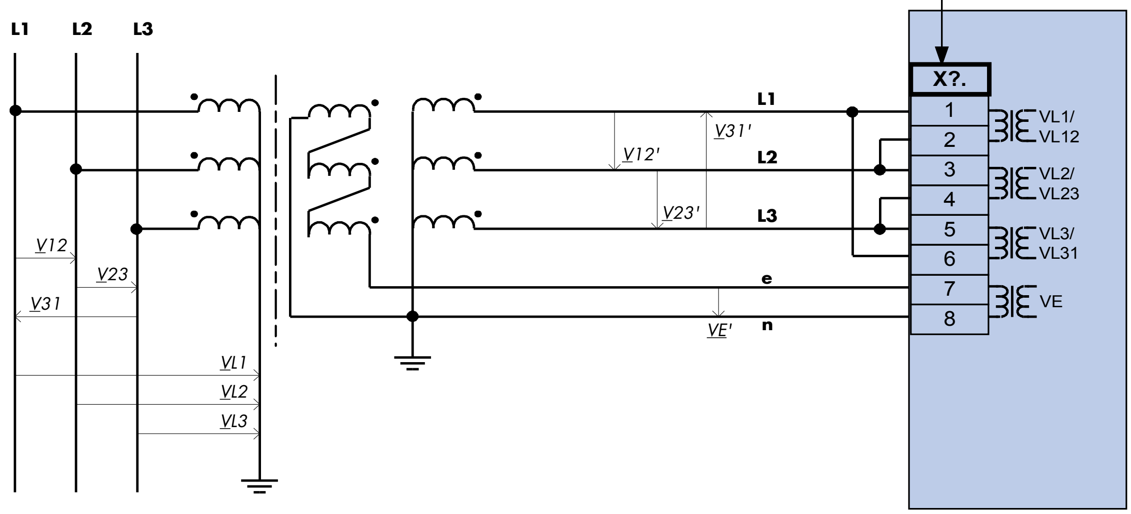
Three-phase voltage measurement - wiring of the measurement inputs: "delta connection"

Notice!
Calculation of the residual voltage VE is not possible

Connection example Clockwise Rotating Field

MRA, MCA => teminal marking X4

MRN4, MRU4, MRF4 => teminal marking X3

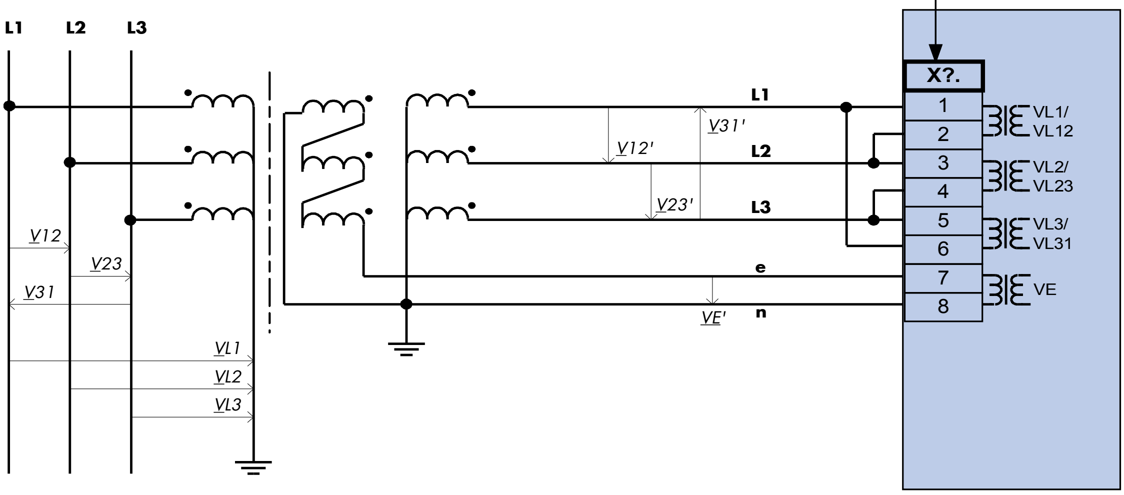


Three-phase voltage measurement - wiring of the measurement inputs: "delta connection"
Measurement of the residual voltage VE via auxilliary windings (e-n) "open delta"

Connection example Clockwise Rotating Field

MRA, MCA => teminal marking X4

MRN4, MRU4, MRF4 => teminal marking X3

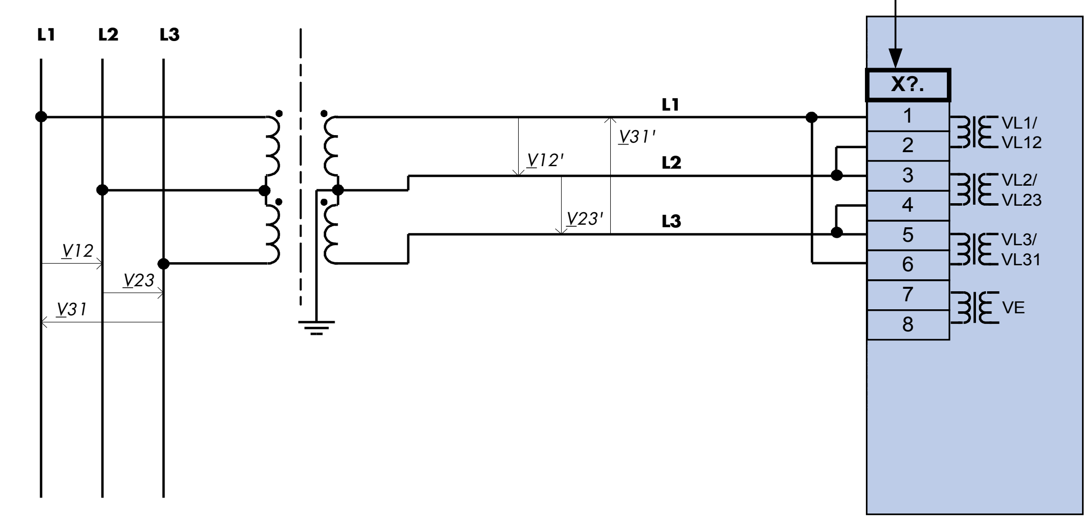


Three-phase voltage measurement - wiring of the measurement inputs: "delta connection"
Measurement of the residual voltage VE via auxilliary windings (e-n) "open delta"

Connection example Clockwise Rotating Field

MRA, MCA => teminal marking X4.

MRN4, MRU4, MRF4 => teminal marking X3.



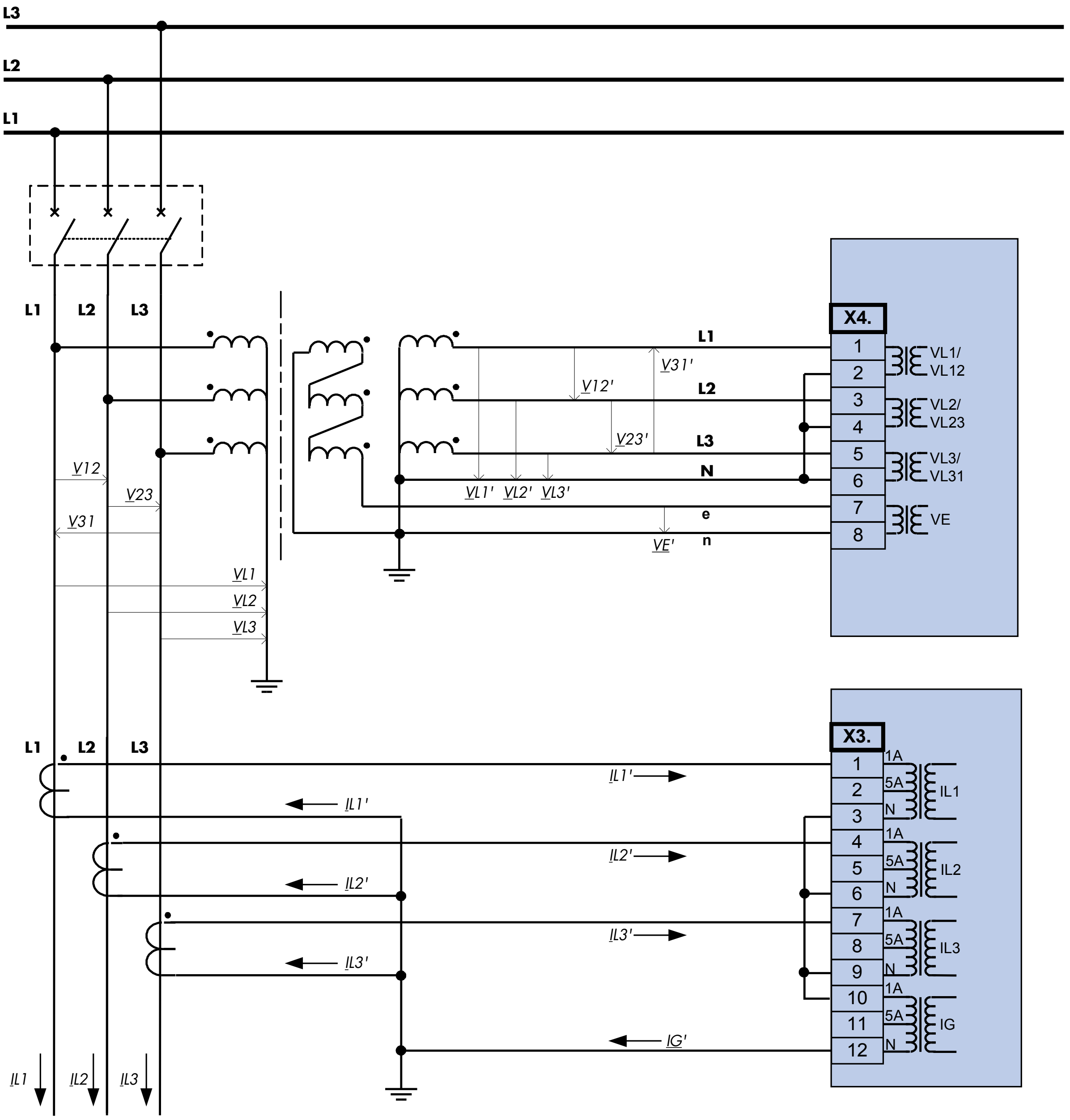
Two-phase voltage measurement - wiring of the measuring inputs: "V-connection"

Notice!

Calculation of the residual voltage VE is not possible

Connection Examples Voltage and Current Transformers

Connection example Clockwise Rotating Field

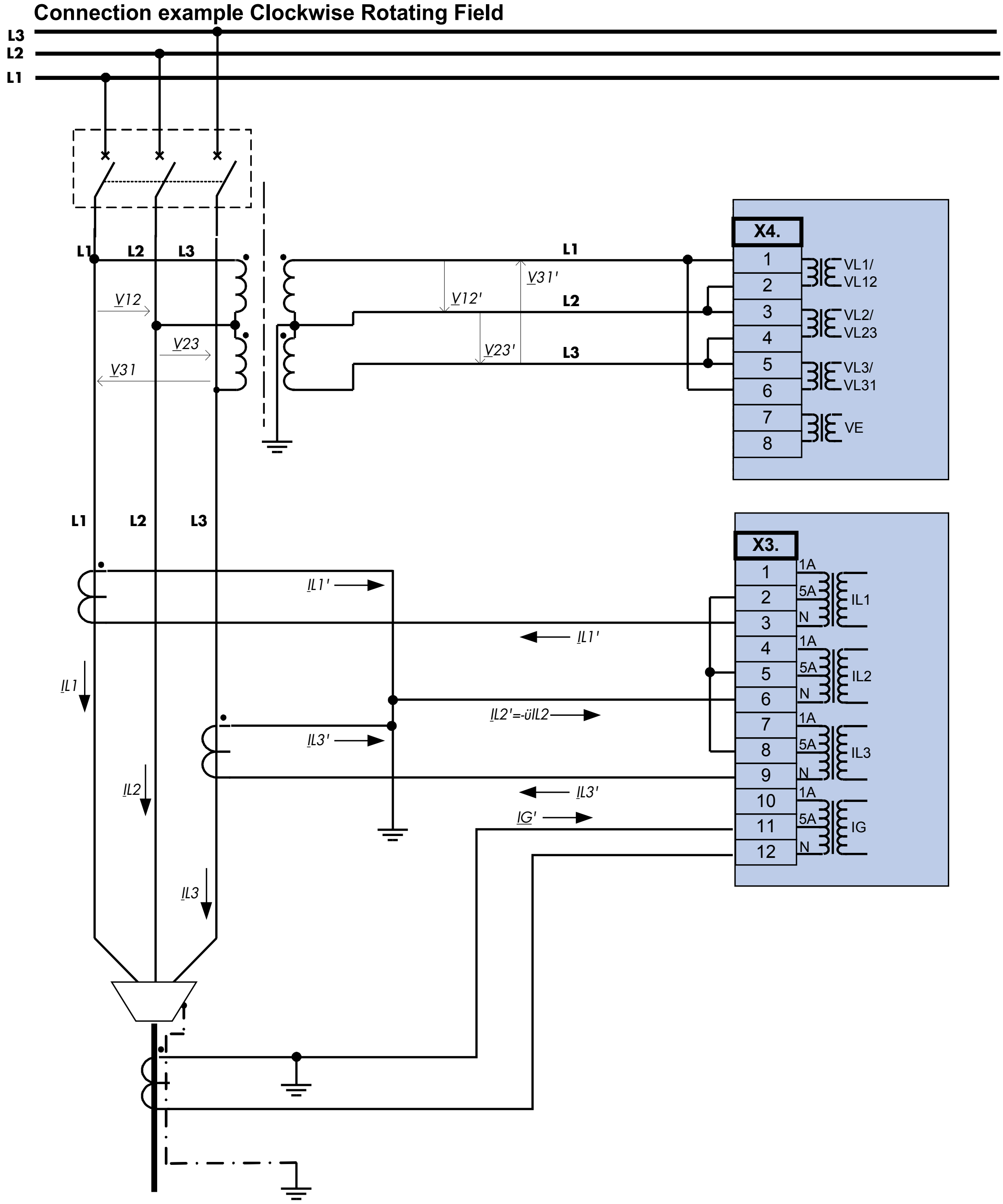


Three phase current measurement; In secondary = 1 A
Earth-current measuring via Holmgreen-connection; IEn secondary = 1 A
Three-phase voltage measurement - wiring of the measurement inputs: "star-connection"
Measurement of the residual voltage VE via auxilliary windings (e-n) "open delta"

Notice!
Measuring of VE and IE is possible

Notice!
Not recommendated for isolated and compensated networks

Connection example Clockwise Rotating Field



Two-phase voltage measurement - wiring of the measuring inputs: "V-connection"

Two phase current measurement (V-connection); In secondary = 5 A

Earth-current measuring via cable-type current transformer ; IEn secondary = 5 A

Warning!

The shielding at the dismantled end of the line has to be put through the cable-type current transformer and has to be grounded at the cable side.

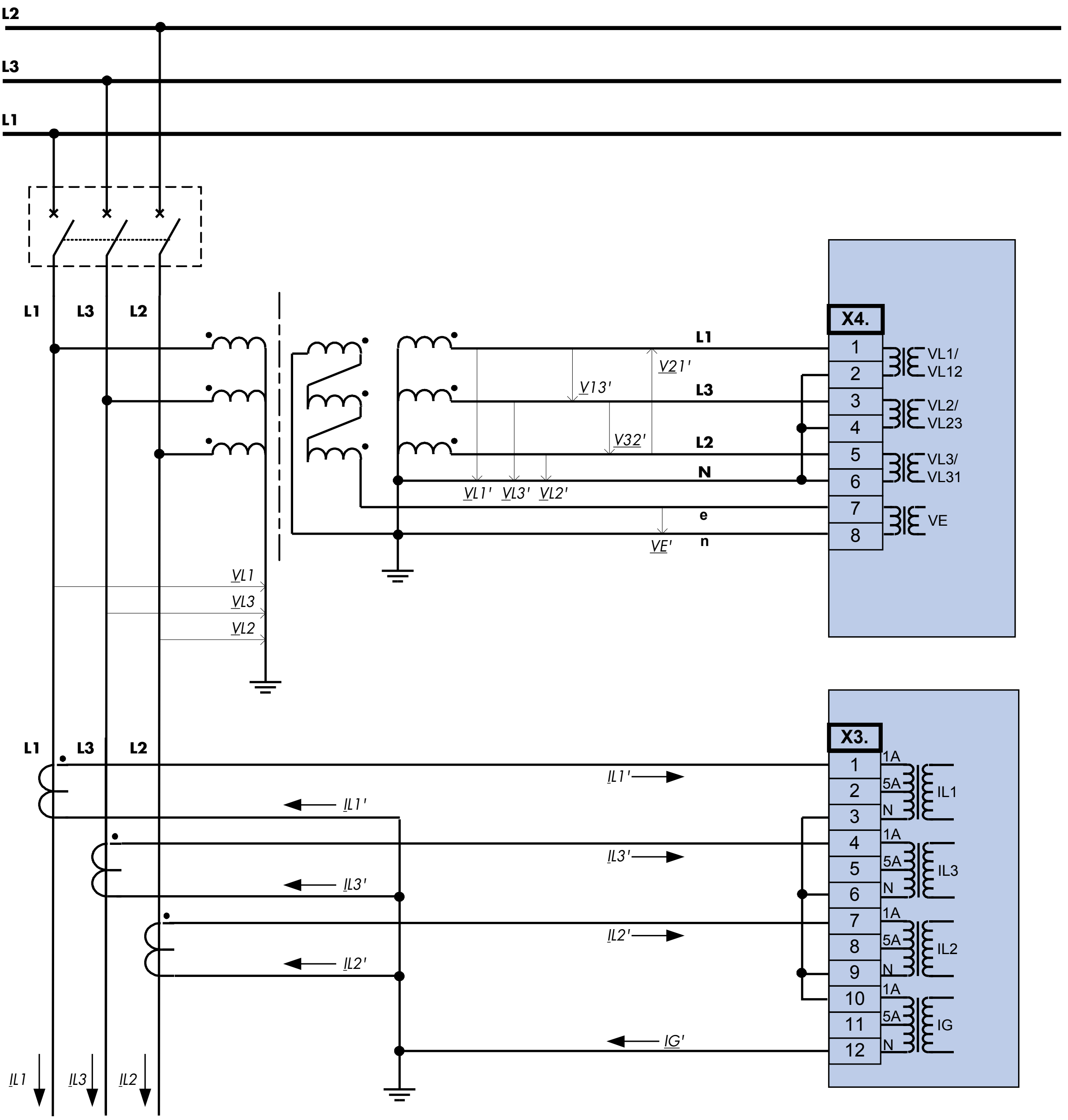
Notice!

Recommended for isolated or compensated networks

Notice!

Calculation of the residual voltage VE is not possible

Connection example Anti-Clockwise Rotating Field

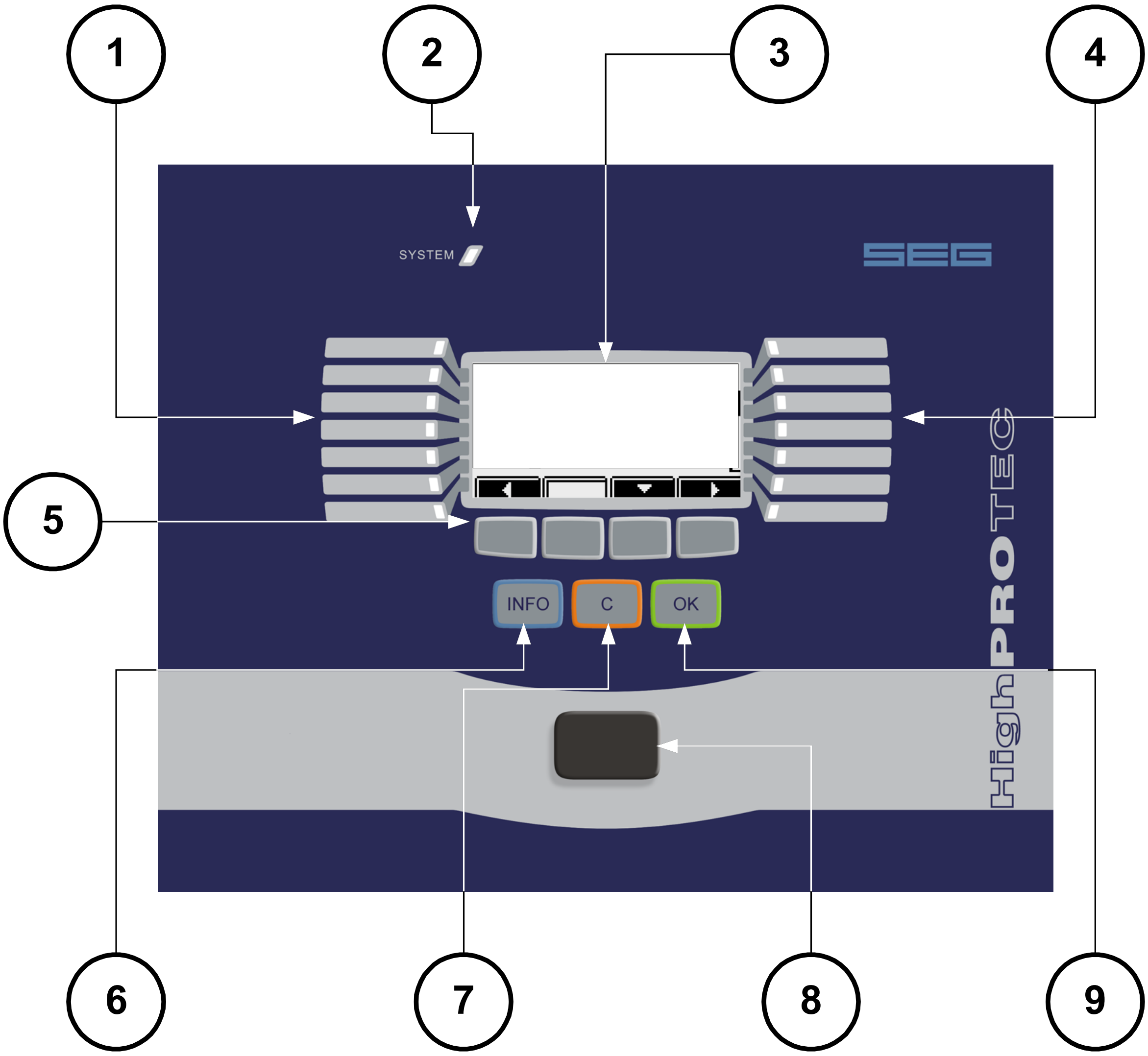


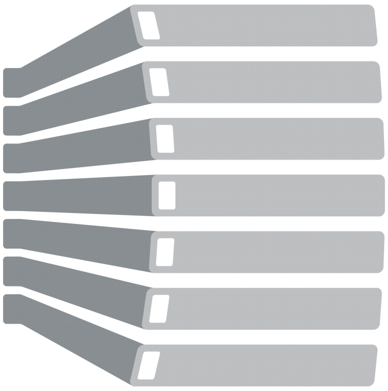
Three phase current measurement; In secondary = 1 A
Earth-current measuring via Holmgreen-connection; IEn secondary = 1 A
Three-phase voltage measurement - wiring of the measurement inputs: "star-connection"
Measurement of the residual voltage VE via auxilliary windings (e-n) "open delta"

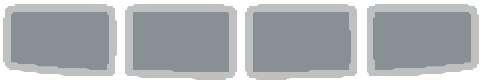
Notice!
Measuring of VE and IE is possible

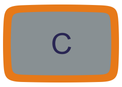
Notice!
Not recommendated for isolated and compensated networks

Navigation - Operation



1		LEDs group A (left)	Messages inform you about operational conditions, system data or other device particulars. They additionally provide you with information regarding failures and functioning of the device as well as other states of the device and the equipment. Alarm signals can be freely allocated to LEDs out of the »assignment list«. An overview about all alarm signals available in the device can be obtained from the »ASSIGNMENT LIST« which can be found in the appendix.
		LED »System OK«	Should LED »System OK« flash red during operation, contact the Service Dept. immediately.
3		Display	Via the display you can read-out operational data and edit parameters.
4		LEDs group B (right)	Messages inform you about operational conditions, system data or other device particulars. They additionally provide you with information regarding failures and functioning of the device as well as other states of the device and the equipment. Alarm signals can be freely allocated to LEDs out of the »assignment list« . An overview about all alarm signals available in the device can be obtained from the »assignment list« which can be found in the appendix.

5		Softkeys	The function of the »SOFTKEYS« are contextual. On the bottom line of the display the present function is displayed/symbolized. Possible functions are: • Navigation • Parameter decrement/increment. • Scrolling up/down a menu page • Moving to a digit • Change into the parameter setting mode »wrench symbol«.
6		INFO Key (Signals/Messages)	Looking through the present LED assignment. The direct select key can be actuated at any time. If the INFO key is actuated once, the »LEFT LED SIGNALS« are inserted, if the INFO key is actuated again, the »RIGHT LED SIGNALS« are inserted. *Multiple Assignments* If there is more than one signal assigned to a LED you can check the state of the multiple assignments if you proceed as follows. If the INFO-Button is pressed only the first assignments of any LED is shown. In order to show all (multiple) assignments select a LED by means of the »SOFTKEYs« »up« and »down« Via the »Softkey« »left« call up a Submenu of this LED that gives you detailed information on the state of all signals assigned to this LED. Via the »C-key« you can call up the reset menu.

7		»C Key«	To abort changes and to ac-knowledge messages. In order to reset please press the Softkey »wrench« and enter the password. The reset menu can be left by pressing the Softkey »Arrow-left«
8		RS232 Interface (*Smart view* Connection)	Connection to software *Smart view* is done via the RS232 interface.
9		»OK Key«	When using the »OK« key parameter changes are temporarily stored. If the »OK« key is pressed again, those changes are stored definitely.

Basic Menu Control

The graphic user interface is equivalent to a hierarchical structured menu tree. For access to the individual submenus the »SOFTKEYS«/Navigation Keys are used. The function of the »SOFTKEYS« can be found as symbol in the footer of the display.

Softkey	***Description***
	• Via »SOFTKEY« »up« you will come to the prior menu point/one parameter up by scrolling upwards.
	• Via »SOFTKEY« »left« you will go one step back.
	• Via »SOFTKEY« »down« you will change to the next menu point/one parameter down by scrolling downwards.
	• Via »SOFTKEY« »right« you will come to a submenu.
	• Via »SOFTKEY« »Top of list« you will jump directly to the top of a list.
	• Via »SOFTKEY« »Bottom of list« you will jump directly to the end of a list.
	• Via »SOFTKEY« »+«the related digit will be incremented. (Continuous pressure -> fast).
	• Via »SOFTKEY« »-«the related digit will be decremented. (Continuous pressure -> fast)
	• Via »SOFTKEY« »left« you will go one digit to the left.
	• Via »SOFTKEY« »right« you will go one digit to the right.
	• Via »SOFTKEY« »Parameter setting« you will call up the parameter setting mode.
	• Via »SOFTKEY« »delete« data will be deleted.

In order to return to the main menu, just keep pressing the Softkey »Arrow-Left« until you arrive at the »main menu».

Smart view Keyboard Commands

You can control *Smart view* alternatively by means of keyboard commands (instead of the mouse)

Key	***Description***
↑	Moving up within the navigation tree or parameter list.
↓	Moving down within the navigation tree or parameter list.
←	Collapse the tree item or select a folder on a higher level.
→	Expands the tree item or selects a subfolder.
Numpad +	Expands the tree item.
Numpad -	Collapses the tree item.
Home	Moves to the top of the active window.
End	Moves to the bottom of the active window.
Ctrl+O	Opens the file opening dialog. Browsing through the file system for an existing device file.
Ctrl+N	Creates a new parameter file file by means of a template.
Ctrl+S	Saves actual loaded parameter file.
F1	Displays the online help information.
F2	Load Device Data
F5	Reloads the displayed data of a device.
Ctrl+F5	Enables automatic refresh.
Ctrl+Shift+T	Back to the navigation window.
Ctrl+F6	Walks through the tabular forms (detail windows).
Page ↑	Previous value (parameter setting).
Page ↓	Next value (parameter setting).

Smart View

Smart view is a parameter setting and evaluation software.

- Menu-controlled parameter setting incl. validity checks
- Offline configuration of all relay types
- Reading and evaluating of statistical data and measuring values
- Setting into operation assistance
- Display of the device status
- Fault analysis via event- and fault recorder

NOTICE ***Smart view* is available in two different versions (with and without *Data Visualizer* (optionally/to analyze disturbance records).**

- Basic Edition
- Standard Edition (option to analyze disturbance records)

Installation of Smart View

NOTICE **Port 52152 must not be blocked by a Firewall**

NOTICE **If the Windows Vista User Access Control pops up while installing Smart view, please "Allow" all installation requirements concerning Smart view.**

System requirements:
Windows 2000 or compatible (e.g. Windows XP or Vista)

- Double-click on the installation file with the left mouse button.
- Select a language for the installation procedure.
- Confirm by pressing the »Continue« button in the INFO frame.
- Select an installation path or confirm the standard installation path by mouse click on the »Continue« button.
- Confirm the entry for the suggested installation folder by mouse click on the »Continue« button.
- By mouse click on the »Install« button, the installation routine is started.
- Close the installation procedure by mouse click on the »Complete« button.

Now you can call up the program via [Start>Programs>Woodward SEG>HighPROTEC>Smart view].

Uninstalling Smart view

Via the menu [Start>System Control >Software] the Smart view can be removed from your computer.

Switching the Language of the Graphical User Interface

Within the menu Settings/Language, you can change the language of the graphical user interface.

Setting up the Connection PC - Device

Set-up a Connection via Serial Interface under Windows 2000

After installation of the software, the »Connection PC/Notebook to the Device« has to be configured once, so that you are able to read device data or re-write them into the device by means of the software *Smart view.*

NOTICE **For connection of your PCs/notebooks with the device you need a special zero-modem cable (no serial cable!/please refer to chapter »Zero Modem Cable«).**

NOTICE **If your PC/notebook does not have a serial interface, you need a special *USB-to-serial-adapter.* Only if the *USB-to-serial-adapter* is correctly installed - aided by the provided CD – the communication with the device can be established. (see next chapter).**

NOTICE **The connection Notebook/PC to the device must not be protected/encrypted via a smartcard.**

If the network connection wizard asks you, to encrypt the connection via a smartcard or not, please choose »Do not use the smartcard«.

Setting up/Configuring the connection

- Connect your PC/notebook with the device via a zero-modem cable.
- Start the software *Smart view*.
- Select the menu point »Device Connection« in menu »Settings«.
- Click on »Serial Connection«.
- Click button »Settings«.
- When initially setting up the connection, a dialogue window appears with the information that, so far, a direct connection with your protection device has not been established. Click on »Yes«.
- If, so far, a location has not been set up on your PC, your location information has to be put in. Confirm the pop-up window »Telephone and Modem Options« with »OK«.
- The Windows network connection assistant appears after the location information is set up. Select the connection type »Establish direct connection to another computer«.
- Select the serial interface (COM-Port) where the device shall be connected to.
- Select »To be used for all users« in window »Availability of the connection«.
- Do not change the connection name appearing in window »Name of the connection« and click the button »Complete«.
- Finally you arrive again in window »Device Installation« from where you started establishing the connection. Confirm the adjustments by clicking the »OK« button.

NOTICE

Due to an bug in Windows 2000 it is possible that the automatically made communication settings are not correctly adopted. In order to overcome this problem, proceed as follows after setting up the serial connection:

- **Select menu point »Device Connection« in menu »Settings«.**
- **Select »Serial Connection«.**
- **Click button »Settings«.**
- **Change to register card »General«.**
- **Ensure that »Communication cable between two computers Com X is selected in the »Drop Down Menu«. X = interface number where you have connected the zero-modem cable to.**
- **Click button »Configure«.**
- **Ensure that the »Hardware Flowing Control« is activated.**
- **Ensure that baud rate *»115200«* is selected.**

Set up a Connection via Serial Interface under Windows XP

After installation of the software, the »Connection PC/Notebook to the Device« has to be configured once so that you are able to read device data or re-write them into the device by means of the software *Smart view.*

NOTICE **For connection of your PCs/notebooks with the device, you need a zero-modem cable (no serial cable!/please refer to chapter »Zero Modem Cable«).**

NOTICE **If your PC/notebook does not have a serial interface, you need a special »USB-to-serial-adapter«. Only if the »USB-to-serial-adapter« is correctly installed - aided by the provided CD – the communication with the device can be established. (see next chapter).**

Setting up/Configuring the connection

- Connect your PC/notebook with the device via a zero-modem cable.
- Start the software *Smart view*.
- Select the menu point »Device Connection« in menu »Settings«.
- Click on »Serial Connection«.
- Click button »Settings«.
- When initially setting up the connection, a dialogue window appears with the information that, so far, a direct connection with your protection device has not been established. Click on »Yes«.
- If, so far, a location has not been set up on your PC, your location information has to be put in. Confirm the following pop-up window »Telephone and Modem Options« with »OK«.
- The Windows network connection assistant appears after the location information is set up. Select the connection type »Establish direct connection to another computer«.
- Select the serial interface (COM-Port) where the device shall be connected to.
- Select »To be used for all users« in window »Availability of the connection«.
- Do not change the connection name appearing in window »Name of the connection« and click the button »Complete«.
- Finally you arrive again in window »Device Installation« from where you started establishing the connection. Confirm the adjustments by clicking the »OK« button.

Set up a Connection via Serial Interface under Windows Vista

Establishing the connection between *Smart view* and the device is a three step procedure.

1. Installing *Smart view* (the application itself)
2. Installing a (virtual) modem (that is a precondition for TCP/IP communication via a zero-modem cable)/ (to be done within the control panel).
3. Establishing a network connection between *Smart view* and the device (to be done within Smart view).

1. Installlation of Smart view (the application itself).
Please see above.

2. Installation of the (virtual) modem

- Call up the »Control Panel«
- Choose »Hardware & Sound«
- Choose »Phone & Modem Options«
- Go to Tab »Modem«
- Click on the »Add« button
- A new window **Install new modem** pops up
- Set the check box **Don´t detect my modem**
- Choose» I will select from list«
- Click on the »Next« button
- Choose the correct **COM-Port**
- Click on the »Next« button
- Select **Computer cable between two computers**
- Click on the »Properties« button
- Go to Tab »General«
- Click on the »Change Settings« button
- Go to Tab »Modem«
- Set within the Drop-Down Menu the correct **baud rate = 115200**
- Click on the »OK« button
- Click on the »OK« button
- **You have to reboot your computer now!**

3. Establishing a network connection between Smart view and the device

- Connect the device to the PC/notebook via a **correct Zero-Modem-Cable**.
- Run *Smart view*.
- Call up »Device Connection« within the menu »Device Connection«.
- Click on the »Settings« button.
- A wizard will pop up asking you **How do you want to connect**.
- Choose »Dial-up«.
- The Telephone number must not be empty. **Please enter any number** (e.g. 1).
- **Don´t care about the username and password**.
- Click on the »OK« button.

Connected to the Device and Calling up Websites at the same Time

In principle, it is possible to call up websites *while* there is an active connection to the device.

If your computer has no direct connection to the internet, that means, that it is placed behind a proxy server, the device connection has to be modified in certain circumstances. The device connection has to be provided with the proxy settings.

Internet Explorer
For each connection the proxy settings have to be set manually. Please proceed as follows:

- Start your *Internet Explorer.*
- Call up the »Tools« menu.
- Call up the menu »Internet options«.
- Call up the tab »Connections«.
- Click with the left hand mouse key on the button »Settings« on the right of the »HighPROTEC-Device-Connection«.
- Set the check box »Use Proxy Server for this connection.
- Enter the proxy settings that are available by your network administrator.
- Confirm the settings by pressing »OK«.

Firefox
The proxy settings are centrally managed, so there is no need to modify any settings.

Establishing the Connection via a USB-/RS232-Adapter

If your PC/notebook is not provided with a serial interface, this can be compensated by a special *USB-/RS232-Adapter+Zero Modem-Cable*.

NOTICE

Only an adapter accepted by *Woodward SEG* may be used. First install the adapter (with the related driver that you can find on the CD) and then establish the connection (*Smart view* => *Device*). The adapters must support very high speed.

Smart view Troubleshooting

- Make sure whether the Windows service *Telephony* is started. In [Start>System Control >Administration >Services] the service »Telephony« must be visible and must have also been started. If not, the service has to be started.
- For establishing the connection, you need to have sufficient rights (administration rights).
- If a firewall is installed on your computer, TCP/IP port 52152 must have been released.
- If your computer is not provided with a serial interface, you need a *USB-to-serial-adapter*, accepted by *Woodward SEG*. This adapter has to be properly installed.
- Ensure that a zero-modem cable is used (a standard serial cable without control wires does not enable communication).

NOTICE

If on a »WINDOWS XP computer a serial interface for direct connection to another computer has not been established so far, the following problem can arise:

If you have selected a serial interface in the connection assistant, it may happen that this is not entered correctly in the dial-up network due to an bug in the Windows operating system. Your attention is drawn to this problem by the operational software and the error message »Warning, invalid connection setting« will be shown.

To solve this problem, you need administration rights.

Please proceed as follows:

- **Select menu point »Device Connection« in menu »Settings«.**
- **Select »Serial Connection«.**
- **Click button »Settings«.**
- **Change to register card »General«.**
- **Ensure that »Communication cable between two computers (Com X)“ is selected in the »Drop Down Menu«. »X« = interface number where you have connected the zero-modem cable to.**

NOTICE

If the message »Warning, invalid connection settings« appears during establishing the connection, this indicates that the connection adjustments you have chosen are not correct.

On this warning you can react as follows:

»Yes«: (to set up the connection completely new).
By this, all adjustments are cancelled and the connection assistant is opened again for renewed adjustment of the connection to the device.

This procedure is advisable in case basic adjustments cannot be modified via the characteristics dialogue (e.g. if a new additional serial interface has been installed on the system).

»No«: (to modify the existing dial-up network entry).
Opens the dialogue for characteristics of the connection settings. During the dialogue it is possible to correct invalid settings (e.g. the recommended baud rate).

»Cancel«:
The warning is ignored and the connection adjustments remain as they are. This procedure is accepted for a limited time, but in such a case, the user is obliged to establish a correct connection later on.

Smart view persistent connecton problems

In case of persistent connection problems you should remove all connection settings and establish them again afterwards. In order to remove all connection settings please proceed as follows:

1. *Remove the settings for the Dial-up Network*

- Close Smart view
- Call up the »Control Panel«
- Choose »Network & Internet«
- On the left side click on »Manage Network Connections«
- Click on HighPROTEC Direct Connection with the right hand mouse key
- Chosse Delete from the shortcut menu
- Click on the OK button

2. *Remove the virtual modem*

- Call up the »Control Panel«
- Choose »Hardware & Sound«
- Choose »Phone & Modem Options«
- Go to Tab Modem
- Click on the correct (in case there is more than one) entry Connection cable between two computers
- Click on the Remove button

Loading of Device Data when using Smart view

- Starting of the *Smart view.*
- Make sure the connection has been established properly.
- Connect your PC with the device via a *zero-modem cable*.
- Select »Receiving Data From The Device« in menu »Device«.

Restoring of Device Data when using Smart view

WARNING

Via the button »Transfer only modified parameters into the device« only modified parameters are transmitted into the device.

Parameter modifications are indicated by a red "star symbol" in front of the parameter.

The star symbol (in the device tree window) indicates that parameters in the opened file (within smart view) differ from parameters stored on your local hard disk.

Via the button »Transfer only modified parameters into the device«, you can transmit all parameters that are marked by this symbol.

If a parameter file is saved on your local hard drive, these parameters are no longer classified to be modified and can not be transmitted via the button »Transfer only modified parameters into the device«.

In case that you have loaded and modified a parameter file from the device and saved it to your local hard drive without transferring the parameters into the device beforehand, you cannot use the button »Transfer only modified parameters into the device«. In a case like that, use »Transfer all parameters into the device«.

NOTICE

The button »Transfer only modified parameters into the device« only works if modified parameters are available in the *Smart view*.

In contrast to that, all parameters of the device are transferred when the button »Transfer all parameters into the device« is pressed (provided all device parameters are valid).

- In order to (re-)transfer changed parameters into the device, please select »Transfer all parameters into the device« in menu »Device«.
- Confirm the safety inquiry »Shall the parameters be overwritten into the device?"«.
- Enter the password for setting parameters in the popup window.
- Thereafter the changed data is transferred to the device and adopted.
- Confirm the inquiry »Parameters successfully updated. It is recommended to save the parameters into a local file on your hard drive. Shall The Data Be Saved Locally?"« with »Yes« (recommended). Select a suitable folder on your hard disk.
- Confirm the chosen folder by clicking »Save«.
- The changed parameter data is now saved in the folder chosen by you.

Backup and Documentation when using Smart view

How to save device data on a PC:

Click on »Save as ...« in menu »File«. Specify a name, choose a folder on your hard disk and save the device data accordingly.

Printing of Device Data When using Smart view (Setting List)

The »Printing menu« offers the following options:

- Printer setting
- Page preview
- Printing
- Export the selected printing range into a txt-file.

The printing menu of the *Smart view* software offers contextual different types of printing ranges.

- *Printing of the complete parameter tree:*
  All values and parameters of the present parameter file are printed.

- *Printing of the displayed working window:*
  Only the data shown on the relevant working window are printed, i.e. this applies, if at least one window is opened.

- *Printing of all opened working windows:*
  The data shown on all windows are printed, i.e. this applies only if more than one window is opened.

- *Printing of the device parameter tree as from a shown position on:*
  All data and parameters of the device parameter tree are printed as from the position/marking in the navigation window. Below this selection the complete name of the marking is additionally displayed.

Saving Data as a txt-file via Smart view

Within the print menu [File>Print] you can choose »Export into File« in order to export the device data into an txt-file.

NOTICE

Only the actual selected printing range will be exported into a text-file. That means: If you have chosen the "Complete device parameter tree" then the "Complete device parameter tree" will be exported. But, if you have chosen "Actual working window", only this window will be exported.

You can print out operating data but not export them.

NOTICE

If you export a txt-file, the content of this file is encoded as Unicode. That means that, if you want to edit this file, your application must support Unicode encoded files (e.g. Microsoft Office 2003 or higher).

Offline Device Planning via Smart view

NOTICE

In order to be able to transmit a parameter file (e.g. offline created) into the device the followinig issues must comply:

- **Type Code (written on the top of the device/type label) and**
- **Version of the device model (can be found in menu [Device Parameters\Version].**

The *Smart view* software enables also to parameterize offline. The advantage is: By using device models you can do planning jobs for a device and set parameters in advance.

You can also read the parameter file out of the device, further process it offline (e.g. from your office) and finally re-transfer it to the device.

You can either:

- load an existing parameter file from a device (please refer to chapter [Loading device data when using Smart view]).
- create a new parameter file (see below),
- open a locally saved parameter file (backup).

In order to create a new device/parameter file by way of a device template offline:

- In order to create a new offline parameter file please choose within the »file-menu« »create new parameter file«.
- A working window pops up. Please make sure, that you select the right device type with the correct version and configuration.
- Finally click on »Apply«
- In order to save the device configuration select »Save« out of the »File-Menu«.
- Within the menu »Modify Device Configuration (Typecode)« you can modify the device configuration or simply find out the type code of your current selection.

If you want to transfer the parameter file into a device, please refer to chapter “Restoring of device data when using Smart view”.

Measuring Values

Read out Measured Values

In menu »Operation/Measured Values« both measured and calculated values can be viewed. The measured values are ordered by »Standard values« and »special values« (depending on the type of device).

Read out of Measured Values via Smart view

- In case *Smart view* is not running – please start it.
- If the device data were not yet loaded – select »Receive Data From The Device« from menu »Device«.
- Double click on icon »Operation« in the navigation tree.
- Double click on icon »Measured Values« within the navigation tree »Operation«.
- Double click the »Standard Values« or special values within the »Measured values«.
- The measured and calculated values are shown now in tabular form on the window.

NOTICE

To have the measuring data read in a cyclic manner, select »Auto refresh« in menu »View«. The measured values are read out about every two seconds.

Standard Measured Values

Value	Description	Menu path
f	Measured value: Frequency	[Operation /Measured values /Standard values]
VL12	Measured value: Phase-to-phase voltage	[Operation /Measured values /Standard values]
VL23	Measured value: Phase-to-phase voltage	[Operation /Measured values /Standard values]
VL31	Measured value: Phase-to-phase voltage	[Operation /Measured values /Standard values]
VL1	Measured value: Phase-to-neutral voltage	[Operation /Measured values /Standard values]
VL2	Measured value: Phase-to-neutral voltage	[Operation /Measured values /Standard values]
VL3	Measured value: Phase-to-neutral voltage	[Operation /Measured values /Standard values]
VE meas	Measured value (measured): VE measured	[Operation /Measured values /Standard values]
V0	Measured value (calculated): Symmetrical components Zero voltage	[Operation /Measured values /Standard values]
V1	Measured value (calculated): Symmetrical components positive phase sequence voltage	[Operation /Measured values /Standard values]
V2	Measured value (calculated): Symmetrical components negative phase sequence voltage	[Operation /Measured values /Standard values]
IL1	Measured value: Phase current	[Operation /Measured values /Standard values]

IL2	Measured value: Phase current	[Operation /Measured values /Standard values]
IL3	Measured value: Phase current	[Operation /Measured values /Standard values]
IG meas	Measured value (measured): IE	[Operation /Measured values /Standard values]
I0	Measured value (calculated): Zero current	[Operation /Measured values /Standard values]
I1	Measured value (calculated): Positive phase sequence current	[Operation /Measured values /Standard values]
I2	Measured value (calculated): Unbalanced load current	[Operation /Measured values /Standard values]
IL1 H2	Measured value: 2nd harmonic/1st harmonic of IL1	[Operation /Measured values /Standard values]
IL2 H2	Measured value: 2nd harmonic/1st harmonic of IL2	[Operation /Measured values /Standard values]
IL3 H2	Measured value: 2nd harmonic/1st harmonic of IL3	[Operation /Measured values /Standard values]
IE H2	Measured value: 2nd harmonic/1st harmonic	[Operation /Measured values /Standard values]
S	Measured value (calculated): Apparent power	[Operation /Measured values /Standard values]
P	Measured value (calculated): Active power	[Operation /Measured values /Standard values]
Q	Measured value (calculated): Reactive power	[Operation /Measured values /Standard values]

cos phi	Measured value (calculated): Power factor	[Operation /Measured values /Standard values]
Wp+	Positive Active Power: Is consumed active energy if consumed power is defined positive. The Positive Active Power is fed active energy if fed power is defined positive.	[Operation /Measured values /Standard values]
Wp-	Negative Active Power: Is fed active energy if consumed power is defined positive. The Negative Active Power is consumed active energy if fed power is defined positive.	[Operation /Measured values /Standard values]
Wq+	Positive Reactive Power: Is consumed reactive energy if consumed power is defined positive. The Positive Reactive Power is fed reactive energy if fed power is defined positive.	[Operation /Measured values /Standard values]
Wq-	Negative Reactive Power: Is fed reactive energy if consumed power is defined positive. The Negative Reactive Power is consumed reactive energy if fed power is defined positive.	[Operation /Measured values /Standard values]

Energy Counter

PowerCr

Direct Commands of the Energy Counter Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Wp+ Reset Cr	Wp+ Reset Counter	inactive, active	inactive	[Operation /Reset]
Wp- Reset Cr	Wp- Reset Counter	inactive, active	inactive	[Operation /Reset]
Wq+ Reset Cr	Wq+ Reset Counter	inactive, active	inactive	[Operation /Reset]
Wq- Reset Cr	Wq- Reset Counter	inactive, active	inactive	[Operation /Reset]
Res all Energy Cr	Reset of all Energy Counters	inactive, active	inactive	[Operation /Reset]

Signals of the Energy Counter Module (States of the Outputs)

Name	*Description*
Cr Overflow Wp+	Signal: Counter Overflow Wp+
Cr Overflow Wp-	Signal: Counter Overflow Wp-
Cr Overflow Wq+	Signal: Counter Overflow Wq+
Cr Overflow Wq-	Signal: Counter Overflow Wq-
Wp+ Reset Cr	Signal: Wp+ Reset Counter
Wp- Reset Cr	Signal: Wp- Reset Counter
Wq+ Reset Cr	Signal: Wq+ Reset Counter
Wq- Reset Cr	Signal: Wq- Reset Counter
Res all Energy Cr	Signal: Reset of all Energy Counters

Statistics

Statistics

In menu *»Operation/Statistics«* the min., max. and mean values of the measured and calculated measured quantities can be found. The statistics are ordered by »Standard values« and »special values« (depending on the type of device and the device planning).

In menu *»Device Parameter/Statistics« y*ou can either set a fixed synchronization time and a calculation interval or start and stop the statistics via a function (e.g. digital input).

Read out Statistics

- Call up the main menu.
- Call up the submenu *»Operation/Statistics«.*
- Call up the »Standard values« or »Special values«

Statistics to be Read-Out via Smart view

- In case *Smart view* is not running – please start it.
- If device data have not yet been loadedt – click »Receive Data From The Device« in menu »Device«.
- Double click on icon »Operation« in the navigation tree
- Double click on icon »Statistics« within the navigation tree »Operation«
- Double click on icon »Standard values« or »Special values«
- In the window the statistical data is shown in tabular form

The values can be read out cyclically. For this purpose, please select »Auto Refresh« out of the menu »View«.

Statistics (Configuration)

The *Statistic*-module can be configured within the menu »Device Parameter/Statistics«.

The time interval, that is taken into account for the calculation of the statistics can either be limited by a fixed duration or it can be limited by a start function (freely assignable signal from the »assignment list«).

Fixed duration:

> If the statistic module is set to a fixed duration/time interval, the minimum, maximum and average values will be calculated and displayed continuously on the basis of this duration/time interval.

Start function (flexible duration):

> If the statistic module is to be started by a start function the *statistics* will be updated not until the start function becomes true (rising edge). At the same time a new time interval will be started.

Statistics (Configuration) via Smart view

In case *Smart view* is not running – please start it

- If device data has not been loaded yet – click »Receive Data From The Device« in menu »Device«
- Double click on icon »Device Parameter« in the navigation tree
- Double click on icon »Statistics« within the navigation tree »Device Parameter«
- Configure the *Statistics*-module

Direct Commands

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Reset	Reset of Statistics	inactive, active	inactive	[Operation /Reset]

Standard Statistic Values

Value	*Description*	*Menu path*
f max	Max. frequency value	[Operation /Statistics /Standard values]
f avg	Average frequency value	[Operation /Statistics /Standard values]
f min	Min. frequency value	[Operation /Statistics /Standard values]
VL12 max	VL12 maximum value	[Operation /Statistics /Standard values]
VL12 avg	VL12 average value	[Operation /Statistics /Standard values]
VL12 min	VL12 minimum value	[Operation /Statistics /Standard values]
VL23 max	VL23 maximum value	[Operation /Statistics /Standard values]
VL23 avg	VL23 average value	[Operation /Statistics /Standard values]
VL23 min	VL23 minimum value	[Operation /Statistics /Standard values]
VL31 max	VL31 maximum value	[Operation /Statistics /Standard values]

VL31 avg	VL31 average value	[Operation /Statistics /Standard values]
VL31 min	VL31 minimum value	[Operation /Statistics /Standard values]
VL1 max	VL1 maximum value	[Operation /Statistics /Standard values]
VL1 avg	VL1 average value	[Operation /Statistics /Standard values]
VL1 min	VL1 minimum value	[Operation /Statistics /Standard values]
VL2 max	VL2 maximum value	[Operation /Statistics /Standard values]
VL2 avg	VL2 average value	[Operation /Statistics /Standard values]
VL2 min	VL2 minimum value	[Operation /Statistics /Standard values]
VL3 max	VL3 maximum value	[Operation /Statistics /Standard values]
VL3 avg	VL3 average value	[Operation /Statistics /Standard values]
VL3 min	VL3 minimum value	[Operation /Statistics /Standard values]
V1 max	Maximum value: Symmetrical components positive phase sequence voltage	[Operation /Statistics /Standard values]
V1 avg	Average value: Symmetrical components positive phase sequence voltage	[Operation /Statistics /Standard values]

V1 min	Minimum value: Symmetrical components positive phase sequence voltage	[Operation /Statistics /Standard values]
V2 max	Maximum value: Symmetrical components negative phase sequence voltage	[Operation /Statistics /Standard values]
V2 avg	Average value: Symmetrical components negative phase sequence voltage	[Operation /Statistics /Standard values]
V2 min	Minimum value: Symmetrical components negative phase sequence voltage	[Operation /Statistics /Standard values]
IL1 max	IL1 maximum value	[Operation /Statistics /Standard values]
IL1 avg	IL1 average value	[Operation /Statistics /Standard values]
IL1 min	IL1 minimum value	[Operation /Statistics /Standard values]
IL2 max	IL2 maximum value	[Operation /Statistics /Standard values]
IL2 avg	IL2 average value	[Operation /Statistics /Standard values]
IL2 min	IL2 minimum value	[Operation /Statistics /Standard values]
IL3 max	IL3 maximum value	[Operation /Statistics /Standard values]
IL3 avg	IL3 average value	[Operation /Statistics /Standard values]
IL3 min	IL3 minimum value	[Operation /Statistics /Standard values]

I1 max	Maximum value positive phase sequence current	[Operation /Statistics /Standard values]
I1 avg	Average value positive phase sequence current	[Operation /Statistics /Standard values]
I1 min	Minimum value positive phase sequence current	[Operation /Statistics /Standard values]
I2 max	Maximum value unbalanced load	[Operation /Statistics /Standard values]
I2 avg	Average value unbalanced load current	[Operation /Statistics /Standard values]
I2 min	Minimum value unbalanced load current	[Operation /Statistics /Standard values]
S max	Maximum value of the apparent power	[Operation /Statistics /Standard values]
S avg	Average of the apparent power	[Operation /Statistics /Standard values]
S min	Minimum value of the apparent power	[Operation /Statistics /Standard values]
P max	Maximum value of the active power	[Operation /Statistics /Standard values]
P avg	Average of the active power	[Operation /Statistics /Standard values]
P min	Minimum value of the active power	[Operation /Statistics /Standard values]
Q max	Maximum value of the reactive power	[Operation /Statistics /Standard values]

Q avg	Average of the reactive power	[Operation /Statistics /Standard values]
Q min	Minimum value of the reactive power	[Operation /Statistics /Standard values]
cos phi max	Maximum value of the power factor	[Operation /Statistics /Standard values]
cos phi avg	Average of the power factor	[Operation /Statistics /Standard values]
cos phi min	Minimum value of the power factor	[Operation /Statistics /Standard values]

Global Protection Parameters of the Statistics Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Start via:	Start statistics by:	Duration, StartFct	Duration	[Device Para /Statistics]
StartFct	Update the displayed statistics and start new measuring interval if the assigned signal becomes true (rising edge): Only available if: Start via: = StartFct	1..n, Assignment List	-	[Device Para /Statistics]
ResetFct	Reset of statistics if the assigned signal becomes true (slope):	1..n, Assignment List	-	[Device Para /Statistics]
Duration	Recording time Only available if: Start via: = Duration	15 s, 30 s, 1 min, 10 min, 30 min, 1 h, 2 h, 6 h, 12 h, 1 d, 2 d, 5 d, 7 d, 10 d, 30 d	15 s	[Device Para /Statistics]

States of the Inputs of the Statistics Module

Name	*Description*	*Assignment via*
StartFct-I	Module input state: Start statistics Module input signal	[Device Para /Statistics]
ResetFct-I	Module input state: Reset statistics Module input signal	[Device Para /Statistics]

Signals of the Statistics Module

Name	*Description*
Reset	Signal: Reset of statistics

Counters of the Module Statistics

Value	*Description*	*Menu path*
MeasPointNo	Each measuring point that is taken over by the statistics increments this counter. By means of this counter you can check whether the statistics is alive and acquires data.	[Operation /Counter and RevData /Statistics]

Acknowledgements

Collective Acknowledgements for latched signals:

Collective Acknowledgements					
	LEDs	*Binary Output Relays*	*SCADA*	*Pending Trip Command*	*LEDs+* *Binary Output Relays+* *SCADA+* *Pending Trip Command*
Via ***Smart view*** or at the ***panel all***... can be acknowledged. At the panel, the menu [Operation\ Acknowledge] can directly be accessed via the **»C« key**	All LEDs at once: Where? [Operation\ Acknowledge]	All Binary Output Relays at once: Where? [Operation\ Acknowledge]	All SCADA signals at once: Where? [Operation\ Acknowledge]	All pending trip commands at once: Where? [Operation\ Acknowledge]	All at once: Where? [Operation\ Acknowledge]
External Acknowledgement: Via a signal from the assignment list (e.g. a digital Input) ***all***... can be acknowledged.	All LEDs at once: Where? Within the menu *Ex Acknowledge*	All Binary Output Relays at once: *Where? Within the menu Ex Acknowledge*	All SCADA signals at once: *Where? Within the menu Ex Acknowledge*	All pending trip commands at once: *Where? Within the menu Ex Acknowledge*	All at once: *Where? Within the menu Ex Acknowledge*

Options for individual acknowledgements for latched signals:

Individual Acknowledgement			
	LEDs	*Binary Output Relays*	*Pending Trip Command*
Via a signal from the assignment list (e.g..a digital Input) a ***single***... can be acknowledged.	Single LED: Where? Within the configuration menu of this single LED.	Binary Output Relay: Where? Within the configuration menu of this single Binary Output Relay.	Pending Trip Command. Where? Within the module *TripControl*

NOTICE **As long as you are within the parameter setting mode, you cannot acknowledge.**

NOTICE **In case of a fault during parameter setting via the operating panel, you must first leave the parameter mode by pressing either push-button »C« or »OK« before you may access to menu »Acknowledgements« via push-button.**

Manual Acknowledgement

- Press the C-Button at the panel.
- Select the item to be acknowledged via the Softkeys:

    - Binary output relays,
    - LEDs,
    - SCADA,
    - a pending trip command or
    - all (above) mentioned items at once.

- Press the Softkey with the »Wrench-Symbol«.
- Enter your password.

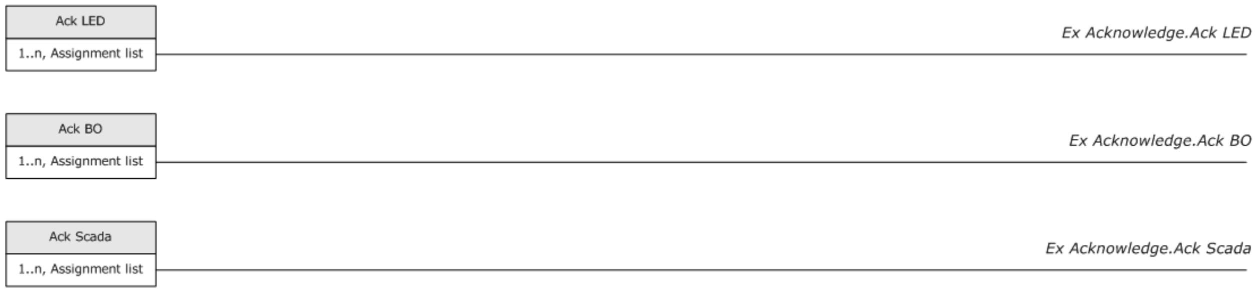
Manual Acknowledgement via Smart view

- In case *Smart view* is not running – please start it
- If the device data were not yet loaded – select »Receive Data From The Device« from menu »Device«
- Double click on icon »Operation« in the navigation tree.
- Double click on icon »Acknowledgement« within the operation menu.
- Double click the entry within the popup that is to be acknowledged.
- Press the button »Execute immediately«.
- Enter your password.

External Acknowledgements

Within the menu [Ex Acknowledge] you can assign a signal (e.g. the state of a digital input) from the assignment list that:

- acknowledges all (acknowledgeable) LEDs at once;
- acknowledges all (acknowledgeable) binary outputs at once:
- acknowledges all (acknowledgeable) SCADA-signals at once.



Within the menu [Protection Para\Global Prot Para\TripControl] you can assign a signal that:

- acknowledges a pending trip command.

For details, please refer to chapter »*TripControl«*.

External Acknowledge via Smart view

In case *Smart view* is not running – please start it.

- If the device data were not yet loaded – select »Receive Data From The Device« from menu »Device«
- Double click on icon »Device Parameter« in the navigation tree
- Double click on icon »Ex Acknowledge« within the operation menu
- In the working window you can assign now each one signal that resets all acknowledgeable LEDs, a signal that resets all binary outputs, a signal that resets the SCADA-signals respectively a signal that acknowledges a pending trip command.

Manual Resets

In menu *»Operation/Reset«* you can:

- reset counters,
- delete records (e.g. disturbance records) and
- reset special things (like statistics, thermal replica...).

NOTICE **The description of the reset commands can be found within the corresponding modules.**

Manual Resets via Smart view

- In case *Smart view* is not running – please start it
- If device data has not been loaded yet – click »Receive Data From The Device« in menu »Device«
- Double click the »Operation« icon in the navigation tree
- Double click the »Reset icon« within the operation menu
- Double click the entry within the popup that is to be reset or deleted.

NOTICE **The description of the reset commands can be found within the corresponding modules.**

Assignment List

The »ASSIGNMENT LIST« below summarizes all module outputs (signals) and inputs (e.g. states of the assignments).

Name	Description
-.-	No assignment
Prot.available	Signal: Protection is available
Prot.active	Signal: active
Prot.ExBlo	Signal: External Blocking
Prot.Alarm L1	Signal: General-Alarm L1
Prot.Alarm L2	Signal: General-Alarm L2
Prot.Alarm L3	Signal: General-Alarm L3
Prot.Alarm G	Signal: General-Alarm - Earth fault
Prot.Alarm	Signal: General Alarm
Prot.Trip L1	Signal: Trip L1
Prot.Trip L2	Signal: Trip L2
Prot.Trip L3	Signal: Trip L3
Prot.Trip E	Signal: Trip E
Prot.Trip	Signal: Trip
Prot.Res Fault a Mains No	Signal: Resetting of fault number and mains fault number.
Prot.I dir fwd	Signal: Phase current failure forward direction
Prot.I dir rev	Signal: Phase current failure reverse direction
Prot.I dir n poss	Signal: Phase fault - missing reference voltage
Prot.IG dir fwd	Signal: Earth fault forward
Prot.IG rev dir	Signal: Earth fault reverse direction
Prot.IE dir n poss	Signal: Earth fault direction detection not possible
Prot.ExBlo1-I	Module input state: External blocking1
Prot.ExBlo2-I	Module input state: External blocking2
TripControl.TripCmd	Signal: Trip Command
TripControl.Res TripCmd Cr	Signal: Resetting of the Counter: total number of trip commands
TripControl.Ack TripCmd	Signal: Acknow TripCmd
TripControl.Res Sum trip	Signal: Reset summation of the tripping currents
TripControl.Acknow Sig-I	Module input state: Acknowledgement Signal (only for automatic acknowledgement) Module input signal
I[1].active	Signal: active
I[1].ExBlo	Signal: External Blocking
I[1].Ex rev Interl	Signal: External reverse Interlocking
I[1].Blo TripCmd	Signal: Trip Command blocked
I[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
I[1].IH2 Blo	Signal: Blocking the trip command by an inrush
I[1].Alarm L1	Signal: Alarm L1

Name	*Description*
I[1].Alarm L2	Signal: Alarm L2
I[1].Alarm L3	Signal: Alarm L3
I[1].Alarm	Signal: Alarm
I[1].Trip L1	Signal: Trip L1
I[1].Trip L2	Signal: Trip L2
I[1].Trip L3	Signal: Trip L3
I[1].Trip	Signal: Trip
I[1].TripCmd	Signal: Trip Command
I[1].ExBlo1-I	Module input state: External blocking1
I[1].ExBlo2-I	Module input state: External blocking2
I[1].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
I[1].Ex rev Interl-I	Module input state: External reverse interlocking
I[2].active	Signal: active
I[2].ExBlo	Signal: External Blocking
I[2].Ex rev Interl	Signal: External reverse Interlocking
I[2].Blo TripCmd	Signal: Trip Command blocked
I[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
I[2].IH2 Blo	Signal: Blocking the trip command by an inrush
I[2].Alarm L1	Signal: Alarm L1
I[2].Alarm L2	Signal: Alarm L2
I[2].Alarm L3	Signal: Alarm L3
I[2].Alarm	Signal: Alarm
I[2].Trip L1	Signal: Trip L1
I[2].Trip L2	Signal: Trip L2
I[2].Trip L3	Signal: Trip L3
I[2].Trip	Signal: Trip
I[2].TripCmd	Signal: Trip Command
I[2].ExBlo1-I	Module input state: External blocking1
I[2].ExBlo2-I	Module input state: External blocking2
I[2].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
I[2].Ex rev Interl-I	Module input state: External reverse interlocking
I[3].active	Signal: active
I[3].ExBlo	Signal: External Blocking
I[3].Ex rev Interl	Signal: External reverse Interlocking
I[3].Blo TripCmd	Signal: Trip Command blocked
I[3].ExBlo TripCmd	Signal: External Blocking of the Trip Command
I[3].IH2 Blo	Signal: Blocking the trip command by an inrush
I[3].Alarm L1	Signal: Alarm L1
I[3].Alarm L2	Signal: Alarm L2
I[3].Alarm L3	Signal: Alarm L3
I[3].Alarm	Signal: Alarm

Name	*Description*
I[3].Trip L1	Signal: Trip L1
I[3].Trip L2	Signal: Trip L2
I[3].Trip L3	Signal: Trip L3
I[3].Trip	Signal: Trip
I[3].TripCmd	Signal: Trip Command
I[3].ExBlo1-I	Module input state: External blocking1
I[3].ExBlo2-I	Module input state: External blocking2
I[3].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
I[3].Ex rev Interl-I	Module input state: External reverse interlocking
I[4].active	Signal: active
I[4].ExBlo	Signal: External Blocking
I[4].Ex rev Interl	Signal: External reverse Interlocking
I[4].Blo TripCmd	Signal: Trip Command blocked
I[4].ExBlo TripCmd	Signal: External Blocking of the Trip Command
I[4].IH2 Blo	Signal: Blocking the trip command by an inrush
I[4].Alarm L1	Signal: Alarm L1
I[4].Alarm L2	Signal: Alarm L2
I[4].Alarm L3	Signal: Alarm L3
I[4].Alarm	Signal: Alarm
I[4].Trip L1	Signal: Trip L1
I[4].Trip L2	Signal: Trip L2
I[4].Trip L3	Signal: Trip L3
I[4].Trip	Signal: Trip
I[4].TripCmd	Signal: Trip Command
I[4].ExBlo1-I	Module input state: External blocking1
I[4].ExBlo2-I	Module input state: External blocking2
I[4].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
I[4].Ex rev Interl-I	Module input state: External reverse interlocking
I[5].active	Signal: active
I[5].ExBlo	Signal: External Blocking
I[5].Ex rev Interl	Signal: External reverse Interlocking
I[5].Blo TripCmd	Signal: Trip Command blocked
I[5].ExBlo TripCmd	Signal: External Blocking of the Trip Command
I[5].IH2 Blo	Signal: Blocking the trip command by an inrush
I[5].Alarm L1	Signal: Alarm L1
I[5].Alarm L2	Signal: Alarm L2
I[5].Alarm L3	Signal: Alarm L3
I[5].Alarm	Signal: Alarm
I[5].Trip L1	Signal: Trip L1
I[5].Trip L2	Signal: Trip L2
I[5].Trip L3	Signal: Trip L3

Name	*Description*
I[5].Trip	Signal: Trip
I[5].TripCmd	Signal: Trip Command
I[5].ExBlo1-I	Module input state: External blocking1
I[5].ExBlo2-I	Module input state: External blocking2
I[5].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
I[5].Ex rev Interl-I	Module input state: External reverse interlocking
I[6].active	Signal: active
I[6].ExBlo	Signal: External Blocking
I[6].Ex rev Interl	Signal: External reverse Interlocking
I[6].Blo TripCmd	Signal: Trip Command blocked
I[6].ExBlo TripCmd	Signal: External Blocking of the Trip Command
I[6].IH2 Blo	Signal: Blocking the trip command by an inrush
I[6].Alarm L1	Signal: Alarm L1
I[6].Alarm L2	Signal: Alarm L2
I[6].Alarm L3	Signal: Alarm L3
I[6].Alarm	Signal: Alarm
I[6].Trip L1	Signal: Trip L1
I[6].Trip L2	Signal: Trip L2
I[6].Trip L3	Signal: Trip L3
I[6].Trip	Signal: Trip
I[6].TripCmd	Signal: Trip Command
I[6].ExBlo1-I	Module input state: External blocking1
I[6].ExBlo2-I	Module input state: External blocking2
I[6].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
I[6].Ex rev Interl-I	Module input state: External reverse interlocking
IG[1].active	Signal: active
IG[1].ExBlo	Signal: External Blocking
IG[1].Ex rev Interl	Signal: External reverse Interlocking
IG[1].Blo TripCmd	Signal: Trip Command blocked
IG[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
IG[1].Alarm	Signal: Alarm IE
IG[1].Trip	Signal: Trip
IG[1].TripCmd	Signal: Trip Command
IG[1].IGH2 Blo	Signal: blocked by an inrush
IG[1].ExBlo1-I	Module input state: External blocking1
IG[1].ExBlo2-I	Module input state: External blocking2
IG[1].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
IG[1].Ex rev Interl-I	Module input state: External reverse interlocking
IG[2].active	Signal: active
IG[2].ExBlo	Signal: External Blocking
IG[2].Ex rev Interl	Signal: External reverse Interlocking

Name	*Description*
IG[2].Blo TripCmd	Signal: Trip Command blocked
IG[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
IG[2].Alarm	Signal: Alarm IE
IG[2].Trip	Signal: Trip
IG[2].TripCmd	Signal: Trip Command
IG[2].IGH2 Blo	Signal: blocked by an inrush
IG[2].ExBlo1-I	Module input state: External blocking1
IG[2].ExBlo2-I	Module input state: External blocking2
IG[2].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
IG[2].Ex rev Interl-I	Module input state: External reverse interlocking
IG[3].active	Signal: active
IG[3].ExBlo	Signal: External Blocking
IG[3].Ex rev Interl	Signal: External reverse Interlocking
IG[3].Blo TripCmd	Signal: Trip Command blocked
IG[3].ExBlo TripCmd	Signal: External Blocking of the Trip Command
IG[3].Alarm	Signal: Alarm IE
IG[3].Trip	Signal: Trip
IG[3].TripCmd	Signal: Trip Command
IG[3].IGH2 Blo	Signal: blocked by an inrush
IG[3].ExBlo1-I	Module input state: External blocking1
IG[3].ExBlo2-I	Module input state: External blocking2
IG[3].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
IG[3].Ex rev Interl-I	Module input state: External reverse interlocking
IG[4].active	Signal: active
IG[4].ExBlo	Signal: External Blocking
IG[4].Ex rev Interl	Signal: External reverse Interlocking
IG[4].Blo TripCmd	Signal: Trip Command blocked
IG[4].ExBlo TripCmd	Signal: External Blocking of the Trip Command
IG[4].Alarm	Signal: Alarm IE
IG[4].Trip	Signal: Trip
IG[4].TripCmd	Signal: Trip Command
IG[4].IGH2 Blo	Signal: blocked by an inrush
IG[4].ExBlo1-I	Module input state: External blocking1
IG[4].ExBlo2-I	Module input state: External blocking2
IG[4].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
IG[4].Ex rev Interl-I	Module input state: External reverse interlocking
ThR.active	Signal: active
ThR.ExBlo	Signal: External Blocking
ThR.Blo TripCmd	Signal: Trip Command blocked
ThR.ExBlo TripCmd	Signal: External Blocking of the Trip Command
ThR.Alarm	Signal: Alarm Thermal Overload

Name	Description
ThR.Trip	Signal: Trip
ThR.TripCmd	Signal: Trip Command
ThR.Reset Theta	Signal: Resetting Thermal Replica
ThR.ExBlo1-I	Module input state: External blocking1
ThR.ExBlo2-I	Module input state: External blocking2
ThR.ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
I2>[1].active	Signal: active
I2>[1].ExBlo	Signal: External Blocking
I2>[1].Blo TripCmd	Signal: Trip Command blocked
I2>[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
I2>[1].Alarm	Signal: Alarm Negative Sequence
I2>[1].Trip	Signal: Trip
I2>[1].TripCmd	Signal: Trip Command
I2>[1].ExBlo1-I	Module input state: External blocking1
I2>[1].ExBlo2-I	Module input state: External blocking2
I2>[1].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
I2>[2].active	Signal: active
I2>[2].ExBlo	Signal: External Blocking
I2>[2].Blo TripCmd	Signal: Trip Command blocked
I2>[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
I2>[2].Alarm	Signal: Alarm Negative Sequence
I2>[2].Trip	Signal: Trip
I2>[2].TripCmd	Signal: Trip Command
I2>[2].ExBlo1-I	Module input state: External blocking1
I2>[2].ExBlo2-I	Module input state: External blocking2
I2>[2].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
IH2.active	Signal: active
IH2.ExBlo	Signal: External Blocking
IH2.Blo L1	Signal: Blocked L1
IH2.Blo L2	Signal: Blocked L2
IH2.Blo L3	Signal: Blocked L3
IH2.Blo IG	Signal: Blocking of the earth protection module
IH2.3-ph Blo	Signal: Inrush was detected in at least one phase - trip command blocked.
IH2.ExBlo1-I	Module input state: External blocking1
IH2.ExBlo2-I	Module input state: External blocking2
V[1].active	Signal: active
V[1].ExBlo	Signal: External Blocking
V[1].Blo TripCmd	Signal: Trip Command blocked
V[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
V[1].Alarm L1	Signal: Alarm L1

Name	*Description*
V[1].Alarm L2	Signal: Alarm L2
V[1].Alarm L3	Signal: Alarm L3
V[1].Alarm	Signal: Alarm voltage stage
V[1].Trip L1	Signal: Trip L1
V[1].Trip L2	Signal: Trip L2
V[1].Trip L3	Signal: Trip L3
V[1].Trip	Signal: Trip
V[1].TripCmd	Signal: Trip Command
V[1].ExBlo1-I	Module input state: External blocking1
V[1].ExBlo2-I	Module input state: External blocking2
V[1].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
V[2].active	Signal: active
V[2].ExBlo	Signal: External Blocking
V[2].Blo TripCmd	Signal: Trip Command blocked
V[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
V[2].Alarm L1	Signal: Alarm L1
V[2].Alarm L2	Signal: Alarm L2
V[2].Alarm L3	Signal: Alarm L3
V[2].Alarm	Signal: Alarm voltage stage
V[2].Trip L1	Signal: Trip L1
V[2].Trip L2	Signal: Trip L2
V[2].Trip L3	Signal: Trip L3
V[2].Trip	Signal: Trip
V[2].TripCmd	Signal: Trip Command
V[2].ExBlo1-I	Module input state: External blocking1
V[2].ExBlo2-I	Module input state: External blocking2
V[2].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
V[3].active	Signal: active
V[3].ExBlo	Signal: External Blocking
V[3].Blo TripCmd	Signal: Trip Command blocked
V[3].ExBlo TripCmd	Signal: External Blocking of the Trip Command
V[3].Alarm L1	Signal: Alarm L1
V[3].Alarm L2	Signal: Alarm L2
V[3].Alarm L3	Signal: Alarm L3
V[3].Alarm	Signal: Alarm voltage stage
V[3].Trip L1	Signal: Trip L1
V[3].Trip L2	Signal: Trip L2
V[3].Trip L3	Signal: Trip L3
V[3].Trip	Signal: Trip
V[3].TripCmd	Signal: Trip Command
V[3].ExBlo1-I	Module input state: External blocking1

Name	Description
V[3].ExBlo2-I	Module input state: External blocking2
V[3].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
V[4].active	Signal: active
V[4].ExBlo	Signal: External Blocking
V[4].Blo TripCmd	Signal: Trip Command blocked
V[4].ExBlo TripCmd	Signal: External Blocking of the Trip Command
V[4].Alarm L1	Signal: Alarm L1
V[4].Alarm L2	Signal: Alarm L2
V[4].Alarm L3	Signal: Alarm L3
V[4].Alarm	Signal: Alarm voltage stage
V[4].Trip L1	Signal: Trip L1
V[4].Trip L2	Signal: Trip L2
V[4].Trip L3	Signal: Trip L3
V[4].Trip	Signal: Trip
V[4].TripCmd	Signal: Trip Command
V[4].ExBlo1-I	Module input state: External blocking1
V[4].ExBlo2-I	Module input state: External blocking2
V[4].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
VE[1].active	Signal: active
VE[1].ExBlo	Signal: External Blocking
VE[1].Blo TripCmd	Signal: Trip Command blocked
VE[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
VE[1].Alarm	Signal: Alarm Residual Voltage Supervision-stage
VE[1].Trip	Signal: Trip
VE[1].TripCmd	Signal: Trip Command
VE[1].ExBlo1-I	Module input state: External blocking1
VE[1].ExBlo2-I	Module input state: External blocking2
VE[1].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
VE[2].active	Signal: active
VE[2].ExBlo	Signal: External Blocking
VE[2].Blo TripCmd	Signal: Trip Command blocked
VE[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
VE[2].Alarm	Signal: Alarm Residual Voltage Supervision-stage
VE[2].Trip	Signal: Trip
VE[2].TripCmd	Signal: Trip Command
VE[2].ExBlo1-I	Module input state: External blocking1
VE[2].ExBlo2-I	Module input state: External blocking2
VE[2].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
f[1].active	Signal: active
f[1].ExBlo	Signal: External Blocking
f[1].Blo by V<	Signal: Module is blocked by undervoltage.

Name	*Description*
f[1].Blo TripCmd	Signal: Trip Command blocked
f[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
f[1].Alarm f	Signal: Alarm Frequency Protection
f[1].Trip f	Signal: Frequency has exceeded the limit.
f[1].TripCmd	Signal: Trip Command
f[1].ExBlo1-I	Module input state: External blocking1
f[1].ExBlo2-I	Module input state: External blocking2
f[1].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
f[2].active	Signal: active
f[2].ExBlo	Signal: External Blocking
f[2].Blo by V<	Signal: Module is blocked by undervoltage.
f[2].Blo TripCmd	Signal: Trip Command blocked
f[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
f[2].Alarm f	Signal: Alarm Frequency Protection
f[2].Trip f	Signal: Frequency has exceeded the limit.
f[2].TripCmd	Signal: Trip Command
f[2].ExBlo1-I	Module input state: External blocking1
f[2].ExBlo2-I	Module input state: External blocking2
f[2].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
f[3].active	Signal: active
f[3].ExBlo	Signal: External Blocking
f[3].Blo by V<	Signal: Module is blocked by undervoltage.
f[3].Blo TripCmd	Signal: Trip Command blocked
f[3].ExBlo TripCmd	Signal: External Blocking of the Trip Command
f[3].Alarm f	Signal: Alarm Frequency Protection
f[3].Trip f	Signal: Frequency has exceeded the limit.
f[3].TripCmd	Signal: Trip Command
f[3].ExBlo1-I	Module input state: External blocking1
f[3].ExBlo2-I	Module input state: External blocking2
f[3].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
f[4].active	Signal: active
f[4].ExBlo	Signal: External Blocking
f[4].Blo by V<	Signal: Module is blocked by undervoltage.
f[4].Blo TripCmd	Signal: Trip Command blocked
f[4].ExBlo TripCmd	Signal: External Blocking of the Trip Command
f[4].Alarm f	Signal: Alarm Frequency Protection
f[4].Trip f	Signal: Frequency has exceeded the limit.
f[4].TripCmd	Signal: Trip Command
f[4].ExBlo1-I	Module input state: External blocking1
f[4].ExBlo2-I	Module input state: External blocking2
f[4].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command

Name	*Description*
f[5].active	Signal: active
f[5].ExBlo	Signal: External Blocking
f[5].Blo by V<	Signal: Module is blocked by undervoltage.
f[5].Blo TripCmd	Signal: Trip Command blocked
f[5].ExBlo TripCmd	Signal: External Blocking of the Trip Command
f[5].Alarm f	Signal: Alarm Frequency Protection
f[5].Trip f	Signal: Frequency has exceeded the limit.
f[5].TripCmd	Signal: Trip Command
f[5].ExBlo1-I	Module input state: External blocking1
f[5].ExBlo2-I	Module input state: External blocking2
f[5].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
f[6].active	Signal: active
f[6].ExBlo	Signal: External Blocking
f[6].Blo by V<	Signal: Module is blocked by undervoltage.
f[6].Blo TripCmd	Signal: Trip Command blocked
f[6].ExBlo TripCmd	Signal: External Blocking of the Trip Command
f[6].Alarm f	Signal: Alarm Frequency Protection
f[6].Trip f	Signal: Frequency has exceeded the limit.
f[6].TripCmd	Signal: Trip Command
f[6].ExBlo1-I	Module input state: External blocking1
f[6].ExBlo2-I	Module input state: External blocking2
f[6].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
AR.active	Signal: active
AR.ExBlo	Signal: External Blocking
AR.CB on Cmd	Signal: CB switch ON Command
AR.Abort Blo	Signal: AR - The AR was aborted or blocked by an active function of the menu "Abort"
AR.running	Signal: Auto Reclosing running
AR.t-Superv	Signal: AR Supervision (blocking) time
AR.Service Alarm	Signal: AR - Alarm, too many switching operations
AR.Service Blo	Signal: AR - Service blocking - too many switching operations
AR.successful	Signal: Auto Reclosing successful
AR.failed	Signal: Auto Reclosing failure
AR.t-dead	Signal: Dead time between trip and reclosure attempt
AR.Res Statistics Cr	Signal: Reset all statistic AR counters: Total number of AR, successful and unsuccessful no of AR.
AR.Res Service Cr	Signal: Reset the Service Counters for Alarm and Blocking
AR.ExBlo1-I	Module input state: External blocking1
AR.ExBlo2-I	Module input state: External blocking2
AR.Ex Sync running-I	Module input state: External synchronism signal
AR.CB Pos ON-I	Module input state: Check back signal of the CB.

Name	*Description*
AR.CB Pos OFF-I	Module input state: The CB is in OFF-position
AR.CB ready-I	Module input state: CB ready
AR.1.FT	Signal: Fast Trip
AR.1.FT Cmd	Signal: Trip Command for Fast Tripping
AR.2.FT	Signal: Fast Trip
AR.2.FT Cmd	Signal: Trip Command for Fast Tripping
AR.3.FT	Signal: Fast Trip
AR.3.FT Cmd	Signal: Trip Command for Fast Tripping
AR.4.FT	Signal: Fast Trip
AR.4.FT Cmd	Signal: Trip Command for Fast Tripping
AR.5.FT	Signal: Fast Trip
AR.5.FT Cmd	Signal: Trip Command for Fast Tripping
AR.6.FT	Signal: Fast Trip
AR.6.FT Cmd	Signal: Trip Command for Fast Tripping
ExP[1].active	Signal: active
ExP[1].ExBlo	Signal: External Blocking
ExP[1].Blo TripCmd	Signal: Trip Command blocked
ExP[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
ExP[1].Alarm	Signal: External Alarm
ExP[1].Trip	Signal: External Trip
ExP[1].TripCmd	Signal: External Trip Command
ExP[1].ExBlo1-I	Module input state: External blocking1
ExP[1].ExBlo2-I	Module input state: External blocking2
ExP[1].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
ExP[1].Alarm-I	Module input state: External Alarm
ExP[1].Trip-I	Module input state: External Trip
ExP[2].active	Signal: active
ExP[2].ExBlo	Signal: External Blocking
ExP[2].Blo TripCmd	Signal: Trip Command blocked
ExP[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
ExP[2].Alarm	Signal: External Alarm
ExP[2].Trip	Signal: External Trip
ExP[2].TripCmd	Signal: External Trip Command
ExP[2].ExBlo1-I	Module input state: External blocking1
ExP[2].ExBlo2-I	Module input state: External blocking2
ExP[2].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
ExP[2].Alarm-I	Module input state: External Alarm
ExP[2].Trip-I	Module input state: External Trip
ExP[3].active	Signal: active
ExP[3].ExBlo	Signal: External Blocking
ExP[3].Blo TripCmd	Signal: Trip Command blocked

Name	*Description*
ExP[3].ExBlo TripCmd	Signal: External Blocking of the Trip Command
ExP[3].Alarm	Signal: External Alarm
ExP[3].Trip	Signal: External Trip
ExP[3].TripCmd	Signal: External Trip Command
ExP[3].ExBlo1-I	Module input state: External blocking1
ExP[3].ExBlo2-I	Module input state: External blocking2
ExP[3].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
ExP[3].Alarm-I	Module input state: External Alarm
ExP[3].Trip-I	Module input state: External Trip
ExP[4].active	Signal: active
ExP[4].ExBlo	Signal: External Blocking
ExP[4].Blo TripCmd	Signal: Trip Command blocked
ExP[4].ExBlo TripCmd	Signal: External Blocking of the Trip Command
ExP[4].Alarm	Signal: External Alarm
ExP[4].Trip	Signal: External Trip
ExP[4].TripCmd	Signal: External Trip Command
ExP[4].ExBlo1-I	Module input state: External blocking1
ExP[4].ExBlo2-I	Module input state: External blocking2
ExP[4].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
ExP[4].Alarm-I	Module input state: External Alarm
ExP[4].Trip-I	Module input state: External Trip
CBF.active	Signal: active
CBF.ExBlo	Signal: External Blocking
CBF.running	Signal: CBF-Module started
CBF.Alarm	Signal: Circuit Breaker Failure
CBF.ExBlo1-I	Module input state: External blocking1
CBF.ExBlo2-I	Module input state: External blocking2
TCS.active	Signal: active
TCS.ExBlo	Signal: External Blocking
TCS.Alarm	Signal: Alarm Trip Circuit Supervision
TCS.ExBlo1-I	Module input state: External blocking1
TCS.ExBlo2-I	Module input state: External blocking2
TCS.Input 1-I	Module input state: Input 1
TCS.Input 2-I	Module input state: Input 2
CTS.active	Signal: active
CTS.ExBlo	Signal: External Blocking
CTS.Alarm	Signal: Alarm Current Transformer Measuring Circuit Supervision
CTS.ExBlo1-I	Module input state: External blocking1
CTS.ExBlo2-I	Module input state: External blocking2
VTS.active	Signal: active

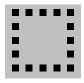
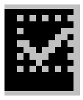
Name	*Description*
VTS.ExBlo	Signal: External Blocking
VTS.Alarm ΔV	Signal: Alarm ΔV Voltage Transformer Measuring Circuit Supervision
VTS.Alarm	Signal: Alarm Voltage Transformer Measuring Circuit Supervision
VTS.Ex FF VT	Signal: Alarm Fuse Failure Voltage Transformers
VTS.Ex FF EVT	Signal: Alarm Fuse Failure Earth Voltage Transformers
VTS.Ex Fuse Fail VT-I	Module input state: External fuse failure voltage transformers
VTS.Ex Fuse Fail EVT-I	Module input state: External fuse failure earth voltage transformer
VTS.ExBlo1-I	Module input state: External blocking1
VTS.ExBlo2-I	Module input state: External blocking2
DI Slot X1.DI 1	Signal: Digital Input
DI Slot X1.DI 2	Signal: Digital Input
DI Slot X1.DI 3	Signal: Digital Input
DI Slot X1.DI 4	Signal: Digital Input
DI Slot X1.DI 5	Signal: Digital Input
DI Slot X1.DI 6	Signal: Digital Input
DI Slot X1.DI 7	Signal: Digital Input
DI Slot X1.DI 8	Signal: Digital Input
DI Slot X6.DI 1	Signal: Digital Input
DI Slot X6.DI 2	Signal: Digital Input
DI Slot X6.DI 3	Signal: Digital Input
DI Slot X6.DI 4	Signal: Digital Input
DI Slot X6.DI 5	Signal: Digital Input
DI Slot X6.DI 6	Signal: Digital Input
DI Slot X6.DI 7	Signal: Digital Input
DI Slot X6.DI 8	Signal: Digital Input
BO Slot X2.BO 1	Signal: Binary Output Relay
BO Slot X2.BO 2	Signal: Binary Output Relay
BO Slot X2.BO 3	Signal: Binary Output Relay
BO Slot X2.BO 4	Signal: Binary Output Relay
BO Slot X2.BO 5	Signal: Binary Output Relay
BO Slot X2.BO 6	Signal: Binary Output Relay
BO Slot X5.BO 1	Signal: Binary Output Relay
BO Slot X5.BO 2	Signal: Binary Output Relay
BO Slot X5.BO 3	Signal: Binary Output Relay
BO Slot X5.BO 4	Signal: Binary Output Relay
BO Slot X5.BO 5	Signal: Binary Output Relay
BO Slot X5.BO 6	Signal: Binary Output Relay
Event rec.Reset all records	Signal: All records deleted
Disturb rec.recording	Signal: Recording

Name	*Description*
Disturb rec.write err	Signal: Writing error in memory
Disturb rec.memory full	Signal: Memory full
Disturb rec.Clear fail	Signal: Clear failure in memory
Disturb rec.Reset all records	Signal: All records deleted
Disturb rec.Reset record	Signal: Delete record
Disturb rec.Man trigger	Signal: Manual trigger
Disturb rec.Start1-I	State of the module input: Trigger event / start recording if:
Disturb rec.Start2-I	State of the module input: Trigger event / start recording if:
Disturb rec.Start3-I	State of the module input: Trigger event / start recording if:
Disturb rec.Start4-I	State of the module input: Trigger event / start recording if:
Disturb rec.Start5-I	State of the module input: Trigger event / start recording if:
Disturb rec.Start6-I	State of the module input: Trigger event / start recording if:
Disturb rec.Start7-I	State of the module input: Trigger event / start recording if:
Disturb rec.Start8-I	State of the module input: Trigger event / start recording if:
Fault rec.Reset record	Signal: Delete record
Fault rec.Man trigger	Signal: Manual trigger
Fault rec.Start1-I	State of the module input: Trigger event / start recording if:
Fault rec.Start2-I	State of the module input: Trigger event / start recording if:
Fault rec.Start3-I	State of the module input: Trigger event / start recording if:
Fault rec.Start4-I	State of the module input: Trigger event / start recording if:
Fault rec.Start5-I	State of the module input: Trigger event / start recording if:
Fault rec.Start6-I	State of the module input: Trigger event / start recording if:
Fault rec.Start7-I	State of the module input: Trigger event / start recording if:
Fault rec.Start8-I	State of the module input: Trigger event / start recording if:
PowerCr.Cr Overflow Wp+	Signal: Counter Overflow Wp+
PowerCr.Cr Overflow Wp-	Signal: Counter Overflow Wp-
PowerCr.Cr Overflow Wq+	Signal: Counter Overflow Wq+
PowerCr.Cr Overflow Wq-	Signal: Counter Overflow Wq-
PowerCr.Wp+ Reset Cr	Signal: Wp+ Reset Counter
PowerCr.Wp- Reset Cr	Signal: Wp- Reset Counter
PowerCr.Wq+ Reset Cr	Signal: Wq+ Reset Counter
PowerCr.Wq- Reset Cr	Signal: Wq- Reset Counter
PowerCr.Res all Energy Cr	Signal: Reset of all Energy Counters
Modbus.Transmission	Signal: SCADA active
Modbus.Scada Cmd 1	Scada Command
Modbus.Scada Cmd 2	Scada Command
Modbus.Scada Cmd 3	Scada Command
Modbus.Scada Cmd 4	Scada Command
Modbus.Scada Cmd 5	Scada Command
Modbus.Scada Cmd 6	Scada Command
Modbus.Scada Cmd 7	Scada Command

Name	*Description*
Modbus.Scada Cmd 8	Scada Command
Modbus.Scada Cmd 9	Scada Command
Modbus.Scada Cmd 10	Scada Command
Modbus.Scada Cmd 11	Scada Command
Modbus.Scada Cmd 12	Scada Command
Modbus.Scada Cmd 13	Scada Command
Modbus.Scada Cmd 14	Scada Command
Modbus.Scada Cmd 15	Scada Command
Modbus.Scada Cmd 16	Scada Command
Statistics.Reset	Signal: Reset of statistics
Statistics.StartFct-I	Module input state: Start statistics Module input signal
Statistics.ResetFct-I	Module input state: Reset statistics Module input signal
Sys.PS 1	Signal: Parameter Set 1
Sys.PS 2	Signal: Parameter Set 2
Sys.PS 3	Signal: Parameter Set 3
Sys.PS 4	Signal: Parameter Set 4
Sys.PS-Switch man	Signal: Manual switch over of a parameter setting group
Sys.Scada	Signal: Scada
Sys.PS via Inp fct	Signal: Switch via input function
Sys.Ack LED-HMI	Signal: LEDs acknowledgement by digital input :HMI
Sys.Ack BO-HMI	Signal: Acknowledgement of the Binary Outputs :HMI
Sys.Ack Scada-HMI	Signal: Acknowledge Scada :HMI
Sys.Ack TripCmd-HMI	Signal: Reset Trip Command :HMI
Sys.Ack LED-Sca	Signal: LEDs acknowledgement by digital input :SCADA
Sys.Ack BO-Sca	Signal: Acknowledgement of the Binary Outputs :SCADA
Sys.Ack Scada-Sca	Signal: Acknowledge Scada :SCADA
Sys.Ack TripCmd-Sca	Signal: Reset Trip Command :SCADA
Sys.Ack LED-I	Module input state: LEDs acknowledgement by digital input
Sys.Ack BO-I	Module input state: Acknowledgement
Sys.Ack Scada-I	Module input state: Acknowledge Scada via digital input. The replica that SCADA has got from the device is to be reset.
Sys.PS1-I	State of the module input respectively of the signal, that should activate this Parameter Setting Group.
Sys.PS2-I	State of the module input respectively of the signal, that should activate this Parameter Setting Group.
Sys.PS3-I	State of the module input respectively of the signal, that should activate this Parameter Setting Group.
Sys.PS4-I	State of the module input respectively of the signal, that should activate this Parameter Setting Group.

Status Display

In the status display within the menu »Operation« the present state of all signals of the »ASSIGNMENT LIST« can be viewed. This means you are able to see if the individual signals are active or inactive at that moment. You can choose whether you want to see all signals in an overall status or whether you want to view the signals sorted by modules.

State of the module input/signal is...	*Is shown at the panel as...*
false / »0«	
true / »1«	

Status Display via Smart View

- In case *Smart view* is not running – please start it.
- If the device data were not yet loaded – select »Receive Data From The Device« from menu »Device«.
- Double click on icon »Operation« in the navigation tree
- Double click on icon »Status Display« within the operational data
- Double click the »Overall status« if you want to see all signals at once or call up a module of which you want to see the states.
- You can see the state of all corresponding signals on the window.

NOTICE **To have the status display updated in a cyclic manner select »Automatic Up-Date« in menu »*VIEW*«.**

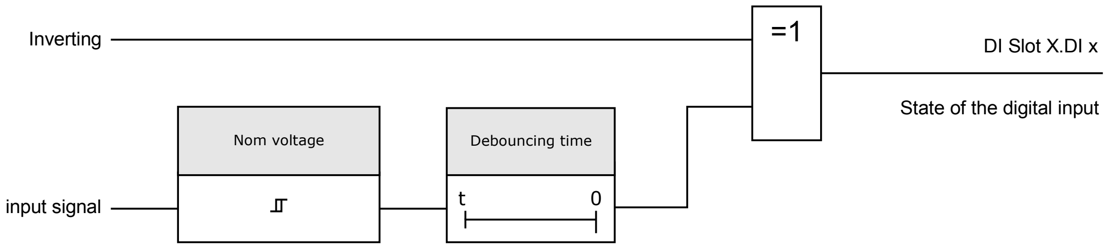
State of the module input/signal is...	*Is shown in Smart view as...*
false / »0«	0
true / »1«	1
No connection to the device	?

Module: Digital Inputs (DIs)

CAUTION **Based on the »assignment list«, the states of digital inputs are allocated to the module inputs.**

Set the following parameters for each of the digital inputs:

- *»Nominal voltage«*
- *»Debouncing time«*: A state change will only be adopted by the digital input after the debouncing time has expired.
- *»Inverting«* (where necessary)



CAUTION **The debouncing time will be started each time the state of the input signal alternates.**

Digital Inputs (Standard)

DI Slot X1

Global Protection Parameters of the Digital Inputs (Standards)

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Nom voltage	Nominal voltage of the digital inputs	24 V DC, 48 V DC, 60 V DC, 110 V DC, 230 V DC, 110 V AC, 230 V AC	24 V DC	[Device Para /Digital Inputs /DI Slot X1 /Group 1]
Inverting 1	Inverting the input signals.	inactive, active	inactive	[Device Para /Digital Inputs /DI Slot X1 /Group 1]
Debouncing time 1	Only after the debouncing time has expired, a state change of a digital input will be taken over by the device. Thus, wipers will not be misinterpreted.	no debouncing time, 20 ms, 50 ms, 100 ms	no debouncing time	[Device Para /Digital Inputs /DI Slot X1 /Group 1]
Nom voltage	Nominal voltage of the digital inputs	24 V DC, 48 V DC, 60 V DC, 110 V DC, 230 V DC, 110 V AC, 230 V AC	24 V DC	[Device Para /Digital Inputs /DI Slot X1 /Group 2]
Inverting 2	Inverting the input signals.	inactive, active	inactive	[Device Para /Digital Inputs /DI Slot X1 /Group 2]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Debouncing time 2	Only after the debouncing time has expired, a state change of a digital input will be taken over by the device. Thus, wipers will not be misinterpreted.	no debouncing time, 20 ms, 50 ms, 100 ms	no debouncing time	[Device Para /Digital Inputs /DI Slot X1 /Group 2]
Nom voltage	Nominal voltage of the digital inputs	24 V DC, 48 V DC, 60 V DC, 110 V DC, 230 V DC, 110 V AC, 230 V AC	24 V DC	[Device Para /Digital Inputs /DI Slot X1 /Group 3]
Inverting 3	Inverting the input signals.	inactive, active	inactive	[Device Para /Digital Inputs /DI Slot X1 /Group 3]
Debouncing time 3	Only after the debouncing time has expired, a state change of a digital input will be taken over by the device. Thus, wipers will not be misinterpreted.	no debouncing time, 20 ms, 50 ms, 100 ms	no debouncing time	[Device Para /Digital Inputs /DI Slot X1 /Group 3]
Inverting 4	Inverting the input signals.	inactive, active	inactive	[Device Para /Digital Inputs /DI Slot X1 /Group 3]
Debouncing time 4	Only after the debouncing time has expired, a state change of a digital input will be taken over by the device. Thus, wipers will not be misinterpreted.	no debouncing time, 20 ms, 50 ms, 100 ms	no debouncing time	[Device Para /Digital Inputs /DI Slot X1 /Group 3]
Inverting 5	Inverting the input signals.	inactive, active	inactive	[Device Para /Digital Inputs /DI Slot X1 /Group 3]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Debouncing time 5	Only after the debouncing time has expired, a state change of a digital input will be taken over by the device. Thus, wipers will not be misinterpreted.	no debouncing time, 20 ms, 50 ms, 100 ms	no debouncing time	[Device Para /Digital Inputs /DI Slot X1 /Group 3]
Inverting 6	Inverting the input signals.	inactive, active	inactive	[Device Para /Digital Inputs /DI Slot X1 /Group 3]
Debouncing time 6	Only after the debouncing time has expired, a state change of a digital input will be taken over by the device. Thus, wipers will not be misinterpreted.	no debouncing time, 20 ms, 50 ms, 100 ms	no debouncing time	[Device Para /Digital Inputs /DI Slot X1 /Group 3]
Inverting 7	Inverting the input signals.	inactive, active	inactive	[Device Para /Digital Inputs /DI Slot X1 /Group 3]
Debouncing time 7	Only after the debouncing time has expired, a state change of a digital input will be taken over by the device. Thus, wipers will not be misinterpreted.	no debouncing time, 20 ms, 50 ms, 100 ms	no debouncing time	[Device Para /Digital Inputs /DI Slot X1 /Group 3]
Inverting 8	Inverting the input signals.	inactive, active	inactive	[Device Para /Digital Inputs /DI Slot X1 /Group 3]
Debouncing time 8	Only after the debouncing time has expired, a state change of a digital input will be taken over by the device. Thus, wipers will not be misinterpreted. 8	no debouncing time, 20 ms, 50 ms, 100 ms	no debouncing time	[Device Para /Digital Inputs /DI Slot X1 /Group 3]

Digital Inputs Signals (Outputs States)

Name	*Description*
DI 1	Signal: Digital Input
DI 2	Signal: Digital Input
DI 3	Signal: Digital Input
DI 4	Signal: Digital Input
DI 5	Signal: Digital Input
DI 6	Signal: Digital Input
DI 7	Signal: Digital Input
DI 8	Signal: Digital Input

Optional Digital Inputs

DI Slot X6

Global Protection Parameters of the Optional Digital Inputs

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Nom voltage	Nominal voltage of the digital inputs	24 V DC, 48 V DC, 60 V DC, 110 V DC, 230 V DC, 110 V AC, 230 V AC	24 V DC	[Device Para /Digital Inputs /DI Slot X6 /Group 1]
Inverting 1	Inverting the input signals.	inactive, active	inactive	[Device Para /Digital Inputs /DI Slot X6 /Group 1]
Debouncing time 1	Only after the debouncing time has expired, a state change of a digital input will be taken over by the device. Thus, wipers will not be misinterpreted.	no debouncing time, 20 ms, 50 ms, 100 ms	no debouncing time	[Device Para /Digital Inputs /DI Slot X6 /Group 1]
Inverting 2	Inverting the input signals.	inactive, active	inactive	[Device Para /Digital Inputs /DI Slot X6 /Group 1]
Debouncing time 2	Only after the debouncing time has expired, a state change of a digital input will be taken over by the device. Thus, wipers will not be misinterpreted.	no debouncing time, 20 ms, 50 ms, 100 ms	no debouncing time	[Device Para /Digital Inputs /DI Slot X6 /Group 1]
Inverting 3	Inverting the input signals.	inactive, active	inactive	[Device Para /Digital Inputs /DI Slot X6 /Group 1]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Debouncing time 3	Only after the debouncing time has expired, a state change of a digital input will be taken over by the device. Thus, wipers will not be misinterpreted.	no debouncing time, 20 ms, 50 ms, 100 ms	no debouncing time	[Device Para /Digital Inputs /DI Slot X6 /Group 1]
Inverting 4	Inverting the input signals.	inactive, active	inactive	[Device Para /Digital Inputs /DI Slot X6 /Group 1]
Debouncing time 4	Only after the debouncing time has expired, a state change of a digital input will be taken over by the device. Thus, wipers will not be misinterpreted.	no debouncing time, 20 ms, 50 ms, 100 ms	no debouncing time	[Device Para /Digital Inputs /DI Slot X6 /Group 1]
Inverting 5	Inverting the input signals.	inactive, active	inactive	[Device Para /Digital Inputs /DI Slot X6 /Group 1]
Debouncing time 5	Only after the debouncing time has expired, a state change of a digital input will be taken over by the device. Thus, wipers will not be misinterpreted.	no debouncing time, 20 ms, 50 ms, 100 ms	no debouncing time	[Device Para /Digital Inputs /DI Slot X6 /Group 1]
Inverting 6	Inverting the input signals.	inactive, active	inactive	[Device Para /Digital Inputs /DI Slot X6 /Group 1]
Debouncing time 6	Only after the debouncing time has expired, a state change of a digital input will be taken over by the device. Thus, wipers will not be misinterpreted.	no debouncing time, 20 ms, 50 ms, 100 ms	no debouncing time	[Device Para /Digital Inputs /DI Slot X6 /Group 1]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 7	Inverting the input signals.	inactive, active	inactive	[Device Para /Digital Inputs /DI Slot X6 /Group 1]
Debouncing time 7	Only after the debouncing time has expired, a state change of a digital input will be taken over by the device. Thus, wipers will not be misinterpreted.	no debouncing time, 20 ms, 50 ms, 100 ms	no debouncing time	[Device Para /Digital Inputs /DI Slot X6 /Group 1]
Inverting 8	Inverting the input signals.	inactive, active	inactive	[Device Para /Digital Inputs /DI Slot X6 /Group 1]
Debouncing time 8	Only after the debouncing time has expired, a state change of a digital input will be taken over by the device. Thus, wipers will not be misinterpreted. 8	no debouncing time, 20 ms, 50 ms, 100 ms	no debouncing time	[Device Para /Digital Inputs /DI Slot X6 /Group 1]

Optional Digital Input Signals (Outputs States)

Name	*Description*
DI 1	Signal: Digital Input
DI 2	Signal: Digital Input
DI 3	Signal: Digital Input
DI 4	Signal: Digital Input
DI 5	Signal: Digital Input
DI 6	Signal: Digital Input
DI 7	Signal: Digital Input
DI 8	Signal: Digital Input

Binary Output Relays

BO Slot X2 ,BO Slot X5

The conditions of module outputs and signals/protective functions (such as reverse interlocking) can be passed by means of alarm relays. The alarm relays are potential-free contacts (which can be used as opening or closing contact). Each alarm relay can be assigned up to 7 functions out of the »assignment list«.

Set the following parameters for each of the binary output relays:

- Up to 7 signals from the »assignment list« (OR-connected)
- Each of the assigned signals can be inverted.
- The (collective) state of the binary output relay can be inverted (open or closed circuit current principle)
- *»Latched«* active or inactive
    - *»Latched = inactive«*:
      If the latching function is *»inactive«*, the alarm relay respectively the alarm contact will adopt the state of those alarms that were assigned.
    - *»Latched = active«*
      If the »latching function« is *»active«*, the state of the alarm relay respectively alarm contact that was set by the alarms will be stored.

      The alarm relay can only be acknowledged after reset of those signals that had initiated setting of the relay and after expiry of the minimum retention time.
- *»Hold time«*: At signal changes, the minimal latching time ensures that the relay will be maintained picked-up or released for at least this period.

CAUTION

If binary outputs are parameterized »Latched=*active«,* they will keep (return into) their position even if there is a break within the power supply.

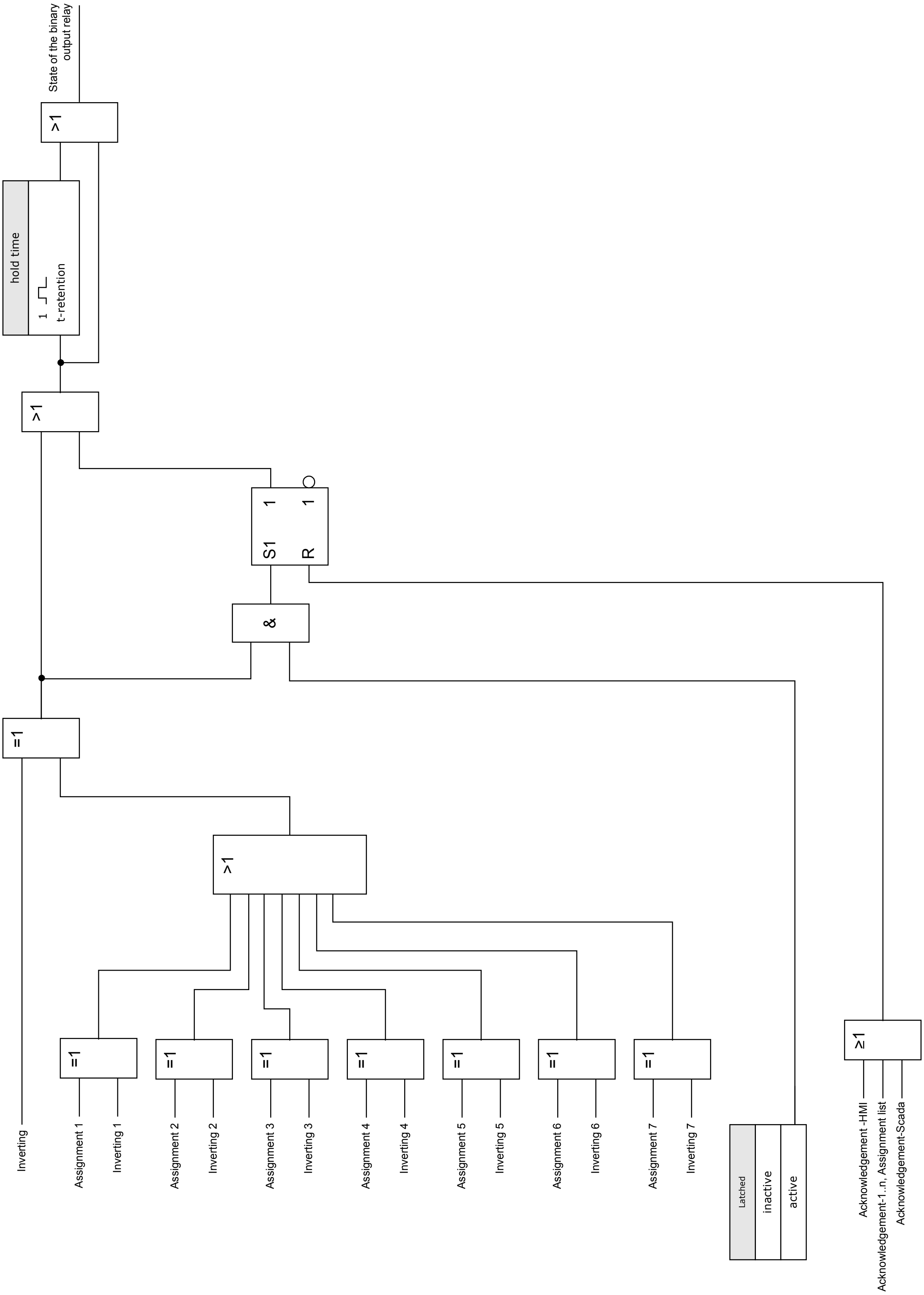
NOTICE

The *»Supervision OK Relay«* (watchdog) cannot be configured.

Acknowledgment options

Binary output relays can be acknowledged:

- Via the push-button »C« at the operating panel.
- Each binary output relay can be acknowledged by a signal of the »assignment list« (If »*Latched is active«*).
- Via the module »Ex Acknowledge« all binary output relays can be acknowledged at once, if the signal for external acknowledgement that was selected from the »assignment list« becomes true. (e.g the state of a digital input).
- Via SCADA, all output relays can be acknowledged at once.


State of the binary output relay
>1
hold time
t-retention
>1
S1
R
&
=1
>1
Inverting
Assignment 1
Inverting 1
Assignment 2
Inverting 2
Assignment 3
Inverting 3
Assignment 4
Inverting 4
Assignment 5
Inverting 5
Assignment 6
Inverting 6
Assignment 7
Inverting 7
Latched
inactive
active
≥1
Acknowledgement -HMI
Acknowledgement-1..n, Assignment list
Acknowledgement-Scada

Supervision-/System Contact

The *System OK alarm relay (SC)* is the devices »LIFE CONTACT«. Its installation location depends on the housing type. Please refer to the wiring diagram of the device (WDC-contact).

The *System-OK relay (SC)* cannot be parameterized. The supervision contact is an operating current contact that picks-up, when the device is free from internal faults. While the device is booting up, the *System OK relay (SC)* remains dropped-off. As soon as the system was duly started up, the relay picks up and the assigned LED is activated accordingly (please refer to chapter Self Supervision).

Global Protection Parameters of the Binary Output Relays

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
t-hold	To clearly identify the state transition of a binary output relay, the "new state" is being hold, at least for the duration of the hold time.	0.00 - 300.00*s	0.03*s	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
Latched	Defines whether the Binary Output Relay will be acknowledged automatically if the event is gone or whether the Binary Output Relay is to be acknowledged by a signal/manually.	inactive, active	BO Slot X2: active BO Slot X5: inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
Acknowledgement	Acknowledgement Signal - An acknowledgement signal (that acknowledges the corresponding binary output relay) can be assigned to each output relay. The acknowledgement-signal is only effective if the parameter "Latched" is set to active. Only available if: Latched = active	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
Inverting	Inverting of the Binary Output Relay.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
Assignment 1	Assignment	1..n, Assignment List	BO Slot X2: TripCmd BO Slot X5: -	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 1]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 2	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
Assignment 3	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
Assignment 4	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
Assignment 5	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
Assignment 6	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
Inverting 6	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 1]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 7	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
Inverting 7	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
t-hold	To clearly identify the state transition of a binary output relay, the "new state" is being hold, at least for the duration of the hold time.	0.00 - 300.00*s	0.03*s	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Latched	Defines whether the Binary Output Relay will be acknowledged automatically if the event is gone or whether the Binary Output Relay is to be acknowledged by a signal/manually.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Acknowledgement	Acknowledgement Signal - An acknowledgement signal (that acknowledges the corresponding binary output relay) can be assigned to each output relay. The acknowledgement-signal is only effective if the parameter "Latched" is set to active. Only available if: Latched = active	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Inverting	Inverting of the Binary Output Relay.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 2]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 1	Assignment	1..n, Assignment List	BO Slot X2: Alarm BO Slot X5: -	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Assignment 2	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Assignment 3	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Assignment 4	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Assignment 5	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 2]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 6	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Inverting 6	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Assignment 7	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Inverting 7	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
t-hold	To clearly identify the state transition of a binary output relay, the "new state" is being hold, at least for the duration of the hold time.	0.00 - 300.00*s	0.03*s	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
Latched	Defines whether the Binary Output Relay will be acknowledged automatically if the event is gone or whether the Binary Output Relay is to be acknowledged by a signal/manually.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 3]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Acknowledgement	Acknowledgement Signal - An acknowledgement signal (that acknowledges the corresponding binary output relay) can be assigned to each output relay. The acknowledgement-signal is only effective if the parameter "Latched" is set to active. Only available if: Latched = active	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
Inverting	Inverting of the Binary Output Relay.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
Assignment 1	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
Assignment 2	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
Assignment 3	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 3]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 4	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
Assignment 5	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
Assignment 6	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
Inverting 6	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
Assignment 7	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
Inverting 7	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
t-hold	To clearly identify the state transition of a binary output relay, the "new state" is being hold, at least for the duration of the hold time.	0.00 - 300.00*s	0.03*s	[Device Para /Binary Outputs /BO Slot X2 /BO 4]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Latched	Defines whether the Binary Output Relay will be acknowledged automatically if the event is gone or whether the Binary Output Relay is to be acknowledged by a signal/manually.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
Acknowledgement	Acknowledgement Signal - An acknowledgement signal (that acknowledges the corresponding binary output relay) can be assigned to each output relay. The acknowledgement-signal is only effective if the parameter "Latched" is set to active. Only available if: Latched = active	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
Inverting	Inverting of the Binary Output Relay.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
Assignment 1	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
Assignment 2	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 4]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 3	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
Assignment 4	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
Assignment 5	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
Assignment 6	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
Inverting 6	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
Assignment 7	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
Inverting 7	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 4]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
t-hold	To clearly identify the state transition of a binary output relay, the "new state" is being hold, at least for the duration of the hold time.	0.00 - 300.00*s	0.03*s	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
Latched	Defines whether the Binary Output Relay will be acknowledged automatically if the event is gone or whether the Binary Output Relay is to be acknowledged by a signal/manually.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
Acknowledgement	Acknowledgement Signal - An acknowledgement signal (that acknowledges the corresponding binary output relay) can be assigned to each output relay. The acknowledgement-signal is only effective if the parameter "Latched" is set to active. Only available if: Latched = active	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
Inverting	Inverting of the Binary Output Relay.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
Assignment 1	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 5]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 2	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
Assignment 3	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
Assignment 4	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
Assignment 5	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
Assignment 6	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
Inverting 6	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 5]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 7	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
Inverting 7	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
t-hold	To clearly identify the state transition of a binary output relay, the "new state" is being hold, at least for the duration of the hold time.	0.00 - 300.00*s	0.03*s	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Latched	Defines whether the Binary Output Relay will be acknowledged automatically if the event is gone or whether the Binary Output Relay is to be acknowledged by a signal/manually.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Acknowledgement	Acknowledgement Signal - An acknowledgement signal (that acknowledges the corresponding binary output relay) can be assigned to each output relay. The acknowledgement-signal is only effective if the parameter "Latched" is set to active. Only available if: Latched = active	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Inverting	Inverting of the Binary Output Relay.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 6]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 1	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Assignment 2	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Assignment 3	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Assignment 4	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Assignment 5	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 6]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 6	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Inverting 6	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Assignment 7	Assignment	1..n, Assignment List	-	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Inverting 7	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 6]

Binary Output Relay Input States

Name	*Description*	*Assignment via*
BO1.1	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
BO1.2	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
BO1.3	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
BO1.4	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
BO1.5	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
BO1.6	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
BO1.7	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
Ack signal BO 1	Module input state: Acknowledgement signal for the binary output relay. If latching is set to active, the binary output relay can only be acknowledged if those signals that initiated the setting are fallen back and the hold time is expired.	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
BO2.1	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 2]

Name	*Description*	*Assignment via*
BO2.2	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
BO2.3	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
BO2.4	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
BO2.5	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
BO2.6	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
BO2.7	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Ack signal BO 2	Module input state: Acknowledgement signal for the binary output relay. If latching is set to active, the binary output relay can only be acknowledged if those signals that initiated the setting are fallen back and the hold time is expired.	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
BO3.1	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
BO3.2	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 3]

Name	*Description*	*Assignment via*
BO3.3	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
BO3.4	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
BO3.5	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
BO3.6	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
BO3.7	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
Ack signal BO 3	Module input state: Acknowledgement signal for the binary output relay. If latching is set to active, the binary output relay can only be acknowledged if those signals that initiated the setting are fallen back and the hold time is expired.	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
BO4.1	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
BO4.2	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
BO4.3	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 4]

Name	*Description*	*Assignment via*
BO4.4	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
BO4.5	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
BO4.6	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
BO4.7	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
Ack signal BO 4	Module input state: Acknowledgement signal for the binary output relay. If latching is set to active, the binary output relay can only be acknowledged if those signals that initiated the setting are fallen back and the hold time is expired.	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
BO5.1	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
BO5.2	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
BO5.3	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
BO5.4	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 5]

Name	*Description*	*Assignment via*
BO5.5	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
BO5.6	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
BO5.7	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
Ack signal BO 5	Module input state: Acknowledgement signal for the binary output relay. If latching is set to active, the binary output relay can only be acknowledged if those signals that initiated the setting are fallen back and the hold time is expired.	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
BO6.1	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
BO6.2	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
BO6.3	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
BO6.4	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
BO6.5	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 6]

Name	*Description*	*Assignment via*
BO6.6	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
BO6.7	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Ack signal BO 6	Module input state: Acknowledgement signal for the binary output relay. If latching is set to active, the binary output relay can only be acknowledged if those signals that initiated the setting are fallen back and the hold time is expired.	[Device Para /Binary Outputs /BO Slot X2 /BO 6]

Binary Output Relay Signals

Name	*Description*
BO 1	Signal: Binary Output Relay
BO 2	Signal: Binary Output Relay
BO 3	Signal: Binary Output Relay
BO 4	Signal: Binary Output Relay
BO 5	Signal: Binary Output Relay
BO 6	Signal: Binary Output Relay

Light Emitting Diodes (LEDs)

LEDs group A ,LEDs group B

CAUTION **Attention must be paid that there are no overlapping functions due to double or multiple LED assignment of colors and flashing codes.**

Via push button »INFO« it is always possible to display the current alarms/alarm texts that are assigned to an LED. Please refer to chapter *Navigation* (description of the »INFO-key«).

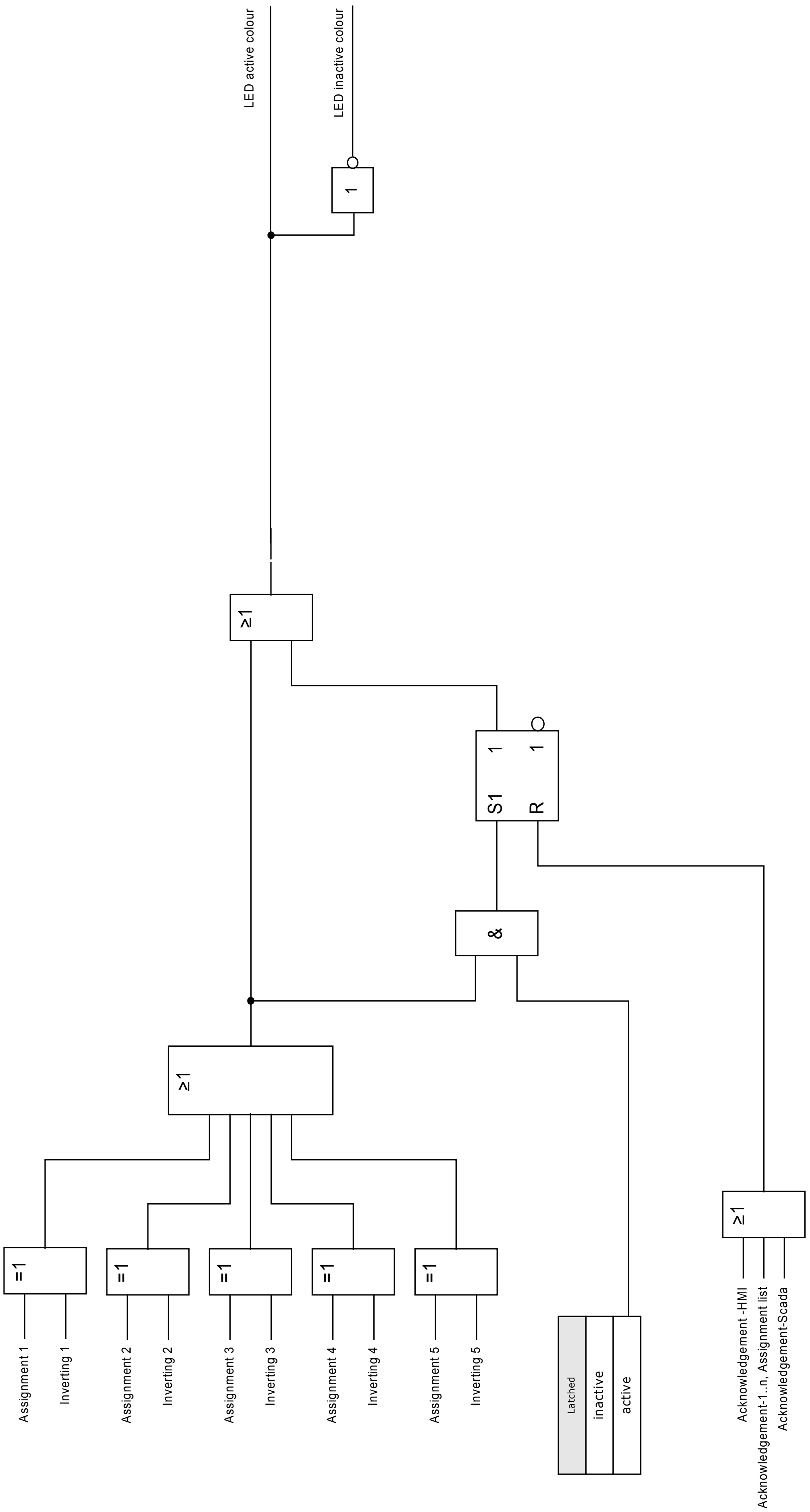
Set the following parameters for each LED:

- *»Latching/self holding function«*: If *»Latching«* is set to *»active«*, the state that is set by the alarms will be stored. If latching *»Latching« is set to »inactive«*, the LED always adopts the state of those alarms that were assigned.
- *»Acknowledgement«* (signal from the »assignment list«)
- *»LED active color«*, LED lights up in this color in case that at least one of the allocated functions is valid (red, red-flashing, green, green flashing, off).
- *»LED inactive color«*, LED lights up in this color in case that none of the allocated functions is valid (red, red-flashing, green, green flashing, off).
- Apart from the *LED for System OK*, each LED can be assigned up to five functions/alarms out of the »assignment list«.
- *»Inverting«* (of the signals), if necessary.

Acknowledgment options

LEDs can be acknowledged by:

- Via the push-button »C« at the operating panel.
- Each LED can be acknowledged by a signal of the »assignment list« (If »*Latched = active*«).
- Via the module »Ex Acknowledge« all LEDs can be acknowledged at once, if the signal for external acknowledgement that was selected from the »assignment list« becomes true (e.g. the state of a digital input).
- Via SCADA, all LEDs can be acknowledged at once.


LED active colour
LED inactive colour
1
≥1
S1
1
R
1
&
≥1
=1
=1
=1
=1
=1
Assignment 1
Inverting 1
Assignment 2
Inverting 2
Assignment 3
Inverting 3
Assignment 4
Inverting 4
Assignment 5
Inverting 5
Latched
inactive
active
≥1
Acknowledgement -HMI
Acknowledgement-1..n, Assignment list
Acknowledgement-Scada

The »System OK« LED

This LED flashes green while the device is booting. After completed booting, the LED for *System OK* lights up in green thus signalizing that the *protection* (function) is »*activated*«. If, however, in spite of successful booting, or after the third unsuccsessful reboot caused by the module self supervision the *System OK – LED* flashes in red, please contact the *Woodward SEG* – Service Dept (See also chapter Self Supervision).

LED System OK cannot be parameterized.

Global Protection Parameters of the LED Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Latched	Defines whether the LED will be acknowledged automatically if the event is gone or whether the LED is to be acknowledged by a signal/manually.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 1]
Ack signal	Acknowledgement signal for the LED. If latching is set to active the LED can only be acknowledged if those signals that initiated the setting are fallen back. Dependency Only available if: Latched = active	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 1]
LED active color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	green, red, red flash, green flash, -	LEDs group A: green LEDs group B: red	[Device Para /LEDs /LEDs group A /LED 1]
LED inactive color	The LED lights up in this color if the state of the OR-assignment of the signals is untrue.	green, red, red flash, green flash, -	-	[Device Para /LEDs /LEDs group A /LED 1]
Assignment 1	Assignment	1..n, Assignment List	LEDs group A: active LEDs group B: -	[Device Para /LEDs /LEDs group A /LED 1]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 1]
Assignment 2	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 1]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 1]
Assignment 3	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 1]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 1]
Assignment 4	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 1]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 1]
Assignment 5	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 1]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 1]
Latched	Defines whether the LED will be acknowledged automatically if the event is gone or whether the LED is to be acknowledged by a signal/manually.	inactive, active	LEDs group A: active LEDs group B: inactive	[Device Para /LEDs /LEDs group A /LED 2]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Ack signal	Acknowledgement signal for the LED. If latching is set to active the LED can only be acknowledged if those signals that initiated the setting are fallen back. Only available if: Latched = active	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 2]
LED active color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	green, red, red flash, green flash, -	red	[Device Para /LEDs /LEDs group A /LED 2]
LED inactive color	The LED lights up in this color if the state of the OR-assignment of the signals is untrue.	green, red, red flash, green flash, -	-	[Device Para /LEDs /LEDs group A /LED 2]
Assignment 1	Assignment	1..n, Assignment List	LEDs group A: TripCmd LEDs group B: -	[Device Para /LEDs /LEDs group A /LED 2]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 2]
Assignment 2	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 2]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 2]
Assignment 3	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 2]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 2]
Assignment 4	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 2]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 2]
Assignment 5	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 2]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 2]
Latched	Defines whether the LED will be acknowledged automatically if the event is gone or whether the LED is to be acknowledged by a signal/manually.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 3]
Ack signal	Acknowledgement signal for the LED. If latching is set to active the LED can only be acknowledged if those signals that initiated the setting are fallen back. Only available if: Latched = active	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 3]
LED active color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	green, red, red flash, green flash, -	LEDs group A: red flash LEDs group B: red	[Device Para /LEDs /LEDs group A /LED 3]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
LED inactive color	The LED lights up in this color if the state of the OR-assignment of the signals is untrue.	green, red, red flash, green flash, -	-	[Device Para /LEDs /LEDs group A /LED 3]
Assignment 1	Assignment	1..n, Assignment List	LEDs group A: Alarm LEDs group B: -	[Device Para /LEDs /LEDs group A /LED 3]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 3]
Assignment 2	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 3]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 3]
Assignment 3	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 3]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 3]
Assignment 4	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 3]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 3]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 5	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 3]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 3]
Latched	Defines whether the LED will be acknowledged automatically if the event is gone or whether the LED is to be acknowledged by a signal/manually.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 4]
Ack signal	Acknowledgement signal for the LED. If latching is set to active the LED can only be acknowledged if those signals that initiated the setting are fallen back. Only available if: Latched = active	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 4]
LED active color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	green, red, red flash, green flash, -	red	[Device Para /LEDs /LEDs group A /LED 4]
LED inactive color	The LED lights up in this color if the state of the OR-assignment of the signals is untrue.	green, red, red flash, green flash, -	-	[Device Para /LEDs /LEDs group A /LED 4]
Assignment 1	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 4]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 4]
Assignment 2	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 4]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 4]
Assignment 3	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 4]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 4]
Assignment 4	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 4]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 4]
Assignment 5	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 4]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 4]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Latched	Defines whether the LED will be acknowledged automatically if the event is gone or whether the LED is to be acknowledged by a signal/manually.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 5]
Ack signal	Acknowledgement signal for the LED. If latching is set to active the LED can only be acknowledged if those signals that initiated the setting are fallen back. Only available if: Latched = active	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 5]
LED active color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	green, red, red flash, green flash, -	red	[Device Para /LEDs /LEDs group A /LED 5]
LED inactive color	The LED lights up in this color if the state of the OR-assignment of the signals is untrue.	green, red, red flash, green flash, -	-	[Device Para /LEDs /LEDs group A /LED 5]
Assignment 1	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 5]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 5]
Assignment 2	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 5]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 5]
Assignment 3	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 5]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 5]
Assignment 4	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 5]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 5]
Assignment 5	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 5]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 5]
Latched	Defines whether the LED will be acknowledged automatically if the event is gone or whether the LED is to be acknowledged by a signal/manually.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 6]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Ack signal	Acknowledgement signal for the LED. If latching is set to active the LED can only be acknowledged if those signals that initiated the setting are fallen back. Only available if: Latched = active	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 6]
LED active color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	green, red, red flash, green flash, -	red	[Device Para /LEDs /LEDs group A /LED 6]
LED inactive color	The LED lights up in this color if the state of the OR-assignment of the signals is untrue.	green, red, red flash, green flash, -	-	[Device Para /LEDs /LEDs group A /LED 6]
Assignment 1	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 6]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 6]
Assignment 2	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 6]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 6]
Assignment 3	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 6]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 6]
Assignment 4	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 6]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 6]
Assignment 5	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 6]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 6]
Latched	Defines whether the LED will be acknowledged automatically if the event is gone or whether the LED is to be acknowledged by a signal/manually.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 7]
Ack signal	Acknowledgement signal for the LED. If latching is set to active the LED can only be acknowledged if those signals that initiated the setting are fallen back. Only available if: Latched = active	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 7]
LED active color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	green, red, red flash, green flash, -	red	[Device Para /LEDs /LEDs group A /LED 7]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
LED inactive color	The LED lights up in this color if the state of the OR-assignment of the signals is untrue.	green, red, red flash, green flash, -	-	[Device Para /LEDs /LEDs group A /LED 7]
Assignment 1	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 7]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 7]
Assignment 2	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 7]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 7]
Assignment 3	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 7]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 7]
Assignment 4	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 7]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 7]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 5	Assignment	1..n, Assignment List	-	[Device Para /LEDs /LEDs group A /LED 7]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 7]

LED Module Input States

Name	*Description*	*Assignment via*
LED1.1	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 1]
LED1.2	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 1]
LED1.3	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 1]
LED1.4	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 1]
LED1.5	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 1]
Acknow Sig 1	Module input state: Acknowledgement Signal (only for automatic acknowledgement)	[Device Para /LEDs /LEDs group A /LED 1]
LED2.1	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 2]
LED2.2	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 2]
LED2.3	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 2]

Name	*Description*	*Assignment via*
LED2.4	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 2]
LED2.5	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 2]
Acknow Sig 2	Module input state: Acknowledgement Signal (only for automatic acknowledgement)	[Device Para /LEDs /LEDs group A /LED 2]
LED3.1	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 3]
LED3.2	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 3]
LED3.3	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 3]
LED3.4	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 3]
LED3.5	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 3]
Acknow Sig 3	Module input state: Acknowledgement Signal (only for automatic acknowledgement)	[Device Para /LEDs /LEDs group A /LED 3]
LED4.1	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 4]

Name	*Description*	*Assignment via*
LED4.2	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 4]
LED4.3	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 4]
LED4.4	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 4]
LED4.5	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 4]
Acknow Sig 4	Module input state: Acknowledgement Signal (only for automatic acknowledgement)	[Device Para /LEDs /LEDs group A /LED 4]
LED5.1	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 5]
LED5.2	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 5]
LED5.3	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 5]
LED5.4	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 5]
LED5.5	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 5]

Name	*Description*	*Assignment via*
Acknow Sig 5	Module input state: Acknowledgement Signal (only for automatic acknowledgement)	[Device Para /LEDs /LEDs group A /LED 5]
LED6.1	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 6]
LED6.2	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 6]
LED6.3	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 6]
LED6.4	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 6]
LED6.5	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 6]
Acknow Sig 6	Module input state: Acknowledgement Signal (only for automatic acknowledgement)	[Device Para /LEDs /LEDs group A /LED 6]
LED7.1	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 7]
LED7.2	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 7]
LED7.3	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 7]

Name	*Description*	*Assignment via*
LED7.4	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 7]
LED7.5	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 7]
Acknow Sig 7	Module input state: Acknowledgement Signal (only for automatic acknowledgement)	[Device Para /LEDs /LEDs group A /LED 7]

Operating Panel (HMI)

HMI

Special Parameters of the Panel

This menu »Device Parameter/HMI« is used to define the contrast of the display,the maximum admissible edit time and the menu language (after expiry of which, all unsaved parameter changes will be rejected).

Direct Commands of the Panel

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Contrast	contrast	30 - 60	50	[Device Para /HMI]

Global Protection Parameters of the Panel

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
t-max Edit	If no key is pressed any more at the panel, after expiry of this time, all cached (changed) parameter changes are being cancelled.	20 - 3600*s	180*s	[Device Para /HMI]
Menu language	Selection of the language	English, My Language	My Language	[Device Para /HMI]

Module: Disturbance Recorder

Disturb rec

The disturbance recorder can be started by one of eight start events (selection from the »assignment list«/OR-Logic).

The disturbance record contains the measuring values inclusively pre-trigger-time. By means of *Smart view/Datavisualizer* (option) the oscillographic curves of the analogue (current, voltage) and digital channels/traces can be shown and evaluated in a graphical form.

The disturbance recorder is able to record minimum 10 disturbance records up to 10 s depending on the file size of each record.

The disturbance recorder can be parameterized in menu *»Device Parameter/Recorder/Disturb rec«*.

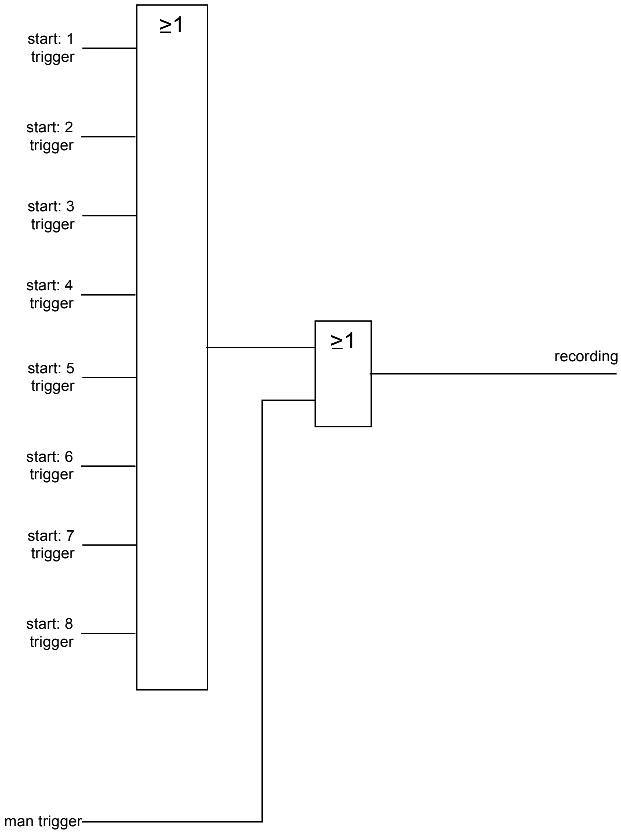
Determine the max. recording time to register a disturbance event. The max. total length of a recording is 10s (inclusive pre-trigger and post-trigger time).

To trigger the disturbance recorder, up to 8 signals can be selected from the »assignment list«. The trigger events are OR-linked. If a disturbance record is written, a new disturbance record cannot be triggered until all trigger signals, which have triggered the previous disturbance record, are gone.

Recording is only done for the time the assigned event exists (event controlled), plus the time for the pre- and post-trigger, but not longer than 10s. The time for forward run and tracking of the disturbance recorder is shown in percent of the total recording length.

Example
The disturbance recorder is started by the general activation facility. After the fault has been cancelled (+ follow-up time), the recording process is stopped (but after 10s at the latest).

The parameter *»Auto Delete«* defines how the device shall react if there is no saving place available. In case *»Auto Delete«* is *»active«*, the first recorded disturbance will be overwritten according to the FIFO principle. If the parameter is set to *»inactive«*, recording of the disturbance events will be stopped until the storage location is released manually.



Read Out Disturbance Records

Within the Menu Operation/Disturb rec you can

- Detect accumulated Disturbance Records.

NOTICE **Within the Menu »Operation/Recorders/Man Trigger« you can trigger the disturbance recorder manually.**

Disturbance Recorder to be Read Out by Smart view

- In case *Smart view* is not running – please start it.
- If device data has not been loaded yet – click »Receive Data From The Device« in menu »Device«.
- Double click the »Operation« icon in the navigation tree.
- Double click the »Recorders« icon in the navigation tree.
- Double click the »Disturb rec-Icon«.
- In the window the disturbance records are shown in tabular form.
- A popup will be appear by a double click onto a disturbance record. Choose a folder where the disturbance record is to be saved to.
- You can analyze the disturbance records by means of the optionally available *Data Visualizer* by clicking on Yes when you are asked “Shall the received disturbance record be opened by the *Data Visualizer?"*

Deleting Disturbance Records

Within the Menu Operation/Disturb rec you can

- Delete Disturbance Records.
- Choose via »SOFTKEY« »up« and »SOFTKEY« »down« the disturbance record that is to be deleted.
- Call up the detailled view of the disturbance record via »SOFTKEY« »right«.
- Confirm by pressing »SOFTKEY« »delete«
- Enter your password followed by pressing the key »OK«
- Choose whether only the current of whether all disturbance records should be deleted.
- Confirm by pressing »SOFTKEY« »OK«

Deleting Disturbance Records via Smart view

- In case *Smart view* is not running – please start it.
- If device data has not been loaded yet – click »Receive Data From The Device« in menu »Device«.
- Double click the »Operation« icon in the navigation tree.
- Double click the »Recorders« icon in the navigation tree.
- Double click the »Disturb rec-Icon«.
- In the window the disturbance records are shown in tabular form.
- In order to delete a disturbance record double click on:

(the red x) in front of the disturbance record and confirm.

Direct Commands of the Disturbance Recorder Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Man trigger	Manual trigger	untrue, true	untrue	[Operation /Recorders /Man trigger]
Reset all records	Reset all records	inactive, active	inactive	[Operation /Reset]

Global Protection Parameters of the Disturbance Recorder Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Start: 1	Start recording if the assigned signal is true.	1..n, Assignment List	Alarm	[Device Para /Recorders /Disturb rec]
Start: 2	Start recording if the assigned signal is true.	1..n, Assignment List	-	[Device Para /Recorders /Disturb rec]
Start: 3	Start recording if the assigned signal is true.	1..n, Assignment List	-	[Device Para /Recorders /Disturb rec]
Start: 4	Start recording if the assigned signal is true.	1..n, Assignment List	-	[Device Para /Recorders /Disturb rec]
Start: 5	Start recording if the assigned signal is true.	1..n, Assignment List	-	[Device Para /Recorders /Disturb rec]
Start: 6	Start recording if the assigned signal is true.	1..n, Assignment List	-	[Device Para /Recorders /Disturb rec]
Start: 7	Start recording if the assigned signal is true.	1..n, Assignment List	-	[Device Para /Recorders /Disturb rec]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Start: 8	Start recording if the assigned signal is true.	1..n, Assignment List	-	[Device Para /Recorders /Disturb rec]
Auto overwriting	If there is no more free memory capacity left, the oldest file will be overwritten.	inactive, active	active	[Device Para /Recorders /Disturb rec]
Follow-up time	Follow-up time	0 - 50*%	20*%	[Device Para /Recorders /Disturb rec]
Pre-trigger time	Pre-trigger time	0 - 50*%	20*%	[Device Para /Recorders /Disturb rec]
Max file size	Maximum duration of the record	0.1 - 10.0*s	2*s	[Device Para /Recorders /Disturb rec]

Disturbance Recorder Module Input States

Name	*Description*	*Assignment via*
Start1-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]
Start2-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]
Start3-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]
Start4-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]
Start5-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]
Start6-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]
Start7-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]
Start8-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]

Disturbance Recorder Module Signals

Name	*Description*
recording	Signal: Recording
write err	Signal: Writing error in memory
memory full	Signal: Memory full
Clear fail	Signal: Clear failure in memory
Reset all records	Signal: All records deleted
Reset record	Signal: Delete record
Man trigger	Signal: Manual trigger

Special Parameters of the Disturbance Recorder

Value	*Description*	*Default*	*Size*	*Menu path*
Recording status	Recording state	ready	ready, recording, writing file, trigger Blo	[Operation /Status display /Disturb rec]
Error code	Error code	OK	OK, write err, Clear fail, Calculation err, File not found, Auto overwriting off	[Operation /Status display /Disturb rec]

Module: Fault Recorder

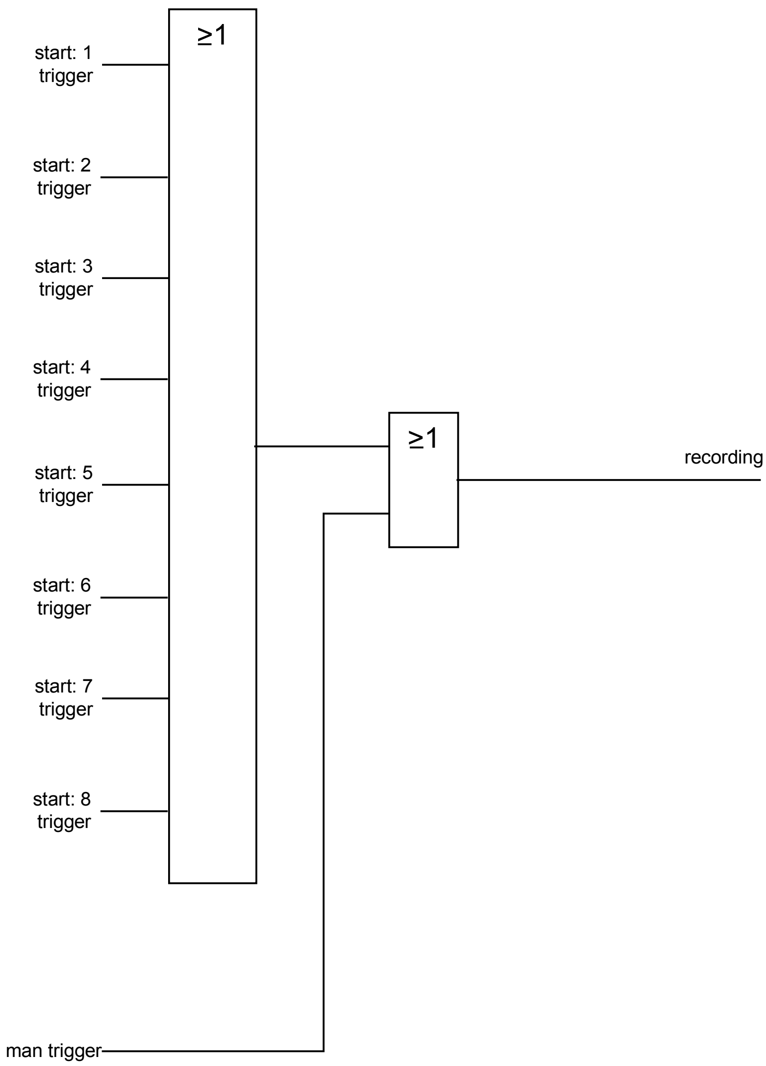
Fault rec

The fault recorder can be started by one of eight start events (selection from the »assignment list«/OR-Logic). The fault recorder can register up to 20 faults. The last of the recorded faults is stored in a fail-safe manner.

If one of the assigned trigger events becomes true, the fault recorder will be started. Each fault is saved inclusive module and name, fault number, mains fault number and record number at that time one of the trigger events becomes true. To each of the faults the measuring values (at the time when the trigger event became true) can be viewed.

Up to 8 signals to trigger the fault recorder can be selected from the »assignment list«. The trigger events are OR-linked.

The parameter *»Auto Delete«* defines how the device shall react if there is no saving place available. In case *»Auto Delete«* is *»active«*, the first recorded fault will be overwritten according to the FIFO principle. If the parameter is set to *»inactive«*, recording of the fault events will be stopped until the storage location is released manually.



Read Out the Fault Recorder

The measured values at the time of tripping are saved (failure safe) within the fault recorder. If there is no more memory free, the oldest record will be overwritten (FIFO).

In order to read out a failure record:

- call up the main menu,
- call up the submenu Operation/Recorders/Fault rec.,
- select a fault record,
- analyze the corresponding measured values.

Read Out the Fault Recorder via Smart View

- In case *Smart view* is not running – please start it.
- If device data has not been loaded yet – click »Receive Data From The Device« in menu »Device«.
- Double click the »Operation« icon in the navigation tree.
- Double click the »Fault Rec« icon within the tree »Operation/Recorders«.
- In the window the fault recordings are shown in tabular form.
- In order to receive more detailed information on a fault, click the »Plus Sign« in front of the fault number.

NOTICE

Via the print menu you can export the data into a file. Please proceed as follows:

- **Call up the data as described above.**
- **Call up the menu [File/Print].**
- **Choose »Print Actual Working Window« within the popup.**
- **Press the »Print« button.**
- **Press the »Export to File« button.**
- **Enter a file name.**
- **Choose a location where to save the file.**
- **Confirm the »Save« button.**

Direct Commands of the Fault Recorder Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Reset all records	Reset all records	inactive, active	inactive	[Operation /Reset]
Man trigger	Manual trigger	untrue, true	untrue	[Operation /Recorders /Man trigger]

Global Protection Parameters of the Fault Recorder Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Start: 1	Start recording if the assigned signal is true.	1..n, Assignment List	Trip	[Device Para /Recorders /Fault rec]
Start: 2	Start recording if the assigned signal is true.	1..n, Assignment List	-	[Device Para /Recorders /Fault rec]
Start: 3	Start recording if the assigned signal is true.	1..n, Assignment List	-	[Device Para /Recorders /Fault rec]
Start: 4	Start recording if the assigned signal is true.	1..n, Assignment List	-	[Device Para /Recorders /Fault rec]
Start: 5	Start recording if the assigned signal is true.	1..n, Assignment List	-	[Device Para /Recorders /Fault rec]
Start: 6	Start recording if the assigned signal is true.	1..n, Assignment List	-	[Device Para /Recorders /Fault rec]
Start: 7	Start recording if the assigned signal is true.	1..n, Assignment List	-	[Device Para /Recorders /Fault rec]
Start: 8	Start recording if the assigned signal is true.	1..n, Assignment List	-	[Device Para /Recorders /Fault rec]
Auto overwriting	If there is no more free memory capacity left, the oldest file will be overwritten.	inactive, active	active	[Device Para /Recorders /Fault rec]

Fault Recorder Module Input States

Name	*Description*	*Assignment via*
Start1-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]
Start2-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]
Start3-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]
Start4-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]
Start5-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]
Start6-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]
Start7-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]
Start8-I	State of the module input: Trigger event / start recording if:	[Device Para /Recorders /Fault rec]

Fault Recorder Module Signals

Name	*Description*
Reset record	Signal: Delete record
Man trigger	Signal: Manual trigger

Module: Event Recorder

Event rec

The event recorder can register up to 300 events and the last (minimum) 50 saved events are recorded fail-safe. The following information is provided for any of the events:

Events are logged as follows:

Record No.	*Fault No.*	*Netfault No.*	*Date of Record*	*Module.Name*	*State*
Sequential Number	Number of the ongoing fault This counter will be incremented by each General Alarm (Prot.Alarm).	A Netfault No. can have several Fault No. This counter will be incremented by each General Alarm. (Exception AR: this applies only to devices that offer auto reclosing).	Time stamp	What has changed?	Changed Value

There are three different classes of events:

- ***Alternation of binary states are shown as:***
  - 0->1 if the signal changes physically from »0« to »1«.
  - 1->0 if the signal changes physically from »1« to »0«.
- ***Counters increment is shown as:***
  - Old Counter state -> New Counter state (e.g. 3->4)
- ***Alternation of multiple states are shown as:***
  - Old state -> New state (e.g. 0->2)

Read Out the Event Recorder

- Call up the »*main menu«.*
- Call up the submenu *»Operation/Recorders/Event rec«*.
- Select an event.

Read Out the Event Recorder via Smart View

- In case *Smart view* is not running – please start it.
- If device data has not been loaded yet – click »Receive Data From The Device« in menu »Device.
- Double click the »Operation« icon in the navigation tree.
- Double click the »Event Rec« icon within the »OPERATION/RECORDERS« menu.
- In the window the events are shown in tabular form.

NOTICE

To have the event recorder up-dated in a cyclic manner, select »Automatic Up-Date« in menu *View.*

Smart view is able to record more events than the device itself, if the window of the event recorder is opened and »Automatic Up-Date« is set to active.

NOTICE

Via the print menu you can export the data into a file. Please proceed as follows:

- **Call up the data as described above.**
- **Call up the menu [File/Print].**
- **Choose »Print Actual Working Window« within the popup.**
- **Press the »Print« button.**
- **Press the »Export to File« button.**
- **Enter a file name.**
- **Choose a location where to save the file.**
- **Confirm the »Save« button.**

Direct Commands of the Event Recorder Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Reset all records	Reset all records	inactive, active	inactive	[Operation /Reset]

Event Recorder Module Signals

Name	*Description*
Reset all records	Signal: All records deleted

Module: Modbus® (Modbus)

Modbus

Modbus® Protocol Configuration

The time-controlled Modbus® protocol is based on the Master-Slave working principle. This means that the substation control and protection system sends an enquiry or instruction to a certain device (slave address) which will then be answered or carried out accordingly. If the enquiry/instruction cannot be answered/carried out (e.g. because of an invalid slave address), a failure message is returned to the master.

The Master (substation control and protection system) can query information from the device, such as:

- Type of unit version
- Measuring values/Statistical measured values
- Switch operating position (in preparation)
- State of device
- Time and date
- State of the device's digital inputs
- Protection-/State alarms

The Master (control system) can give commands/instructions to the device, such as:

- Control of switchgear (where applicable, i.e. each acc. to the applied device version)
- Change-over of parameter set
- Reset and acknowledgement of alarms/signals
- Adjustment of date and time
- Control of alarm relays

For detailed information on data point lists and error handling, please refer to the Modbus® documentation.

To allow configuration of the devices for Modbus® connection, some default values of the control system must be available.

Part 1: Configuration of the Devices

Call up *»Device parameter/Modbus«* and set the following communication parameters there:

- Slave-address, to allow clear identification of the device.

- Baud-Rate

Also, select below indicated RS485 interface-related parameters from there, such as:

- Number of data bits

- One of the following supported communication variants: Number of data bits, even, odd, parity or no parity, number of stop bits.

- *»t-timeout«*: communication errors are only identified after expiry of a supervision time *»t-timeout«*.

- Response time (defining the period within which an enquiry from the master has to be answered).

Part 1: Hardware Connection

- For hardware connection to the control system, there is an RS485 interface at the rear side of the device (RS485, fiber optic or terminals).
- Connect bus and device (wiring).
- Up to 32 devices can be connected to the bus (point to point connection/spurs).
- Connect a terminating resistor to the bus.

Error Handling - Hardware Errors

Information on physical communication errors, such as:

- Baudrate Error
- Parity Error ...

can be obtained from the event recorder.

Error Handling – Errors on protocol level

If, for example, an invalid memory address is enquired, error codes will be returned by the device that need to be interpreted.

Direct Commands of the Modbus®

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Reset Comds	All Modbus Commands will be reset.	inactive, active	inactive	[Operation /Reset]
Reset Diagn Cr	All Modbus Diagnosis Counters will be reset.	inactive, active	inactive	[Operation /Reset]

Global Protection Parameters of the Modbus®

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Slave ID	Device address (Slave ID) within the bus system. Each device address has to be unique within a bus system.	1 - 247	1	[Device Para /Modbus]
t-timeout	Within this time the answer has to be received by the SCADA system, otherwise the request will be disregarded. In that case the Scada system detects a communication failure and the Scada System has to send a new request.	0.01 - 10.00*s	1*s	[Device Para /Modbus]
t-call	If there is no request telegram sent from Scada to the device after expiry of this time - the device concludes a communication failure within the Scada system.	1 - 3600*s	10*s	[Device Para /Modbus]
Baud rate	Baud rate	1200, 2400, 4800, 9600, 19200, 38400	19200	[Device Para /Modbus]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Physical Settings	Digit 1: Number of bits. Digit 2: E=even parity, O=odd parity, N=no parity. Digit 3: Number of stop bits. More information on the parity: It is possible that the last data bit is followed by a parity bit which is used for recognition of communication errors. The parity bit ensures that with even parity ("EVEN") always an even number of bits with valence "1" or with odd parity ("ODD") an odd number of "1" valence bits are transmitted. But it is also possible to transmit no parity bits (here the setting is "Parity = None"). More information on the stop-bits: The end of a data byte is terminated by the stop-bits.	8E1, 8O1, 8N1, 8N2	8E1	[Device Para /Modbus]
Scada CmdBlo	Activating (allowing)/ Deactivating (disallowing) the blocking of the Scada Commands	inactive, active	inactive	[Device Para /Modbus]

Modbus® Module Signals (Output States)

Name	*Description*
Transmission	Signal: SCADA active
Scada Cmd 1	Scada Command
Scada Cmd 2	Scada Command
Scada Cmd 3	Scada Command
Scada Cmd 4	Scada Command
Scada Cmd 5	Scada Command
Scada Cmd 6	Scada Command
Scada Cmd 7	Scada Command
Scada Cmd 8	Scada Command
Scada Cmd 9	Scada Command
Scada Cmd 10	Scada Command
Scada Cmd 11	Scada Command
Scada Cmd 12	Scada Command
Scada Cmd 13	Scada Command
Scada Cmd 14	Scada Command
Scada Cmd 15	Scada Command
Scada Cmd 16	Scada Command

Modbus® Module Values

Value	*Description*	*Default*	*Size*	*Menu path*
NoOfRequestsTotal	Total number of requests. Includes requests for other slaves.	0	0 - 9999999999	[Operation /Counter and RevData /Modbus]
NoOfRequestsForMe	Total Number of requests for this slave.	0	0 - 9999999999	[Operation /Counter and RevData /Modbus]
NoOfResponsTimeOverruns	Physically corrupted frame.	0	0 - 9999999999	[Operation /Counter and RevData /Modbus]
NoOfOverrunErros	Physically corrupted frame.	0	0 - 9999999999	[Operation /Counter and RevData /Modbus]
NoOfParityErrors	Physically corrupted frame.	0	0 - 9999999999	[Operation /Counter and RevData /Modbus]
NoOfFrameErrors	Physically corrupted frame.	0	0 - 9999999999	[Operation /Counter and RevData /Modbus]
NoOfBreaks	Number of detected communication aborts	0	0 - 9999999999	[Operation /Counter and RevData /Modbus]
NoOfQueryInvalid	Request error. Request could not be interpreted	0	0 - 9999999999	[Operation /Counter and RevData /Modbus]
NoOfInternalError	Internal error while interpreting the request.	0	0 - 9999999999	[Operation /Counter and RevData /Modbus]

Parameters

Parameter setting and planning can be done:

- directly at the device or
- by way of the *Smart view* software.

Operational Modes (access authorization)

Operational Mode – »Display Only«

- The protection is activated.
- All data, measuring values, records and counters/meters can be viewed.

Operation Mode – »Parameter Setting and Planning«

In this mode you are able to:

- edit and set parameters.
- change device planning details and
- parameterize and reset operational data (event recorder/fault recorder/power meter/switching cycles).

NOTICE **If the device was not active within the parameter setting mode for a longer time (can be set between 20 – 3600 seconds) it changes automatically into »Display Only« mode. (Please refer to the appendix *Module Panel*).**

NOTICE **As long as you are within the parameter setting mode you cannot acknowledge.**

In order to change into operation mode »Parameter Setting« please proceed as follows:

1. Mark in the device display the parameter you want to change.
2. Press the softkey »Wrench« to change temporarily into the parameter setting mode.
3. Enter the parameter password.
4. Change the parameter.
5. Change perhaps additional parameters.

NOTICE **As long as you are within the parameter setting mode a wrench icon will be shown in the upper right corner of the display.**

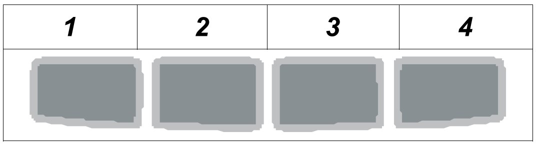
6. For saving the altered parameter:
   - press the »OK« key,
   - confirm by pressing the softkey »Yes«.

7. Then the device changes into mode »Display Only«.

Password

Password Entry at the Panel

Passwords can be entered by way of the softkeys.



Example: For password (3244) press successively:

- Softkey 3
- Softkey 2
- Softkey 4
- Softkey 4

Password Changes

Passwords can be changed at the device in menu »Device Para/Password« or by means of the *Smart view* software.

NOTICE

A password must be a user-defined combination of the numerics 1, 2, 3 and 4.
All other characters and keys won´t be accepted.

The password of operation mode »Parameter setting and planning« enables you to transfer parameters from the *Smart view* software into the device.

When you want to change a password, the existing one has to be entered firstly. The new password (up to 8 digits) is then to be confirmed twice. Please proceed as follows:

- In order to change the password please enter your old password followed by pressing the »OK«-key.
- Afterwards enter the new password and press the »OK«-key.
- Finally confirm your new password and press the »OK-key«.

Password Forgotten

All passwords can be reset to the fail-safe adjustment *»1234«* by pressing the »C« key during cold booting. For this procedure confirm the inquiry »Shall All Passwords Be Reset?« with »Yes«.

Changing of Parameters - Example

- Move to the parameter you want to change by using the softkeys .
- Press the softkey »Wrench«.
- Enter the password for parameter setting.
- Edit/change the parameter.

Now you can:

- save the change you made and have them adopted by the system or:
- change additional parameters and save finally all the altered parameters and have them adopted by the system.

To save parameter changes immediately,

- press the »OK« key for saving changed parameters directly and to have them adopted by the device. Confirm the parameter changes by pressing the »Yes« softkey or dismiss by pressing »No«.

To change additional parameters and save afterwards,

- move to other parameters and change them

NOTICE

A star symbol in front of the changed parameters indicates that the modifications have only temporarily been saved, they are not yet finally stored and adopted by the device.
In order to make things easier to follow, especially where complex parameter changes are involved, on every superior/higher-ranking menu level the intended change of the parameter is indicated by the star symbol (star trace). This makes it possible to control or follow from the main menu level at any time where parameter changes have been made and have not finally been saved.
In addition to the star trace to the temporarily saved parameter changes, a general parameter changing symbol is faded-in at the left corner of the display, and so it is possible from each point of the menu tree to see that there are parameter changes still not adopted by the device.

Press the »OK« key to initiate the final storage of all parameter changes. Confirm the parameter changes by pressing the »Yes« softkey or dismiss by pressing Softkey »No«.

NOTICE

Plausibility check: In order to prevent obvious wrong settings the device monitors constantly all temporarily saved parameter changes. If the device detects an implausibility, this is indicated by a question mark in front of the respective parameter.
In order to make things easier to follow, especially where complex parameter changes are involved, on every superior/higher-ranking menu level, above the temporarily saved parameters an invalidity is indicated by the question mark (plausibility trace). This makes it possible to control or follow from the main menu level at any time where implausibilities are intended to be saved.

In addition to the question mark trace to the temporarily saved implausible parameter changes a general implausibility symbol/question mark is faded-in at the left corner of the display, and so it is possible to see from each point of the menu tree that implausibilies have been detected by the device.

A star/parameter change indication is always overwritten by the question mark/implausibility symbol.

If a device detects an implausibility, it rejects saving and adopting of the parameters.

Example: If the residual voltage has been parameterized as »calculated« (*»EVTcon = calculated«*), then the device recognizes an implausibility in case voltage measuring is parameterized as »phase to phase« (*»VTcon = Phase to Phase«*). The calculation of the residual voltage is physically not possible by means of phase-to-phase voltages.

Changing of Parameters when using the Smart View - Example

Example: Changing of a protective parameter (to alter the characteristic for the overcurrent protection function I[1] in parameter set 1).

- In case *Smart view* is not in operation – start this software.
- In case the device data has not been loaded – select »Data To Be Received From The Device« in menu »Device«.
- Double-click the »Protection Para Icon« in the navigation tree.
- Double-click the »Protection Para Set Icon« in the navigation tree.
- Double-click the »Set 1 Icon« in the navigation tree.
- Double-click the »protection stage I[1]« in the navigation tree.
- In the working window a tabulated overview appears, showing the parameters assigned to this protective function.
- In this table double-click the value/parameter you want to change (here: *»Char«*).
- Another window (popup) is opened where you can select the required characteristic.
- Close this window by clicking the »OK« key.

NOTICE

A star symbol in front of the changed parameters indicates that the alterations have only temporarily been saved. They are not yet finally stored and adopted by the software/device.
In order to make things easier to follow, especially where complex parameter changes are involved, on every superior/higher menu level, the intended change of the parameter is indicated by the star symbol (star trace). This makes it possible to control or follow from the main menu level at any time where parameter changes have been made and have not finally been saved.

NOTICE

Plausibility check: In order to prevent obvious wrong settings the software monitors constantly all temporarily saved parameter changes. If it detects an implausibility, this is indicated by a question mark in front of the respective parameter.
In order to make things easier to follow, especially where complex parameter changes are involved, on every superior/higher menu level above of the temporarily saved parameters, an implausibility is indicated by a question mark (plausibility trace). This makes it possible to control or follow from the main menu level at any time where implausibilities exist.

So it is possible to see from each point of the menu tree that implausibilities have been detected by the software.

A star/parameter change indication is always overwritten by the question mark/implausibility symbol.

If the software detects an implausibility it rejects saving and adopting of the parameters.

Example: If the residual voltage has been parameterized as calculated (*»EVTcon = calculated«*), then the software recognizes an implausibility in case voltage measuring is parameterized as »phase to phase« (*»VTcon = Phase to Phase«*). The calculation of the residual voltage is physically not possible by means of phase-to-phase voltages.

- Additional parameters can be changed if required.
- In order to transfer changed parameters into the device, please select »Transfer all parameters into the device« in menu »Device«.
- Confirm the safety inquiry »Shall The Parameters Be Overwritten?«.
- Enter the password for setting parameters in the popup window.
- Confirm the inquiry »Shall The Data Be Saved Locally?« with »Yes« (recommended). Select a suitable storing location on your hard disk.
- Confirm the chosen storing location by clicking »Save«.
- The changed parameter data is now saved in the data file chosen by you. Thereafter the changed data is transferred to the device and adopted. .

NOTICE

Once you have entered the parameter setting password, Smart view wont ask you again for the password for at least 10 minutes. This time intervall will start again, each time parameters are transmited into the device. If for more than 10 minutes no parameters are transmitted into the device, Smart view will ask you again for the password, when you are trying to transmit parameters into the device.

Protection Parameters

WARNING **It has to be taken into account that by deactivating, for instance, protective functions, you also change the functionality of the device.**

The manufacturer does not accept liability for any personal or material damage as a result of wrong planning.

A planning/parameter setting service is also offered by *Woodward SEG*.

The protection parameters include the following protection parameter trees:

- Global Protection Parameters: *»Global Prot Para«*: Here you can find all protection parameters that are universally valid, that means that they are valid independent of the protection parameter sets.
- Setting Group Parameters: *»Set1..4«*: The protection parameters that you set within a parameter set are only valid, if the parameter set where you set them is switched to active.

Setting Groups

Setting Group Switch

Within the menu »Protection Para/P-Set Switch« you have the following possibilities:

- To set one of the four setting groups active manually.
- To assign a signal to each setting group that sets this group to active.
- Scada switches the setting groups.

Setting Group Switch			
	Manual Selection	*Via Input Function (e.g. Digital Input)*	*Via Scada*
Switching Options	Switch over, if another setting group is chosen manually within the menu »Protection Para/P-Set Switch«	Switch over not until the request is clear. That means, if there is more or less than one request signal active, no switch over will be executed.	Switch over if there is a clear Scada request. Otherwise no switch over will be executed.

NOTICE **The description of the parameters can be found within chapter System Parameters.**

Setting Group Switch via Smart View

- In case *Smart view* is not running – please start it.
- If device data has not been loaded yet – click »Receive Data From The Device« in menu »Device«.
- Double click the »Protection Para« icon in the navigation tree.
- Double click the »P-Set Switch« within the protection parameters.
- Configure the Setting Group Switch respectively choose an active set manually.

NOTICE **The description of the parameters can be found within chapter System Parameters.**

Copying Setting Groups (Parameter Sets) via Smart View

NOTICE **Setting groups can only be copied if there are no implausibilities (no red question mark).**

It is not necessary to set up two setting groups that only differ in few parameters.

With the help of „Smart view" you can simply copy an existing setting group to another (not yet configured) one. You only need to change those parameters where the two setting groups are different.

To efficiently establish a second parameter set where only few parameters are different, proceed as follows:

- In case *Smart view* is not running – please start it.
- Open an (offline) parameter file of a device or load data of a connected device.
- By way of precaution, save (the relevant) device parameters [File\Save as].
- Select »Copy Parameter Sets« out of the menu "Edit".
- Then define both, source and destination of the parameter sets to be copied (source = copy from; destination: copy to).
- Mouse click on »OK« to start copy procedure.
- The copied parameter set is now cached (not yet saved!).
- Then, modify the copied parameter set(s), if applicable.
- Assign a new file name to the revised device parameter file and save it on your hard disk (backup copy).
- To transfer the modified parameters back to the device, click on menu item »Device« and select »Transfer All Parameters into the Device«.

Comparing Setting Groups via Smart View

- In case *Smart view* is not running – please start it.
- Click on menu item »Edit« and select »Compare Parameter Sets«.
- Select the two parameter sets from the (two) drop down menus you would like to have compared with each other.
- Press the pushbutton »compare«.
- The values that are different from the set parameters will be listed in tabular form.

Comparing Parameter Files via Smart view

With the help of „Smart view“ you can simply compare/diff the currently open parameter/device file against a file on your hard disk. The precondition is that the versions and type of devices match. Please proceed as follows:

- Click on »Compare with a Parameter File« within the menu »Device«.
- Click on the Folder icon in order to select a file on your hard disk.
- The differences will be shown in tabular form.

Converting Parameter Files via Smart view

Parameter files of the same type can be up- or downgraded (converted). As many parameters as possible will be taken over.

- Parameters, that are newly added, will be set to default.
- Parameters, that are not included in the target file version, will be deleted.

In order to convert a parameter file please proceed as follows:

- In case *Smart view* is not in operation – start this software.
- Open a parameter file or load the parameters from a device that should be converted.
- Make a backup of this file at a fail safe place.
- Choose »Save as« from menu »File«
- Enter a new file name (in order to prevent overwriting the original file)
- Choose the new file type from drop down menu »File Type«.
- Confirm the security check by clicking on »yes« if and only you are sure that the file conversion should be executed.
- In tabular form the modifications will be shown as follows.

Added parameter:	
Deleted parameter:	

Field Parameters

Field Para

Within the field parameters you can set all parameters, that are relevant for the primary side and the mains operational method like frequency, primary and secondary values and the star point treatment.

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Phase Sequence	Phase Sequence direction	ABC, ACB	ABC	[Field Para]
f	Nominal frequency	50*Hz, 60*Hz	50*Hz	[Field Para]
VT pri	Nominal voltage of the Voltage Transformers at the primary side	60 - 500000*V	10000*V	[Field Para]
VT sec	Nominal voltage of the Voltage Transformers at the secondary side.	60.00 - 440.00*V	100*V	[Field Para]
VT con	This parameter has to be set in order to ensure the correct assignment of the voltage measurement channels in the device.	Phase to Earth, Phase to Phase	Phase to Earth	[Field Para]
EVT pri	Primary nominal voltage of the e-n winding of the voltage transformers, which is only taken into account in the direct measurement of the residual voltage (EVT con=measured/open delta).	60 - 500000*V	10000*V	[Field Para]

EVT sek	Secondary nominal voltage of the e-n winding of the voltage transformers, which is only taken into account in the direct measurement of the residual voltage (EVT con=measured/open delta).	35.00 - 440.00*V	100*V	[Field Para]
EVT con	Method how the residual voltage is to be detected. Calculation is only possible, if the device is connected to phase-to-earth voltages. Calculated: that means that the residual voltage is calculated from the geometrical sum of the phase-to-neutral voltages. Measured: The e-n-windings are connected in series to the measuring inputs for the residual voltage (open delta). The primary and secondary rated data (ESpW pri and ESpW sek) of the voltage transformers have to be taken into account. WARNING! For V-connections no calculation of the residual voltage is possible. Calculation of the residual voltage is only possible if: VT con = Phase to Earth	measured, calculated	measured	[Field Para]
V Block f	Threshold for the release of the frequency stages	0.15 - 1.00*Vn	0.5*Vn	[Field Para]

I MTA	Maximum Torque Angle: Angle between phase current and reference voltage in case of a short circuit. This angle is needed to determine the fault direction in case of short circuits.	0 - 355*°	45*°	[Field Para]
Star point treatm	Star point treatment	sin (-90°), cos (180°), SOLI-RESI	SOLI-RESI	[Field Para]
IG MTA	Maximum Torque Angle: Angle between earth current and residual voltage in case of a short circuit. This angle is needed to determine the fault direction in case of short circuits. Only available if: Star point treatment = Solidly or low resistance earthed	0 - 355*°	110*°	[Field Para]
EVT Angle Cor	Fine adjustment of the measuring angle of the earth current transformers. For SIN and COS the MTA is fixed. By means of the Angle Correction, faults of the earth voltage transformers can be taken into account.	-45 - 45*°	0*°	[Field Para]
CT pri	Nominal current of the primary side of the current transformers.	1 - 50000*A	1000*A	[Field Para]
CT sek	Nominal current of the secondary side of the current transformers.	1*A, 5*A	1*A	[Field Para]

CT dir	Protection functions with directional feature can only work properly if the connection of the current transformers is free of wiring errors. If all current transformers are connected to the device with a wrong polarity, the wiring error can be compensated by this parameter. This parameter turns the current vectors by 180 degrees.	0*°, 180*°	0*°	[Field Para]
ECT pri	This parameter defines the primary nominal current of the connected earth current transformer. If the earth current is measured via the Holmgreen connection, the primary value of the phase current transformer must be entered here	1 - 50000*A	1000*A	[Field Para]
ECT sec	This parameter defines the secondary nominal current of the connected earth current transformer. If the earth current is done via the Holmgreen connection, the primary value of the phase current transformer must be entered here.	1*A, 5*A	1*A	[Field Para]

ECT dir	Earth fault protection with directional feature depends also on the correct wiring of the earth current transformer. A wrong polarity/wiring can be corrected by means of the settings "0°" or "180°". The operator has the possibility of turning the current vector by 180 degrees (change of sign) without modification of the wiring. This means, that – in terms of figures - the determined current indicator was turned by 180° by the device.	0*°, 180*°	0*°	[Field Para]
ECT con	Earth current measured or calculated.	measured, calculated	measured	[Field Para]

Blockings

The device provides a function for temporary and permanent blocking of the complete protection functionality or of single protection stages.

WARNING **Make absolutely sure that no illogical or even life-threatening blockings are allocated.**

Make sure that you do not carelessly deactivate protection functions which have to be available according to the protection concept.

Permanent Blocking

Switching ON or OFF the complete protection functionality
In module *»Protection«* the complete protection of the device can be switched on or off. Set the parameter *Function* to *»active«* or *»inactive«* in module *»Prot«*.

WARNING **Only if in module »Prot« the parameter *»Function«* is = *»active«*, the protection is activated; i.e. with *»Function«* = *»inactive«,* no protection function is operating. Then the device cannot protect any components.**

Switching modules ON or OFF
Each of the modules can be switched on or off (permanently). This is achieved when the parameter »Function« is set to »active« or »inactive« in the respective module.

Activating or deactivating the tripping command of a protection stage permanently
In each of the protection stages the tripping command to the CB can be permanently blocked. For this purpose the parameter *»TripCmd Blo«* has to be set to *»active«*.

Temporary Blocking

To block the complete protection of the device temporarily by a signal
In module *»Prot«* the complete protection of the device can be blocked temporarily by a signal. On condition that a module-external blocking is permitted *»ExBlo Fc=active«*. In addition to this, a related blocking signal from the »assignment list« must have been assigned. For the time the allocated blocking signal is active, the module is blocked.

WARNING **If the module *»Prot«* is blocked, the complete protection function does not work. As long as the blocking signal is active, the device cannot protect any components.**

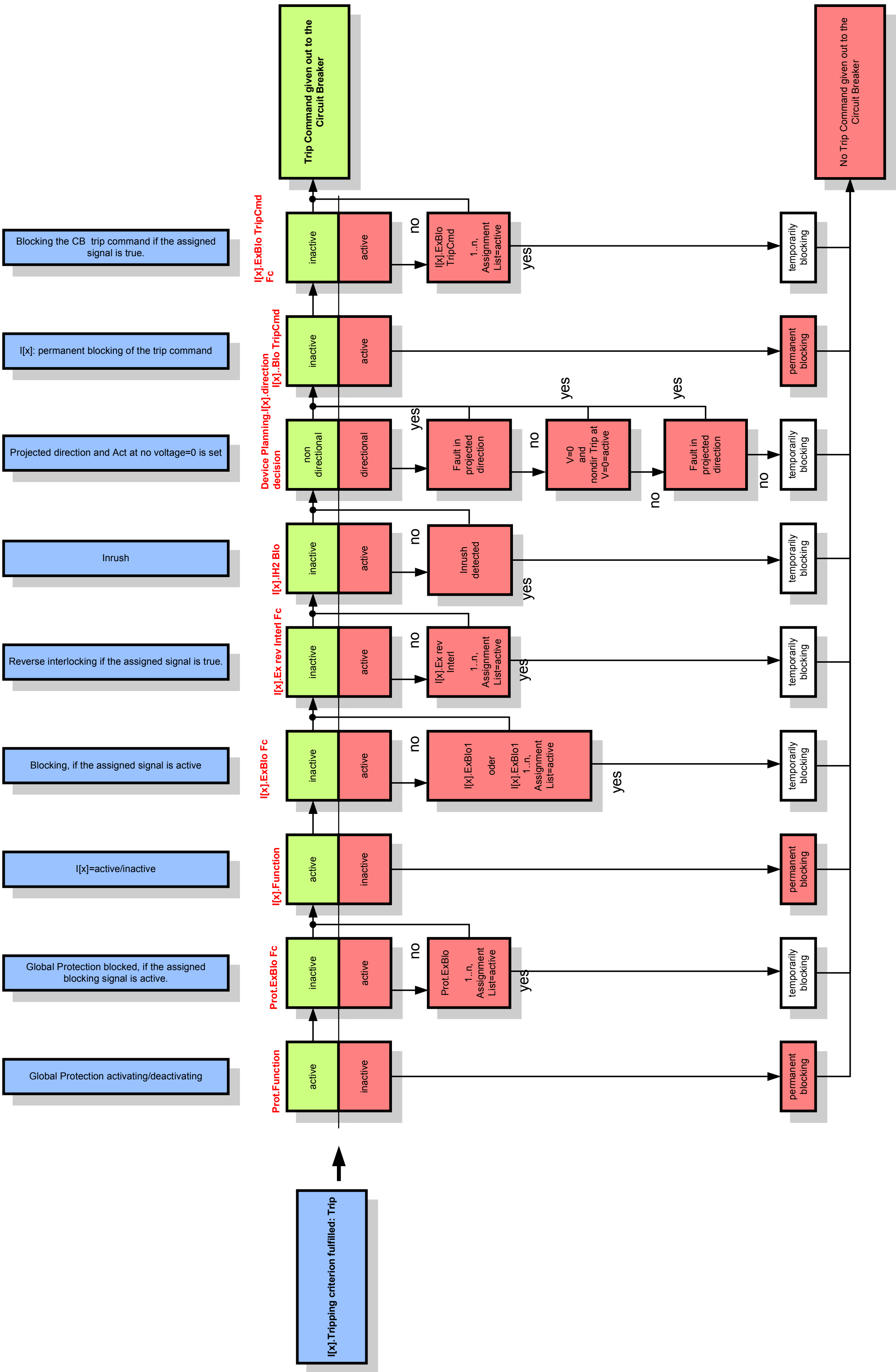
To block a complete protection module temporarily by an active assignment

- In order to establish a temporary blockage of a protection module, the parameter *»ExBlo Fc«* of the module has to be set to *»active«*. This gives the permission: »This module can be blocked«.
- Within the general protection parameters a signal has to be additionally chosen from the »ASSIGNMENT LIST«. The blocking only becomes active when the assigned signal is active.

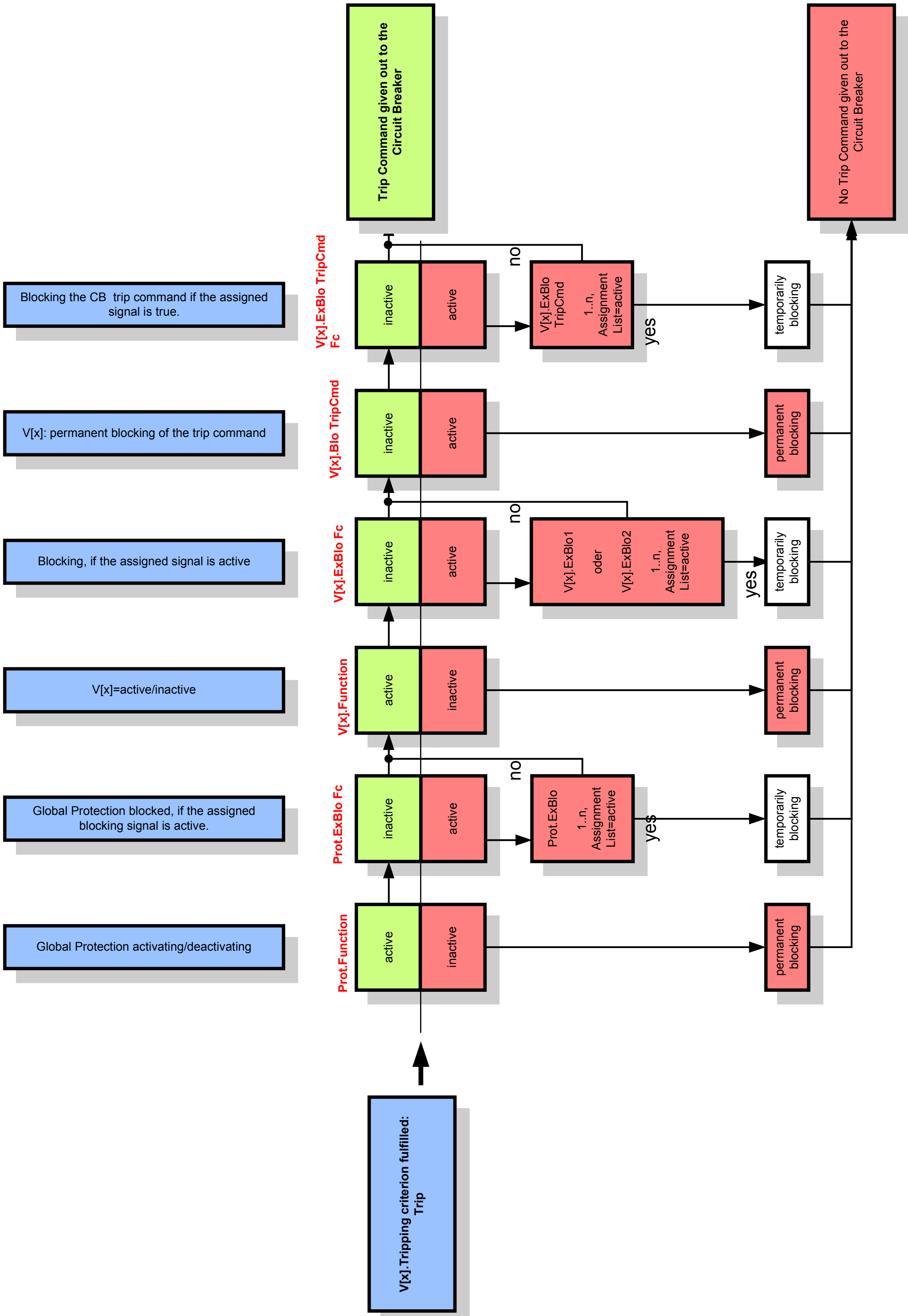
To block the tripping command of a protection stage temporarily by an active assignment.
The tripping command of any of the protection modules can be blocked from external. In this case, external does not only mean from outside the device, but also from outside the module. Not only real external signals are permitted to be used as blocking signals, as for example, the state of a digital input, but you can also choose any other signal from the »assignment list«.

- In order to establish a temporary blockage of a protection stage, the parameter *»ExBlo TripCmd Fc«* of the module has to be set to *»active«*. This gives the permission: »The tripping command of this stage can be blocked«.

- Within the general protection parameters, a signal has to be chosen additionally and assigned to the parameter *»ExBlo«* from the »assignment list«. If the selected signal is activated, the temporary blockage becomes effective.

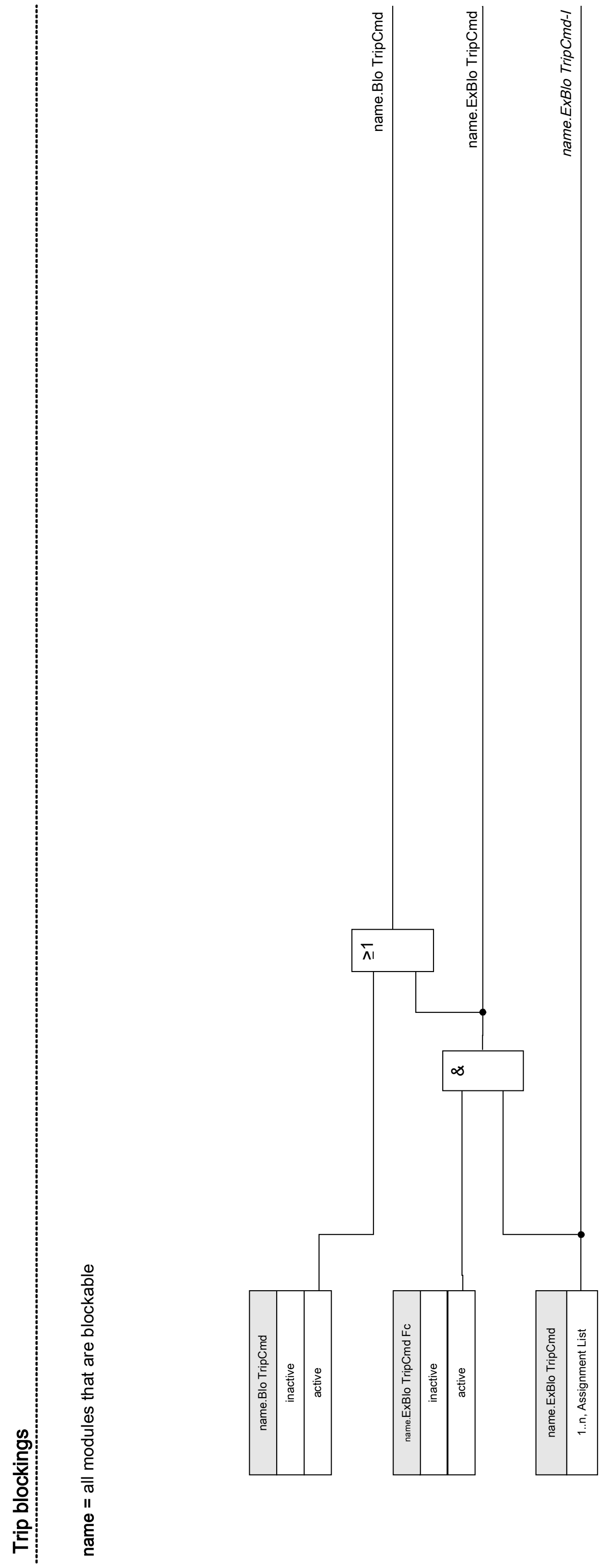


Tripping criterion fulfilled for I. How could the trip command be blocked?

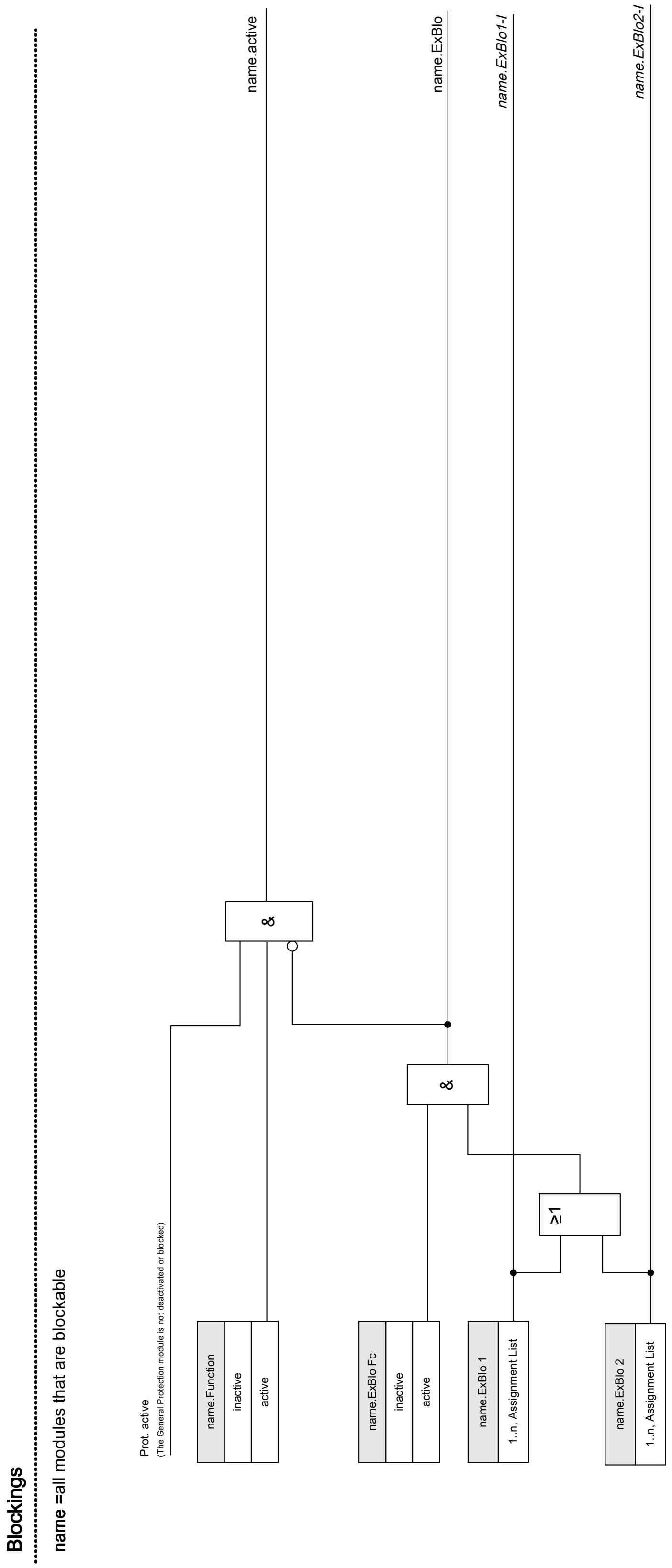


Tripping criterion fulfilled for V. How could the trip command be blocked?

To Activate or Deactivate the Tripping Command of a Protection Module

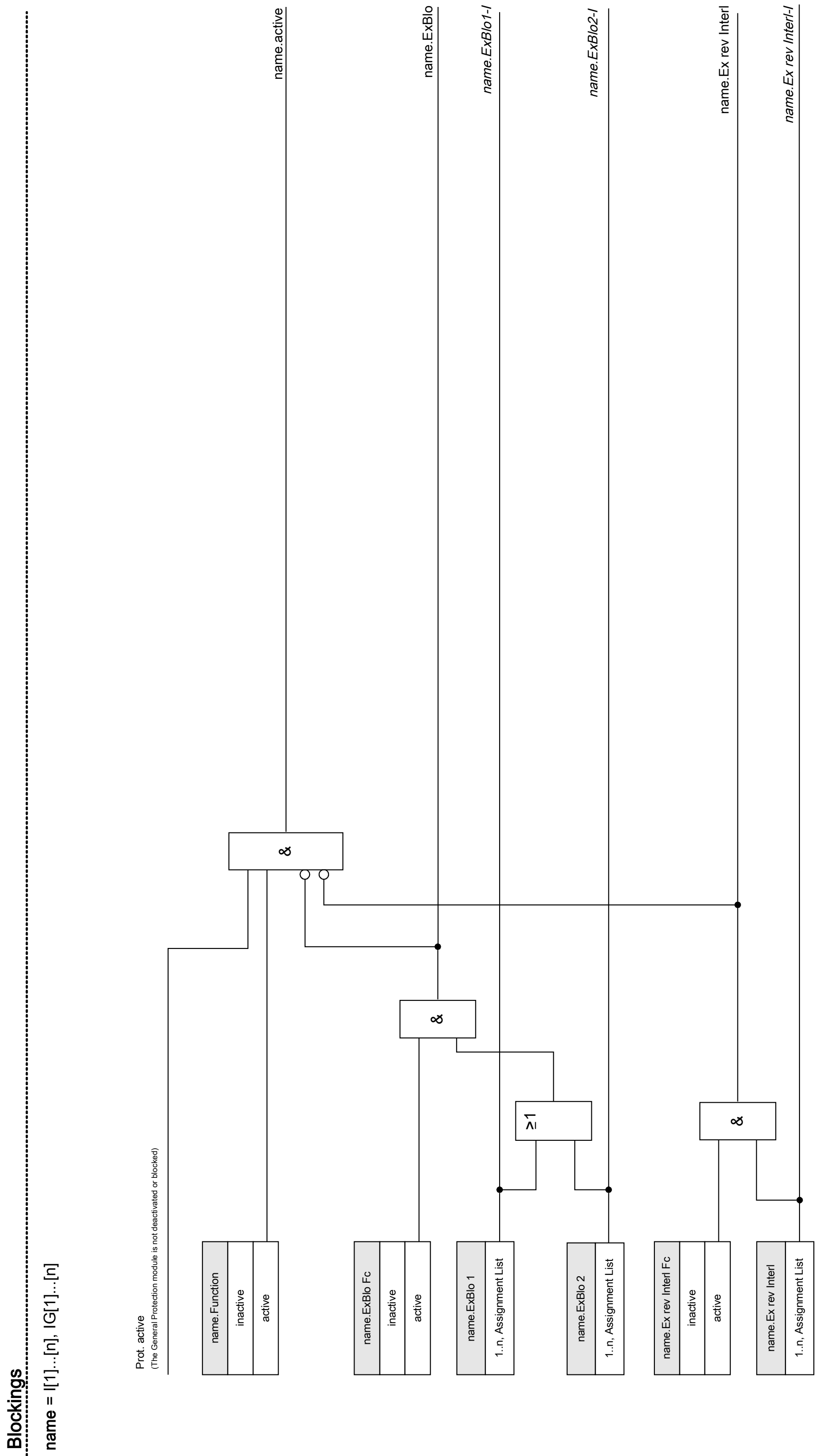


Activate, Deactivate Respectively Block Temporarily Protection Functions



Current protective functions cannot only be blocked permanently (»*function = inactive*«) or temporarily by any blocking signal from the »assignment list«, but also by *»reverse Interlocking«*.

All other protection functions can be activated, deactivated or blocked in the same manner.



Module: Protection (Prot)

Prot

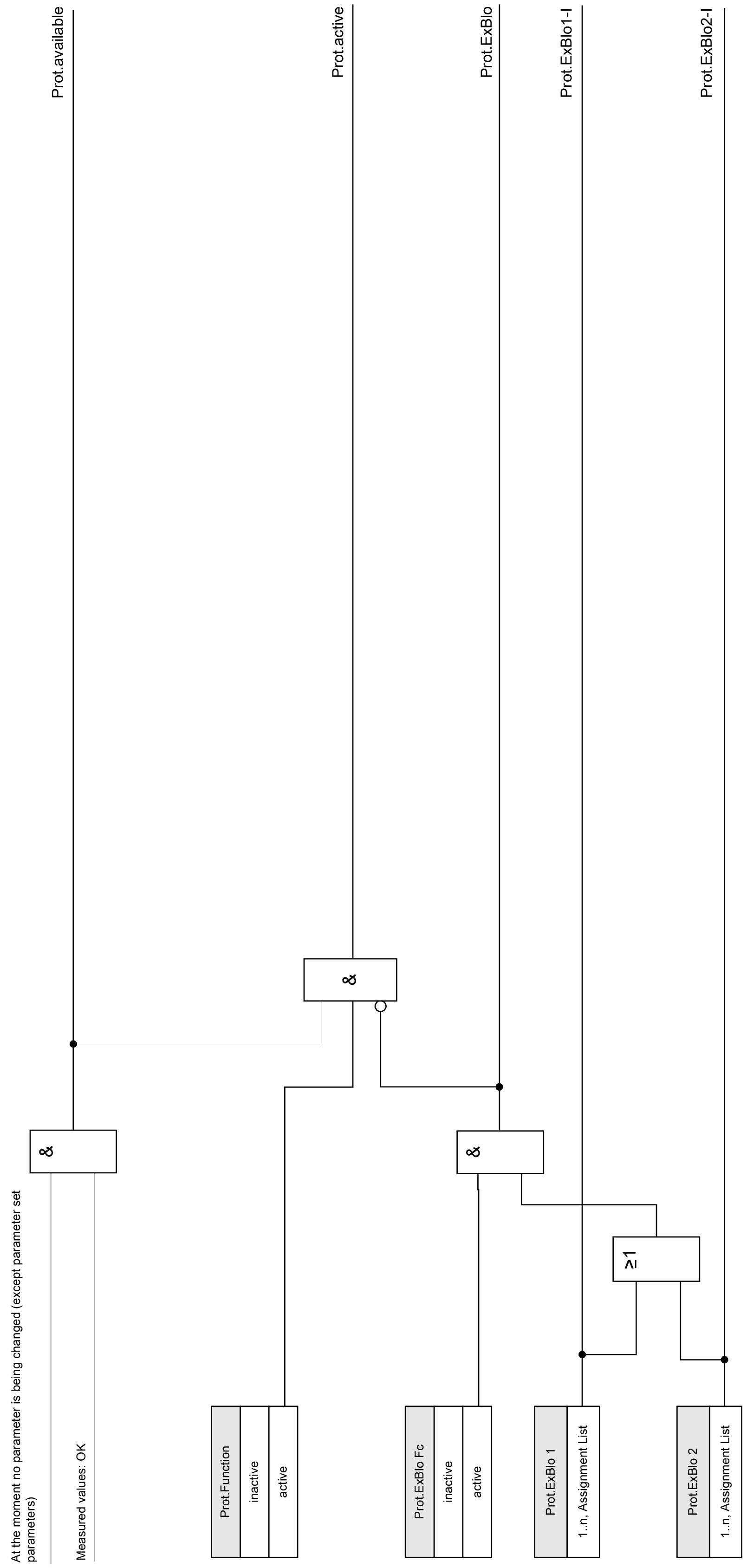
The module *»Protection«* serves as outer frame for all other protection modules, i.e. they are all enclosed by the module *»Protection«*. All alarms and tripping commands are combined in module *»Protection«* by an OR-logic.

WARNING **If in module *»Protection«* the parameter *»Function«* is set on »inactive« or in case the module is blocked, then the complete protective function of the device does not work anymore.**

Protection inactive
If the master module *»Protection«* was permanently deactivated or if a temporary blockage of this module has occurred and the allocated blocking signal is still active, then the complete functionality (protection) of the device is zero. In such a case the protective function is »inactive«.

Protection active
If the master module *»Protection«* was activated and a blockade for this module was not activated respectively the assigned blocking signal is inactive at that moment, then the *»Protection«* is *»active«*.

Prot - active


Prot.available
Prot.active
Prot.ExBlo
Prot.ExBlo1-I
Prot.ExBlo2-I
&
&
&
≥1
At the moment no parameter is being changed (except parameter set parameters)
Measured values: OK
Prot.Function
inactive
active
Prot.ExBlo Fc
inactive
active
Prot.ExBlo 1
1..n, Assignment List
Prot.ExBlo 2
1..n, Assignment List

Each protection stage can decide automatically about a trip. The trip decision is passed on to module *»Prot«* and The tripping commands of all protection stages are combined in module *»Prot«* by an OR logic (Collective signals, direction decisions, information about phases). The tripping commands are executed by the module »*TripControl«*.

WARNING **The tripping commands are executed by the module *»TripControl«***

If a protection module is activated respectively issues a trip command to the CB two alarm signals will be created:

1. The module or the protection stage issues an alarm e.g. »I[1].Alarm« or »I[1].Trip«.

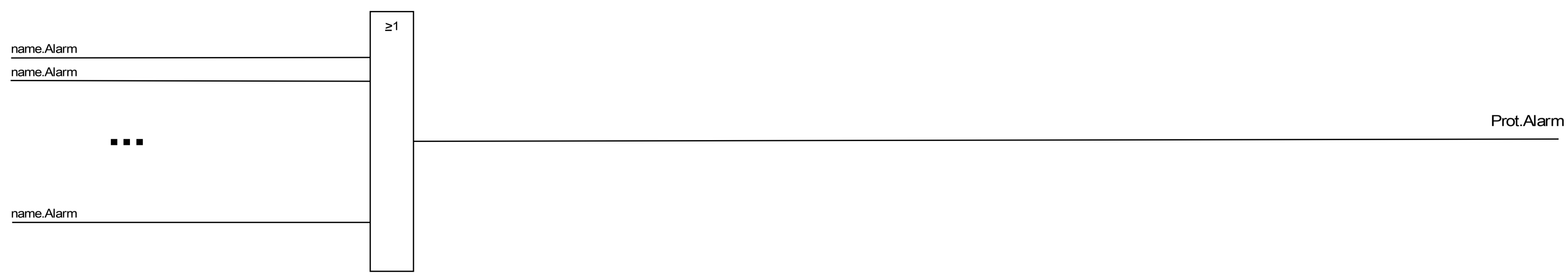
2. The master module *»Prot«* collects/summarizes the signals and issues an alarm or a trip signal »Prot.Alarm« »Prot.Trip«.

Prot.Trip

name = Each trip of an active, trip authorized protection module will leed to a general trip.

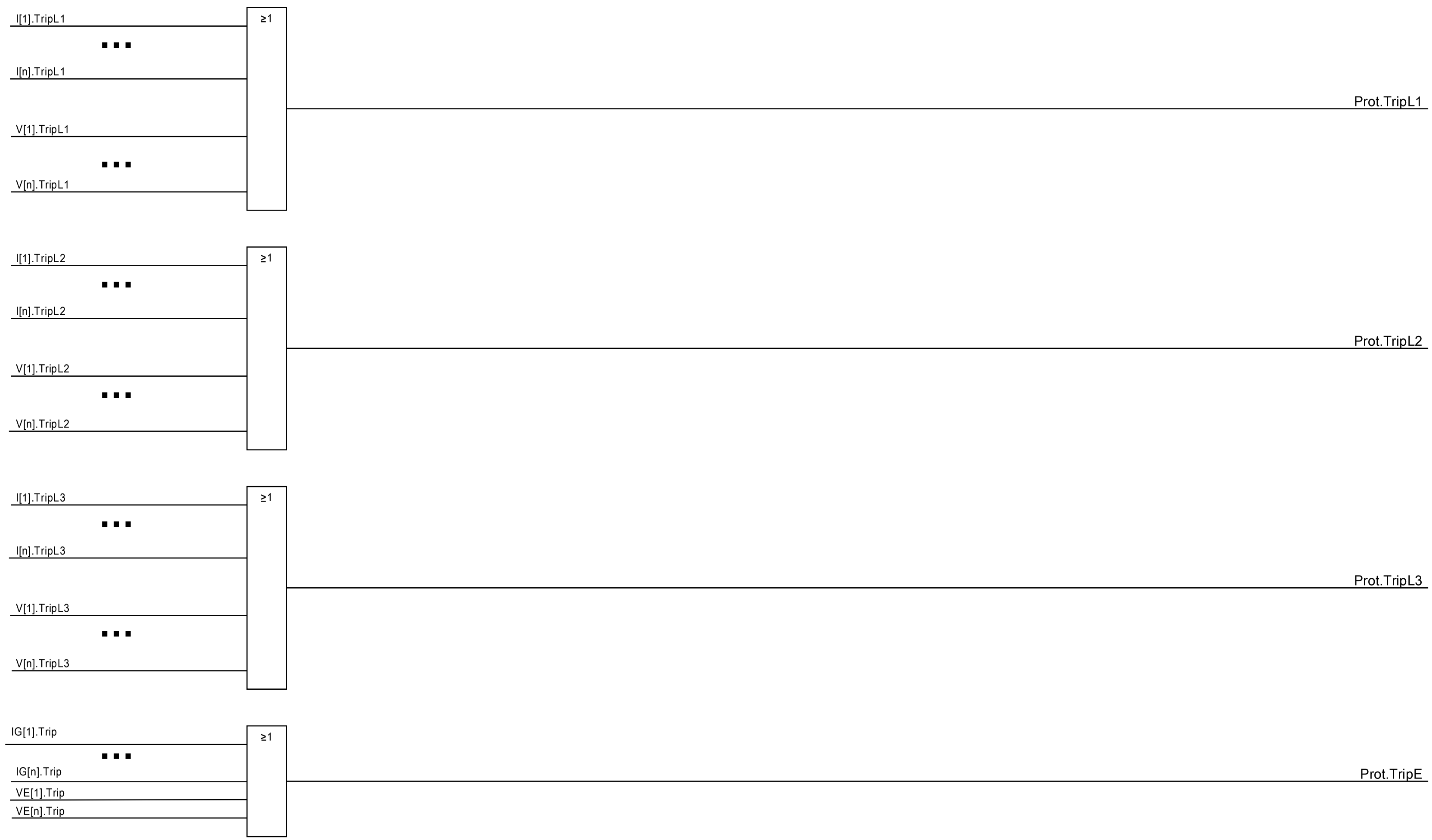
Prot.Alarm

name = Each alarm of a module (except from supervision modules but including CBF) will leed to a general alarm (collective alarm).



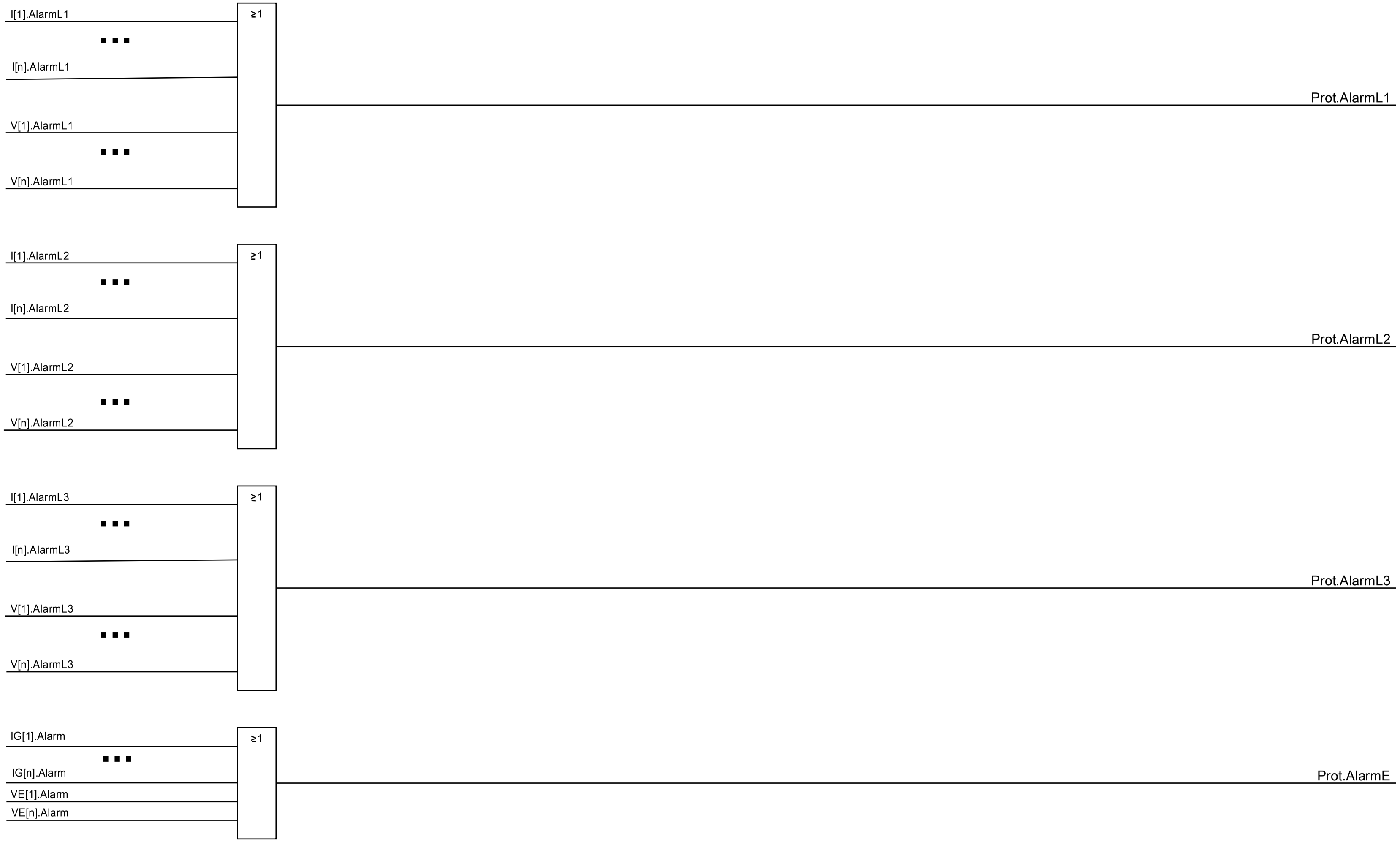
Prot.Trip

Each phase selective trip of a trip authorized module (I, IE, V, VE depending on the device type) will leed to a phase selective general trip.



Prot.Alarm

Each phase selective alarm of a module (I, IE, V, VE depending on the device type) will leed to a phase selective general alarm (collective alarm).



Direct Commands of the Protection Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Res Fault a Mains No	Resetting of fault number and mains fault number.	inactive, active	inactive	[Operation /Reset]

Global Protection Parameters of the Protection Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	active	[Protection Para /Global Prot Para /Prot]
ExBlo Fc	Activate (allow) the external blocking of the global protection functionality of the device.	inactive, active	inactive	[Protection Para /Global Prot Para /Prot]
ExBlo1	If external blocking of this module is activated (allowed), the global protection functionality of the device will be blocked if the state of the assigned signal becomes true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /Prot]
ExBlo2	If external blocking of this module is activated (allowed), the global protection functionality of the device will be blocked if the state of the assigned signal becomes true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /Prot]

Protection Module Input States

Name	*Description*	*Assignment via*
ExBlo1-I	Module input state: External blocking1	[Protection Para /Global Prot Para /Prot]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /Prot]

Protection Module Signals (Output States)

Name	*Description*
available	Signal: Protection is available
active	Signal: active
ExBlo	Signal: External Blocking
Alarm L1	Signal: General-Alarm L1
Alarm L2	Signal: General-Alarm L2
Alarm L3	Signal: General-Alarm L3
Alarm G	Signal: General-Alarm - Earth fault
Alarm	Signal: General Alarm
Trip L1	Signal: Trip L1
Trip L2	Signal: Trip L2
Trip L3	Signal: Trip L3
Trip E	Signal: Trip E
Trip	Signal: Trip
Res Fault a Mains No	Signal: Resetting of fault number and mains fault number.
I dir fwd	Signal: Phase current failure forward direction
I dir rev	Signal: Phase current failure reverse direction
I dir n poss	Signal: Phase fault - missing reference voltage
IG dir fwd	Signal: Earth fault forward
IG rev dir	Signal: Earth fault reverse direction
IE dir n poss	Signal: Earth fault direction detection not possible

Protection Module Values

Value	*Description*	*Menu path*
FaultNo	Disturbance No	[Operation /Counter and RevData /Prot]
MainsFaultNo	Mains disturbance No	[Operation /Counter and RevData /Prot]

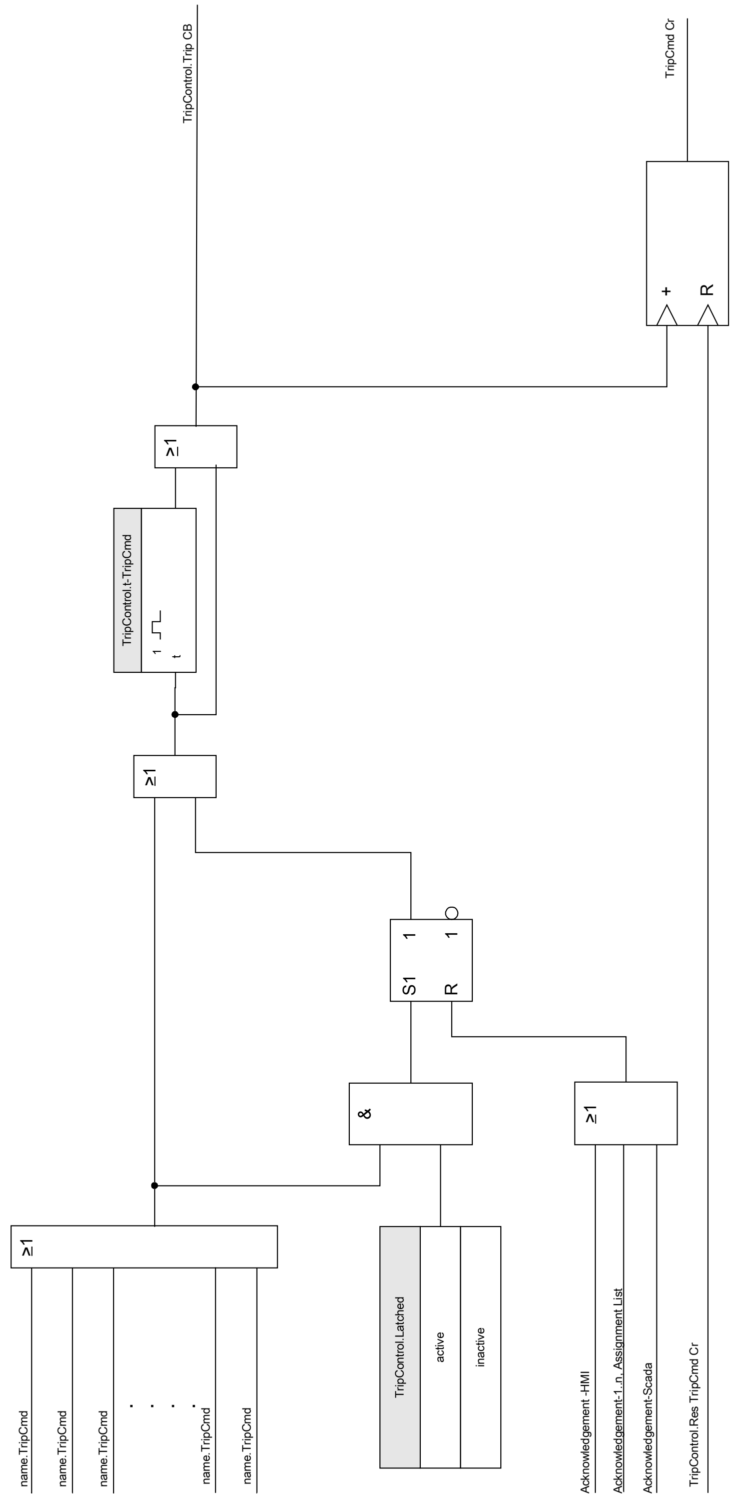
Module: Trip Control (TripControl)

TripControl

The tripping commands of all protection modules are combined in module *»TripLogic«* by an OR logic. The command for tripping can come from each of the protection modules, but the actual tripping command to the CB is only given by the module *»TripLogic«*.
In addition to that you can set within this module the minimum hold time of the tripping command and define whether the tripping command is latched or not.

TripControl.Trip CB

name =Each trip of an active, trip authorized protection module will leed to a general trip.



Direct Commands of the Trip Control Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Ack TripCmd	Acknow TripCmd	inactive, active	inactive	[Operation /Acknowledgement]
Res TripCmd Cr	Resetting of the Counter: total number of trip commands	inactive, active	inactive	[Operation /Reset]
Res Sum trip	Reset summation of the tripping currents	inactive, active	inactive	[Operation /Reset]

Global Protection Parameters of the Trip Control Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
t-TripCmd	Minimum hold time of the OFF-command (circuit breaker, load break switch)	0.1 - 10.0*s	0.2*s	[Protection Para /Global Prot Para /TripControl]
Latched	Defines whether the Binary Output Relay will be acknowledged automatically if the event is gone or whether the Binary Output Relay is to be acknowledged by a signal/manually.	inactive, active	inactive	[Protection Para /Global Prot Para /TripControl]
Ack TripCmd	Acknow TripCmd	1..n, Assignment List	-	[Protection Para /Global Prot Para /TripControl]

Trip Control Module Input States

Name	*Description*	*Assignment via*
Acknow Sig-I	Module input state: Acknowledgement Signal (only for automatic acknowledgement) Module input signal	[Protection Para /Global Prot Para /TripControl]

Trip Control Module Signals (Outputs States)

Name	*Description*
TripCmd	Signal: Trip Command
Res TripCmd Cr	Signal: Resetting of the Counter: total number of trip commands
Ack TripCmd	Signal: Acknow TripCmd
Res Sum trip	Signal: Reset summation of the tripping currents

Trip Control Module – Sum of Tripping Currents

Value	*Description*	*Menu path*
Sum trip I L1	Summation of the tripping currents phase1	[Operation /Counter and RevData /TripControl]
Sum trip I L2	Summation of the tripping currents phase2	[Operation /Counter and RevData /TripControl]
Sum trip I L3	Summation of the tripping currents phase3	[Operation /Counter and RevData /TripControl]

Trip Control Module Values

Value	*Description*	*Default*	*Size*	*Menu path*
TripCmd Cr	Counter: Total number of trips of the switchgear (circuit breaker, load break switch…).	0	0 - 65535	[Operation /Counter and RevData /TripControl]

I-Protection Module – Overcurrent Protection [ANSI 50, 51, 67]

Available stages:
I[1] ,I[2] ,I[3] ,I[4] ,I[5] ,I[6]

WARNING **If you are using inrush blockings the tripping delay of the current protection functions must be at least 30ms or more in order to prevent faulty trippings.**

CAUTION **In order to ensure correct functioning of the directional detection after single-phase short-circuits, the following reference voltage is used: For phase current *I1* it is the line-to-line voltage *U23*, for phase current *I2* the line-to-line voltage *U31* and for phase current *I3* the line-to-line voltage *U12*.**

In case the fault happens to be near the measuring location and there is no reference voltage for directional recognition available any more (neither measured or from history (voltage memory)), then the module will - depending on the parameter setting - either trip non-directional or it will be blocked.

NOTICE **All overcurrent protective elements *I[1]..I[6]* are identically structured.**

All *I[1]...I[6]* overcurrent protective elements can be planned as non-directional or optionally as directional elements. This means, all 6 elements can be planned user defined in forward/reverse or non directional. For each element the following characteristics are available:

- DEFT (UMZ)
- NINV (AMZ)
- VINV (AMZ)
- LINV (AMZ)
- EINV (AMZ)

NINV (AMZ) Type A:
Normal Inverse

$$t = \frac{0.14}{\left(\frac{I}{I>}\right)^{0.02} - 1} \text{ *t-char [s]}$$

VINV (AMZ) Type B
Very Inverse

$$t = \frac{13.5}{\left(\frac{I}{I>}\right) - 1} \text{ *t-char [s]}$$

EINV (AMZ) Type C
Extremely Inverse

$$t = \frac{80}{\left(\frac{I}{I>}\right)^{2} - 1} \text{ *t-char [s]}$$

LINV (AMZ) Type D
Long Time Inverse

$$t = \frac{120}{\left(\frac{I}{I>}\right) - 1} \text{ *t-char [s]}$$

Explanation:

t = Tripping delay

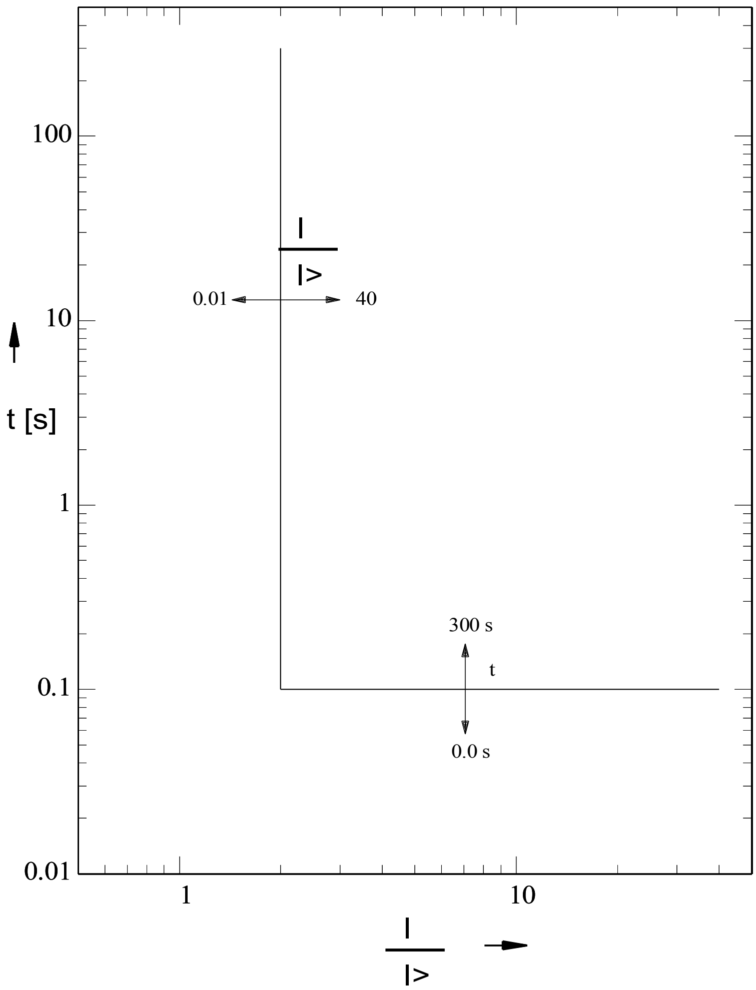
t-char = Time multiplier/tripping characteristic factor

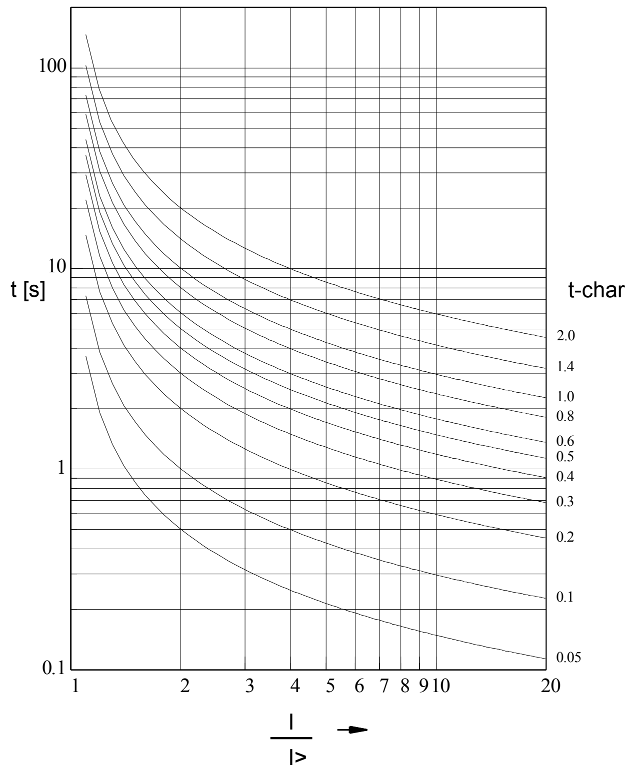
I = Fault current

I> = If the pick-up value is exceeded, the module/stage will be started.

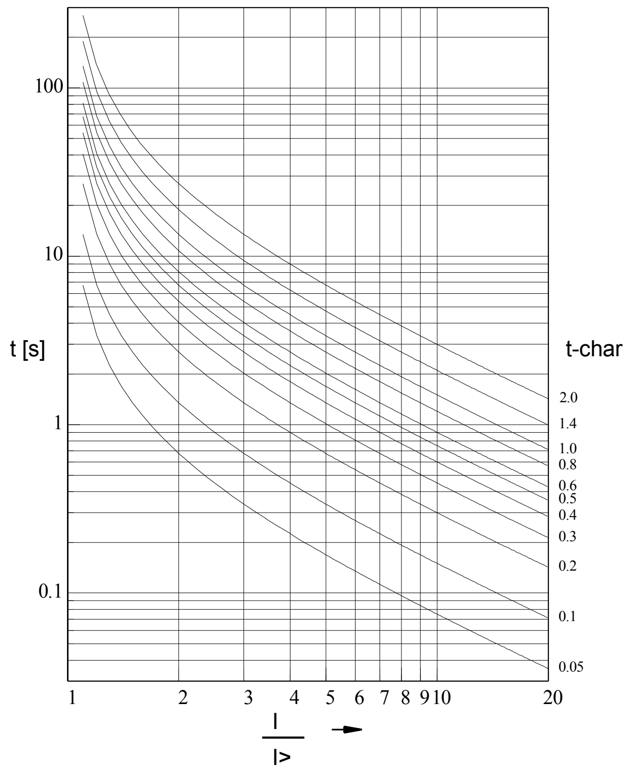
By using the projecting parameters each of the overcurrent protective elements can be defined as *»forward«*, *»reverse«* or *»non-directional«*. The forward or reverse direction is based on the characteristic angle for the phase direction specified by the field parameter *»I MTA«*. No directional information will be taken into account if the current protective element is planned as *»non-directional«*

Definite Time (DEFT)

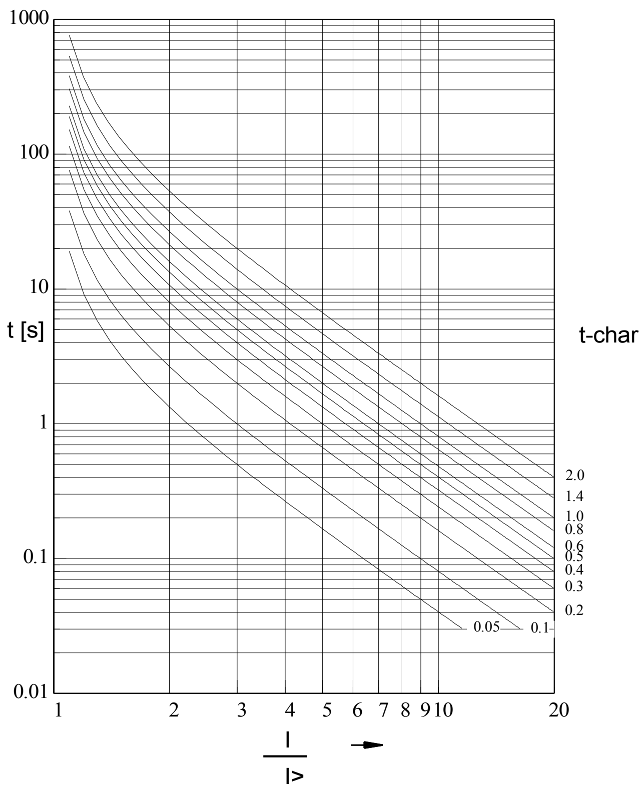




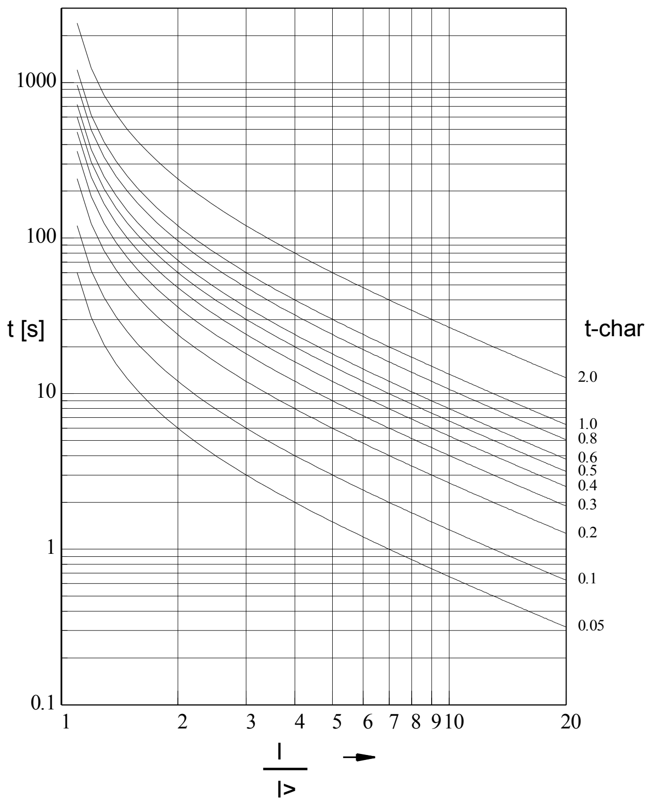
Normal Inverse (NINV)



Very Inverse (VINV)

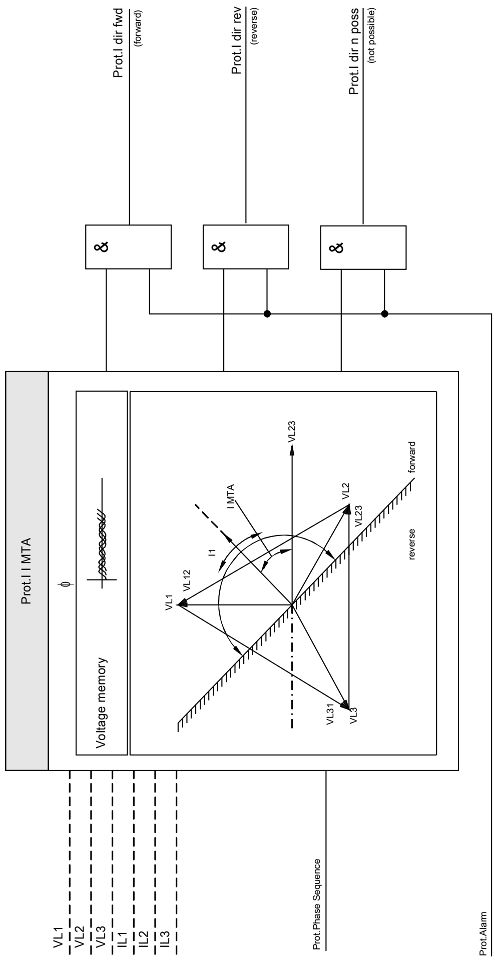


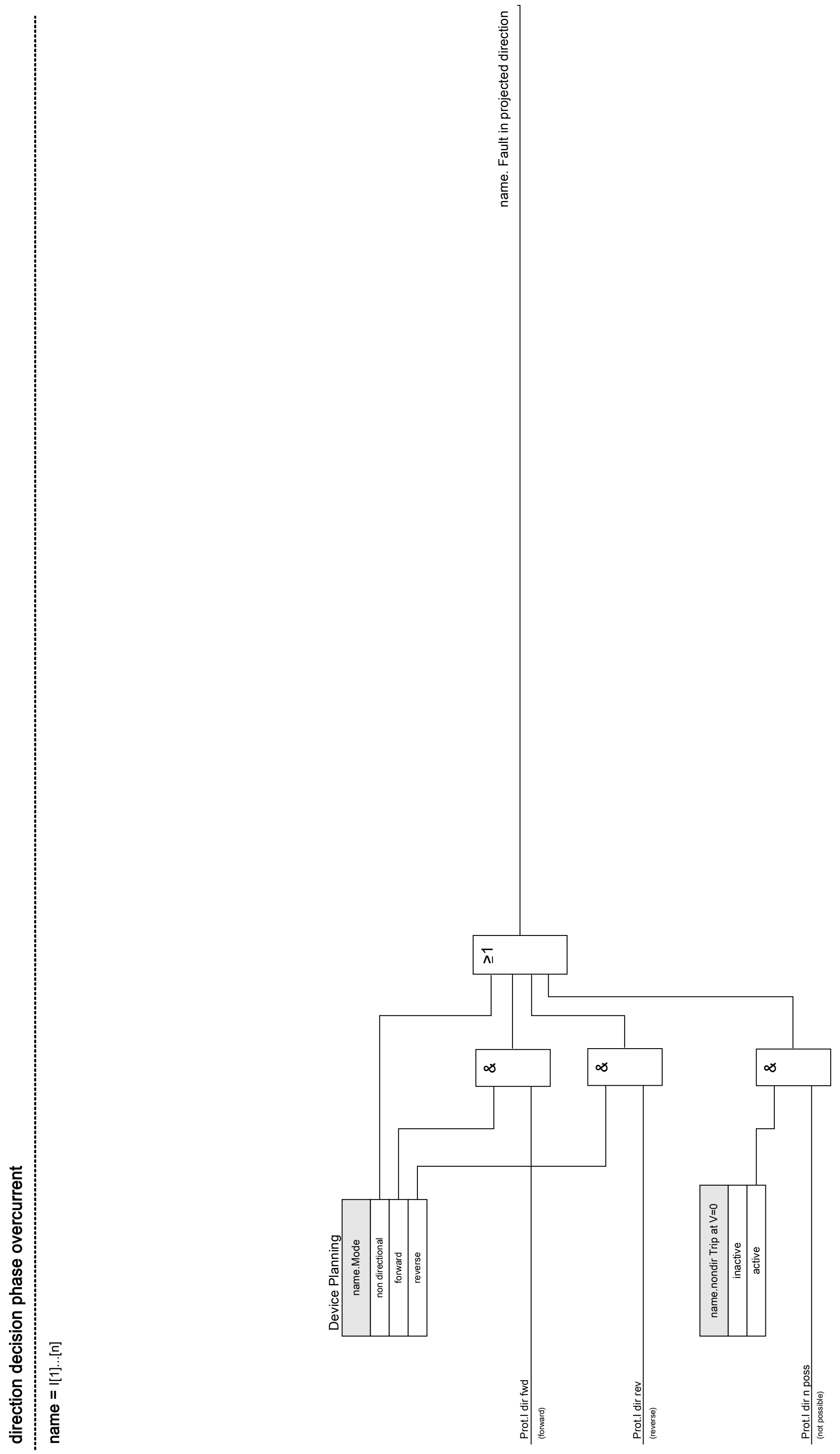
Extremely Inverse (EINV)

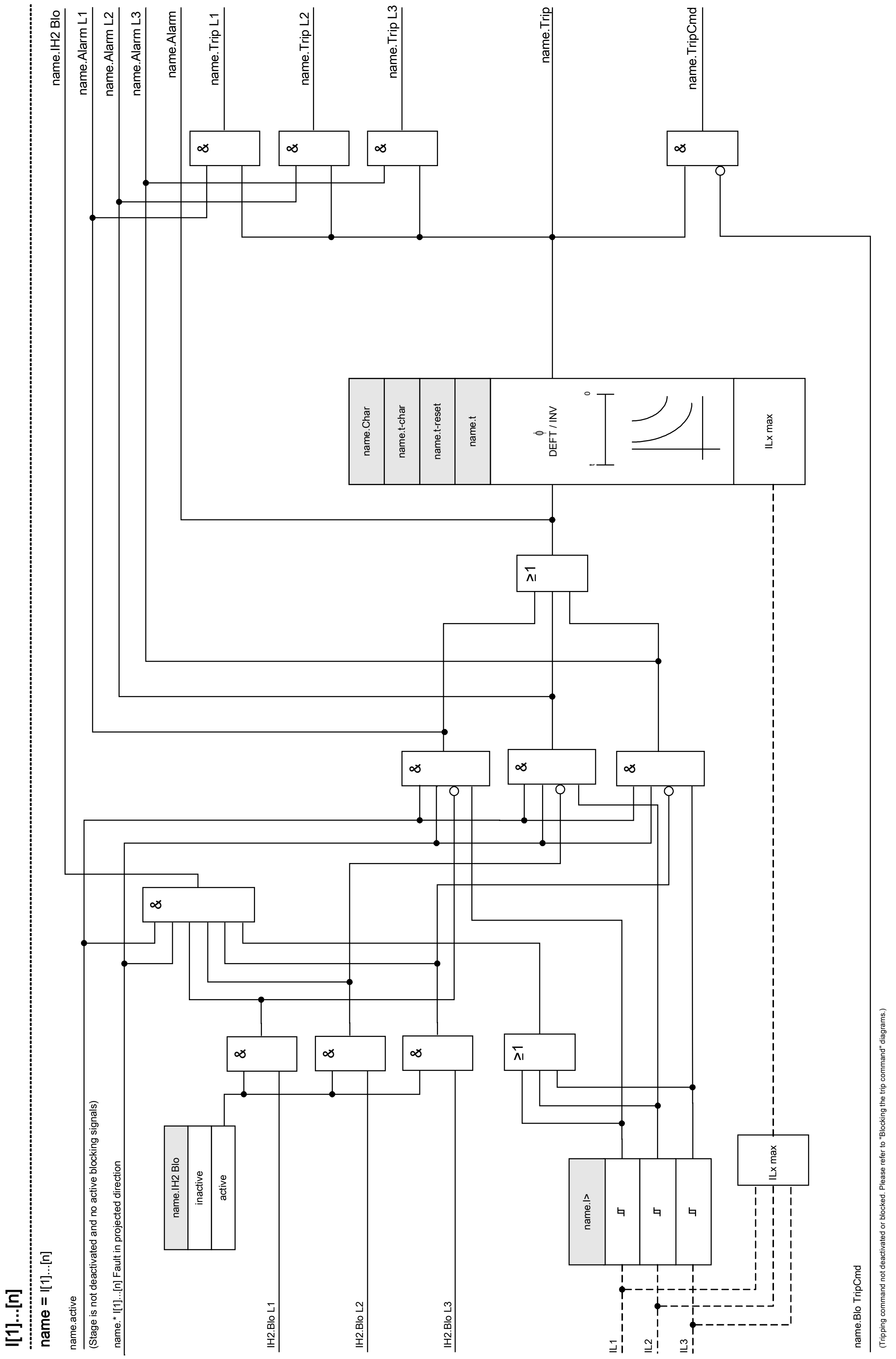


Long Time Inverse (LINV)

Prot - phase failure direction detection




direction decision phase overcurrent
name = I[1]...[n]
name. Fault in projected direction
≥1
&
&
&
Device Planning
name.Mode
non directional
forward
reverse
name.nondir Trip at V=0
inactive
active
Prot.I dir fwd
(forward)
Prot.I dir rev
(reverse)
Prot.I dir n poss
(not possible)


I[1]...[n]
name = I[1]...[n]
name.active
(Stage is not deactivated and no active blocking signals)
name.* I[1]...[n] Fault in projected direction
name.IH2 Blo
inactive
active
IH2.Blo L1
IH2.Blo L2
IH2.Blo L3
name.I>
IL1
IL2
IL3
ILx max
name.Char
name.t-char
name.t-reset
name.t
DEFT / INV
name.Blo TripCmd
(Tripping command not deactivated or blocked. Please refer to "Blocking the trip command" diagrams.)
name.IH2 Blo
name.Alarm L1
name.Alarm L2
name.Alarm L3
name.Alarm
name.Trip L1
name.Trip L2
name.Trip L3
name.Trip
name.TripCmd

Device Planning Parameters of the I Module

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, non directional, forward, reverse	non directional	[Device Planning]

Global Protection Parameters of the I Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /I-Prot /I[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /I-Prot /I[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the stage, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /I-Prot /I[1]]
Ex rev Interl	External blocking of the module by external reverse interlocking, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /I-Prot /I[1]]

Setting Group Parameters of the I Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	I[1]: active I[2]: inactive I[3]: inactive I[4]: inactive I[5]: inactive I[6]: inactive	[Protection Para /<n> /I-Prot /I[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /I-Prot /I[1]]
Ex rev Interl Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "Ex rev Interl Fc = active".	inactive, active	inactive	[Protection Para /<n> /I-Prot /I[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<n> /I-Prot /I[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo TripCmd Fc=active".	inactive, active	inactive	[Protection Para /<n> /I-Prot /I[1]]
I>	If the pick-up value is exceeded, the module/stage will be started.	0.01 - 40.00*In	I[1]: 1*In I[2]: 0.01*In I[3]: 0.01*In I[4]: 0.01*In I[5]: 0.01*In I[6]: 0.01*In	[Protection Para /<n> /I-Prot /I[1]]
Char	Characteristic	DEFT, NINV, VINV, EINV, LINV	DEFT	[Protection Para /<n> /I-Prot /I[1]]
t	Tripping delay Only available if: Characteristic = DEFT	0.00 - 300.00*s	I[1]: 1*s I[2]: 0.00*s I[3]: 0.00*s I[4]: 0.00*s I[5]: 0.00*s I[6]: 0.00*s	[Protection Para /<n> /I-Prot /I[1]]
t-char	Time multiplier/tripping characteristic factor Only available if: Characteristic = INV	0.05 - 2.00	1	[Protection Para /<n> /I-Prot /I[1]]
t-reset	Reset time for intermittent phase failures (INV characteristics only) Only available if: Characteristic = INV	0.00 - 60.00*s	1.00*s	[Protection Para /<n> /I-Prot /I[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
IH2 Blo	Blocking the trip command, if an inrush is detected.	inactive, active	inactive	[Protection Para /<n> /I-Prot /I[1]]
nondir Trip at V=0	Only relevant for current protection modules/stages with directional feature! The device will trip non directional if this parameter is set to active and no direction could be determined because no reference voltage (V=0) could be measured any more (e.g. if there is a three-phase short circuit close to the device). If this parameter is set to inactive, the protection stage will be blocked in case of V=0. Only available if: Device Planning: I.Mode = directional	inactive, active	inactive	[Protection Para /<n> /I-Prot /I[1]]

I Module Input States

Name	*Description*	*Assignment via*
ExBlo1-I	Module input state: External blocking1	[Protection Para /Global Prot Para /I-Prot /I[1]]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /I-Prot /I[1]]
ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command	[Protection Para /Global Prot Para /I-Prot /I[1]]
Ex rev Interl-I	Module input state: External reverse interlocking	[Protection Para /Global Prot Para /I-Prot /I[1]]

I Module Signals (Output States)

Name	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
Ex rev Interl	Signal: External reverse Interlocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
IH2 Blo	Signal: Blocking the trip command by an inrush
Alarm L1	Signal: Alarm L1
Alarm L2	Signal: Alarm L2
Alarm L3	Signal: Alarm L3
Alarm	Signal: Alarm
Trip L1	Signal: Trip L1
Trip L2	Signal: Trip L2
Trip L3	Signal: Trip L3
Trip	Signal: Trip
TripCmd	Signal: Trip Command

Commissioning: Overcurrent Protection, non-directional [ANSI 50, 51]

Object to be tested

- Signals to be measured for each current protection element *I[1]...I[6]*, the threshold values, total tripping time (recommended), or alternatively tripping delays and the fallback ratios; each time 3 x single-phase and
1 x three-phase.

NOTICE **Especially in Holmgreen connections, wiring errors can easily happen, and these are then detected safely. Measuring the total tripping time can ensure that the secondary wiring is o.k. (from the terminal on, up to the trip coil of the CB).**

NOTICE **It is recommended to measure the total tripping time instead of the tripping delay. The tripping delay should be specified by the customer. The total tripping time is measured at the position signaling contact of the CB (not at the relay output!).**

Total tripping time = tripping delay
+ reaction time of the relay (about 10-15 ms)
+ CB operating time (about 50 ms)

Please take the CB operating times from the technical data specified in the relevant documentation provided by the CB manufacturer.

Necessary means
- Current source
- May be: ampere meters
- Timer

Procedure

Testing the threshold values (3 x single-phase and 1 x three-phase)
Each time feed a current which is about 3-5% above the threshold value for activation/tripping. Then check the threshold values.

Testing the total tripping delay (recommendation)
Measure the total tripping times at the auxiliary contacts of the CB (CB tripping).

Testing the tripping delay (measuring at the relay output)
Measure the tripping times at the relay output.

Testing the fallback ratio
Reduce the current to 97% below the trip value and check the fallback ratio.

Successful test result

The measured total tripping delays or individual tripping delays, threshold values and fallback ratios correspond with those values, specified in the adjustment list. Permissible deviations/tolerances can be found under Technical Data.

Commissioning: Overcurrent Protection, directional [ANSI 67]

Object to be tested

- For each directional overcurrent element *I[1]...I[6]* are to be measured: the total tripping time (recommendation) or alternatively tripping delays and the fallback ratios; each time 3 x single-phase and 1 x three-phase.

NOTICE **Especially in Holmgreen connections, wiring errors can happen easily and these are then detected safely. By measuring the total tripping time, it can be ensured that the secondary wiring is o.k. (from the terminal on, up to the trip coil of the CB).**

NOTICE **It is recommended to measure the total tripping time instead of the tripping time. The tripping delay should be specified by the customer. The total tripping time is measured at the position signaling contacts of the CBs (not at the relay output!).**

Total tripping time: = tripping delay
+ reaction time of the relay (about 10-15 ms)
+ CB operating time (about 50 ms)

Please take the CB switching times from the technical data, specified in the relevant documentation, provided by the CB manufacturer.

Necessary means

- Synchronizable current and voltage sources
- May be: ampere meters
- Timer

Procedure

Synchronize the 3-phase current and voltage sources with each other. Then simulate the tripping directions to be tested by the angle between current and voltage.

Testing the threshold values (3 x single-phase and 1 x three-phase)
Each time feed a current which is about 3-5% above the threshold value for activation/tripping. Check then the threshold values.

Testing the total tripping delay (recommendation)
Measure the total tripping times at the auxiliary contacts of the CB (CB tripping).

Testing the trip delay (measured at the relay output)
Measure the tripping times at the relay output.

Testing the fallback ratio
Reduce the current to 97% below the trip value and check the fallback ratio.

Successful test result
The measured total tripping delays or individual tripping delays, threshold values and fallback ratios correspond with those values, specified in the adjustment list. Permissible deviations/tolerances can be found under Technical Data.

IG-Protection Module – Ground Fault [ANSI 50N, 51N, 67N]

Available stages:
IG[1] ,IG[2] ,IG[3] ,IG[4]

WARNING **If you are using inrush blockings the tripping delay of the earth current protection functions must be at least 30ms or more in order to prevent faulty trippings.**

NOTICE **All earth current elements *IE[1]..IE[4]* are identically structured.**

All *IG[1]...IG[4]* earth current protective elements can be planned user defined as non-directional or as directional stages. This means, for instance, all 4 elements can be projected in forward/reverse direction. For each element the following characteristics are available:

- DEFT (UMZ)
- NINV (AMZ)
- VINV (AMZ)
- LINV (AMZ)
- EINV (AMZ)

NINV (AMZ) Type A:
Normal Inverse

$$t = \frac{0.14}{\left(\frac{IG}{IG>}\right)^{0.02} - 1} \text{*t-char [s]}$$

VINV (AMZ) Type B
Very Inverse

$$t = \frac{13.5}{\left(\frac{IG}{IG>}\right) - 1} \text{*t-char [s]}$$

EINV (AMZ) Type C
Extremely Inverse

$$t = \frac{80}{\left(\frac{IG}{IG>}\right)^{2} - 1} \text{*t-char [s]}$$

LINV (AMZ) Type D
Long Time Inverse

$$t = \frac{120}{\left(\frac{IG}{IG>}\right) - 1} \text{*t-char [s]}$$

Explanation:

t = Tripping delay

t-char = Time multiplier/tripping characteristic factor

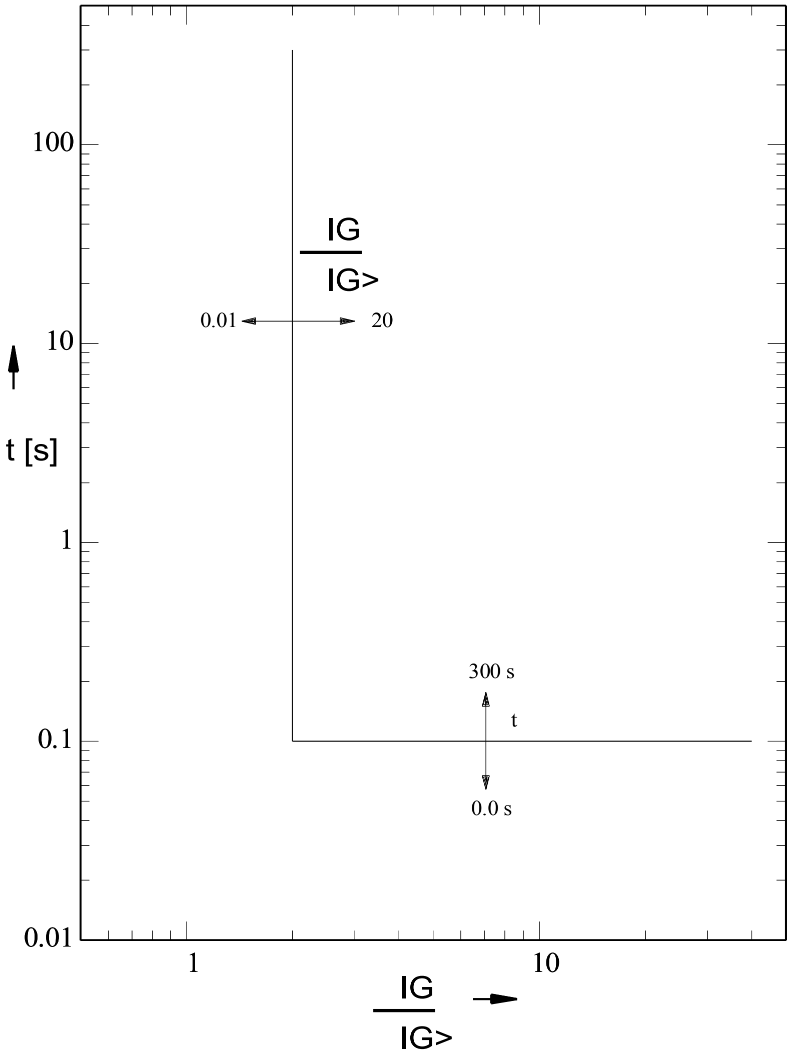
IG = Fault current

IG> = If the pick-up value is exceeded, the module/stage will be started.

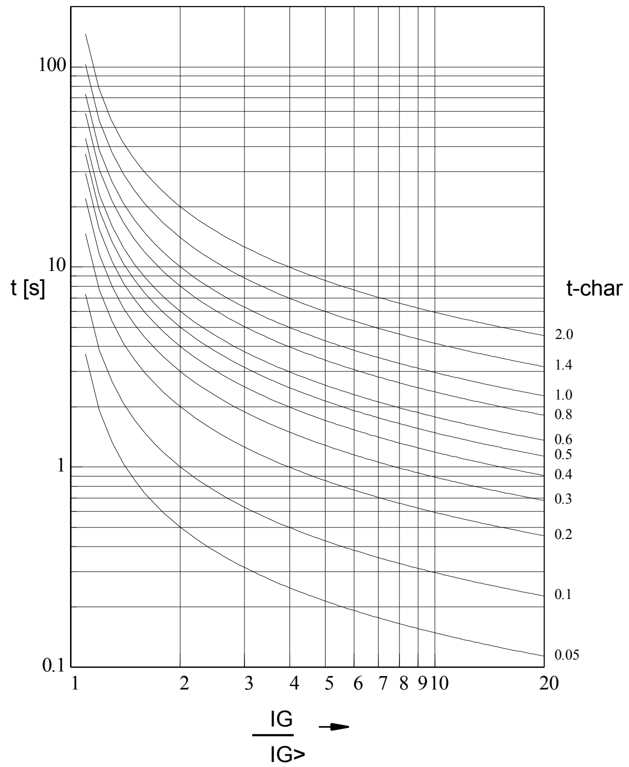
The directional decision depends on the layout of the mains star-point or the angle between residual voltage and ground current. The residual voltage can be measured via suitable transformers (da-dn winding – formerly: e-n) or can be calculated, provided the VTs are in star-connection.

The earth current can be measured either directly via a cable-type transformer or detected by a Holmgreen connection. The earth current can alternatively be calculated from the phase currents; but this is only possible if the phase currents are not ascertained by a V-connection.

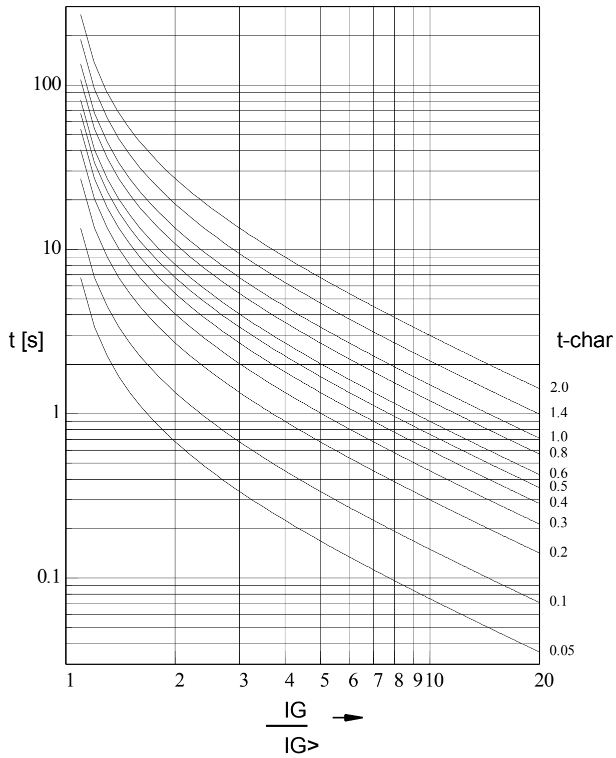
The device can optionally be procured with a sensitive earth current measuring input (in preparation).



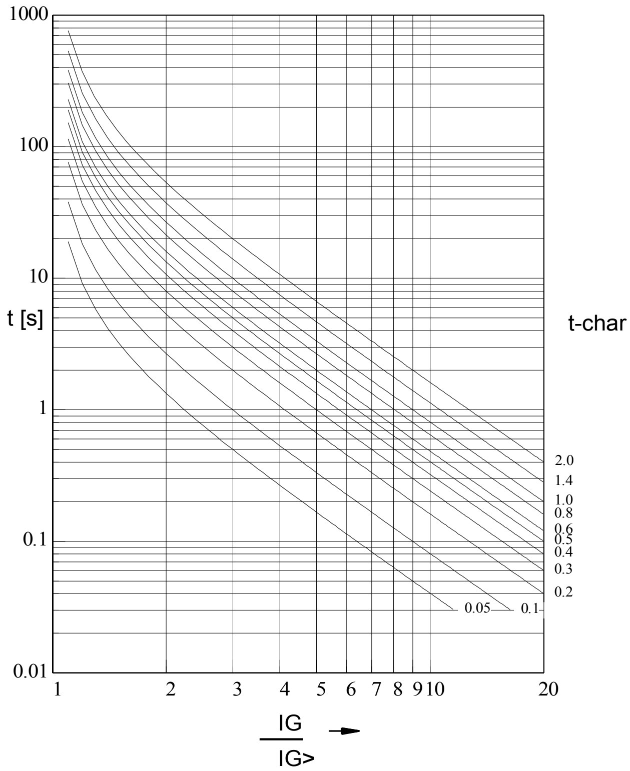
Definite Time (DEFT)



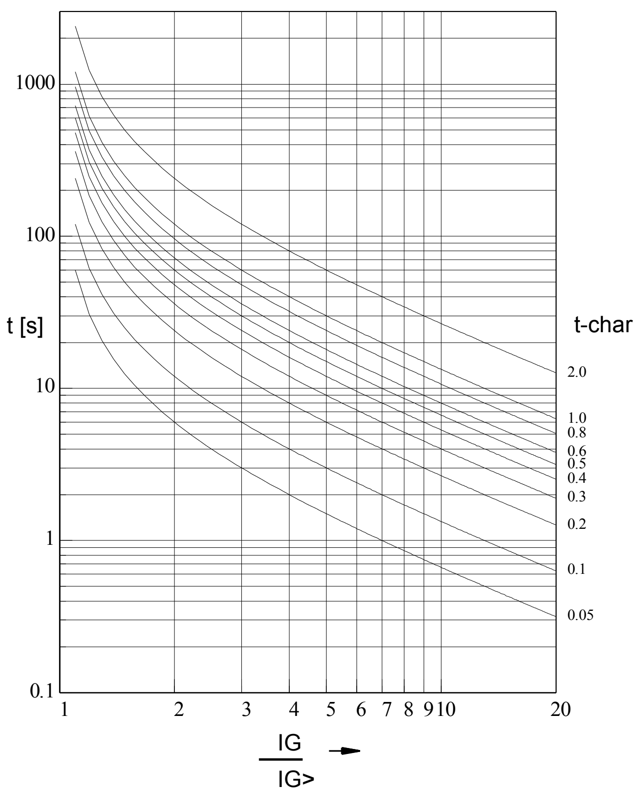
Normal Inverse (NINV)



Very Inverse (VINV)

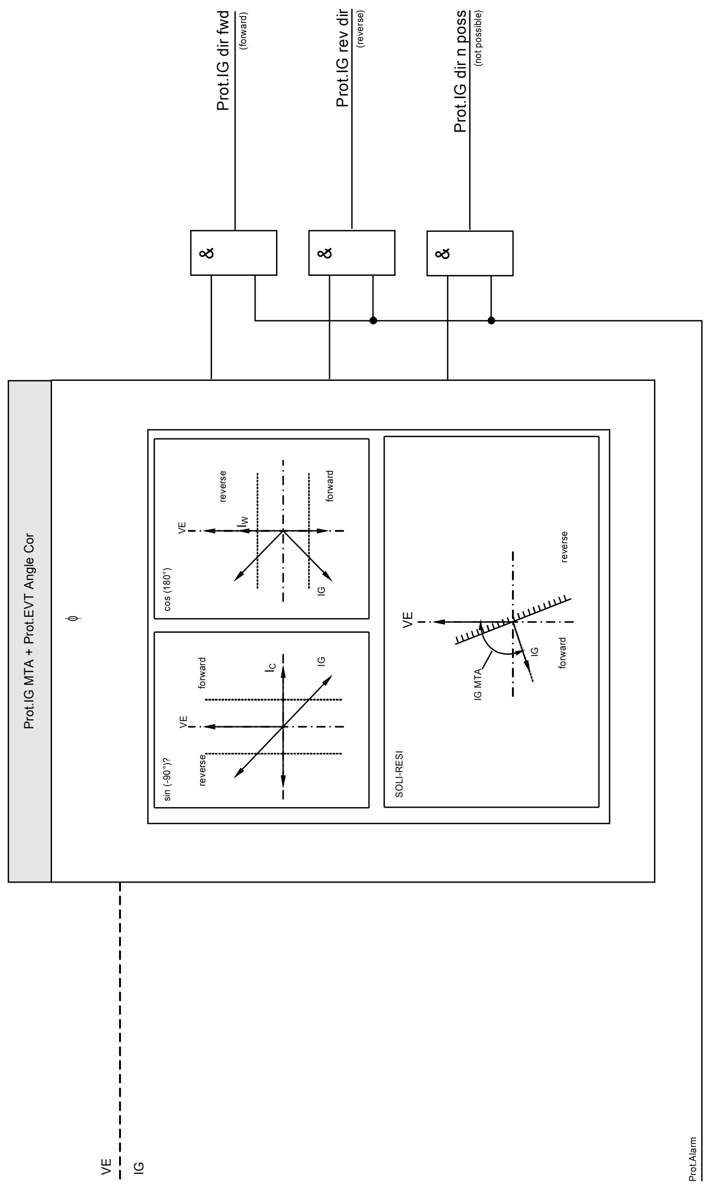


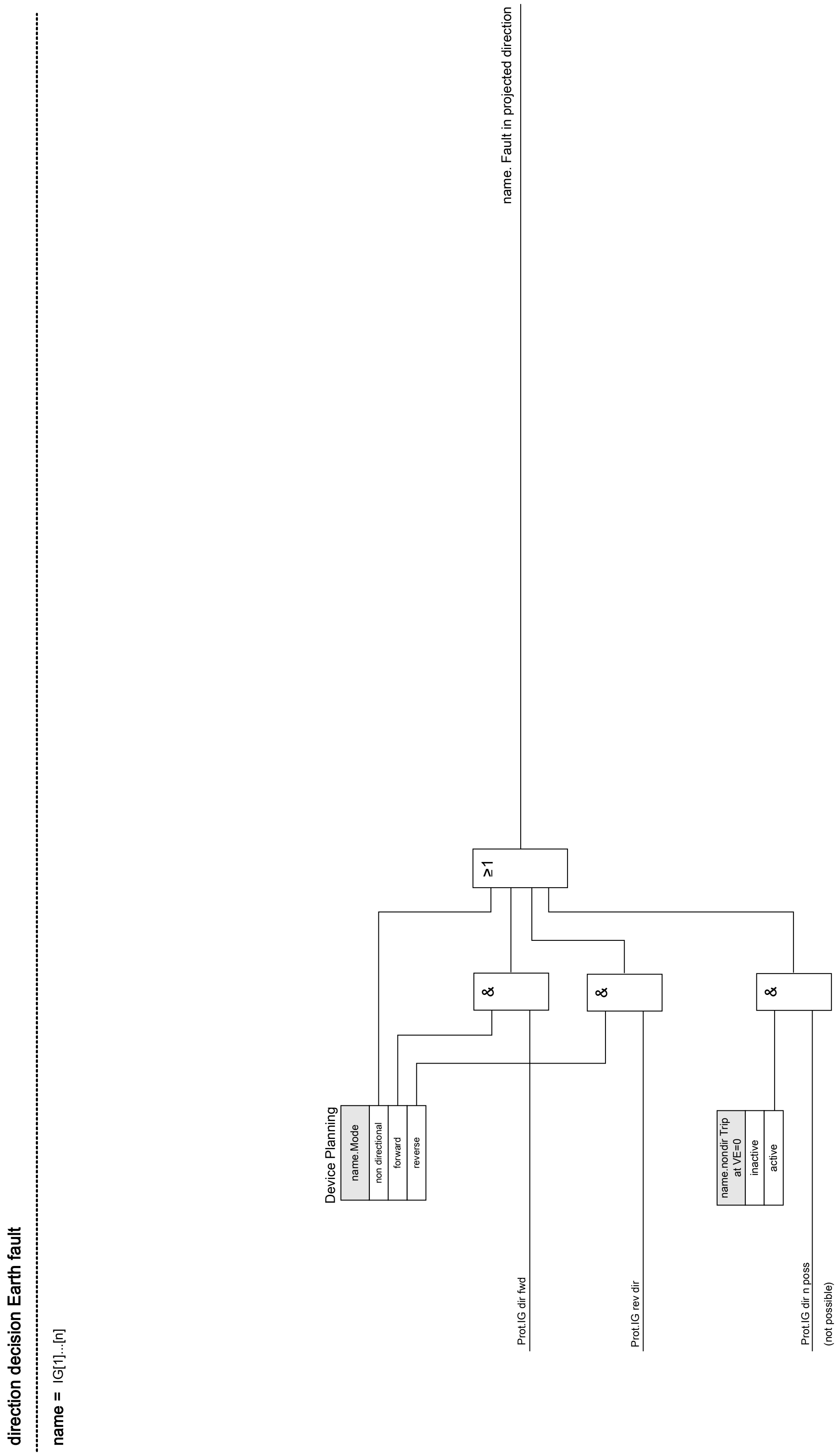
Extremely Inverse (EINV)

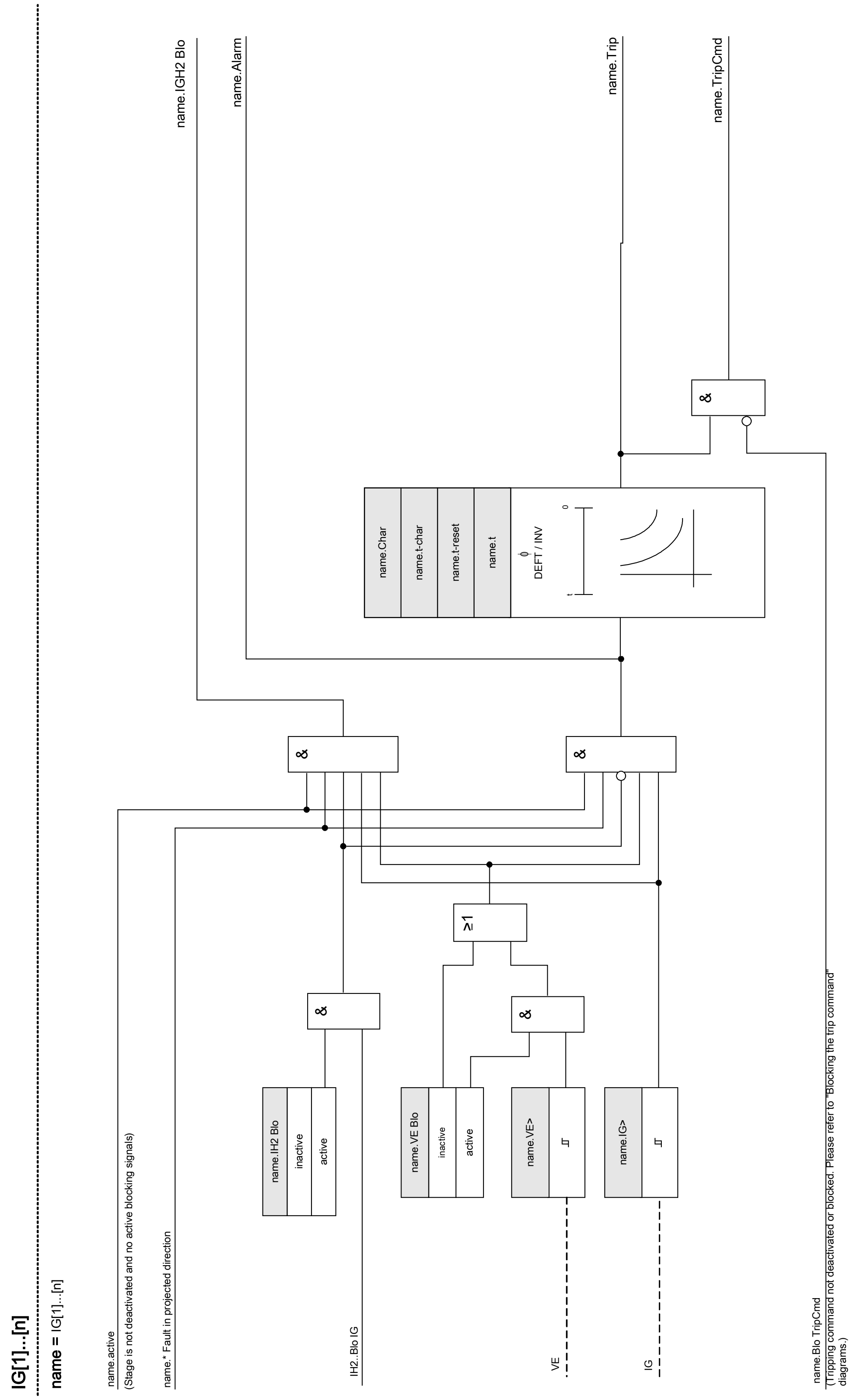


Long Time Inverse (LINV)

Prot - Earth fault - direction detection




direction decision Earth fault
name = IG[1]...[n]
name. Fault in projected direction
≥1
&
&
&
Device Planning
name.Mode
non directional
forward
reverse
name.nondir Trip at VE=0
inactive
active
Prot.IG dir fwd
Prot.IG rev dir
Prot.IG dir n poss
(not possible)


IG[1]...[n]
name = IG[1]...[n]
name.active
(Stage is not deactivated and no active blocking signals)
name.* Fault in projected direction
IH2..Blo IG
VE
IG
name.Blo TripCmd
(Tripping command not deactivated or blocked. Please refer to "Blocking the trip command" diagrams.)
name.IH2 Blo
inactive
active
name.VE Blo
inactive
active
name.VE>
name.IG>
&
&
&
&
&
≥1
name.Char
name.t-char
name.t-reset
name.t
DEFT / INV
name.IGH2 Blo
name.Alarm
name.Trip
name.TripCmd

Device Planning Parameters of the Ground Fault Protection

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, non directional, forward, reverse	non directional	[Device Planning]

Global Protection Parameters of the Ground Fault Protection

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /I-Prot /IG[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /I-Prot /IG[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the stage, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /I-Prot /IG[1]]
Ex rev Interl	External blocking of the module by external reverse interlocking, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /I-Prot /IG[1]]

Setting Group Parameters of the Ground Fault Protection

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<n> /I-Prot /IG[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /I-Prot /IG[1]]
Ex rev Interl Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "Ex rev Interl Fc = active".	inactive, active	inactive	[Protection Para /<n> /I-Prot /IG[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<n> /I-Prot /IG[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo TripCmd Fc=active".	inactive, active	inactive	[Protection Para /<n> /I-Prot /IG[1]]
IG>	If the pick-up value is exceeded, the module/stage will be started. Only available if: Characteristic = INV	0.01 - 20.00*In	0.01*In	[Protection Para /<n> /I-Prot /IG[1]]
Char	Characteristic	DEFT, NINV, VINV, EINV, LINV	DEFT	[Protection Para /<n> /I-Prot /IG[1]]
VE Blo	VE Blo = active means that the IE-stage will only excite if a residual voltage higher than the pick-up value is measured at the same time. VE Blo = inactive means that the excitation of the IE stage does not depend on any residual voltage stage.	inactive, active	inactive	[Protection Para /<n> /I-Prot /IG[1]]
VE>	Pickup value Only available if: VE Blo = active	0.01 - 2.00*Vn	1.00*Vn	[Protection Para /<n> /I-Prot /IG[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
t	Tripping delay Only available if: Characteristic = DEFT	0.00 - 300.00*s	0.00*s	[Protection Para /<n> /I-Prot /IG[1]]
t-char	Time multiplier/tripping characteristic factor Only available if: Characteristic = INV	0.05 - 2.00	1	[Protection Para /<n> /I-Prot /IG[1]]
t-reset	Reset time for intermittent phase failures (INV characteristics only) Only available if: Characteristic = INV	0.00 - 60.00*s	1.00*s	[Protection Para /<n> /I-Prot /IG[1]]
IH2 Blo	Blocking the trip command, if an inrush is detected.	inactive, active	inactive	[Protection Para /<n> /I-Prot /IG[1]]
nondir Trip at VE=0	Only relevant for current protection modules/stages with directional feature! The device will trip non directional if this parameter is set to active and no direction could be determined because no reference voltage (V=0) could be measured any more (e.g. if there is a three-phase short circuit close to the device). If this parameter is set to inactive, the protection stage will be blocked in case of V=0. Only available if: Device Planning: Earth current protection - Stage.Mode = directional	inactive, active	inactive	[Protection Para /<n> /I-Prot /IG[1]]

Ground Fault Protection Input States

Name	*Description*	*Assignment via*
ExBlo1-I	Module input state: External blocking1	[Protection Para /Global Prot Para /I-Prot /IG[1]]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /I-Prot /IG[1]]
ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command	[Protection Para /Global Prot Para /I-Prot /IG[1]]
Ex rev Interl-I	Module input state: External reverse interlocking	[Protection Para /Global Prot Para /I-Prot /IG[1]]

Ground Fault Protection Signals (Output States)

Name	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
Ex rev Interl	Signal: External reverse Interlocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Alarm	Signal: Alarm IE
Trip	Signal: Trip
TripCmd	Signal: Trip Command
IGH2 Blo	Signal: blocked by an inrush

Commisioning: Ground Fault Protection – non-directional [ANSI 50N, 51N]

Please test the non-directional earth overcurrent analog to the non-directional phase overcurrent protection.

Commissioning: Ground Fault Protection – directional [ANSI 50N, 51N, 67N]

Please test the directional earth overcurrent analog to the directional phase overcurrent protection.

ThR-Protection Module: Thermal Replica [ANSI 49]

ThR

The maximal permissible thermal loading capacity, and consequently the tripping delay of a component, depends on the amount of the flowing current at a specific time, the »previously existing load (current)« as well as on a constant specified by the component.

The thermal overload protection is in compliance with IEC255-8 (VDE 435 T301). A complete thermal replica function is implemented in the device as Homogeneous-Body Replica of the equipment to be protected and by taking the previously existing load into account. The protection function is of one step design, provided with a warning limit.

For this the device calculates the thermal load of the equipment by using the existing measured values and the parameter settings. When knowing the thermal constants, the temperature of the equipment can be established (simulated).

The general tripping times of the overload protection can be gathered from the following equation according to IEC 255-8:

$$t = t\text{-warm} \ln\left(\frac{I^2 - Ip^2}{I^2 - (K^*Ib)^2}\right)$$

Legend:

t = Tripping delay

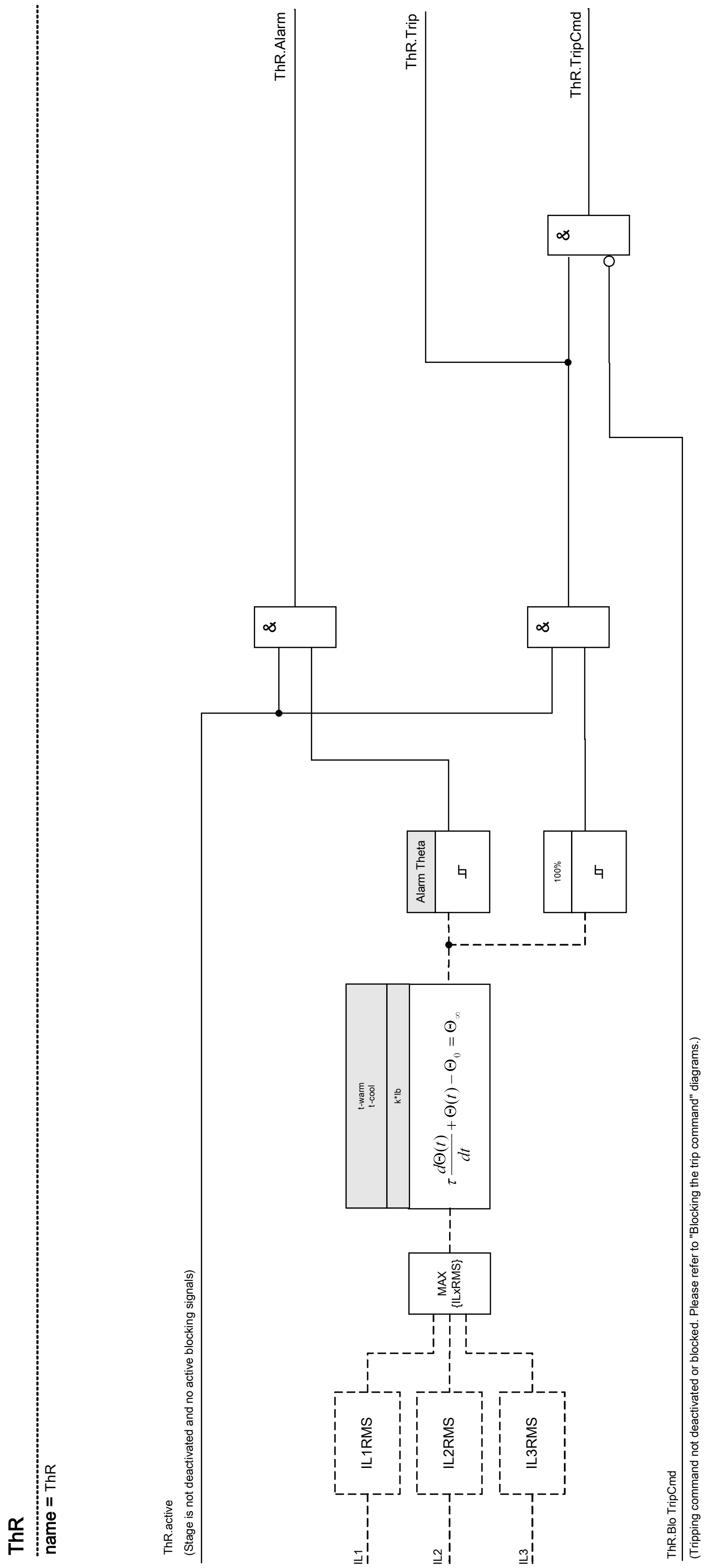
t-warm = Warming-up time constant

Ib = Base current: Maximum permissible thermal continuous current.

K = Over load factor: The maximum admissible thermal limit is defined/ calculated by the product of overload factor and basic current k*IB.

I = measured current (x In)

Ip = previously existing load


ThR
name = ThR
ThR.active
(Stage is not deactivated and no active blocking signals)
IL1
IL2
IL3
IL1RMS
IL2RMS
IL3RMS
MAX
(ILxRMS)
t-warm
t-cool
k*Ib
$\tau \frac{d\Theta(t)}{dt} + \Theta(t) - \Theta_0 = \Theta_\infty$
Alarm Theta
100%
&
&
&
ThR.Alarm
ThR.Trip
ThR.TripCmd
ThR.Blo TripCmd
(Tripping command not deactivated or blocked. Please refer to "Blocking the trip command" diagrams.)

Direct Commands of the Thermal Overload Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Reset	Reset the Thermal Replica	inactive, active	inactive	[Operation /Reset]

Device Planning Parameters of the Thermal Overload Module

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, use	use	[Device Planning]

Global Protection Parameters of the Thermal Overload Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /I-Prot /ThR]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /I-Prot /ThR]
ExBlo TripCmd	External blocking of the Trip Command of the module/the stage, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /I-Prot /ThR]

Setting Group Parameters of the Thermal Overload Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<n> /I-Prot /ThR]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /I-Prot /ThR]
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<n> /I-Prot /ThR]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo TripCmd Fc=active".	inactive, active	inactive	[Protection Para /<n> /I-Prot /ThR]
Ib	Base current: Maximum permissible thermal continuous current.	0.01 - 4.00*In	1.00*In	[Protection Para /<n> /I-Prot /ThR]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
K	Over load factor: The maximum admissible thermal limit is defined/calculated by the product of overload factor and basic current k*IB.	0.80 - 1.20	1.00	[Protection Para /<n> /I-Prot /ThR]
Alarm Theta	Pick-up value	50 - 100*%	80*%	[Protection Para /<n> /I-Prot /ThR]
τ-warm	Warming-up time constant	1 - 60000*s	10*s	[Protection Para /<n> /I-Prot /ThR]
τ-cool	Cooling time constant	1 - 60000*s	10*s	[Protection Para /<n> /I-Prot /ThR]

Thermal Overload Module Input States

Name	*Description*	*Assignment via*
ExBlo1-I	Module input state: External blocking1	[Protection Para /Global Prot Para /I-Prot /ThR]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /I-Prot /ThR]
ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command	[Protection Para /Global Prot Para /I-Prot /ThR]

Signals of the Thermal Overload Signals (Output States)

Name	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Alarm	Signal: Alarm Thermal Overload
Trip	Signal: Trip
TripCmd	Signal: Trip Command
Reset Theta	Signal: Resetting Thermal Replica

Thermal Overload Module Values

Value	*Description*	*Menu path*
Theta	Measured value: Theta	[Operation /Measured values /ThR]
t-Theta	Measured value (calculated/measured): Tripping delay	[Operation /Measured values /ThR]

Thermal Overload Module Statistics

Value	*Description*	*Menu path*
Theta max	Theta maximum value	[Operation /Statistics /ThR]
Theta avg	Theta average value	[Operation /Statistics /ThR]
Theta min	Theta minimum value	[Operation /Statistics /ThR]

Commissioning: Thermal Replica [ANSI 49]

Object to be tested
Protective function *ThR*

Necessary means
- Three-phase current source
- Timer

Procedure
Calculate the tripping time for the current to be constantly impressed by using the formula for the thermal image.

NOTICE **The parameter of the temperature rise of the component »τ_w« has to be known to guarantee an optimal protection.**

$$t = t\text{-warm}\ \ln\left(\frac{I^2 - Ip^2}{I^2 - (K*Ib)^2}\right)$$

Legend:

t = Tripping delay

t-warm = Warming-up time constant

Ib = Base current: Maximum permissible thermal continuous current.

K = Over load factor: The maximum admissible thermal limit is defined/ calculated by the product of overload factor and basic current k*IB.

I = measured current (x In)

Ip = previously existing load

Testing the threshold values
Apply the current you have based your mathematical calculation on.

Testing the trip delay

NOTICE **The thermal capacity should be zero before the test is started. See »Measuring Values«.**

For testing the trip delay, a timer is to be connected to the contact of the associated trip relay.
Apply the current you have based your mathematical calculation on. The timer is started as soon as the current is applied and it is stopped when the relay trips.

Successful test result
The calculated tripping time and the fallback ratio comply with the measured values. For permissible deviations/tolerances, please see Technical Data.

I2>-Protection Module – Unbalanced Load Protection [ANSI 46]

Available stages:
I2>[1] ,I2>[2]

Asymmetrical loading of an electrical machine produces a negative-sequence field which heavily affects the rotor heavy in thermal respect or even can destroy it. The unbalanced load protection mainly prevents that the rotor warms-up to an inadmissible degree. The unbalanced load protection can also detect phase failures and transformer wiring errors.

NOTICE **Both elements, i.e. *I2>[1]* and *I2>[2]* are identically structured.**

Rating value I2> is the permitted continuous unbalanced load current of the machines (generator/engine) to be protected referring to the rated current of the device (not to the rated current of the machine!). This parameter for the individual step used as machine protection against overheating caused by unbalanced load current should be adjusted according to the permitted continuous unbalanced load current stated by the manufacturer of the generator/engine. For both steps trip characteristics are provided, namely a definite time characteristic (DEFT) and an inverse characteristic (INV).

The characteristic of the inverse curve is as follows:

$$t \leq \frac{K}{I2^2 - I2>^2}$$

Legend:

t = Tripping delay

K = Indicates the thermal load capability of the engine while running with 100% unbalanced load current.

I2> = If the pick-up value is exceeded, the module/stage will be started.

I2 = Measured value (calculated): Unbalanced load current

In the equation shown above the heating-up process is assumed by integration of the counter system current I2. When I2> is undershoot, the built-up heat amount will be reduced in line with the adjusted cooling-down constant “tau-cool”.

$$\mathrm{Theta}(t) = \mathrm{Theta}_0 * e^{-\frac{t}{t\text{-cool}}}$$

Legend:

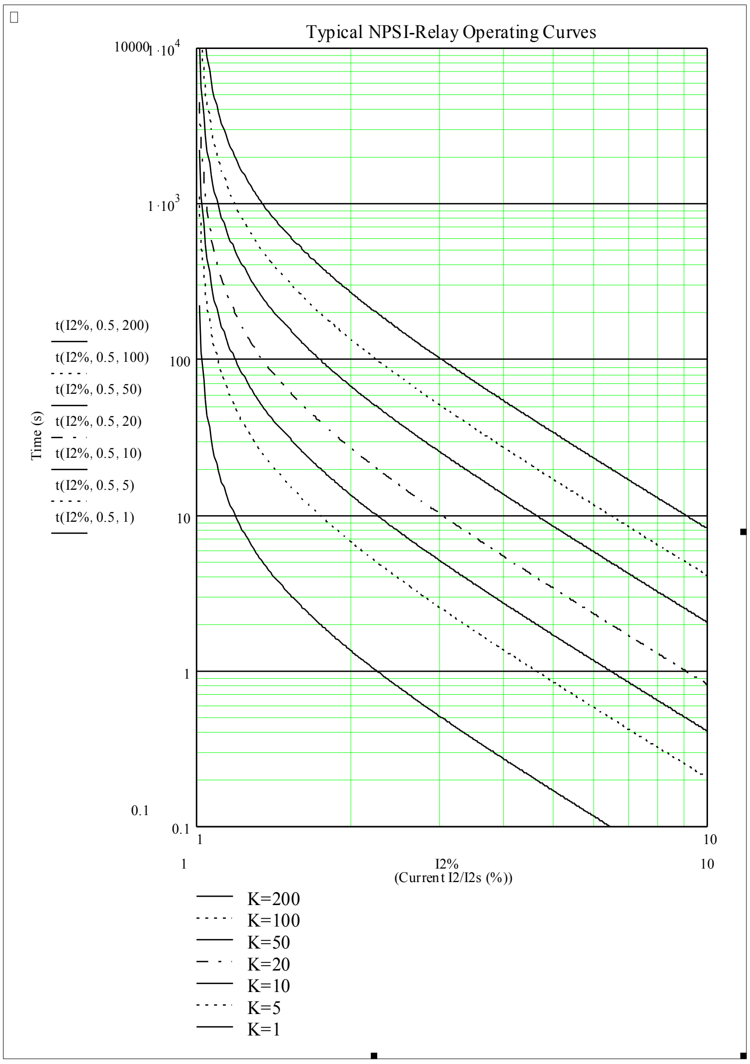
t = Tripping delay

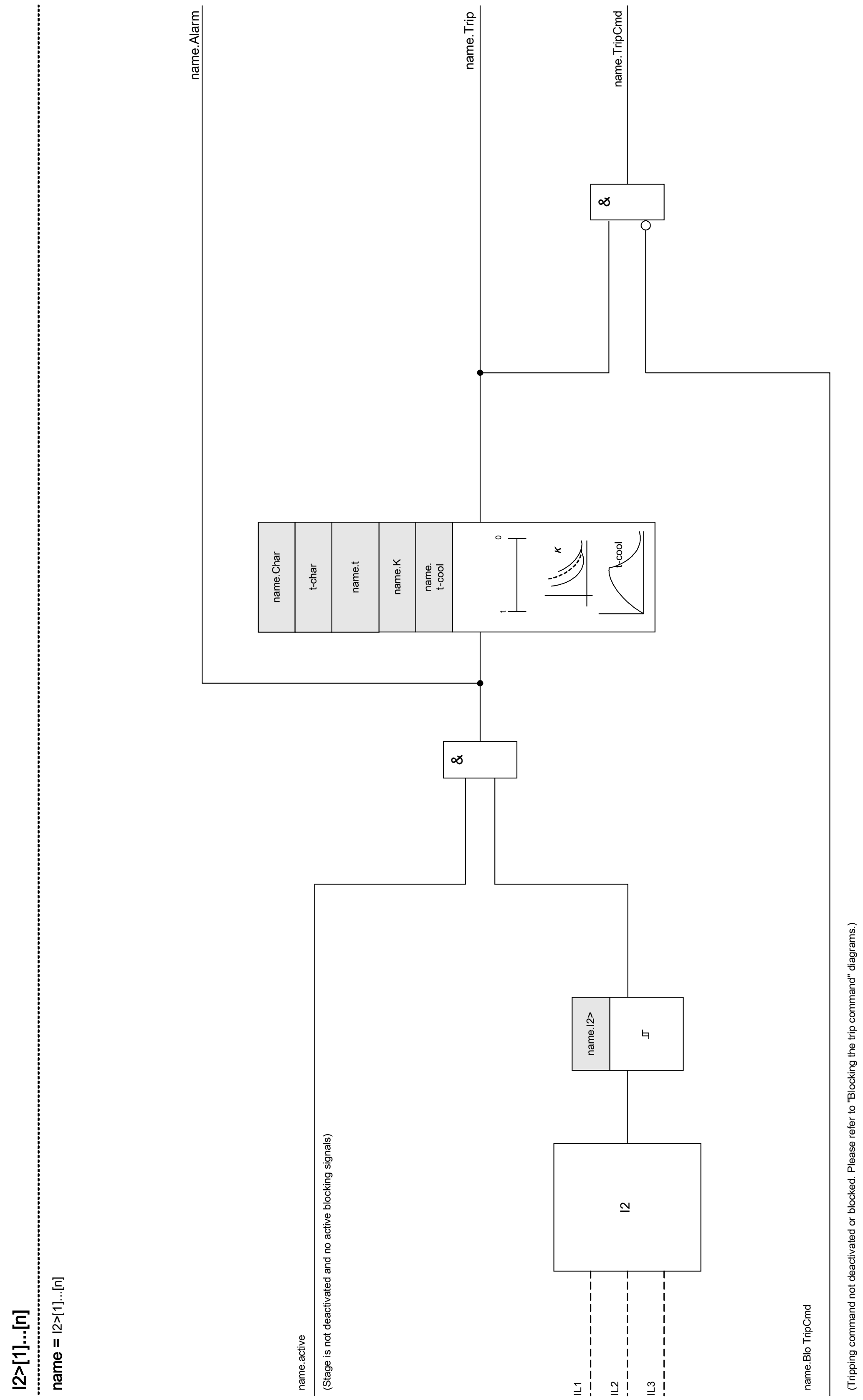
t-cool = Cooling time constant

Theta(t) = Momentanous heat (thermal) energy

Theta $_0$ = Heat (thermal) energy before the cooling down has started

If the heat amount is not reduced when the permitted unbalanced load current is overshoot again, the remaining heat amount will cause an earlier tripping.




I2>[1]...[n]
name = I2>[1]...[n]
name.active
(Stage is not deactivated and no active blocking signals)
IL1
IL2
IL3
I2
name.I2>
&
name.Char
t-char
name.t
name.K
name.
t-cool
K
t-cool
&
name.Blo TripCmd
(Tripping command not deactivated or blocked. Please refer to "Blocking the trip command" diagrams.)
name.Alarm
name.Trip
name.TripCmd

Device Planning Parameters of the Unbalanced Load Module

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, use	use	[Device Planning]

Global Protection Parameters of the Unbalanced Load Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /I-Prot /I2>[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /I-Prot /I2>[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the stage, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /I-Prot /I2>[1]]

Setting Group Parameters of the Unbalanced Load Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<n> /I-Prot /I2>[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /I-Prot /I2>[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<n> /I-Prot /I2>[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo TripCmd Fc=active".	inactive, active	inactive	[Protection Para /<n> /I-Prot /I2>[1]]
I2>	If the pick-up value is exceeded, the module/stage will be started.	0.01 - 4.00*In	0.01*In	[Protection Para /<n> /I-Prot /I2>[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Char	Characteristic	DEFT, INV	DEFT	[Protection Para /<n> /I-Prot /I2>[1]]
t	Tripping delay Only available if: Characteristic = DEFT	0.00 - 300.00*s	0.00*s	[Protection Para /<n> /I-Prot /I2>[1]]
K	Indicates the thermal load capability of the engine while running with 100% unbalanced load current. Only available if: Characteristic = INV	1.0 - 200.0	10.0	[Protection Para /<n> /I-Prot /I2>[1]]
τ-cool	If the unbalanced load current falls below the pick-up value, the cooling-off time is taken into account. If the unbalanced load exceeds the pick-up value again, than the saved heat within the electrical equipment will lead to an accelerated trip. Only available if: Characteristic = INV	0.0 - 60000.0	0.0	[Protection Para /<n> /I-Prot /I2>[1]]

Unbalanced Load Module Input States

Name	*Description*	*Assignment via*
ExBlo1-I	Module input state: External blocking1	[Protection Para /Global Prot Para /I-Prot /I2>[1]]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /I-Prot /I2>[1]]
ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command	[Protection Para /Global Prot Para /I-Prot /I2>[1]]

Unbalanced Load Module Signals (Output States)

Name	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Alarm	Signal: Alarm Negative Sequence
Trip	Signal: Trip
TripCmd	Signal: Trip Command

Commissioning: Unbalanced Load Protection [ANSI 46]

Object to be tested:
Test of the unbalanced load protection function

Necessary means
- Three-phase current source
- Timer

Procedure:

Check of the rotating field direction

- Ensure that the rotating field direction corresponds with the direction set in the field parameters.
- Feed-in a 3-phase nominal current.
- Change to menu »Measuring Values«
- Check the measuring value for the unbalanced current *»I2«*. The measuring value displayed for »*I2«* should be zero (within the physical measuring accuracy).

NOTICE

If despite a feeding symmetrical nominal current, the displayed value for »*I2«* is >zero (33%), than a left rotating field is falsely being fed.
Correct the direction of the rotating field.

- Now disconnect phase L1.
- Check again the measuring value of the unbalanced current »*I2«* in menu »Measuring Values«
  The measuring value of the asymmetrical current »*I2«* should now be 33%.
- Re-connect phase L1, but disconnect phase L2.
- Check once more the measuring value of the asymmetrical current I2 in menu »Measuring Values«.
  The measuring value of the asymmetrical current »*I2«* should be again 33%.
- Re-connect phase L2, but disconnect phase L3.
- Check again the measuring value of asymmetrical current »*I2«* in menu »Measuring Values«.
  The measuring value of the asymmetrical current »*I2«* should still be 33%.

Testing the threshold values
For testing the threshold value, a current has to be fed to phase 1 which is three times lower than the adjusted threshold value of »*I2«*. Now the current in phase 1 is to be reduced until the relay is activated.

Testing the trip delay
Impress a symmetrical three-phase current system (nominal currents). Switch off IL1 (the threshold value for »*I2*« must be below 33%). Measure the tripping time.

The present asymmetrical load »*I2*« corresponds with 1/3 of the existing phase current displayed.

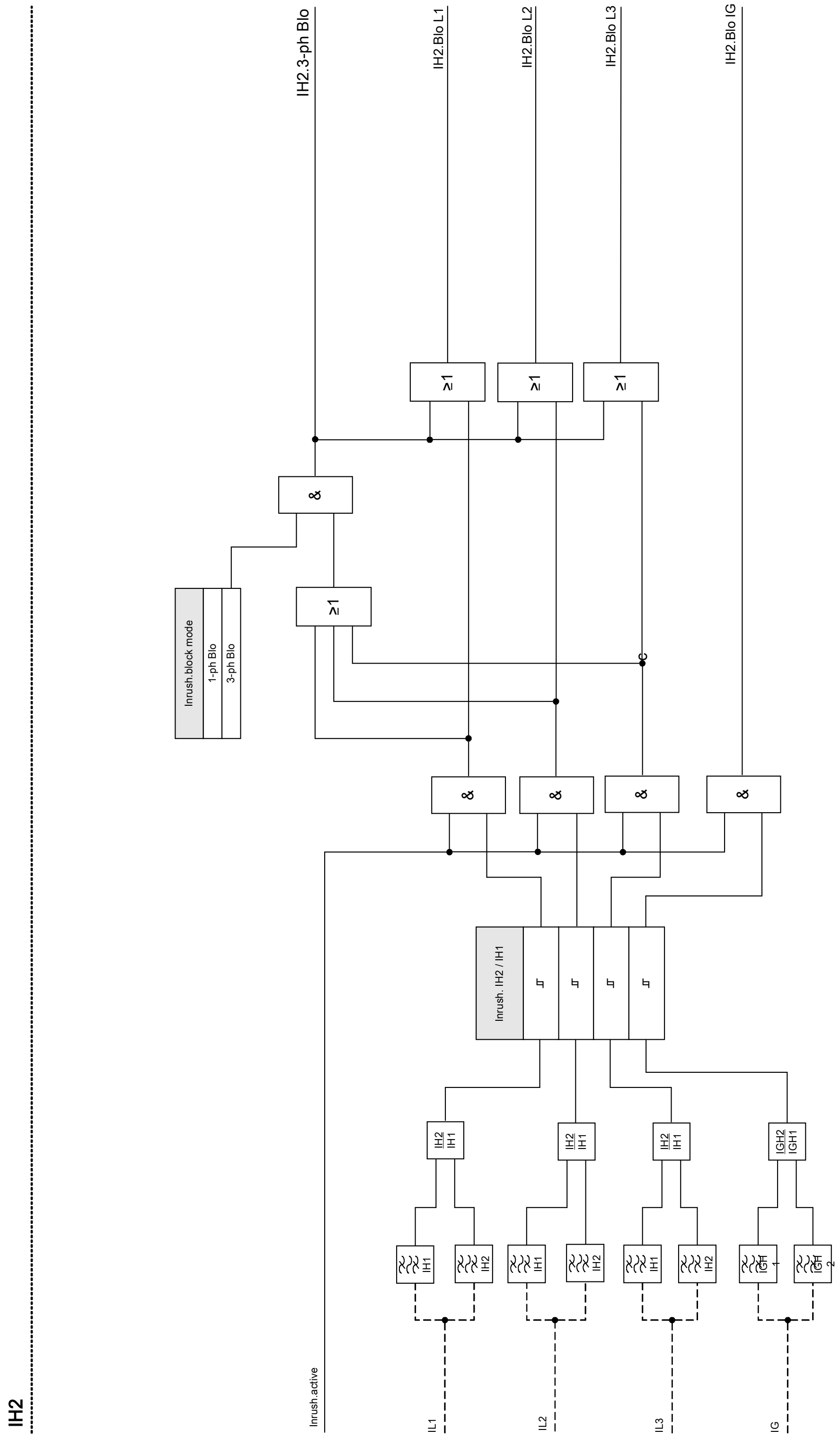
Testing the fallback ratio
The fallback ratio must not be higher than 0.95 times the threshold value.

Successful test result
The measured trip delays, threshold values and fallback ratios are within the permitted deviations/tolerances, specified under Technical Data.

IH2 Module – Inrush

IH2

The inrush module can prevent false trips caused by switching actions of saturated inductive loads. The ratio of the 2nd harmonic to the 1st harmonic is taken into account.



Device Planning Parameters of the Inrush Module

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, use	use	[Device Planning]

Global Protection Parameters of the Inrush module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /I-Prot /IH2]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /I-Prot /IH2]

Setting Group Parameters of the Inrush Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<n> /I-Prot /IH2]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /I-Prot /IH2]
IH2 / In	Maximum permissible percentage of the 2nd harmonic of the 1st harmonic.	10 - 40*%	15*%	[Protection Para /<n> /I-Prot /IH2]
block mode	1-ph Blo: If an inrush is detected in one phase, the corresponding phase of those modules will be blocked, where inrush blocking is set to active./3-ph Blo: If an inrush is detected in at least one phase, all three phases of those modules where inrush blocking is set to active will be blocked (cross blocking).	1-ph Blo, 3-ph Blo	1-ph Blo	[Protection Para /<n> /I-Prot /IH2]

Inrush Module Input States

Name	*Description*	*Assignment via*
ExBlo1-I	Module input state: External blocking1	[Protection Para /Global Prot Para /I-Prot /IH2]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /I-Prot /IH2]

Inrush Module Signals (Output States)

Name	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
Blo L1	Signal: Blocked L1
Blo L2	Signal: Blocked L2
Blo L3	Signal: Blocked L3
Blo IG	Signal: Blocking of the earth protection module
3-ph Blo	Signal: Inrush was detected in at least one phase - trip command blocked.

Commissioning: Inrush

NOTICE

Dependent on the parameterized inrush-blocking-mode (»*1-ph Blo or 3-ph Blo*«), the test procedure is different.

For mode »*1-ph-Blo*« the test has to be carried out first for each individual phase and then for all three phases together.

For mode »*3-ph-Blo*« the test is a three-phase one.

Object to be tested
Test of inrush blocking.

Necessary means
- three-phase current source with adjustable frequency
- three-phase current source (for the first harmonic)

Procedure (dependent on the parameterized blocking mode)

- Feed the current to the secondary side with nominal frequency.
- Feed abruptly current to the secondary side with double nominal frequency. The amplitude must exceed the preset ratio/threshold »*IH2/IN*«.
- Ascertain that the signal »Inrush Alarm« is generated now.

Successful test results
The signal »Inrush Alarm« is generated and the event recorder indicates the blocking of the current protection stage.

V-Protection Module – Voltage Protection [ANSI 27/59]

Available stages:
V[1] ,V[2] ,V[3] ,V[4]

WARNING

Whenever the setting range refers to *»Vn«*, *»Vn«* means the phase to phase voltage.

If the phase-to-neutral voltages (57.7 % of Vn) are connected to the measuring inputs of the device this fact has to be taken into account when setting the limit values.

The protection stages supervise the voltage that is fed to the terminals.

CAUTION

If the VT measurement location is not at the bus bar side but at the output side, the following has to be taken into account:

When disconnecting the line is it has to be ensured that by an *»External Blocking«* undervoltage tripping of the U<-elements cannot happen. This is realized through detecting of the CB position (via digital inputs).

When the aux. voltage is switched on and the measuring voltage has not yet been applied, undervoltage tripping has to be prevented by an *»External Blocking«*

CAUTION

In case of an fuse failure, it is important to block the *»U<-stages«* so that an undesired operation can be prevented.

NOTICE

All 4 voltage elements are identically structured and can optionally be projected as over- or undervoltage element.

NOTICE

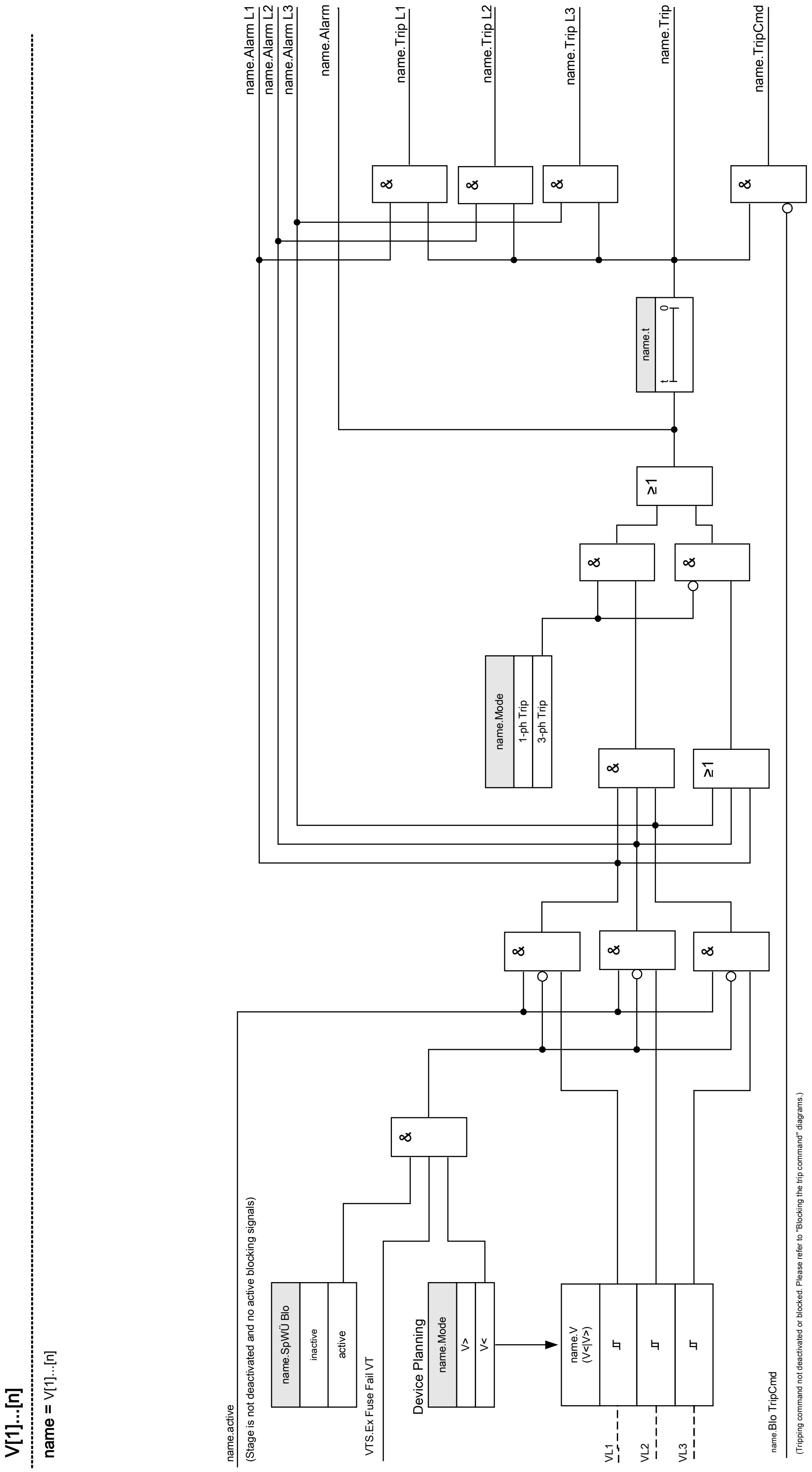
If phase voltages are applied to the measuring inputs of the device and field parameter *»VT con«* is set to *»Phase-to-neutral«*, the messages issued by the voltage protection module in case of actuation or trip should be interpreted as follows:

»V[1].Alarm L1« or »V[1].Trip L1« => alarm or trip caused by phase voltage *»VL1«*.
»V[1].Alarm L2« or »V[1].Trip L2« => alarm or trip caused by phase voltage *»VL2«*.
»V[1].Alarm L3« or »V[1].Trip L3« => alarm or trip caused by phase voltage *»VL3«*.

If, however, line-to-line voltages are applied to the measuring inputs and field parameter *»VT con«* is set to *»Phase to Phase«*, then the messages should be interpreted as follows:

»V[1].Alarm L1« or »V[1].Trip L1« => alarm or trip caused by line-to-line voltage *»V12«*.
»V[1].Alarm L2« or »V[1].Trip L2« => alarm or trip caused by line-to-line voltage *»V23«*.
»V[1].Alarm L3« or »V[1].Trip L3« => alarm or trip caused by line-to-line voltage *»V31«*

For each of the voltage protection stages it can be defined if it should be actuated in case over- or undervoltage was detected in all three phases, or if it already should be alarmed when the over- or undervoltage was detected in only one of the phases.


V[1]...[n]
name = V[1]...[n]
name.active
(Stage is not deactivated and no active blocking signals)
name.SpWÜ Blo
inactive
active
VTS.Ex Fuse Fail VT
Device Planning
name.Mode
V>
V<
name.V
(V<|V>)
VL1
VL2
VL3
name.Blo TripCmd
(Tripping command not deactivated or blocked. Please refer to "Blocking the trip command" diagrams.)
&
≥1
name.Mode
1-ph Trip
3-ph Trip
name.t
t
0
name.Alarm L1
name.Alarm L2
name.Alarm L3
name.Alarm
name.Trip L1
name.Trip L2
name.Trip L3
name.Trip
name.TripCmd

Device Planning Parameters of the Voltage Protection Module

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, V>, V<	V[1]: V> V[2]: V< V[3]: V> V[4]: V>	[Device Planning]

Global Protection Parameters of the Voltage Protection Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /V-Prot /V[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /V-Prot /V[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the stage, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /V-Prot /V[1]]

Setting Group Parameters of the Voltage Protection Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	V[1]: active V[2]: active V[3]: inactive V[4]: inactive	[Protection Para /<n> /V-Prot /V[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /V-Prot /V[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<n> /V-Prot /V[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo TripCmd Fc=active".	inactive, active	inactive	[Protection Para /<n> /V-Prot /V[1]]
Mode	Alarm criterion for the voltage protection stage.	1-ph Trip, 3-ph Trip	1-ph Trip	[Protection Para /<n> /V-Prot /V[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
V>	Pick-up value Only available if: Device Planning: V.Mode = V>	0.01 - 2.00*Vn	V[1]: 1.1*Vn V[2]: 1.20*Vn V[3]: 1.20*Vn V[4]: 1.20*Vn	[Protection Para /<n> /V-Prot /V[1]]
V<	Pick-up value Only available if: Device Planning: V.Mode = V<	0.01 - 2.00*Vn	V[1]: 0.80*Vn V[2]: 0.9*Vn V[3]: 0.80*Vn V[4]: 0.80*Vn	[Protection Para /<n> /V-Prot /V[1]]
VTS Blo	Blocking if a voltage transformer failure is detected. Only available if: Device Planning: V.Mode = V<	inactive, active	inactive	[Protection Para /<n> /V-Prot /V[1]]
t	Tripping delay	0.00 - 300.00*s	V[1]: 1*s V[2]: 1*s V[3]: 0.00*s V[4]: 0.00*s	[Protection Para /<n> /V-Prot /V[1]]

Voltage Protection Module Input States

Name	*Description*	*Assignment via*
ExBlo1-I	Module input state: External blocking1	[Protection Para /Global Prot Para /V-Prot /V[1]]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /V-Prot /V[1]]
ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command	[Protection Para /Global Prot Para /V-Prot /V[1]]

Voltage Protection Module Signals (Output States)

Name	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Alarm L1	Signal: Alarm L1
Alarm L2	Signal: Alarm L2
Alarm L3	Signal: Alarm L3
Alarm	Signal: Alarm voltage stage
Trip L1	Signal: Trip L1
Trip L2	Signal: Trip L2
Trip L3	Signal: Trip L3
Trip	Signal: Trip
TripCmd	Signal: Trip Command

Commissioning: Overvoltage Protection [ANSI 59]

Object to be tested
Test of the overvoltage protection elements, 3 x single-phase and 1 x three-phase (for each element)

CAUTION

Through testing the overvoltage protection stages, it can also be ensured that the wiring from the switchboard input terminals is correct. Wiring errors at the voltage measuring inputs might result in:

- **False tripping of the directional current protection Example: Device suddenly trips in reverse direction but it does not trip in forward direction.**
- **Wrong or no cos phi indication**
- **Errors with regard to power directions etc.**

Necessary means

- 3-phase AC voltage source
- Timer for measuring of the tripping time
- Voltmeter

Procedure (3 x single-phase, 1 x three-phase, for each element)

Testing the threshold values
For testing the threshold values and fallback values, the test voltage has to be increased until the relay is activated. When comparing the displayed values with those of the voltmeter, the deviation must be within the permissible tolerances.

Testing the trip delay
For testing the trip delay, a timer is to be connected to the contact of the associated trip relay.
The timer is started when the limiting value of the tripping voltage is exceeded and it is stopped when the relay trips.

Testing the fallback ratio
Reduce the measuring quantity to less than 97% of the trip value. The relay must only fall back at 97% of the trip value at the earliest.

Successful test result
The measured threshold values, trip delays and fallback ratios comply with those specified in the adjustment list. Permissible deviations/tolerances can be taken from the Technical Data.

Commissioning: Undervoltage Protection [ANSI 27]

This test can be carried out similar to the test for overvoltage protection (by using the related undervoltage values).

Please consider the following deviations:

- For testing the threshold values the test voltage has to be decreased until the relay is activated.
- For detection of the fallback value, the measuring quantity has to be increased so to achieve more than 103% of the trip value. At 103% of the trip value the relay is to fall back at the earliest.

VE-Protection Module – Residual Voltage [ANSI 59N]

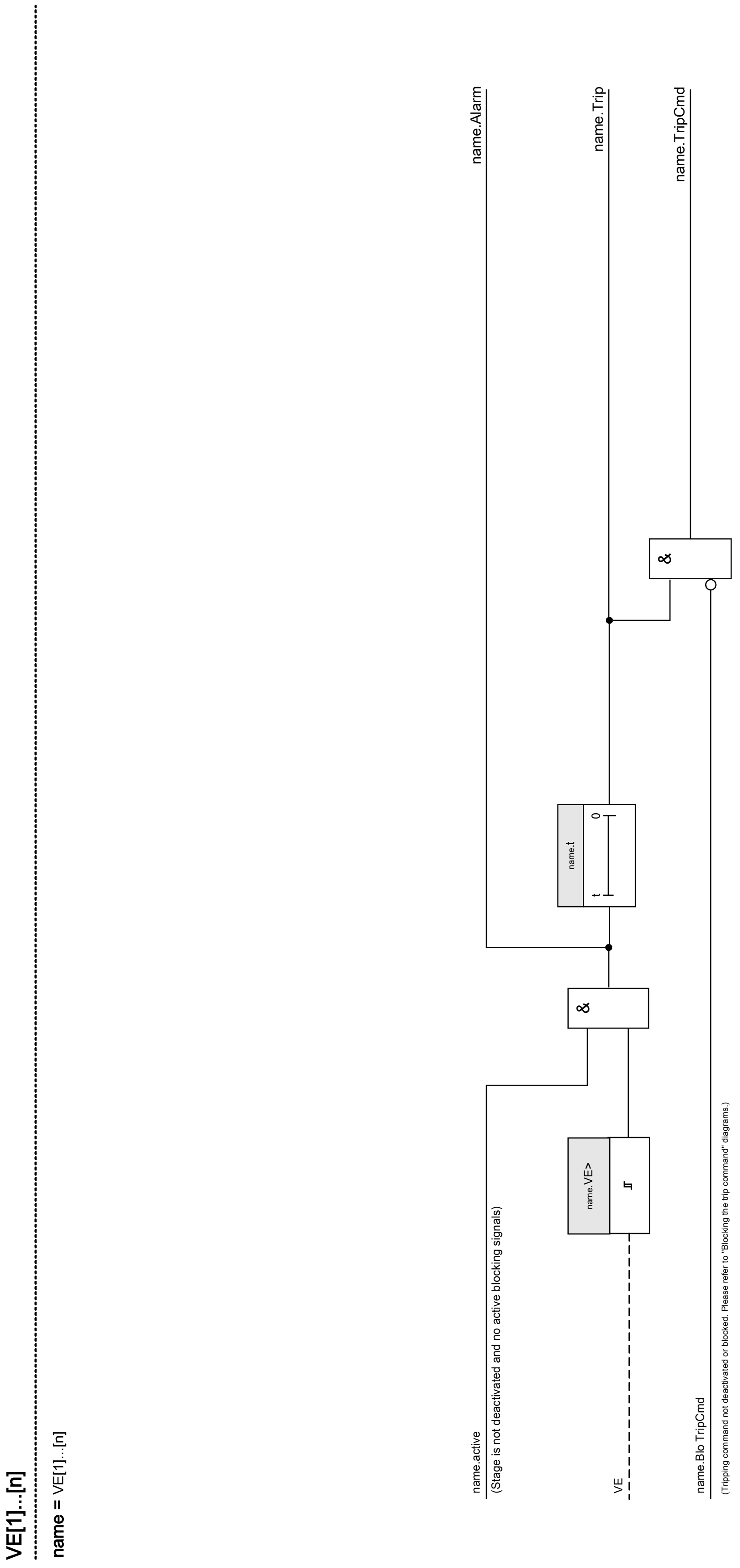
Available stages:
VE[1] ,VE[2]

NOTICE

Both elements of the residual voltage supervision *VE[1]* and *VE[2]* are identically structured.

The residual voltage can be measured in via the auxiliary winding da-dn (e-n) (open delta).

The residual voltage can be calculated only if the phase voltages (star connection) are connected to the measuring inputs of the device.


VE[1]...[n]
name = VE[1]...[n]
name.active
(Stage is not deactivated and no active blocking signals)
VE
name.VE>
&
name.t
t
0
name.Alarm
name.Trip
&
name.TripCmd
name.Blo TripCmd
(Tripping command not deactivated or blocked. Please refer to "Blocking the trip command" diagrams.)

Device Planning Parameters of the Residual Voltage Supervision Module

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, use	use	[Device Planning]

Global Protection Parameters of the Residual Voltage Supervision Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /V-Prot /VE[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /V-Prot /VE[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the stage, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /V-Prot /VE[1]]

Setting Group Parameters of the Residual Voltage Supervision Module.

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<n> /V-Prot /VE[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /V-Prot /VE[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<n> /V-Prot /VE[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo TripCmd Fc=active".	inactive, active	inactive	[Protection Para /<n> /V-Prot /VE[1]]
VE>	Pickup value	0.01 - 2.00*Vn	1*Vn	[Protection Para /<n> /V-Prot /VE[1]]
t	Tripping delay	0.00 - 300.00*s	0.00*s	[Protection Para /<n> /V-Prot /VE[1]]

Residual Voltage Supervision Module Input States

Name	*Description*	*Assignment via*
ExBlo1-I	Module input state: External blocking1	[Protection Para /Global Prot Para /V-Prot /VE[1]]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /V-Prot /VE[1]]
ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command	[Protection Para /Global Prot Para /V-Prot /VE[1]]

Residual Voltage Supervision Module Signals (Output States)

Name	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Alarm	Signal: Alarm Residual Voltage Supervision-stage
Trip	Signal: Trip
TripCmd	Signal: Trip Command

Commissioning: Residual Voltage Protection - Measured [ANSI 59N]

Object to be tested
Residual voltage protection stages.

Necessary components
- 1-phase AC voltage source
- Timer for measuring of the tripping time
- Voltmeter

Procedure (for each element)

Testing the threshold values
For testing the threshold and fallback values, the test voltage at the measuring input for the residual voltage has to be increased until the relay is activated. When comparing the displayed values with those of the voltmeter, the deviation must be within the permissible tolerances.

Testing the trip delay
For testing the trip delay a timer is to be connected to the contact of the associated trip relay.
The timer is started when the limiting value of the tripping voltage is exceeded and it is stopped when the relay trips.

Testing the fallback ratio
Reduce the measuring quantity to less than 97% of the trip value. The relay must only fall back at 97% of the trip value at the earliest.

Successful test result
The measured threshold values, trip delays and fallback ratios comply with those specified in the adjustment list. Permissible deviations/tolerances can be taken from the Technical Data.

Commissioning: Residual Voltage Protection - Calculated [ANSI 59N]

Object to be tested
Test of the residual voltage protection elements

Necessary means
- 3-phase voltage source

NOTICE **Calculation of the residual voltage is only possible if phase voltages (star) were applied to the voltage measuring inputs and if *»VT con=phase-to-neutral«* and *»EVT con=calculated«* were set in the field parameters.**

Procedure
- Feed a three-phase, symmetrical voltage system (Un) into the voltage measuring inputs of the relay.
- Set the limiting value of UE[x] to 20% Un.
- Disconnect the phase voltage at two measuring inputs (symmetrical feeding at the secondary side has to be maintained).
- Now the »*UE«* measuring value has to be about 33% of the value Un.
- Ascertain that the signal »VE.ALARM« or »VE.TRIP« is generated now.

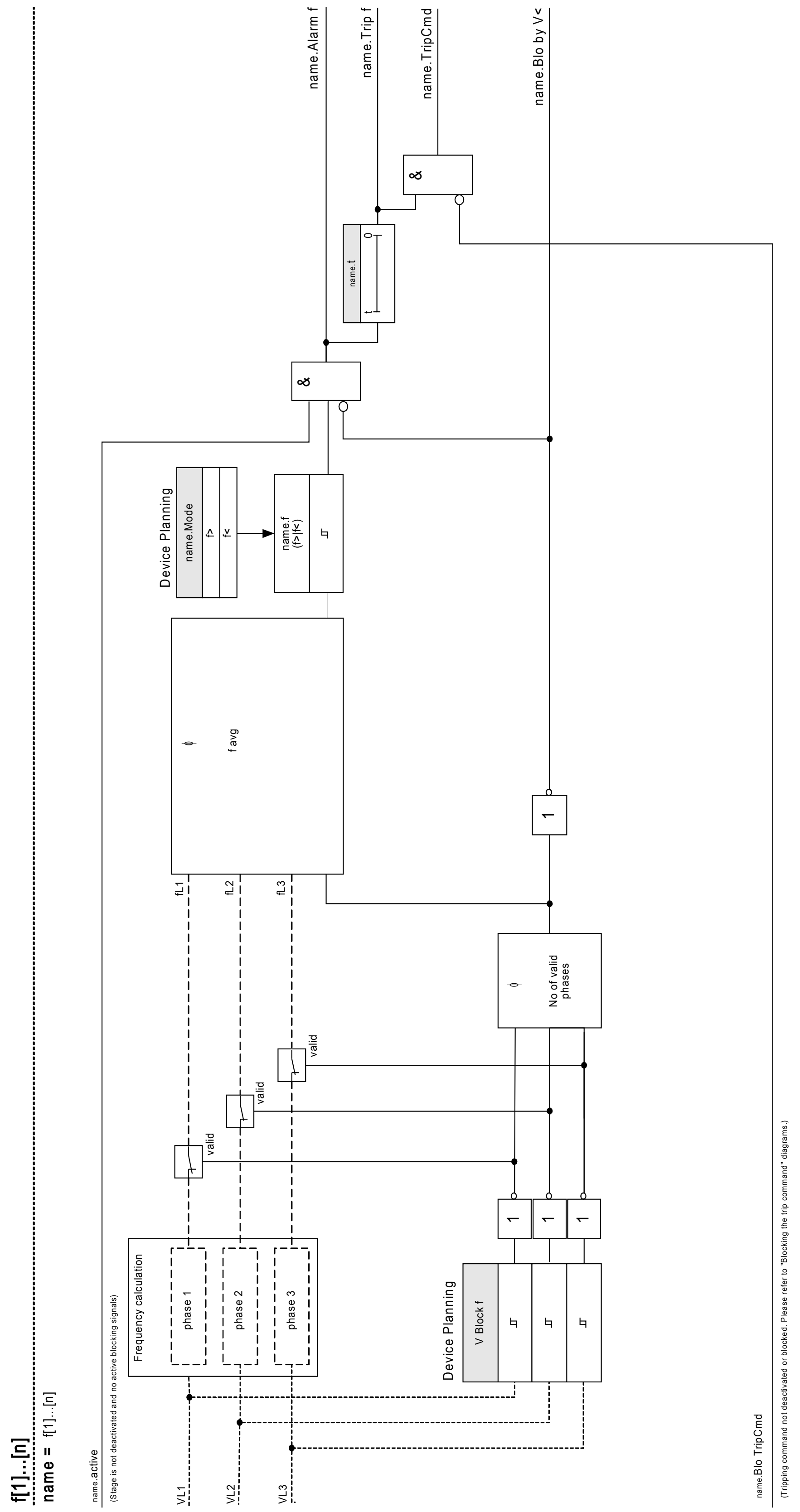
Successful test result
The signal »VE.ALARM« or »VE.TRIP« is generated.

f-Protection Module – Frequency Protection [ANSI 81 O/U]

Available stages: 6
f[1] ,f[2] ,f[3] ,f[4] ,f[5] ,f[6]

NOTICE **All frequency protective elements *f[1]* to *f[6]* are identically structured and can be optionally projected as over- or underfrequency protection stages.**

NOTICE **The frequency is calculated as the average of the measured values of the three phase frequencies. Only valid measured frequency values are taken into account. If a phase voltage is no longer measurable, this phase will be excluded from the calculation of the average value.**


f[1]...[n]
name = f[1]...[n]
name.active
(Stage is not deactivated and no active blocking signals)
VL1
VL2
VL3
Frequency calculation
phase 1
phase 2
phase 3
valid
valid
valid
fL1
fL2
fL3
f avg
Device Planning
name.Mode
f>
f<
name.f
(f>|f<)
&
name.t
&
name.Alarm f
name.Trip f
name.TripCmd
name.Blo by V<
1
No of valid phases
1
1
1
Device Planning
V Block f
name.Blo TripCmd
(Tripping command not deactivated or blocked. Please refer to "Blocking the trip command" diagrams.)

Device Planning Parameters of the Frequency Protection Module

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, f<, f>	f[1]: f< f[2]: f> f[3]: f< f[4]: f< f[5]: f< f[6]: f<	[Device Planning]

Global Protection Parameters of the Frequency Protection Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /f-Prot /f[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /f-Prot /f[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the stage, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /f-Prot /f[1]]

Setting Group Parameters of the Frequency Protection Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	f[1]: active f[2]: active f[3]: inactive f[4]: inactive f[5]: inactive f[6]: inactive	[Protection Para /<n> /f-Prot /f[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /f-Prot /f[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<n> /f-Prot /f[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo TripCmd Fc=active".	inactive, active	inactive	[Protection Para /<n> /f-Prot /f[1]]
f>	Pick-up value for overfrequency. Only available if: Device Planning: f.Mode = f> or f> and df/dt or f> and DF/DT	40.00 - 70.00*Hz	51.00*Hz	[Protection Para /<n> /f-Prot /f[1]]
f<	Pick-up value for underfrequency. Only available if: Device Planning: f.Mode = f< or f< and df/dt or f< and DF/DT	40.00 - 70.00*Hz	49.00*Hz	[Protection Para /<n> /f-Prot /f[1]]
t	Tripping delay	0.00 - 3600.00*s	1.00*s	[Protection Para /<n> /f-Prot /f[1]]

Frequency Protection Module Input States

Name	*Description*	*Assignment via*
ExBlo1-I	Module input state: External blocking1	[Protection Para /Global Prot Para /f-Prot /f[1]]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /f-Prot /f[1]]
ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command	[Protection Para /Global Prot Para /f-Prot /f[1]]

Frequency Protection Module Signals (Output States)

Name	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
Blo by V<	Signal: Module is blocked by undervoltage.
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Alarm f	Signal: Alarm Frequency Protection
Trip f	Signal: Frequency has exceeded the limit.
TripCmd	Signal: Trip Command

Commissioning: Frequency Protection (Overfrequency) [ANSI 81 O]

Object to be tested
All parameterized overfrequency protection stages.

Necessary means
- Three-phase voltage source with variable frequency.
- Timer

Procedure

Testing the threshold values
- Keep on increasing the frequency until the respective frequency element is activated
- Note the frequency value.
- Disconnect the test voltage.

Testing the trip delay
- Set the test voltage to nominal frequency.
- Now connect a frequency jump (activation value) and then start a timer. Measure the tripping time at the relay output.

Testing the fallback ratio
Reduce the measuring quantity to less than 97% of the trip value. The relay must only fall back at 97% of the trip value at the earliest.

Successful test result
Permissible deviations/tolerances can be taken from the Technical Data.

Commissioning: Frequency Protection (Underfrequency) [ANSI 81 U]

For all parameterized underfrequency elements, this test can be carried out similar to the test for overfrequency protection (by using the related underfrequency values).

Please consider the following deviations:

- For testing the threshold values the frequency has to be decreased until the protection element is activated.

- For detection of the fallback ratio the measuring quantity has to be increased to more than 103% of the trip value. At 103% of the trip value the relay is to fall back at the earliest.

AR-Protection Module – Automatic Reclosure [ANSI 79] (option)

AR

Module *AR* is used for auto reclosing of overhead lines.

CAUTION **The start timer must not exceed the supervision timer. Otherwise, a series of uncontrolled reclosure attempts can be provoked.**

Tripping times that are longer exceed the parameterized start time due to an abort of the AR attempt.

Thus, it has to be ensured by all means that:

Supervision time t-Superv > Start time t-Start > longest tripping time

CAUTION **The AR-module requires a signal »CB READY«.**

NOTICE **An AR-cycle can be stopped by one of 6 assignable blocking signals.**

AR procedure:

Initialization/Activation
The state of the AR changes from the inactive to the active state when parameter *»Function = active«* is selected and at least one (authorized) protective function is allocated to the AR and provided that the AR-module is not being blocked by an active blocking signal.

AR activated
When the AR is activated, this state is called »AR.ACTIVE« and is signaled as well.

Supervision time (applies only if the CB is switched on manually)
When position »CB POS ON« (THAT MEANS CB POS ON = TRUE and CB POS OFF = FALSE) is signaled, the AR module changes into the »AR.T-SUPERV« state and the supervision timer is started. The supervision time is to prevent that the AR will be started by a protection function on a faulty line after a manual CB-Switch-ON command. While the supervision time(r) is running down, no auto reclosure attempt can be started.

AR ready
After expiration of the supervision time, the AR module is ready to switch on the CB after a trip by an AR authorized protection module.

Starting the AR
An alarm or trip of an AR authorized protection stage (up to 6 start functions) sets the AR module in the »AR.RUNNING« state. At the same time, the *»start time(r)«* is started. An reclosure attempt will only be started, if the trip command of the AR authorized protection function is given within the set start time/duration. The location and the resistance of the fault have an direct impact on the tripping delay (Inverse characteristics). Via the start time you have a influence on whether far remote and high resistance failures should start (only inverse characteristics) a reclosure attempt or not.

Starting the dead time
If the Off-command is given out to the CB and the device can clearly detect within the start time the OFF position of the CB (that means CB Pos On = false and CB Pos Off = true) then the dead time(r) will be started.

Dead time (»AR.t-dead«)
The AR module waits for the dead time to finish. When this time has elapsed it is checked if the CB is still in OFF-position and if the CB is ready for reclosing (e.g. Function: CB ready?). Additionally it is checked whether another trip exists and if the synchronization signal is active (option) before the reclosing command is actually issued. If the result of the check is negative this puts the AR in the »Ar.t-Superv« state; the AR is being blocked for this time.

For phase and earth faults or for a start from external trips individual dead times can be parameterized. When trips are caused by phase fault or external trips via digital inputs the dead time *»t DPn«* is always used (the letter »n« stands for the number of the present AR shot).
When trips are caused by faults in the grounding system the dead time *»t DEn«* is always used (the letter »n« stands for the number of the present AR shot).

Dead time is expired – issuing the CB on command

If the dead time has expired the CB on command is issued to the circuit breaker if:

- No active blocking
- The circuit breaker is ready for operation.
- There is no pending trip command of an AR authorized protection function.
- The CB is clearly in the OFF position that means CB Pos On = false and CB Pos Off = true.
- If a synchronous check is parameterized, the device must recognize the Sync-Signal during t-sync is running.

If all the pre-conditions are fulfilled the CB on command will be given out at most as long as »*t-CB on Cmd*«. The command will be terminated if the CB is clearly in the ON position that means CB Pos On = true and CB Pos Off = false. The counters are incremented.

Test – Was the auto reclosure attempt successful?

The reclosure attempt has been successful if and only if:

1. Not later than the »*t-CB On Cmd*« timer has expired the CB is clearly in the ON-position that means CB Pos On = true and CB Pos Off = false.
2. Within the supervision time no new alarm/trip, caused by an AR-authorized protection function, occurs (otherwise the AR-cycle will be aborted).
3. The AR-module is not aborted by any blocking or abort signal.

NOTICE

If an alarm/trip is generated by an AR authorized protection function while the supervision/discrimination timer runs down the AR-module is put back into the state AR ready if and only if the maximum number of AR-cycles is not reached yet. Otherwise the AR will be broken up/stopped and the signal »AR.failed« will be given out.

If the reclosure attempt has been successful, the signal AR.successful will be issued.

External AR Blockade
The input signal »AR.EXBLO-I« changes the running AR into the »AWE.EXBLO« state, i.e. the started AR action is interrupted and blocked. The blockade is only cancelled when this signal is not applied any more. But precondition for this blockage is the activated parameter »*ExBlo Fc«*. If the blocking signal is no longer active and after the blocking time has expired, the AR module will fall back into the ready state.

Volitional Abort of the AR
An AR-cycle can be stopped by one of 6 assignable blocking signals »AWE.ABORT:«. If the Abort Signal is gone the AR-Module checks the position of the CB. If the CB is in the On-Position, the AR-Module starts the dead time. After expiring of the dead time the module falls back into the state »AR.READY«. If the CB is in the Off-Position, the AR-Module will wait for a manual switch on of the CB. If the CB is in the On-Position while the AR is aborted, the »AR.SUCCESSFUL« command could be given out if at least one reclosure attempt has taken place.

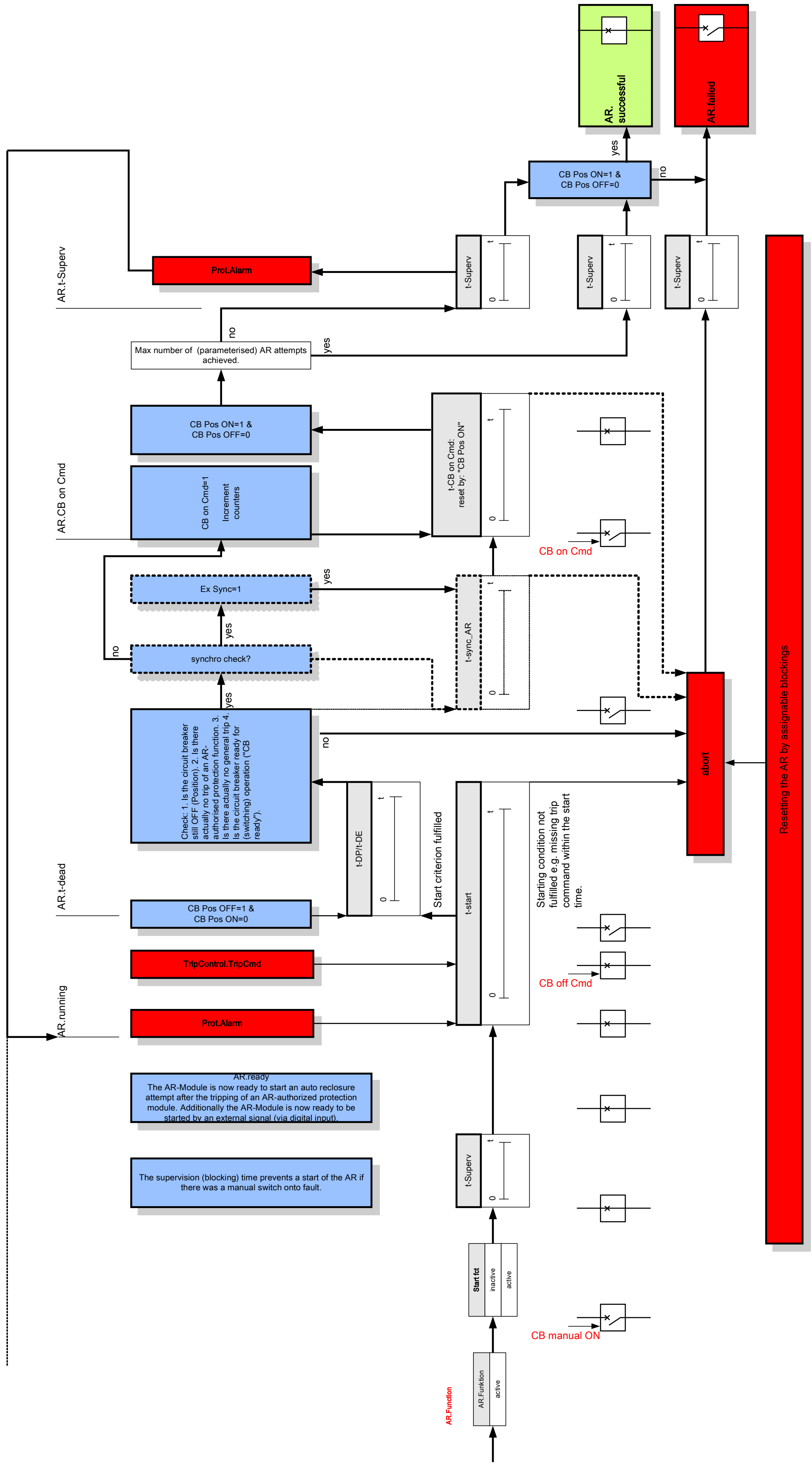
NOTICE

Via the fast trip the AR-module is able to trip the circuit breaker ahead of the protection stage that has activated the AR-module.

As a general rule a fast trip is either issued beforehand the first reclosure attempt or afterwards the last permitted reclosure attempt.

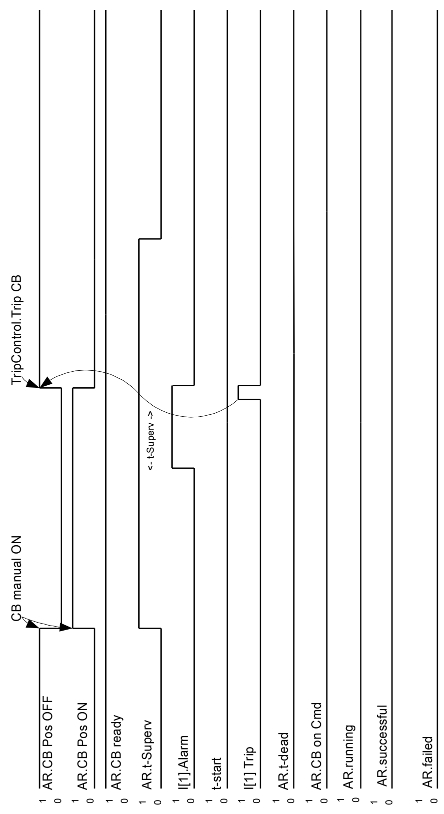
1. **Fast trip at the beginning (before the first reclosure attempt/shot is executed) Purpose: Keeping the complete feeder energized (After a short break)**
   For radial feeders it could make sense to switch of the complete line by a fast trip beforehand a line sections is switched of by time-graded protection. 80%-90% of the faults are not permanent. After 0,5 up to 1 s the line is probably no longer faulty and the complete line can be restored/re-energized. If the line is still faulty, segments of the line will be switched off selectively by the time-graded protection devices.

2. **Fast trip at the end (after the last permitted reclosure attempt/shot is executed) Purpose: To prevent unnecessary damage from the electrical equipment in case of permanent faults.**
   If the last reclosure attempt/shot is executed and the fault is still there/permanent, then the circuit breaker can be switched off by a fast trip beforehand the tipping delay of the protection module that has activated the AR-module has expired.

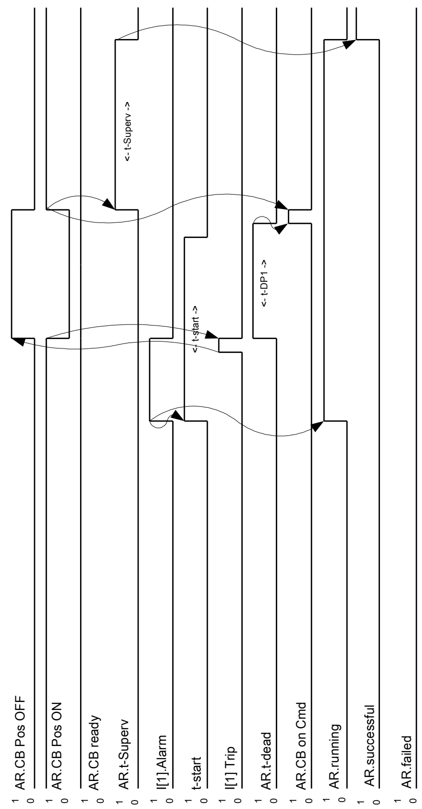


Caution
Tripping times that are longer than the parameterized operative time will cause an abortion of the AR.

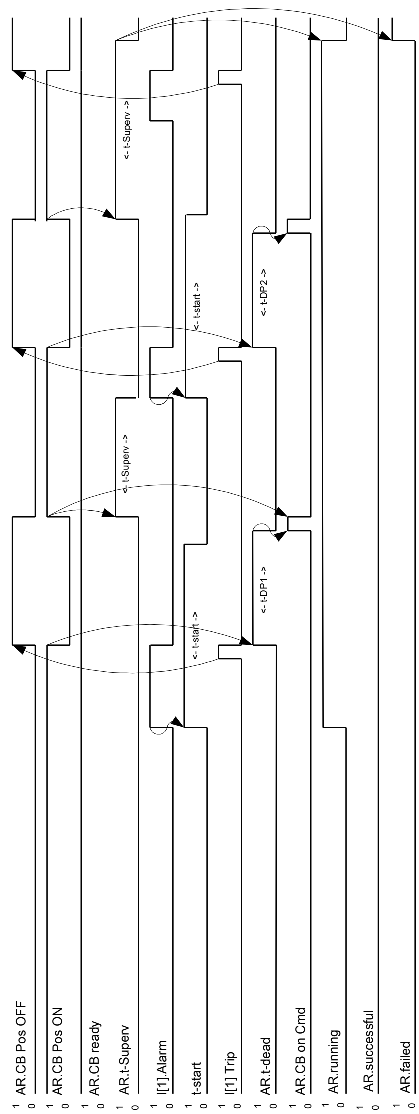
No start of the AR after manual switching on the CB, while supervision (blocking) timer is running.



Successful Auto Reclosure (1st Shot)



Twice auto reclosed, unsuccessful



Direct Commands of the Automatic Reclosure Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Res TotNo suc unsuc	Reset all statistic AR counters: Total number of AR, successful and unsuccessful no of AR.	inactive, active	inactive	[Operation /Reset]
Res Service Cr	Reset the Service Counters	inactive, active	inactive	[Operation /Reset]

Device Planning Parameters of the Module Automatic Reclosure

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, use	use	[Device Planning]

Global Protection Parameters of the Module Automatic Reclosure

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /AR]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /AR]
Ex Sync	Signal that indicates the synchronism	1..n, Assignment List	-	[Protection Para /Global Prot Para /AR]
CB Pos ON	The CB is in ON-position if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /AR]
CB Pos OFF	The CB is in OFF-position if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /AR]
CB ready	Circuit breaker is ready for operation if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /AR]

Setting Group Parameters of the Module Automatic Reclosure

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<n> /AR /General settings]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /AR /General settings]
Ex Sync	External Synchronisation OK	inactive, active	inactive	[Protection Para /<n> /AR /General settings]
Attempts	Maximum number of permitted reclosure attempts.	1 - 6	1	[Protection Para /<n> /AR /General settings]
t-start	Start timer - While the start timer runs down, an AR attempt can be started. Only if the trip command is given within the start time/duration an AR attempt could be started. The location and the resistance of the fault have a big influence on the tripping time. The start time has an impact on whether an AR attempt should be started when the fault is far away or high resistance.	0.1 - 10.00*s	1*s	[Protection Para /<n> /AR /General settings]
t-DP1	Dead time between trip and reclosure attempt for phase faults.	0.1 - 200.00*s	1*s	[Protection Para /<n> /AR /General settings]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
t-DP2	Dead time between trip and reclosure attempt for phase faults.	0.1 - 200.00*s	1*s	[Protection Para /<n> /AR /General settings]
t-DP3	Dead time between trip and reclosure attempt for phase faults.	0.1 - 200.00*s	1*s	[Protection Para /<n> /AR /General settings]
t-DP4	Dead time between trip and reclosure attempt for phase faults.	0.1 - 200.00*s	1*s	[Protection Para /<n> /AR /General settings]
t-DP5	Dead time between trip and reclosure attempt for phase faults.	0.1 - 200.00*s	1*s	[Protection Para /<n> /AR /General settings]
t-DP6	Dead time between trip and reclosure attempt for phase faults.	0.1 - 200.00*s	1*s	[Protection Para /<n> /AR /General settings]
t-DE1	Dead time between trip and reclosure attempt for earth faults	0.1 - 200.00*s	1*s	[Protection Para /<n> /AR /General settings]
t-DE2	Dead time between trip and reclosure attempt for earth faults	0.1 - 200.00*s	1*s	[Protection Para /<n> /AR /General settings]
t-DE3	Dead time between trip and reclosure attempt for earth faults	0.1 - 200.00*s	1*s	[Protection Para /<n> /AR /General settings]
t-DE4	Dead time between trip and reclosure attempt for earth faults	0.1 - 200.00*s	1*s	[Protection Para /<n> /AR /General settings]
t-DE5	Dead time between trip and reclosure attempt for earth faults	0.1 - 200.00*s	1*s	[Protection Para /<n> /AR /General settings]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
t-DE6	Dead time between trip and reclosure attempt for earth faults	0.1 - 200.00*s	1*s	[Protection Para /<n> /AR /General settings]
t-Superv	Supervision time	1 - 300.00*s	10*s	[Protection Para /<n> /AR /General settings]
t-CB on Cmd	The CB On control command is given out as long as the CB is in the on-position and the position indicator signal is being detected. If the CB is in the ON-Position, the Control-command will be cancelled/stopped and the time stage will be reset.	0.1 - 300.00*s	0.2*s	[Protection Para /<n> /AR /General settings]
t-sync_AR	Synchronizing time for synchronized AR start. Only available if: Ex Sync = active	0.01 - 100.00*s	0.01*s	[Protection Para /<n> /AR /General settings]
Service Alarm	As soon as the AR-Counter exceeds this number of reclosure attempts an alarm will be given out (overhauling of the CB)	1 - 65535	1000	[Protection Para /<n> /AR /General settings]
Service Blo	Too many auto reclosure attempts. If the parameterized number of AR cycles is reached, an alarm will be given out.	1 - 65535	65535	[Protection Para /<n> /AR /General settings]

Module Automatic Reclosure Input States

Name	*Description*	*Assignment via*
ExBlo1-I	Module input state: External blocking1	[Protection Para /Global Prot Para /AR]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /AR]
Ex Sync running-I	Module input state: External synchronism signal	[Protection Para /Global Prot Para /AR]
CB Pos ON-I	Module input state: Check back signal of the CB.	[Protection Para /Global Prot Para /AR]
CB Pos OFF-I	Module input state: The CB is in OFF-position	[Protection Para /Global Prot Para /AR]
CB ready-I	Module input state: CB ready	[Protection Para /Global Prot Para /AR]

Module Automatic Reclosure Signals (Output States)

Name	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
CB on Cmd	Signal: CB switch ON Command
Abort Blo	Signal: AR - The AR was aborted or blocked by an active function of the menu "Abort"
running	Signal: Auto Reclosing running
t-Superv	Signal: AR Supervision (blocking) time
Service Alarm	Signal: AR - Alarm, too many switching operations
Service Blo	Signal: AR - Service blocking - too many switching operations
successful	Signal: Auto Reclosing successful
failed	Signal: Auto Reclosing failure
t-dead	Signal: Dead time between trip and reclosure attempt
Res Statistics Cr	Signal: Reset all statistic AR counters: Total number of AR, successful and unsuccessful no of AR.
Res Service Cr	Signal: Reset the Service Counters for Alarm and Blocking

Automatic Reclosure Module Values

Value	*Description*	*Default*	*Size*	*Menu path*
Total number Cr	Total number of all executed Automatic Reclosures Attempts	0	0 - 65536	[Operation /Counter and RevData /AR]
Cr successfl	Total number of successfully executed Automatic Reclosures	0	0 - 65536	[Operation /Counter and RevData /AR]
Cr failed	Total number of unsuccessfully executed automatic reclosure attempts	0	0 - 65536	[Operation /Counter and RevData /AR]
AR Cr Alarm	Remaining numbers of ARs until Maintenance Alarm	1000	0 - 1000	[Operation /Counter and RevData /AR]
AR Cr Block	Remaining numbers of ARs until Maintenance Blocking	65536	0 - 65536	[Operation /Counter and RevData /AR]

Setting Group Parameters of the Start Functions and Fast Trip of the Module Automatic Reclosure

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
1.Startfct	Assignment	Start fct	-	[Protection Para /<n> /AR /Start / FT]
1.FT	Fast Trip Only available if a start function was assigned	inactive, active	inactive	[Protection Para /<n> /AR /Start / FT]
1.n FT	Fast Trip after AR attempt number. Only available if a start function was assigned	0 - 6	0	[Protection Para /<n> /AR /Start / FT]
1.t-FT	Trip delay for Fast Trip Only available if a start function was assigned	0 - 10.00*s	0*s	[Protection Para /<n> /AR /Start / FT]
2.Startfct	Assignment	Start fct	-	[Protection Para /<n> /AR /Start / FT]
2.FT	Fast Trip Only available if a start function was assigned	inactive, active	inactive	[Protection Para /<n> /AR /Start / FT]
2.n FT	Fast Trip after AR attempt number. Only available if a start function was assigned	0 - 6	0	[Protection Para /<n> /AR /Start / FT]
2.t-FT	Trip delay for Fast Trip Only available if a start function was assigned	0 - 10.00*s	0*s	[Protection Para /<n> /AR /Start / FT]

3.Startfct	Assignment	Start fct	-	[Protection Para /<n> /AR /Start / FT]
3.FT	Fast Trip Only available if a start function was assigned	inactive, active	inactive	[Protection Para /<n> /AR /Start / FT]
3.n FT	Fast Trip after AR attempt number. Only available if a start function was assigned	0 - 6	0	[Protection Para /<n> /AR /Start / FT]
3.t-FT	Trip delay for Fast Trip Only available if a start function was assigned	0 - 10.00*s	0*s	[Protection Para /<n> /AR /Start / FT]
4.Startfct	Assignment	Start fct	-	[Protection Para /<n> /AR /Start / FT]
4.FT	Fast Trip Only available if a start function was assigned	inactive, active	inactive	[Protection Para /<n> /AR /Start / FT]
4.n FT	Fast Trip after AR attempt number. Only available if a start function was assigned	0 - 6	0	[Protection Para /<n> /AR /Start / FT]
4.t-FT	Trip delay for Fast Trip Only available if a start function was assigned	0 - 10.00*s	0*s	[Protection Para /<n> /AR /Start / FT]
5.Startfct	Assignment	Start fct	-	[Protection Para /<n> /AR /Start / FT]
5.FT	Fast Trip Only available if a start function was assigned	inactive, active	inactive	[Protection Para /<n> /AR /Start / FT]

5.Startfct	Assignment	Start fct	-	[Protection Para /<n> /AR /Start / FT]
5.n FT	Fast Trip after AR attempt number. Only available if a start function was assigned	0 - 6	0	[Protection Para /<n> /AR /Start / FT]
5.t-FT	Trip delay for Fast Trip Only available if a start function was assigned	0 - 10.00*s	0*s	[Protection Para /<n> /AR /Start / FT]
6.Startfct	Assignment	Start fct	-	[Protection Para /<n> /AR /Start / FT]
6.FT	Fast Trip Only available if a start function was assigned	inactive, active	inactive	[Protection Para /<n> /AR /Start / FT]
6.n FT	Fast Trip after AR attempt number. Only available if a start function was assigned	0 - 6	0	[Protection Para /<n> /AR /Start / FT]
6.t-FT	Trip delay for Fast Trip Only available if a start function was assigned	0 - 10.00*s	0*s	[Protection Para /<n> /AR /Start / FT]

Module Automatic Reclosure Fast Trip Signals (Output States)

Name	*Description*
1.FT	Signal: Fast Trip
1.FT Cmd	Signal: Trip Command for Fast Tripping
2.FT	Signal: Fast Trip
2.FT Cmd	Signal: Trip Command for Fast Tripping
3.FT	Signal: Fast Trip
3.FT Cmd	Signal: Trip Command for Fast Tripping
4.FT	Signal: Fast Trip
4.FT Cmd	Signal: Trip Command for Fast Tripping
5.FT	Signal: Fast Trip
5.FT Cmd	Signal: Trip Command for Fast Tripping
6.FT	Signal: Fast Trip
6.FT Cmd	Signal: Trip Command for Fast Tripping

Setting Group Parameters of the AR Abort Functions

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
abort: 1	Abort the AR-cycle, if the state of the assigned signal is true. If the state of this function is true the AR will be aborted.	Abort	-	[Protection Para /<n> /AR /Abort]
abort: 2	Abort the AR-cycle, if the state of the assigned signal is true. If the state of this function is true the AR will be aborted.	Abort	-	[Protection Para /<n> /AR /Abort]
abort: 3	Abort the AR-cycle, if the state of the assigned signal is true. If the state of this function is true the AR will be aborted.	Abort	-	[Protection Para /<n> /AR /Abort]
abort: 4	Abort the AR-cycle, if the state of the assigned signal is true. If the state of this function is true the AR will be aborted.	Abort	-	[Protection Para /<n> /AR /Abort]
abort: 5	Abort the AR-cycle, if the state of the assigned signal is true. If the state of this function is true the AR will be aborted.	Abort	-	[Protection Para /<n> /AR /Abort]
abort: 6	Abort the AR-cycle, if the state of the assigned signal is true. If the state of this function is true the AR will be aborted.	Abort	-	[Protection Para /<n> /AR /Abort]

AR Abort Functions

Name	*Description*
-.-	No assignment
I[1].TripCmd	Signal: Trip Command
I[2].TripCmd	Signal: Trip Command
I[3].TripCmd	Signal: Trip Command
I[4].TripCmd	Signal: Trip Command
I[5].TripCmd	Signal: Trip Command
I[6].TripCmd	Signal: Trip Command
IG[1].TripCmd	Signal: Trip Command
IG[2].TripCmd	Signal: Trip Command
IG[3].TripCmd	Signal: Trip Command
IG[4].TripCmd	Signal: Trip Command
ThR.TripCmd	Signal: Trip Command
I2>[1].TripCmd	Signal: Trip Command
I2>[2].TripCmd	Signal: Trip Command
V[1].TripCmd	Signal: Trip Command
V[2].TripCmd	Signal: Trip Command
V[3].TripCmd	Signal: Trip Command
V[4].TripCmd	Signal: Trip Command
VE[1].TripCmd	Signal: Trip Command
VE[2].TripCmd	Signal: Trip Command
f[1].TripCmd	Signal: Trip Command
f[2].TripCmd	Signal: Trip Command
f[3].TripCmd	Signal: Trip Command
f[4].TripCmd	Signal: Trip Command
f[5].TripCmd	Signal: Trip Command
f[6].TripCmd	Signal: Trip Command
ExP[1].TripCmd	Signal: External Trip Command
ExP[2].TripCmd	Signal: External Trip Command
ExP[3].TripCmd	Signal: External Trip Command
ExP[4].TripCmd	Signal: External Trip Command
CBF.Alarm	Signal: Circuit Breaker Failure
TCS.Alarm	Signal: Alarm Trip Circuit Supervision

AR Start Functions

Name	*Description*
-	No assignment
I[1]	Phase Overcurrent Stage
I[2]	Phase Overcurrent Stage
I[3]	Phase Overcurrent Stage
I[4]	Phase Overcurrent Stage
I[5]	Phase Overcurrent Stage
I[6]	Phase Overcurrent Stage
IG[1]	Earth current protection - Stage
IG[2]	Earth current protection - Stage
IG[3]	Earth current protection - Stage
IG[4]	Earth current protection - Stage
I2>[1]	Unbalanced Load-Stage
I2>[2]	Unbalanced Load-Stage
ExP[1]	External Protection - Module
ExP[2]	External Protection - Module
ExP[3]	External Protection - Module
ExP[4]	External Protection - Module

Commissioning: Automatic Reclosure [ANSI 79]

Object to be tested
AR function of a (current) protective function

Necessary means
- Current source or, if the protection is directional - current and voltage source
- Timer

Procedure

CAUTION **Supervision time > start time > longest tripping time of an AR current protective function.**

Supervision time and start time are parameterized via the AR function. The tripping time is parameterized via the protective function.

- Switch the CB on.
- Wait until the blocking time *»t-Superv«* has expired. The supervision time ensures that the AR wont be started after a manual switch on of the CB.
- Feed trip causing currents.
- As soon as the trip occurs, switch the current off (immediately).
- After expiry of the dead time the CB should reclose.

NOTICE **Only tripping commands that are given within the active time of the AR will activate the function (reclosure attempts). Therefore make sure, that the tripping time is shorter than the starting time (mains calculated)!**

- If more than one attempt is parameterized, with each reclosure of the CB, the current quantity which is applied to the current measuring inputs has to be high enough to result in tripping. The test should be continued until all set AR attempts have been carried out.

NOTICE **The number of attempts permitted can be found in the Technical Data provided by the CB manufacturer. The specified dead times have to be kept.**

Successful test result
The AR test is successfully completed when the last AR attempt also results in tripping.

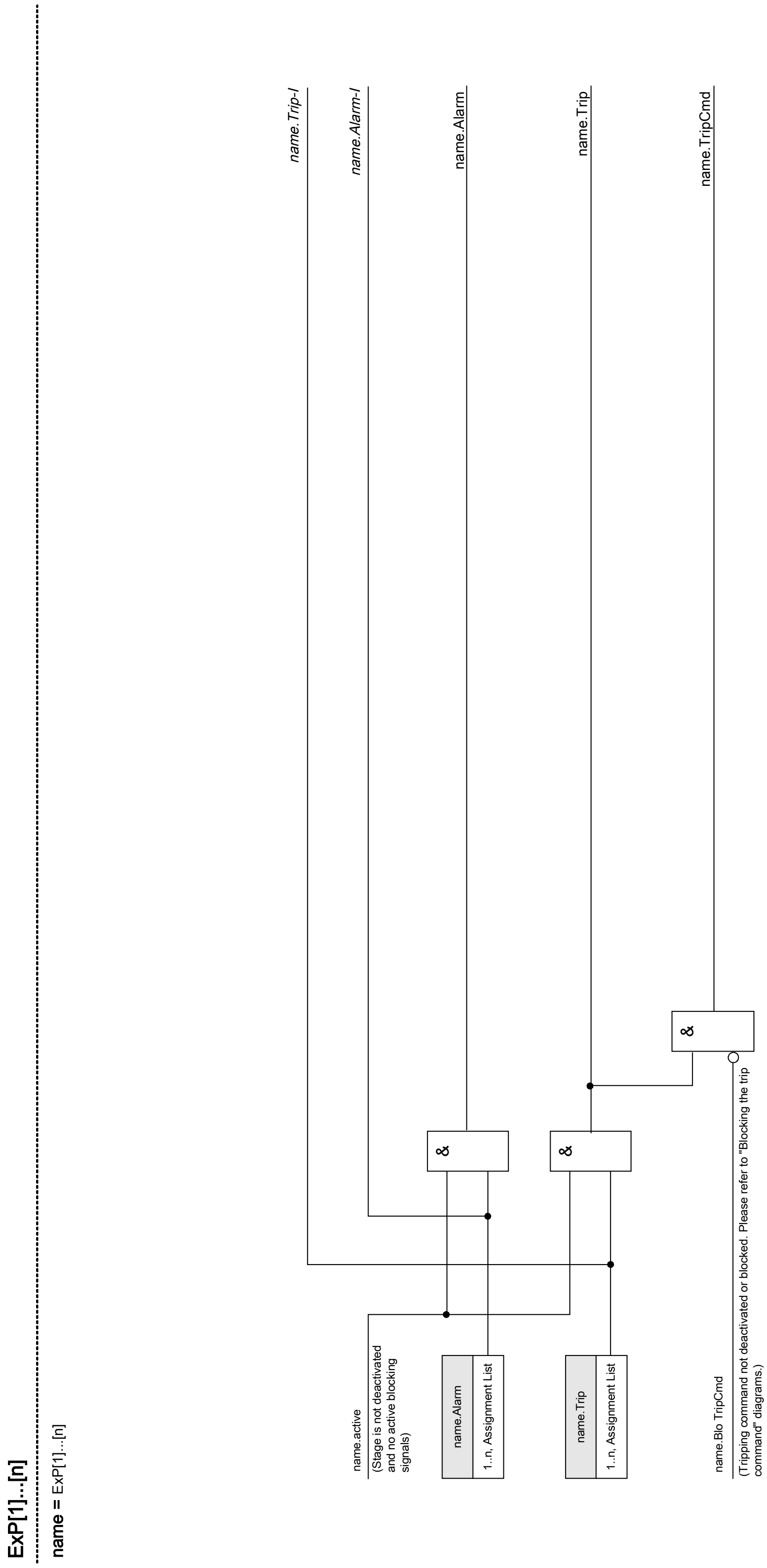
ExP Protection Module – External Protection

Available stages:
ExP[1] ,ExP[2] ,ExP[3] ,ExP[4]

NOTICE

All 4 stages of the external protection *ExP[1]...[4]* are identically structured.

By using the module *External Protection* the following can be incorporated into the device function: trip commands, alarms and blockades of external protection facilities. Devices which are not provided with a communication interface can be connected to the control system as well.


ExP[1]...[n]
name = ExP[1]...[n]
name.active
(Stage is not deactivated and no active blocking signals)
name.Alarm
1..n, Assignment List
name.Trip
1..n, Assignment List
name.Blo TripCmd
(Tripping command not deactivated or blocked. Please refer to "Blocking the trip command" diagrams.)
&
&
&
name.Trip-I
name.Alarm-I
name.Alarm
name.Trip
name.TripCmd

Device Planning Parameters of the Module External Protection

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, use	use	[Device Planning]

Global Protection Parameters of the Module External Protection

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.1	1..n, Assignment List	-	[Protection Para /Global Prot Para /ExP /ExP[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.2	1..n, Assignment List	-	[Protection Para /Global Prot Para /ExP /ExP[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the stage, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /ExP /ExP[1]]
Alarm	Assignment for External Alarm	1..n, Assignment List	-	[Protection Para /Global Prot Para /ExP /ExP[1]]
Trip	External trip of the CB if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /ExP /ExP[1]]

Setting Group Parameters of the Module External Protection

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<n> /ExP /ExP[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /ExP /ExP[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<n> /ExP /ExP[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo TripCmd Fc=active".	inactive, active	inactive	[Protection Para /<n> /ExP /ExP[1]]

Module External Protection Input States

Name	*Description*	*Assignment via*
ExBlo1-I	Module input state: External blocking1	[Protection Para /Global Prot Para /ExP /ExP[1]]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /ExP /ExP[1]]
ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command	[Protection Para /Global Prot Para /ExP /ExP[1]]
Alarm-I	Module input state: External Alarm	[Protection Para /Global Prot Para /ExP /ExP[1]]
Trip-I	Module input state: External Trip	[Protection Para /Global Prot Para /ExP /ExP[1]]

Module External Protection Signals (Output States)

Name	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Alarm	Signal: External Alarm
Trip	Signal: External Trip
TripCmd	Signal: External Trip Command

Commissioning: External Protection

Object to be tested
Test of the module External Protection

Necessary means
- Depending on the application

Procedure
Simulate the functionality of the External Protection (Alarm, Trip, Blockings...) by (de-)energizing of the digital inputs.

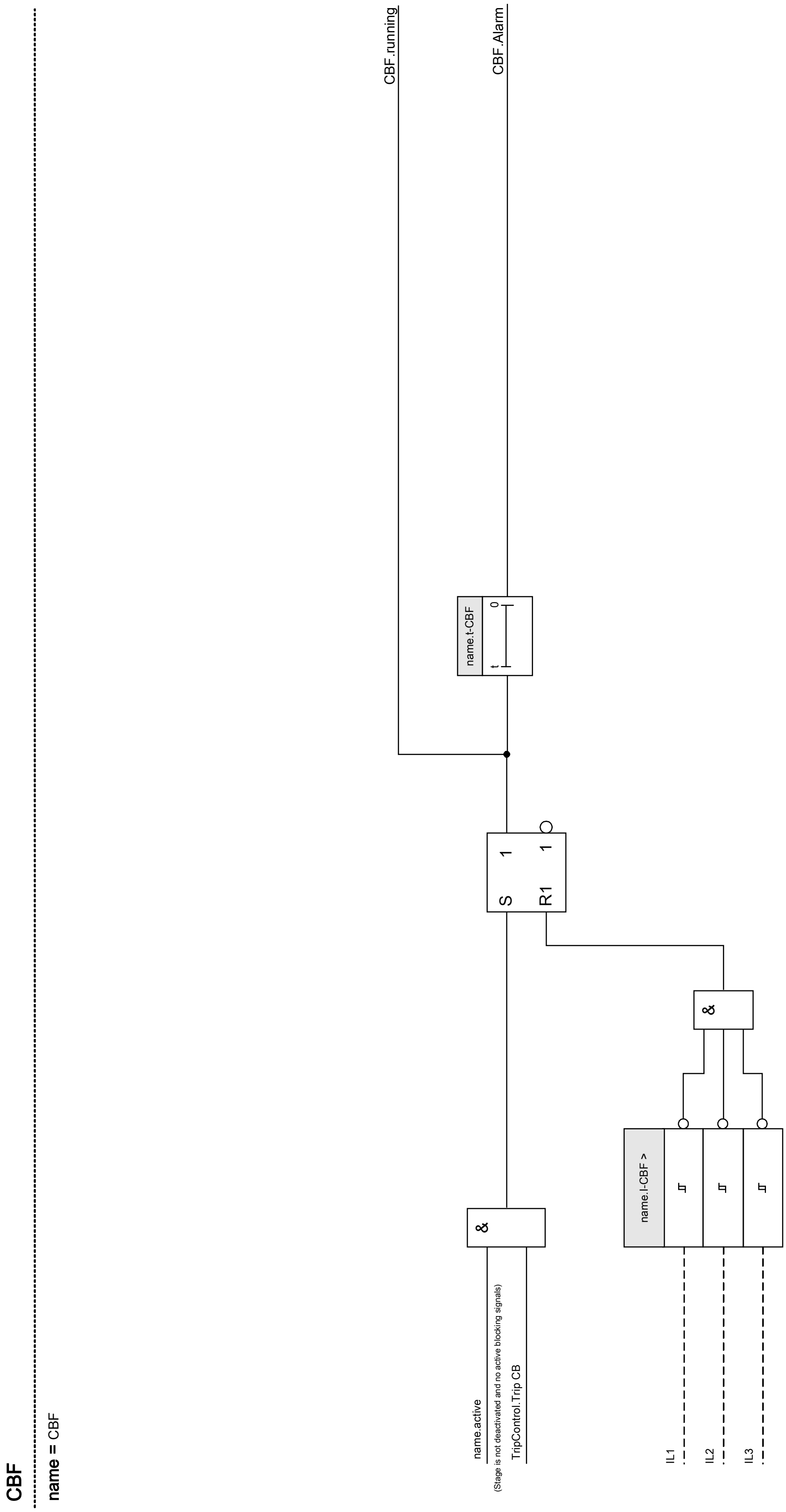
Successful test result
All external alarms, external trips and external blockings are correctly recognized and processed by the device.

CBF-Supervision Module – Circuit Breaker Failure Protection [ANSI 50BF]

CBF

The CBF Protection is used to detect those tripping commands that had not been executed by the circuit breaker (if defective for example). If a trip command was not executed that means that the current does not fall below the set threshold (approx. zero) within a specified time delay, a CB failure has occurred; this will be signaled by an alarm. Via an output relay this alarm can be passed on to a primary CB (e.g. by feeding to the bus bar).

The CB failure protection will start immediately after a tripping command was issued by the module *»Prot«.* That means as soon as any of the protection modules has passed its trip decision on to the *»Prot«* master module, the *CBF* will be started.


CBF
name = CBF
name.active
(Stage is not deactivated and no active blocking signals)
TripControl.Trip CB
&
IL1
IL2
IL3
name.I-CBF >
&
S
R1
1
1
name.t-CBF
t
0
CBF.running
CBF.Alarm

Device Planning Parameters of the CBF Module

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, use	use	[Device Planning]

Global Protection Parameters of the CBF Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /Supervision /CBF]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /Supervision /CBF]

Setting Group Parameters of the CBF Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<n> /Supervision /CBF]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /Supervision /CBF]
I-CBF >	If the pick-up value is exceeded, the module/stage will be started.	0.00 - 0.10*In	0.00*In	[Protection Para /<n> /Supervision /CBF]
t-CBF	If the delay time is expired, an CBF alarm is given out.	0.00 - 10.00*s	0.20*s	[Protection Para /<n> /Supervision /CBF]

CBF Module Input States

Name	*Description*	*Assignment via*
ExBlo1-I	Module input state: External blocking1	[Protection Para /Global Prot Para /Supervision /CBF]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /Supervision /CBF]

CBF Module Signals (Output States)

Name	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
running	Signal: CBF-Module started
Alarm	Signal: Circuit Breaker Failure

Commissioning: Circuit Breaker Failure Protection [ANSI 50BF]

NOTICE

The time that is parameterized for the *CBF* must not be below the CB control time, otherwise an unwanted operation of the *CBF* is caused by any protective trip.

Object to be tested
Test of the circuit breaker failure protection.

Necessary means
- Current source
- May be: ampere meter
- Timer

NOTICE

When testing the applied test current must always be higher than the tripping threshold *»I-LSV«*. If the test current falls below the threshold while the CB is in the OFF-position, no alarm will be generated.

Procedure (single-phase)
For testing the tripping time of the CBF protection a test current has to be impressed which is higher than the threshold value of one of the current protection modules. When the trip relay that is assigned to the protection function, picks up, a timer will be started and the time until the CBF is signaled by the corresponding relay will be measured.

To avoid wiring errors, it should be checked, if the CB in the higher-level system switches off.

The time, measured by the timer, should be in line with the specified tolerances. Alternatively the timer can be started when the auxiliary voltage is applied and the test current impressed and then stopped when the relay for the CBF protection picks up. In this case, the previously measured tripping delay has to be subtracted from the measured time.

WARNING

Re-connect the control cable to the circuit breaker!

Successful test result
The actual times measured comply with the set-point times. The CB in the higher-level section switches off.

TCS-Supervision Module – Trip Circuit Supervision [74TC]

TCS

The trip circuit is monitored by evaluating the auxiliary contacts of the circuit breaker. The CB trip circuits inclusive cable can be monitrored by two non-grouped digital inputs. If a circuit is broken an alarm is issued. With this protection module it is assumed that the CB is provided with auxiliary contacts (CB-open and CB-closed), allocated to the digital inputs.

NOTICE **In Slot 1 has 2 digital inputs, each of which has a separate root (contact separation) for the trip circuit supervision.**

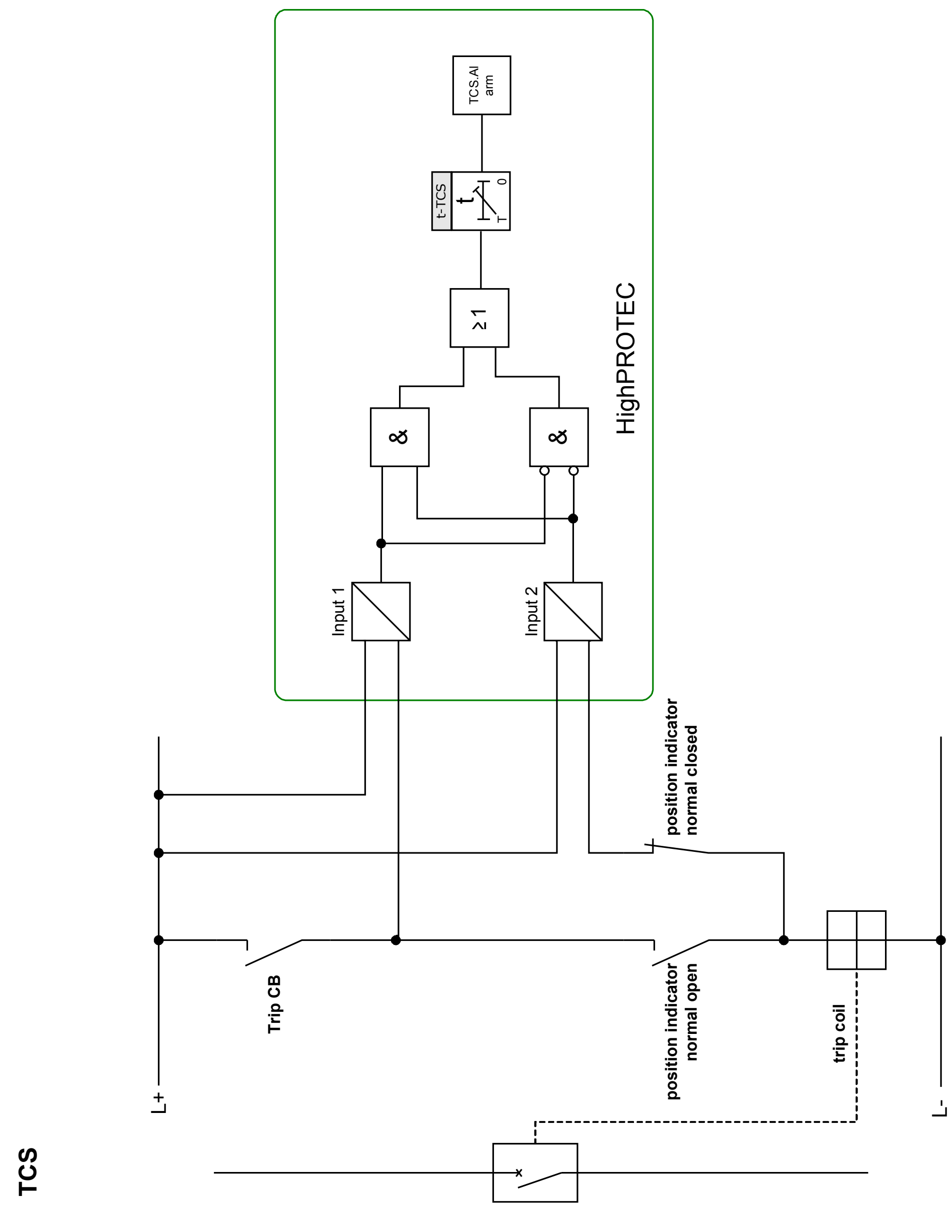
In this case the trip circuit supply voltage serves also as supply voltage for the digital inputs and so the supply voltage failure of a trip circuit can be detected directly.

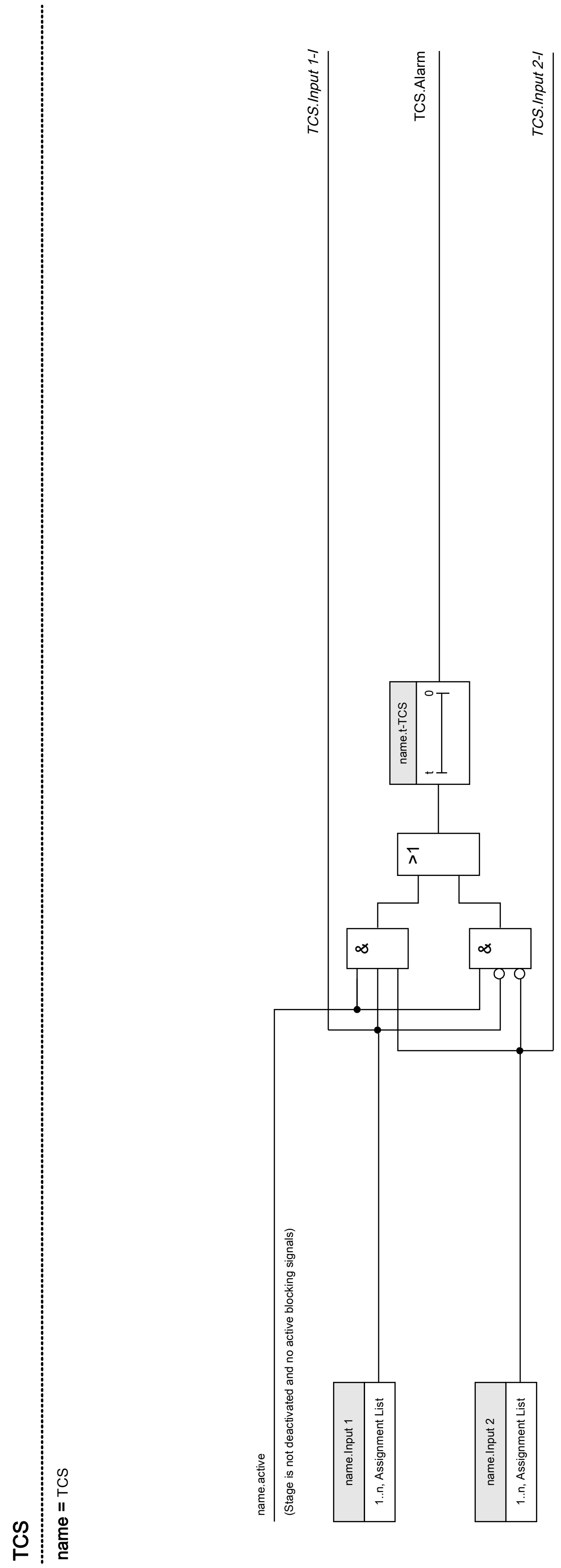
In order to identify a conductor-failure in the trip circuit on the supply line or in the trip coil, the off-coil has to be looped-in to the supervision circuit.

Via the two digital inputs the auxiliary contacts are checked continuously (»Input 1« and »Input 2«) for »identity« (both open or both closed). If »identity« is identified, the trip circuit is checked for a possible defect after a set time delay and if necessary the »TCS.Alarm« is issued.

The time delay is to be set in a way that switching actions cannot cause false trips in this module.

Connection example: Trip circuit supervision with two CB auxiliary contacts.




TCS
name = TCS
name.active
(Stage is not deactivated and no active blocking signals)
name.Input 1
1..n, Assignment List
name.Input 2
1..n, Assignment List
&
&
>1
name.t-TCS
t
0
TCS.Input 1-I
TCS.Alarm
TCS.Input 2-I

Device Planning Parameters of the Trip Circuit Supervision Module

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, use	use	[Device Planning]

Global Protection Parameters of the Trip Circuit Supervision Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /Supervision /TCS]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /Supervision /TCS]
Input 1	Input 1	1..n, Assignment List	-	[Protection Para /Global Prot Para /Supervision /TCS]
Input 2	Input 2	1..n, Assignment List	-	[Protection Para /Global Prot Para /Supervision /TCS]

Setting Group Parameters of the Trip Circuit Supervision Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<n> /Supervision /TCS]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /Supervision /TCS]
t-TCS	Tripping delay time of the Trip Circuit Supervision	0.10 - 10.00*s	0.2*s	[Protection Para /<n> /Supervision /TCS]

Trip Circuit Supervision Module Input States

Name	*Description*	*Assignment via*
ExBlo1-I	Module input state: External blocking1	[Protection Para /Global Prot Para /Supervision /TCS]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /Supervision /TCS]
Input 1-I	Module input state: Input 1	[Protection Para /Global Prot Para /Supervision /TCS]
Input 2-I	Module input state: Input 2	[Protection Para /Global Prot Para /Supervision /TCS]

Trip Circuit Supervision Module Signals (Output States)

Name	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
Alarm	Signal: Alarm Trip Circuit Supervision

Commissioning: Trip Circuit Supervision for Circuit Breakers [74TC]

NOTICE **For CBs that trip by means of little energy (e.g. via an optocoupler), it has to be ensured that the current applied by the digital inputs will not cause false tripping of the CB.**

Object to be tested
Test of the trip circuit supervision.

Procedure, part 1
Simulate failure of the control voltage in the power circuits.

Successful test result, part 1
After expiry of *»t-TCS«* the trip circuit supervision *TCS* of the device should signal an alarm.

Procedure, part 2
Simulate a broken cable in the CB control circuit.

Successful test result, part 2
After expiry of *»t-TCS«* the trip circuit supervision *TCS* of the device should signal an alarm.

CTS-Supervision Module – Current Transformer Supervision

CTS

Wire breaks and failures within measuring circuits cause current transformer failures.
The module *»CTS«* can detect a failure of the CT if the calculated earth current does not match the measured one. If an adjustable threshold value (Difference of measured and calculated earth current) is exceeded, a CT failure can be assumed. This is signaled through a message/alarm.
The precondition is that the conductor currents are measured by the device and the earth current, for instance, by a ring core type current transformer.

The measuring principles of the circuit supervision are based on comparing the measured and the calculated residual currents:
In an ideal case these are:

$$(\vec{IL1}+\vec{IL2}+\vec{IL3})+KI*\vec{IE}=3*I_0+KI*\vec{IE}=0$$

KI represents a correction factor which takes the different transformation ratio of the phase- and earth current transformers into account. The device automatically calculates this factor from the rated field parameters, i.e. the relation between the rated primary and secondary current values of the phase- and earth current transformers.

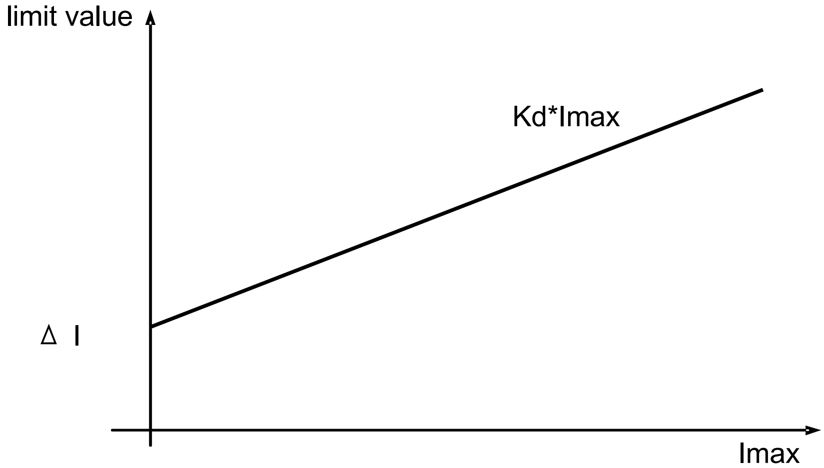
For compensating the current proportional ratio error of the measuring circuits, the dynamic correction factor Kd can be used. As a function of the measured max. current this factor is considering the linear rising measuring error.
The limiting value of the CT supervision is calculated as follows:

ΔI = deviation I (rated value)
Kd = correction factor
Imax = current maximum
Limiting value = ΔI + Kd x Imax

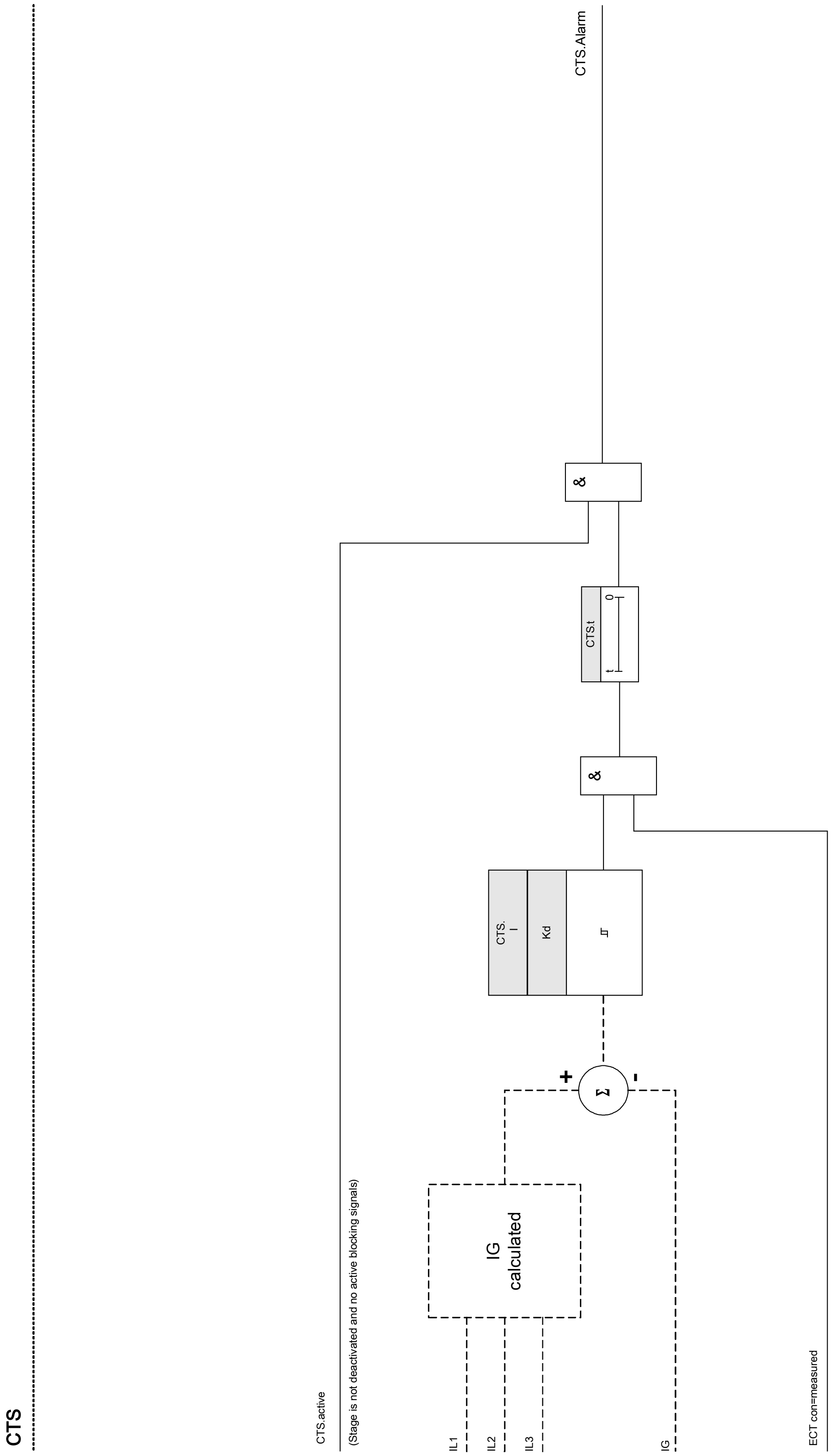
Precondition for identifying an error

$$3*\vec{I}_0+KI*\vec{IE}\geqslant Delta\,I+Kd*Imax$$

The evaluation method of the circuit supervision by using factor Kd can be graphically represented as follows:



CAUTION **If the current is measured in two phases only (for instant only IL1/IL3) or if there is no separate earth current measuring (e.g. normally via a cable-type CT), the supervision function should be deactivated.**



Device Planning Parameters of the Current Transformer Supervision

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, use	use	[Device Planning]

Global Protection Parameter of the Current Transformer Supervision

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /Supervision /CTS]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /Supervision /CTS]

Setting Group Parameters of the Current Transformer Supervision

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<n> /Supervision /CTS]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /Supervision /CTS]
ΔI	In order to prevent faulty tripping of phase selective protection functions that use the current as tripping criterion. If the difference of the measured earth current and the calculated value I0 is higher than the pick up value ΔI, an alarm event is generated after expiring of the excitation time. In such a case, a fuse failure, a broken wire or a faulty measuring circuit can be assumed.	0.10 - 1.00*In	0.50*In	[Protection Para /<n> /Supervision /CTS]
Alarm delay	Alarm delay	0.1 - 9999.0*s	1.0*s	[Protection Para /<n> /Supervision /CTS]
Kd	Dynamic correction factor for the evaluation of the difference between calculated and measured earth current. This correction factor allows transformer faults, caused by higher currents, to be compensated.	0.00 - 0.99	0.00	[Protection Para /<n> /Supervision /CTS]

Current Transformer Supervision Input States

Name	*Description*	*Assignment via*
ExBlo1-I	Module input state: External blocking1	[Protection Para /Global Prot Para /Supervision /CTS]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /Supervision /CTS]

Current Transformer Supervision Signals (Outputs States)

Name	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
Alarm	Signal: Alarm Current Transformer Measuring Circuit Supervision

Commissioning: Current Transformer Failure Supervision

NOTICE

Precondition:

1. Measurement of all three phase currents (are applied to the measuring inputs of the device).

2. The earth current is detected via a cable-type transformer (not in Holmgreen connection).

Object to be tested

Check of the CT supervision (by comparing the calculated with the measured earth current).

Necessary means

- Three-phase current source

Procedure, part 1

- Set the limiting value of the CTS to *»delta I=0.1*In«*.
- Feed a three-phase, symmetrical current system (approx. nominal current) to the secondary side.
- Disconnect the current of one phase from one of the measuring inputs (the symmetrical feeding at secondary side has to be maintained).
- Make sure that the signal »CTS.ALARM« is generated now.

Successful test result, part 1

- The signal »CTS.ALARM« is generated.

Procedure, part 2

- Feed a three-phase, symmetrical current system (approx. nominal current) to the secondary side.
- Feed a current that is higher than the threshold value for the measuring circuit supervision to the earth current measuring input.
- Ascertain that the signal »CTS.ALARM« is generated now.

Successful test result, part 2

The signal »CTS.ALARM« is generated.

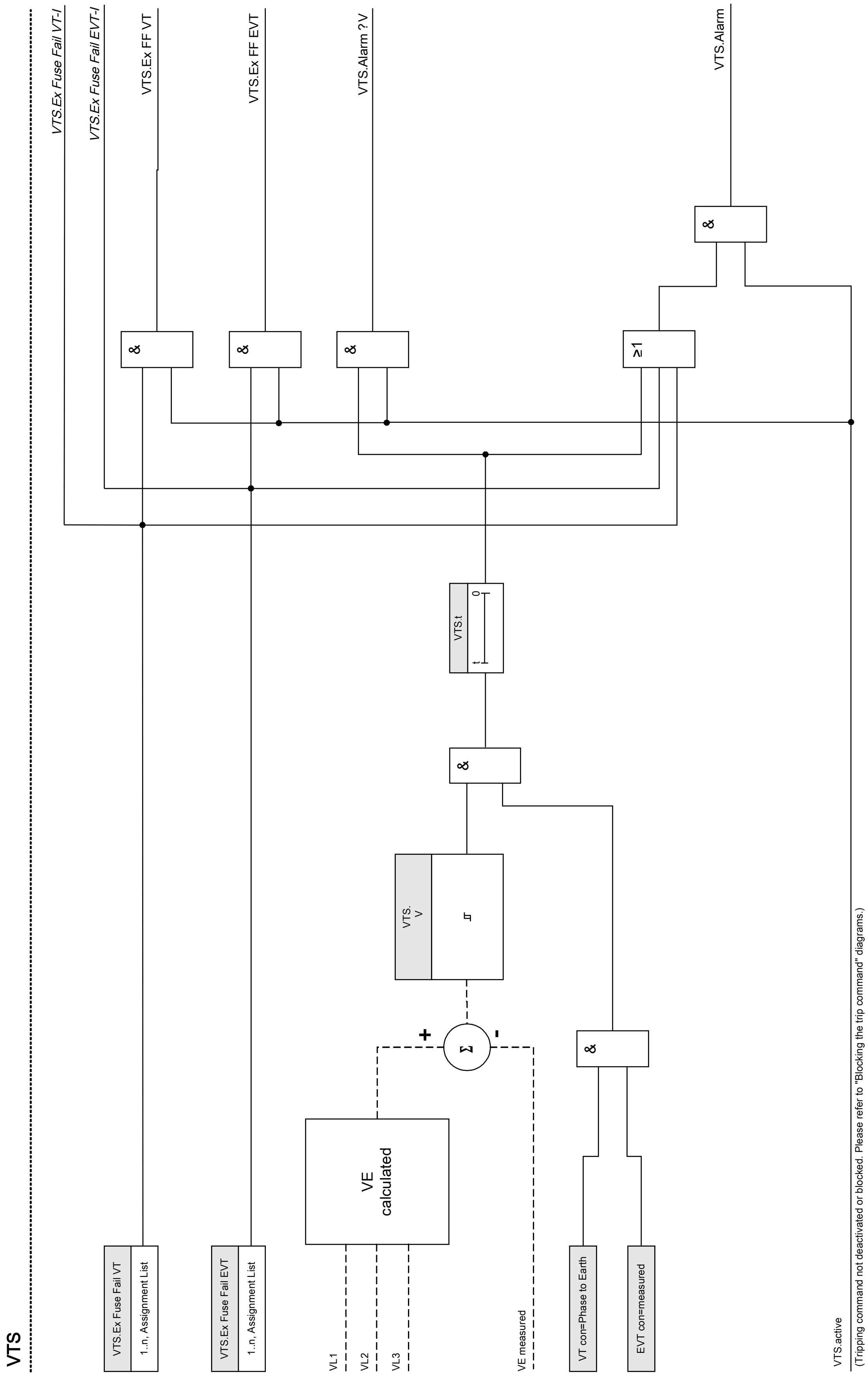
VTS-Supervision Module - Voltage Transformer Supervision [ANSI 60FL]

Available stages:
VTS

Supervision of the voltage transformers (VTs) by a digital input
The module *»VTS«* is capable of detecting a fuse failure at the secondary side of the VTs as long as the automatic circuit breakers of the VTs are connected with the device via a digital input and if this input is assigned to the module *»VTS«*.

Supervision of the VTs by comparing the measured and calculated residual voltage
The module *»VTS«* can detect a VT failure if the calculated residual voltage does not match the measured one. As a precondition, however the phase voltages (not the line-to-line voltage) are connected to the device and so the residual voltage can be calculated. It is furthermore necessary that the residual voltage is actually being measured by means of the VTs auxiliary windings (e-n).

If an adjustable threshold value (difference between measured and calculated residual voltage) has been exceeded, a VT failure can be assumed. This will then be signaled by an alarm/message.


VTS
VTS.Ex Fuse Fail VT-I
VTS.Ex Fuse Fail EVT-I
VTS.Ex FF VT
VTS.Ex FF EVT
VTS.Alarm ?V
VTS.Alarm
&
≥1
VTS.t
VTS.
V
VE
calculated
VTS.Ex Fuse Fail VT
1..n, Assignment List
VTS.Ex Fuse Fail EVT
1..n, Assignment List
VL1
VL2
VL3
VE measured
VT con=Phase to Earth
EVT con=measured
VTS.active
(Tripping command not deactivated or blocked. Please refer to "Blocking the trip command" diagrams.)

Device Planning Parameters of the Voltage Transformer Module

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, use	use	[Device Planning]

Global Protection Parameters of the Voltage Transformer Supervision Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /Supervision /VTS]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /Supervision /VTS]
Ex Fuse Fail VT	Fuse failure of voltage transformers	1..n, Assignment List	-	[Protection Para /Global Prot Para /Supervision /VTS]
Ex Fuse Fail EVT	Fuse failure earth voltage transformer if the state of the assigned signal is true.	1..n, Assignment List	-	[Protection Para /Global Prot Para /Supervision /VTS]

Setting Group Parameters of the Voltage Transformer Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<n> /Supervision /VTS]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /Supervision /VTS]
ΔV	In order to prevent faulty tripping of phase selective protection functions that use the voltage as tripping criterion. If the difference of the residual voltage and the calculated value V0 is higher than the pick up value ΔV, an alarm event effected after the excitation time. In such a case, the existence of a fuse failure, a broken wire or a faulty measuring circuit can be assumed.	0.20 - 1.00*Vn	0.50*Vn	[Protection Para /<n> /Supervision /VTS]
Alarm delay	Alarm delay	0.1 - 9999.0*s	1.0*s	[Protection Para /<n> /Supervision /VTS]

Voltage Transformer Supervision Module Input States

Name	*Description*	*Assignment via*
Ex Fuse Fail VT-I	Module input state: External fuse failure voltage transformers	[Protection Para /Global Prot Para /Supervision /VTS]
Ex Fuse Fail EVT-I	Module input state: External fuse failure earth voltage transformer	[Protection Para /Global Prot Para /Supervision /VTS]
ExBlo1-I	Module input state: External blocking1	[Protection Para /Global Prot Para /Supervision /VTS]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /Supervision /VTS]

Voltage Transformer Module Signals (Output States)

Name	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
Alarm ΔV	Signal: Alarm ΔV Voltage Transformer Measuring Circuit Supervision
Alarm	Signal: Alarm Voltage Transformer Measuring Circuit Supervision
Ex FF VT	Signal: Alarm Fuse Failure Voltage Transformers
Ex FF EVT	Signal: Alarm Fuse Failure Earth Voltage Transformers

Commissioning: Voltage Transformer Supervision (via DI) [ANSI 60FL]

Object to be tested
Check if the auto fuse failure is correctly identified by the device.

Procedure
Disconnect the automatic circuit breaker of the VTs (all poles to be dead)

Successful test result
- The state of the respective digital input changes.
- If a LED is allocated to the auto fuse failure, this is indicated accordingly.

Commissioning: Voltage Transformer Failure [ANSI 60FL]

NOTICE

Precondition:
1. The residual voltage is measured via the residual voltage measuring input.
2. Phase voltages are applied to the voltage measuring inputs (no line-to-line voltages)

NOTICE

Calculation of the residual voltage is only possible, if phase voltages (star) were applied to the voltage measuring inputs and *»VT con = phase-to-neutral« and »EVT con=calculated«* were set in the field parameters.

Object to be tested
Check of the VT supervision (by comparing the calculated residual voltage with the measured one). It is to be tested whether VE=3xV0.

Necessary means
- 4-channel voltage source (3+1)

Procedure, part 1
- Set the limiting value of the VT supervision to *»ΔV=0.1*Vn«.*
- Feed a three-phase, symmetrical voltage system (nominal voltage) in to the secondary side.
- Disconnect the voltage of one phase at one of the measuring inputs (symmetrical feeding at the secondary side has to be maintained).
- Make sure that the signal »VTS.ALARM« is generated now.

Successful test result, part 1
The signal »VTS.ALARM« is generated.

Procedure, part 2
- Feed a three-phase, symmetrical voltage system to the secondary side (nominal current).
- Feed a voltage of about 20% Un in to the measuring input of the residual voltage.
- Make sure that the signal »VTS.ALARM« is generated now.

Successful test result, part 2
The signal »VTS.ALARM« is generated.

System Parameters

Sys

Date and Time

In menu *»Device parameters/Date/Time«* you can set date and time.

Synchronize Date and Time via Smart View

- In case *Smart view* is not running – please start it.
- If device data has not been loaded yet – click »Receive Data From The Device« in menu »Device«
- Double click the »Device parameters« icon in the navigation tree.
- Double click the »Date/time-icon« within the operational data.
- Out of the working window you can now synchronize date and time of the device with your PC i.e. That means, that the device takes over date and time from your PC.

Version

Within this menu *»Device parameters/Version«* you can obtain information on the soft- and hardware version.

Version via Smart view

Within this menu *»File/Properties«* you can obtain detailed information on the currently opend file like e.g. soft- and hardware version....

NOTICE

In order to be able to transmit a parameter file (e.g. offline created) into the device the followinig issues must comply:

- **Type Code (written on the top of the device/type label) and**
- **Version of the device model (can be found in menu [Device Parameters\Version].**

Direct Commands of the System Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Ack LED	All acknowledgeable LEDs will be acknowledged.	inactive, active	inactive	[Operation /Acknowledgement]
Ack BO	All acknowledgeable binary output relays will be acknowledged.	inactive, active	inactive	[Operation /Acknowledgement]
Ack Scada	SCADA will be acknowledged.	inactive, active	inactive	[Operation /Acknowledgement]
Ack BO LED Scd TCmd	Reset the binary output relays, LEDs, SCADA and the Trip Command.	inactive, active	inactive	[Operation /Acknowledgement]
Reboot	Rebooting the device	no, yes	no	[Service /General]

CAUTION

CAUTION, rebooting the device manually will release the Supervision Contact.

Global Protection Parameters of the System

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
PSet-Switch	Switching Parameter Set	PS1, PS2, PS3, PS4, PS via Inp fct, PS via Scada	PS1	[Protection Para /PSet-Switch]
PS1: activated by	This Setting Group will be the active one if: The Parameter Setting Group Switch is set to "Switch via Input" and the other three input functions are inactive at the same time. In case that there is more than one input function active no Parameter Setting Group Switch will be executed. In case that all input functions are inactive the device will keep working with the Setting Group that was activated lastly. Only available if: PSet-Switch = PS via Inp fct	1..n, Assignment List	-	[Protection Para /PSet-Switch]
PS2: activated by	This Setting Group will be the active one if: The Parameter Setting Group Switch is set to "Switch via Input" and the other three input functions are inactive at the same time. In case that there is more than one input function active no Parameter Setting Group Switch will be executed. In case that all input functions are inactive the device will keep working with the Setting Group that was activated lastly. Only available if: PSet-Switch = PS via Inp fct	1..n, Assignment List	-	[Protection Para /PSet-Switch]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
PS3: activated by	This Setting Group will be the active one if: The Parameter Setting Group Switch is set to "Switch via Input" and the other three input functions are inactive at the same time. In case that there is more than one input function active no Parameter Setting Group Switch will be executed. In case that all input functions are inactive the device will keep working with the Setting Group that was activated lastly. Only available if: PSet-Switch = PS via Inp fct	1..n, Assignment List	-	[Protection Para /PSet-Switch]
PS4: activated by	This Setting Group will be the active one if: The Parameter Setting Group Switch is set to "Switch via Input" and the other three input functions are inactive at the same time. In case that there is more than one input function active no Parameter Setting Group Switch will be executed. In case that all input functions are inactive the device will keep working with the Setting Group that was activated lastly. Only available if: PSet-Switch = PS via Inp fct	1..n, Assignment List	-	[Protection Para /PSet-Switch]
Ack LED	All acknowledgeable LEDs will be acknowledged, if the state of the assigned signal becomes true.	1..n, Assignment List	-	[Device Para /Ex Acknowledge]
Ack BO	All acknowledgeable binary output relays will be acknowledged, if the state of the assigned signal becomes true.	1..n, Assignment List	-	[Device Para /Ex Acknowledge]
Ack Scada	SCADA will be acknowledged, if the state of the assigned signal becomes true.	1..n, Assignment List	-	[Device Para /Ex Acknowledge]
Scaling	Display of the measured values as primary, secondary or per unit values	Per unit values, Primary values, Secondary values	Per unit values	[Operation /General settings]

System Module Input States

Name	*Description*	*Assignment via*
Ack LED-I	Module input state: LEDs acknowledgement by digital input	[Device Para /Ex Acknowledge]
Ack BO-I	Module input state: Acknowledgement	[Device Para /Ex Acknowledge]
Ack Scada-I	Module input state: Acknowledge Scada via digital input. The replica that SCADA has got from the device is to be reset.	[Device Para /Ex Acknowledge]
PS1-I	State of the module input respectively of the signal, that should activate this Parameter Setting Group.	[Protection Para /PSet-Switch]
PS2-I	State of the module input respectively of the signal, that should activate this Parameter Setting Group.	[Protection Para /PSet-Switch]
PS3-I	State of the module input respectively of the signal, that should activate this Parameter Setting Group.	[Protection Para /PSet-Switch]
PS4-I	State of the module input respectively of the signal, that should activate this Parameter Setting Group.	[Protection Para /PSet-Switch]

System Module Signals

Name	*Description*
Reboot	Signal: Rebooting the device: 1=Restart initiated by power supply; 2=Restart initiated by the user; 3=Set on defaults (Super Reset); 4=Restart by the debugger; 5=General failure; 6=Restart initiated by System Abort (host side); 7=Restart initiated by watchdog timeout (host side); 8=Restart initiated by System Abort (dsp side); 9=Restart initiated by watchdog timeout (dsp side); 10=Power supply failure (short term interruption) or power supply voltage to low; 11=illegal memory access;
Act Set	Signal: Active Parameter Set
PS 1	Signal: Parameter Set 1
PS 2	Signal: Parameter Set 2
PS 3	Signal: Parameter Set 3
PS 4	Signal: Parameter Set 4
PS-Switch man	Signal: Manual switch over of a parameter setting group
Scada	Signal: Scada
PS via Inp fct	Signal: Switch via input function
Param to be saved	No of parameters to be saved. 0 means that all parameter changes are
Ack LED-HMI	Signal: LEDs acknowledgement by digital input :HMI
Ack BO-HMI	Signal: Acknowledgement of the Binary Outputs :HMI
Ack Counter-HMI	Signal: Reset of all Counters :HMI
Ack Scada-HMI	Signal: Acknowledge Scada :HMI
Ack TripCmd-HMI	Signal: Reset Trip Command :HMI
Ack LED-Sca	Signal: LEDs acknowledgement by digital input :SCADA
Ack BO-Sca	Signal: Acknowledgement of the Binary Outputs :SCADA
Ack Scada-Sca	Signal: Acknowledge Scada :SCADA
Ack TripCmd-Sca	Signal: Reset Trip Command :SCADA

Special Values of the System Module

Value	*Description*	*Menu path*
Build	Build	[Device Para /Version]
Version	Version	[Device Para /Version]
Operating hours Cr	Operating hours counter	[Operation /Counter and RevData /Sys]

Commissioning

Before starting work on an opened switchboard it is imperative that the complete switchboard is dead and the following 5 safety regulations are always met: ,

DANGER

Safety precautions:

- **Disconnect from the power supply**
- **Secure against reconnection**
- **Verify if the equipment is dead**
- **Connect to ground and short-circuit all phases**
- **Cover or safeguard all live adjacent parts**

DANGER

The secondary circuit of a current transformer must never be opened during operation. The prevailing high voltages are dangerous to life.

WARNING

Even when the auxiliary voltage is switched off, it is likely that there are still hazardous voltages at the component connections.
All locally applicable national and international installation and safety regulations for working at electrical power installations must always to be followed (e.g. VDE, EN, DIN, IEC).

WARNING

Prior to the initial voltage connection, the following must be guaranteed:

- **Correct grounding of the device**
- **That all signal circuits are tested**
- **That all control circuits are tested**
- **Transformer wiring is checked**
- **Correct rating of the CTs**
- **Correct burden of the CTs**
- **That the operational conditions are in line with the Technical Data**
- **Correct rating of the transformer protection**
- **Function of the transformer fuses**
- **Correct wiring of all digital inputs**
- **Polarity and capacity of the supply voltage**
- **Correct wiring of the analogue inputs and outputs**

NOTICE

The permissible deviations of measuring values and device adjustment are dependent on the technical data/tolerances.

Commissioning/Protection Test

WARNING **Putting into operation/Protection test must be carried out by authorized and qualified personnel. Before the device is put into operation the related documentation has to be read and understood.**

WARNING **With any test of the protection functions the following has to be checked:**

- **Is activation/tripping saved in the event recorder?**
- **Is tripping saved in the fault recorder?**
- **Is tripping saved in the disturbance recorder?**
- **Are all signals/messages correctly generated?**
- **Do all general parameterized blocking functions work properly?**
- **Do all temporary parameterized (via DI) blocking functions work properly?**
- **To enable checks on all LEDs and relay functions, these have to be provided with the relevant alarm and tripping functions of the respective protection functions/elements. This has to be tested in practical operation.**

WARNING **Check of all temporary blockings (via digital inputs):**

- **In order to avoid malfunctions, all blockings related to tripping/non-tripping of protection function have to be tested. The test can be very complex and should therefore be performed by the same people who set up the protection concept.**

CAUTION **Check of all general trip blockings:**

- **All general trip blockings have to be tested.**

NOTICE **Prior to the initial operation of the protection device all tripping times and values shown in the adjustment list have to be confirmed by a secondary test**

NOTICE **Any description of functions, parameters, inputs or outputs that does not match the device in hand, can be ignored.**

Putting out of Operation – Plug out the Relay

WARNING

Warning! Dismounting the relay will lead to a loss of the protection functionallity. Ensure that there is a back-up protection. If you are not aware of the consequences of dismounting the device – stop! Don´t start.

WARNING

Inform SCADA before you start.

Switch-off the power supply.

Ensure, that the cabinet is dead and that there are no voltages that could lead to personal injury.

Plug-out the terminals at the rear-side of the device. Do not pull any cable – pull on the plugs! If it is stuck use for example a screw driver.

Fasten the cables and terminals in the cabinet by means of cable clips to ensure that no accidental elektrical connections are caused.

Hold the device at the front-side while opening the mounting nuts.

Remove the device carefully out of the cabinet.

In case no other device is to be mounted or replaced cover/close the cut-out in the front-door.

Close the cabinet.

Self Supervision

HighPROTEC devices are continuously monitored and supervised through different methods during normal operation as well as during start-up phase.

Results of this supervision may be:

- messages appearing within event-recorder (from release 1.2 or later),
- indications within the display or Smart view,
- corrective measures,
- disabling of protection functions,
- restart of the device
-

or any combination out of these.

In case of failures that cannot be corrected immediately three restarts within 20 minutes are accepted before the device will be deactivated. The device should be removed in for service in such case to ensure continuous correct operation. Contact data and address can be found at the end of this manual.
In case of any failures the recorders of the device should be left untouched to ensure an easy diagnosis and proper repair at the factory. Besides the records and visible indications to the customer there exists internal information about failures. These allow service personnel to make a detailed analysis of files with failure reports, at least at factory site.

Self supervision is applied by different functions at different cyclic or noncyclic timings to the following parts and functions of the device:

- faultless cyclic execution of software,
- functional capability of memory boards,
- consistency of data,
- functional capability of hardware sub-assemblies and
- faultless operation of the measuring unit.

Faultless cyclic operation of software is supervised by timing analysis and checking results of different functions. Errors of the software function (watchdog function) lead to restarting the device and switching off the self-supervision relay (life-contact). Also the System-OK LED will blink red, after three unsuccessful attempts to restart the device within a time-period of 20 minutes.

The main processor cyclically monitors the operation of the signal processor and initiates corrective actions or restart of the device in case of faulty operation.

Data and files are generally secured against unintended overwriting or faulty changes by checksums.

The measuring unit continuously checks the measured data by comparing received data with data from a second channel sampled in parallel.

Monitoring of the auxiliary voltage is done by reset-IC's. If the voltage of one of the different supply circuits falls below a certain threshold a restart of the device is initiated. There are three major supply groups (24 V, 3.3 V and 1.6 V), each of them being monitored separately and forcing the processor to reset (stop of the device) until the voltage again reaches nominal value. If the voltage staggers around the threshold the device also starts again after 5 s.

Independent of these separate monitoring functions the intermediate voltage circuit is buffered for 100 ms until all important and relevant operational and fault-data have been saved and the device initiates a restart.

Errormessages / -codes

After a reboot of the device the reason for rebooting will be displayed under
[Operation/Status Display/Sys/Reset].
For more information about the reboot reason please follow this chapter.

The reboot will also be logged within the event recorder. Rebooting causes an event named: Sys.reboot.

Numerical reboot codes:

Errormessages / -codes	
1.	Reboot after clean switching off of the device normal reboot after clean shut down of the device.
2.	Reboot by user command user-initiated reboot through panel-command.
3.	Super reset: reset to factory settings
4.	Restart by debugger;WW-SEG internally for system-analysis purpose.
5.	General failure: reboot without definite reason.
6.	Reoot by SW-systemabort (HOST-side); summary of several reboot reasons detected by software, i.e. wrong pointer, corrupted files etc.
7.	Reboot by watchdog timeout (HOST-side);signalling if the protection-class-task hangs for more than 800 ms.
8.	Reboot by system abort (DSP-side); summary of several reboot reasons detected by software, i.e. wrong pointer, DSP-side.
9.	Reboot by watchdog timeout (DS-side);appears when DSP sequence needs longer than 3 ms for one cycle.
10.	Loss of auxiliary voltage or low voltage reboot after loss of auxiliary voltage or voltage dropping below reboot-level but not becoming zero.
11.	Faulty memory access: message of MMU (memory mapping unit) that prohibited memory access has occurred.

Technical Data

Climatic Environmental Conditions

Storage Temperature:	-25°C up to +70°C (-13°F to 158°F)
Operating Temperature:	0°C up to +55°C (32°F to 131°F)
Permissible Humidity at Ann. Average:	<75% rel. (on 56d up to 95% rel.)
Permissible Installation Altitude:	<2000 m (6561.67 ft) above sea level If 4000 m (13123.35 ft) altitude apply a changed classification of the operating and test voltages may be necessary.

Routine Test

Insulation test acc. to IEC60255-5:	All tests to be carried out against earth and other input- and output circuits
Aux. voltage supply, digital inputs, current measuring inputs, signal relay outputs:	2.5 kV (eff) / 50 Hz
Voltage measuring inputs:	3.0 kV (eff) / 50 Hz
All wire-bound communication interfaces:	1.5 kV DC

Housing

Housing B2: height/-width	173 mm (6.811” / 4 U)/ 212.7 mm (8.374” / 42 HP)
Housing depth (incl. terminals):	208 mm (8.189”)
Material, housing:	Aluminum extruded section
Material, front panel:	Aluminum/Foil front
Mounting position:	Horizontal (±45° around the X-axis must be permitted)
Weight:	MRA4 housing B2: approx. 4.2 kg (9.259 lb)

Plug-in Connectors with Integrated Short-Circuiter (Conventional Current Inputs)

Nominal current:	1 A and 5 A
Continuous loading capacity:	4 x In/continuously
Overcurrent withstand:	30 x In/10 s 100 x In/1 s 250 x In/10 ms (1 half-wave)
Screws:	M4, captive type acc. to VDEW
Connection cross-section:	2 x 2.5 mm² (2 x AWG 14) with wire end ferrule 1 x or 2 x 4.0 mm² (2 x AWG 12) with ring cable sleeve or cable sleeve 1 x or 2 x 6 mm² (2 x AWG 10) with ring cable sleeve or cable sleeve:

Voltage Supply

Aux. Voltage:	19 - 300 V DC/40 - 250 V AC
Buffer time in case of supply failure:	>= 50 ms at minimal aux. voltage communication is permitted to be interrupted
Max. permissible making current:	18 A peak value for <0.25 ms 12 A peak value for <1 ms
DC output:	24 V short-circuit proof

Power Consumption

Power supply range:	Power consumption in idle mode	Max. power consumption
19-300 V DC:	7 W	13 W
40-250 V AC (for frequencies of 40-70 Hz):	7 VA	13 VA

Real Time Clock

Running reserve of the real time clock: 1 year min.

Display

Display type:	LCD with LED background illumination
Resolution graphics display:	128 x 64 pixel

LED-Type:	Two colored: red/green
Number of LEDs, Housing B2:	15

Digital Inputs

Max. input voltage:	300 V DC/270 V AC
Input current:	<4 mA
Reaction time:	<20 ms
Fallback time:	<30 ms

(Safe state of the digital inputs)

4 Switching thresholds:	Un = 24 V DC, 48 V DC, 60 V DC, 110 V AC/DC, 230 V AC/DC
Un = 24 V DC:	
Switching threshold 1 ON:	min. 19.2 V DC
Switching threshold 1 OFF:	max. 9.6 V DC
Un = 48 V/60V DC:	
Switching threshold 2 ON:	Min. 42.6 V DC
Switching threshold 2 OFF:	max. 21.3 V DC
Un = 110 V AC/DC:	
Switching threshold 3 ON:	min. 88.0 V DC/88.0 V AC
Switching threshold 3 OFF:	max. 44.0 V DC/44.0 V AC
Un = 230 V AC/DC:	
Switching threshold 4 ON:	min. 184 V DC/184 V AC
Switching threshold 4 OFF	max. 92 V DC/92 V AC
Terminals:	Screw-type terminals

Current and Earth Current Measurement

Nominal currents:	1 A / 5 A
Max. measuring range:	up to 40 x In (phase currents) up to 25 x In (earth current standard) up to 2.5 x In (earth current sensitive)
Continuous loading capacity:	4 x In/continuously
Overcurrent proof:	30 x In/10 s 100 x In/1 s 250 x In/10 ms (1 half-wave)
Power consumption:	Phase current inputs: at In = 1A S = 0.15 mVA at In = 5A S = 0.15 mVA Earth current input: at In = 1A S = 0.35 mVA at In = 5A S = 0.35 mVA
Frequency range:	50 Hz / 60 Hz ±10%
Terminals:	Screw-type terminals with integrated short-circuiters (contacts)

Voltage and Residual Voltage Measurement

Nominal voltages:	100 V/110 V/230 V/400 V (can be parameterized)
Max. measuring range:	2 x nominal voltage
Continuous loading capacity:	2 x nominal voltage (800V AC)
Power consumption:	at Vn = 100 V S = 0.1 mVA at Vn = 110 V S = 0.1 mVA at Vn = 230 V S = 0.4 mVA at Vn = 400 V S = 1.0 mVA
Frequency range:	50 Hz or 60 Hz ±10%
Terminals:	Screw-type terminals

Frequency Measurement

Nominal frequencies:	50 Hz / 60 Hz

Binary Output Relays

Continuous current:	5 A AC/DC
Switch-on current:	25 A AC/DC for 4 s
Max. breaking current:	5 A AC up to 125 V AC 5 A DC up to 50 V (resistive) 0.2 A DC at 300 V
Max. switching voltage:	250 V AC/300 V DC
Switching capacity:	2000 VA
Contact type:	1 changeover contact
Terminals:	Screw-type terminals

Time Synchronization IRIG

Nominal input voltage:	5 V
Connection:	Screw-type terminals (twisted pair)

Front Interface RS232

Baud rates:	115200 Baud
Handshake:	RTS and CTS
Connection:	9-pole D-Sub plug

RS485

Master/Slave:	Slave
Connection:	9-pole D-Sub socket (external terminating resistors/in D-Sub) or 6 screw-clamping terminals RM 3.5 mm (138 MIL) (terminating resistors internal) or fiber optic connection (ST plug)

CAUTION **In case that the RS485 interface is realized via terminals, the communication cable has to be shielded. The shielding has to be fixed at the screw that is marked with the ground symbol (rear side of the device).**

Boot phase

After switching on the power supply the protection will be available in approximately 24 seconds. After approximately 60 seconds the boot phase is completed (HMI and Communication initialized).

Standards

Design Standards

Generic standard	EN 61000-6-2 EN 61000-6-3
Product standard	IEC 60255-6 EN 50178 UL 508 (Industrial Control Equipment) CSA C22.2 No. 14-95 (Industrial Control Equipment) ANSI C37.90

High Voltage Tests (IEC 60255-6)

High frequency interference test

IEC 60255-22-1 class 3	Within one circuit	1 kV/2 s
	Circuit to earth	2.5 kV/2 s
	Circuit to circuit	2.5 kV/2 s

Insulation voltage test

IEC 60255-5 EN 50178	All circuits to other circuits and exposed conductive parts	2.5 kV (eff.)/50Hz, 1 min.
	Except interfaces	1,5 kV DC, 1 min.
	and Voltage measuring input	3 kV (eff.)/50 Hz, 1 min.

Impulse voltage test

IEC 60255-5		5 kV/0.5J, 1.2/50 μs

EMC Immunity Tests

Fast transient disturbance immunity test (Burst)

IEC 60255-22-4 IEC 61000-4-4 class 4	Power supply, mains inputs	±4 kV, 2.5 kHz
	Other in- and outputs	±2 kV, 5 kHz

Surge immunity test

IEC 61000-4-5 class 4	Within one circuit	2 kV
	Circuit to earth	4 kV

Electrical discharge immunity test

IEC 60255-22-2 IEC 61000-4-2 class 3	Air discharge Contact discharge	8 kV 6 kV

Radiated radio-frequency electromagnetic field immunity test

IEC 61000-4-3 class X ANSI C37.90.2		35 V/m

Immunity to conducted disturbances induced by radio frequency fields

IEC 61000-4-6 class 3		10 V

Power frequency magnetic field immunity test

IEC 61000-4-8 class 4	continues 3 sec	30 A/m 300 A/m

EMC Emission Tests

Radio interference suppression test

IEC/CISPR11		Limit value class B

Radio interference radiation test

IEC/CISPR11		Limit value class B

Environmental Tests

Classification:

IEC 60068-1	Climatic classification	0/055/56
IEC 60721-3-1	Classification of ambient conditions (Storage)	1K5/1B1/1C1L/1S1/1M2 but min. -25°C
IEC 60721-3-2	Classification of ambient conditions (Transportation)	2K3/2B1/2C1/2S1/2M2
IEC 60721-3-3	Classification of ambient conditions (Stationary use at weatherprotected locations)	3K6/3B1/3C1/3S1/3M2 but min. 0°C and 3K8H for 2 h

Test Ad: Cold

IEC 60068-2-1	Temperature	0°C
	test duration	16 h

Test Ad: Cold

IEC 60068-2-1	Temperature	-10°C
	test duration	2 h (emergency operation)

Test Bd: Dry Heat

IEC 60068-2-2	Temperature	55°C
	Relative humidity	<50%
	test duration	72 h

Test Bd: Dry Heat

IEC 60068-2-2	Temperature	70°C
	Relative humidity	<50%
	test duration	2 h
	(The clearness of the display is constricted)	

Test Cab: Damp Heat (steady state)

IEC 60068-2-78	Temperature	40°C
	Relative humidity	93%
	test duration	56 d

Test Db: Damp Heat (cyclic)

IEC 60068-2-30	Temperature	55°C
	Relative humidity	95%
	Cycles (12 + 12-hour)	2

Mechanical Tests

Test Fc: Vibration response test		
IEC 60068-2-6 IEC 60255-21-1 class 1	(10 Hz – 59 Hz) Displacement	0.035 mm
	(59Hz – 150Hz) Acceleration	0.5 gn
	Number of cycles in each axis	1
Test Fc: Vibration endurance test		
IEC 60068-2-6 IEC 60255-21-1 class 1	(10 Hz – 150 Hz) Acceleration	1.0 gn
	Number of cycles in each axis	20
Test Ea: Shock tests		
IEC 60068-2-27 IEC 60255-21-2 class 1	Shock response test	5 gn, 11 ms, 3 impulses in each direction
	Shock resistance test	15 gn, 11 ms, 3 impulses in each direction
Test Eb: Shockendurance test		
IEC 60068-2-29 IEC 60255-21-2 class 1	Shock endurance test	10 gn, 16 ms, 1000 impulses in each direction
Test Fe: Earthquake test		
IEC 60068-3-3 KTA 3503 IEC 60255-21-3	Single axis earthquake vibration test	3 – 7 Hz: Horizontal 10 mm, 1 cycle each axis
class 2		7 – 35 Hz Horizontal: 2 gn, 1 cycle each axis

Tolerances

Real Time Clock Tolerances

Resolution:	1 ms
Tolerance:	<1 minute / month (+20°C) <±1ms if synchronized via IRIG-B

Measured Values Tolerances

Phase and Earth Current Measuring

Max measuring range:	up to 40 x In (phase currents) up to 25 x In (Earth current standard) up to 2.5 x In (Earth current sensitive)
Please note:	The precision does not depend on the nominal value but is referenced to 100 mA (with In =1 A) respectively. 500 mA (with In = 5 A)
Frequency range:	50 Hz / 60 Hz ± 10%
Accuracy:	Class 0,5
Amplitude error if I < 1 x IN:	±0.5% of the rated value
Amplitude error if I > 1 x IN:	±0.5% of the measured value
Amplitude error if I > 2 x IN:	±1.0% of the measured value
Resolution:	0.01 A
Harmonics	up to 20% 3rd harmonic ±1% up to 20% 5th harmonic ±1%
Frequency influence	<±2% / Hz in the range of ±5 Hz of the parameterized nominal frequency
Temperature influence	<±1% within the range of 0°C up to +55°C

Phase-to-earth and Residual Voltage Measurement

Nominal voltage (Vn):	100 V / 110 V / 230 V / 400 V (parameterizable)
Max measuring range:	2 x nominal value (Vn)
Frequency range:	50 Hz or 60 Hz ±10%
Precision:	Class 0,5
Amplitude error for V<Vn:	±0.5% (of the nominal value)
Amplitude error for V>Vn:	±0.5% (of the nominal value)
Resolution:	0.1 V
Harmonics	up to 20% 3rd harmonic ±1% up to 20% 5th harmonic ±1%
Frequency influence	< ±2% / Hz in the range of ±5 Hz of the parameterized nominal frequency
Temperature influence	<±1% within the range of 0°C up to +55°C

Frequency measurement

Nominal frequency:	50 Hz / 60 Hz
Precision:	±0.05% of fn within the range of 40-70 Hz
Voltage dependency	frequency acquisition of 5 V – 800 V

Protection Stages Tolerances

Note:
The tripping delay relates to the time between alarm and trip. The tolerance of the tripping delay relates to the time between the measured value has exceeded the threshold until the protection stage is alarmed.

Overcurrent protection stages: I[x]		*Range*	*Step range*	*Tolerance*
I MTA	Maximum Torque Angle: Angle between phase current and reference voltage in case of a short circuit.	0°...355°	1°	±2° at I>0.1 x In und V> 0.1 x Vn
I>	If the pick-up value is exceeded the module/stage will be started.	0.01...40.00 x In	0.01 x In	±1.5% of the setting value resp. 1% In
resetting ratio		97% or 0.5% x In		
t	Tripping delay	0.00...300.00 x s	0.01 x s	DEFT ±1% resp.. ±10 ms
Tripping delay	Starting from I higher than 1.1 x I>			non-directional <+35ms directional <+35ms
disengaging time				directional and non-directional <+45ms
t-char	Tripping characteristic factor	0.05...2.00	0.01	±5% NINV, VINV, LINV, EINV
t-reset	Only available if: Characteristic = INV	0.00...60.00 x s	0.01 x s	±1% resp. ±10 ms

Earth current stages: IE[x]		*Range*	*Step range*	*Tolerance*
IE MTA	Maximum Torque Angle: Angle between earth current and residual voltage in case of a short circuit. This angle is needed to determine the fault direction in case of short circuits.This applies only to the Star point treatment SOLI-RESI.	0°...355°	1°	±3° approx close to the star point treatment.
Star point treatment	Star point treatment Information on the selected value: Isolated star point	sin (-90°)		±5° at IE * sin phi >20% In and VE> 10 V
	Star point treatment Information on the selected value: Compensated start point	cos (180°)		±5° at IE * cos phi >20% In and VE> 10 V
	Star point treatment Information on the selected value: Solid or low resistance earthed start point.	SOLI-RESI		±5° of the setting value at IE>1.0*In and VE> 5% Vn
IE>	If the pick-up value is exceeded the module/stage will be started.	0.1...20.00 x In	0.01 x In	±1,5% of the setting value resp. 1% In
resetting ratio		97% or 0.5% x In		
VE>	Pickup value	0.01 ... 2.0 x Vn	0.01 x Vn	±1,5% of the setting value resp. 1% In
resetting ratio		97% or 0.5% x In		
t	Tripping delay	0.00 ... 300.00 x s	0.01 x s	DEFT ±1% resp. ±10 ms
Tripping delay	Starting from IE higher than 1.1 x IE>			non-directional <+35 ms directional <+40ms
disengaging time				directional and non-directional <+45ms
t-char	Tripping characteristic factor	0.05 ... 2.00	0.01	±5% NINV, VINV, LINV, EINV
t-reset	Only available if: Characteristic = INV	0.00 ... 60.00 x s	0.01 x s	±1% resp. ±10 ms

Thermal Replica: ThR		*Range*	*Step range*	*Tolerance*
Ib	Base current: Maximum permissible thermal continuous current.	0.01 ... 4.00 x In	0.01 x In	±2% of the setting value resp. 1% In
K	Over load factor: The maximal admissible thermal limit is defined/calculated by the product from overload factor and basic current k*IB.	0.80 ... 1.20	0.01	
Alarm ThR	Signal: Alarm Thermal Overload	50 ... 100 x %	1 x %	±1.5 % of the setting value

Unbalanced load :I2>[x]		*Range*	*Step range*	*Tolerance*
I2>	If the pick-up value is exceeded, the module/stage will be started.	0.01 ... 4.00 x In	0.01 x In	±2% of the setting value resp.1% In
resetting ratio		97% or 0.5% x In		
t	Tripping delay time (DEFT)	0.00 ... 300.00 x s	0.01 x s	DEFT ±1% resp. ±10 ms
Tripping delay	Starting from I2 higher than 1.3 x I2>			<+60ms
disengaging time				<+40ms
k	Indicates the thermal load capability of the engine while running with 100% unbalanced load current.	1 ... 200	1	±5% INV
τ-cool	Cooling time constant	1 ... 60000 x s	1 x s	±5% INV

Inrush Supervision IH2		*Range*	*Step range*	*Tolerance*
IH2/In	Maximum permissible ratio between 2nd harmonic and 1st harmonic	10...40 %	1 x %	±1% In
resetting ratio		1% x In or 5% x IH2		

Inrush supervision is possible, if 1st Harmonic > 0.1xIn and 2nd Harmonic > 0.01xIn.

Voltage Protection V>[x]		*Range*	*Step range*	*Tolerance*
V>	Pickup value	0.01 ... 2.00 x Vn	0.01 x Vn	±1.5% of the setting value resp.1% Vn
resetting ratio		97% or 0.5% x Vn		
t	Tripping delay	0.00 ... 300.00 x s	0.01 x s	±1% resp. ±10 ms
Tripping delay	Starting from U higher than 1.3 x U>			<+40ms
disengaging time				<+40ms

Voltage Protection V<[x]		*Range*	*Step range*	*Tolerance*
V<	Pickup value	0.01 ... 2.00 x Vn	0.01 x Vn	±1.5% of the setting value resp.1% Vn
resetting ratio		103% or 0.5% x Vn		
t	Tripping delay	0.00 ... 300.00 x s	0.01 x s	±1% resp. ±10 ms
Tripping delay	Starting from V lower than 0.7 x V<			<+40ms
disengaging time				<+40ms

Residual Voltage Protection VE[x]		*Range*	*Step range*	*Tolerance*
VE>	Pickup value	0.01 ... 2.00 x Vn	0.01 x Vn	±1.5% of the setting value resp.1% Vn
resetting ratio		97% or 0.5% x Vn		
t	Tripping delay	0.00 ... 300.00 x s	0.01 x s	±1% resp. ±10 ms
Tripping delay	Starting from VE higher than 1.3 x VE>			<+40ms
disengaging time				<+40ms

Frequency Protection f>[x]		*Range*	*Step range*	*Tolerance*
f>	Pickup value	40.00 ... 70.00 x Hz	0.01 x	0.05% fn of the setting value
resetting ratio		99.95% or 0.05% fn		
t	Tripping delay	0.00 ... 3600.00 x s	0.01 x s	±1% resp. ±10 ms
Tripping delay	Starting from f higher than f>+0.02 Hz			40-50Hz <+60ms 50-70Hz <+50ms
disengaging time				40-50Hz <+85ms 50-70Hz <+75ms
Frequency Protection f<[x]		*Range*	*Step range*	*Tolerance*
f<	Pickup value	40.00 ... 70.00 x Hz	0.01 x	0.05% fn of the setting value
t	Tripping delay	0.00 ... 3600.00 x s	0.01 x s	±1% resp. ±10 ms
resetting ratio		100.05% or 0.05% fn		
Tripping delay	Starting from f lower than f<-0.02 Hz			40-50Hz <+60ms 50-70Hz <+50ms
disengaging time				40-50Hz <+85ms 50-70Hz <+75ms
V Block f	Threshold for the release of the frequency stages	0.01 ... 2.00 x Vn	0.01 x Vn	±1.5% of the setting value resp. 1% Un
resetting ratio		103% or 0.5% x Un		

Circuit Breaker Failure Protection CBF		*Range*	*Step range*	*Tolerance*
I-CBF>	If the pick-up value is exceeded, the module/stage will be started.	0.0...0.1 x In	0.01 x In	±1.5% of the setting value resp.1% In
resetting ratio		0.5% x In		
t-CBF	If the delay time is expired, an CBF alarm is given out.	0.03...10.00 x s	0.01 x s	±1% resp. ±10 ms
Tripping delay	Starting from I higher than 1.3 x I-CBF>			<+40 ms
disengaging time				<+40 ms

Trip Ciruit Supervision TCS		*Range*	*Step range*	*Tolerance*
t-TCS	Tripping delay	0.1...10.00 x s	0.1 x s	±1% resp. ±10 ms

Current Transformer Supervision CTS		*Range*	*Step range*	*Tolerance*
ΔI	In order to prevent faulty tripping of phase selective protection functions that use the current as tripping criterion. If the difference of the measured earth current and the calculated value I0 is higher than the pick up value ΔI, an alarm event is generated after expiring of the excitation time. In such a case, the existence of a fuse failure, a broken wire or a faulty measuring circuit can be assumed.	0.1...1.0 x In	0.1 x In	±2% of the setting value resp.1.5% In
resetting ratio		94%		
t	Alarm delay	0.1...9999 s	0.1 x s	±1% resp. ± 10 ms

Voltage Transformer Supervision VTS		*Range*	*Step range*	*Tolerance*
ΔV	In order to prevent faulty tripping of phase selective protection functions that use the voltage as tripping criterion. If the difference of the residual voltage and the calculated value V0 is higher than the pick up value ΔV, an alarm event effected after the excitation time. In such a case, a fuse failure, a broken wire or a faulty measuring circuit can be assumed.	0.2...1.0 x Vn	0.2 x Vn	±2% of the setting value resp.1.5% Vn
resetting ratio		94%		
t	Alarm delay	0.1...9999 s	0.1 x s	±1% resp. ± 10 ms

Options				
Automatic Reclosing AR		*Range*	*Step range*	*Tolerance*
t-start	Start time - Within this time/duration, the AR can be started.	0.1 ... 10.00 x s	0.01 x s	±1% resp. ±20 ms
t-DP1 .... t-DP6	Dead time between trip and reclosure attempt in case of phase faults.	0.1 ... 200.00 x s	0.01 x s	±1% resp. ±20 ms
t-DE1 …. t-DE6	Dead time between trip and reclosure attempt in case of earth faults.	0.1 ... 200.00 x s	0.01 x s	±1% resp. ±20 ms
t-Superv	Supervision time	1 ... 300.00 x s	0.01 x s	±1% resp. ±20 ms
t-CB ON Cmd	The command "CB on" will be given out for this time.	0.1 ... 300.00 x s	0.01 x s	±1% resp. ±20 ms
t-sync_AR	Within this synchronizing time/duration, the AR can be started.	0.01 ... 100.00 x s	0.01 x s	±1% resp. ±20 ms
1.n SA ... 6.t-SA	Trip delay for fast trip	0 ... 10.00 x s	0.01 x s	±1% resp. ±20 ms

Asymmetry V012[x]		*Range*	*Step range*	*Tolerance*
V1>	Overvoltage Positive Phase Sequence	0.01 ... 2.00 x Vn	0.01 x Vn	±2% of the setting value resp.1,5% Vn
resetting ratio		97% or 0.5% x Vn		
V1<	Undervoltage Positive Phase Sequence	0.01 ... 2.00 x Vn	0.01 x Vn	±2% of the setting value resp.1,5% Vn
resetting ratio		103% or 0.5% x Vn		
V2>	Overvoltage Negative Phase Sequence	0.01 ... 2.00 x Vn	0.01 x Vn	±2% of the setting value resp.1,5% Vn
resetting ratio		97% or 0.5% x Vn		
t	Tripping delay	0.00 ... 300.00 x s	0.01 x s	±1% resp. ±10 ms

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