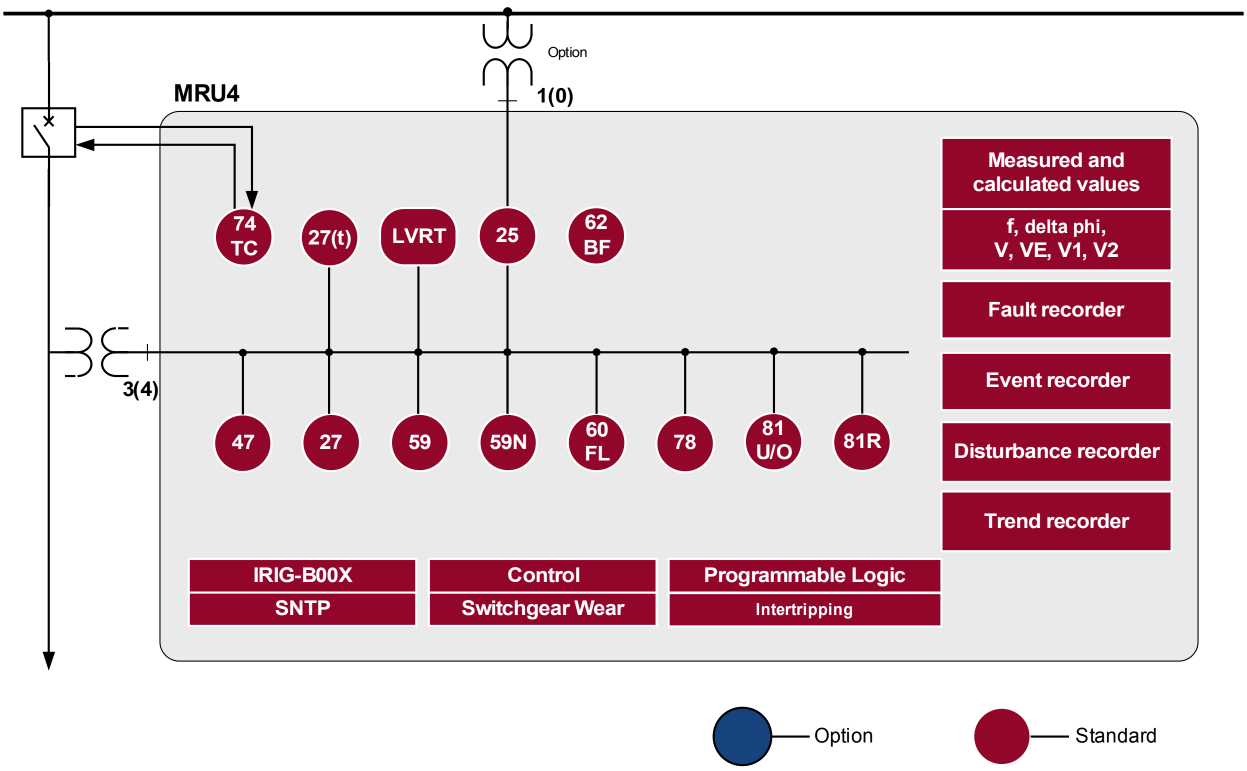
HighPROTEC

Manual | Voltage Relay

MRU4
Software-Version: 2.2.d
DOK-HB-MRU4E
Revision: A
English

MRU4 Functional Overview



Order Code

Voltage and Frequency supervision	MRU4-	A	0		

Digital Inputs	Binary output relays	Housing	Large display
8	6	B1	-

Hardware variant		
Standard		
Housing and mounting		
Door mounting	A	
Door mounting 19” (flush mounting)	B	
Communication protocol		
Without protocol		A
Modbus RTU, IEC60870-5-103, RS485/terminals		B
Modbus TCP, IEC61850 prepared, Ethernet 100 MB/RJ45		C
Profibus-DP, optic fiber		D
Profibus-DP, RS485/D-SUB		E
Modbus RTU, IEC60870-5-103, optic fiber		F
Modbus RTU, IEC60870-5-103, RS485/D-SUB		G
IEC61850, Ethernet 100MB/ RJ45		H
Pre-setting from available menu languages		
Standard English/German/Russian/Polish/Portuguese/French		

The parameterizing- and disturbance analyzing software Smart view is included in the delivery of HighPROTEC devices.

ANSI: 27, 59, 59N, 81U/O, 60FL, 47, 86, 74TC, 81R, 78, ROCOF, LVRT

Table of Contents

This manual applies to devices (version):

Version 2.2.d

Build: 19709

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 Kempen GmbH* 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 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* specialists.

Warranty and liability conditions stated in *Woodward* 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 programmable devices subject to this manual are designed for protection and also control of power installations and operational devices that are fed by voltage sources with a fixed frequency, i.e. fixed at 50 or 60 Hertz. They are not intended for use with Variable Frequency Drives. 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 programming 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 programming and parameterization all operational conditions (failures). The proper use requires a backup protection by an additional protective device. Before starting any operation and after any modification of the programming (parameterization) test make a documentary proof that your programming 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**
- **Transformer Differential Protection**

Any usage beyond these applications the devices are not designed for. This applies also to the use as a partly completed machinery. 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 and tolerances specified by *Woodward* 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, please visit the download section of our website:

www.woodward.com

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

CAUTION

Electrostatic Discharge Awareness

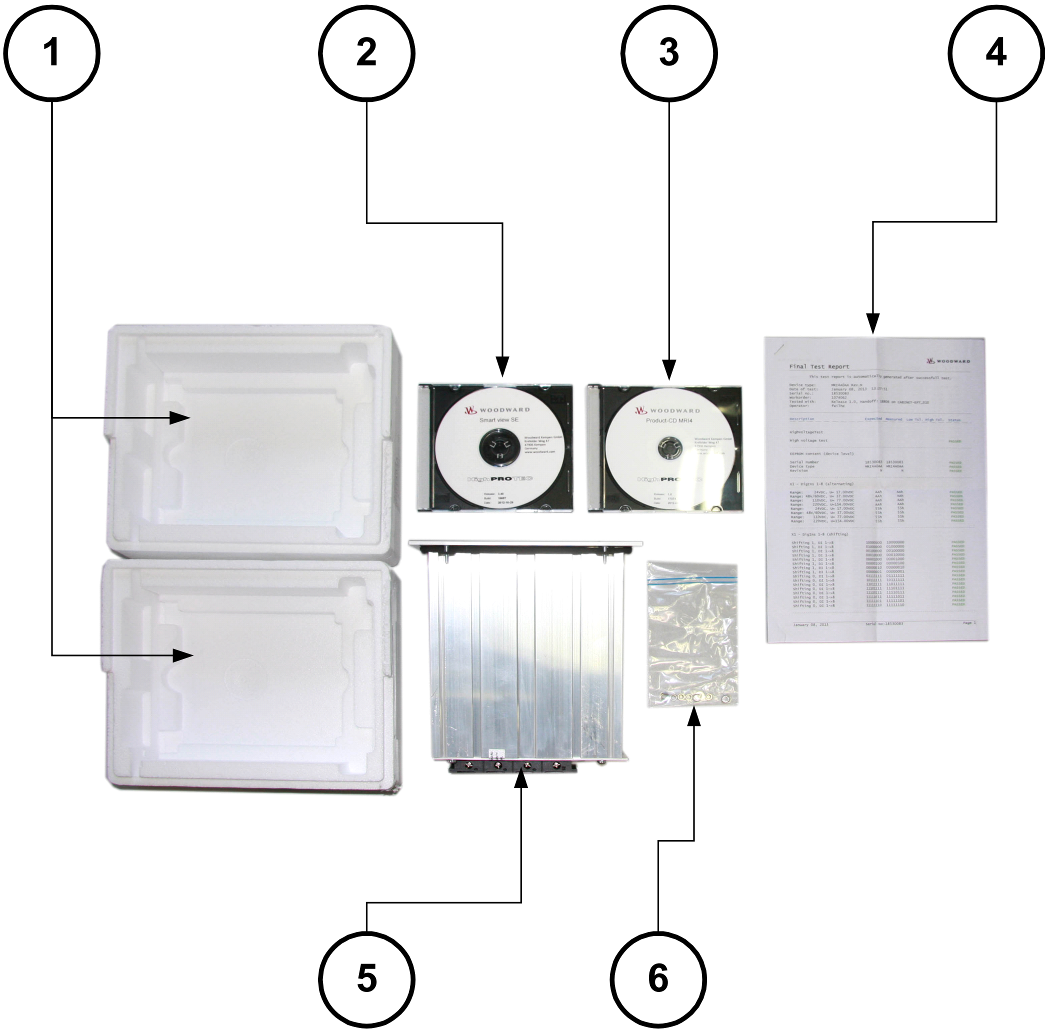
All electronic equipment is electro static-sensitive, some components more than others. To protect these components from electro static damage, you must take special precautions to minimize or eliminate electrostatic discharges.

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:**
   - **Verify the safe isolation from supply. All connectors have to be unplugged.**
   - **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 includes:

1	The transportation box
2	The protective device
3	The mounting nuts
4	The test report
5	The product CD that includes the manuals
6	The parameter and evaluation software Smart view

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

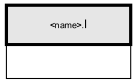
The devices must not be stored outdoors. The storing facilities have to be sufficiently ventilated and must be dry (see Technical Data).

Important Information

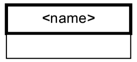
WARNING **In line with the customer's requirement the devices are combined in a modular way (in compliance with the order code). The terminal assignment of the device can be found on the top of the device (wiring diagram).**

Symbols

Setting value:

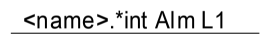


Device planning:

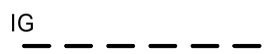


Signal:

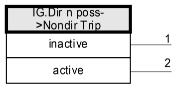
internal message



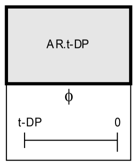
Measured values:



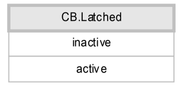
Functional description: If the setting value "IG.Block at VG=0" is set to "inactive" the output 1 is active and output 2 is inactive. If the setting value "IG.Block at VG=0" is set to "active" the output 2 is active and the output 1 is inactive.



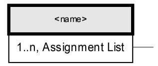
"ϕ"=Elements with complex functions "gray-box".



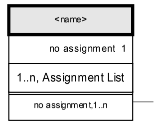
Option/features to be realised in the future



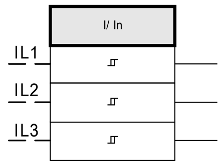
Parameter of a Module-Input with a SelectionList/DropDown. An (1..n) signal/output from the list or a pre-defined value can be selected.



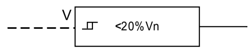
Parameter of a Module-Input (with special values): An (1..n) output from the list will be assigned to the input "<name>.identifier". If the parameter is set to "ItemNull", an "inactive"-signal will be given out.

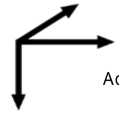


Limit value monitoring with three analogue input values. Compares 3 analogue values with the set limit; output values are three different binary values as a result of the comparision. If the analogue signal exceeds the limit I/In the corresponding output signal becomes "1".



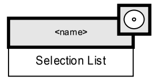
Limit value monitoring (Compared to a fixed value). Compares a value with the fixed set limit; output value is binary as a result of the comparision. If the signal exceeds the limit the corresponding output signal becomes "1".



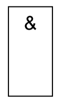


Adaptive Parameter

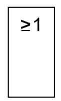
Direct Command



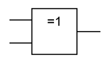
And



Or



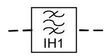
Exclusive-OR



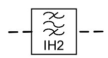
Negated input

Negated output

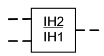
Band-pass (filter)
IH1



Band-pass (filter)
IH2



Quotient of analogue values

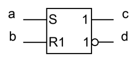


Analog values

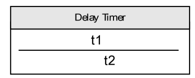
Analogue values comparator

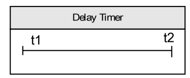
RS flip-flop

a	b	c	d
0	0	Unchanged	
0	1	0	1
1	0	1	0
1	1	0	1

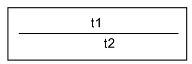


Time stage: A "1" at the input starts the stage. If the time <name>.t is expired the output becomes "1" too. The time stage will be reset by "0" at the input. Thus the output will be set to "0" at the same time.

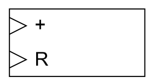




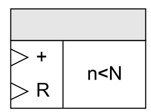
t1: Switch On Delay
t2: Switch Off Delay



Edge triggered counter
+ increment
R Reset

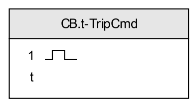


Counter increments with every rising edge. Output will be set as long as n<N.



+ 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.



Output Signal —— 2

2 —— Input Signal

Signal	Description	No.
Prot.available	Please Refer To Diagram: **Prot**	1
name.active	Please Refer To Diagram: Blockings	2
name.Blo TripCmd	Please Refer To Diagram: Trip blockings	3
name.active	Please Refer To Diagram: Blockings**	4
IH2.Blo L1	Please Refer To Diagram: IH2	5
IH2.Blo L2	Please Refer To Diagram: IH2	6
IH2.Blo L3	Please Refer To Diagram: IH2	7
IH2.Blo IG	Please Refer To Diagram: IH2	8
name. Fault in projected direction	Please Refer To Diagram: direction decision phase overcurrent	9
name. Fault in projected direction	Please Refer To Diagram: direction decision Earth fault	10
CB.Trip CB	Please Refer To Diagram: CB	11
VTS.Alarm	Please Refer To Diagram: VTS	12a
VTS.VTS.Ex FF VT	Please Refer To Diagram: VTS	12b
VTS.VTS.Ex FF EVT	Please Refer To Diagram: VTS	12c
name.Alarm	Each alarm of a module (except from supervision modules but including CBF) will lead to a general alarm (collective alarm).	14
name.TripCmd	Each trip of an active, trip authorized protection module will lead to a general trip.	15
name.Trip L1	Each trip of an active, trip authorized protection module will lead to a general trip.	16
name.Trip L1	Each trip of an active, trip authorized protection module will lead to a general trip.	16a
name.Trip L1	Each trip of an active, trip authorized protection module will lead to a general trip.	16b
name.Trip L2	Each trip of an active, trip authorized protection module will lead to a general trip.	17
name.Trip L2	Each trip of an active, trip authorized protection module will lead to a general trip.	17a
name.Trip L2	Each trip of an active, trip authorized protection module will lead to a general trip.	17b
name.Trip L3	Each trip of an active, trip authorized protection module will lead to a general trip.	18
name.Trip L3	Each trip of an active, trip authorized protection module will lead to a general trip.	18a
name.Trip L3	Each trip of an active, trip authorized protection module will lead to a general trip.	18b
name.TripCmd	Each trip of an active, trip authorized protection module will lead to a general trip.	19
name.TripCmd	Each trip of an active, trip authorized protection module will lead to a general trip.	19a
name.TripCmd	Each trip of an active, trip authorized protection module will lead to a general trip.	19b
name.TripCmd	Each trip of an active, trip authorized protection module will lead to a general trip.	19c
name.TripCmd	Each trip of an active, trip authorized protection module will lead to a general trip.	19d

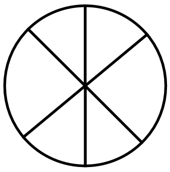
No.	Signal	Definition
20	name.Trip L1	Each trip of an active, trip authorized protection module will lead to a general trip.
21	name.Trip L2	Each trip of an active, trip authorized protection module will lead to a general trip.
22	name.Trip L3	Each trip of an active, trip authorized protection module will lead to a general trip.
23	name.Trip	Each trip of an active, trip authorized protection module will lead to a general trip.
24	name.Alarm L1	Each phase selective alarm of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general alarm (collective alarm).
24a	name.Alarm L1	Each phase selective alarm of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general alarm (collective alarm).
24b	name.Alarm L1	Each phase selective alarm of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general alarm (collective alarm).
25	name.Alarm L2	Each phase selective alarm of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general alarm (collective alarm).
25a	name.Alarm L2	Each phase selective alarm of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general alarm (collective alarm).
25b	name.Alarm L2	Each phase selective alarm of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general alarm (collective alarm).
26	name.Alarm L3	Each phase selective alarm of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general alarm (collective alarm).
26a	name.Alarm L3	Each phase selective alarm of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general alarm (collective alarm).
26b	name.Alarm L3	Each phase selective alarm of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general alarm (collective alarm).
27	name.Alarm	Each phase selective alarm of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general alarm (collective alarm).
27a	name.Alarm	Each phase selective alarm of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general alarm (collective alarm).
27b	name.Alarm	Each phase selective alarm of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general alarm (collective alarm).
27c	name.Alarm	Each phase selective alarm of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general alarm (collective alarm).
27d	name.Alarm	Each phase selective alarm of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general alarm (collective alarm).
28	name.Alarm L1	Each phase selective alarm of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general alarm (collective alarm).
29	name.Alarm L2	Each phase selective alarm of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general alarm (collective alarm).
30	name.Alarm L3	Each phase selective alarm of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general alarm (collective alarm).
31	name.Alarm	Each phase selective alarm of a module (I, IG, V, VX depending on the device type) will lead to a phase selective general alarm (collective alarm).
32	Prot.Blo TripCmd	
33	CB.Pos	Please Refer To Diagram: CB.CB Manager
34	CB.Pos ON	Please Refer To Diagram: CB.CB Manager
35	CB.Pos OFF	Please Refer To Diagram: CB.CB Manager
36	CB.Pos Indeterm	Please Refer To Diagram: CB.CB Manager
37	CB.Pos Disturb	Please Refer To Diagram: CB.CB Manager
38a	LOP.LOP Blo	Please Refer To Diagram: LOP.LOP Blo
38b	LOP.Ex FF VT	Please Refer To Diagram: LOP.Ex FF VT
38c	LOP.Ex FF EVT	Please Refer To Diagram: LOP.Ex FF EVT

Q->&V<.Decoupling Energy Resource	Please Refer To Diagram: Q->&V<.Decoupling Energy Resource	39
CTS.Alarm	Please Refer To Diagram: CTS.Alarm	40
	Please Refer To Diagram: SG.Prot ON	41
SG.ON Cmd	Please Refer To Diagram: SG.ON Cmd	42
AnIn[1].Value	Please Refer To Diagram: Analog values	43
AnIn[2].Value	Please Refer To Diagram: Analog values	44
AnIn[n].Value	Please Refer To Diagram: Analog values	45

Access Level

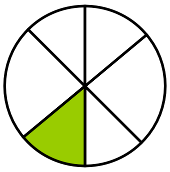
(Please refer to chapter [Parameter\Access Level])

Read Only-Lv0



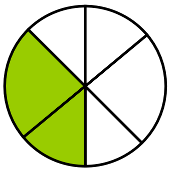
Parameters can only be read within this level.

Prot-Lv1



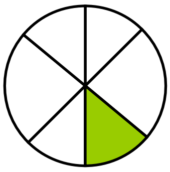
This level enables to execute Resets and Acknowledgements

Prot-Lv2



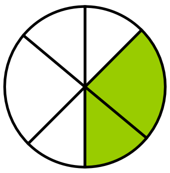
This level enables to modify protection settings

Control-Lv1



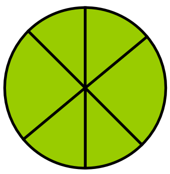
This level enables to control switchtgears

Control-Lv2



This level enables to modify the settings of switchgears

Supervisor-Lv3



This level provides full access (not limited) to all settings

General Conventions

»*Parameters are indicated by right and left double arrow heads and written in italic*«

»SIGNALS are indicated by right and left double arrow heads and small caps«

[Paths are indicated by brackets.]

Software and Device names are written in italic

Module and Instance (Element) names are displayed italic and underlined.

»Pushbuttons, Modes and Menu entries are indicated by right and left double arrow heads.«

1	2	3	Image References (Squares)

Load Reference Arrow System

Within the HighPROTEC the “Load Reference Arrow System” is used in principal. Generator protection relays are working based on the “Generator Reference System”.

Device

MRU4

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 Kempen GmbH*.

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

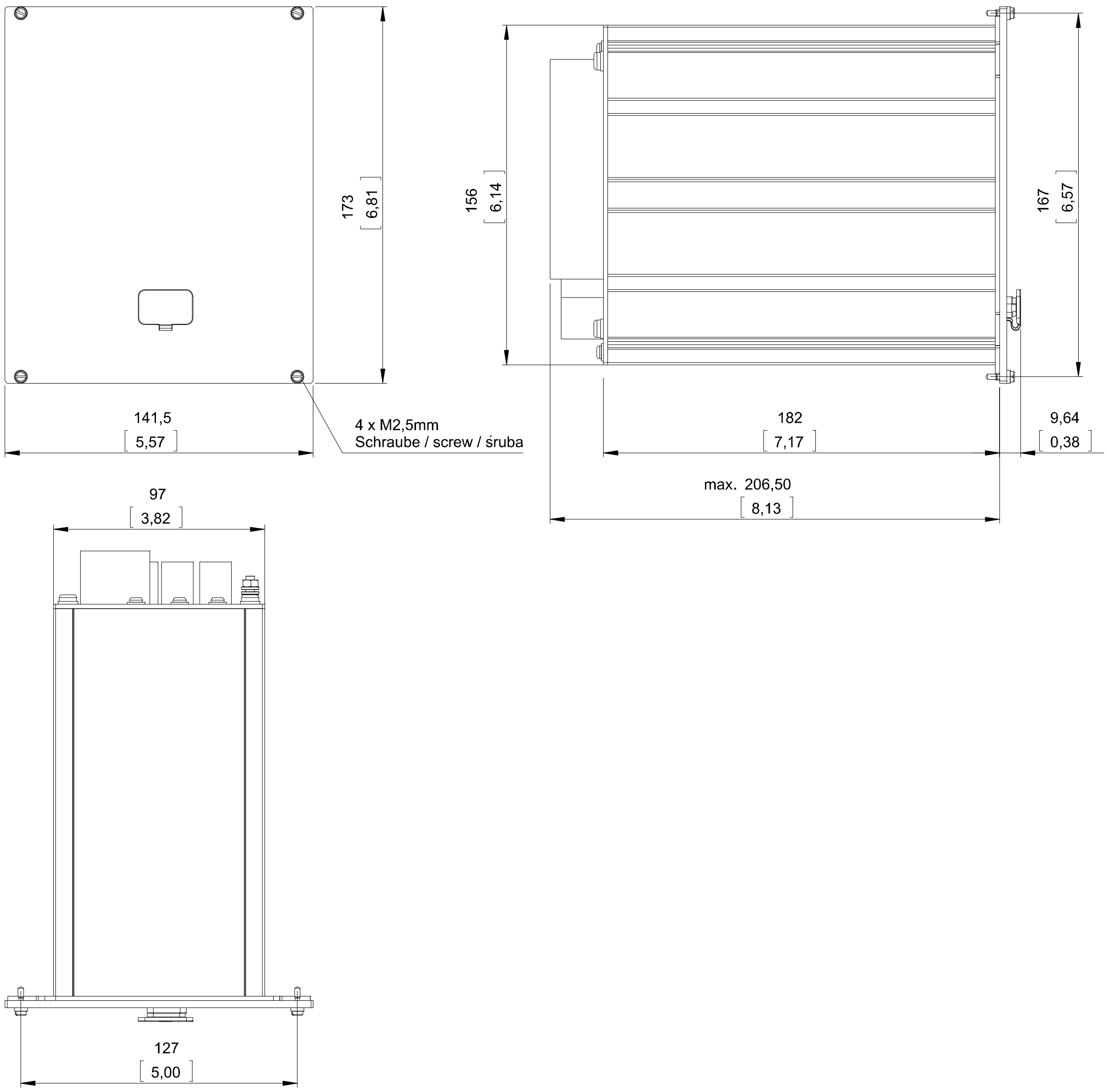
Parameter	*Description*	*Options*	*Default*	*Menu path*
Hardware Variant 1	Optional Hardware Extension	»A« 8 digital inputs | 6 binary output relays	8 digital inputs | 6 binary output relays	[MRU4]
Hardware Variant 2	Optional Hardware Extension	»0« Standard	»0« Standard	[MRU4]
Housing	Mounting form	»A« Flush mounting, »B« 19 inch mounting (semi-flush), »H« Customized Version 1	Flush mounting	[MRU4]
Communication	Communication	»A« Without, »B« RS 485: Modbus RTU | IEC 60870-5-103, »C« Ethernet: Modbus TCP, »D« Fiber Optics: Profibus-DP, »E« D-SUB: Profibus-DP, »F« Fiber Optics: Modbus RTU | IEC 60870-5-103, »G« RS 485/D-SUB: Modbus RTU | IEC 60870-5-103, »H« Ethernet: IEC61850	Ethernet: IEC61850	[MRU4]

Installation and Connection

Three-Side-View - 19”

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.**

NOTICE **The three-side-view shown in this section is exclusively valid for 19” devices.**



3-Side-View B1 Housing (19” Devices)

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 (0.56-0.79 Nm [5-7 lb·in]).

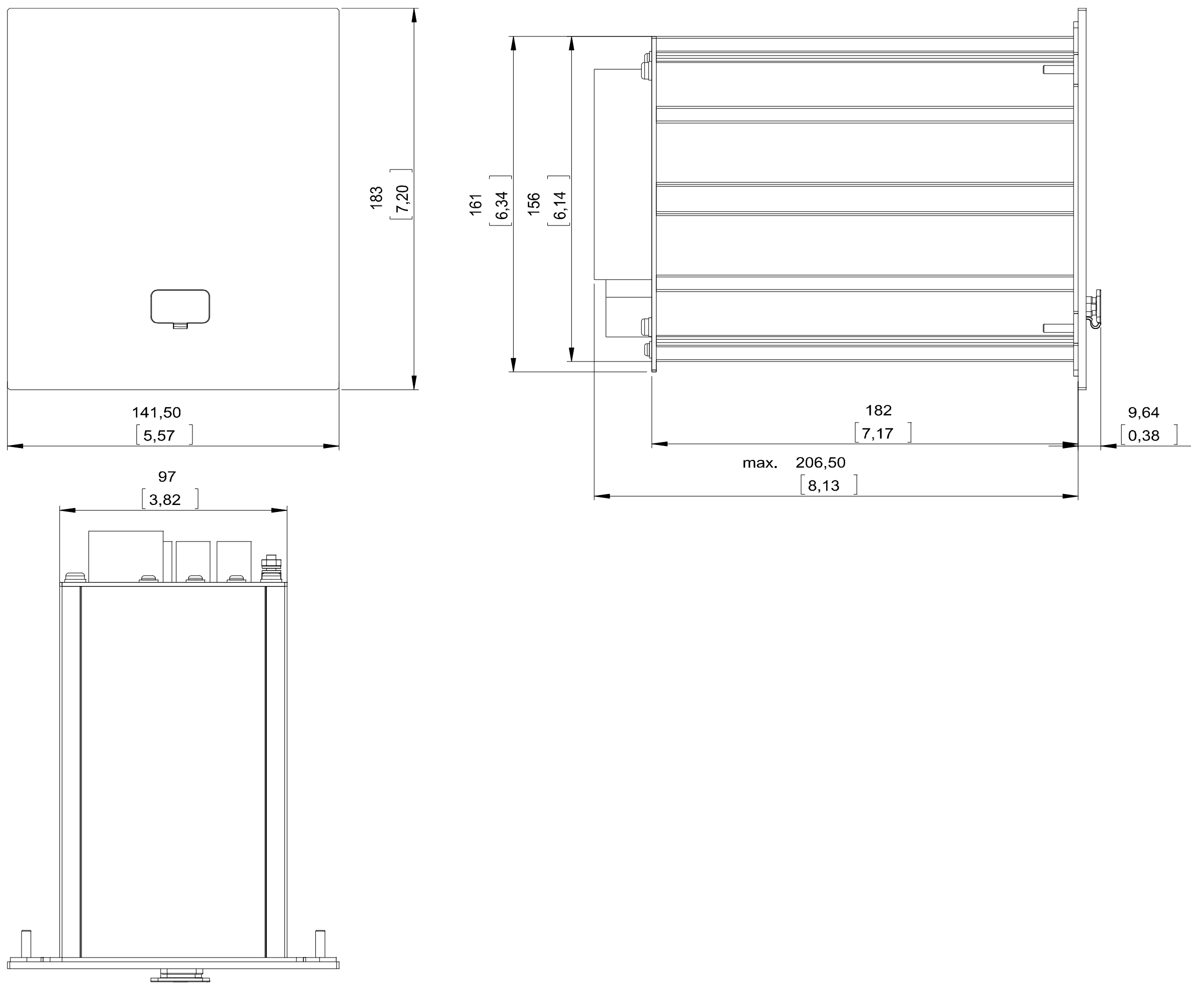
Three-Side-View - 8-Pushbutton Version

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.

NOTICE

**The installation diagram shown in this section is exclusively valid for devices with 8 pushbuttons at the front side of the HMI.
(INFO-, C-, OK-, CTRL-Pushbutton and 4 Softkeys (Pushbuttons)).**



3-Side-View B1 Housing (Devices with 8 Softkeys)

WARNING

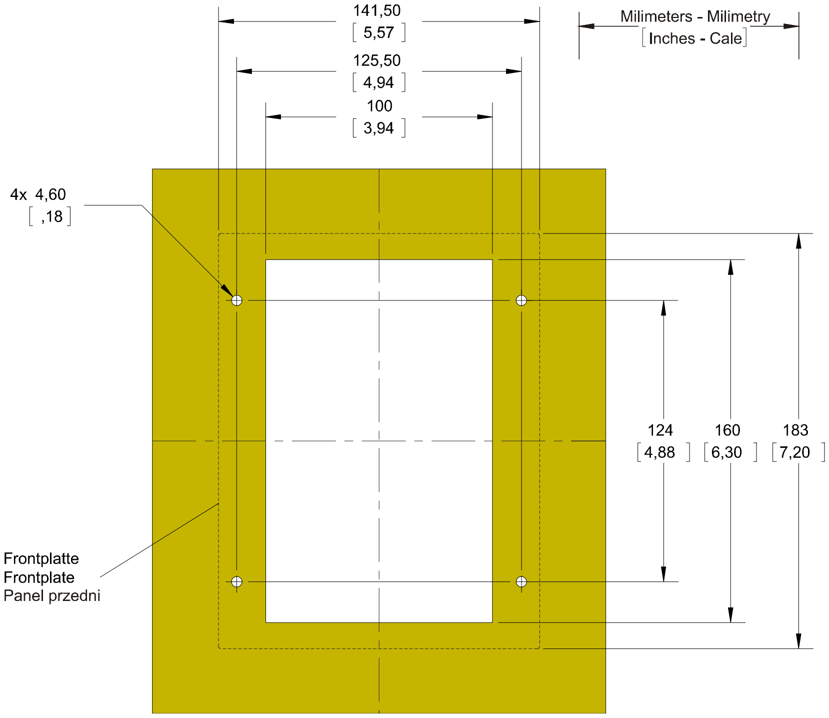
The housing must be carefully grounded. Connect a ground cable (4 to 6 mm^2 / AWG 12-10) / 1,7 Nm [15 lb·in]) to the housing, using the screw, which is marked with the ground symbol (at the rear side of the device).

The power supply card needs a separate ground connection (2.5 mm^2 (AWG 14) at terminal X1 (0.56-0.79 Nm [5-7 lb·in]).

Installation Diagram 8-Pushbutton Version

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

NOTICE **The installation diagram shown in this section is exclusively valid for devices with 8 pushbuttons at the front side of the HMI. (INFO-, C-, OK-, CTRL-Pushbutton and 4 Softkeys (Pushbuttons)).**



B1 Housing Door Cut-out (8-Pushbutton Version)

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 (0.56-0.79 Nm [5-7 lb·in]).

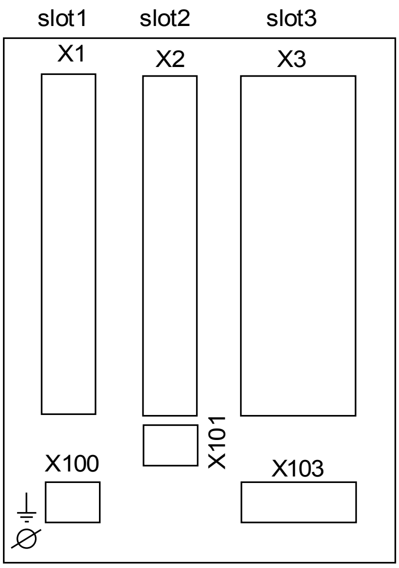
CAUTION **Be careful. Do not overtighten the mountings nuts of the relay (M4 metric 4 mm). Check the torque by means of a torque wrench (1,7 Nm [15 lb•in]). Overtightening the mounting nuts could due to personal injury or damage the relay.**

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.

Housing B1



B1 housing – schematic diagram

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 (0.56-0.79 Nm [5-7 lb·in]).

CAUTION

The devices are very sensitive to electro-static discharges.

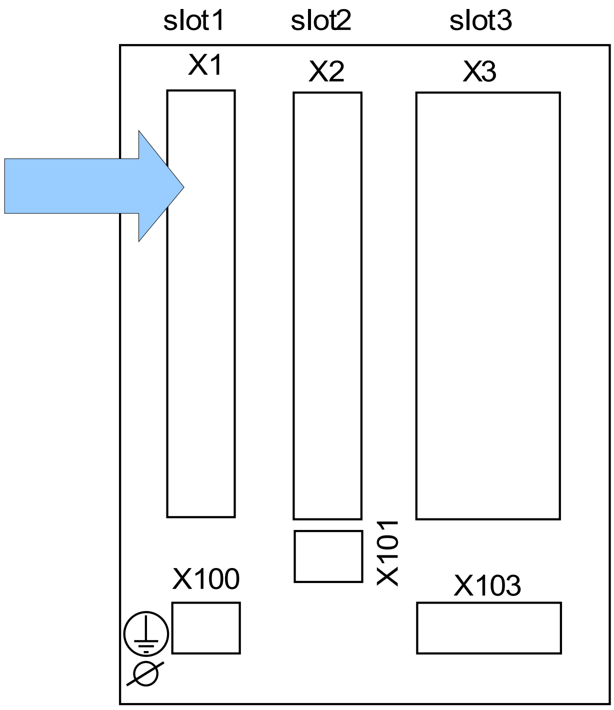
Legend for Wiring Diagrams

In this legend designations of various device types are listed, e. g. transformer protection, motor protection, generator protection, etc. Therefor it can occur that you will not find each designation on the wiring diagram of your device.

Designation	**Meaning**
FE	Connection of functional earth
Power Supply	Connection for auxiliary power supply
I L1	Phase current input L1
I L2	Phase current input L2
I L3	Phase current input L3
IG	Earth current input IG
I L1 W1	Phase current input L1, winding side 1
I L2 W1	Phase current input L2, winding side 1
I L3 W1	Phase current input L3, winding side 1
I G W1	Earth current input IG, winding side 1
I L1 W2	Phase current input L1, winding side 2
I L2 W2	Phase current input L2, winding side 2
I L3 W2	Phase current input L3, winding side 2
I G W2	Earth current input IG, winding side 2
V L1	Phase voltage L1
V L2	Phase voltage L2
V L3	Phase voltage L3
V 12	Phase to phase voltage V 12
V 23	Phase to phase voltage V 23
V 31	Phase to phase voltage V 31
V X	Forth voltage measuring input for measuring residual voltage or for Synchro-check
BO	Contact output, change over contact
NO	Contact output, normally open
DI	Digital input
COM	Common connection of digital inputs
Out+	Analog output + (0/4...20 mA or 0...10 V)
IN-	Analog input + (0/4...20 mA or 0...10 V)
N.C.	Not connected
DO NOT USE	Do not use
SC	Self supervision contact
GND	Ground

HF SHIELD	Connection cable shield
Fibre Connection	Fibre optic connection
Only for use with external galvanic decoupled CTs. See chapter Current Transformers of the manual.	Only for use with external galvanic decoupled CTs. See chapter Current Transformers of the manual.
Caution Sensitive Current Inputs	Caution Sensitive Current Inputs
Connection Diagram see specification	Connection Diagram see specification

Slot X1: Power Supply Card with Digital Inputs



Rear side of the device (Slots)

The type of power supply card and the number of digital inputs on it used in this slot is dependent on the ordered device type. The different variants have a different scope of functions.

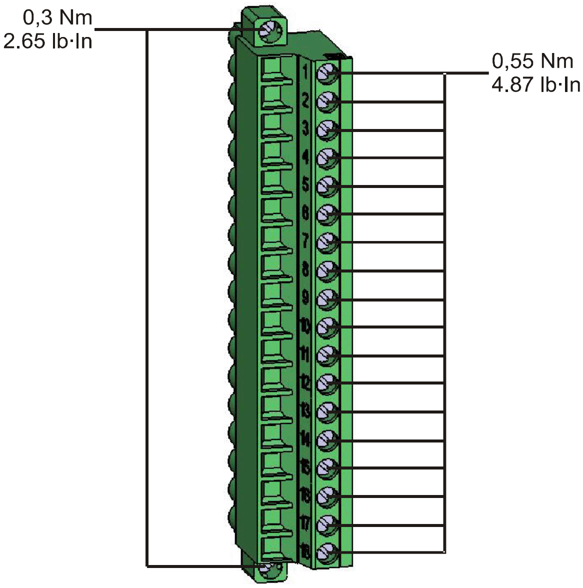
Available assembly groups in this slot:

- (**DI8-X1):** This assembly group comprises a wide-range power supply unit; and two non-grouped digital inputs and six (6) digital inputs (grouped).

NOTICE **The available combinations can be gathered from the ordering code.**

DI8-X Power Supply and Digital Inputs

WARNING **Ensure the correct tightening torques.**



This assembly group comprises:

- a wide-range power supply unit
- 6 digital inputs, grouped
- 2 digital inputs, non-grouped

Auxiliary voltage supply

- The aux. voltage inputs (wide-range power supply unit) are 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.**

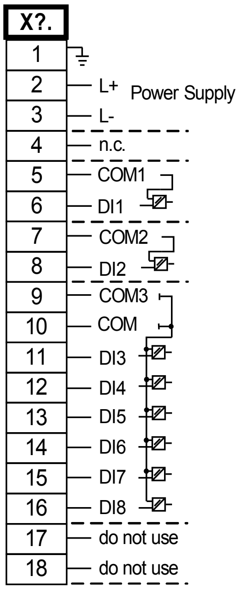
The digital inputs are provided with different switching thresholds (can be parameterized) (two AC and five DC input ranges). For the six grouped (connected to common potential) inputs and the two non-grouped inputs the following switching levels can be defined:

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

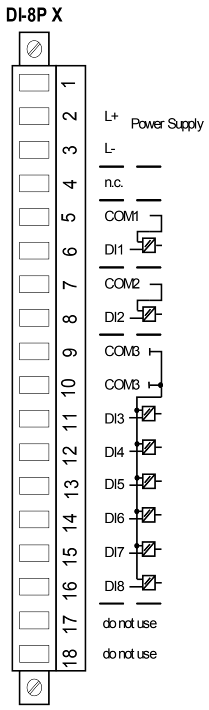
If a voltage >80% of the set switching threshold is applied at the digital input, the state change is recognized (physically "1"). If the voltage is below 40% of the set switching threshold, the device detects physically "0".

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

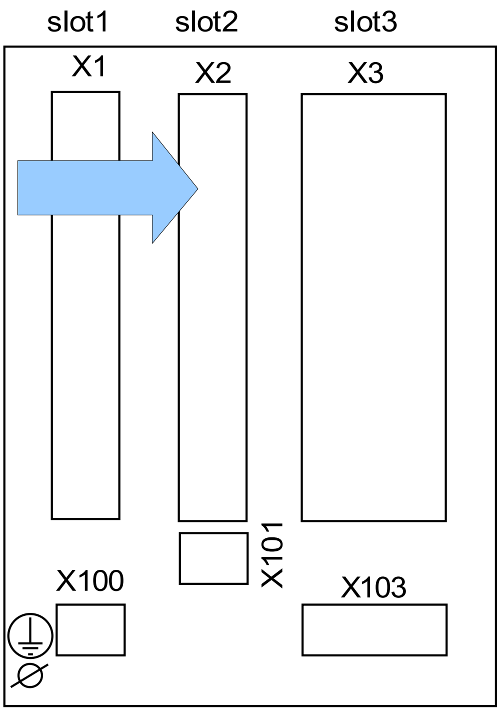
Terminals



Electro-mechanical assignment



Slot X2: Relay Output Card



Rear side of the device (Slots)

The type of card in this slot is dependent on the ordered device type. The different variants have a different scope of functions.

Available assembly groups in this slot:

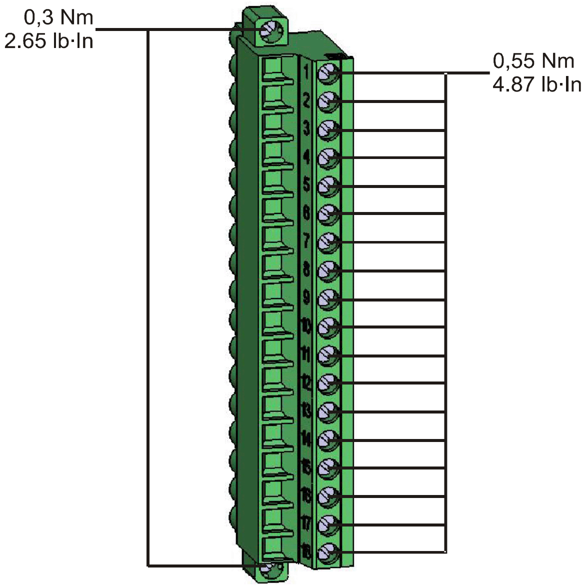
- **(RO-6 X2):** Assembly Group with 6 Relay Outputs.

NOTICE **The available combinations can be gathered from the ordering code.**

Binary Output Relays and System Contact

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.

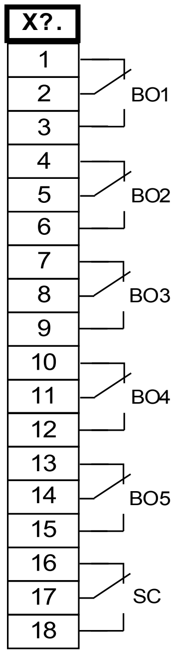
WARNING **Ensure the correct tightening torques.**



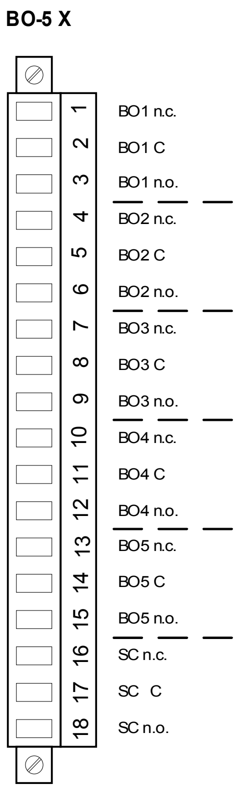
CAUTION **Please duly consider the current carrying capacity of the binary output relays. Please refer to the Technical Data.**

The *System-OK contact (SC relay)* cannot be configured. The system contact is a changeover 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 (unenergized). As soon as the system is properly started (and protection is active), the System Contact picks up and the assigned LED is activated accordingly (please refer to the Self Supervision chapter).

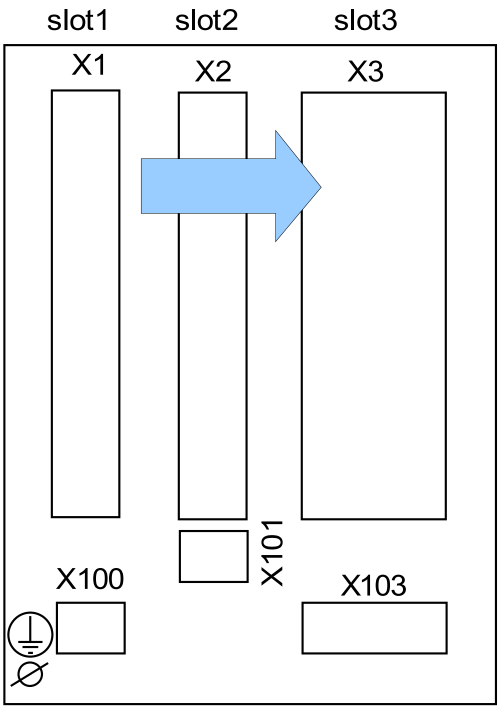
Terminals



Electro-mechanical assignment



Slot X3: Voltage Transformer Measuring Inputs



Rear side of the device (Slots)

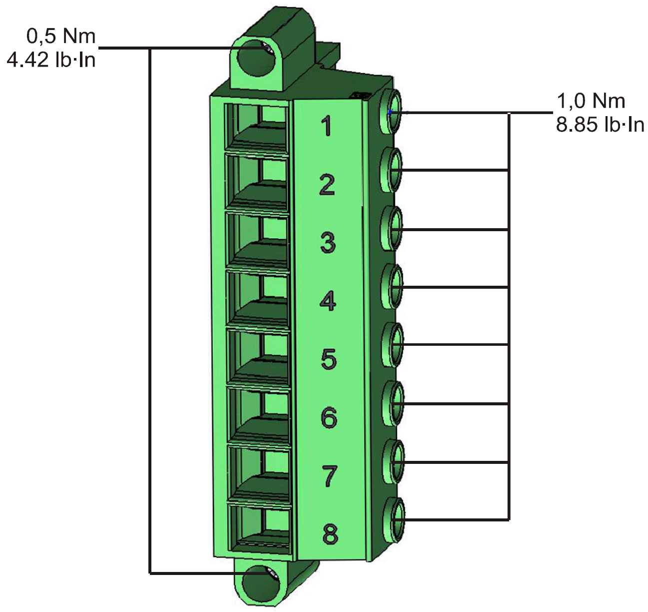
This slot contains the voltage transformer measuring inputs.

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 (Open Delta respectively V-Connection)

WARNING **Ensure the correct tightening torques.**

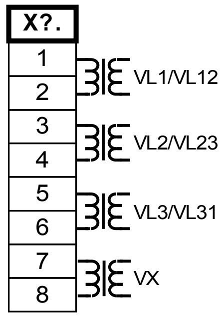


CAUTION **The rotating field of your power supply system has to be taken in to account. Make sure that the transformer is wired correctly.**

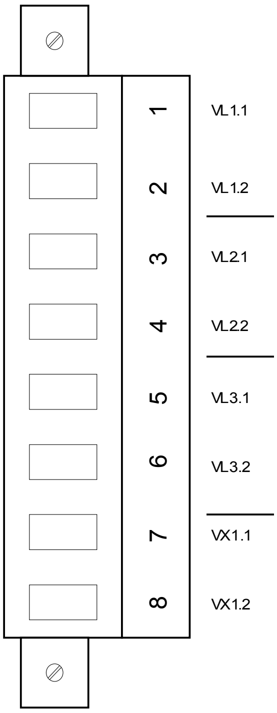
For the V-connection the parameter »VT con« has to be set to »phase-to-phase«.

Please refer to the Technical Data.

Terminals



Electro-mechanical assignment



Voltage Transformers

Check the installation direction of the VTs.

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

NOTICE **For current and voltage sensing function external wired and appropriate current and voltage transformer shall be used, based on the required input measurement ratings. Those devices provide the necessary insulation functionality.**

Check of the Voltage Measuring Values

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

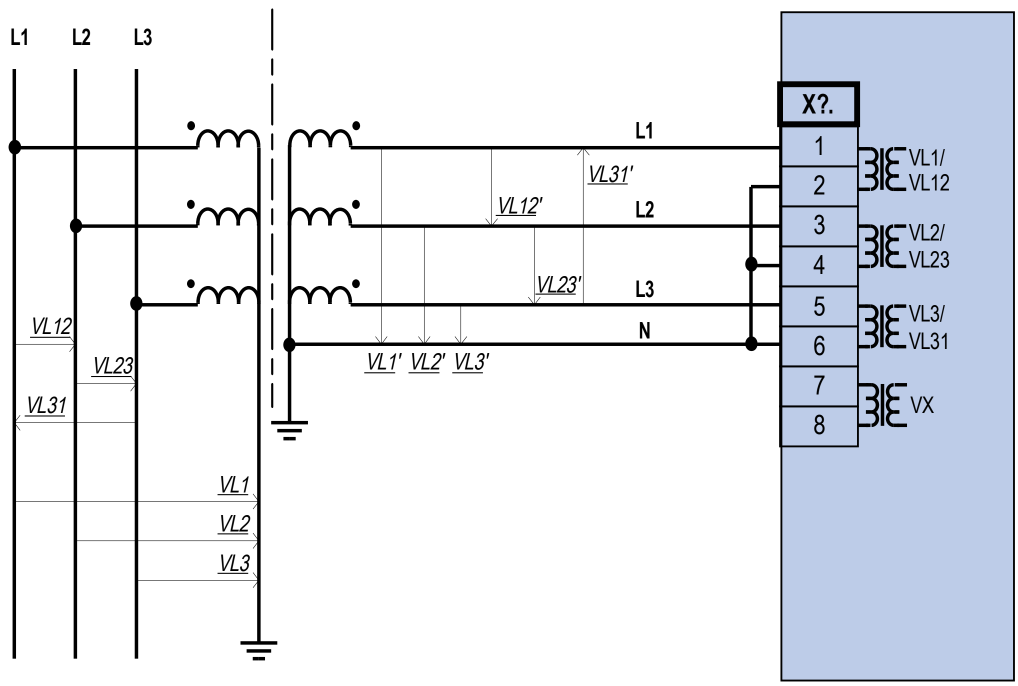
NOTICE **Take connection of the measuring transformers (star connection/open delta connection) duly into account.**

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

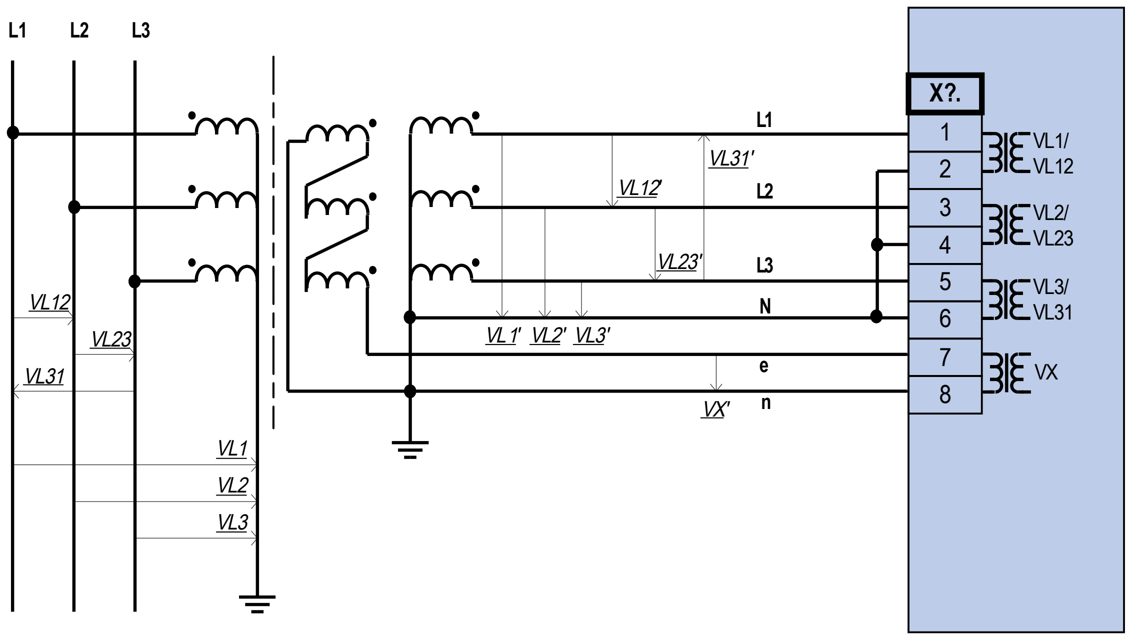
Compare the values shown in the device display with the readings of the measuring instruments. The deviation must be according to the technical data.

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.**

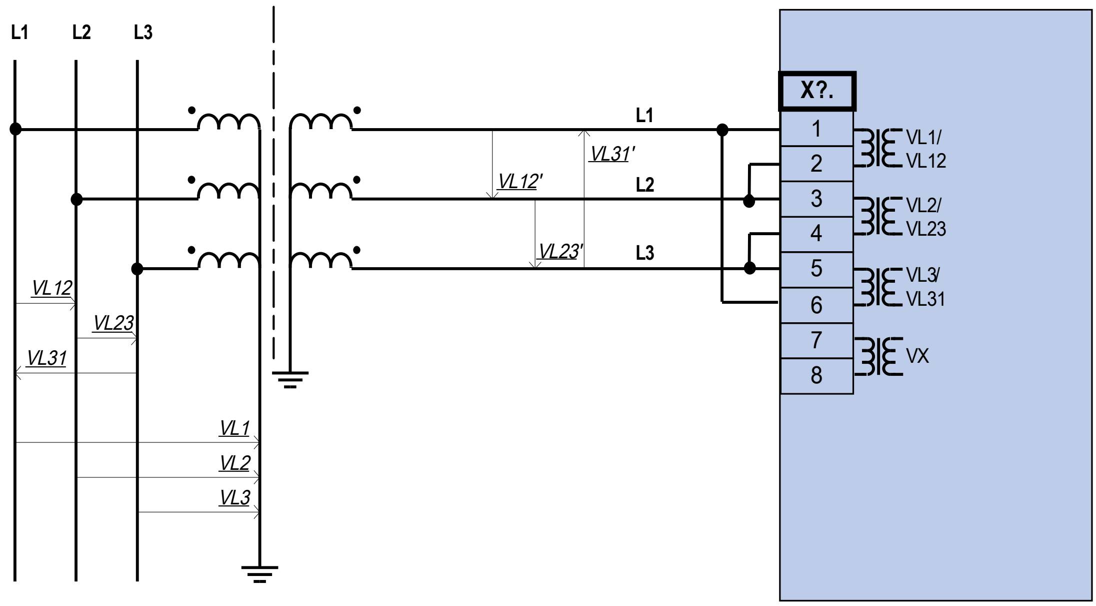
Wiring Examples of the Voltage Transformers



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

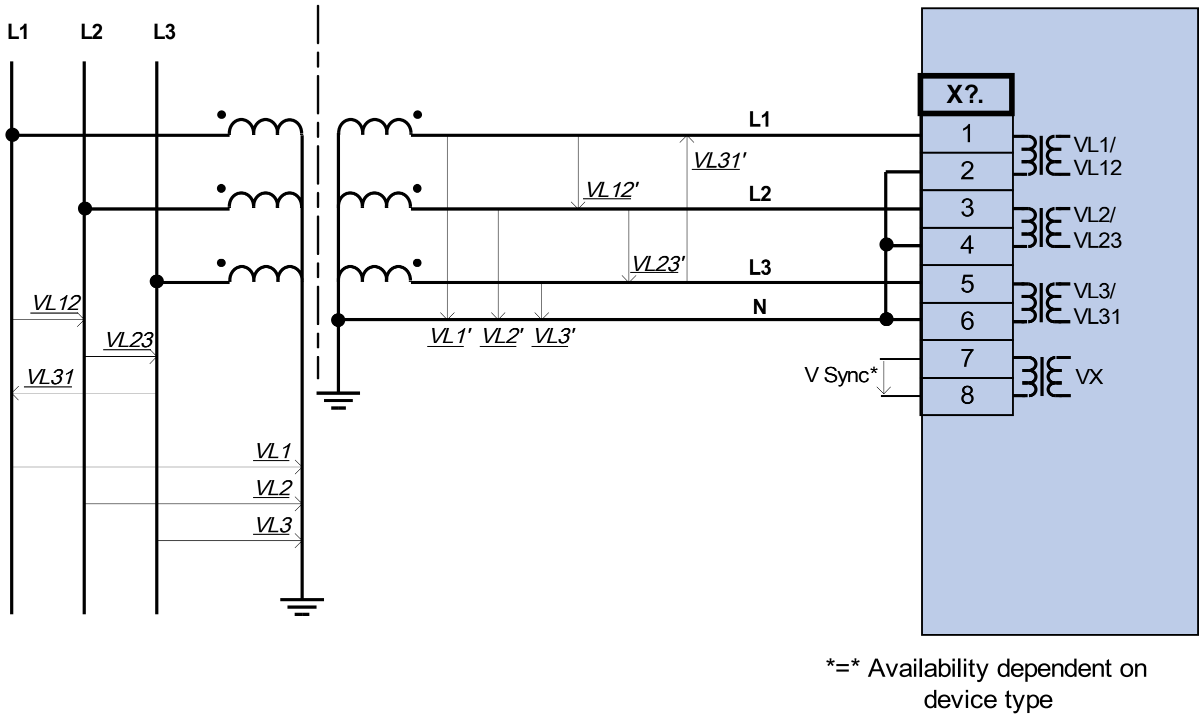


Three-phase voltage measurement - wiring of the measurement inputs: "star-connection"
Measurement of the residual voltage VG via auxilliary windings (e-n) "broken delta"

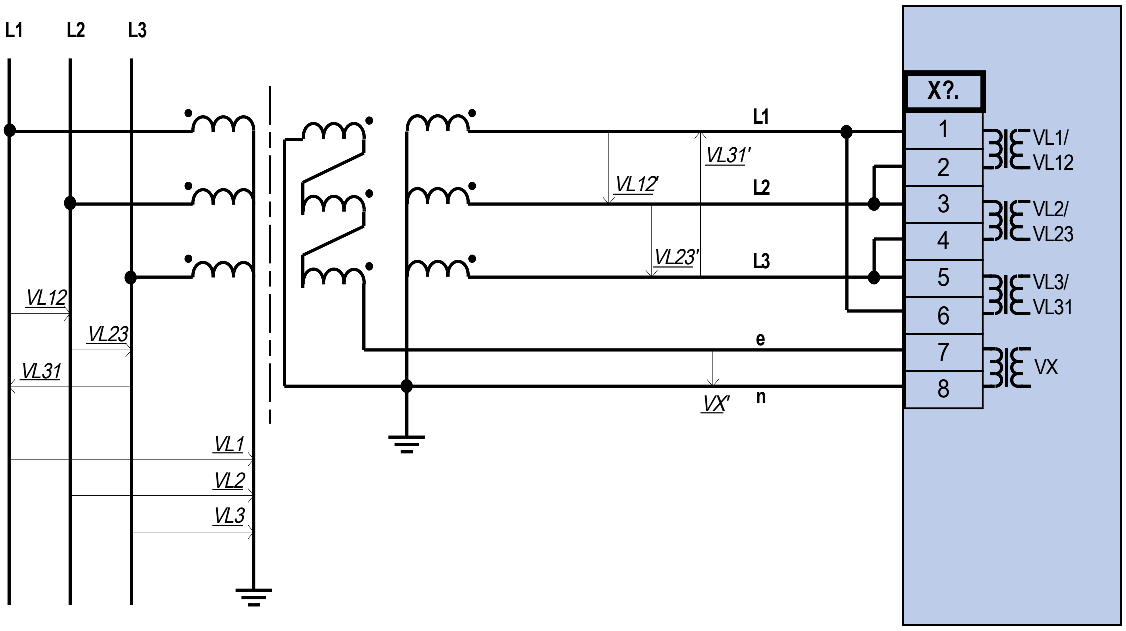


Three-phase voltage measurement - wiring of the measurement inputs: "open delta"

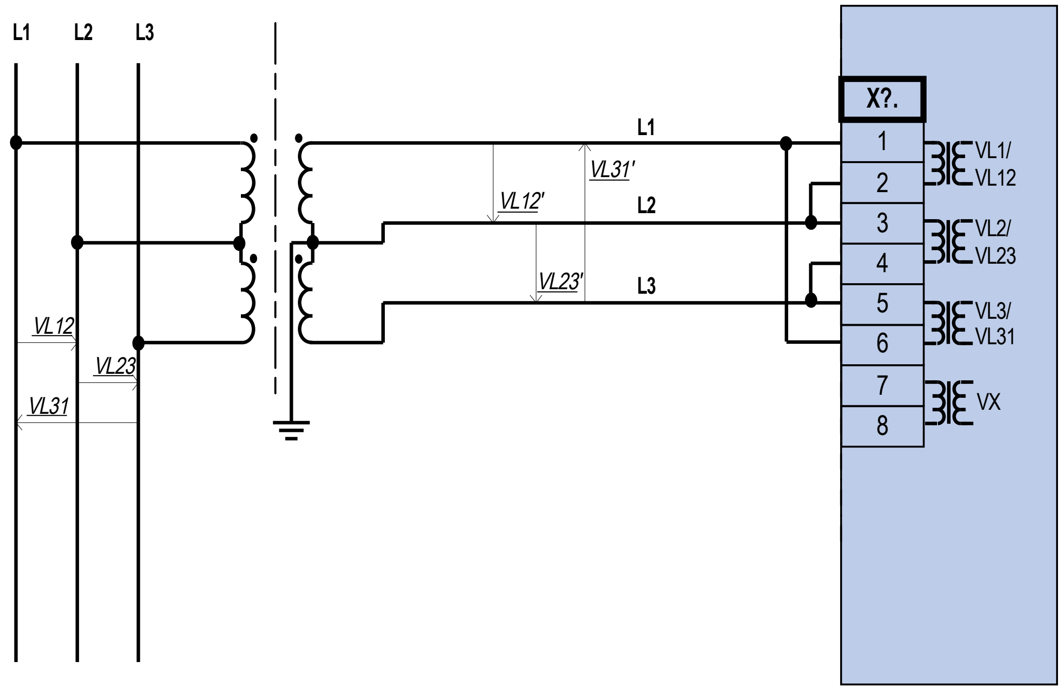
Notice!
Calculation of the residual voltage VG is not possible



Three-phase voltage measurement - wiring of the measurement inputs : "star-connection". Fourth measuring input for measuring a synchronisation voltage .

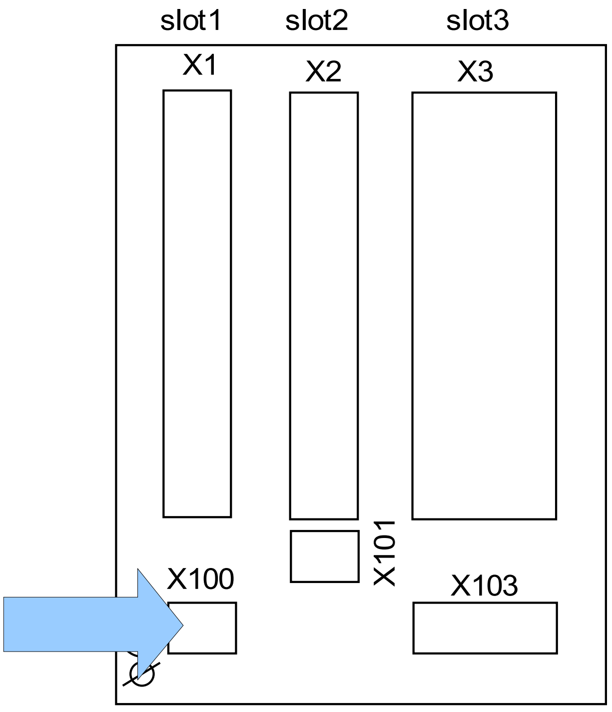


Three-phase voltage measurement - wiring of the measurement inputs : "open delta"
Measurement of the residual voltage VG via auxilliary windings (e-n) "broken delta"



Two-phase voltage measurement - wiring of the measuring inputs: "Open Delta"

Slot X100: Ethernet Interface

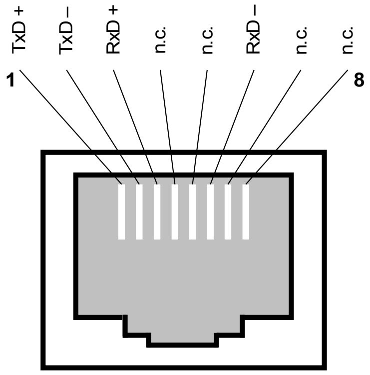


Rear side of the device (Slots)

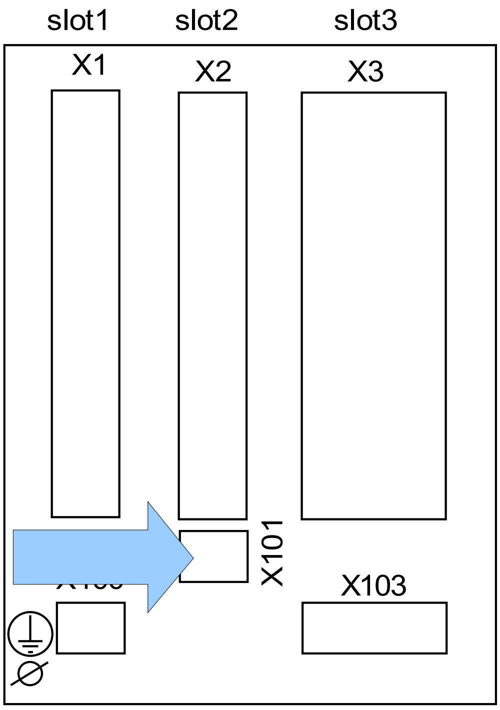
An Ethernet interface may be available depending on the device type ordered.

NOTICE **The available combinations can be gathered from the ordering code.**

Ethernet - RJ45

Terminals


Slot X101: IRIG-B00X



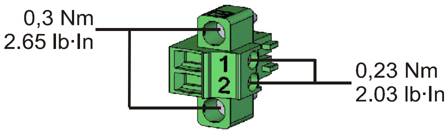
Rear side of the device (Slots)

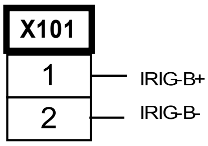
If the device is equipped with an IRIG-B00X interface is dependent on the ordered device type.

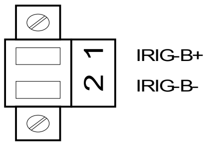
NOTICE **The available combinations can be gathered from the ordering code.**

IRIG-B00X

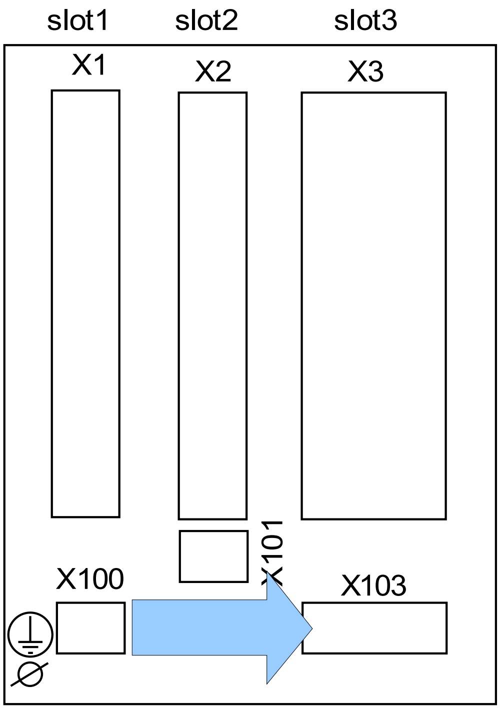
WARNING **Ensure the correct tightening torques.**



Terminal Markings


Electromechanical Assignment


Slot X103: Data Communication



Rear side of the device (Slots)

The data communication interface in the **X103** slot is dependent on the ordered device type. The scope of functions is dependent on the type of data communication interface.

Available assembly groups in this slot:

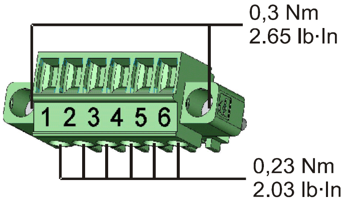
- RS485 Terminals for Modbus and IEC
- LWL Interface for Modbus, IEC and Profibus
- D-SUB Interface for Modbus and IEC
- D-SUB Interface for Profibus

NOTICE **The available combinations can be gathered from the ordering code.**

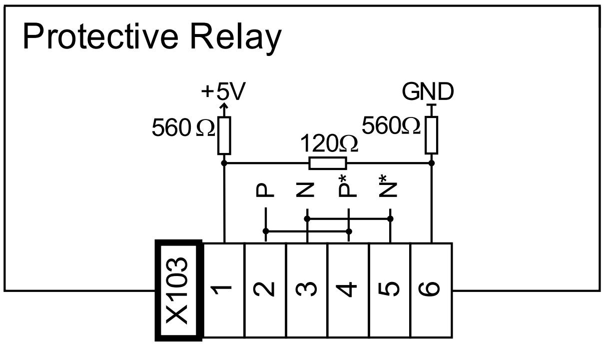
Modbus® RTU / IEC 60870-5-103 via RS485

WARNING **There are two different versions of the RS485 interface. By means of the wiring diagram on the top of your device, you have to find out which version is built in your device (Type1 or Type2).**

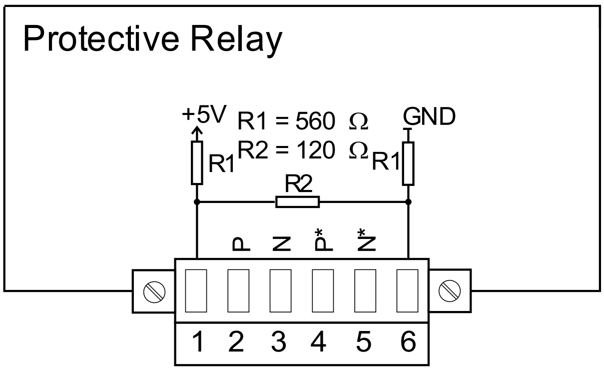
WARNING **Ensure the correct tightening torques.**



RS485 – Type 1 (see wiring diagram)



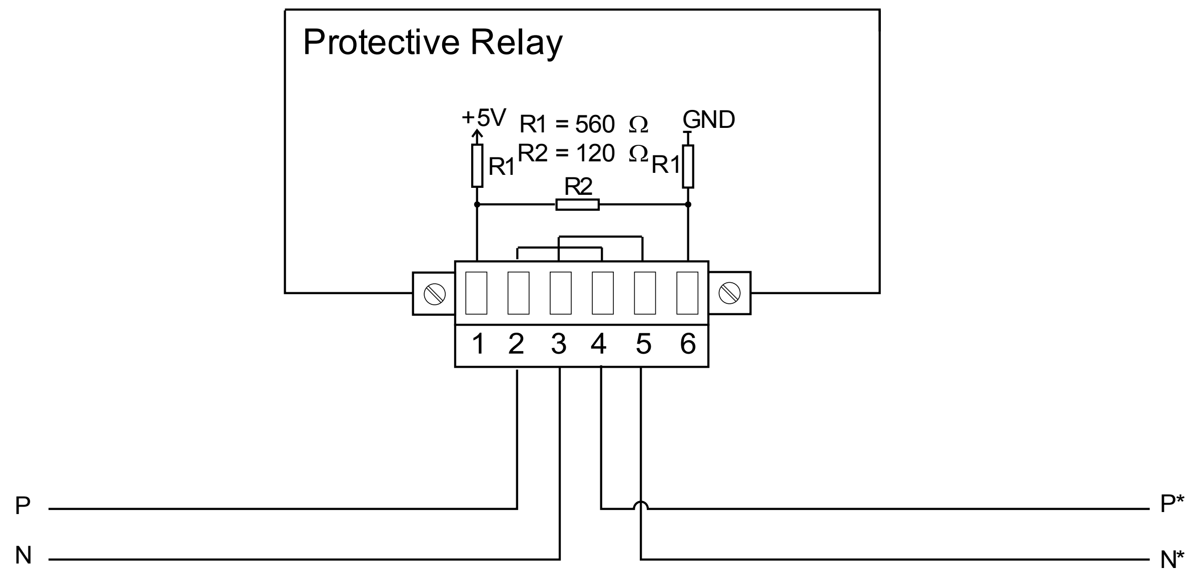
Electro-mechanical assignment Type 1 (see wiring diagram)



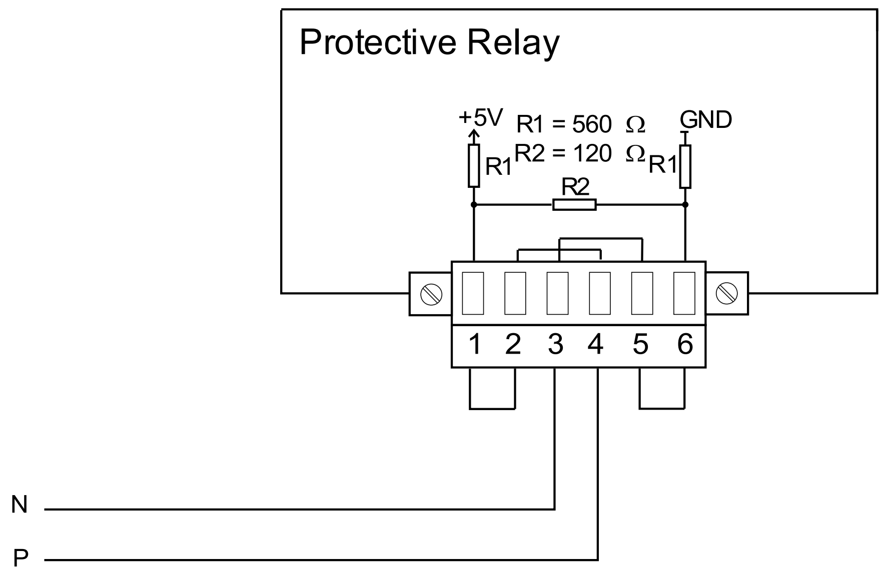
NOTICE **The Modbus® / IEC 60870-5-103 connection cable must be shielded. The shielding has to be fixed at the screw which is marked with the ground symbol at the rear side of the device.**

The communication is Halfduplex.

Type 1 Wiring example, Device in the Middle of the BUS

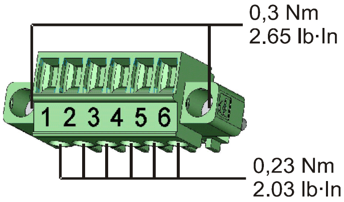


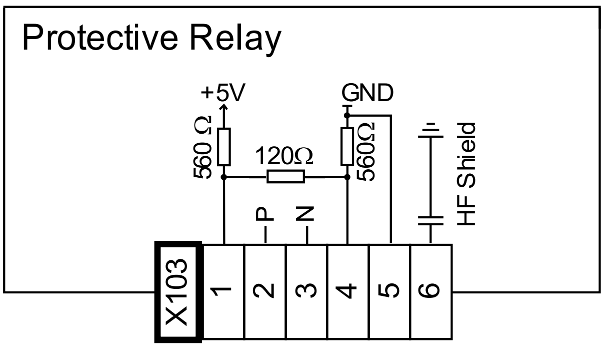
Type 1 Wiring example, Device at the End of the BUS (using the integrated Terminal Resistor)

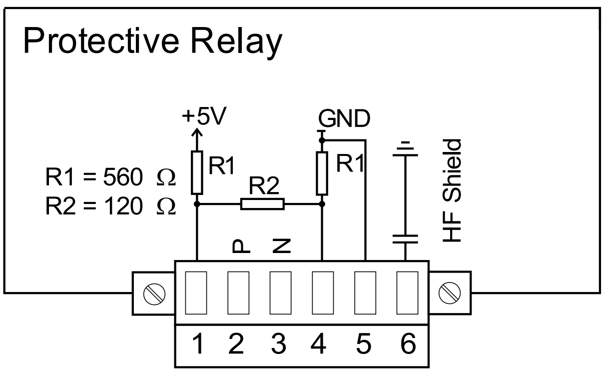


WARNING There are two different versions of the RS485 interface. By means of the wiring diagram on the top of your device, you have to find out which version is built in your device (Type1 or Type2).

WARNING Ensure the correct tightening torques.



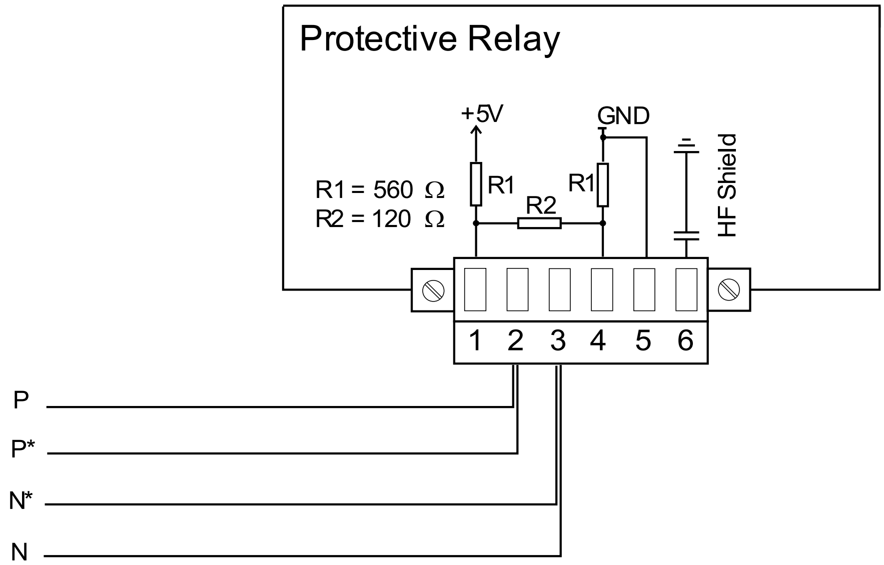
RS485 – Type 2 (see wiring diagram)


Electro-mechanical assignment Type 2 (see wiring diagram)


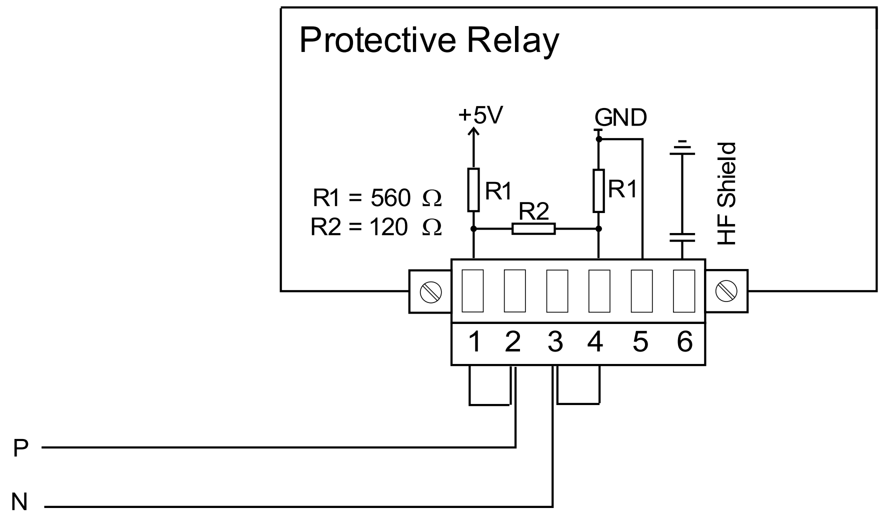
NOTICE **The Modbus® / IEC 60870-5-103 connection cable must be shielded. The shielding has to be fixed at the screw which is marked with the ground symbol at the rear side of the device.**

The communication is Halfduplex.

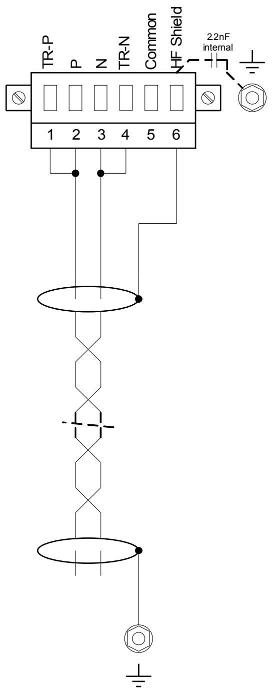
Type 2 Wiring example, Device in the Middle of the BUS



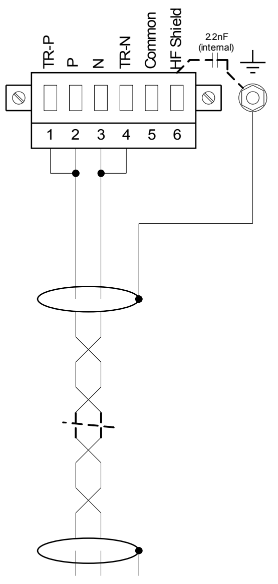
Type 2 Wiring example, Device at the End of the BUS (using the integrated Terminal Resistor)



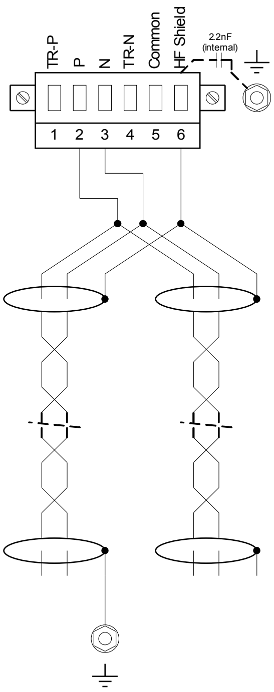
Type 2 Shielding Options (2-wire + Shield)



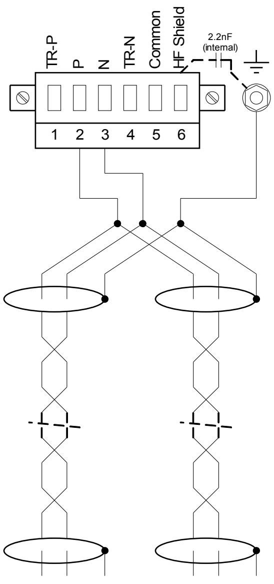
Shield at bus master side
connected to earth termination
resistors used



Shield at bus device side
connected to earth termination
resistors used

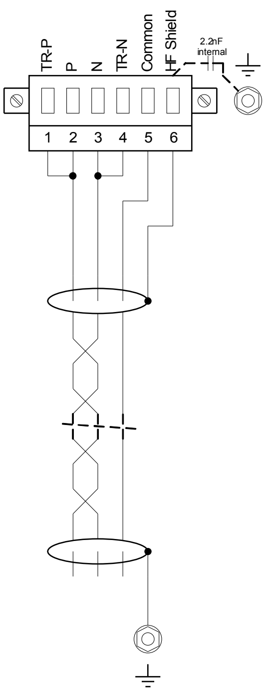


Shield at bus master side
connected to earth termination
resistors not used

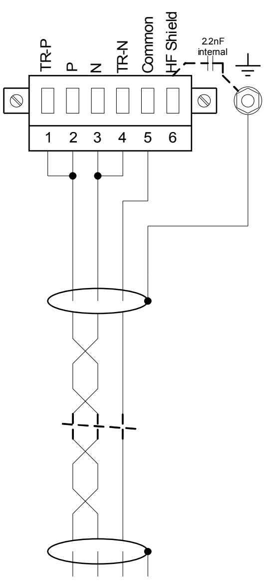


Shield at bus device side
connected to earth termination
resistors not used

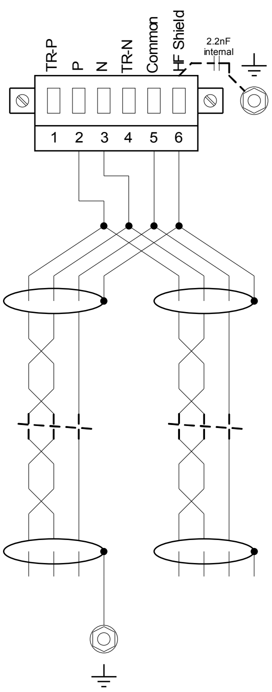
Type 2 Shielding Options (3-wire + Shield)



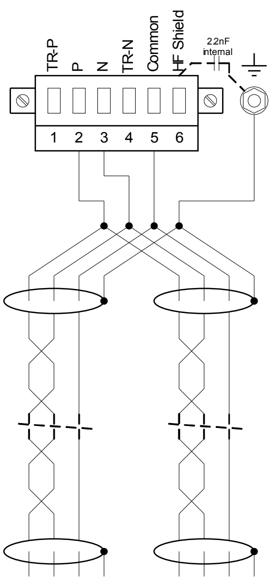
Shield at bus master side
connected to earth termination
resistors used



Shield at bus device side
connected to earth termination
resistors used



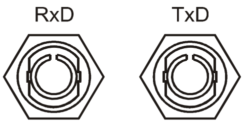
Shield at bus master side
connected to earth termination
resistors not used

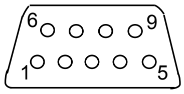


Shield at bus device side
connected to earth termination
resistors not used

Profibus DP/ Modbus® RTU / IEC 60870-5-103 via fibre optic

Modbus® RTU / IEC 60870-5-103 via D-SUB



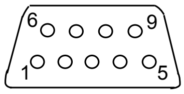
D-SUB


Electro-mechanical assignment
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 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.**

Profibus DP via D-SUB

D-SUB



Electro-mechanical assignment

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

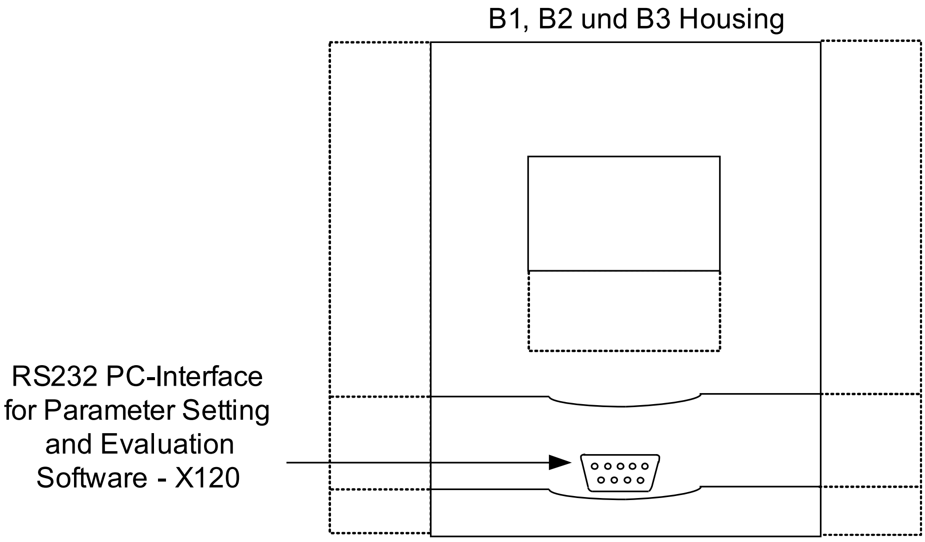
6 VP: pos. Potential of the aux voltage supply

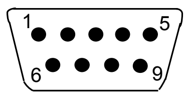
8 RxD TxD - N: Low-Level

NOTICE **The 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.**

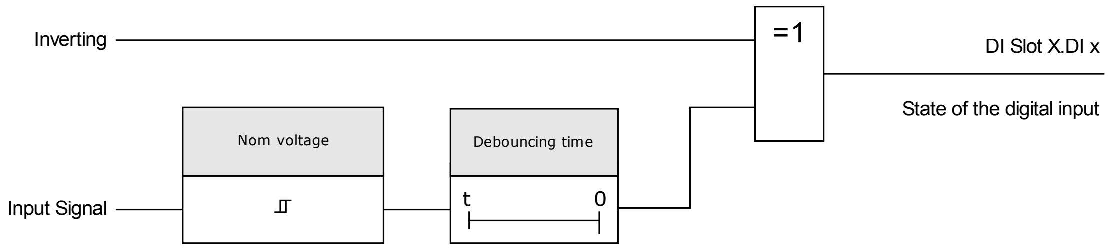
Input, Output and LED Settings

Configuration of the Digital Inputs

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.**

CAUTION **In addition to the debouncing time that can be set via software, there is always a hardware debouncing time (approx 12 ms) that cannot be turned of.**

DI-8P X

DI Slot X1

Device Parameters of the Digital Inputs on DI-8P X

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	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, transient signals 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]
Debouncing time 2	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, transient signals 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]

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 3]
Inverting 3	Inverting the input signals.	inactive, active	inactive	[Device Para /Digital Inputs /DI Slot X1 /Group 3]
Debouncing time 3	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, transient signals 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	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, transient signals 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]
Debouncing time 5	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, transient signals 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]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Debouncing time 6	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, transient signals 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	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, transient signals 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	A change of the state of a digital input will only be recognized after the debouncing time has expired (become effective). Thus, transient signals 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]

Signals of the Digital Inputs on DI-8P X

Signal	*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

Output Relays Settings

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)
- By the Operating Mode it can be determined whether the relay output works in working current or closed-circuit 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.

If binary output relays are parameterized »Latched=*active«,* The binary output will also retain, if the binary output is reprogrammed in another way. This applies also if »Latched is set to ina*ctive«*. Resetting a binary output that has latched a signal will always require an acknowledgement.

NOTICE

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

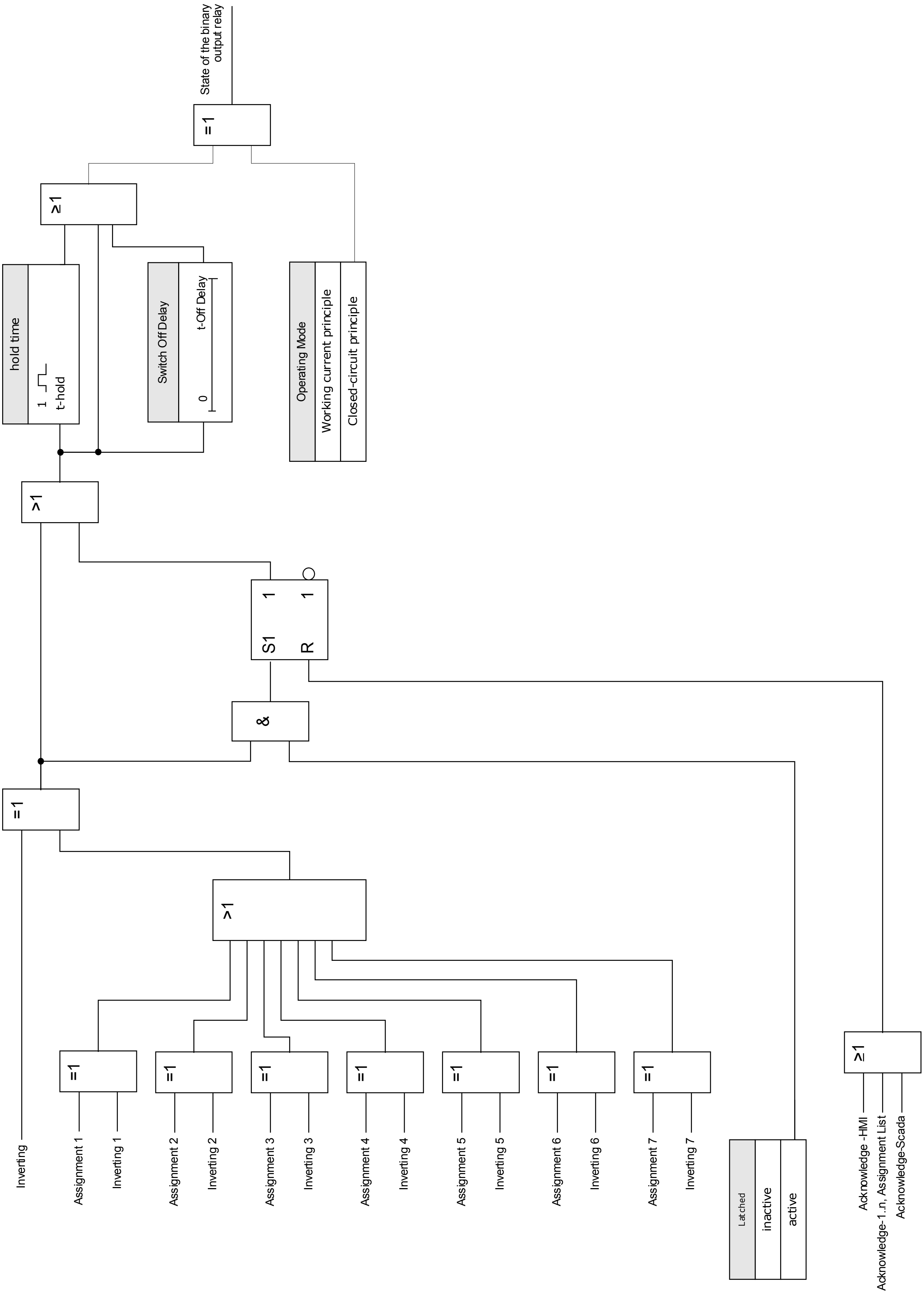
Acknowledgment options

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.

WARNING

Relay output contacts can be set by force or disarmed (for commisioning support, please refer to the „Service/Disarming the Output Relay Contacts“ and „Service/Forcing the Output Relay Contacts“ sections).


State of the binary output relay
=1
≥1
hold time
1
t-hold
Switch Off Delay
0
t-Off Delay
Operating Mode
Working current principle
Closed-circuit principle
>1
S1
R
1
1
&
=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
Acknowledge -HMI
Acknowledge-1..n, Assignment List
Acknowledge-Scada

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 system 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).

OR-5 X

BO Slot X2

Direct Commands of OR-5 X

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
DISARMED	This is the second step, after the "DISARMED Ctrl" has been activated, that is required to DISARM the relay outputs. This will DISARM those output relays that are currently not latched and that are not on “hold” by a pending minimum hold time. CAUTION! RELAYS DISARMED in order to safely perform maintenance while eliminating the risk of taking an entire process off-line. (Note: Zone Interlocking and Supervision Contact cannot be disarmed). YOU MUST ENSURE that the relays are ARMED AGAIN after maintenance. Only available if: DISARMED Ctrl = active	inactive, active	inactive	[Service /Test (Prot inhibit) /DISARMED /BO Slot X2]
Force all Outs	By means of this function the normal Output Relay State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state. Forcing all outputs relays of an entire assembly group is superior to forcing a single output relay.	Normal, De-Energized, Energized	Normal	[Service /Test (Prot inhibit) /Force OR /BO Slot X2]
Force OR1	By means of this function the normal Output Relay State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Normal, De-Energized, Energized	Normal	[Service /Test (Prot inhibit) /Force OR /BO Slot X2]
Force OR2	By means of this function the normal Output Relay State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Normal, De-Energized, Energized	Normal	[Service /Test (Prot inhibit) /Force OR /BO Slot X2]
Force OR3	By means of this function the normal Output Relay State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Normal, De-Energized, Energized	Normal	[Service /Test (Prot inhibit) /Force OR /BO Slot X2]

Parameter	Description	Setting range	Default	Menu path
Force OR4	By means of this function the normal Output Relay State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Normal, De-Energized, Energized	Normal	[Service /Test (Prot inhibit) /Force OR /BO Slot X2]
Force OR5	By means of this function the normal Output Relay State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Normal, De-Energized, Energized	Normal	[Service /Test (Prot inhibit) /Force OR /BO Slot X2]

Device Parameters of the Binary Output Relays on OR-5 X

Parameter	Description	Setting range	Default	Menu path
Operating Mode	Operating Mode	Working current principle, Closed-circuit principle	Working current principle	[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 - 300.00s	0.00s	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
t-Off Delay	Switch Off Delay	0.00 - 300.00s	0.00s	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
Latched	Defines whether the Relay Output will be latched when it picks up.	inactive, active	active	[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]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 1	Assignment	1..n, Assignment List	SG[1].TripCmd	[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]
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]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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]
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]
Operating Mode	Operating Mode	Working current principle, Closed-circuit principle	Working current principle	[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 - 300.00s	0.00s	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
t-Off Delay	Switch Off Delay	0.00 - 300.00s	0.00s	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Latched	Defines whether the Relay Output will be latched when it picks up.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 2]

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 2]
Inverting	Inverting of the Binary Output Relay.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Assignment 1	Assignment	1..n, Assignment List	Prot.Alarm	[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]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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]
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]
Operating Mode	Operating Mode	Working current principle, Closed-circuit prin-ciple	Working current principle	[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 - 300.00s	0.00s	[Device Para /Binary Outputs /BO Slot X2 /BO 3]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
t-Off Delay	Switch Off Delay	0.00 - 300.00s	0.00s	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
Latched	Defines whether the Relay Output will be latched when it picks up.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
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	SG[1].ON Cmd	[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]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
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]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Operating Mode	Operating Mode	Working current principle, Closed-circuit principle	Working current principle	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
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 - 300.00s	0.00s	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
t-Off Delay	Switch Off Delay	0.00 - 300.00s	0.00s	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
Latched	Defines whether the Relay Output will be latched when it picks up.	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	SG[1].OFF Cmd	[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]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
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]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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]
Operating Mode	Operating Mode	Working current principle, Closed-circuit principle	Working current principle	[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 - 300.00s	0.00s	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
t-Off Delay	Switch Off Delay	0.00 - 300.00s	0.00s	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
Latched	Defines whether the Relay Output will be latched when it picks up.	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]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
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]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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]
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]
DISARMED Ctrl	Enables and disables the disarming of the relay outputs. This is the first step of a two step process, to inhibit the operation or the relay outputs. Please refer to "DISARMED" for the second step.	inactive, active	inactive	[Service /Test (Prot inhibit) /DISARMED /BO Slot X2]
Disarm Mode	CAUTION!RELAYS DISARMED in order to safely perform maintenance while eliminating the risk of taking an entire process off-line. (Note: The Supervision Contact cannot be disarmed). YOU MUST ENSURE that the relays are ARMED AGAIN after maintenance.	permanent, timeout	permanent	[Service /Test (Prot inhibit) /DISARMED /BO Slot X2]
t-Timeout DISARM	The relays will be armed again after expiring of this time. Only available if: Mode = Timeout DISARM	0.00 - 300.00s	0.03s	[Service /Test (Prot inhibit) /DISARMED /BO Slot X2]
Force Mode	By means of this function the normal Output Relay States can be overwritten (forced) in case that the Relay is not in a disarmed state. The relays can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	permanent, timeout	permanent	[Service /Test (Prot inhibit) /Force OR /BO Slot X2]
t-Timeout Force	The Output State will be set by force for the duration of this time. That means for the duration of this time the Output Relay does not show the state of the signals that are assigned on it. Only available if: Mode = Timeout DISARM	0.00 - 300.00s	0.03s	[Service /Test (Prot inhibit) /Force OR /BO Slot X2]

Input States of the Binary Output Relays on OR-5 X

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]

Signals of the Binary Output Relays on OR-5 X

Signal	*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
DISARMED!	Signal: CAUTION! RELAYS DISARMED in order to safely perform maintenance while eliminating the risk of taking an entire process off-line. (Note: The Self Supervision Contact cannot be disarmed). YOU MUST ENSURE that the relays are ARMED AGAIN after maintenance
Outs forced	Signal: The State of at least one Relay Output has been set by force. That means that the state of at least one Relay is forced and hence does not show the state of the assigned signals.

LED configuration

The LEDs can be configured within menu:

[Device Para/LEDs/Group X]

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

CAUTION **If LEDs are parameterized »Latched=*active«,* they will keep (return into) their blink code/color even if there is a break within the power supply.**

If LEDs are parameterized »Latched=*active«,* The LED blink code will also retain, if the LED is reprogrammed in another way. This applies also if »Latched is set to ina*ctive«*. Resetting a LED that has latched a signal will always require an acknowledgement.

NOTICE **This chapter contains information on the LEDs that are placed on the left hand of the display (group A).**

If your device is also equipped with LEDs on the right hand of the display (group B), the information in this chapter is valid analog. The only difference is “group A” and “group B” within the menu paths.

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.
- *»Acknowledgment«* (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.

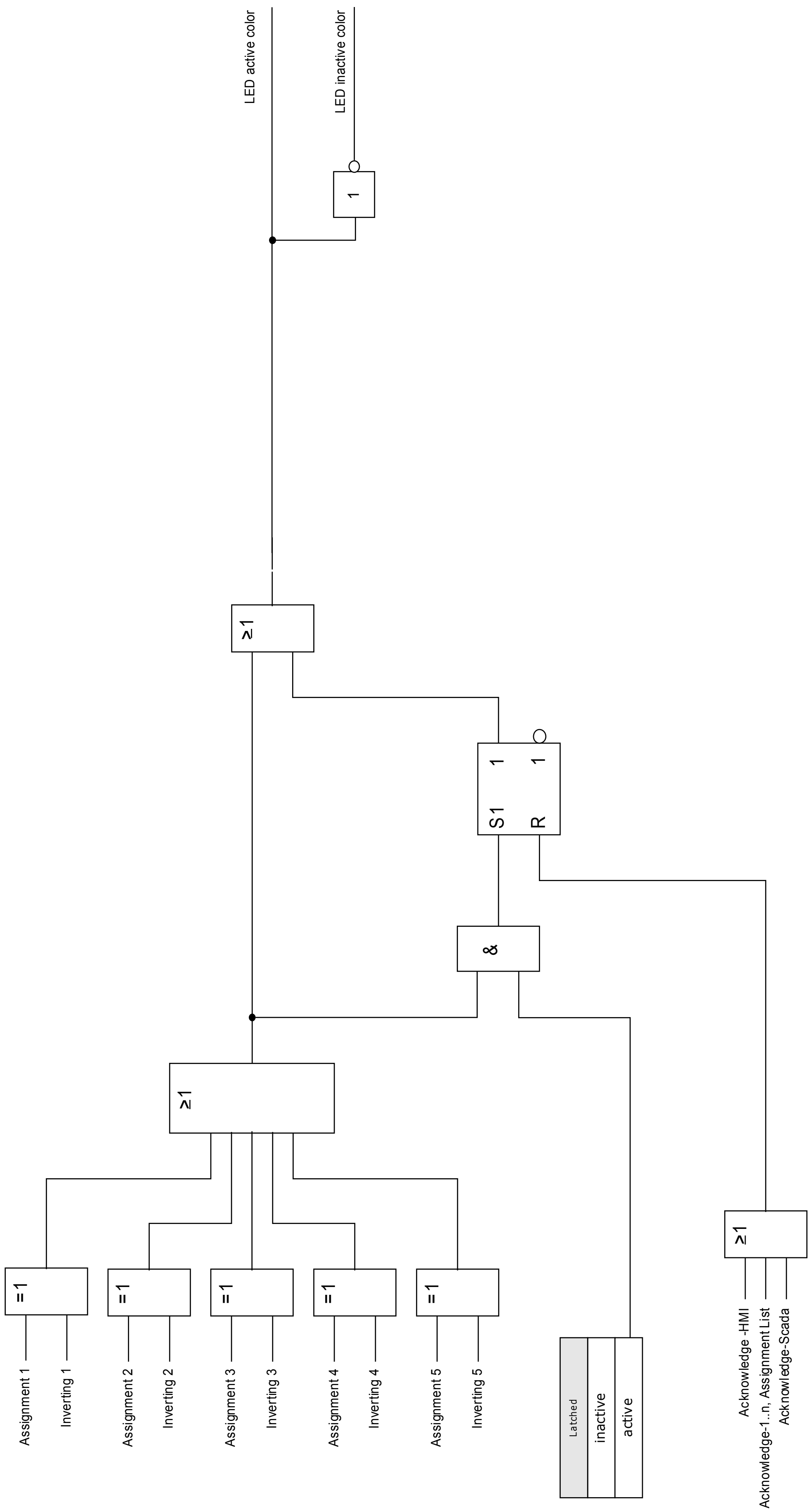
Acknowledgment options

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 acknowledgment 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.

NOTICE

The Product-CD that is delivered with the device contains a PDF-Template in order to create and print out self adhesive films for LED assignment texts (front foil) by means of a laser printer. Recommendation: (AVERY Zweckform Art.Nr.3482)



LED active color
LED inactive color
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
Acknowledge -HMI
Acknowledge-1..n, Assignment List
Acknowledge-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 unsuccessful reboot caused by the module self supervision the *System OK – LED* flashes in red or is red illuminated, please contact the *Woodward Kempen GmbH* – Service Dept (See also chapter Self Supervision).

LED System OK cannot be parameterized.

Global Protection Parameters of the LED Module

LEDs group A

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Latched	Defines whether the LED will be latched when it picks up.	inactive, active	inactive	[Device Para /LEDs /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 no longer present. Dependency Only available if: Latched = active	1..n, Assignment List	-.-	[Device Para /LEDs /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, -	green	[Device Para /LEDs /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 /LED 1]
Assignment 1	Assignment	1..n, Assignment List	Prot.active	[Device Para /LEDs /LED 1]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 1]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 1]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 1]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 1]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 1]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 1]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 1]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 1]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 1]
Latched	Defines whether the LED will be latched when it picks up.	inactive, active	active	[Device Para /LEDs /LED 2]
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 no longer present. Only available if: Latched = active	1..n, Assignment List	-.-	[Device Para /LEDs /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 /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 /LED 2]
Assignment 1	Assignment	1..n, Assignment List	SG[1].TripCmd	[Device Para /LEDs /LED 2]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 2]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 2]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 2]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 2]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 2]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 2]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 2]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 2]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 2]
Latched	Defines whether the LED will be latched when it picks up.	inactive, active	inactive	[Device Para /LEDs /LED 3]

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 no longer present. Only available if: Latched = active	1..n, Assignment List	-.-	[Device Para /LEDs /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, -	red flash	[Device Para /LEDs /LED 3]
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 /LED 3]
Assignment 1	Assignment	1..n, Assignment List	Prot.Alarm	[Device Para /LEDs /LED 3]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 3]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 3]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 3]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 3]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 3]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 3]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 3]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 3]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 3]
Latched	Defines whether the LED will be latched when it picks up.	inactive, active	inactive	[Device Para /LEDs /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 no longer present. Only available if: Latched = active	1..n, Assignment List	-.-	[Device Para /LEDs /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 /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 /LED 4]
Assignment 1	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 4]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 4]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 4]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 4]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 4]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 4]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 4]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 4]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 4]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 4]
Latched	Defines whether the LED will be latched when it picks up.	inactive, active	inactive	[Device Para /LEDs /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 no longer present. Only available if: Latched = active	1..n, Assignment List	-.-	[Device Para /LEDs /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 /LED 5]

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 /LED 5]
Assignment 1	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 5]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 5]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 5]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 5]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 5]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 5]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 5]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 5]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 5]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 5]
Latched	Defines whether the LED will be latched when it picks up.	inactive, active	inactive	[Device Para /LEDs /LED 6]
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 no longer present. Only available if: Latched = active	1..n, Assignment List	-.-	[Device Para /LEDs /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 /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 /LED 6]
Assignment 1	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 6]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 6]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 6]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 6]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /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 /LED 6]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 6]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 6]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 6]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 6]
Latched	Defines whether the LED will be latched when it picks up.	inactive, active	inactive	[Device Para /LEDs /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 no longer present. Only available if: Latched = active	1..n, Assignment List	-.-	[Device Para /LEDs /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 /LED 7]
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 /LED 7]
Assignment 1	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 7]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 7]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 7]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 7]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 7]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 7]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 7]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 7]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 7]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 7]

LED Module Input States

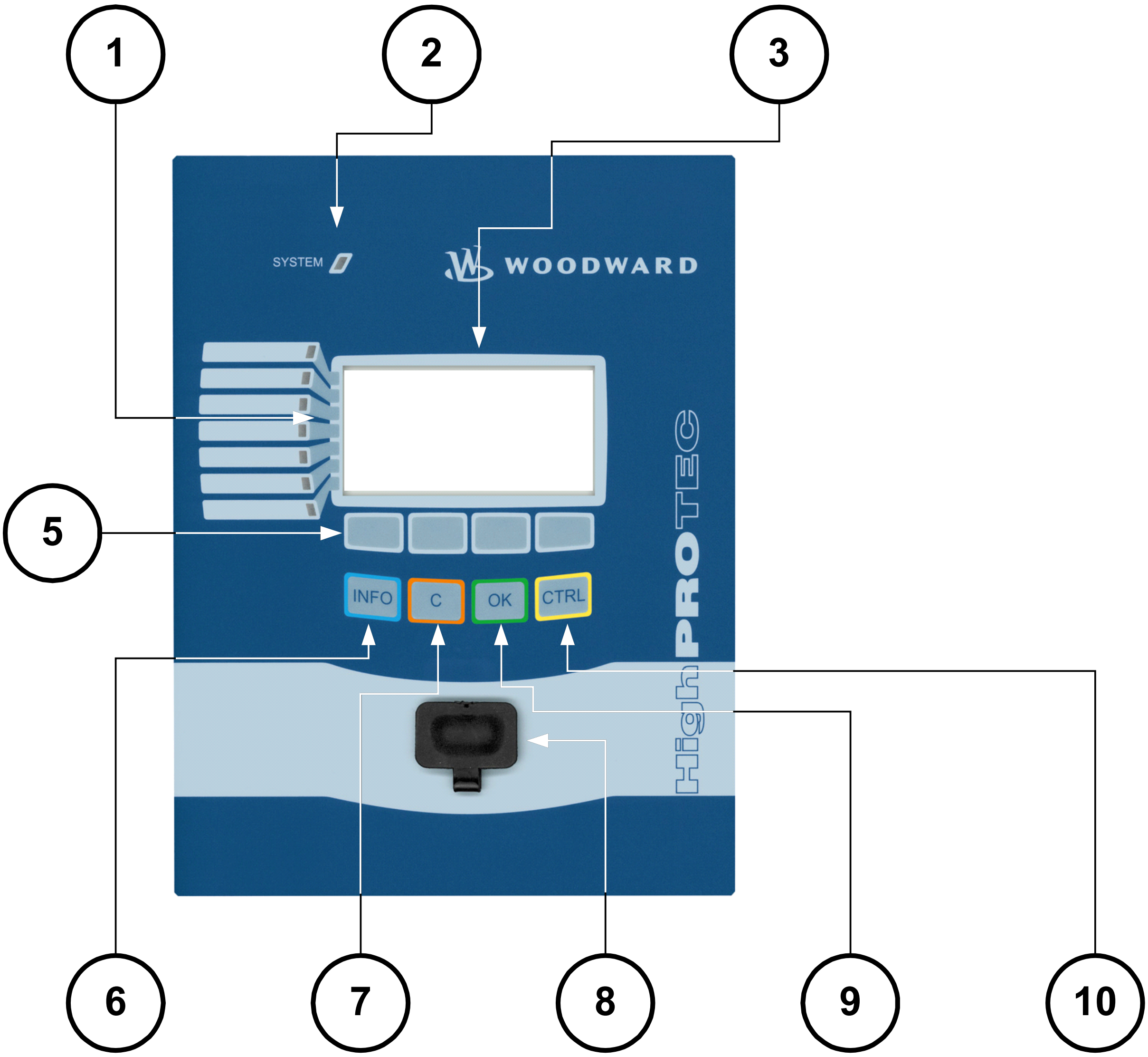
Name	*Description*	*Assignment via*
LED1.1	Module input state: LED	[Device Para /LEDs /LED 1]
LED1.2	Module input state: LED	[Device Para /LEDs /LED 1]
LED1.3	Module input state: LED	[Device Para /LEDs /LED 1]
LED1.4	Module input state: LED	[Device Para /LEDs /LED 1]
LED1.5	Module input state: LED	[Device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

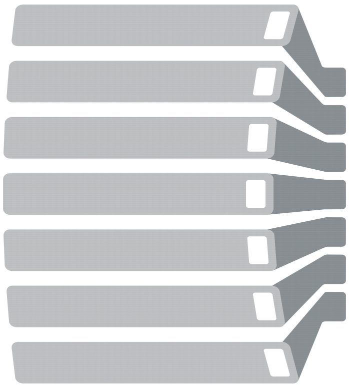
Name	*Description*	*Assignment via*
LED3.1	Module input state: LED	[Device Para /LEDs /LED 3]
LED3.2	Module input state: LED	[Device Para /LEDs /LED 3]
LED3.3	Module input state: LED	[Device Para /LEDs /LED 3]
LED3.4	Module input state: LED	[Device Para /LEDs /LED 3]
LED3.5	Module input state: LED	[Device Para /LEDs /LED 3]
Acknow Sig 3	Module input state: Acknowledgement Signal (only for automatic acknowledgement)	[Device Para /LEDs /LED 3]
LED4.1	Module input state: LED	[Device Para /LEDs /LED 4]
LED4.2	Module input state: LED	[Device Para /LEDs /LED 4]
LED4.3	Module input state: LED	[Device Para /LEDs /LED 4]
LED4.4	Module input state: LED	[Device Para /LEDs /LED 4]
LED4.5	Module input state: LED	[Device Para /LEDs /LED 4]
Acknow Sig 4	Module input state: Acknowledgement Signal (only for automatic acknowledgement)	[Device Para /LEDs /LED 4]
LED5.1	Module input state: LED	[Device Para /LEDs /LED 5]

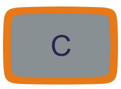
Name	*Description*	*Assignment via*
LED5.2	Module input state: LED	[Device Para /LEDs /LED 5]
LED5.3	Module input state: LED	[Device Para /LEDs /LED 5]
LED5.4	Module input state: LED	[Device Para /LEDs /LED 5]
LED5.5	Module input state: LED	[Device Para /LEDs /LED 5]
Acknow Sig 5	Module input state: Acknowledgement Signal (only for automatic acknowledgement)	[Device Para /LEDs /LED 5]
LED6.1	Module input state: LED	[Device Para /LEDs /LED 6]
LED6.2	Module input state: LED	[Device Para /LEDs /LED 6]
LED6.3	Module input state: LED	[Device Para /LEDs /LED 6]
LED6.4	Module input state: LED	[Device Para /LEDs /LED 6]
LED6.5	Module input state: LED	[Device Para /LEDs /LED 6]
Acknow Sig 6	Module input state: Acknowledgement Signal (only for automatic acknowledgement)	[Device Para /LEDs /LED 6]
LED7.1	Module input state: LED	[Device Para /LEDs /LED 7]
LED7.2	Module input state: LED	[Device Para /LEDs /LED 7]

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

Navigation - Operation



1		LEDs	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.
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 again you will leave the LED menu. Here only the first assignments of the LEDs will be shown. Every three seconds the »SOFTKEYs« will be shown (flashing). *Displaying the multiple Assignments* If the INFO-Button is pressed only the first assignments of any LED is shown. Every three seconds the »SOFTKEYs« will be shown (flashing). If there is more than one signal assigned to a LED (indicated by three dots) you can check the state of the multiple assignments if you proceed as follows. In order to show all (multiple) assignments select a LED by means of the »SOFTKEYs« »up« and »down« Via the »Softkey« »right« call up a Submenu of this LED that gives you detailed information on the state of all signals assigned to this LED. An arrow symbol points to the LED whose assignments are currently displayed. Via the »SOFTKEYs« »up« and »down« you can call up the next / previous LED. In order to leave the LED menu press the »SOFTKEY« »left« multiple times.
7		»C Key«	To abort changes and to acknowledge 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.
10		»CTRL Key«*	Direct Access to the Control Menu.

*=Not for all devices available.

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« »Parameter setting« you will call up the parameter setting mode. Password authorization required.
	■ Via »SOFTKEY« »delete« data will be deleted.
	■ Fast forward scrolling is possible via »SOFTKEY« »Fast forward«
	■ Fast backward scrolling is possible via »SOFTKEY« »Fast backward«

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 3.0 or higher supports reading parameter files generated by older versions of Smart view. Parameter files generated by Smart view 3.0 and higher cannot be read by older versions of Smart view.**

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 XP, Windows Vista or Windows 7

- 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>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 Ethernet - TCP/IP

NOTICE **Establishing a connection via TCP/IP to the device is only possible if your device is equipped with an Ethernet Interface (RJ45).**

Contact your IT administrator in order to establish the network connection.

Part 1: Set the TCP/IP Parameters at the panel (Device)

Call up the menu *»Device parameter/TCP/IP«* at the HMI (panel) and set the following parameters:

- TCP/IP address
- Subnetmask
- Gateway

Part 2: Setting the IP address within Smart view

- Call up the menu Settings/Device Connection within Smart view.
- Set radio button Network Connection.
- Enter the IP-Address of the device that should be connected.

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).**

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 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 or Windows 7

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 Windows Phone and Modem dialog).

3. Establishing a network connection between *Smart view* and the device (to be done within Smart view).

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

2. Installation of the (virtual) modem

- Open the Windows Start menu and type “Phone and Modem” and RETURN. This opens the “Phone and Modem” Dialog
- Go to Tab »Modem«
- Click on the »Add« button
- The Hardware Wizard window Install New Modem pops up
- Set the check box Don´t detect my modem; I will select it from a list
- Click on the »Next« button
- Select Communications cable between two computers
- Click on the »Next« button
- Choose the correct COM-Port
- Click on the »Next« button
- Click on the »Finish« button
- Select the new added modem and 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
- Close this dialog with the »OK« button
- Close the Phone and Modem dialog with 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 »Settings«.
- Click on the »Settings« button.
- A connection 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).
- Please ensure, that the checkbox “Allow other people to use this connection” is **not** set (deactivated).
- **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 Kempen GmbH* 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.

Set-up a Connection via Ethernet - TCP/IP

WARNING

Warning: Mixing up IP-Addresses (In case that there is more than one protective device within the TCP/IP network). Establishing an unintentional wrong connection to a protective device based on a wrong entered IP-Address. Transferring parameters into a wrong protective device might lead to death, personal injury or damage of electrical equipment.

In order to prevent faulty connections the user has to document and maintain a list with the IP addresses of any switchboard/protective device.

The user has to doublecheck the IP addresses of the connection that is to be established. That means, the user must first read out the IP address at the HMI of the device (within menu [Device para/TCP IP] then compare the IP address with the list. If the addresses are identical, establish the connection. If not, DO not connect.

NOTICE

Establishing a connection via TCP/IP to the device is only possible if your device is equipped with an Ethernet Interface (RJ45).

Contact your IT administrator in order to establish the network connection.

Part 1: Set the TCP/IP Parameters at the panel (Device)

Call up the menu *»Device parameter/TCP/IP«* at the HMI (panel) and set the following parameters:

•TCP/IP address

•Subnet mask

•Gateway

Part 2: Setting the IP address within Smart view

- Call up the menu Settings/Device Connection within Smart view.
- Set radio button Network Connection.
- Enter the IP-Address of the device that should be connected.

Smart view Troubleshooting during Setting up the Connection

- 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 Kempen GmbH*. 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 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 connection 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
-
- Choose 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 cannot 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 a text-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 following 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.**

Measurement Display

Menu [Device Para\Measurem Display] offers options to change the display of measured values within the HMI and Smart view.

Scaling of Measured values

By means of the parameter »Scaling« the user can determine how measured values are to be displayed within the HMI and *Smart view*:

- Primary quantities
- Secondary quantities
- Per Unit quantities

Power Units (applies only for devices with power measurement)

By means of the parameter »*Power Units*« the User can determine how measured values are to be displayed within the HMI and *Smart view*:

- Power Auto Scaling
- kW, kVAr or kVA
- MW, MVAr or MVA
- GW, GVAr or GVA

Energy Units (applies only for devices with energy measurement)

By means of the parameter »*Energy Units*« the User can determine how measured values are to be displayed within the HMI and *Smart view*:

- Energy Auto Scaling
- kWh, kVArh or kVAh
- MWh, MVArh or MVAh
- GWh, GVArh or GVAh

Temperature Unit (applies only for devices with temperature measurement)

By means of the parameter »*Temperatur Unit*« the User can determine how measured values are to be displayed within the HMI and *Smart view*:

- ° Celsius
- ° Fahrenheit

Cutoff level

In order to suppress noise within measured values that are close to zero the user has the option to set cutoff levels. By means of the cutoff levels, measuring quantities that are close to zero will be displayed as zero. These parameters have no impact on recorded values.

Voltage - Measured Values

Voltage

The first measuring input on the first measuring card (slot with the lowest number) is used as the reference angle. E.g. »*VL1*« respectively »*VL12*«.

Value	*Description*	*Menu path*
f	Measured value: Frequency	[Operation /Measured values /Voltage]
VL12	Measured value: Phase-to-phase voltage (fundamental)	[Operation /Measured values /Voltage]
VL23	Measured value: Phase-to-phase voltage (fundamental)	[Operation /Measured values /Voltage]
VL31	Measured value: Phase-to-phase voltage (fundamental)	[Operation /Measured values /Voltage]
VL1	Measured value: Phase-to-neutral voltage (fundamental)	[Operation /Measured values /Voltage]
VL2	Measured value: Phase-to-neutral voltage (fundamental)	[Operation /Measured values /Voltage]
VL3	Measured value: Phase-to-neutral voltage (fundamental)	[Operation /Measured values /Voltage]
VX meas	Measured value (measured): VX measured (fundamental)	[Operation /Measured values /Voltage]
VG calc	Measured value (calculated): VG (fundamental)	[Operation /Measured values /Voltage]
V0	Measured value (calculated): Symmetrical components Zero voltage(fundamental)	[Operation /Measured values /Voltage]
V1	Measured value (calculated): Symmetrical components positive phase sequence voltage(fundamental)	[Operation /Measured values /Voltage]

Value	*Description*	*Menu path*
V2	Measured value (calculated): Symmetrical components negative phase sequence voltage(fundamental)	[Operation /Measured values /Voltage]
VL12 RMS	Measured value: Phase-to-phase voltage (RMS)	[Operation /Measured values /Voltage RMS]
VL23 RMS	Measured value: Phase-to-phase voltage (RMS)	[Operation /Measured values /Voltage RMS]
VL31 RMS	Measured value: Phase-to-phase voltage (RMS)	[Operation /Measured values /Voltage RMS]
VL1 RMS	Measured value: Phase-to-neutral voltage (RMS)	[Operation /Measured values /Voltage RMS]
VL2 RMS	Measured value: Phase-to-neutral voltage (RMS)	[Operation /Measured values /Voltage RMS]
VL3 RMS	Measured value: Phase-to-neutral voltage (RMS)	[Operation /Measured values /Voltage RMS]
VX meas RMS	Measured value (measured): VX measured (RMS)	[Operation /Measured values /Voltage RMS]
VG calc RMS	Measured value (calculated): VG (RMS)	[Operation /Measured values /Voltage RMS]
phi VL12	Measured value (calculated): Angle of Phasor VL12	[Operation /Measured values /Voltage]
phi VL23	Measured value (calculated): Angle of Phasor VL23	[Operation /Measured values /Voltage]
phi VL31	Measured value (calculated): Angle of Phasor VL31	[Operation /Measured values /Voltage]
phi VL1	Measured value (calculated): Angle of Phasor VL1	[Operation /Measured values /Voltage]

Value	*Description*	*Menu path*
phi VL2	Measured value (calculated): Angle of Phasor VL2	[Operation /Measured values /Voltage]
phi VL3	Measured value (calculated): Angle of Phasor VL3	[Operation /Measured values /Voltage]
phi VX meas	Measured value: Angle of Phasor VX meas	[Operation /Measured values /Voltage]
phi VG calc	Measured value (calculated): Angle of Phasor VG calc	[Operation /Measured values /Voltage]
phi V0	Measured value (calculated): Angle Zero Sequence System	[Operation /Measured values /Voltage]
phi V1	Measured value (calculated): Angle of Positive Sequence System	[Operation /Measured values /Voltage]
phi V2	Measured Value (calculated): Angle of Negative Sequence System	[Operation /Measured values /Voltage]
%(V2/V1)	Measured value (calculated): V2/V1, phase sequence will be taken into account automatically.	[Operation /Measured values /Voltage]
%VL12 THD	Measured value (calculated): V12 Total Harmonic Distortion / Ground wave	[Operation /Measured values /Voltage RMS]
%VL23 THD	Measured value (calculated): V23 Total Harmonic Distortion / Ground wave	[Operation /Measured values /Voltage RMS]
%VL31 THD	Measured value (calculated): V31 Total Harmonic Distortion / Ground wave	[Operation /Measured values /Voltage RMS]
%VL1 THD	Measured value (calculated): VL1 Total Harmonic Distortion / Ground wave	[Operation /Measured values /Voltage RMS]

Value	*Description*	*Menu path*
%VL2 THD	Measured value (calculated): VL2 Total Harmonic Distortion / Ground wave	[Operation /Measured values /Voltage RMS]
%VL3 THD	Measured value (calculated): VL3 Total Harmonic Distortion / Ground wave	[Operation /Measured values /Voltage RMS]
VL12 THD	Measured value (calculated): V12 Total Harmonic Distortion	[Operation /Measured values /Voltage RMS]
VL23 THD	Measured value (calculated): V23 Total Harmonic Distortion	[Operation /Measured values /Voltage RMS]
VL31 THD	Measured value (calculated): V31 Total Harmonic Distortion	[Operation /Measured values /Voltage RMS]
VL1 THD	Measured value (calculated): VL1 Total Harmonic Distortion	[Operation /Measured values /Voltage RMS]
VL2 THD	Measured value (calculated): VL2 Total Harmonic Distortion	[Operation /Measured values /Voltage RMS]
VL3 THD	Measured value (calculated): VL3 Total Harmonic Distortion	[Operation /Measured values /Voltage RMS]

Statistics

Statistics

In menu *»Operation/Statistics«* the min., max. and mean values of the measured and calculated measured quantities can be found.

Configuration of the Minimum and Maximum Values

The calculation of the minimum and maximum values will be started:

- When a Reset signal becomes active (Min-/Max)
- When the device is restarted
- After configuration

	Minimum and Maximum Values (Peak Values/Pointers)	
	Time interval for the calculation of the minimum and maximum values	**Reset**
Configuration Options Where to configure? Within menu [Device Para\ Statistics\ Min/Max]	The minimum and maximum values will be resetted with the rising edge of the corresponding reset signal.	Res Min Res Max (e.g. via digital Inputs). These signals will reset the minimum and maximum pointers.
Display of Minimum Values	Where? Within menu [Operation\Statistics\Min]	
Display of Maximum Values	Where? Within menu [Operation\Statistics\Max]	

Configuration of the Average Value Calculation

Configuration of the Current Based Average Value Calculation*

*=Availability depends on the ordered device code.

	Current based Average Values and Peak Values		
	Time period for the calculation of the average and peak values	**Start options**	**Reset of the average and peak values**
Configuration Options Where to configure? In [Device Para\ Statistics\ Demand\ Current Demand]	sliding: (sliding: average calculation based on sliding period) fixed: (fixed: Average calculation is resetted by the end of the period, that means with the next starting period)	duration: (fixed or sliding period) Start Fct: (The average values are calculated based on the time period between two rising edges ot this signal)	Res Fc (e.g. via Digital Input in order to reset the average values in advance (before the next rising edge of the start signal). This applies to option „Start FC“ only.
Trip (command) option to limit the average current demand: Yes	Please refert to chapter „System Alarms“		
View average values and peak values	Where? Within menu [Operation\Statistics\Demand]		

Configuration of the Voltage Based Average Value Calculation*

*=Availability depends on the ordered device code.

	Voltage based Average Values		
	Time period for the calculation of the average values	**Start options**	**Reset of the average and peak values**
Configuration Options Where to configure? In [Device Para\ Statistics\ Umit]	sliding: (sliding: average calculation based on sliding period) fixed: (fixed: Average calculation is resetted by the end of the period, that means with the next starting period)	duration: (fixed or sliding period) Start Fct: (The average values are calculated based on the time period between two rising edges ot this signal)	Res Fc (e.g. via Digital Input in order to reset the average values in advance (before the next rising edge of the start signal). This applies to option „Start FC“ only.
View average values	Where? Within menu [Operation\Statistics\Vavg]		

Configuration of the Power Based Average Value Calculation*

*=Availability depends on the ordered device code.

	Power based Average Values (Demand) and Peak Values		
	Time period for the calculation of the average and peak values	**Start options**	**Reset of the average and peak values**
Configuration Options Where to configure? In [Device Para\ Statistics\ Bezugsmanagm\ Power Demand]	sliding: (sliding: average calculation based on sliding period) fixed: (fixed: Average calculation is resetted by the end of the period, that means with the next starting period)	duration: (fixed or sliding period) Start Fct: (The average values are calculated based on the time period between two rising edges ot this signal)	Res Fc (e.g. via Digital Input in order to reset the average values in advance (before the next rising edge of the start signal). This applies to option „Start FC“ only.
Trip (command) option to limit the average power demand: Yes	Please refert to chapter „System Alarms“		
View average values and peak values	Where? Within menu [Operation\Statistics\Demand]		

Direct Commands

Parameter	Description	Setting range	Default	Menu path
ResFc all	Resetting of all Statistic values (Current Demand, Power Demand, Min, Max)	inactive, active	inactive	[Operation /Reset]
ResFc Vavg	Resetting of the sliding average calculation.	inactive, active	inactive	[Operation /Reset]
ResFc Min	Resetting of all Minimum values	inactive, active	inactive	[Operation /Reset]
ResFc Max	Resetting of all Maximum values	inactive, active	inactive	[Operation /Reset]

Global Protection Parameters of the Statistics Module

Parameter	Description	Setting range	Default	Menu path
ResFc Max	Resetting of all Maximum values	1..n, Assignment List	-.-	[Device Para /Statistics /Min / Max]
ResFc Min	Resetting of all Minimum values	1..n, Assignment List	-.-	[Device Para /Statistics /Min / Max]
Start Vavg via:	Start sliding average supervision by:	Duration, StartFct	Duration	[Device Para /Statistics /Vavg]
Start Vavg Fc	Start of the calculation, if the assigned signal becomes true. Only available if: Start P Demand via: = StartFct	1..n, Assignment List	-.-	[Device Para /Statistics /Vavg]
ResFc Vavg	Resetting of the sliding average calculation.	1..n, Assignment List	-.-	[Device Para /Statistics /Vavg]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Duration Vavg	Recording time	2 s, 5 s, 10 s, 15 s, 30 s, 1 min, 5 min, 10 min, 15 min, 30 min, 1 h, 2 h, 6 h, 12 h, 1 d, 2 d, 5 d, 7 d, 10 d, 30 d	10 min	[Device Para /Statistics /Vavg]
Window Vavg	Window configuration	sliding, fixed	sliding	[Device Para /Statistics /Vavg]

States of the Inputs of the Statistics Module

Name	*Description*	*Assignment via*
StartFc Vavg-I	State of the module input: (StartFunc3_h)	[Device Para /Statistics /Vavg]
ResFc Vavg-I	State of the module input: Resetting of the sliding average calculation.	[Device Para /Statistics /Vavg]
ResFc I Demand-I	State of the module input: Resetting of Statistics - Current Demand (avg, peak avg)	[]
ResFc P Demand-I	State of the module input: Resetting of Statistics - Power Demand (avg, peak avg)	[]
ResFc Max-I	State of the module input: Resetting of all Maximum values	[Device Para /Statistics /Min / Max]
ResFc Min-I	State of the module input: Resetting of all Minimum values	[Device Para /Statistics /Min / Max]

Signals of the Statistics Module

Signal	*Description*
ResFc all	Signal: Resetting of all Statistic values (Current Demand, Power Demand, Min, Max)
ResFc Vavg	Signal: Resetting of the sliding average calculation.
ResFc Max	Signal: Resetting of all Maximum values
ResFc Min	Signal: Resetting of all Minimum values

Counters of the Module Statistics

Value	*Description*	*Menu path*
Res Cr Vavg	Number of resets since last booting. The timestamp shows date and time of the last reset.	[Operation /Statistics /Vavg]
Res Cr Min values	Number of resets since last booting. The timestamp shows date and time of the last reset.	[Operation /Statistics /Min /Voltage]
Res Cr Max values	Number of resets since last booting. The timestamp shows date and time of the last reset.	[Operation /Statistics /Max /Voltage]

Voltage - Statistic Values

Value	*Description*	*Menu path*
f max	Max. frequency value	[Operation /Statistics /Max /Voltage]
f min	Min. frequency value	[Operation /Statistics /Min /Voltage]
V1 max	Maximum value: Symmetrical components positive phase sequence voltage(fundamental)	[Operation /Statistics /Max /Voltage]
V1 min	Minimum value: Symmetrical components positive phase sequence voltage(fundamental)	[Operation /Statistics /Min /Voltage]
V2 max	Maximum value: Symmetrical components negative phase sequence voltage(fundamental)	[Operation /Statistics /Max /Voltage]
V2 min	Minimum value: Symmetrical components negative phase sequence voltage(fundamental)	[Operation /Statistics /Min /Voltage]
VL12 max RMS	VL12 maximum value (RMS)	[Operation /Statistics /Max /Voltage]
VL12 avg RMS	VL12 average value (RMS)	[Operation /Statistics /Vavg]
VL12 min RMS	VL12 minimum value (RMS)	[Operation /Statistics /Min /Voltage]

Value	*Description*	*Menu path*
VL23 max RMS	VL23 maximum value (RMS)	[Operation /Statistics /Max /Voltage]
VL23 avg RMS	VL23 average value (RMS)	[Operation /Statistics /Vavg]
VL23 min RMS	VL23 minimum value (RMS)	[Operation /Statistics /Min /Voltage]
VL31 max RMS	VL31 maximum value (RMS)	[Operation /Statistics /Max /Voltage]
VL31 avg RMS	VL31 average value (RMS)	[Operation /Statistics /Vavg]
VL31 min RMS	VL31 minimum value (RMS)	[Operation /Statistics /Min /Voltage]
VL1 max RMS	VL1 maximum value (RMS)	[Operation /Statistics /Max /Voltage]
VL1 avg RMS	VL1 average value (RMS)	[Operation /Statistics /Vavg]
VL1 min RMS	VL1 minimum value (RMS)	[Operation /Statistics /Min /Voltage]
VL2 max RMS	VL2 maximum value (RMS)	[Operation /Statistics /Max /Voltage]

Value	*Description*	*Menu path*
VL2 avg RMS	VL2 average value (RMS)	[Operation /Statistics /Vavg]
VL2 min RMS	VL2 minimum value (RMS)	[Operation /Statistics /Min /Voltage]
VL3 max RMS	VL3 maximum value (RMS)	[Operation /Statistics /Max /Voltage]
VL3 avg RMS	VL3 average value (RMS)	[Operation /Statistics /Vavg]
VL3 min RMS	VL3 minimum value (RMS)	[Operation /Statistics /Min /Voltage]
VX meas max RMS	Measured value: VX maximum value (RMS)	[Operation /Statistics /Max /Voltage]
VX meas min RMS	Measured value: VX minimum value (RMS)	[Operation /Statistics /Min /Voltage]
VG calc max RMS	Measured value (calculated):VX maximum value (RMS)	[Operation /Statistics /Max /Voltage]
VG calc min RMS	Measured value (calculated):VX minimum value (RMS)	[Operation /Statistics /Min /Voltage]
%(V2/V1) max	Measured value (calculated):V2/V1 maximum value, phase sequence will be taken into account automatically	[Operation /Statistics /Max /Voltage]

Value	*Description*	*Menu path*
%(V2/V1) min	Measured value (calculated):V2/V1 minimum value , phase sequence will be taken into account automatically	[Operation /Statistics /Min /Voltage]

System Alarms

Available Elements:
SysA

NOTICE **Please note that Power Protection and (Active/Reactive/Apparent) Power Demand is only available within Protective Devices that offer current and voltage measurement.**

Within the System Alarms menu [SysA] the User can configure:

- General Settings (activate/inactivate the Demand Management, optional assign a signal, that will block the Demand Management);
- Power Protection (Peak values);
- Demand Management (Power and Current); and
- THD Protection.

Please note, that all thresholds are to be set as primary values.

Demand Management

Demand is the average of system current or power over a time interval (window). Demand management supports the User to keep energy demand below target values bound by contract (with the energy supplier). If the contractual target values are exceeded, extra charges are to be paid to the energy supplier.

Therefore, demand management helps the User detect and avoid averaged peak loads that are taken into account for the billing. In order to reduce the demand charge respective to demand rate, peak loads, if possible, should be diversified. That means, if possible, avoiding large loads at the same time. In order to assist the User in analyzing the demand, demand management might inform the User by an alarm. The User might also use demand alarms and assign them on relays in order to perform load shedding (where applicable).

Demand management comprises:

- Power Demand
  - Watt Demand (Active Power);
  - VAr Demand (Reactive Power);
  - VA Demand (Apparent Power); and
  - Current Demand.

Configuring the Demand

Configuring the demand is a two step procedure. Proceed as follows.

Step1: Configure the general settings within the [Device Para/Statistics/Demand] menu:

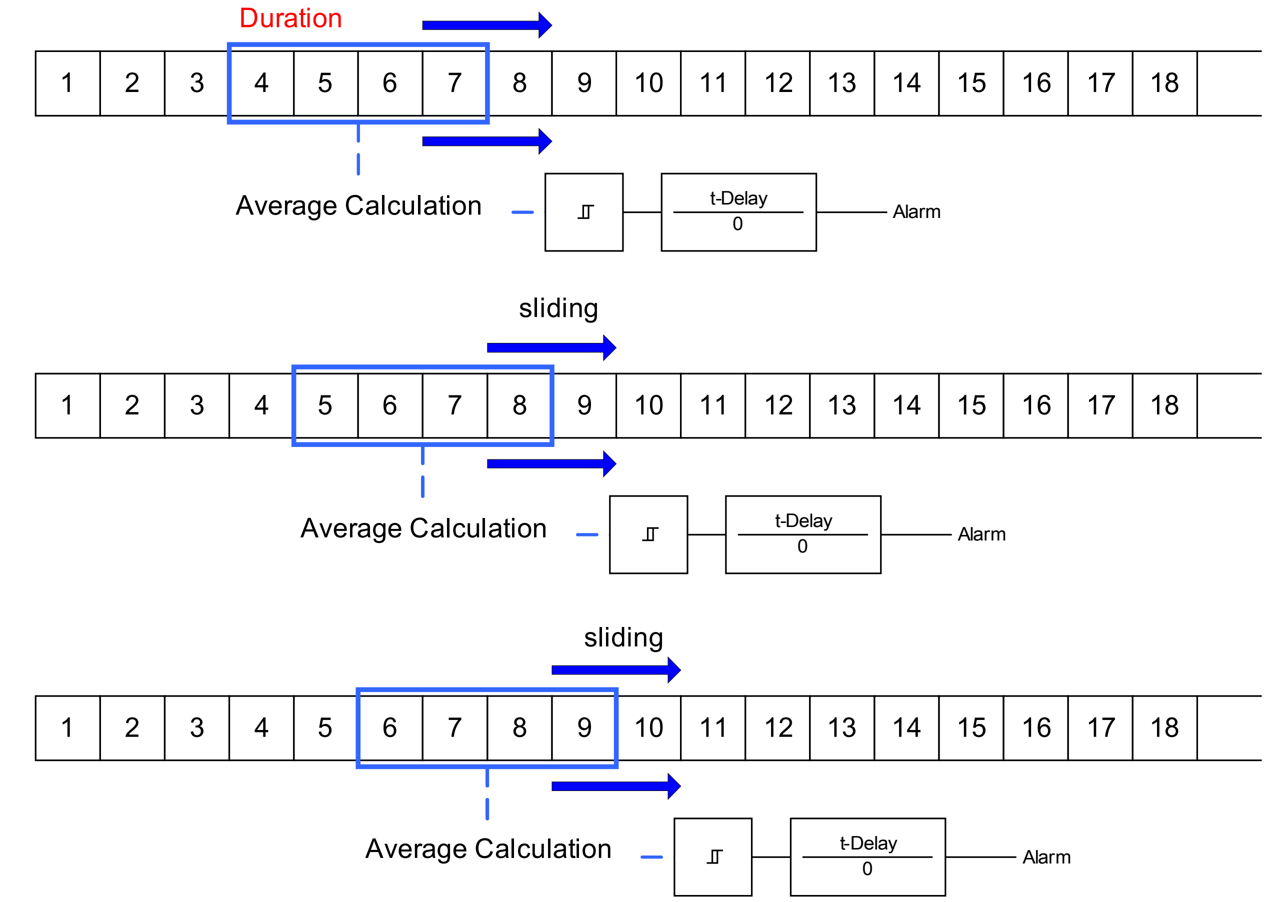
- Set the trigger source to »*Duration*«.
- Select a time base for the »*window*«.
- Determine if the window is »*fixed*« or »*sliding*«.
- If applicable assign a reset signal.

The interval time (window) can be set to fixed or sliding.

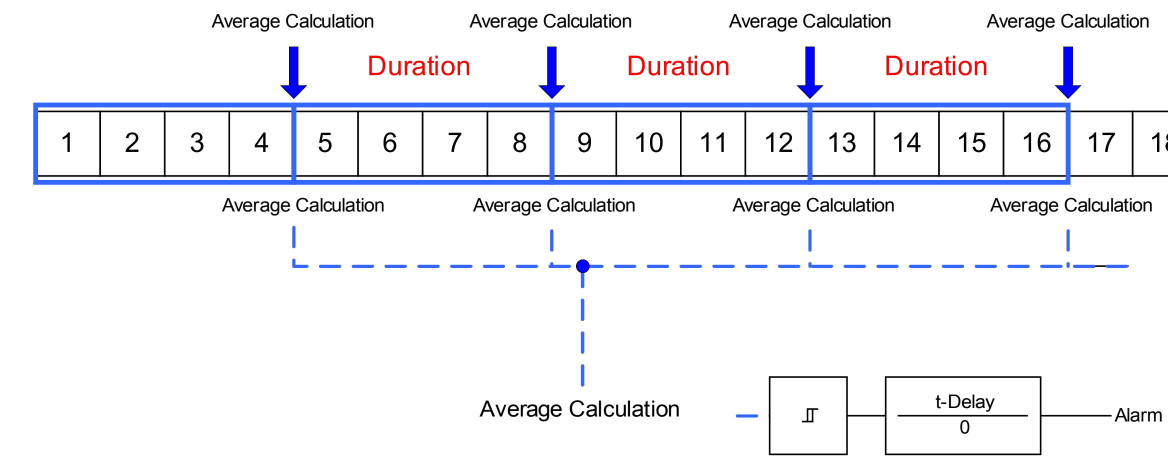
Example for a fixed window: If the range is set for 15 minutes, the protective device calculates the average current or power over the past 15 minutes and updates the value every 15 minutes.

Example for a sliding window: If the sliding window is selected and the interval is set to 15 minutes, the protective device calculates and updates the average current or power continuously, for the past 15 minutes (the newest measuring value replaces the oldest measuring value continuously).

Window configuration = sliding



Window configuration = fixed



Step 2:

- In addition, the Demand specific settings have to be configured in the [SysA/Demand] menu.
- Determine if the demand should generate an alarm or if it should run in the silent mode. (Alarm active/inactive).
- Set the threshold.
- Where applicable, set a delay time for the alarm.

Peak Values

The protective device also saves the peak demand values for current and power. The quantities represent the largest demand value since the demand values were last reset. Peak demands for current and system power are date and time stamped.

Within the [Operation/Statistics] menu, the current Demand and Peak demand values can be seen.

Configuring the Peak Value Supervision

The supervision for the peak values can be configurated within menu [SysA/Power] in order to monitor:

- Active Power (Watt),
- Reactive Power (VAr)
- Apparent Powr (VA)

The specific settings are to be set within menu [SysA/Power].

- Determine if the peak value supervision should generate an alarm or if it should run in the silent mode. (Alarm active/inactive).
- Set the threshold.
- Where applicable, set a delay time for the alarm.

Min. and Max. Values.

Within [Operation/Statistics] menu the minimum (min.) and maximum (max.) values can be seen.

Minimum values since last reset: The minimum values are continuously compared to the last minimum value for that measuring value. If the new value is less than the last minimum, the value is updated. Within the [Device Para/Statistics/"Min / Max"] menu, a reset signal can be assigned.

Maximum values since last reset: The maximum values are continuously compared to the last maximum value for that measuring value. If the new value is greater than the last maximum, the value is updated. Within the [Device Para/Statistics/"Min / Max"] menu, a reset signal can be assigned.

THD Protection

In order to supervise power quality, the protective device can monitor the voltage (phase-to-phase) and current THDs.

Within the [SysA/THD] menu:

- Determine if an alarm is to be issued or not (Alarm active/inactive);
- Set the threshold; and
- Where applicable, set a delay time for the alarm.

Device Planning Parameters of the Demand Management

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

Signals of the Demand Management (States of the Outputs)

Signal	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
Alarm V THD	Signal: Alarm Total Harmonic Distortion Voltage
Trip V THD	Signal: Trip Total Harmonic Distortion Voltage

Global Protection Parameter of the Demand Management

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[SysA /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".	1..n, Assignment List	-.-	[SysA /General settings]
Alarm	Alarm	inactive, active	inactive	[SysA /THD /V THD]
Threshold	Threshold (to be entered as primary value)	1 - 500000V	10000V	[SysA /THD /V THD]
t-Delay	Tripping Delay	0 - 3600s	0s	[SysA /THD /V THD]

States of the Inputs of the Demand Management

Name	*Description*	*Assignment via*
ExBlo-I	Module input state: External blocking	[SysA /General settings]

Acknowledgments

Collective Acknowledgments for latched signals:

Collective Acknowledgments					
	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 Acknowledgment*: 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*	

*The External Acknowledgement might be disabled if parameter »*Ex Ack* «is set to »*inactive*« within menu [Device Para/Ex Acknowledge]. This blocks also the acknowlegement via Communication (e.g. Modbus).

Options for individual acknowledgments for latched signals:

Individual Acknowledgment			
	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 »Acknowledgments« via push-button.

Manual Acknowledgment

- 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.

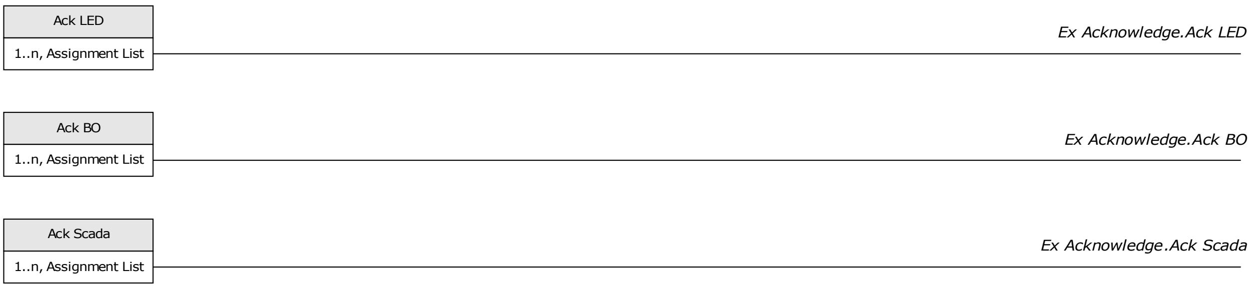
Manual Acknowledgment via Smart view

- 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 »Acknowledgment« 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 Acknowledgments

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.**

Reset to Factory Defaults

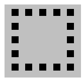
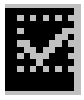
WARNING **This Function will reset the device to the factory defaults. All records will be deleted and and the measured values and counters will be reset. The operation hours counter will be kept.**

This Function is available at the HMI only.

- Press the »C-key« during a cold start, in order to access the »Reset« menu.
- Select »Reset to factory default«.
- Confirm »Reset device to factory defaults and reboot« with »Yes« in order to execute the reset to factory defaults.«

Status Display

In the status display within the »Operation« menu, the present state of all signals can be viewed. This means the User is able to see if the individual signals are active or inactive at that moment. The User can see all signals sorted by protective elements/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 on a subfolder (e.g. *Prot*) in order to see e.g. the states of the general alarms.

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	?

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	0 - 100%	50%	[Device Para /HMI]

Global Protection Parameters of the Panel

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
t-max Edit	If no other key(s) is pressed at the panel, after expiration of this time, all cached (changed) parameters are canceled.	20 - 3600s	180s	[Device Para /HMI]
Menu language	Selection of the language	English, German, Russian, Polish, French, Portuguese	English	[Device Para /HMI]

Recorders

Disturbance Recorder

Available elements:
Disturb rec

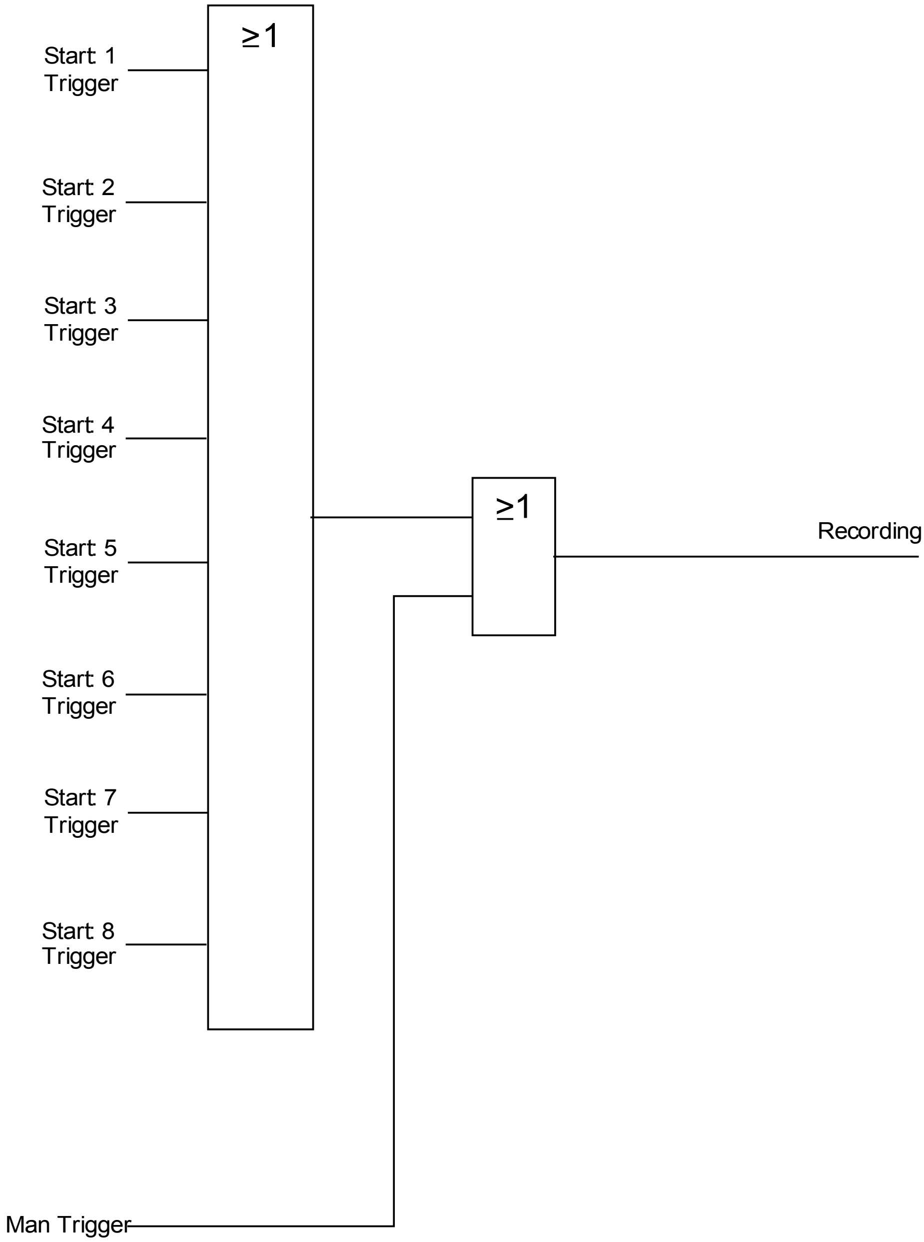
The disturbance recorder works with 32 samples per cycle. The disturbance recorder can be started by one of eight start events (selection from the »assignment list«/OR-Logic).The disturbance record contains the measuring values inclusively pre-trigger-time. By means of *Smart view/Datavisualizer* (option) the oscillographic curves of the analogue (current, voltage) and digital channels/traces can be shown and evaluated in a graphical form. The disturbance recorder has a storage capacity of 120s. The disturbance recorder is able to record up to 10 s (adjustable) per record. The amount of records depends on the file size of each record.

The disturbance recorder can be parameterized in the 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.

NOTICE **The post-trigger time will be up to "Post-trigger time" depending on the duration of the trigger signal. The post-trigger will be the remaining time of the "Max file size" but at maximum "Post-trigger time"**

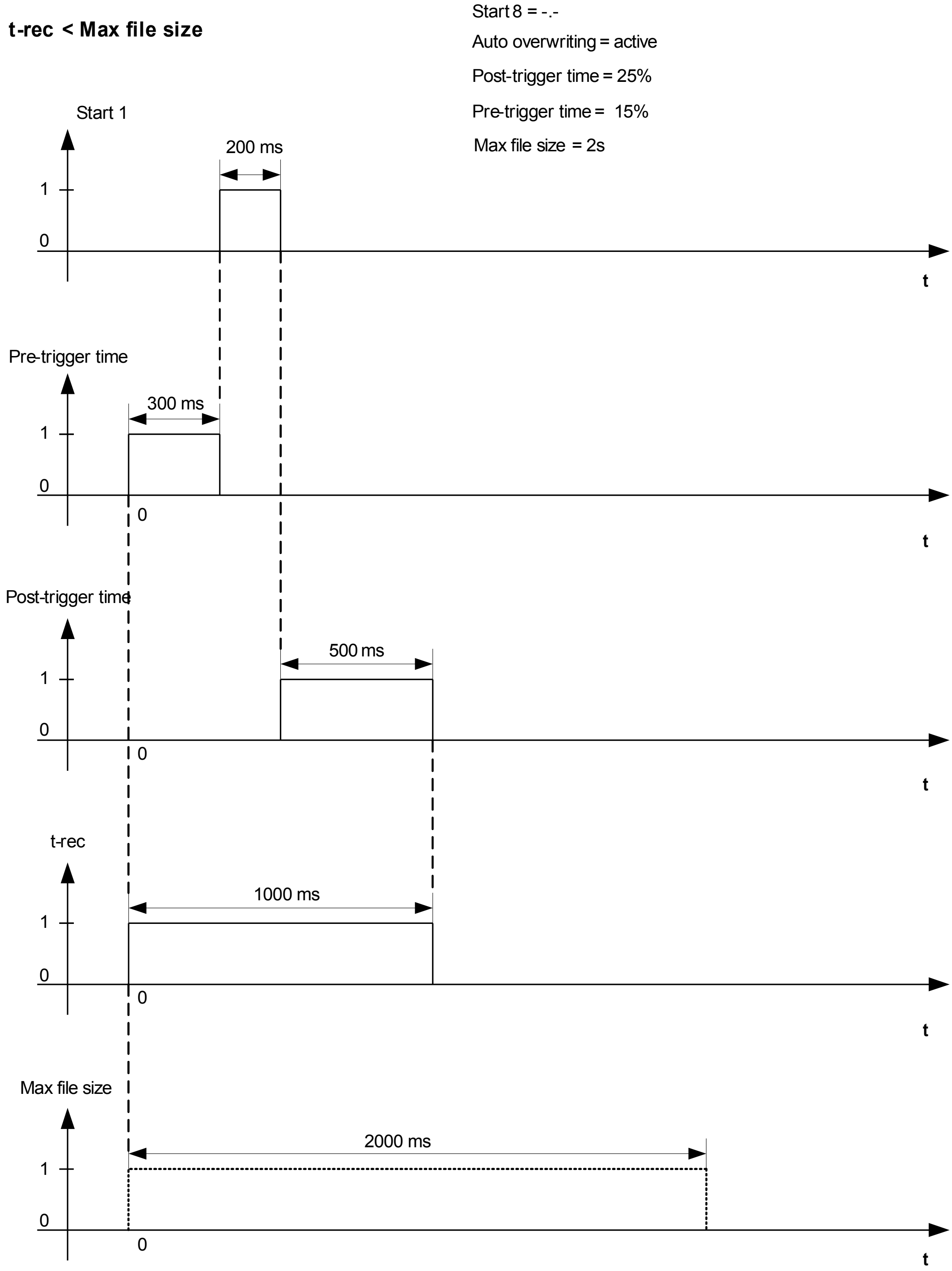


Example
The disturbance recorder is started by the general activation facility. After the fault has been cancelled (+ follow-up time), the recording process is stopped (but after 10s at the latest).

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.

Example Disturbance Recorder Timing Chart I

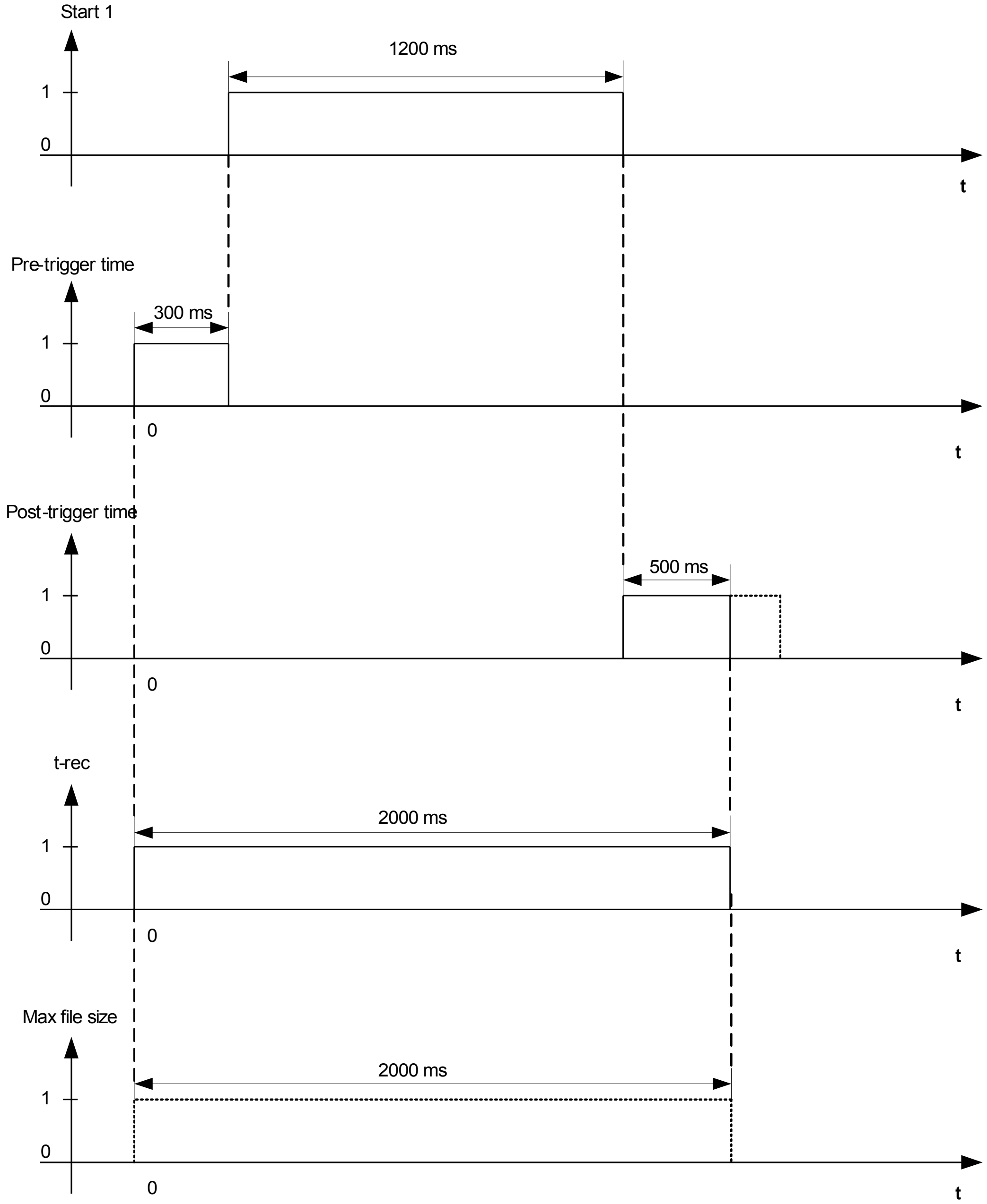
Start 1 = Prot.Trip
Start 2 = -.-
Start 3 = -.-
Start 4 = -.-
Start 5 = -.-
Start 6 = -.-
Start 7 = -.-
Start 8 = -.-
Auto overwriting = active
Post-trigger time = 25%
Pre-trigger time = 15%
Max file size = 2s



Example Disturbance Recorder Timing Chart II

Start 1 = Prot.Alarm
Start 2 = -.-
Start 3 = -.-
Start 4 = -.-
Start 5 = -.-
Start 6 = -.-
Start 7 = -.-
Start 8 = -.-
Auto overwriting = active
Post-trigger time = 25%
Pre-trigger time = 15%
Max file size = 2s

t-rec = Max file size



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 detailed 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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Man Trigger	Manual Trigger	False, True	False	[Operation /Recorders /Man Trigger]
Res all rec	Reset all records	inactive, active	inactive	[Operation /Reset]

Global Protection Parameters of the Disturbance Recorder

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Start: 1	Start recording if the assigned signal is true.	1..n, Assignment List	Prot.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]
Post-trigger time	The post trigger time is settable up to a maximum of 50% of the Maximum file size setting. The post-trigger will be the remaining time of the "Max file size" but at maximum "Post-trigger time"	0 - 50%	20%	[Device Para /Recorders /Disturb rec]
Pre-trigger time	The pre trigger time is settable up to a maximum of 50% of the Maximum file size setting.	0 - 50%	20%	[Device Para /Recorders /Disturb rec]
Max file size	The maximum storage capacity per record is 10 seconds, including pre-trigger and post-trigger time. The disturbance recorder has a total storage capacity of 120 seconds.	0.1 - 10.0s	2s	[Device Para /Recorders /Disturb rec]

Disturbance Recorder 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 Signals

Signal	*Description*
recording	Signal: Recording
memory full	Signal: Memory full
Clear fail	Signal: Clear failure in memory
Res all records	Signal: All records deleted
Res rec	Signal: Delete record
Man Trigger	Signal: Manual Trigger

Special Parameters of the Disturbance Recorder

Value	*Description*	*Default*	*Size*	*Menu path*
Rec state	Recording state	Ready	Ready, Recording, Writing file, Trigger Blo	[Operation /Status display /Recorders /Disturb rec]
Error code	Error code	OK	OK, Write err, Clear fail, Calculation err, File not found, Auto overwriting off	[Operation /Status display /Recorders /Disturb rec]

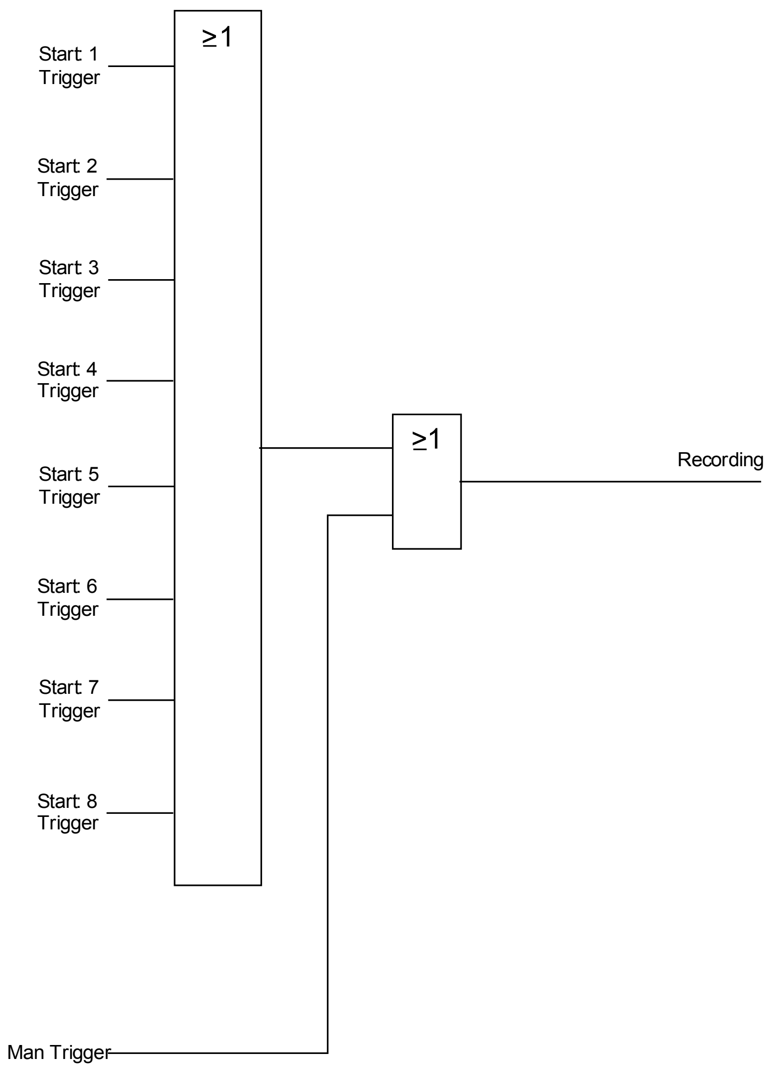
Fault Recorder

<u>Fault rec</u>

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 following 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 double click the selected item in the list.

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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Res all rec	Reset all records	inactive, active	inactive	[Operation /Reset]
Man Trigger	Manual Trigger	False, True	False	[Operation /Recorders /Man Trigger]

Global Protection Parameters of the Fault Recorder

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Start: 1	Start recording if the assigned signal is true.	1..n, Assignment List	Prot.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]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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 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 Signals

Signal	*Description*
Res rec	Signal: Delete record
Man Trigger	Signal: Manual Trigger

Trend Recorder

Available Elements:
Trend rec

Functional Description

The Trend Data are data points stored by the Trend Recorder on the relay device over fixed intervals of time, and can be downloaded from the device using *Smart view*. A Trend Record is viewable using the *Data Visualizer* software by selecting files saved by *Smart view* with a file extension of ". HptTR". The list of available trend recorder data is viewable by selecting [Operation/ Recorders/Trend Recorder].

When viewed within the *Data Visualizer*, the trend record will show the observed values (up to 10) that the User has specified. The values available in the *Trend Recorder* depend on the type of the connected device and the configuration of the *Trend Recorder*.

Managing Trend Records

To download information from the Trend Recorder, select [Operation/Recorder/Trend Rec] from the menu tree. The User will find three options within the Trend Recorder window that will allow the User to:

- Receive Trend Records,
- Refresh the Trend Recorder, and
- Delete Trend Records.

Selecting the »Receive Trend Record« button will download data from the relay to the User's PC. By selecting the »*Refresh Trend Recorder«*", *Smart view* updates the list of the Trend Recorder. The »*Delete Trend Records«* function will clear all trend data from the relay. Trend Recorder data previously stored on the User's PC remains untouched.

After having received trend data from the device, the User can view the data in the *Data Visualizer* by double-clicking on the received ".ErTr" file stored on the PC. Once the ".ErTr" file is open, the User will see the "Analog Channels" that are monitored by the Trend Recorder. By clicking on the "Analog Channels", all monitored parameters are listed. To view a channel, the User must click on the left mouse key, then drag and drop the channel onto the right side of the *Data Visualizer* screen. The channel is then listed under the »*Displayed Channels«*.

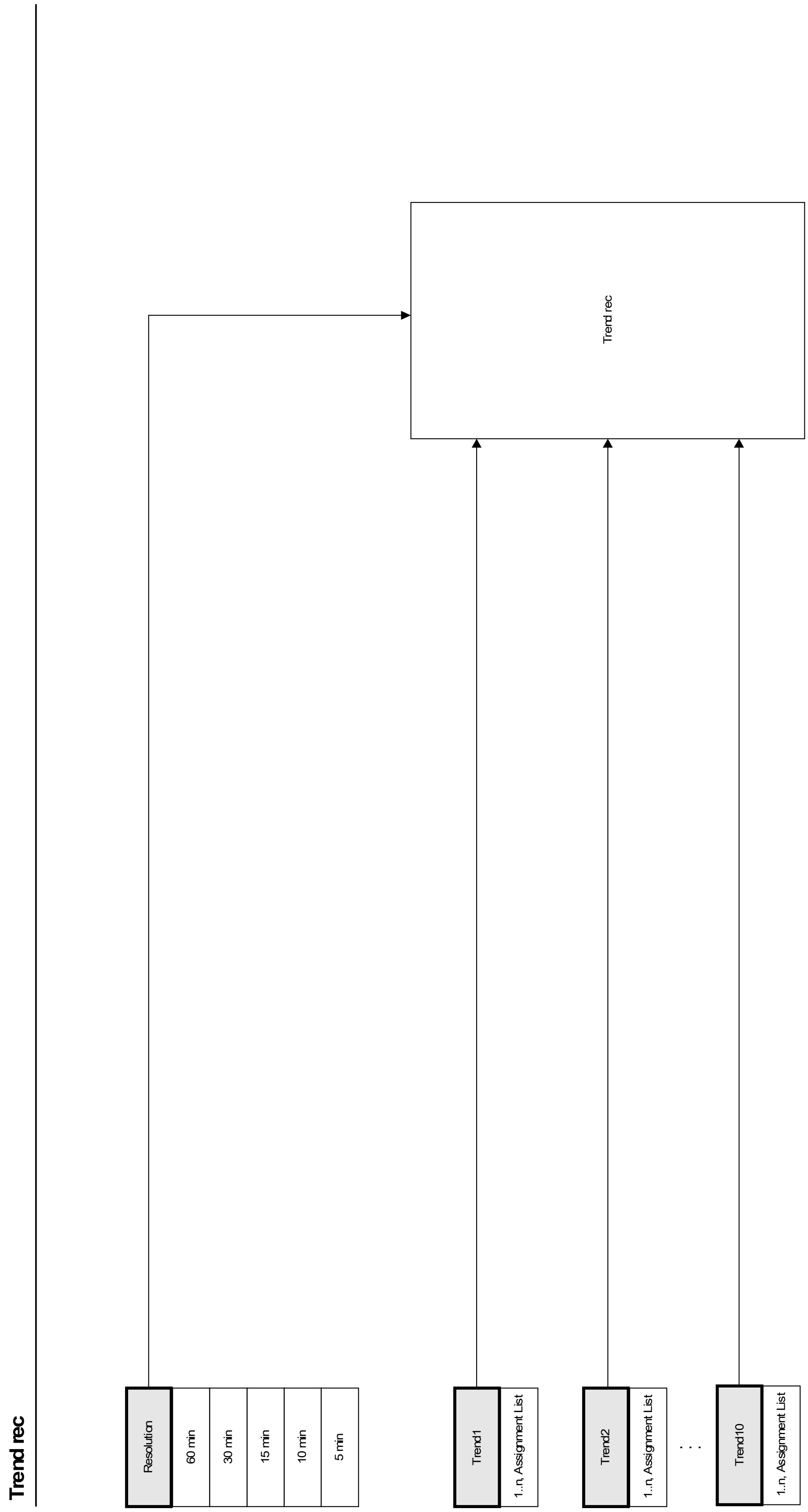
To remove a channel from view, the User must select the Trend Data to be removed in the »*Displayed Channels«* menu tree, then click on the right mouse button to bring up the menu options. Here, the User will find the »Remove« menu option that, when selected, will remove the trend data.

Configuring the Trend Recorder

The Trend Recorder is to be configured within [Device Para/Recorders/Trend Recorder] menu.

The User has to set the time interval. This defines the distance between two measuring points.

The User can select up to ten values that will be recorded.


Trend rec
Resolution
60 min
30 min
15 min
10 min
5 min
Trend1
1..n, Assignment List
Trend2
1..n, Assignment List
Trend10
1..n, Assignment List
Trend rec

Global Protection Parameters of the Trend Recorder

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Resolution	Resolution (recording frequency)	60 min, 30 min, 15 min, 10 min, 5 min	15 min	[Device Para /Recorders /Trend rec]
Trend1	Observed Value1	1..n, TrendRecList	Voltage.VL1 RMS	[Device Para /Recorders /Trend rec]
Trend2	Observed Value2	1..n, TrendRecList	Voltage.VL2 RMS	[Device Para /Recorders /Trend rec]
Trend3	Observed Value3	1..n, TrendRecList	Voltage.VL3 RMS	[Device Para /Recorders /Trend rec]
Trend4	Observed Value4	1..n, TrendRecList	Voltage.VX meas RMS	[Device Para /Recorders /Trend rec]
Trend5	Observed Value5	1..n, TrendRecList	Voltage.VL12 RMS	[Device Para /Recorders /Trend rec]
Trend6	Observed Value6	1..n, TrendRecList	Voltage.VL23 RMS	[Device Para /Recorders /Trend rec]
Trend7	Observed Value7	1..n, TrendRecList	Voltage.VL31 RMS	[Device Para /Recorders /Trend rec]
Trend8	Observed Value8	1..n, TrendRecList	Voltage.f	[Device Para /Recorders /Trend rec]
Trend9	Observed Value9	1..n, TrendRecList	Voltage.V1	[Device Para /Recorders /Trend rec]

Parameter	Description	Setting range	Default	Menu path
Trend10	Observed Value10	1..n, TrendRecList	Voltage.V2	[Device Para /Recorders /Trend rec]

Trend Recorder Signals (Output States)

Signal	Description
Hand Reset	Hand Reset

Direct Commands of the Trend Recorder

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

Assignable Values of the Trend Recorder

Name	Description
-.-	No assignment
Voltage.VL1	Measured value: Phase-to-neutral voltage (fundamental)
Voltage.VL2	Measured value: Phase-to-neutral voltage (fundamental)
Voltage.VL3	Measured value: Phase-to-neutral voltage (fundamental)
Voltage.VX meas	Measured value (measured): VX measured (fundamental)
Voltage.VG calc	Measured value (calculated): VG (fundamental)
Voltage.VL12	Measured value: Phase-to-phase voltage (fundamental)
Voltage.VL23	Measured value: Phase-to-phase voltage (fundamental)
Voltage.VL31	Measured value: Phase-to-phase voltage (fundamental)
Voltage.VL1 RMS	Measured value: Phase-to-neutral voltage (RMS)
Voltage.VL2 RMS	Measured value: Phase-to-neutral voltage (RMS)
Voltage.VL3 RMS	Measured value: Phase-to-neutral voltage (RMS)
Voltage.VX meas RMS	Measured value (measured): VX measured (RMS)
Voltage.VG calc RMS	Measured value (calculated): VG (RMS)
Voltage.VL12 RMS	Measured value: Phase-to-phase voltage (RMS)
Voltage.VL23 RMS	Measured value: Phase-to-phase voltage (RMS)
Voltage.VL31 RMS	Measured value: Phase-to-phase voltage (RMS)
Voltage.V0	Measured value (calculated): Symmetrical components Zero voltage(fundamental)
Voltage.V1	Measured value (calculated): Symmetrical components positive phase sequence voltage(fundamental)

Name	*Description*
Voltage.V2	Measured value (calculated): Symmetrical components negative phase sequence voltage(fundamental)
Voltage.VL1 avg RMS	VL1 average value (RMS)
Voltage.VL2 avg RMS	VL2 average value (RMS)
Voltage.VL3 avg RMS	VL3 average value (RMS)
Voltage.VL12 avg RMS	VL12 average value (RMS)
Voltage.VL23 avg RMS	VL23 average value (RMS)
Voltage.VL31 avg RMS	VL31 average value (RMS)
Voltage.f	Measured value: Frequency
Voltage.VL1 THD	Measured value (calculated): VL1 Total Harmonic Distortion
Voltage.VL2 THD	Measured value (calculated): VL2 Total Harmonic Distortion
Voltage.VL3 THD	Measured value (calculated): VL3 Total Harmonic Distortion
Voltage.VL12 THD	Measured value (calculated): V12 Total Harmonic Distortion
Voltage.VL23 THD	Measured value (calculated): V23 Total Harmonic Distortion
Voltage.VL31 THD	Measured value (calculated): V31 Total Harmonic Distortion

Genearal Values of the Trend Recorder

Value	*Description*	*Default*	*Size*	*Menu path*
Max avail Entries	Maximum available entries in the current configuration	0	0 - 9999999999	[Operation /Count and RevData /Trend rec]

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.*	*No of grid faults*	*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 grid fault 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

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

Event Recorder Signals

Signal	*Description*
Res all records	Signal: All records deleted

Communication Protocols

SCADA Interface

X103

Device Planning Parameters of the Serial Scada Interface

Parameter	*Description*	*Options*	*Default*	*Menu path*
Protocol	Caution! Changing the protocol will cause a restart of the device	-, Modbus, IEC60870-5-103, Profibus	Modbus	[Device planning]

Global Protection Parameters of the Serial Scada Interface

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Optical rest position	Optical rest position	Light off, Light on	Light on	[Device Para /X103]

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
- 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.

Modbus RTU

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 2: 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).

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.

Modbus TCP

NOTICE **Establishing a connection via TCP/IP to the device is only possible if your device is equipped with an Ethernet Interface (RJ45).**

Contact your IT administrator in order to establish the network connection.

Part 1: Setting the TCP/IP Parameters

Call up *»Device parameter/TCP/IP«* at the HMI (panel) and set the following parameters:

- TCP/IP address
- Subnetmask
- Gateway

Part 2: Configuration of the Devices

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

- Setting a Unit Identifier is only necessary if a TCP network should be coupled to a RTU network.
- If a different port than the default port 502 should be used please proceed as follows:
  - Choose “Private” within the TCP-Port-Configuration.
  - Set the port-number.
- Set the maximum accepted time of “no communication”. If this time has expired – without any comunication, the device concludes a failure within the master system.
- Allow or disallow the blocking of SCADA commands.

Part 3: Hardware Connection

- There is a RJ45 interface at the rear side of the device for the hardware connection to the control system.
- Establish the connection to the device by means of a proper Ethernet cable.

Direct Commands of the Modbus®

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Res 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. Only available if:Device planning = RTU	1 - 247	1	[Device Para /Modbus]
Unit ID	The Unit Identifier is used for routing. This parameter is to be set, if a Modbus RTU and a Modbus TCP network should be coupled. Only available if:Device planning = TCP	1 - 255	255	[Device Para /Modbus]
TCP Port Config	TCP Port Configuration. This parameter is to be set only if the default Modubs TCP Port should not be used. Only available if:Device planning = TCP	Default, Private	Default	[Device Para /Modbus]
Port	Port number Only available if:Device planning = TCP And Only available if: TCP Port Config = Private	502 - 65535	502	[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. Only available if:Device planning = RTU	0.01 - 10.00s	1s	[Device Para /Modbus]
Baud rate	Baud rate Only available if:Device planning = RTU	1200, 2400, 4800, 9600, 19200, 38400	19200	[Device Para /Modbus]
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. Only available if:Device planning = RTU	8E1, 8O1, 8N1, 8N2	8E1	[Device Para /Modbus]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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 - 3600s	10s	[Device Para /Modbus]
Scada CmdBlo	Activating (allowing)/ Deactivating (disallowing) the blocking of the Scada Commands	inactive, active	inactive	[Device Para /Modbus]
Disable Latching	Disable Latching: If this parameter is active (true), none of the Modbus states will be latched. That means that trip signals wont be latched by Modbus.	inactive, active	inactive	[Device Para /Modbus]
AllowGap	If this parameter is active (True), the user can request a set of modbus register without getting an exception, because of invalid address in the requested array. The invalid addresses have a special value 0xFAFA, but the user is responsible for ignoring invalid addresses. Attention: This special value can be valid, if address is valid.	inactive, active	inactive	[Device Para /Modbus]

Modbus® Signals (Output States)

NOTICE Some signals (that are for a short time active only) have to be acknowledged separately (e.g. Trip signals) by the Communication System.

Signal	*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® Values

Value	Description	Default	Size	Menu path
NoOfRequestsTotal	Total number of requests. Includes requests for other slaves.	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfRequestsForMe	Total Number of requests for this slave.	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfResponse	Total number of requests having been responded. Only available if:Device planning = TCP	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfResponsTimeOverruns	Total number of requests with exceeded response time. Physically corrupted Frame. Only available if:Device planning = RTU	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfOverrunErros	Total Number of Overrun Failures. Physically corrupted Frame. Only available if:Device planning = RTU	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfParityErrors	Total number of parity errors. Physically corrupted Frame. Only available if:Device planning = RTU	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfFrameErrors	Total Number of Frame Errors. Physically corrupted Frame. Only available if:Device planning = RTU	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfBreaks	Number of detected communication aborts Only available if:Device planning = RTU	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfQueryInvalid	Total number of Request errors. Request could not be interpreted	0	0 - 9999999999	[Operation /Count and RevData /Modbus]
NoOfInternalError	Total Number of Internal errors while interpreting the request.	0	0 - 9999999999	[Operation /Count and RevData /Modbus]

Profibus

<u>Profibus</u>

Part 1: Configuration of the Devices

Call up *»Device parameter/Profibus«* and set the following communication parameter:

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

In addition to that the Master has to be provided with the GSD-file. The GSD-file can be taken from the Product-CD.

Part 2: Hardware Connection

- For hardware connection to the control system, there is optional an D-SUB interface at the rear side of the device.
- Connect bus and device (wiring).
- Up to 123 slaves can be connected.
- Terminate the Bus by means of an Terminate Resistor.

Error Handling

Information on physical communication errors, such as:

- Baudrate Error

can be obtained from the event recorder or the status display.

Error Handling – Status LED at the rear side

The Profibus D-SUB interface at the rear side of the device is equipped with an status LED.

- Baud Search -> red flashing
- Baud Found -> green flashing
- Data Exchange -> green
- No Profibus/Unplugged, not connected -> red

Direct Commands of the Profibus

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Reset Comds	All Profibus Commands will be reset.	inactive, active	inactive	[Operation /Reset]

Global Protection Parameters of the Profibus

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 1	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 1-16]
Latched 1	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 1-16]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 1-16]
Latched 2	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 1-16]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 1-16]
Latched 3	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 1-16]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 1-16]
Latched 4	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 1-16]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 1-16]
Latched 5	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 1-16]
Assignment 6	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 1-16]
Latched 6	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 1-16]
Assignment 7	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 1-16]
Latched 7	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 1-16]
Assignment 8	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 1-16]
Latched 8	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 1-16]
Assignment 9	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 1-16]
Latched 9	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 1-16]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 10	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 1-16]
Latched 10	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 1-16]
Assignment 11	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 1-16]
Latched 11	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 1-16]
Assignment 12	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 1-16]
Latched 12	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 1-16]
Assignment 13	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 1-16]
Latched 13	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 1-16]
Assignment 14	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 1-16]
Latched 14	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 1-16]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 15	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 1-16]
Latched 15	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 1-16]
Assignment 16	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 1-16]
Latched 16	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 1-16]
Assignment 17	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 17-32]
Latched 17	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 17-32]
Assignment 18	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 17-32]
Latched 18	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 17-32]
Assignment 19	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 17-32]
Latched 19	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 17-32]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 20	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 17-32]
Latched 20	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 17-32]
Assignment 21	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 17-32]
Latched 21	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 17-32]
Assignment 22	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 17-32]
Latched 22	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 17-32]
Assignment 23	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 17-32]
Latched 23	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 17-32]
Assignment 24	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 17-32]
Latched 24	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 17-32]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 25	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 17-32]
Latched 25	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 17-32]
Assignment 26	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 17-32]
Latched 26	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 17-32]
Assignment 27	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 17-32]
Latched 27	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 17-32]
Assignment 28	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 17-32]
Latched 28	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 17-32]
Assignment 29	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 17-32]
Latched 29	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 17-32]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 30	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 17-32]
Latched 30	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 17-32]
Assignment 31	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 17-32]
Latched 31	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 17-32]
Assignment 32	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 17-32]
Latched 32	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 17-32]
Slave ID	Device address (Slave ID) within the bus system. Each device address has to be unique within a bus system.	2 - 125	2	[Device Para /Profibus /Bus parameters]

Inputs of the Profibus

Name	*Description*	*Assignment via*
Assignment 1-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 1-16]
Assignment 2-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 1-16]
Assignment 3-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 1-16]
Assignment 4-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 1-16]
Assignment 5-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 1-16]
Assignment 6-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 1-16]
Assignment 7-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 1-16]
Assignment 8-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 1-16]
Assignment 9-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 1-16]
Assignment 10-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 1-16]
Assignment 11-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 1-16]
Assignment 12-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 1-16]

Name	*Description*	*Assignment via*
Assignment 13-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 1-16]
Assignment 14-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 1-16]
Assignment 15-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 1-16]
Assignment 16-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 1-16]
Assignment 17-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 17-32]
Assignment 18-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 17-32]
Assignment 19-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 17-32]
Assignment 20-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 17-32]
Assignment 21-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 17-32]
Assignment 22-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 17-32]
Assignment 23-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 17-32]
Assignment 24-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 17-32]
Assignment 25-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 17-32]

Name	*Description*	*Assignment via*
Assignment 26-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 17-32]
Assignment 27-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 17-32]
Assignment 28-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 17-32]
Assignment 29-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 17-32]
Assignment 30-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 17-32]
Assignment 31-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 17-32]
Assignment 32-I	Module input state: Scada Assignment	[Device Para /Profibus /Assignment 17-32]

Profibus Signals (Output States)

Signal	*Description*
Data OK	Data within the Input field are OK (Yes=1)
SubModul Err	Assignable Signal, Failure in Sub-Module, Communication Failure.
Connection active	Connection 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

Profibus Values

Value	*Description*	*Default*	*Size*	*Menu path*
Fr Sync Err	Frames, that were sent from the Master to the Slave are faulty.	1	1 - 99999999	[Operation /Count and RevData /Profibus]
crcErrors	Number of CRC errors that the ss manager has recognized in received response frames from ss (each error caused a subsystem reset)	1	1 - 99999999	[Operation /Count and RevData /Profibus]
frLossErrors	Number of frame loss errors that the ss manager recognized in received response frames from ss (each error caused a subsystem reset)	1	1 - 99999999	[Operation /Count and RevData /Profibus]
ssCrcErrors	Number of CRC errors that the subsystem has recognized in received trigger frames from host	1	1 - 99999999	[Operation /Count and RevData /Profibus]
ssResets	Number of subsystem resets/restarts from ss manager	1	1 - 99999999	[Operation /Count and RevData /Profibus]
Master ID	Device address (Master ID) within the bus system. Each device address has to be unique within a bus system.	1	1 - 125	[Operation /Status display /Profibus /State]
HO Id PSub	Handoff Id of PbSub	0	0 - 9999999999	[Operation /Status display /Profibus /State]
t-WatchDog	The Profibus Chip detects a communication issue if this timer is expired without any communication (Parameterising telegram).	0	0 - 9999999999	[Operation /Status display /Profibus /State]

Value	*Description*	*Default*	*Size*	*Menu path*
Slave State	Communication State between Slave and Master.	Baud Search	Baud Search, Baud Found, PRM OK, PRM REQ, PRM Fault, CFG Fault, Clear Data, Data exchange	[Operation /Status display /Profibus /State]
Baud rate	The baud rate that has been detected lastly, will still be shown after a connection issue.	-.-	12 Mb/s, 6 Mb/s, 3 Mb/s, 1.5 Mb/s, 0.5 Mb/s, 187500 baud, 93750 baud, 45450 baud, 19200 baud, 9600 baud, -.-	[Operation /Status display /Profibus /State]
PNO Id	PNO Identification Number. GSD Identification Number.	0C50h	0C50h	[Operation /Status display /Profibus /State]

IEC60870-5-103

IEC 103

IEC60870-5-103 Protocol Configuration

In order to use the IEC60870-5-103 protocol it has to be assigned to the X103 Interface within the Device Planning. The device will reboot after setting this parameter.

NOTICE **The parameter X103 is only available if the device is at the rear side equipped with an interface like RS485 or Fiber Optic.**

NOTICE **If the device is equipped with an Fiber Optic Interface, the Optical Rest Position has to be set within the Device Parameters .**

The time-controlled IEC60870-5-103 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.
The device meets the compatibility mode 2. Compatibility mode 3 is not supported.

The following IEC60870-5-103-functions will be supported:

- Initialization (Reset)
- Time Synchronization
- Reading out of time stamped, instantaneous signals
- General Queries
- Cyclic Signals
- General Commands
- Transmission of Disturbance Data

Initialization
The communication has to be reset by a Reset Command each time that the device is turned on or that communication parameters have been changed. The “Reset CU” Command resets. The relay acts on both Reset Commands (Reset CU or Reset FCB).

The relay acts on the reset command by an identification signal ASDU 5 (Application Service Data Unit), as a reason (Cause Of Transmission, COT) for the transmission of the answer either a “Reset CU” or a “Reset FCB” will be sent depending on the type of the reset command. This information can be part of the data section of the ASDU-signal.

Name of the Manufacturer
The section for the identification of the software contains three digits of the device code for the identification of the device type. Beside the upper mentioned identification number the device generates a communication start event.

Time Synchronization
Time and date of the relay can be set by means of the time synchronization function of the IEC60870-5-103 protocol. If the time synchronization signal is send out with a confirmation request, the device will answer with a confirmation signal.

Spontaneous Events

The events that are generated by the device will be forwarded to the master with numbers for standard function types / standard information. The data point list comprises all events that can be generated by the device.

Cyclic Measurement

The device generates on a cyclic base measured values by means of ASDU 9. They can be read out via a class 2 query. Please take into account that the measured values will be send out as multiples (1.2 or 2.4 times the rated value). How to set 1.2 or 2.4 as multiplier for a value can be taken from the data point list.

The parameter “Transm priv meas val” defines if additional measurement values should be transmitted in the private part. Public and private measured values are transmitted by ASDU9. That means that either a “private” or a “public” ASDU9 will be transmitted. If this parameter is set, the ASDU9 will contain additional measured values that are an enhancement of the standard. The “private” ASDU9 is send with a fixed function type and information number that does not depend the type of device. Please refer to the data point list.

Commands

The data point list comprises a list of the supported commands. Any command will be responded by the device with a positive or negative confirmation. If the command is executable, the execution with the corresponding reason for the transmission (COT) will be lead in at first, and subsequently the execution will be confirmed with COT1 within a ASDU9.

Disturbance Recording

The disturbances recorded by the device can be read out by means described in standard IEC60870-5-103. The device is in compliance with the VDEW-Control System by transmission of an ASDU 23 without disturbance records at the beginning of an GI-Cycle.

A disturbance record contains the following information:

- Analog Measured Values, IL1, IL2, IL3, IN, Voltages VL1, VL2, VL3, VEN;
- Binary States, transmitted as marks, e.g. Alarms and Trips.
- The Transmission ratio will not be supported. The transmission ratio is included in the “Multiplier”.

Blocking the Transmission Direction

The relay does not support functions to block the transmission in a certain direction (supervision direction).

Global Protection Parameters of the IEC60870-5-103

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 /IEC 103]
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 - 3600s	60s	[Device Para /IEC 103]
Transm priv meas val	Transmit additional (private) measuring values	inactive, active	inactive	[Device Para /IEC 103]
Baud rate	Baud rate	1200, 2400, 4800, 9600, 19200, 38400, 57600	19200	[Device Para /IEC 103]
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 /IEC 103]

IEC60870-5-103 Signals (Output States)

Signal	*Description*
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
Transmission	Signal: SCADA active
Fail phy Interf	Failure in the physical interface
Failure Event lost	Failure event lost

IEC60870-5-103 Values

Value	*Description*	*Default*	*Size*	*Menu path*
Internal errors	Internal errors	0	0 - 9999999999	[Operation /Count and RevData /IEC 103]
NReceived	Total Number of received Messages	0	0 - 9999999999	[Operation /Count and RevData /IEC 103]
NSent	Total Number of sent Messages	0	0 - 9999999999	[Operation /Count and RevData /IEC 103]
NBadFramings	Number of bad Messages	0	0 - 9999999999	[Operation /Count and RevData /IEC 103]
NBadParities	Number of Parity Errors	0	0 - 9999999999	[Operation /Count and RevData /IEC 103]
NBreakSignals	Number of Communication Interrupts	0	0 - 9999999999	[Operation /Count and RevData /IEC 103]
NInternalError	Number of Internal Errors	0	0 - 9999999999	[Operation /Count and RevData /IEC 103]
NBadCharChecksum	Number of Checksum Errors	0	0 - 9999999999	[Operation /Count and RevData /IEC 103]

IEC61850

IEC61850

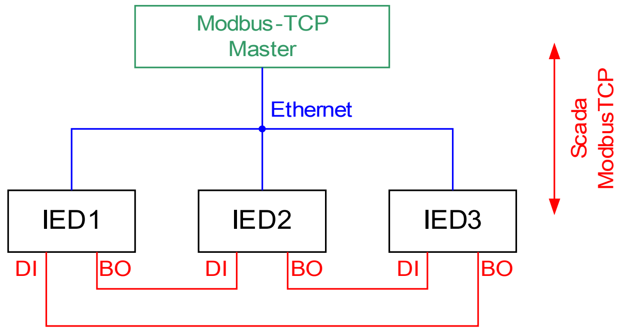
Introduction

To understand the functioning and mode of operation of a substation in an IEC61850 automation environment, it is useful to compare the commissioning steps with those of a conventional substation in a Modbus TCP environment.

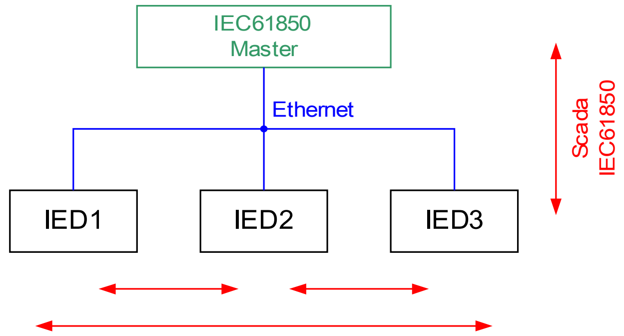
In a conventional substation the individual IEDs (Intelligent Electronic Devices) communicate in vertically direction with the higher level control center via SCADA. The horizontal communication is exclusively realized by wiring output relays (OR) and digital inputs (DI) among each other.

In an IEC61850 environment communication between the IEDs takes place digitally (via Ethernet) by a service called GOOSE (Generic Object Oriented Substation Event). By means of this service information about events is submitted between each IED. Therefore each IED has to know about the functional capability of all other connected IEDs.

Each IEC61850 capable device includes a description of it's own functionality and communications skills (IED Capability Description, *.ICD).
By means of a Substation Configuration Tool to describe the structure of the substation, assignment of the devices to the primary technique, etc. a virtual wiring of the IEDs among each other and with other switch gear of the substation can be done. A description of the substation configuration will be generated in form of a *.SCD file. At last this file has to be submitted to each device. Now the IEDs are able to communicate closed among each other, react to interlockings and operate switch gear.



Conventional hard wiring



GOOSE IEC61850 soft wiring

Commissioning steps for a conventional substation with modbus TCP environment:

- Parameter setting of the IEDs
- Ethernet installation
- TCP/IP settings for the IEDs
- Wiring according to wiring scheme

Commissioning steps for a substation with IEC61850 environment:

1. Parameter setting of the IEDs
   Ethernet installation
   TCP/IP settings for the IEDs

2. IEC61850 configuration (software wiring)
   a) Exporting an ICD file from each device
   b) Configuration of the substation
      (generating a SCD file)
   c) Transmit SCD file to each device

Generation/Export of a device specific ICD file

Each device of the HighPROTEC line includes a description of it's own functionality and communications skills in form of an *.ICD file (IED Capability Description). This file can be exported as follows and be used for the configuration of the substation.

NOTICE

- **A change of the devices parameters has an influence on the content of the ICD file.**

1. Connect the device with your PC/Notebook.
2. Start Smart view.
3. Click on »*Receive data from Device*« in the menu »*Device*«.
4. Click on »*IEC61850*« in the menu »*Device Para*«.
5. Click on the ICD icon in the IEC61850 window.
6. Select a drive and file name for the ICD file and click "save".
7. Repeat the steps 1 to 6 for all connected devices in this IEC61850 environment.

Generation/Export of a SCD file

Each device of the HighPROTEC can create an export it's own functionality and communications skills in form of a *.SCD file.

1. Connect the device with your PC/Notebook.
2. Start Smart view.
3. Click on »*Receive data from Device*« in the menu »*Device*«.
4. Click on »*IEC61850*« in the menu »*Device Para*«.
5. Click on the SCD icon in the IEC61850 window.
6. Select a drive and file name for the SCD file and click "save".
7. Repeat the steps 1 to 6 for all connected devices in this IEC61850 environment.

Substation configuration, Generation of .SCD file (Station Configuration Description)

The substation configuration, i. e. connection of all logical nodes of protection and control devices, as well as switch gear usually is done with a „Substation Configuration Tool“. Therefore the ICD files of all connected IEDs in the IEC61850 environment have to be available. The result of the station wide “software wiring” can be exported in the form of a SCD file (Station Configuration Description).

Suitable Substation Configuration Tools (SCT) are available by the following Companies:

H&S, Hard- & Software Technologie GmbH & Co. KG, Dortmund (Germany) (www.hstech.de).
Applied Systems Engineering Inc. (www.ase-systems.com)
Kalki Communication Technologies Limited (www.kalkitech.com)

Import of the .SCD file into the device

When the substation configuration is completed, the .SCD file has to be transmitted to all connected devices. This is has to be done as follows:

1. Connect the device with your PC/Notebook.
2. Start Smart view.
3. Click on »*Receive data from Device*« in the menu »*Device*«.
4. Click on »*IEC61850*« in the menu »*Device Para*«.
5. Switch the parameter »*IEC61850 Communication*« to »*OFF*« and submit the changed parameter set into the device.
6. Click on the IEC icon in the IEC61850 window.
7. Select the folder, where the .SCD file is stored. Select the .SCD file and click "open".
8. Now a password is requested. Enter the same password, which you use for parameter setting of the device (4 digits).
9. Acc. to step 5 switch on again the IEC Communication and submit the changed parameter set into the device.
10. Repeat the steps 1 to 9 for all devices connected to this IEC61850 environment.
11. If no error message occurs, the configuration has been completed successfully.

WARNING

- **When changing the substation configuration, usually a new .SCD file has to be generated. This .SCD file has to be mandatory transmitted to all devices by means of Smart view. For the case, that this step will be forgotten, IEC61850 malfunctions will be the result**

- **Provided that parameters of the devices are changed after the substation configuration completion, changes in the corresponding .ICD file may result – this in turn may make an update of the .SCD file necessary.**

IEC 61850 Virtual Outputs

Additionally to the standardized logical node status information up to 16 free configurable status information can be assigned to 16 Virtual Outputs. This can be done in the menu [Device Para/IEC61850].

Device Planning Parameters of the IEC 61850

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

Direct Commands of the IEC 61850

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ResetStatistic	Reset of all IEC61850 diagnostic counters	inactive, active	inactive	[Operation /Reset]

Global Parameters of the IEC 61850

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Device Para /IEC61850]
VirtualOutput1	Virtual Output. This signal can be assigned or visualized via the SCD file to other devices within the IEC61850 substation.	1..n, Assignment List	-.-	[Device Para /IEC61850]
VirtualOutput2	Virtual Output. This signal can be assigned or visualized via the SCD file to other devices within the IEC61850 substation.	1..n, Assignment List	-.-	[Device Para /IEC61850]
VirtualOutput3	Virtual Output. This signal can be assigned or visualized via the SCD file to other devices within the IEC61850 substation.	1..n, Assignment List	-.-	[Device Para /IEC61850]
VirtualOutput4	Virtual Output. This signal can be assigned or visualized via the SCD file to other devices within the IEC61850 substation.	1..n, Assignment List	-.-	[Device Para /IEC61850]
VirtualOutput5	Virtual Output. This signal can be assigned or visualized via the SCD file to other devices within the IEC61850 substation.	1..n, Assignment List	-.-	[Device Para /IEC61850]
VirtualOutput6	Virtual Output. This signal can be assigned or visualized via the SCD file to other devices within the IEC61850 substation.	1..n, Assignment List	-.-	[Device Para /IEC61850]
VirtualOutput7	Virtual Output. This signal can be assigned or visualized via the SCD file to other devices within the IEC61850 substation.	1..n, Assignment List	-.-	[Device Para /IEC61850]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
VirtualOutput8	Virtual Output. This signal can be assigned or visualized via the SCD file to other devices within the IEC61850 substation.	1..n, Assignment List	-.-	[Device Para /IEC61850]
VirtualOutput9	Virtual Output. This signal can be assigned or visualized via the SCD file to other devices within the IEC61850 substation.	1..n, Assignment List	-.-	[Device Para /IEC61850]
VirtualOutput10	Virtual Output. This signal can be assigned or visualized via the SCD file to other devices within the IEC61850 substation.	1..n, Assignment List	-.-	[Device Para /IEC61850]
VirtualOutput11	Virtual Output. This signal can be assigned or visualized via the SCD file to other devices within the IEC61850 substation.	1..n, Assignment List	-.-	[Device Para /IEC61850]
VirtualOutput12	Virtual Output. This signal can be assigned or visualized via the SCD file to other devices within the IEC61850 substation.	1..n, Assignment List	-.-	[Device Para /IEC61850]
VirtualOutput13	Virtual Output. This signal can be assigned or visualized via the SCD file to other devices within the IEC61850 substation.	1..n, Assignment List	-.-	[Device Para /IEC61850]
VirtualOutput14	Virtual Output. This signal can be assigned or visualized via the SCD file to other devices within the IEC61850 substation.	1..n, Assignment List	-.-	[Device Para /IEC61850]
VirtualOutput15	Virtual Output. This signal can be assigned or visualized via the SCD file to other devices within the IEC61850 substation.	1..n, Assignment List	-.-	[Device Para /IEC61850]
VirtualOutput16	Virtual Output. This signal can be assigned or visualized via the SCD file to other devices within the IEC61850 substation.	1..n, Assignment List	-.-	[Device Para /IEC61850]

States of the Inputs of the IEC 61850

Name	*Description*	*Assignment via*
VirtOut1-I	Module input state: Binary state of the Virtual Output (GGIO)	[Device Para /IEC61850]
VirtOut2-I	Module input state: Binary state of the Virtual Output (GGIO)	[Device Para /IEC61850]
VirtOut3-I	Module input state: Binary state of the Virtual Output (GGIO)	[Device Para /IEC61850]
VirtOut4-I	Module input state: Binary state of the Virtual Output (GGIO)	[Device Para /IEC61850]
VirtOut5-I	Module input state: Binary state of the Virtual Output (GGIO)	[Device Para /IEC61850]
VirtOut6-I	Module input state: Binary state of the Virtual Output (GGIO)	[Device Para /IEC61850]
VirtOut7-I	Module input state: Binary state of the Virtual Output (GGIO)	[Device Para /IEC61850]
VirtOut8-I	Module input state: Binary state of the Virtual Output (GGIO)	[Device Para /IEC61850]
VirtOut9-I	Module input state: Binary state of the Virtual Output (GGIO)	[Device Para /IEC61850]
VirtOut10-I	Module input state: Binary state of the Virtual Output (GGIO)	[Device Para /IEC61850]
VirtOut11-I	Module input state: Binary state of the Virtual Output (GGIO)	[Device Para /IEC61850]
VirtOut12-I	Module input state: Binary state of the Virtual Output (GGIO)	[Device Para /IEC61850]
VirtOut13-I	Module input state: Binary state of the Virtual Output (GGIO)	[Device Para /IEC61850]
VirtOut14-I	Module input state: Binary state of the Virtual Output (GGIO)	[Device Para /IEC61850]
VirtOut15-I	Module input state: Binary state of the Virtual Output (GGIO)	[Device Para /IEC61850]
VirtOut16-I	Module input state: Binary state of the Virtual Output (GGIO)	[Device Para /IEC61850]

IEC 61850 Module Signals (Output States)

Signal	*Description*
VirtInp1	Signal: Virtual Input (IEC61850 GGIO Ind)
VirtInp2	Signal: Virtual Input (IEC61850 GGIO Ind)
VirtInp3	Signal: Virtual Input (IEC61850 GGIO Ind)
VirtInp4	Signal: Virtual Input (IEC61850 GGIO Ind)
VirtInp5	Signal: Virtual Input (IEC61850 GGIO Ind)
VirtInp6	Signal: Virtual Input (IEC61850 GGIO Ind)
VirtInp7	Signal: Virtual Input (IEC61850 GGIO Ind)
VirtInp8	Signal: Virtual Input (IEC61850 GGIO Ind)
VirtInp9	Signal: Virtual Input (IEC61850 GGIO Ind)
VirtInp10	Signal: Virtual Input (IEC61850 GGIO Ind)
VirtInp11	Signal: Virtual Input (IEC61850 GGIO Ind)
VirtInp12	Signal: Virtual Input (IEC61850 GGIO Ind)
VirtInp13	Signal: Virtual Input (IEC61850 GGIO Ind)
VirtInp14	Signal: Virtual Input (IEC61850 GGIO Ind)
VirtInp15	Signal: Virtual Input (IEC61850 GGIO Ind)
VirtInp16	Signal: Virtual Input (IEC61850 GGIO Ind)

IEC 61850 Module Values

Value	*Description*	*Default*	*Size*	*Menu path*
NoOfGooseRxAll	Total number of received GOOSE messages including messages for other devices (subscribed and not subscribed messages).	0	0 - 9999999999	[Operation /Count and RevData /IEC61850]
NoOfGooseRxSubscribed	Total Number of subscribed GOOSE messages including messages with incorrect content.	0	0 - 9999999999	[Operation /Count and RevData /IEC61850]
NoOfGooseRxCorrect	Total Number of subscribed and correctly received GOOSE messages.	0	0 - 9999999999	[Operation /Count and RevData /IEC61850]
NoOfGooseRxNew	Number of subscribed and correctly received GOOSE messages with new content.	0	0 - 9999999999	[Operation /Count and RevData /IEC61850]
NoOfGooseTxAll	Total Number of GOOSE messages that have been published by this device.	0	0 - 9999999999	[Operation /Count and RevData /IEC61850]
NoOfGooseTxNew	Total Number of new GOOSE messages (modified content) that have been published by this device.	0	0 - 9999999999	[Operation /Count and RevData /IEC61850]
NoOfServerRequestsAll	Total number of MMS Server requests including incorrect requests.	0	0 - 9999999999	[Operation /Count and RevData /IEC61850]
NoOfDataReadAll	Total Number of values read from this device including incorrect requests.	0	0 - 9999999999	[Operation /Count and RevData /IEC61850]
NoOfDataReadCorrect	Total Number of correctly read values from this device.	0	0 - 9999999999	[Operation /Count and RevData /IEC61850]
NoOfDataWrittenAll	Total Number of values written by this device including incorrect ones.	0	0 - 9999999999	[Operation /Count and RevData /IEC61850]

Value	Description	Default	Size	Menu path
NoOfDataWrittenCorrect	Total Number of correctly written values by this device.	0	0 - 9999999999	[Operation /Count and RevData /IEC61850]
NoOfDataChangeNotification	Number of detected changes within the datasets that are published with GOOSE messages.	0	0 - 9999999999	[Operation /Count and RevData /IEC61850]

Values of the IEC 61850

Value	Description	Default	Size	Menu path
GoosePublisherState	State of the GOOSE Publisher (on or off)	Off	Off, On, Error	[Operation /Status display /IEC61850]
GooseSubscriberState	State of the GOOSE Subscriber (on or off)	Off	Off, On, Error	[Operation /Status display /IEC61850]
MmsServerState	State of MMS Server (on or off)	Off	Off, On, Error	[Operation /Status display /IEC61850]

Time Synchronisation

TimeZones

The user has the possibility to synchronise the device with a central time generator. This offers the following advantages:

- The time does not drift off from the reference time. A continuously accumulating deviation from the reference time thereby will be balanced. Also refer to the chapter Specifications (Tolerances Real Time Clock).
- All time synchronised devices operate with the same time. Thus logged events of the individual devices can be compared exactly and be evaluated in conjunction (single events of the event recorder, disturbance records).

The device's time can be synchronised via the following protocols:

- IRIG-B
- SNTP
- Communications-Protocol Modbus (RTU or TCP)
- Communications-Protocol IEC60870-5-103

The provided protocols use different hardware interfaces and differ also in their achieved time accuracy. Further information can be found in the chapter Specifications.

Used Protocol	***Hardware-Interface***	***Recommended Application***
Without time synchronisation	---	Not recommended
IRIG-B	IRIG-B Terminal	Recommended, if interface available
SNTP	RJ45 (Ethernet)	Recommended alternative to IRIG-B, especially when using IEC 61850 or Modbus TCP
Modbus RTU	RS485, D-SUB or Fibre Optic	Recommended when using Modbus RTU communication protocol and when no IRIG-B code generator is available
Modbus TCP	RJ45 (Ethernet)	Limited recommendation when Modbus TCP communication protocol is used and no IRIG-B code generator or SNTP-Server is available
IEC 60870-5-103	RS485, D-SUB or Fibre Optic	Recommended when using IEC 10870-5-103 communication protocol and no IRIG-B code generator is available

Accuracy of Time Synchronisation

The accuracy of the device's synchronised system time depends on several factors:

- accuracy of the connected time generator
- used synchronisation protocol
- when using Modbus TCP or SNTP: Network load and data package transmission times

NOTICE **Please consider the accuracy of the used time generator. Fluctuations of the time generator's time will cause the same fluctuations of the protection relay's system time.**

Selection of Timezone and Synchronisation Protocol

The protection relay masters both UTC and local time. This means that the device can be synchronised with UTC time while using local time for user display.

Time Synchronisation with UTC time (recommended):
Time synchronisation is usually done using UTC time. This means for example that an IRIG-B time generator is sending UTC time information to the protection relay. This is the recommended use case, since here a continuous time synchronisation can be ensured. There are no “leaps in time” through change of summer- and wintertime.

To achieve that the device shows the current local time, the timezone and the change between summer- and wintertime can be configured.

Please carry out the following parameterization steps under [Device Para/ Time]:
1.Select your local timezone in the timezone menu.
2.There also configure the switching of daylight saving time.
3.Select the used time synchronisation protocol in the TimeSync menu (e.g. “IRIG-B”).
4.Set the parameters of the synchronisation protocol (refer to the according chapter).

Time Synchronisation with local time:
Should the time synchronisation however be done using local time, then please leave the timezone to »*UTC+0 London*« and do not use switching of daylight saving time.

NOTICE **The synchronisation of the relay´s system time is exclusively done by the synchronisation protocol selected in the menu [Device Para/ Time/ TimeSync/ Used Protocol].**

Without Time Synchronisation:
To achieve that the device shows the current local time, the timezone and the change between summer- and wintertime can be configured.

Please carry out the following parameterization steps under [Device Para/ Time]:
5.Select your local timezone in the timezone menu.
6.There also configure the switching of daylight saving time.
7.Select »*manual*« as your used protocol in the TimeSync menu.
8.Set date and time.

Global Protection Parameters of the Time Synchronization

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
DST offset	Difference to wintertime	-180 - 180min	60min	[Device Para /Time /Timezone]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
DST manual	Manual setting of the Daylight Saving Time	inactive, active	active	[Device Para /Time /Timezone]
Summertime	Daylight Saving Time Only available if: DST manual = active	inactive, active	inactive	[Device Para /Time /Timezone]
Summertime m	Month of clock change summertime Only available if: DST manual = active	January, February, March, April, May, June, July, August, September, October, November, December	March	[Device Para /Time /Timezone]
Summertime d	Day of clock change summertime Only available if: DST manual = active	Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, General day	Saturday	[Device Para /Time /Timezone]
Summertime w	Place of selected day in month (for clock change summertime) Only available if: DST manual = active	First, Second, Third, Fourth, Last	Last	[Device Para /Time /Timezone]
Summertime h	Hour of clock change summertime Only available if: DST manual = active	0 - 23h	2h	[Device Para /Time /Timezone]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Summertime min	Minute of clock change summertime Only available if: DST manual = active	0 - 59min	0min	[Device Para /Time /Timezone]
Wintertime m	Month of clock change wintertime Only available if: DST manual = active	January, February, March, April, May, June, July, August, September, October, November, December	October	[Device Para /Time /Timezone]
Wintertime d	Day of clock change wintertime Only available if: DST manual = active	Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, General day	Saturday	[Device Para /Time /Timezone]
Wintertime w	Place of selected day in month (for clock change wintertime) Only available if: DST manual = active	First, Second, Third, Fourth, Last	Last	[Device Para /Time /Timezone]
Wintertime h	Hour of clock change wintertime Only available if: DST manual = active	0 - 23h	3h	[Device Para /Time /Timezone]
Wintertime min	Minute of clock change wintertime Only available if: DST manual = active	0 - 59min	0min	[Device Para /Time /Timezone]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Time Zones	Time Zones	UTC+14 Kiritimati, UTC+13 Rawaki, UTC+12.75 Chat-ham Island, UTC+12 Welling-ton, UTC+11.5 Kings-ton, UTC+11 Port Vila, UTC+10.5 Lord Howe Island, UTC+10 Sydney, UTC+9.5 Adelaide, UTC+9 Tokyo, UTC+8 Hong Kong, UTC+7 Bangkok, UTC+6.5 Rangoon, UTC+6 Colombo, UTC+5.75 Kath-mandu, UTC+5.5 New Del-hi, UTC+5 Islamabad, UTC+4.5 Kabul, UTC+4 Abu Dhabi, UTC+3.5 Tehran, UTC+3 Moscow, UTC+2 Athens, UTC+1 Berlin, UTC+0 London, UTC-1 Azores, UTC-2 Fern. d. No-ronha, UTC-3 Buenos Ai-res, UTC-3.5 St. John’s, UTC-4 Santiago, UTC-5 New York, UTC-6 Chicago, UTC-7 Salt Lake City, UTC-8 Los Ange-les,	UTC+0 London	[Device Para /Time /Timezone]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
TimeSync	Time synchronisation	-, IRIG-B, SNTP, Modbus, IEC60870-5-103	-	[Device Para /Time /TimeSync /TimeSync]

SNTP

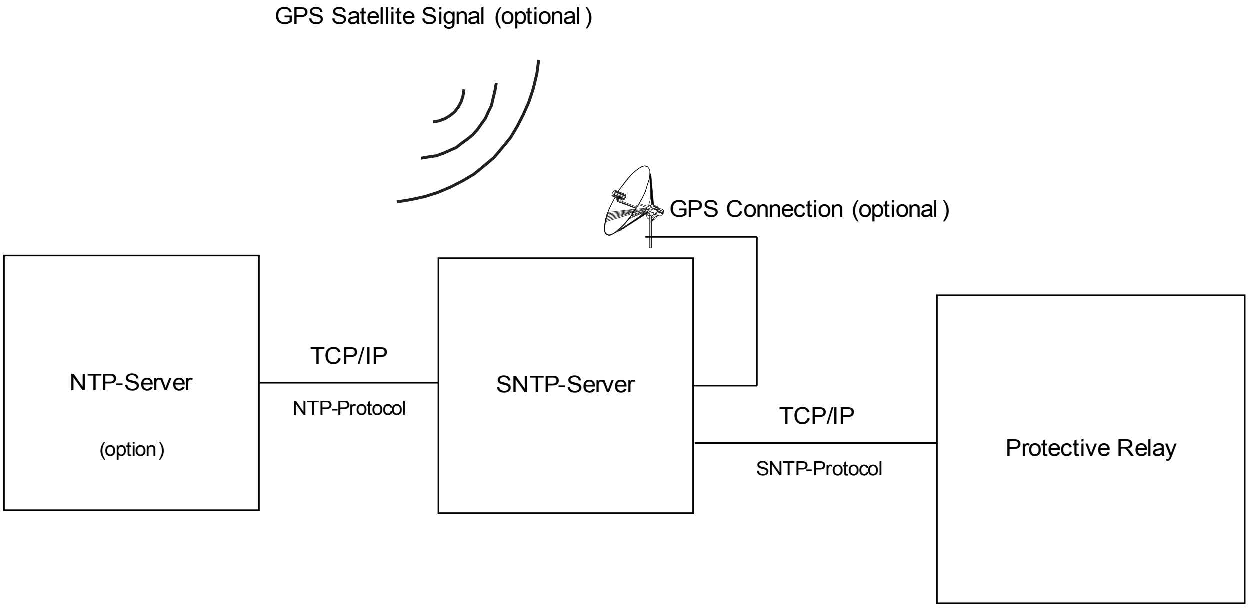
SNTP

NOTICE **Important pre-condition: The protective relay needs to have access to a SNTP server via the connected network. This server preferably should be installed locally.**

Principle – General Use

SNTP is a standard protocol for time synchronisation via a network. For this at least one SNTP server has to be available within the network. The device can be configured for one or two SNTP servers.

The protection relay's system time will be synchronised with the connected SNTP server 1-4 times per minute. In turn the SNTP server synchronises its time via NTP with other NTP servers. This is the normal case. Alternatively it can synchronise its time via GPS, radio controlled clock or the like.



Accuracy

The accuracy of the used SNTP server and the excellence of its reference clock influences the accuracy of the protection relay's clock.
For further information about accuracy refer to chapter Specifications.

With each transmitted time information, the SNTP server also sends information about its accuracy:

- Stratum: The stratum indicates over how many interacting NTP-Servers the used SNTP server is connected to an atomic or radio controlled clock.
- Precision: This indicates the accuracy of the system time provided by the SNTP server.

Additionally the performance of the connected network (traffic and data package transmission times) has an influence on the accuracy of the time synchronisation.

Recommended is a locally installed SNTP server with an accuracy of ≤200 μsec. If this cannot be realised, the connected server's excellence can be checked in the menu [Operation/Status Display/TimeSync]:

- The server quality gives information about the accuracy of the used server. The quality should be GOOD or SUFFICIENT. A server with BAD quality should not be used, because this could cause fluctuations in time synchronisation.
- The network quality gives information about the network's load and data package transmission time. The quality should be GOOD or SUFFICIENT. A network with BAD quality should not be used, because this could cause fluctuations in time synchronisation.

Using two SNTP Servers

When configuring two SNTP servers, the device selects the server with the lower stratum value, because this generally provides a more precise time synchronisation. If the servers have the same stratum value, the device selects the server with the better precision. It does not matter, which of the servers is configured as server 1 or server 2.

When the last used server fails, the device automatically switches to the other server. Should the first server recover after some time, the device switches back to this (better) server automatically.

SNTP Commissioning

Activate the SNTP time synchronisation by means of the menu [Device Para/ Time/ TimeSync]:

- Select »*SNTP*« in the time synchronisation menu.
- Set the IP address of the first server in the SNTP menu.
- Set the IP address of the second server, if available.
- Set all configured servers to “active”.

Fault Analysis

If there is no SNTP signal for more than 120 sec, the SNTP status changes from “active” to “inactive” and an entry in the Event Recorder will be created.

The SNTP functionality can be checked in the menu [Operation/Status Display/TimeSync/Sntp]:
If the SNTP status is not indicated as being “active”, please proceed as follows:

- Check if the wiring is correct (Ethernet-cable connected).
- Check if a valid IP address is set in the device (Device Para/TCP/IP).
- Check if the Ethernet connection is active (Device Para/TCP/IP/Link = Up?).
- Check if both the SNTP server and the protection device answer to a Ping.
- Check if the SNTP server is up and working.

Device Planning Parameters of the SNTP

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

Direct Commands of the SNTP

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Res Counter	Reset all Counters.	inactive, active	inactive	[Operation /Reset]

Global Protection Parameters of the SNTP

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Server1	Server 1	inactive, active	inactive	[Device Para /Time /TimeSync /SNTP]
IP Byte1	IP1.IP2.IP3.IP4	0 - 255	0	[Device Para /Time /TimeSync /SNTP]
IP Byte2	IP1.IP2.IP3.IP4	0 - 255	0	[Device Para /Time /TimeSync /SNTP]
IP Byte3	IP1.IP2.IP3.IP4	0 - 255	0	[Device Para /Time /TimeSync /SNTP]
IP Byte4	IP1.IP2.IP3.IP4	0 - 255	0	[Device Para /Time /TimeSync /SNTP]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Server2	Server 2	inactive, active	inactive	[Device Para /Time /TimeSync /SNTP]
IP Byte1	IP1.IP2.IP3.IP4	0 - 255	0	[Device Para /Time /TimeSync /SNTP]
IP Byte2	IP1.IP2.IP3.IP4	0 - 255	0	[Device Para /Time /TimeSync /SNTP]
IP Byte3	IP1.IP2.IP3.IP4	0 - 255	0	[Device Para /Time /TimeSync /SNTP]
IP Byte4	IP1.IP2.IP3.IP4	0 - 255	0	[Device Para /Time /TimeSync /SNTP]

Signals of the SNTP

Signal	*Description*
SNTP active	Signal: If there is no valid SNTP signal for 120 sec, SNTP is regarded as inactive.

SNTP Counters

Value	*Description*	*Default*	*Size*	*Menu path*
NoOfSyncs	Total Number of Synchronizations.	0	0 - 9999999999	[Operation /Count and RevData /TimeSync /SNTP]
NoOfConnectLost	Total Number of lost SNTP Connections (no sync for 120 sec).	0	0 - 9999999999	[Operation /Count and RevData /TimeSync /SNTP]
NoOfSmallSyncs	Service counter: Total Number of very small Time Corrections.	0	0 - 9999999999	[Operation /Count and RevData /TimeSync /SNTP]
NoOfNormSyncs	Service counter: Total Number of normal Time Corrections	0	0 - 9999999999	[Operation /Count and RevData /TimeSync /SNTP]
NoOfBigSyncs	Service counter: Total Number of big Time Corrections	0	0 - 9999999999	[Operation /Count and RevData /TimeSync /SNTP]
NoOfFiltSyncs	Service counter: Total Number of filtered Time Corrections	0	0 - 9999999999	[Operation /Count and RevData /TimeSync /SNTP]
NoOfSlowTrans	Service counter: Total Number of slow Transfers.	0	0 - 9999999999	[Operation /Count and RevData /TimeSync /SNTP]
NoOfHighOffs	Service counter: Total Number of high Offsets.	0	0 - 9999999999	[Operation /Count and RevData /TimeSync /SNTP]

Value	Description	Default	Size	Menu path
NoOfIntTimeouts	Service counter: Total Number of internal timeouts.	0	0 - 9999999999	[Operation /Count and RevData /TimeSync /SNTP]
StratumServer1	Stratum of Server 1	0	0 - 9999999999	[Operation /Status display /TimeSync /SNTP]
StratumServer2	Stratum of Server 2	0	0 - 9999999999	[Operation /Status display /TimeSync /SNTP]

SNTP Values

Value	Description	Default	Size	Menu path
Used Server	Which Server is used for SNTP synchronization.	None	Server1, Server2, None	[Operation /Status display /TimeSync /SNTP]
PrecServer1	Precision of Server 1	0ms	0 - 1000.00000ms	[Operation /Status display /TimeSync /SNTP]
PrecServer2	Precision of Server 2	0ms	0 - 1000.00000ms	[Operation /Status display /TimeSync /SNTP]
ServerQlty	Quality of Server used for Synchronization (GOOD, SUFFICIENT, BAD)	-	GOOD, SUFFICENT, BAD, -	[Operation /Status display /TimeSync /SNTP]
NetConn	Quality of Network Connection (GOOD, SUFFICIENT, BAD).	-	GOOD, SUFFICENT, BAD, -	[Operation /Status display /TimeSync /SNTP]

IRIG-B00X

IRIG-B

NOTICE **Requirement: An IRIG-B00X time code generator is needed. IRIG-B004 and higher will support/transmit the "year information".**

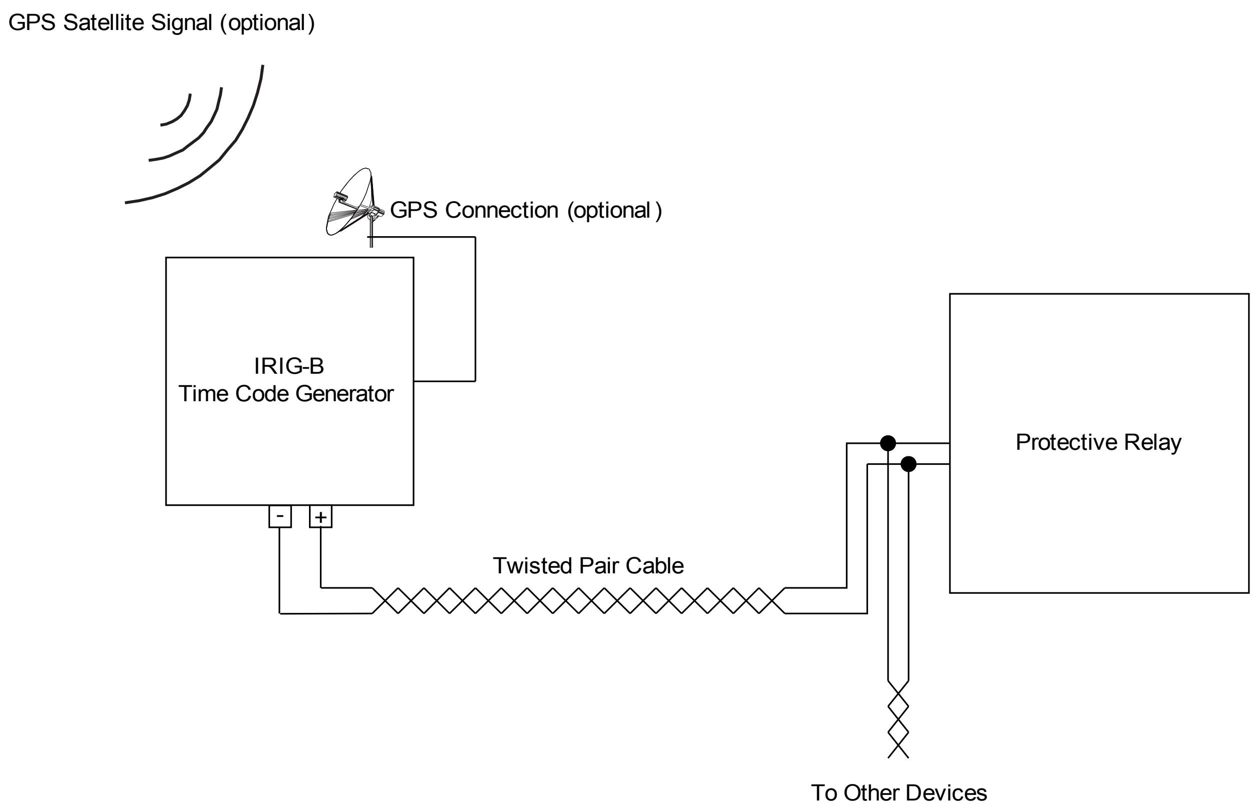
If you are using an IRIG time code that does not support the "year information" (IRIG-B000, IRIG-B001, IRIG-B002, IRIG-B003), you have to set the "year" manually within the device. In these cases the correct year information is a precondition for a properly working IRIG-B.

Principle - General Use

The IRIG-B standard is the most used standard to synchronize the time of protection devices in medium voltage applications.

The protection device supports IRIG-B according to the IRIG STANDARD 200-04.
This means that all time synchronization formats IRIG-B00X (IRIG-B000 / B001 / B002 / B003 / B004 / B005 / B006 / B007) are supported. It is recommended to use IRIG-B004 and higher which also transmits the "year information".

The system time of the protection device is being synchronized with the connected IRIG-B code generator once a second. The accuracy of the used IRIG-B code generator can be increased by connecting a GPS-receiver to it.



The location of the IRIG-B interface depends to the device type. Please refer to the wiring diagram supplied with the protective device.

IRIG-B Commissioning

Activate the IRIG-B synchronization within menu [Device Para/ Time/ TimeSync]:

- Select »*IRIG-B*« in the time synchronisation menu.
- Set the time synchronization in the IRIG-B menu to »*Active*«.
- Select the IRIG-B type (choose B000 through B007).

Fault Analysis

If the device does not receive any IRIG-B time code for more than 60 s, the IRIG-B status switches from »*active*« to »*inactive*« and there is created an entry within the Event Recorder.

Check the IRIG-B functionality through the menu [Operation/ Status display/ TimeSync/ IRIG-B]:
Should the IRIG-B status not be reported as being »*active*«, please proceed as follows:

- To begin with check the IRIG-B wiring.
- Check, if the correct IRIG-B00X type is configured.

IRIG-B Control Commands

In addition to the date and time information, the IRIG-B code offers the option to transmit up to 18 control commands that can be processed by the protective device. They have to be set and issued by the IRIG-B code generator.

The protective device offers up to 18 IRIG-B assignment options for those control commands in order to carry out the assigned action. If there is a control command assigned to an action, this action is being triggered as soon as the control command is transmitted as being true. As an example there can be triggered the start of statistics or the street lighting can be switched on through a relay.

Device Planning Parameters of the IRIG-B00X

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

Direct Commands of the IRIG-B00X

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Res IRIG-B Cr	Resetting of the Diagnosis Counters: IRIG-B	inactive, active	inactive	[Operation /Reset]

Global Protection Parameters of the IRIG-B00X

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Device Para /Time /TimeSync /IRIG-B]
IRIG-B00X	Determination of the Type: IRIG-B00X. IRIG-B types differ in types of included “Coded Expressions” (year, control-functions, straight-binary-seconds).	IRIGB-000, IRIGB-001, IRIGB-002, IRIGB-003, IRIGB-004, IRIGB-005, IRIGB-006, IRIGB-007	IRIGB-000	[Device Para /Time /TimeSync /IRIG-B]

Signals of the IRIG-B00X (Output States)

Signal	*Description*
active	Signal: active
inverted	Signal: IRIG-B inverted
Control Signal1	Signal: IRIG-B Control Signal
Control Signal2	Signal: IRIG-B Control Signal
Control Signal4	Signal: IRIG-B Control Signal
Control Signal5	Signal: IRIG-B Control Signal
Control Signal6	Signal: IRIG-B Control Signal
Control Signal7	Signal: IRIG-B Control Signal
Control Signal8	Signal: IRIG-B Control Signal
Control Signal9	Signal: IRIG-B Control Signal
Control Signal10	Signal: IRIG-B Control Signal
Control Signal11	Signal: IRIG-B Control Signal
Control Signal12	Signal: IRIG-B Control Signal
Control Signal13	Signal: IRIG-B Control Signal
Control Signal14	Signal: IRIG-B Control Signal
Control Signal15	Signal: IRIG-B Control Signal
Control Signal16	Signal: IRIG-B Control Signal
Control Signal17	Signal: IRIG-B Control Signal
Control Signal18	Signal: IRIG-B Control Signal

IRIG-B00X Values

Value	*Description*	*Default*	*Size*	*Menu path*
NoOfFramesOK	Total Number valid Frames.	0	0 - 65535	[Operation /Count and RevData /TimeSync /IRIG-B]
NoOfFrameErrors	Total Number of Frame Errors. Physically corrupted Frame.	0	0 - 65535	[Operation /Count and RevData /TimeSync /IRIG-B]
Edges	Edges	0	0 - 65535	[Operation /Count and RevData /TimeSync /IRIG-B]

Parameters

Parameter setting and planning can be done:

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

Parameter Definitions

Device Parameters

Device Parameters are part of the Parameter Tree. By means of them you can (depending on the type of device):

- Set cutoff levels,
- Configure Digital Inputs,
- Configure Output Relays,
- Assign LEDs,
- Assign Acknowledgment Signals,
- Configure Statistics,
- Configure Protocol Parameters,
- Adapt HMI Settings,
- Configure Recorders (reports),
- Set Date and Time,
- Change Passwords,
- Check the version (build) of the device.

Field Parameters

Field Parameters are part of the Parameter Tree. Field Parameters comprise the essential, basic settings of your switchboard such as rated frequency, transformer ratios.

Protection Parameters

Protection Parameters are part of the Parameter Tree. This tree comprises:

- ***Global Protection Parameters are part of the Protection Parameters:*** All settings and assignments that are done within the Global Parameter Tree are valid independent of the Setting Groups. They have to be set once only. In addition to that they comprise the CB Management.

- ***The Parameter Setting Switch is part of the Protection Parameters:*** You can either direct switch onto a certain parameter setting group or you can determine the conditions for switching onto another parameter setting group.

- ***Setting Group Parameters are part of the Protection Parameters:*** By means of the Parameter Setting Group Parameters you can individually adapt your protective device to the current conditions or grid conditions. They can be individually set in each Setting group.

Device Planning Parameters

Device Planning Parameters are part of the Parameter Tree.

- ***Improving the Usability (clearness):*** All protection modules that are currently not needed can be
- de-protected (switched to invisible) by means of Device Planning. In Menu Device Planning you can adapt the scope of functionality of the protective device exactly to your needs. You can improve the usability by de-projecting all modules that are currently not needed.

- ***Adapting the device to your application:*** For those modules that you need, determine how they should work (e.g. directional, non-directional, <, >...).

Direct Commands

Direct Commands are part of the Device Parameter Tree but they are ***NOT*** part of the parameter file. They will be executed directly (e.g. Resetting of a Counter).

State of the Module Inputs

Module Inputs are part of the Parameter Tree. The State of the Module Input is context-dependent.

By means of the Module Inputs influence can be taken on the Modules. You can assign Signals onto ***Module Inputs***. The state of the signals that are assigned to an input can be taken from the Status Display. Module Inputs can be identified by an ***„-I“*** at the end of the name.

Signals

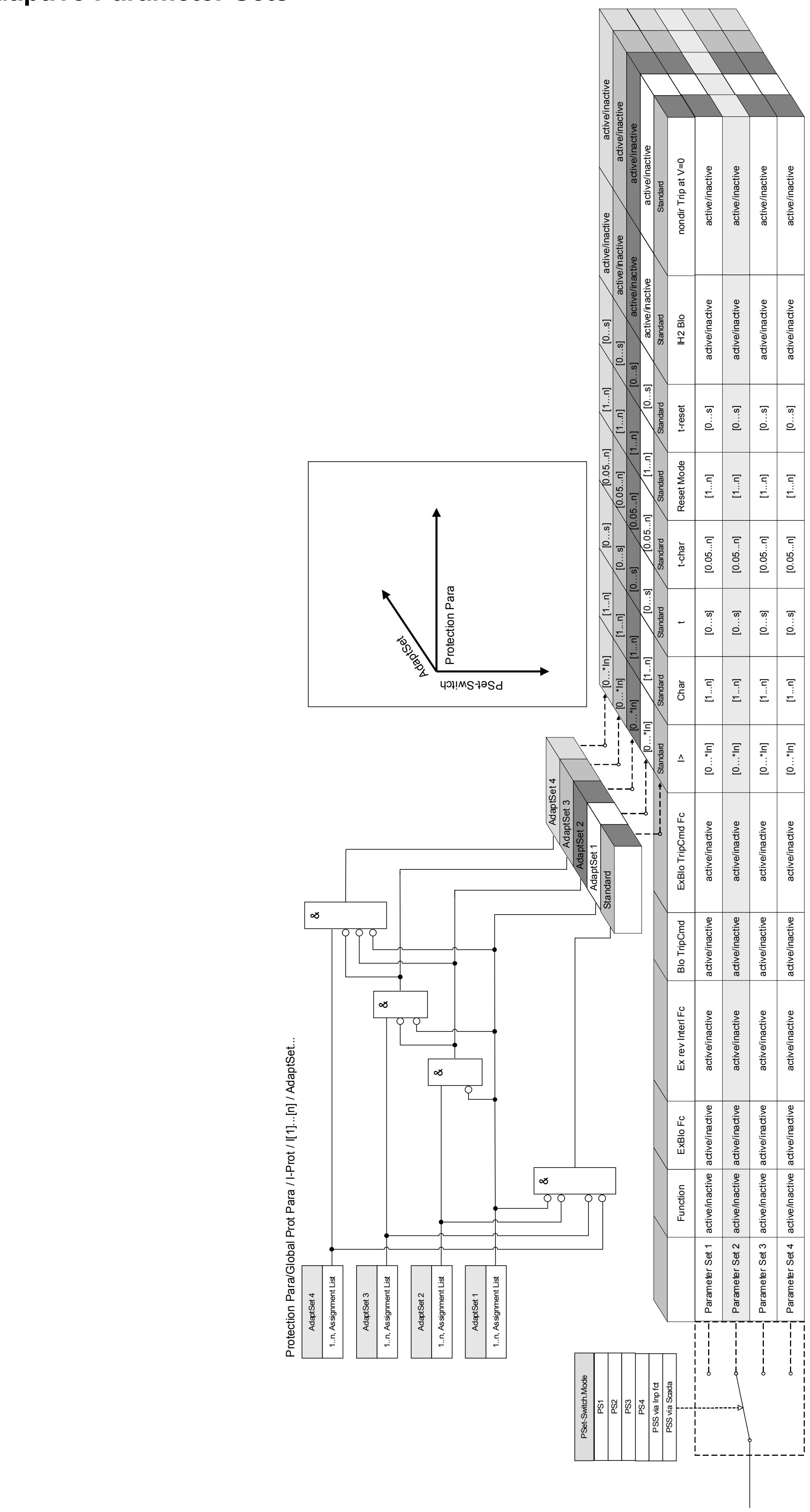
Signals are part of the Parameter Tree. The state of the signal is context-dependent.

- ***Signals*** represent the state of your installation/equipment (e.g. Position Indicators of the Circuit Breaker).

- ***Signals*** are assessments of the state of the grid and the equipment (System OK, Transformer failure detected...).

- ***Signals*** represent decisions that are taken by the device (e.g. Trip command) based on your parameter settings.

Adaptive Parameter Sets



Adaptive Parameter Sets are part of the Parameter Tree.
By means of ***Adaptive Parameter Sets*** you can modify temporarily single parameters within the parameter setting groups.

NOTICE

Adaptive Parameters fall back automatically, if the acknowledged signal, that has activated them, has fallen back. Please take into account that Adaptive Set 1 is dominant to Adaptive Set 2. Adaptive Set 2 is dominant to Adaptive Set 3. Adaptive Set 3 is dominant to Adaptive Set 4.

NOTICE

In order to increase the usability (clearness) Adaptive Parameter Sets become visible if an corresponding activation signals has been assigned (Smart view 2.0 and higher).

Example: In order to use Adaptive Parameters within Protective Element I[1] please proceed as follows:

- Assign within the Global Parameter tree within Protective Element I[1] an activation signal for AdaptiveParameterSet 1.
- AdaptiveParameterSet 1 becomes now visible within the Protection Parameter Sets for element I[1].

By means of additional activation signals further Adaptive Parameter Sets can be used.

The functionality of the IED (relay) can be enhanced / adapted by means of ***Adaptive Parameters*** in order to meet the requirements of modified states of the grid or the power supply system respectively to manage unpredictable events.

Moreover, the adaptive parameter can also be used to realize various special protective functions or to expand the existing function modules in a simple way without to redesign the existing hardware or software platform costly.

The ***Adaptive Parameter*** feature allows, besides a standard parameter set, one of the four parameter sets labeled from 1 to 4, to be used for example in a time overcurrent element under the control of the configurable Set Control Logics. The dynamical switch-over of the adaptive parameter set is only active for a particular element when its adaptive set control logic is configured and only as long as the activation signal is true.

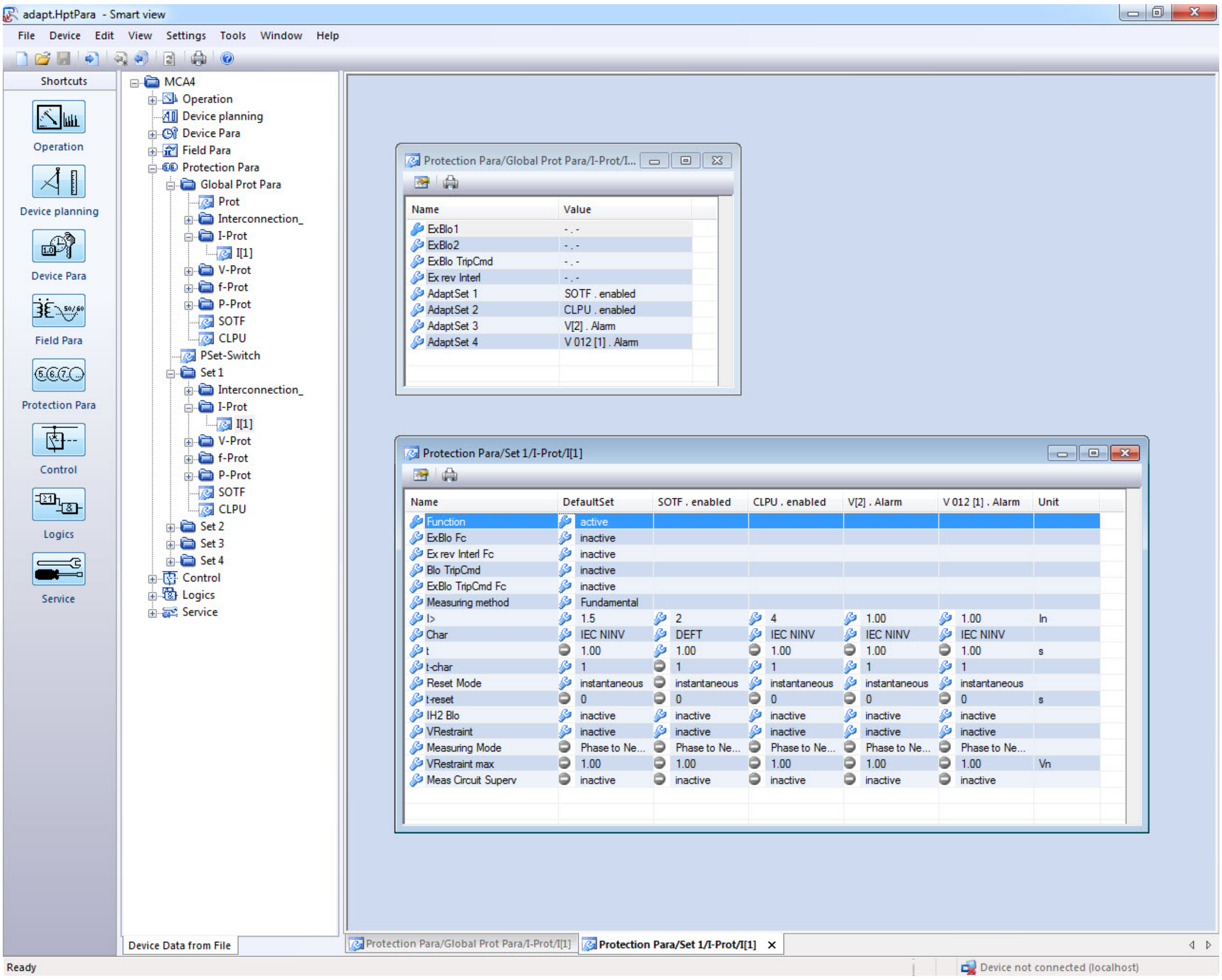
For some protection elements such as time overcurrent and instantaneous overcurrent (50P, 51P, 50G, 51G…), besides the “default” setting there exist another 4 “alternative” settings for pickup value, curve type, time dial, reset mode set values which can be switched-over dynamically by means of the configurable adaptive setting control logics in the single set parameter.

If the ***Adaptive Parameter*** feature is not used, the adaptive set control logics will not be selected (assigned). The protective elements work in this case just like a normal protection using the “Default” settings. If one of the ***Adaptive Set*** Control logics” is assigned to a logic function, the protective element will be “switched-over” to the corresponding adaptive settings if the assigned logic function is asserted and will fall back to the “Default” Setting if the assigned signal that has been activated the ***Adaptive Set*** has fallen back.

Application Example

During a Switch-OnTo-Fault condition, it is usually requested to make the embedded protective function tripping the faulted line faster, instantaneously or sometimes non-directionally.

Such a Switch-OnTo-Fault application can easily be realized using the ***Adaptive Parameter*** features above mentioned: The standard time overcurrent protection element (e.g. 51P) normally works with an inverse curve type (e.g. ANSI Type A), while in case of *SOTF* condition, it should trip instantaneously. If the *SOTF* logic function »SOTF ENABLED« is detecting a manual circuit breaker close condition the relay switches to ***AdaptiveSet1*** if the signal »SOTF.ENABLED« is assigned to ***AdaptiveSet1***. The corresponding ***AdaptiveSet1*** will become active and that means e.g. »*curve type = DEFT*« and »*t = 0*« sec.



The screenshot above shows the adaptive setting configurations following applications based on only one simple overcurrent protection element:

1. Standard Set: Default settings
2. Adaptive Set 1: *SOTF* application (Switch-Onto-Fault)
3. Adaptive Set 2: *CLPU* application (Cold Load Pickup)
4. Adaptive Set 3: Voltage-Controlled time overcurrent protection (ANSI 51V)
5. Adaptive Set 4: Negative- Phase- Sequence- Voltage-Controlled time overcurrent protection

Application Examples

- The output signal of the *Switch Onto Fault* module can be used to activate an ***Adaptive Parameter Set*** that sensibilizes the overcurrent protection.
- The output signal of the *Cold Load Pickup* module can be used to activate an ***Adaptive Parameter Set*** that desensitizes the overcurrent protection.
- By means of ***Adaptive Parameter Sets*** an Adaptive *Auto Reclosure* can be realized. After a reclosure attempt the tripping thresholds or tripping curves of the overcurrent protection can be adapted.
- Depending on undervoltage the overcurrent protection can be modified (Voltage Controlled).
- The earth overcurrent protection can be modified by the residual voltage.
- Matching the ground current protective settings dynamically and automatically according to the single-phase load diversity (Adaptive relay Setting – Normal Setting/Alternative Setting)

NOTICE **Adaptive Parameter Sets are only available for devices with current protection modules.**

Adaptive Parameter Set Activation Signals

Name	*Description*
-.-	No assignment
V[1].Alarm	Signal: Alarm voltage stage
V[2].Alarm	Signal: Alarm voltage stage
V[3].Alarm	Signal: Alarm voltage stage
V[4].Alarm	Signal: Alarm voltage stage
V[5].Alarm	Signal: Alarm voltage stage
V[6].Alarm	Signal: Alarm voltage stage
Intertripping.Alarm	Signal: Alarm
LVRT.Alarm	Signal: Alarm voltage stage
LVRT.t-LVRT is running	Signal: t-LVRT is running
VG[1].Alarm	Signal: Alarm Residual Voltage Supervision-stage
VG[2].Alarm	Signal: Alarm Residual Voltage Supervision-stage
V012[1].Alarm	Signal: Alarm voltage asymmetry
V012[2].Alarm	Signal: Alarm voltage asymmetry
V012[3].Alarm	Signal: Alarm voltage asymmetry
V012[4].Alarm	Signal: Alarm voltage asymmetry
V012[5].Alarm	Signal: Alarm voltage asymmetry
V012[6].Alarm	Signal: Alarm voltage asymmetry
ExP[1].Alarm	Signal: Alarm
ExP[2].Alarm	Signal: Alarm
ExP[3].Alarm	Signal: Alarm
ExP[4].Alarm	Signal: Alarm
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
Logics.LE1.Gate Out	Signal: Output of the logic gate
Logics.LE1.Timer Out	Signal: Timer Output
Logics.LE1.Out	Signal: Latched Output (Q)
Logics.LE1.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE2.Gate Out	Signal: Output of the logic gate
Logics.LE2.Timer Out	Signal: Timer Output
Logics.LE2.Out	Signal: Latched Output (Q)
Logics.LE2.Out inverted	Signal: Negated Latched Output (Q NOT)

Name	*Description*
Logics.LE3.Gate Out	Signal: Output of the logic gate
Logics.LE3.Timer Out	Signal: Timer Output
Logics.LE3.Out	Signal: Latched Output (Q)
Logics.LE3.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE4.Gate Out	Signal: Output of the logic gate
Logics.LE4.Timer Out	Signal: Timer Output
Logics.LE4.Out	Signal: Latched Output (Q)
Logics.LE4.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE5.Gate Out	Signal: Output of the logic gate
Logics.LE5.Timer Out	Signal: Timer Output
Logics.LE5.Out	Signal: Latched Output (Q)
Logics.LE5.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE6.Gate Out	Signal: Output of the logic gate
Logics.LE6.Timer Out	Signal: Timer Output
Logics.LE6.Out	Signal: Latched Output (Q)
Logics.LE6.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE7.Gate Out	Signal: Output of the logic gate
Logics.LE7.Timer Out	Signal: Timer Output
Logics.LE7.Out	Signal: Latched Output (Q)
Logics.LE7.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE8.Gate Out	Signal: Output of the logic gate
Logics.LE8.Timer Out	Signal: Timer Output
Logics.LE8.Out	Signal: Latched Output (Q)
Logics.LE8.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE9.Gate Out	Signal: Output of the logic gate
Logics.LE9.Timer Out	Signal: Timer Output
Logics.LE9.Out	Signal: Latched Output (Q)
Logics.LE9.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE10.Gate Out	Signal: Output of the logic gate
Logics.LE10.Timer Out	Signal: Timer Output
Logics.LE10.Out	Signal: Latched Output (Q)
Logics.LE10.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE11.Gate Out	Signal: Output of the logic gate
Logics.LE11.Timer Out	Signal: Timer Output
Logics.LE11.Out	Signal: Latched Output (Q)
Logics.LE11.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE12.Gate Out	Signal: Output of the logic gate
Logics.LE12.Timer Out	Signal: Timer Output
Logics.LE12.Out	Signal: Latched Output (Q)
Logics.LE12.Out inverted	Signal: Negated Latched Output (Q NOT)

Name	*Description*
Logics.LE13.Gate Out	Signal: Output of the logic gate
Logics.LE13.Timer Out	Signal: Timer Output
Logics.LE13.Out	Signal: Latched Output (Q)
Logics.LE13.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE14.Gate Out	Signal: Output of the logic gate
Logics.LE14.Timer Out	Signal: Timer Output
Logics.LE14.Out	Signal: Latched Output (Q)
Logics.LE14.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE15.Gate Out	Signal: Output of the logic gate
Logics.LE15.Timer Out	Signal: Timer Output
Logics.LE15.Out	Signal: Latched Output (Q)
Logics.LE15.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE16.Gate Out	Signal: Output of the logic gate
Logics.LE16.Timer Out	Signal: Timer Output
Logics.LE16.Out	Signal: Latched Output (Q)
Logics.LE16.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE17.Gate Out	Signal: Output of the logic gate
Logics.LE17.Timer Out	Signal: Timer Output
Logics.LE17.Out	Signal: Latched Output (Q)
Logics.LE17.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE18.Gate Out	Signal: Output of the logic gate
Logics.LE18.Timer Out	Signal: Timer Output
Logics.LE18.Out	Signal: Latched Output (Q)
Logics.LE18.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE19.Gate Out	Signal: Output of the logic gate
Logics.LE19.Timer Out	Signal: Timer Output
Logics.LE19.Out	Signal: Latched Output (Q)
Logics.LE19.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE20.Gate Out	Signal: Output of the logic gate
Logics.LE20.Timer Out	Signal: Timer Output
Logics.LE20.Out	Signal: Latched Output (Q)
Logics.LE20.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE21.Gate Out	Signal: Output of the logic gate
Logics.LE21.Timer Out	Signal: Timer Output
Logics.LE21.Out	Signal: Latched Output (Q)
Logics.LE21.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE22.Gate Out	Signal: Output of the logic gate
Logics.LE22.Timer Out	Signal: Timer Output
Logics.LE22.Out	Signal: Latched Output (Q)
Logics.LE22.Out inverted	Signal: Negated Latched Output (Q NOT)

Name	*Description*
Logics.LE23.Gate Out	Signal: Output of the logic gate
Logics.LE23.Timer Out	Signal: Timer Output
Logics.LE23.Out	Signal: Latched Output (Q)
Logics.LE23.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE24.Gate Out	Signal: Output of the logic gate
Logics.LE24.Timer Out	Signal: Timer Output
Logics.LE24.Out	Signal: Latched Output (Q)
Logics.LE24.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE25.Gate Out	Signal: Output of the logic gate
Logics.LE25.Timer Out	Signal: Timer Output
Logics.LE25.Out	Signal: Latched Output (Q)
Logics.LE25.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE26.Gate Out	Signal: Output of the logic gate
Logics.LE26.Timer Out	Signal: Timer Output
Logics.LE26.Out	Signal: Latched Output (Q)
Logics.LE26.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE27.Gate Out	Signal: Output of the logic gate
Logics.LE27.Timer Out	Signal: Timer Output
Logics.LE27.Out	Signal: Latched Output (Q)
Logics.LE27.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE28.Gate Out	Signal: Output of the logic gate
Logics.LE28.Timer Out	Signal: Timer Output
Logics.LE28.Out	Signal: Latched Output (Q)
Logics.LE28.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE29.Gate Out	Signal: Output of the logic gate
Logics.LE29.Timer Out	Signal: Timer Output
Logics.LE29.Out	Signal: Latched Output (Q)
Logics.LE29.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE30.Gate Out	Signal: Output of the logic gate
Logics.LE30.Timer Out	Signal: Timer Output
Logics.LE30.Out	Signal: Latched Output (Q)
Logics.LE30.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE31.Gate Out	Signal: Output of the logic gate
Logics.LE31.Timer Out	Signal: Timer Output
Logics.LE31.Out	Signal: Latched Output (Q)
Logics.LE31.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE32.Gate Out	Signal: Output of the logic gate
Logics.LE32.Timer Out	Signal: Timer Output
Logics.LE32.Out	Signal: Latched Output (Q)
Logics.LE32.Out inverted	Signal: Negated Latched Output (Q NOT)

Name	*Description*
Logics.LE33.Gate Out	Signal: Output of the logic gate
Logics.LE33.Timer Out	Signal: Timer Output
Logics.LE33.Out	Signal: Latched Output (Q)
Logics.LE33.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE34.Gate Out	Signal: Output of the logic gate
Logics.LE34.Timer Out	Signal: Timer Output
Logics.LE34.Out	Signal: Latched Output (Q)
Logics.LE34.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE35.Gate Out	Signal: Output of the logic gate
Logics.LE35.Timer Out	Signal: Timer Output
Logics.LE35.Out	Signal: Latched Output (Q)
Logics.LE35.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE36.Gate Out	Signal: Output of the logic gate
Logics.LE36.Timer Out	Signal: Timer Output
Logics.LE36.Out	Signal: Latched Output (Q)
Logics.LE36.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE37.Gate Out	Signal: Output of the logic gate
Logics.LE37.Timer Out	Signal: Timer Output
Logics.LE37.Out	Signal: Latched Output (Q)
Logics.LE37.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE38.Gate Out	Signal: Output of the logic gate
Logics.LE38.Timer Out	Signal: Timer Output
Logics.LE38.Out	Signal: Latched Output (Q)
Logics.LE38.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE39.Gate Out	Signal: Output of the logic gate
Logics.LE39.Timer Out	Signal: Timer Output
Logics.LE39.Out	Signal: Latched Output (Q)
Logics.LE39.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE40.Gate Out	Signal: Output of the logic gate
Logics.LE40.Timer Out	Signal: Timer Output
Logics.LE40.Out	Signal: Latched Output (Q)
Logics.LE40.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE41.Gate Out	Signal: Output of the logic gate
Logics.LE41.Timer Out	Signal: Timer Output
Logics.LE41.Out	Signal: Latched Output (Q)
Logics.LE41.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE42.Gate Out	Signal: Output of the logic gate
Logics.LE42.Timer Out	Signal: Timer Output
Logics.LE42.Out	Signal: Latched Output (Q)
Logics.LE42.Out inverted	Signal: Negated Latched Output (Q NOT)

Name	*Description*
Logics.LE43.Gate Out	Signal: Output of the logic gate
Logics.LE43.Timer Out	Signal: Timer Output
Logics.LE43.Out	Signal: Latched Output (Q)
Logics.LE43.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE44.Gate Out	Signal: Output of the logic gate
Logics.LE44.Timer Out	Signal: Timer Output
Logics.LE44.Out	Signal: Latched Output (Q)
Logics.LE44.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE45.Gate Out	Signal: Output of the logic gate
Logics.LE45.Timer Out	Signal: Timer Output
Logics.LE45.Out	Signal: Latched Output (Q)
Logics.LE45.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE46.Gate Out	Signal: Output of the logic gate
Logics.LE46.Timer Out	Signal: Timer Output
Logics.LE46.Out	Signal: Latched Output (Q)
Logics.LE46.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE47.Gate Out	Signal: Output of the logic gate
Logics.LE47.Timer Out	Signal: Timer Output
Logics.LE47.Out	Signal: Latched Output (Q)
Logics.LE47.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE48.Gate Out	Signal: Output of the logic gate
Logics.LE48.Timer Out	Signal: Timer Output
Logics.LE48.Out	Signal: Latched Output (Q)
Logics.LE48.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE49.Gate Out	Signal: Output of the logic gate
Logics.LE49.Timer Out	Signal: Timer Output
Logics.LE49.Out	Signal: Latched Output (Q)
Logics.LE49.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE50.Gate Out	Signal: Output of the logic gate
Logics.LE50.Timer Out	Signal: Timer Output
Logics.LE50.Out	Signal: Latched Output (Q)
Logics.LE50.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE51.Gate Out	Signal: Output of the logic gate
Logics.LE51.Timer Out	Signal: Timer Output
Logics.LE51.Out	Signal: Latched Output (Q)
Logics.LE51.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE52.Gate Out	Signal: Output of the logic gate
Logics.LE52.Timer Out	Signal: Timer Output
Logics.LE52.Out	Signal: Latched Output (Q)
Logics.LE52.Out inverted	Signal: Negated Latched Output (Q NOT)

Name	*Description*
Logics.LE53.Gate Out	Signal: Output of the logic gate
Logics.LE53.Timer Out	Signal: Timer Output
Logics.LE53.Out	Signal: Latched Output (Q)
Logics.LE53.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE54.Gate Out	Signal: Output of the logic gate
Logics.LE54.Timer Out	Signal: Timer Output
Logics.LE54.Out	Signal: Latched Output (Q)
Logics.LE54.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE55.Gate Out	Signal: Output of the logic gate
Logics.LE55.Timer Out	Signal: Timer Output
Logics.LE55.Out	Signal: Latched Output (Q)
Logics.LE55.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE56.Gate Out	Signal: Output of the logic gate
Logics.LE56.Timer Out	Signal: Timer Output
Logics.LE56.Out	Signal: Latched Output (Q)
Logics.LE56.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE57.Gate Out	Signal: Output of the logic gate
Logics.LE57.Timer Out	Signal: Timer Output
Logics.LE57.Out	Signal: Latched Output (Q)
Logics.LE57.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE58.Gate Out	Signal: Output of the logic gate
Logics.LE58.Timer Out	Signal: Timer Output
Logics.LE58.Out	Signal: Latched Output (Q)
Logics.LE58.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE59.Gate Out	Signal: Output of the logic gate
Logics.LE59.Timer Out	Signal: Timer Output
Logics.LE59.Out	Signal: Latched Output (Q)
Logics.LE59.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE60.Gate Out	Signal: Output of the logic gate
Logics.LE60.Timer Out	Signal: Timer Output
Logics.LE60.Out	Signal: Latched Output (Q)
Logics.LE60.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE61.Gate Out	Signal: Output of the logic gate
Logics.LE61.Timer Out	Signal: Timer Output
Logics.LE61.Out	Signal: Latched Output (Q)
Logics.LE61.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE62.Gate Out	Signal: Output of the logic gate
Logics.LE62.Timer Out	Signal: Timer Output
Logics.LE62.Out	Signal: Latched Output (Q)
Logics.LE62.Out inverted	Signal: Negated Latched Output (Q NOT)

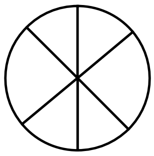
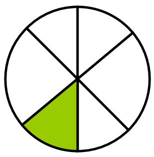
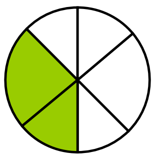
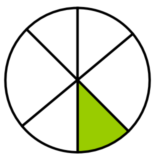
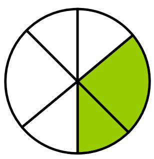
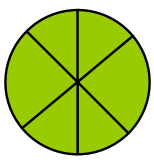
Name	*Description*
Logics.LE63.Gate Out	Signal: Output of the logic gate
Logics.LE63.Timer Out	Signal: Timer Output
Logics.LE63.Out	Signal: Latched Output (Q)
Logics.LE63.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE64.Gate Out	Signal: Output of the logic gate
Logics.LE64.Timer Out	Signal: Timer Output
Logics.LE64.Out	Signal: Latched Output (Q)
Logics.LE64.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE65.Gate Out	Signal: Output of the logic gate
Logics.LE65.Timer Out	Signal: Timer Output
Logics.LE65.Out	Signal: Latched Output (Q)
Logics.LE65.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE66.Gate Out	Signal: Output of the logic gate
Logics.LE66.Timer Out	Signal: Timer Output
Logics.LE66.Out	Signal: Latched Output (Q)
Logics.LE66.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE67.Gate Out	Signal: Output of the logic gate
Logics.LE67.Timer Out	Signal: Timer Output
Logics.LE67.Out	Signal: Latched Output (Q)
Logics.LE67.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE68.Gate Out	Signal: Output of the logic gate
Logics.LE68.Timer Out	Signal: Timer Output
Logics.LE68.Out	Signal: Latched Output (Q)
Logics.LE68.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE69.Gate Out	Signal: Output of the logic gate
Logics.LE69.Timer Out	Signal: Timer Output
Logics.LE69.Out	Signal: Latched Output (Q)
Logics.LE69.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE70.Gate Out	Signal: Output of the logic gate
Logics.LE70.Timer Out	Signal: Timer Output
Logics.LE70.Out	Signal: Latched Output (Q)
Logics.LE70.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE71.Gate Out	Signal: Output of the logic gate
Logics.LE71.Timer Out	Signal: Timer Output
Logics.LE71.Out	Signal: Latched Output (Q)
Logics.LE71.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE72.Gate Out	Signal: Output of the logic gate
Logics.LE72.Timer Out	Signal: Timer Output
Logics.LE72.Out	Signal: Latched Output (Q)
Logics.LE72.Out inverted	Signal: Negated Latched Output (Q NOT)

Name	*Description*
Logics.LE73.Gate Out	Signal: Output of the logic gate
Logics.LE73.Timer Out	Signal: Timer Output
Logics.LE73.Out	Signal: Latched Output (Q)
Logics.LE73.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE74.Gate Out	Signal: Output of the logic gate
Logics.LE74.Timer Out	Signal: Timer Output
Logics.LE74.Out	Signal: Latched Output (Q)
Logics.LE74.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE75.Gate Out	Signal: Output of the logic gate
Logics.LE75.Timer Out	Signal: Timer Output
Logics.LE75.Out	Signal: Latched Output (Q)
Logics.LE75.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE76.Gate Out	Signal: Output of the logic gate
Logics.LE76.Timer Out	Signal: Timer Output
Logics.LE76.Out	Signal: Latched Output (Q)
Logics.LE76.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE77.Gate Out	Signal: Output of the logic gate
Logics.LE77.Timer Out	Signal: Timer Output
Logics.LE77.Out	Signal: Latched Output (Q)
Logics.LE77.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE78.Gate Out	Signal: Output of the logic gate
Logics.LE78.Timer Out	Signal: Timer Output
Logics.LE78.Out	Signal: Latched Output (Q)
Logics.LE78.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE79.Gate Out	Signal: Output of the logic gate
Logics.LE79.Timer Out	Signal: Timer Output
Logics.LE79.Out	Signal: Latched Output (Q)
Logics.LE79.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE80.Gate Out	Signal: Output of the logic gate
Logics.LE80.Timer Out	Signal: Timer Output
Logics.LE80.Out	Signal: Latched Output (Q)
Logics.LE80.Out inverted	Signal: Negated Latched Output (Q NOT)

Access Authorizations (access areas)

Passwords – Areas

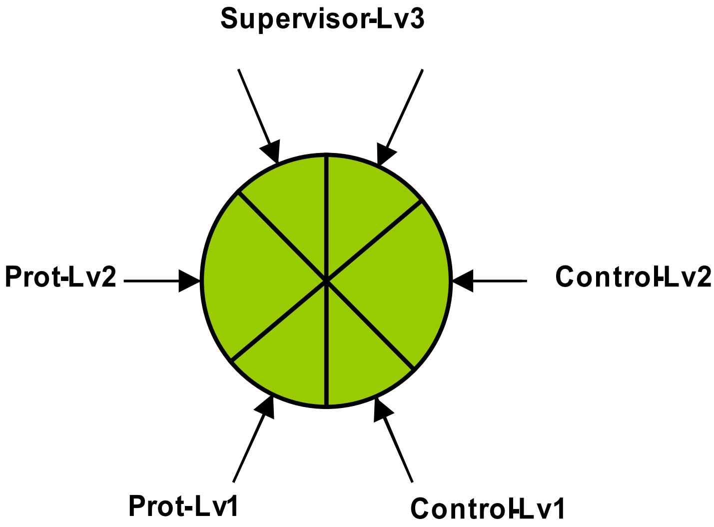
The following table shows the access areas and the authorization passwords that they require in order to access them.

Area Symbol		***Authorization Password***	***Access to:***
		**Read Only-Lv0**	Level 0 provides Read Only access to all settings and parameters of the device. The device will fall back into this level automatically after a longer period or inactivity
		**Prot-Lv1**	This password provides access to the reset- and acknowledge options. In addition to that, it permits the execution of manual trigger signals.
		**Prot-Lv2**	This password provides access to the reset and acknowledge options. In addition to that it permits changing of protection settings and the configuration of the trip manager.
		**Control-Lv1**	This password grants permission for switching operations (switching switchgears)
		**Control-Lv2**	This password grants permission for switching operations (switching switchgears). In addition to that it gives access to the switchgear settings (switching authority, interlockings, general settings of switchgears, Breaker wear...).
		**Supervisor-Lv3**	This password grants non-restricted access to all parameters and settings of the device (device configuration). This includes also the devices planning, device parameters (e.g. Date and Time), Field Parameters, Service Parameters and Logic Parameters.

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 into »Read Only-Lv0« mode automatically. This parameter (t-max-Edit) can be modified within menu [Device Para\HMI].

Access Areas (Password Level):



NOTICE **You have to ensure, that the access authorizations are protected by secure passwords. These passwords have to be kept as a secret and to be known only by the authorized persons.**

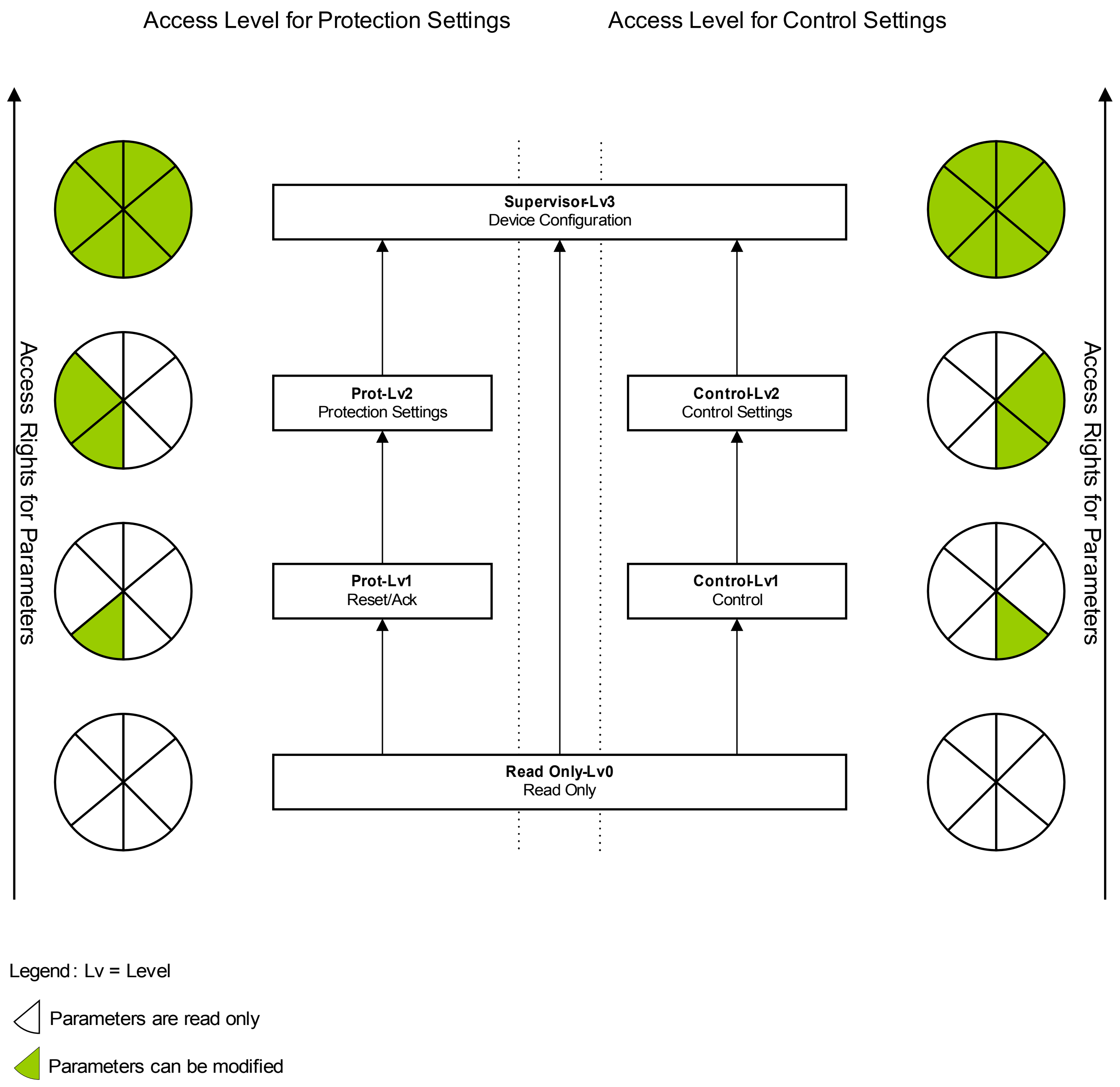
NOTICE **A lock symbol indicates in the upper right corner of the display if there are any access authorizations active at the moment . That means, within the mode "Read Only Lv0" a closed (locked) lock symbol will be shown in the upper right corner of the display. As soon as there are any access authorizations active (above the "Read Only-Lv0" level), the upper right corner of the display will show an unlocked (open) lock symbol.**

NOTICE **During setting parameters the C-Button will be used for the cancelling of parameter changes. Because of that it is not possible, to acknowledge (LEDs, Output Relays...) as long as there are non saved (cached only) parameters.**

Acknowledgement can only be executed, when the upper right corner of the display shows this symbol:

NOTICE **The passwords are part of the device (fixed assignments). That means, passwords will not be overwritten, if a parameter file is transmitted into a device.**
Existing passwords are persistent (assined to a device). If an offline created parameter file is transmitted into a device, or if a parameter file is transmitted from one device to another, this will have no impact on existing passwords within the device.

Available Levels/Access Authorizations
The access authorizations are designed in form of two hierachic strings.
The supervisor (administrator) password provides access to all parameters and settings.



How to find out what access areas/levels are unlocked?

The menu [Device para\Access levels] provides the information, which access areas (authorizations) are currently unlocked.

As soon as there is an unlocked access area (authorization) above *»Read Only-Lv0«*, this will be indicated by an unlocked lock symbol within the upper right corner of the device display.

Unlocking Access Areas

Within the menu [Device Para\Access level] access areas can be unlocked or locked (at the HMI).

Changing Passwords

Passwords can be changed at the device in menu [Device Para/Passwords] 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.

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 by means of the Softkeys followed by pressing the »OK«-key.
- Enter the new password by means of the Softkeys and press the »OK«-key.
- Afterwards enter the new password once again by means of the Softkeys and press the »OK«-key.

Deactivating Passwords during Commissioning

It is possible optionally to deactivate passwords during commissioning. It is not allowed to use this feature for other purposes than commissioning. In order to deactivate the password protection replace the existing password with an empty one for the corresponding access areas. All access authorizations (access areas) that are protected by an empty password are unlocked permanent. That means, that all parameters and settings within those areas can be modified without any further access authorization. It is no longer possible to change into the »*Read Only-Lv0*« level (the protective device will also not fall back into this mode if the maximum edit time is expired (t-max-Edit).

WARNING

You have to ensure that all passwords are activated again after the commissioning. That means, that all access areas have to be protected by a password that consists of 4 digits as minimum.

Woodward will not overtake any liability for any personal injuries or damages that are caused by deactivated password protection.

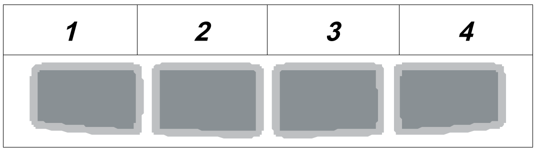
Changing Passwords via Smart view

Download the parameter file from the device.

- Passwords can be changed by a double-click within menu [Device Para\Password\Change Password] on the corresponding password.
- Enter the old password and the new password twice
- Confirm the changes by a cklick on »OK«.

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 Forgotten

By pressing the »C« key during cold booting a reset menu will be called up. By selecting »Reset All Passwords?« and confirming with »Yes« all passwords will be reset to the defaults *»1234«*.

Parameter Setting at the HMI

Every parameter belongs to an access area. Editing and changing of a parameter requires a sufficient access authorization.
The User can obtain the required access authorizations by unlocking access areas in advance of parameter changes or context-dependent. In the following sections both options will be explained.

Option 1: Direct Authorization for an Access Area

Call up menu [Device Para\Access level].

Select the required access level respectively navigate to the required access authorization (level). Enter the required password. If the correct password has been entered, the required access authorization will be obtained. In order to do the parameter changes please proceed as follows:

- Move to the parameter you want to change by using the Softkeys. If the parameter is selected, the lower right corner of the display should show a »Wrench« symbol.

This symbol indicates, that the parameter is unlocked and can be edited, because the required access authorization is available. Confirm the Softkey »Wrench«, in order to edit the parameter. 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 been saved temporarily, 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 up from the main menu level at any time where parameter changes have been made and have not been saved finally.
In addition to the star trace to the temporary 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«.

HINWEIS

If the display shows a Key Symbol instead of a Wrench-Symbol, this will indicate, that the required access authorization is not available.

In order to edit this parameter, a password is required, that provides the required authorization.

NOTICE

Plausibility check: In order to prevent obvious wrong settings the device monitors constantly all temporary 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 up, 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 temporary 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 implausibilities 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.

Option 2: Context-dependent Access Authorization

Navigate to the parameter, that is to be changed. If the parameter is selected, the lower right corner of the display shows a »*Key«*-Symbol.

This symbol indicates, that the device is still within the *»Read Only Lv0«*-Level, or that the current level does not provide sufficient access rights to allow editing of this parameter.

Press this Softkey and enter the password[1)] that provides access to this parameter.
Please change the parameter settings.

[1)] This page provides also information, which password/access authorization is required to do changes on this 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 been saved temporary, they are not yet finally stored and adopted by the device.
In order to make things easier to follow up, 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 been saved finally.
In addition to the star trace to the temporary 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 temporary 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 up, especially where complex parameter changes are involved, on every superior/higher-ranking menu level, above the temporary 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 temporary 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 implausibilities 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.

Parameter Setting via Smart view

Smart view shows within the windows, where parameters are edited also the required access level for the parameters and settings. The required access authorizations will be verified when the parameter file should be transferred into the protective device. For the transmission, two options are available.

1. The transfer of *all Parameters*. This always requires the Supervisor (administrator) password.

2. The transfer of the *modified Parameters* only. It has to be taken into account, the passwords that are required by this are determined by those parameters, that require the highest passwords (access authorizations).

   Example1:
   A »*Prot-Lv1*«-parameter and a »*Prot-Lv2*« parameter have been edited and should be transferred. The User will be asked for the »*Prot-Lv2*« password.

   Example2:
   A »*Prot-Lv1*« parameter and a »*Prot-Lv2*« parameter and a device planning parameter have been changed and should be transferred. The User will be asked for the »*Supervisor-Lv3*« password.

   Example3:
   A »*Prot-Lv1*« *p*arameter and a »*Prot-Lv2*« parameter as well as a »*Ctrl-Lv2*« parameter have been changed and should be transferred. The User will be asked for the »*Prot-Lv2*« and the »*Ctrl-Lv2*« password.

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 been saved temporarily. 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 up from the main menu level at any time where parameter changes have been made and have not been saved finally.

NOTICE

Plausibility check: In order to prevent obvious wrong settings the software monitors constantly all temporary 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 up, especially where complex parameter changes are involved, on every superior/higher menu level above of the temporary 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.

- Additional parameters can be changed if required.

- There are two options available to transfer changed parameters into the device within menu »Device«.

1. »Transfer all Parameters into the Device«. This always requires the Supervisor (administrator) password.
2. »Transfer only modified parameters into the Device«. For this parameter transfer the User needs passwords that provide sufficient access authorization for all parameters that are to be transferred.

- 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 saved now 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 10 minutes at least. This time interval will start again, each time parameters are transmitted 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 Kempen GmbH*.

The protection parameters include the following protection parameter trees:

- Global Protection Parameters: *»Global Prot Para«*: Here you can find all protection parameters that are valid universally, 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.

Option	***Setting Group Switch***
Manual Selection	Switch over, if another setting group is chosen manually within the menu »Protection Para/P-Set Switch«
Via Input Function (e.g. Digital Input)	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. Example:: DI3 is assigned onto Parameter set 1. DI3 is active „1“. DI4 is assigned onto Parameter set 2. DI4 is inactive „0“. Now the device should switch from parameter set 1 to parameter set 2. Therefore at first DI3 has to become inactive “0”. Than DI4 has to be active “1”. If DI4 becomes again inactive „0“, parameter set 2 will remain active “1” as long as there is no clear request (e.g. DI3 becomes active “1”, all the other assignments are inactive “0”)
Via Scada	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.**

Signals that can be used for PSS

Name	*Description*
-.-	No assignment
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
Logics.LE1.Gate Out	Signal: Output of the logic gate
Logics.LE1.Timer Out	Signal: Timer Output
Logics.LE1.Out	Signal: Latched Output (Q)
Logics.LE1.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE2.Gate Out	Signal: Output of the logic gate
Logics.LE2.Timer Out	Signal: Timer Output
Logics.LE2.Out	Signal: Latched Output (Q)
Logics.LE2.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE3.Gate Out	Signal: Output of the logic gate
Logics.LE3.Timer Out	Signal: Timer Output
Logics.LE3.Out	Signal: Latched Output (Q)
Logics.LE3.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE4.Gate Out	Signal: Output of the logic gate
Logics.LE4.Timer Out	Signal: Timer Output
Logics.LE4.Out	Signal: Latched Output (Q)
Logics.LE4.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE5.Gate Out	Signal: Output of the logic gate
Logics.LE5.Timer Out	Signal: Timer Output
Logics.LE5.Out	Signal: Latched Output (Q)
Logics.LE5.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE6.Gate Out	Signal: Output of the logic gate
Logics.LE6.Timer Out	Signal: Timer Output
Logics.LE6.Out	Signal: Latched Output (Q)
Logics.LE6.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE7.Gate Out	Signal: Output of the logic gate
Logics.LE7.Timer Out	Signal: Timer Output
Logics.LE7.Out	Signal: Latched Output (Q)
Logics.LE7.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE8.Gate Out	Signal: Output of the logic gate

Name	*Description*
Logics.LE8.Timer Out	Signal: Timer Output
Logics.LE8.Out	Signal: Latched Output (Q)
Logics.LE8.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE9.Gate Out	Signal: Output of the logic gate
Logics.LE9.Timer Out	Signal: Timer Output
Logics.LE9.Out	Signal: Latched Output (Q)
Logics.LE9.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE10.Gate Out	Signal: Output of the logic gate
Logics.LE10.Timer Out	Signal: Timer Output
Logics.LE10.Out	Signal: Latched Output (Q)
Logics.LE10.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE11.Gate Out	Signal: Output of the logic gate
Logics.LE11.Timer Out	Signal: Timer Output
Logics.LE11.Out	Signal: Latched Output (Q)
Logics.LE11.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE12.Gate Out	Signal: Output of the logic gate
Logics.LE12.Timer Out	Signal: Timer Output
Logics.LE12.Out	Signal: Latched Output (Q)
Logics.LE12.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE13.Gate Out	Signal: Output of the logic gate
Logics.LE13.Timer Out	Signal: Timer Output
Logics.LE13.Out	Signal: Latched Output (Q)
Logics.LE13.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE14.Gate Out	Signal: Output of the logic gate
Logics.LE14.Timer Out	Signal: Timer Output
Logics.LE14.Out	Signal: Latched Output (Q)
Logics.LE14.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE15.Gate Out	Signal: Output of the logic gate
Logics.LE15.Timer Out	Signal: Timer Output
Logics.LE15.Out	Signal: Latched Output (Q)
Logics.LE15.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE16.Gate Out	Signal: Output of the logic gate
Logics.LE16.Timer Out	Signal: Timer Output
Logics.LE16.Out	Signal: Latched Output (Q)
Logics.LE16.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE17.Gate Out	Signal: Output of the logic gate
Logics.LE17.Timer Out	Signal: Timer Output
Logics.LE17.Out	Signal: Latched Output (Q)
Logics.LE17.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE18.Gate Out	Signal: Output of the logic gate

Name	*Description*
Logics.LE18.Timer Out	Signal: Timer Output
Logics.LE18.Out	Signal: Latched Output (Q)
Logics.LE18.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE19.Gate Out	Signal: Output of the logic gate
Logics.LE19.Timer Out	Signal: Timer Output
Logics.LE19.Out	Signal: Latched Output (Q)
Logics.LE19.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE20.Gate Out	Signal: Output of the logic gate
Logics.LE20.Timer Out	Signal: Timer Output
Logics.LE20.Out	Signal: Latched Output (Q)
Logics.LE20.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE21.Gate Out	Signal: Output of the logic gate
Logics.LE21.Timer Out	Signal: Timer Output
Logics.LE21.Out	Signal: Latched Output (Q)
Logics.LE21.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE22.Gate Out	Signal: Output of the logic gate
Logics.LE22.Timer Out	Signal: Timer Output
Logics.LE22.Out	Signal: Latched Output (Q)
Logics.LE22.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE23.Gate Out	Signal: Output of the logic gate
Logics.LE23.Timer Out	Signal: Timer Output
Logics.LE23.Out	Signal: Latched Output (Q)
Logics.LE23.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE24.Gate Out	Signal: Output of the logic gate
Logics.LE24.Timer Out	Signal: Timer Output
Logics.LE24.Out	Signal: Latched Output (Q)
Logics.LE24.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE25.Gate Out	Signal: Output of the logic gate
Logics.LE25.Timer Out	Signal: Timer Output
Logics.LE25.Out	Signal: Latched Output (Q)
Logics.LE25.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE26.Gate Out	Signal: Output of the logic gate
Logics.LE26.Timer Out	Signal: Timer Output
Logics.LE26.Out	Signal: Latched Output (Q)
Logics.LE26.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE27.Gate Out	Signal: Output of the logic gate
Logics.LE27.Timer Out	Signal: Timer Output
Logics.LE27.Out	Signal: Latched Output (Q)
Logics.LE27.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE28.Gate Out	Signal: Output of the logic gate

Name	*Description*
Logics.LE28.Timer Out	Signal: Timer Output
Logics.LE28.Out	Signal: Latched Output (Q)
Logics.LE28.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE29.Gate Out	Signal: Output of the logic gate
Logics.LE29.Timer Out	Signal: Timer Output
Logics.LE29.Out	Signal: Latched Output (Q)
Logics.LE29.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE30.Gate Out	Signal: Output of the logic gate
Logics.LE30.Timer Out	Signal: Timer Output
Logics.LE30.Out	Signal: Latched Output (Q)
Logics.LE30.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE31.Gate Out	Signal: Output of the logic gate
Logics.LE31.Timer Out	Signal: Timer Output
Logics.LE31.Out	Signal: Latched Output (Q)
Logics.LE31.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE32.Gate Out	Signal: Output of the logic gate
Logics.LE32.Timer Out	Signal: Timer Output
Logics.LE32.Out	Signal: Latched Output (Q)
Logics.LE32.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE33.Gate Out	Signal: Output of the logic gate
Logics.LE33.Timer Out	Signal: Timer Output
Logics.LE33.Out	Signal: Latched Output (Q)
Logics.LE33.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE34.Gate Out	Signal: Output of the logic gate
Logics.LE34.Timer Out	Signal: Timer Output
Logics.LE34.Out	Signal: Latched Output (Q)
Logics.LE34.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE35.Gate Out	Signal: Output of the logic gate
Logics.LE35.Timer Out	Signal: Timer Output
Logics.LE35.Out	Signal: Latched Output (Q)
Logics.LE35.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE36.Gate Out	Signal: Output of the logic gate
Logics.LE36.Timer Out	Signal: Timer Output
Logics.LE36.Out	Signal: Latched Output (Q)
Logics.LE36.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE37.Gate Out	Signal: Output of the logic gate
Logics.LE37.Timer Out	Signal: Timer Output
Logics.LE37.Out	Signal: Latched Output (Q)
Logics.LE37.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE38.Gate Out	Signal: Output of the logic gate

Name	*Description*
Logics.LE38.Timer Out	Signal: Timer Output
Logics.LE38.Out	Signal: Latched Output (Q)
Logics.LE38.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE39.Gate Out	Signal: Output of the logic gate
Logics.LE39.Timer Out	Signal: Timer Output
Logics.LE39.Out	Signal: Latched Output (Q)
Logics.LE39.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE40.Gate Out	Signal: Output of the logic gate
Logics.LE40.Timer Out	Signal: Timer Output
Logics.LE40.Out	Signal: Latched Output (Q)
Logics.LE40.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE41.Gate Out	Signal: Output of the logic gate
Logics.LE41.Timer Out	Signal: Timer Output
Logics.LE41.Out	Signal: Latched Output (Q)
Logics.LE41.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE42.Gate Out	Signal: Output of the logic gate
Logics.LE42.Timer Out	Signal: Timer Output
Logics.LE42.Out	Signal: Latched Output (Q)
Logics.LE42.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE43.Gate Out	Signal: Output of the logic gate
Logics.LE43.Timer Out	Signal: Timer Output
Logics.LE43.Out	Signal: Latched Output (Q)
Logics.LE43.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE44.Gate Out	Signal: Output of the logic gate
Logics.LE44.Timer Out	Signal: Timer Output
Logics.LE44.Out	Signal: Latched Output (Q)
Logics.LE44.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE45.Gate Out	Signal: Output of the logic gate
Logics.LE45.Timer Out	Signal: Timer Output
Logics.LE45.Out	Signal: Latched Output (Q)
Logics.LE45.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE46.Gate Out	Signal: Output of the logic gate
Logics.LE46.Timer Out	Signal: Timer Output
Logics.LE46.Out	Signal: Latched Output (Q)
Logics.LE46.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE47.Gate Out	Signal: Output of the logic gate
Logics.LE47.Timer Out	Signal: Timer Output
Logics.LE47.Out	Signal: Latched Output (Q)
Logics.LE47.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE48.Gate Out	Signal: Output of the logic gate

Name	*Description*
Logics.LE48.Timer Out	Signal: Timer Output
Logics.LE48.Out	Signal: Latched Output (Q)
Logics.LE48.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE49.Gate Out	Signal: Output of the logic gate
Logics.LE49.Timer Out	Signal: Timer Output
Logics.LE49.Out	Signal: Latched Output (Q)
Logics.LE49.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE50.Gate Out	Signal: Output of the logic gate
Logics.LE50.Timer Out	Signal: Timer Output
Logics.LE50.Out	Signal: Latched Output (Q)
Logics.LE50.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE51.Gate Out	Signal: Output of the logic gate
Logics.LE51.Timer Out	Signal: Timer Output
Logics.LE51.Out	Signal: Latched Output (Q)
Logics.LE51.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE52.Gate Out	Signal: Output of the logic gate
Logics.LE52.Timer Out	Signal: Timer Output
Logics.LE52.Out	Signal: Latched Output (Q)
Logics.LE52.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE53.Gate Out	Signal: Output of the logic gate
Logics.LE53.Timer Out	Signal: Timer Output
Logics.LE53.Out	Signal: Latched Output (Q)
Logics.LE53.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE54.Gate Out	Signal: Output of the logic gate
Logics.LE54.Timer Out	Signal: Timer Output
Logics.LE54.Out	Signal: Latched Output (Q)
Logics.LE54.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE55.Gate Out	Signal: Output of the logic gate
Logics.LE55.Timer Out	Signal: Timer Output
Logics.LE55.Out	Signal: Latched Output (Q)
Logics.LE55.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE56.Gate Out	Signal: Output of the logic gate
Logics.LE56.Timer Out	Signal: Timer Output
Logics.LE56.Out	Signal: Latched Output (Q)
Logics.LE56.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE57.Gate Out	Signal: Output of the logic gate
Logics.LE57.Timer Out	Signal: Timer Output
Logics.LE57.Out	Signal: Latched Output (Q)
Logics.LE57.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE58.Gate Out	Signal: Output of the logic gate

Name	*Description*
Logics.LE58.Timer Out	Signal: Timer Output
Logics.LE58.Out	Signal: Latched Output (Q)
Logics.LE58.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE59.Gate Out	Signal: Output of the logic gate
Logics.LE59.Timer Out	Signal: Timer Output
Logics.LE59.Out	Signal: Latched Output (Q)
Logics.LE59.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE60.Gate Out	Signal: Output of the logic gate
Logics.LE60.Timer Out	Signal: Timer Output
Logics.LE60.Out	Signal: Latched Output (Q)
Logics.LE60.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE61.Gate Out	Signal: Output of the logic gate
Logics.LE61.Timer Out	Signal: Timer Output
Logics.LE61.Out	Signal: Latched Output (Q)
Logics.LE61.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE62.Gate Out	Signal: Output of the logic gate
Logics.LE62.Timer Out	Signal: Timer Output
Logics.LE62.Out	Signal: Latched Output (Q)
Logics.LE62.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE63.Gate Out	Signal: Output of the logic gate
Logics.LE63.Timer Out	Signal: Timer Output
Logics.LE63.Out	Signal: Latched Output (Q)
Logics.LE63.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE64.Gate Out	Signal: Output of the logic gate
Logics.LE64.Timer Out	Signal: Timer Output
Logics.LE64.Out	Signal: Latched Output (Q)
Logics.LE64.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE65.Gate Out	Signal: Output of the logic gate
Logics.LE65.Timer Out	Signal: Timer Output
Logics.LE65.Out	Signal: Latched Output (Q)
Logics.LE65.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE66.Gate Out	Signal: Output of the logic gate
Logics.LE66.Timer Out	Signal: Timer Output
Logics.LE66.Out	Signal: Latched Output (Q)
Logics.LE66.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE67.Gate Out	Signal: Output of the logic gate
Logics.LE67.Timer Out	Signal: Timer Output
Logics.LE67.Out	Signal: Latched Output (Q)
Logics.LE67.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE68.Gate Out	Signal: Output of the logic gate

Name	*Description*
Logics.LE68.Timer Out	Signal: Timer Output
Logics.LE68.Out	Signal: Latched Output (Q)
Logics.LE68.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE69.Gate Out	Signal: Output of the logic gate
Logics.LE69.Timer Out	Signal: Timer Output
Logics.LE69.Out	Signal: Latched Output (Q)
Logics.LE69.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE70.Gate Out	Signal: Output of the logic gate
Logics.LE70.Timer Out	Signal: Timer Output
Logics.LE70.Out	Signal: Latched Output (Q)
Logics.LE70.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE71.Gate Out	Signal: Output of the logic gate
Logics.LE71.Timer Out	Signal: Timer Output
Logics.LE71.Out	Signal: Latched Output (Q)
Logics.LE71.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE72.Gate Out	Signal: Output of the logic gate
Logics.LE72.Timer Out	Signal: Timer Output
Logics.LE72.Out	Signal: Latched Output (Q)
Logics.LE72.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE73.Gate Out	Signal: Output of the logic gate
Logics.LE73.Timer Out	Signal: Timer Output
Logics.LE73.Out	Signal: Latched Output (Q)
Logics.LE73.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE74.Gate Out	Signal: Output of the logic gate
Logics.LE74.Timer Out	Signal: Timer Output
Logics.LE74.Out	Signal: Latched Output (Q)
Logics.LE74.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE75.Gate Out	Signal: Output of the logic gate
Logics.LE75.Timer Out	Signal: Timer Output
Logics.LE75.Out	Signal: Latched Output (Q)
Logics.LE75.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE76.Gate Out	Signal: Output of the logic gate
Logics.LE76.Timer Out	Signal: Timer Output
Logics.LE76.Out	Signal: Latched Output (Q)
Logics.LE76.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE77.Gate Out	Signal: Output of the logic gate
Logics.LE77.Timer Out	Signal: Timer Output
Logics.LE77.Out	Signal: Latched Output (Q)
Logics.LE77.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE78.Gate Out	Signal: Output of the logic gate

Name	Description
Logics.LE78.Timer Out	Signal: Timer Output
Logics.LE78.Out	Signal: Latched Output (Q)
Logics.LE78.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE79.Gate Out	Signal: Output of the logic gate
Logics.LE79.Timer Out	Signal: Timer Output
Logics.LE79.Out	Signal: Latched Output (Q)
Logics.LE79.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE80.Gate Out	Signal: Output of the logic gate
Logics.LE80.Timer Out	Signal: Timer Output
Logics.LE80.Out	Signal: Latched Output (Q)
Logics.LE80.Out inverted	Signal: Negated Latched Output (Q NOT)

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 a few parameters.

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

To establish efficiently a second parameter set where only a 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 set that should be copied (source = copy from; destination: copy to).
- Mouse click on »OK« to start copy procedure.
- The copied parameter set is cached now (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 added newly 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:	

Setting Lock

By means of the *Setting Lock*, parameter settings can be locked against any changes as long as the assigned signal is true (active). The *Setting Lock* can be activated within menu
[Field Para/General Settings/Lock Settings].

Bypass of the Setting Lock

The setting lock can be overwritten (temporarily) in case that the status of the signal that activates the setting lock cannot be modified or should not be modified (spare key).

The *Setting Lock* can be bypassed by means of the Direct Control Parameter »*Setting Lock Bypass*«
[Field Para/General Settings/Setting Lock Bypass]. The protective device will fall back into the *Setting Lock* either:

- Directly after a parameter change has been saved, else
- 10 minutes after the bypass has been activated.

Device 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 opened 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 following 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].**

TCP/IP Settings

Within menu *»Device Para / TCP/IP«* the TCP/IP settings have to be set.

The first-time setting of the TCP/IP Parameters can be done at the panel (HMI) only.

NOTICE

Establishing a connection via TCP/IP to the device is only possible if your device is equipped with an Ethernet Interface (RJ45).

Contact your IT administrator in order to establish the network connection.

Set the TCP/IP Parameters

Call up *»Device parameter/TCP/IP«* at the HMI (panel) and set the following parameters:

- TCP/IP address
- Subnetmask
- Gateway

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 /Acknowledge]
Ack BO	All acknowledgeable binary output relays will be acknowledged.	inactive, active	inactive	[Operation /Acknowledge]
Ack Scada	SCADA will be acknowledged.	inactive, active	inactive	[Operation /Acknowledge]
Ack BO LED Scd TCmd	Reset the binary output relays, LEDs, SCADA and the Trip Command.	inactive, active	inactive	[Operation /Acknowledge]
Reboot	Rebooting the device.	no, yes	no	[Service /General]
Setting Lock Bypass	Short-period unlock of the Setting Lock	inactive, active	inactive	[Field Para /General settings]

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, PSS via Inp fct, PSS 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 all input functions are inactive, the device will keep working with the Setting Group that was activated lastly. Only available if: PSet-Switch = PSS via Inp fct	1..n, PSS	-.-	[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 all input functions are inactive, the device will keep working with the Setting Group that was activated lastly. Only available if: PSet-Switch = PSS via Inp fct	1..n, PSS	-.-	[Protection Para /PSet-Switch]
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 all input functions are inactive, the device will keep working with the Setting Group that was activated lastly. Only available if: PSet-Switch = PSS via Inp fct	1..n, PSS	-.-	[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 all input functions are inactive, the device will keep working with the Setting Group that was activated lastly. Only available if: PSet-Switch = PSS via Inp fct	1..n, PSS	-.-	[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]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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	[Device Para /Measurem Display]
Lock Settings	No parameters can be changed as long as this input is true. The parameter settings are locked.	1..n, Assignment List	-.-	[Field Para /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 of the binary Output Relays	[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]
Lock Settings-I	State of the module input: No parameters can be changed as long as this input is true. The parameter settings are locked.	[Field Para /General settings]

System Module Signals

Signal	*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=Restart because of configuration change; 6=General failure; 7=Restart initiated by System Abort (host side); 8=Restart initiated by watchdog timeout (host side); 9=Restart initiated by System Abort (dspside); 10=Restart initiated by watchdog timeout (dspside); 11=Power supply failure (short term interruption) or power supply voltage too low; 12=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
PSS manual	Signal: Manual Switch over of a Parameter Set
PSS via Scada	Signal: Parameter Set Switch via Scada
PSS via Inp fct	Signal: Parameter Set Switch via input function
min 1 param changed	Signal: At least one parameter has been changed
Setting Lock Bypass	Signal: Short-period unlock of the Setting Lock
Param to be saved	Number of parameters to be saved. 0 means that all parameter changes are overtaken.
Ack LED	Signal: LEDs acknowledgement
Ack BO	Signal: Acknowledgement of the Binary Outputs
Ack Counter	Signal: Reset of all Counters
Ack Scada	Signal: Acknowledge Scada
Ack TripCmd	Signal: Reset Trip Command
Ack LED-HMI	Signal: LEDs acknowledgement :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 :SCADA
Ack BO-Sca	Signal: Acknowledgement of the Binary Outputs :SCADA
Ack Counter-Sca	Signal: Reset of all Counters :SCADA
Ack Scada-Sca	Signal: Acknowledge Scada :SCADA
Ack TripCmd-Sca	Signal: Reset Trip Command :SCADA
Res OperationsCr	Signal:: Res OperationsCr
Res AlarmCr	Signal:: Res AlarmCr
Res TripCmdCr	Signal:: Res TripCmdCr
Res TotalCr	Signal:: Res TotalCr

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 of the protective device	[Operation /Count and RevData /Sys]

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...

General Field Parameters

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Phase Sequence	Phase Sequence direction	ABC, ACB	ABC	[Field Para /General settings]
f	Nominal frequency	50Hz, 60Hz	50Hz	[Field Para /General settings]

Field Parameters – Voltage Related

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
VT pri	Nominal voltage of the Voltage Transformers at the primary side. The phase to phase voltage is to be entered even if the load is in delta connection.	60 - 500000V	10000V	[Field Para /Voltage]
VT sec	Nominal voltage of the Voltage Transformers at the secondary side. The phase to phase voltage is to be entered even if the load is in delta connection.	60.00 - 520.00V	100V	[Field Para /Voltage]
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 Phase, Phase to Ground	Phase to Ground	[Field Para /Voltage]
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 (GVT con=measured/broken delta).	60 - 500000V	10000V	[Field Para /Voltage]
EVT sec	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.	35.00 - 520.00V	100V	[Field Para /Voltage]
V Block f	Threshold for the release of the frequency stages	0.15 - 1.00Vn	0.5Vn	[Field Para /General settings]
V Sync	The fourth measuring input of the voltage measuring card measures the voltage that is to be synchronized.	L1, L2, L3, L12, L23, L31	L12	[Field Para /Voltage]
delta phi - Mode	delta phi - Mode	one phase, two phases, three phases	two phases	[Field Para /Voltage]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
V Cutoff Level	The Phase Voltage shown in the Display or within the PC Software will be displayed as zero, if the Phase Voltage falls below this Cutoff Level. This parameter has no impact on recorders. This parameter is related to the voltage that is connected to the device (phase-to-phase or phase-to-earth).	0.0 - 0.100Vn	0.005Vn	[Device Para /Measurem Display]
VG meas Cutoff Level	The measured Residual Voltage shown in the Display or within the PC Software will be displayed as zero, if the measured Residual Voltage falls below this Cutoff Level. This parameter has no impact on recorders.	0.0 - 0.100Vn	0.005Vn	[Device Para /Measurem Display]
VG calc Cutoff Level	The calculated Residual Voltage shown in the Display or within the PC Software will be displayed as zero, if the calculated Residual Voltage falls below this Cutoff Level. This parameter has no impact on recorders.	0.0 - 0.100Vn	0.005Vn	[Device Para /Measurem Display]

Parameter	Description	Setting range	Default	Menu path
V012 Comp Cutoff Level	The Symmetrical Component shown in the Display or within the PC Software will be displayed as zero, if the Symmetrical Component falls below this Cutoff Level. This parameter has no impact on recorders.	0.0 - 0.100Vn	0.005Vn	[Device Para /Measurem Display]

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

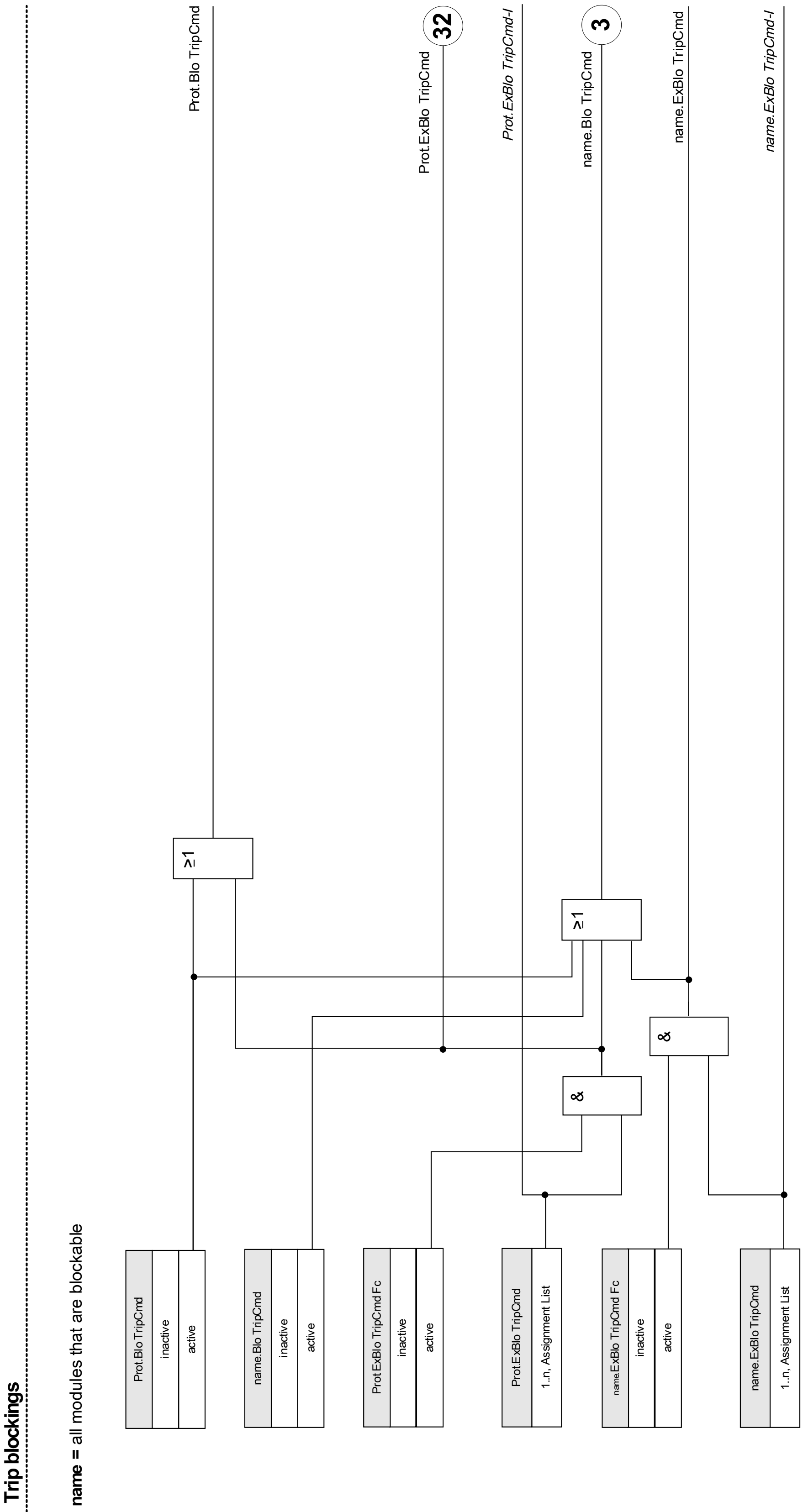
- In order to establish a temporary blockage of a protection module, the parameter *»ExBlo Fc«* of the module has to be set to *»active«*. This gives the permission: »This module can be blocked«.
- Within the general protection parameters a signal has to be additionally chosen from the »ASSIGNMENT LIST«.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

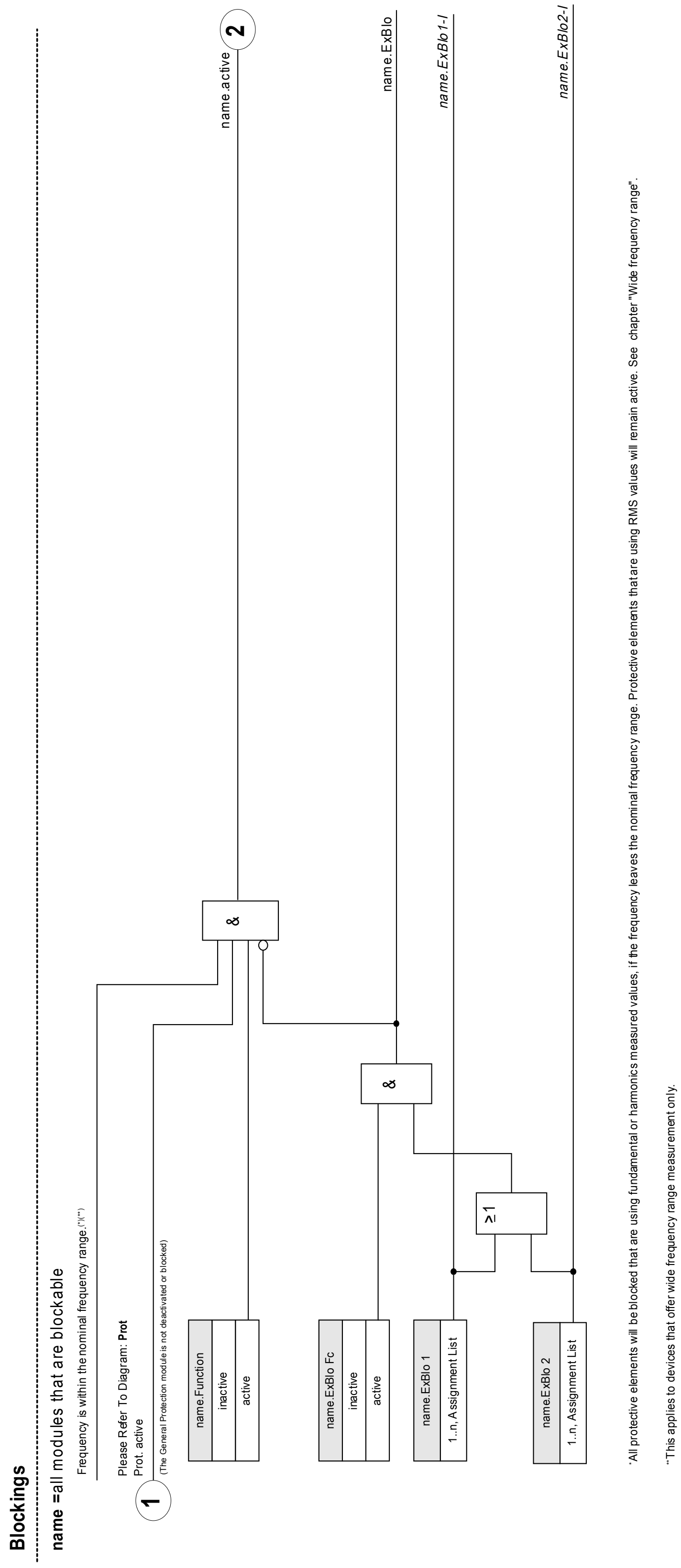
- In order to establish a temporary blockage of a protection stage, the parameter *»ExBlo TripCmd Fc«* of the module has to be set to *»active«*. This gives the permission: »The tripping command of this stage can be blocked«.

- 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.

To Activate or Deactivate the Tripping Command of a Protection Module



Activate, Deactivate respectively Block Temporarily Protection Functions



Module: Protection (Prot)

Prot

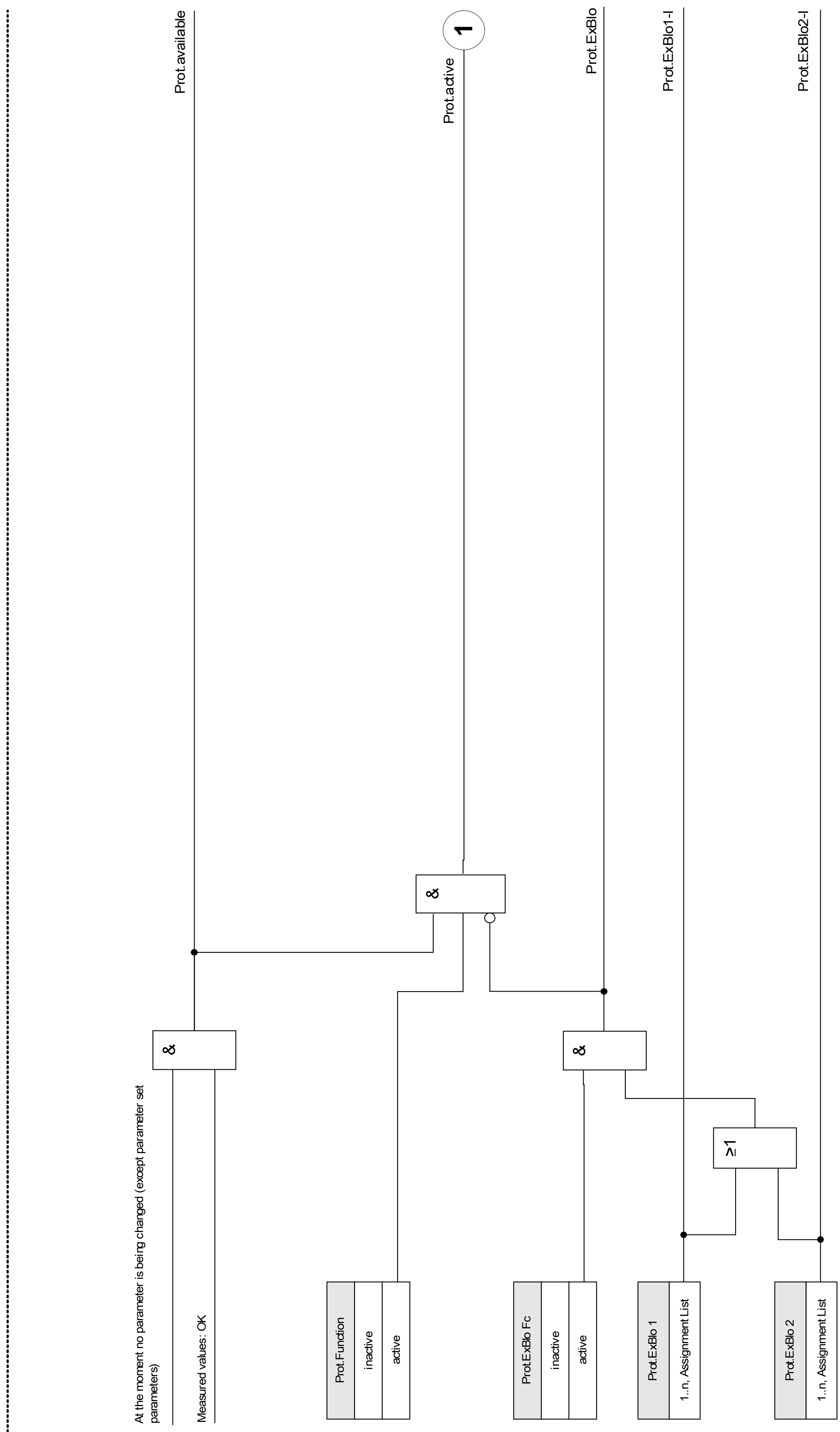
The module *»Protection«* serves as outer frame for all other protection modules, i.e. they are all enclosed by the module *»Protection«*. All alarms and tripping commands are combined in module *»Protection«* by an OR-logic.

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
1
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«***

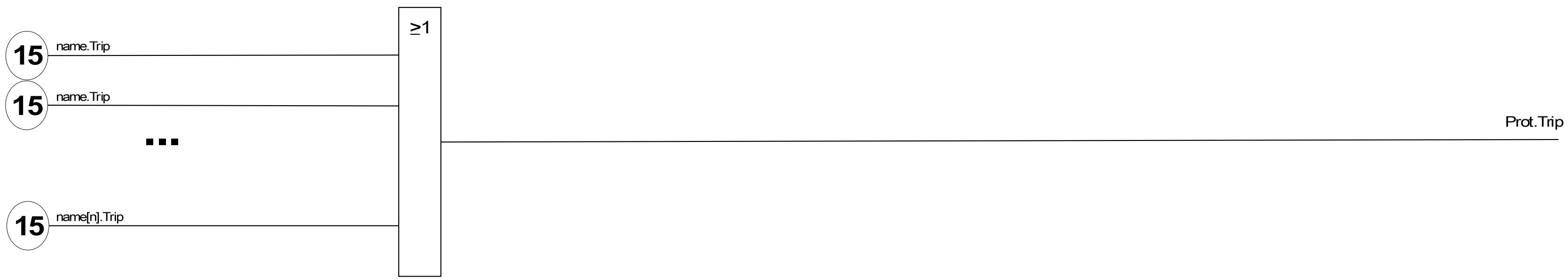
If a protection module is activated respectively issues a trip command to the CB two alarm signals will be created:

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 lead to a general trip.

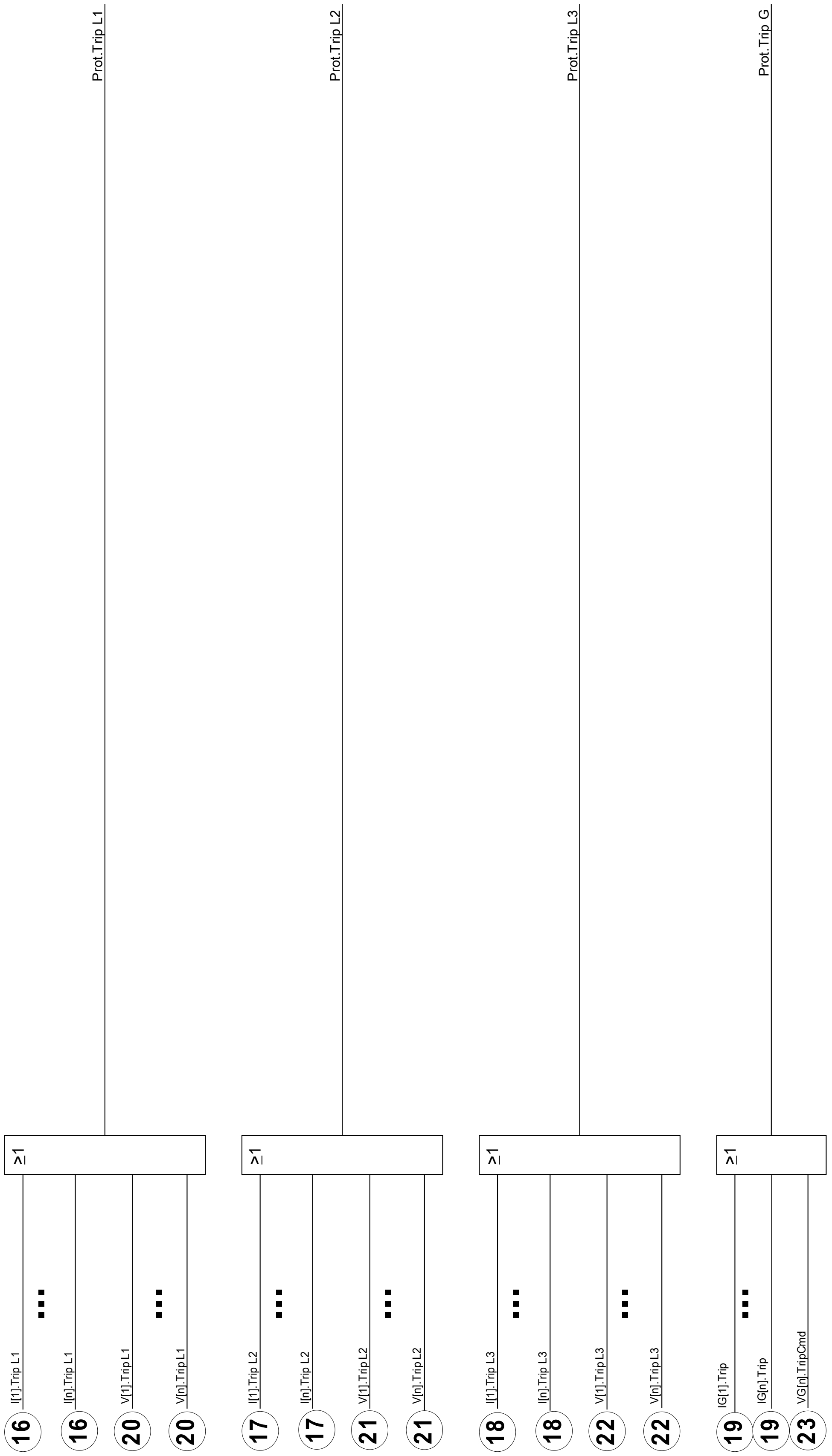


Prot.Alarm

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

Prot.Trip

Each phase selective trip of a trip authorized module (I, IG, V, VX depending on the device type) will lead to a phase selective general trip.



Prot.Alarm

Each phase selective alarm of a module (I, IG, V, VX depending on the device type) will lead 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 number of grid faults.	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]
Blo TripCmd	Permanent blocking of the Trip Command of the entire Protection.	inactive, active	inactive	[Protection Para /Global Prot Para /Prot]
ExBlo TripCmd Fc	Activate (allow) the external blocking of the trip command of the entire device.	inactive, active	inactive	[Protection Para /Global Prot Para /Prot]
ExBlo TripCmd	If external blocking of the tripping command is activated (allowed), the tripping command of the entire 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]
ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command	[Protection Para /Global Prot Para /Prot]

Protection Module Signals (Output States)

Signal	*Description*
available	Signal: Protection is available
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: 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: General Trip L1
Trip L2	Signal: General Trip L2
Trip L3	Signal: General Trip L3
Trip G	Signal: General Trip Ground fault
Trip	Signal: General Trip
Res Fault a Mains No	Signal: Resetting of fault number and number of grid faults.

Protection Module Values

Parameter	*Description*
FaultNo	Disturbance No
No of grid faults	Number of grid faults: A grid fault, e.g. a short circuit, might cause several faults with trip and autoreclosing, each fault being identified by an increased fault number. In this case, the grid fault number remains the same.

Switchgear/Breaker – Manager

WARNING **WARNING Misconfiguration of the switchgear can result in death or serious injury.**

Beside protection functions, protective relays more and more will take care about controlling switchgear, like circuit breakers, load break switches, disconnectors and ground connectors.

The Switchgear/Breaker-Manager of this protective device is designed to manage one switchgear.

The correct configuration is an indispensable precondition for the proper functioning of the protective device. This also is the case, when the switchgear is not controlled, but supervised only.

Single Line Diagram

The single line diagram includes the graphically description of the switchgear and its designation (name) as well as its features (short circuit proof or not ...). For displaying in the devices software, the switchgear' designations (e. g. QA1, QA2, instead of SG[x]) will be taken from the single line diagram (configuration file).

The configuration file includes the single line diagram and the switchgear properties. Switchgear properties and single line diagram are coupled via the configuration file.

Switchgear Configuration

Wiring

At first the switchgears' positioning indicators have to be connected to the digital inputs of the protection device. One of the position indicators (either the »Aux ON*«* or the »Aux OFF*«)* contact has to be connected necessarily. It is recommended to connect both contacts.

Thereafter the command outputs (relay outputs) have to be connected with the switchgear.

NOTICE **Please observe the following option: In the general settings of a circuit breaker, the ON/OFF commands of a protection element can be issued to the same output relays, where the other control commands are issued.**
If the commands are issued to different relays output relays the amount of wiring increases.

Assignment of Position Indications

The position indication is needed by the device to get (evaluate) the information about the current status /position of the breaker. The switchgears' position is shown in the devices display. Each position change results in a change of the switchgear symbol.

NOTICE

For the detection of a switchgear's position always two separate Aux contacts are recommended! If only one Aux contact is used, no intermediate or disturbed positions can be detected.
A reduced transition supervision (time between issue of the command and position feedback indication of the switchgear) is also possible by one Aux contact.

In the menu [Control/Bkr/Pos Indicators wiring] the assignments for the position indications have to be set.

*Detection of switchgear position with two Aux contacts – **Aux ON and Aux OFF (recommended!)***

For detection of position the switchgear is provided with Aux contacts (Aux ON and Aux OFF). It is recommended to use both contacts to detect intermediate and disturbed positions too.

The protection device continuously supervises the status of the inputs *»Aux ON-I«* and *»Aux OFF-I«.*
These signals are validated based on the supervision timers »*t-Move ON«* and »*t-Move OFF«* validation functions. As a result, the switchgear position will be detected by the following signals:

- Pos ON
- Pos OFF
- Pos Indeterm
- Pos Disturb.
- Pos (State=0,1,.2 or 3)

Supervision of the ON command
When an ON command is initiated, the »*t-Move ON«* timer will be started. While the timer is running, the »POS INDETERM« State will become true. If the command is executed and properly fed back from the switchgear before the timer has run down, »POS ON« will become true. Otherwise, if the timer has expired »POS DISTURB« will become true.

Supervision of the OFF command
When an OFF command is initiated, the »*t-Move OFF«* timer will be started. While the timer is running, the »POS INDETERM« State will become true. If the command is executed and properly fed back before the timer has run down, »POS OFF« will become true. Otherwise, if the timer has expired »POS DISTURB« will become true.

The following table shows how switchgear positions are validated:

States of the Digital Inputs		***Validated Switchgear Positions***				
Aux ON-I	*Aux OFF-I*	*POS ON*	*POS OFF*	*POS Indeterm*	*POS Disturb*	*POS State*
0	0	0	0	1 (while a Moving timer is running)	0 (while a Moving timer is running)	0 Intermediate
1	1	0	0	1 (while a Moving timer is running)	0 (while a Moving timer is running)	0 Intermediate
0	1	0	1	0	0	1 OFF
1	0	1	0	0	0	2 ON
0	0	0	0	0 (Moving timer elapsed)	1 (Moving timer elapsed)	3 Disturbed
1	1	0	0	0 (Moving timer elapsed)	1 (Moving timer elapsed)	3 Disturbed

Single Position Indication ***Aux ON or Aux OFF***

If the single pole indication is used, the »SI SINGLECONTACTIND« will become true.

The moving time supervision works only in one direction. If the Aux OFF signal is connected to the device, only the “OFF command” can be supervised and if the Aux ON signal is connected to the device, only the “ON command” can be supervised.

Single Position Indication – ***Aux ON***

If only the Aux ON signal is used for the Status Indication of an “ON command”, the switch command will also start the moving time, the position indication indicates an INTERMEDIATE position during this time interval. When the switchgear reaches the end position indicated by the signals »POS ON« and »CES SUCCESF« before the moving time has elapsed the signal Pos Indeterm disappears.

If the moving time elapsed before the switchgear has reached the end position, the switching operation was not successful and the Position Indication will change to POS Disturb and the signal Pos Indeterm disappears.

The following table shows how breaker positions are validated based on ***Aux ON****:*

States of the Digital Input		***Validated Switchgear Positions***				
Aux ON-I	*Aux OFF-I*	*POS ON*	*POS OFF*	*POS Indeterm*	*POS Disturb*	*POS State*
0	Not wired	0	0	1 (while t-Move ON is running)	0 (while t-Move ON is running)	0 Intermediate
0	Not wired	0	1	0	0	1 OFF
1	Not wired	1	0	0	0	2 ON

If there is no digital input assigned to the *»Aux On«* contact, the position indication will have the value 3 (disturbed).

*Single Position Indication – **Aux OFF***

If only the Aux OFF signal is used for the monitoring of the “OFF command”, the switch command will start the moving timer. The Position Indication will indicate an INTERMEDIATE position. When the the switchgear reaches its end position before the moving timer elapses, and »CES succesf« will be indicated. At the same time the signal »Pos Indeterm« disappears.
If the moving time elapsed before the switchgear has reached the OFF position, the switching operation was not successful and the Position Indication will change to »Pos Disturb« and the signal »Pos Indeterm« disappears.

*The following table shows how breaker positions are validated based on **Aux OFF**:*

States of the Digital Input		***Validated Switchgear Positions***				
Aux ON-I	*Aux OFF-I*	*POS ON*	*POS OFF*	*POS Indeterm*	*POS Disturb*	*POS State*
Not wired	0	0	0	1 (while t-Move OFF is running)	0 (while t-Move OFF is running)	0 Intermediate
Not wired	0	0	1	0	0	1 OFF
Not wired	1	1	0	0	0	2 ON

If there is no digital input assigned to the *»Aux OFF«* contact, the position indication will have the value 3 (disturbed).

Setting of Supervision Times

In the menu [Control/Bkr/General Settings] the supervision times of the individual switchgear have to be set. Dependent on the type of switchgear it can be necessary to set further parameters.

Interlockings

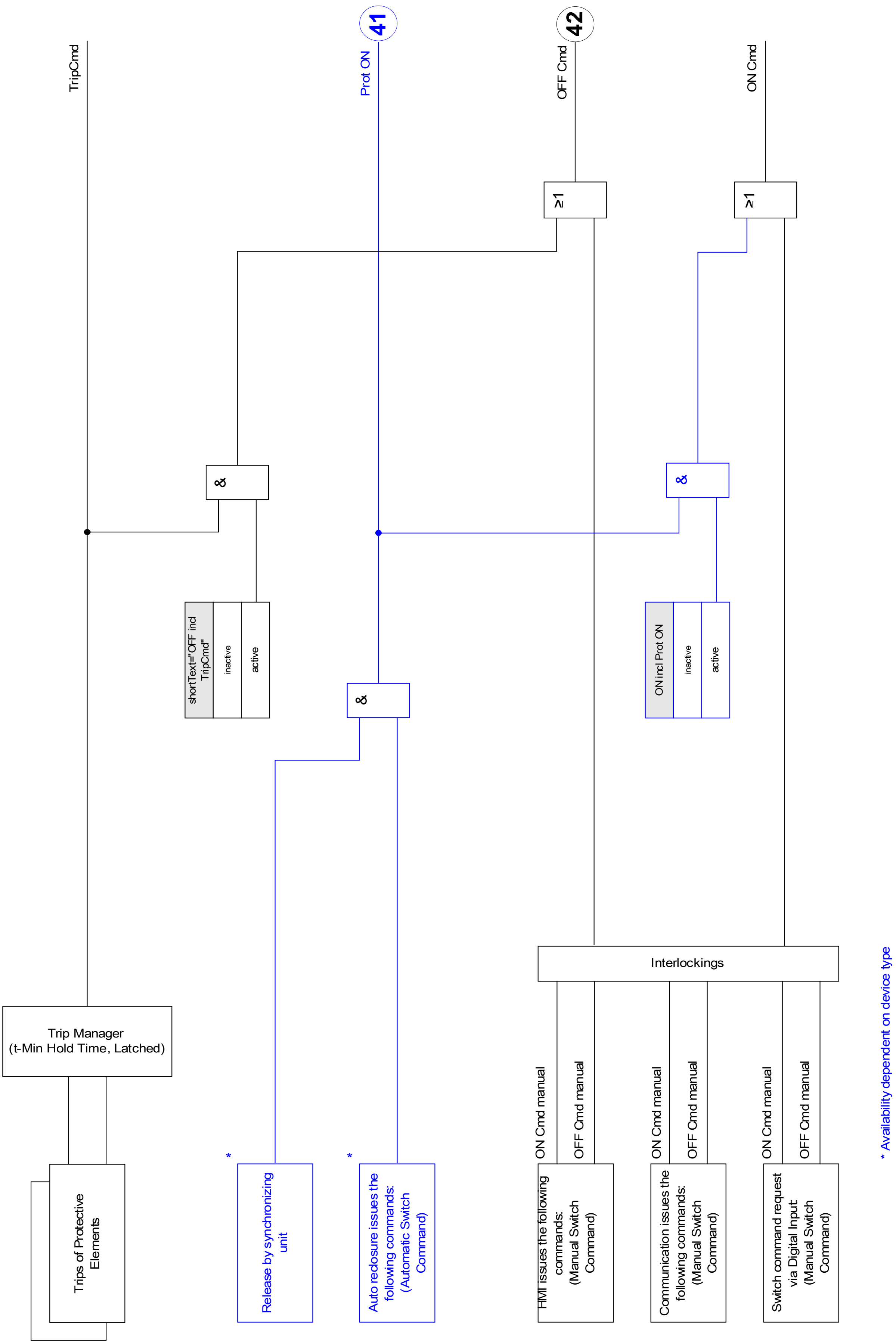
To avoid faulty operations, interlockings have to be provided. This can be realised mechanically, or electrically within the menu [Control/Bkr/General Settings] .

For a controllable switchgear up to three interlockings can be assigned in both switching directions (ON/OFF). These interlockings prevent switching in the corresponding direction.

The protection OFF command and the reclosing command of the AR* module are always executed without interlockings. For the case, that a protection OFF command must not be issued, this must be blocked separately.

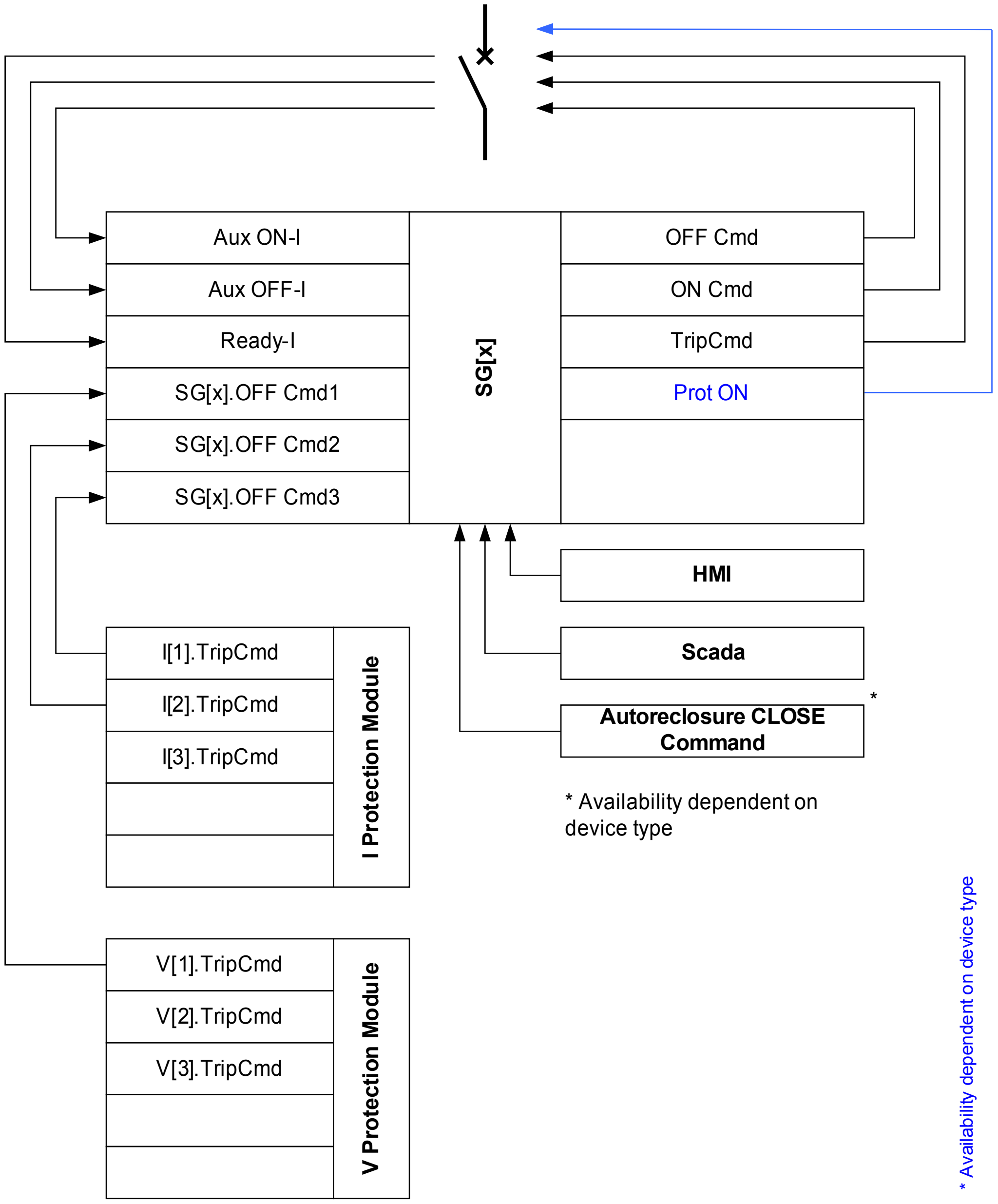
Further interlockings can be realised by means of the Logic module.

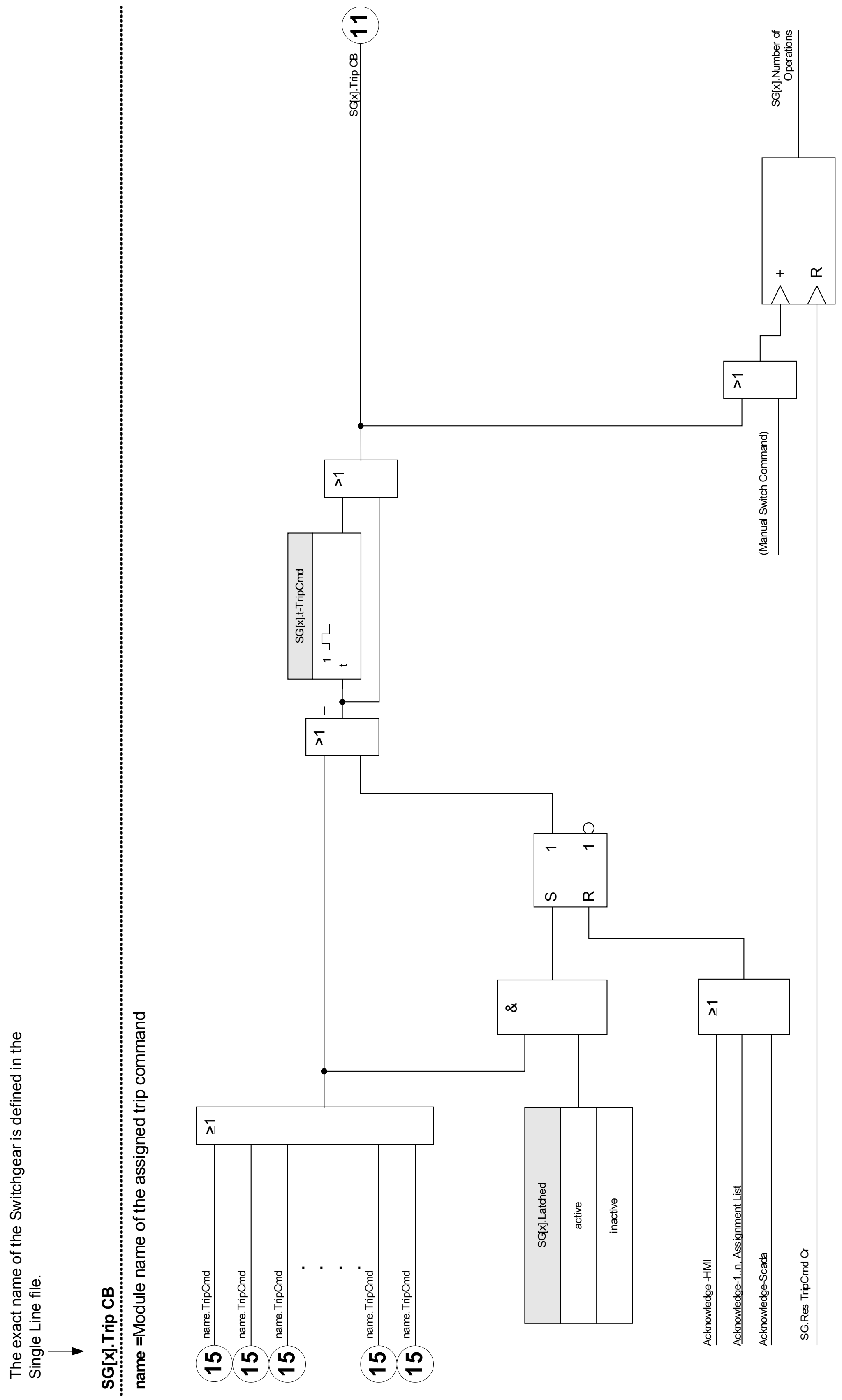
*=availability depends on ordered device.


TripCmd
Prot ON
41
OFF Cmd
42
ON Cmd
≥1
≥1
&
&
&
shortText="OFF incl TripCmd"
inactive
active
ON incl Prot ON
inactive
active
Interlockings
Trip Manager
(t-Min Hold Time, Latched)
Trips of Protective Elements
*
Release by synchronizing unit
*
Auto reclosure issues the following commands: (Automatic Switch Command)
ON Cmd manual
OFF Cmd manual
HMI issues the following commands: (Manual Switch Command)
ON Cmd manual
OFF Cmd manual
Communication issues the following commands: (Manual Switch Command)
ON Cmd manual
OFF Cmd manual
Switch command request via Digital Input: (Manual Switch Command)
* Availability dependent on device type

Trip Manager – Assignment of commands

The trip commands of the protection elements have to be assigned within menu [Control/Bkr/Trip Manager] to the switchgear (presumed, that the switchgear is make/break capable) .
In the Trip Manger all tripping commands are combined by an "OR" logic. The actual tripping command to the switchgear is exclusively given by the Trip Manager. This means, that only tripping commands which are assigned in the Trip Manager lead to an operation of the switchgear. In addition to that, the User can set the minimum hold time of the tripping command within this module and define whether the tripping command is latched or not.





The exact name of the Switchgear is defined in the Single Line file.
SG[x].Trip CB
name =Module name of the assigned trip command
15
name.TripCmd
≥1
SG[x].Latched
active
inactive
&
Acknowledge -HMI
Acknowledge-1..n, Assignment List
Acknowledge-Scada
SG.Res TripCmd Cr
S
R
1
>1
SG[x].t-TripCmd
t
SG[x].Trip CB
11
(Manual Switch Command)
+
SG[x].Number of Operations

Ex ON/OFF

If the switchgear should be opened or closed by an external signal, the User can assign one signal that will trigger the ON and one signal that will trigger the OFF command (e.g. digital inputs or output signals of the Logics) within menu [Control/Bkr/Ex ON/OFF Cmd] . An OFF command has priority. ON commands are slope oriented, OFF commands are level oriented

Synchronised Switching*

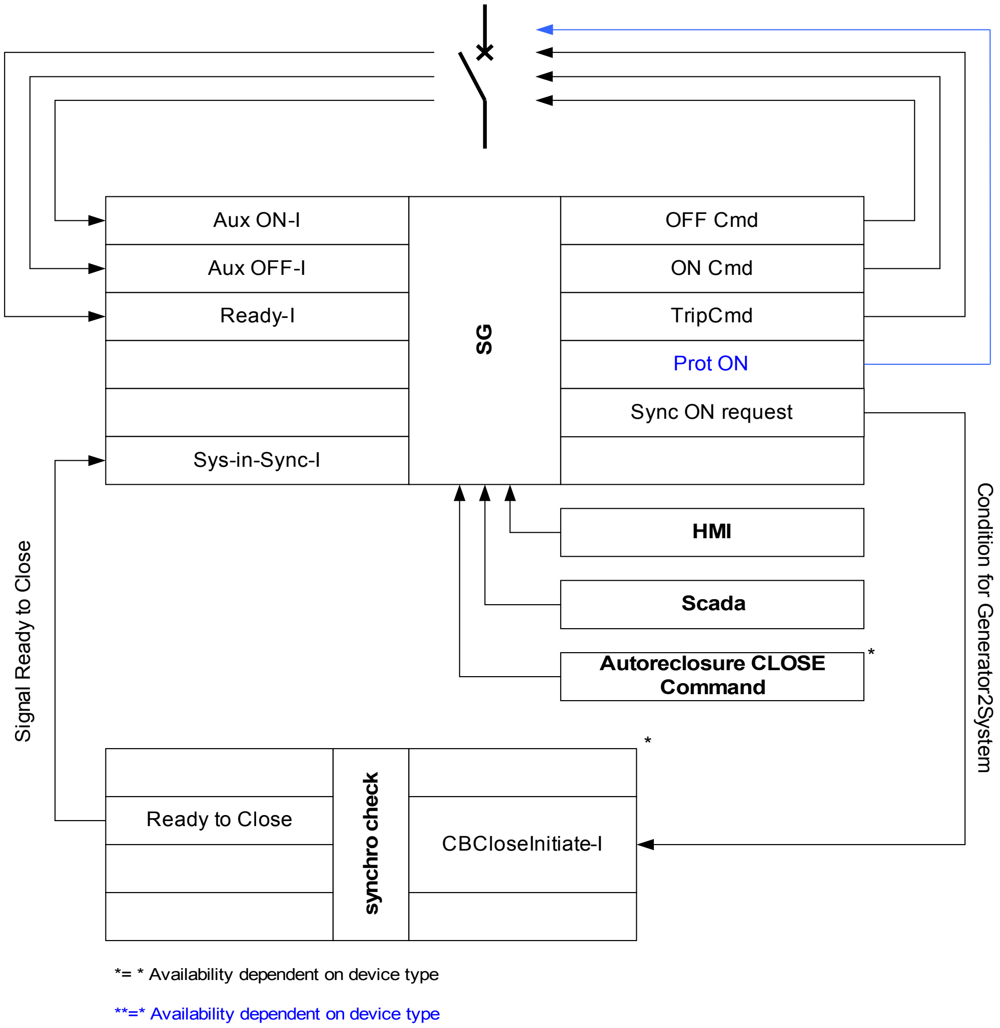
*=availability depends on ordered device type

Before a switchgear may connect two mains sections, synchronism of these sections must be assured.
In the submenu [Synchronous Switching] the parameter »Synchronism« defines which signal indicates synchronism.

If the synchronism condition shall be evaluated by the internal Synch-Check module the signal *»Sync. Ready to Close«* (release by synch-check module) has to be assigned. Alternatively a digital input or a logic output can be assigned.

In the synchronisation mode "Generator-to-System" additionally the synchronism request has to be assigned to the Sync-check function in the menu [Protection Para\Global Prot Para\Sync].

If a synchronism signal is assigned, the switching command will only be executed, when the synchronism signal will become true within the maximum supervision time »*t-MaxSyncSuperv«.* This supervision time will be started with the issued ON command. If no synchronism signal has been assigned, the synchronism release is permanently.



Switching Authority

For the Switching Authority [Control\General Settings], the following general settings are possible:

NONE:	No control function;
LOCAL:	Control only via push buttons at the panel;
REMOTE:	Control only via SCADA, digital inputs, or internal signals; and
LOCAL&REMOTE:	Control via push buttons, SCADA, digital inputs, or internal signals.

Non interlocked Switching

For test purposes, during commissioning and temporarily operations, interlockings can be disabled.

WARNING **WARNING: Non interlocked Switching can lead to serious injuries or death!**

For non interlocked switching the menü [Control\General Settings] provides the following options:

- Non interlocked switching for one single command
- Permanent
- Non interlocked switching for a certain time
- Non interlocked switching, activated by an assigned signal

The set time for non interlocked switching applies also for the „single Operation“ mode.

Manual Manipulation of the Switchgear Position

In case of faulty position indication contacts (Aux contacts) or broken wires, the position indication resulted from the assigned signals can be manipulated (overwritten) manually, to keep the ability to switch the affected switchgear. A manipulated switchgearposition will be indicated on the display by an exclamation mark "!" beside the switchgear symbol.

WARNING **WARNING: Manipulation of the Switchgear Position can lead to serious injuries or death!**

Double Operation Locking

All control commands to any switchgear in a bay have to be processed sequentially. During a running control command no other command will be handled.

Switch Direction Control

Switching command are validated before execution. When the switchgear is already in the desired position, the switch command will not be issued again. An opened circuit breaker cannot be opened again. This also applies for switching command at the HMI or via SCADA.

Anti Pumping

By pressing the ON command softkey only a single switching ON impulse will be issued independent, how low the softkey is actuated. The switchgear will close only once per close command.

Counters of the Switching Authority

Name	*Description*	*Assignment via*
CES SAuthority	Command Execution Supervision: Number of rejected Commands because of missing switching authority.	[]
CES DoubleOperating	Command Execution Supervision: Number of rejected Commands because a second switch command is in conflict with a pending one.	[]
CES No. of rej. Com	Command Execution Supervision: Number of rejected Commands because Locked by ParaSystem	[]

Switchgear Wear

NOTICE

NOTICE: Current related functions of the swichtgear wear element (e.g. breaker wear curve) are available in devices only, that offer minimum one current measurement (card).

Switchgear Wear Features

The sum of the accumulated interrupted currents.

A »SGwear Slow Switchgear« might indicate malfunction at an early stage.

The protective relay will calculate the »SG OPEN Capacity*«* continuously. 100% means, that switchgear maintenance is mandatory now.

The protective relay will make a alarm decision based on the curve that the user provides.

The relay will monitor the frequency of ON/OFF cycles. The User can set thresholds for the maximum allowed sum of interrupt currents and the maximum allowed sum of interrupt currents per hour. By means of this alarm, excessive switchgear operations can be detected at an early stage.

Slow Switchgear Alarm

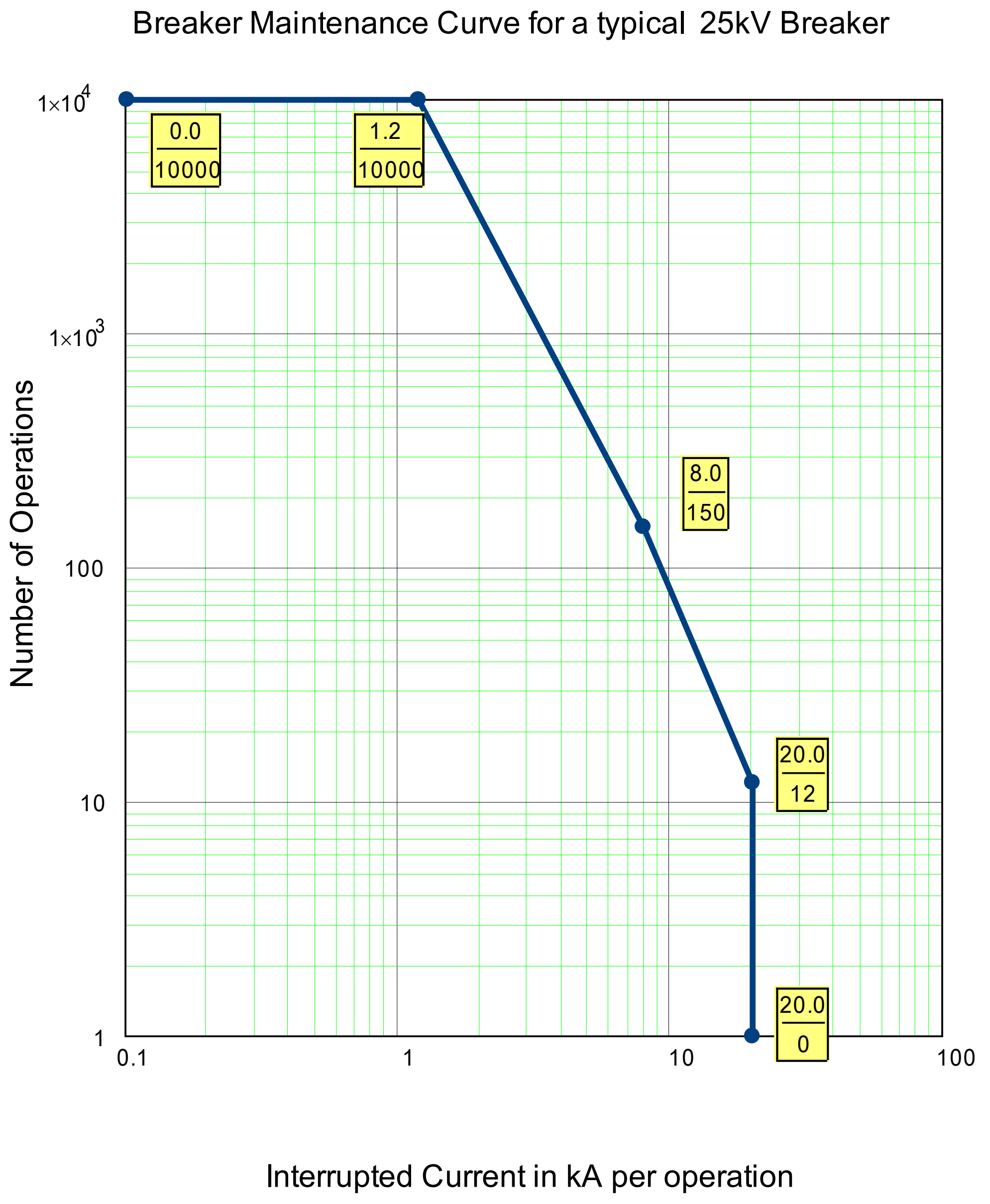
An increase of the close or opening time of the switchgear is an indication for the maintenance need. If the measured time exceeds the time »*t-Move OFF«* or »*t-Move ON«,* the signal »SGwear Slow Switchgear« will be activated.

Switchgear Wear Curve

In order to keep the switchgear in good working condition, the switchgear needs to be monitored. The switchgear health (operation life) depends above all on:

- The number of CLOSE/OPEN cycles.
- The amplitudes of the interrupting currents.
- The frequency that the switchgear operates (Operations per hour).

The User has to maintain the switchgear accordingly to the maintenance schedule that is to be provided by the manufacturer (switchgear operation statistics). By means of up to ten points that the user can replicate the switchgear wear curve within menu [Control/SG/SG[x]/SGW] . Each point has two settings: the interrupt current in kilo amperes and the allowed operation counts. No matter how many points are used, the operation counts the last point as zero. The protective relay will interpolate the allowed operations based on the switchgear wear curve. When the interrupted current is greater than the interrupt current at the last point, the protective relay will assume zero operation counts.



Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Operations Alarm	Service Alarm, too many Operations	1 - 100000	9999	[Control /SG /SG[1] /SG Wear]

Breaker Wear Signals (Output States)

Signal	*Description*
Operations Alarm	Signal: Service Alarm, too many Operations
Res TripCmd Cr	Signal: Resetting of the Counter: total number of trip commands

Breaker Wear Counter Values

Value	*Description*	*Default*	*Size*	*Menu path*
TripCmd Cr	Counter: Total number of trips of the switchgear (circuit breaker, load break switch…). Resettable with Total or All.	0	0 - 200000	[Operation /Count and RevData /Ctrl /SG[1]]

Direct Commands of the Breaker Wear Module

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

Control Parameters

Ctrl

Direct Commands of the Control Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Switching Authority	Switching Authority	None, Local, Remote, Local and Remote	Local	[Control /General settings]
NonInterl	DC for Non-Interlocking	inactive, active	inactive	[Control /General settings]

Global Protection Parameters of the Control Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Res NonIL	Resetmode Non-Interlocking	single Operation, timeout, permanent	single Operation	[Control /General settings]
Timeout NonIL	Timeout Non-Interlocking Only available if: Res NonIL = permanent	2 - 3600s	60s	[Control /General settings]
NonIL Assign	Assignment Non-Interlocking	1..n, Assignment List	-.-	[Control /General settings]

Control Moduel Input States

Name	*Description*	*Assignment via*
NonInterl-I	Non-Interlocking	[Control /General settings]

Signals of the Control Module

Signal	*Description*
Local	Switching Authority: Local
Remote	Switching Authority: Remote
NonInterl	Non-Interlocking is active
SG Indeterm	Minimum one Switchgear is moving (Position cannot be determined).
SG Disturb	Minimum one Switchgear is disturbed.

Synchronization inputs

Parameter	*Description*
-.-	No assignment
Sync.Ready to Close	Signal: Ready to Close
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
Logics.LE1.Gate Out	Signal: Output of the logic gate
Logics.LE1.Timer Out	Signal: Timer Output
Logics.LE1.Out	Signal: Latched Output (Q)
Logics.LE1.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE2.Gate Out	Signal: Output of the logic gate
Logics.LE2.Timer Out	Signal: Timer Output
Logics.LE2.Out	Signal: Latched Output (Q)
Logics.LE2.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE3.Gate Out	Signal: Output of the logic gate
Logics.LE3.Timer Out	Signal: Timer Output
Logics.LE3.Out	Signal: Latched Output (Q)
Logics.LE3.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE4.Gate Out	Signal: Output of the logic gate
Logics.LE4.Timer Out	Signal: Timer Output
Logics.LE4.Out	Signal: Latched Output (Q)
Logics.LE4.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE5.Gate Out	Signal: Output of the logic gate

Logics.LE5.Timer Out	Signal: Timer Output
Logics.LE5.Out	Signal: Latched Output (Q)
Logics.LE5.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE6.Gate Out	Signal: Output of the logic gate
Logics.LE6.Timer Out	Signal: Timer Output
Logics.LE6.Out	Signal: Latched Output (Q)
Logics.LE6.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE7.Gate Out	Signal: Output of the logic gate
Logics.LE7.Timer Out	Signal: Timer Output
Logics.LE7.Out	Signal: Latched Output (Q)
Logics.LE7.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE8.Gate Out	Signal: Output of the logic gate
Logics.LE8.Timer Out	Signal: Timer Output
Logics.LE8.Out	Signal: Latched Output (Q)
Logics.LE8.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE9.Gate Out	Signal: Output of the logic gate
Logics.LE9.Timer Out	Signal: Timer Output
Logics.LE9.Out	Signal: Latched Output (Q)
Logics.LE9.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE10.Gate Out	Signal: Output of the logic gate
Logics.LE10.Timer Out	Signal: Timer Output
Logics.LE10.Out	Signal: Latched Output (Q)
Logics.LE10.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE11.Gate Out	Signal: Output of the logic gate
Logics.LE11.Timer Out	Signal: Timer Output
Logics.LE11.Out	Signal: Latched Output (Q)
Logics.LE11.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE12.Gate Out	Signal: Output of the logic gate
Logics.LE12.Timer Out	Signal: Timer Output
Logics.LE12.Out	Signal: Latched Output (Q)
Logics.LE12.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE13.Gate Out	Signal: Output of the logic gate
Logics.LE13.Timer Out	Signal: Timer Output
Logics.LE13.Out	Signal: Latched Output (Q)
Logics.LE13.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE14.Gate Out	Signal: Output of the logic gate
Logics.LE14.Timer Out	Signal: Timer Output
Logics.LE14.Out	Signal: Latched Output (Q)
Logics.LE14.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE15.Gate Out	Signal: Output of the logic gate
Logics.LE15.Timer Out	Signal: Timer Output

Logics.LE15.Out	Signal: Latched Output (Q)
Logics.LE15.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE16.Gate Out	Signal: Output of the logic gate
Logics.LE16.Timer Out	Signal: Timer Output
Logics.LE16.Out	Signal: Latched Output (Q)
Logics.LE16.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE17.Gate Out	Signal: Output of the logic gate
Logics.LE17.Timer Out	Signal: Timer Output
Logics.LE17.Out	Signal: Latched Output (Q)
Logics.LE17.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE18.Gate Out	Signal: Output of the logic gate
Logics.LE18.Timer Out	Signal: Timer Output
Logics.LE18.Out	Signal: Latched Output (Q)
Logics.LE18.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE19.Gate Out	Signal: Output of the logic gate
Logics.LE19.Timer Out	Signal: Timer Output
Logics.LE19.Out	Signal: Latched Output (Q)
Logics.LE19.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE20.Gate Out	Signal: Output of the logic gate
Logics.LE20.Timer Out	Signal: Timer Output
Logics.LE20.Out	Signal: Latched Output (Q)
Logics.LE20.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE21.Gate Out	Signal: Output of the logic gate
Logics.LE21.Timer Out	Signal: Timer Output
Logics.LE21.Out	Signal: Latched Output (Q)
Logics.LE21.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE22.Gate Out	Signal: Output of the logic gate
Logics.LE22.Timer Out	Signal: Timer Output
Logics.LE22.Out	Signal: Latched Output (Q)
Logics.LE22.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE23.Gate Out	Signal: Output of the logic gate
Logics.LE23.Timer Out	Signal: Timer Output
Logics.LE23.Out	Signal: Latched Output (Q)
Logics.LE23.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE24.Gate Out	Signal: Output of the logic gate
Logics.LE24.Timer Out	Signal: Timer Output
Logics.LE24.Out	Signal: Latched Output (Q)
Logics.LE24.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE25.Gate Out	Signal: Output of the logic gate
Logics.LE25.Timer Out	Signal: Timer Output
Logics.LE25.Out	Signal: Latched Output (Q)

Logics.LE25.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE26.Gate Out	Signal: Output of the logic gate
Logics.LE26.Timer Out	Signal: Timer Output
Logics.LE26.Out	Signal: Latched Output (Q)
Logics.LE26.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE27.Gate Out	Signal: Output of the logic gate
Logics.LE27.Timer Out	Signal: Timer Output
Logics.LE27.Out	Signal: Latched Output (Q)
Logics.LE27.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE28.Gate Out	Signal: Output of the logic gate
Logics.LE28.Timer Out	Signal: Timer Output
Logics.LE28.Out	Signal: Latched Output (Q)
Logics.LE28.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE29.Gate Out	Signal: Output of the logic gate
Logics.LE29.Timer Out	Signal: Timer Output
Logics.LE29.Out	Signal: Latched Output (Q)
Logics.LE29.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE30.Gate Out	Signal: Output of the logic gate
Logics.LE30.Timer Out	Signal: Timer Output
Logics.LE30.Out	Signal: Latched Output (Q)
Logics.LE30.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE31.Gate Out	Signal: Output of the logic gate
Logics.LE31.Timer Out	Signal: Timer Output
Logics.LE31.Out	Signal: Latched Output (Q)
Logics.LE31.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE32.Gate Out	Signal: Output of the logic gate
Logics.LE32.Timer Out	Signal: Timer Output
Logics.LE32.Out	Signal: Latched Output (Q)
Logics.LE32.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE33.Gate Out	Signal: Output of the logic gate
Logics.LE33.Timer Out	Signal: Timer Output
Logics.LE33.Out	Signal: Latched Output (Q)
Logics.LE33.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE34.Gate Out	Signal: Output of the logic gate
Logics.LE34.Timer Out	Signal: Timer Output
Logics.LE34.Out	Signal: Latched Output (Q)
Logics.LE34.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE35.Gate Out	Signal: Output of the logic gate
Logics.LE35.Timer Out	Signal: Timer Output
Logics.LE35.Out	Signal: Latched Output (Q)
Logics.LE35.Out inverted	Signal: Negated Latched Output (Q NOT)

Logics.LE36.Gate Out	Signal: Output of the logic gate
Logics.LE36.Timer Out	Signal: Timer Output
Logics.LE36.Out	Signal: Latched Output (Q)
Logics.LE36.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE37.Gate Out	Signal: Output of the logic gate
Logics.LE37.Timer Out	Signal: Timer Output
Logics.LE37.Out	Signal: Latched Output (Q)
Logics.LE37.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE38.Gate Out	Signal: Output of the logic gate
Logics.LE38.Timer Out	Signal: Timer Output
Logics.LE38.Out	Signal: Latched Output (Q)
Logics.LE38.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE39.Gate Out	Signal: Output of the logic gate
Logics.LE39.Timer Out	Signal: Timer Output
Logics.LE39.Out	Signal: Latched Output (Q)
Logics.LE39.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE40.Gate Out	Signal: Output of the logic gate
Logics.LE40.Timer Out	Signal: Timer Output
Logics.LE40.Out	Signal: Latched Output (Q)
Logics.LE40.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE41.Gate Out	Signal: Output of the logic gate
Logics.LE41.Timer Out	Signal: Timer Output
Logics.LE41.Out	Signal: Latched Output (Q)
Logics.LE41.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE42.Gate Out	Signal: Output of the logic gate
Logics.LE42.Timer Out	Signal: Timer Output
Logics.LE42.Out	Signal: Latched Output (Q)
Logics.LE42.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE43.Gate Out	Signal: Output of the logic gate
Logics.LE43.Timer Out	Signal: Timer Output
Logics.LE43.Out	Signal: Latched Output (Q)
Logics.LE43.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE44.Gate Out	Signal: Output of the logic gate
Logics.LE44.Timer Out	Signal: Timer Output
Logics.LE44.Out	Signal: Latched Output (Q)
Logics.LE44.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE45.Gate Out	Signal: Output of the logic gate
Logics.LE45.Timer Out	Signal: Timer Output
Logics.LE45.Out	Signal: Latched Output (Q)
Logics.LE45.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE46.Gate Out	Signal: Output of the logic gate

Logics.LE46.Timer Out	Signal: Timer Output
Logics.LE46.Out	Signal: Latched Output (Q)
Logics.LE46.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE47.Gate Out	Signal: Output of the logic gate
Logics.LE47.Timer Out	Signal: Timer Output
Logics.LE47.Out	Signal: Latched Output (Q)
Logics.LE47.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE48.Gate Out	Signal: Output of the logic gate
Logics.LE48.Timer Out	Signal: Timer Output
Logics.LE48.Out	Signal: Latched Output (Q)
Logics.LE48.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE49.Gate Out	Signal: Output of the logic gate
Logics.LE49.Timer Out	Signal: Timer Output
Logics.LE49.Out	Signal: Latched Output (Q)
Logics.LE49.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE50.Gate Out	Signal: Output of the logic gate
Logics.LE50.Timer Out	Signal: Timer Output
Logics.LE50.Out	Signal: Latched Output (Q)
Logics.LE50.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE51.Gate Out	Signal: Output of the logic gate
Logics.LE51.Timer Out	Signal: Timer Output
Logics.LE51.Out	Signal: Latched Output (Q)
Logics.LE51.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE52.Gate Out	Signal: Output of the logic gate
Logics.LE52.Timer Out	Signal: Timer Output
Logics.LE52.Out	Signal: Latched Output (Q)
Logics.LE52.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE53.Gate Out	Signal: Output of the logic gate
Logics.LE53.Timer Out	Signal: Timer Output
Logics.LE53.Out	Signal: Latched Output (Q)
Logics.LE53.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE54.Gate Out	Signal: Output of the logic gate
Logics.LE54.Timer Out	Signal: Timer Output
Logics.LE54.Out	Signal: Latched Output (Q)
Logics.LE54.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE55.Gate Out	Signal: Output of the logic gate
Logics.LE55.Timer Out	Signal: Timer Output
Logics.LE55.Out	Signal: Latched Output (Q)
Logics.LE55.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE56.Gate Out	Signal: Output of the logic gate
Logics.LE56.Timer Out	Signal: Timer Output

Logics.LE56.Out	Signal: Latched Output (Q)
Logics.LE56.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE57.Gate Out	Signal: Output of the logic gate
Logics.LE57.Timer Out	Signal: Timer Output
Logics.LE57.Out	Signal: Latched Output (Q)
Logics.LE57.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE58.Gate Out	Signal: Output of the logic gate
Logics.LE58.Timer Out	Signal: Timer Output
Logics.LE58.Out	Signal: Latched Output (Q)
Logics.LE58.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE59.Gate Out	Signal: Output of the logic gate
Logics.LE59.Timer Out	Signal: Timer Output
Logics.LE59.Out	Signal: Latched Output (Q)
Logics.LE59.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE60.Gate Out	Signal: Output of the logic gate
Logics.LE60.Timer Out	Signal: Timer Output
Logics.LE60.Out	Signal: Latched Output (Q)
Logics.LE60.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE61.Gate Out	Signal: Output of the logic gate
Logics.LE61.Timer Out	Signal: Timer Output
Logics.LE61.Out	Signal: Latched Output (Q)
Logics.LE61.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE62.Gate Out	Signal: Output of the logic gate
Logics.LE62.Timer Out	Signal: Timer Output
Logics.LE62.Out	Signal: Latched Output (Q)
Logics.LE62.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE63.Gate Out	Signal: Output of the logic gate
Logics.LE63.Timer Out	Signal: Timer Output
Logics.LE63.Out	Signal: Latched Output (Q)
Logics.LE63.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE64.Gate Out	Signal: Output of the logic gate
Logics.LE64.Timer Out	Signal: Timer Output
Logics.LE64.Out	Signal: Latched Output (Q)
Logics.LE64.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE65.Gate Out	Signal: Output of the logic gate
Logics.LE65.Timer Out	Signal: Timer Output
Logics.LE65.Out	Signal: Latched Output (Q)
Logics.LE65.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE66.Gate Out	Signal: Output of the logic gate
Logics.LE66.Timer Out	Signal: Timer Output
Logics.LE66.Out	Signal: Latched Output (Q)

Logics.LE66.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE67.Gate Out	Signal: Output of the logic gate
Logics.LE67.Timer Out	Signal: Timer Output
Logics.LE67.Out	Signal: Latched Output (Q)
Logics.LE67.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE68.Gate Out	Signal: Output of the logic gate
Logics.LE68.Timer Out	Signal: Timer Output
Logics.LE68.Out	Signal: Latched Output (Q)
Logics.LE68.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE69.Gate Out	Signal: Output of the logic gate
Logics.LE69.Timer Out	Signal: Timer Output
Logics.LE69.Out	Signal: Latched Output (Q)
Logics.LE69.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE70.Gate Out	Signal: Output of the logic gate
Logics.LE70.Timer Out	Signal: Timer Output
Logics.LE70.Out	Signal: Latched Output (Q)
Logics.LE70.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE71.Gate Out	Signal: Output of the logic gate
Logics.LE71.Timer Out	Signal: Timer Output
Logics.LE71.Out	Signal: Latched Output (Q)
Logics.LE71.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE72.Gate Out	Signal: Output of the logic gate
Logics.LE72.Timer Out	Signal: Timer Output
Logics.LE72.Out	Signal: Latched Output (Q)
Logics.LE72.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE73.Gate Out	Signal: Output of the logic gate
Logics.LE73.Timer Out	Signal: Timer Output
Logics.LE73.Out	Signal: Latched Output (Q)
Logics.LE73.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE74.Gate Out	Signal: Output of the logic gate
Logics.LE74.Timer Out	Signal: Timer Output
Logics.LE74.Out	Signal: Latched Output (Q)
Logics.LE74.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE75.Gate Out	Signal: Output of the logic gate
Logics.LE75.Timer Out	Signal: Timer Output
Logics.LE75.Out	Signal: Latched Output (Q)
Logics.LE75.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE76.Gate Out	Signal: Output of the logic gate
Logics.LE76.Timer Out	Signal: Timer Output
Logics.LE76.Out	Signal: Latched Output (Q)
Logics.LE76.Out inverted	Signal: Negated Latched Output (Q NOT)

Logics.LE77.Gate Out	Signal: Output of the logic gate
Logics.LE77.Timer Out	Signal: Timer Output
Logics.LE77.Out	Signal: Latched Output (Q)
Logics.LE77.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE78.Gate Out	Signal: Output of the logic gate
Logics.LE78.Timer Out	Signal: Timer Output
Logics.LE78.Out	Signal: Latched Output (Q)
Logics.LE78.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE79.Gate Out	Signal: Output of the logic gate
Logics.LE79.Timer Out	Signal: Timer Output
Logics.LE79.Out	Signal: Latched Output (Q)
Logics.LE79.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE80.Gate Out	Signal: Output of the logic gate
Logics.LE80.Timer Out	Signal: Timer Output
Logics.LE80.Out	Signal: Latched Output (Q)
Logics.LE80.Out inverted	Signal: Negated Latched Output (Q NOT)

Assignable Trip Commands (Trip Manager)

Name	*Description*
-.-	No assignment
V[1].TripCmd	Signal: Trip Command
V[2].TripCmd	Signal: Trip Command
V[3].TripCmd	Signal: Trip Command
V[4].TripCmd	Signal: Trip Command
V[5].TripCmd	Signal: Trip Command
V[6].TripCmd	Signal: Trip Command
df/dt.TripCmd	Signal: Trip Command
delta phi.TripCmd	Signal: Trip Command
Intertripping.TripCmd	Signal: Trip Command
LVRT.TripCmd	Signal: Trip Command
VG[1].TripCmd	Signal: Trip Command
VG[2].TripCmd	Signal: Trip Command
V012[1].TripCmd	Signal: Trip Command
V012[2].TripCmd	Signal: Trip Command
V012[3].TripCmd	Signal: Trip Command
V012[4].TripCmd	Signal: Trip Command
V012[5].TripCmd	Signal: Trip Command
V012[6].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: Trip Command
ExP[2].TripCmd	Signal: Trip Command
ExP[3].TripCmd	Signal: Trip Command
ExP[4].TripCmd	Signal: Trip Command

Controlled Circuit Breaker

SG[1]

Direct Commands of a Controlled Circuit Breaker

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Manipulate Position	WARNING! Fake Position - Manual Position Manipulation	inactive, Pos OFF, Pos ON	inactive	[Control /SG /SG[1] /General settings]
Res SGwear Sl SG	Resetting the slow Switchgear Alarm	inactive, active	inactive	[Operation /Reset]
Ack TripCmd	Acknowledge Trip Command	inactive, active	inactive	[Operation /Acknowledge]

Global Protection Parameters of a Controlled Circuit Breaker

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Aux ON	The CB is in ON-position if the state of the assigned signal is true (52a).	1..n, DI-LogicList	DI Slot X1.DI 1	[Control /SG /SG[1] /Pos Indicatrs Wirng]
Aux OFF	The CB is in OFF-position if the state of the assigned signal is true (52b).	1..n, DI-LogicList	DI Slot X1.DI 2	[Control /SG /SG[1] /Pos Indicatrs Wirng]
Ready	Circuit breaker is ready for operation if the state of the assigned signal is true. This digital input can be used by some protective elements (if they are available within the device) like Auto Reclosure (AR), e.g. as a trigger signal.	1..n, DI-LogicList	-.-	[Control /SG /SG[1] /Pos Indicatrs Wirng]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Removed	The withdrawable circuit breaker is Removed	1..n, DI-LogicList	-.-	[Control /SG /SG[1] /Pos Indicatrs Wirng]
Interl ON1	Interlocking of the ON command	1..n, Assignment List	-.-	[Control /SG /SG[1] /Interlockings]
Interl ON2	Interlocking of the ON command	1..n, Assignment List	-.-	[Control /SG /SG[1] /Interlockings]
Interl ON3	Interlocking of the ON command	1..n, Assignment List	-.-	[Control /SG /SG[1] /Interlockings]
Interl OFF1	Interlocking of the OFF command	1..n, Assignment List	-.-	[Control /SG /SG[1] /Interlockings]
Interl OFF2	Interlocking of the OFF command	1..n, Assignment List	-.-	[Control /SG /SG[1] /Interlockings]
Interl OFF3	Interlocking of the OFF command	1..n, Assignment List	-.-	[Control /SG /SG[1] /Interlockings]
SCmd ON	Switching ON Command, e.g. the state of the Logics or the state of the digital input	1..n, DI-LogicList	-.-	[Control /SG /SG[1] /Ex ON/OFF Cmd]
SCmd OFF	Switching OFF Command, e.g. the state of the Logics or the state of the digital input	1..n, DI-LogicList	-.-	[Control /SG /SG[1] /Ex ON/OFF Cmd]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
t-TripCmd	Minimum hold time of the OFF-command (circuit breaker, load break switch)	0 - 300.00s	0.2s	[Control /SG /SG[1] /Trip Manager]
Latched	Defines whether the Binary Output Relay will be Latched when it picks up.	inactive, active	inactive	[Control /SG /SG[1] /Trip Manager]
Ack TripCmd	Ack TripCmd	1..n, Assignment List	-.-	[Control /SG /SG[1] /Trip Manager]
Off Cmd1	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	V[1].TripCmd	[Control /SG /SG[1] /Trip Manager]
Off Cmd2	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	V[2].TripCmd	[Control /SG /SG[1] /Trip Manager]
Off Cmd3	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	f[1].TripCmd	[Control /SG /SG[1] /Trip Manager]
Off Cmd4	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	f[2].TripCmd	[Control /SG /SG[1] /Trip Manager]
Off Cmd5	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]
Off Cmd6	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Off Cmd7	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]
Off Cmd8	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]
Off Cmd9	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]
Off Cmd10	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]
Off Cmd11	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]
Off Cmd12	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]
Off Cmd13	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]
Off Cmd14	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]
Off Cmd15	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Off Cmd16	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]
Off Cmd17	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]
Off Cmd18	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]
Off Cmd19	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]
Off Cmd20	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]
Off Cmd21	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]
Off Cmd22	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]
Off Cmd23	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]
Off Cmd24	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Off Cmd25	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]
Off Cmd26	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]
Off Cmd27	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]
Off Cmd28	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]
Off Cmd29	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]
Off Cmd30	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /SG[1] /Trip Manager]
Synchronism	Synchronism	1..n, In-SyncList	-.-	[Control /SG /SG[1] /Synchron Switchg]
t-MaxSyncSuperv	Synchron-Run timer: Max. time allowed for synchronizing process after a close initiate. Only used for GENERATOR2SYSTEM working mode.	0 - 3000.00s	0.2s	[Control /SG /SG[1] /Synchron Switchg]
ON incl Prot ON	The ON Command includes the ON Command issued by the Protection module.	inactive, active	active	[Control /SG /SG[1] /General settings]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
OFF incl TripCmd	The OFF Command includes the OFF Command issued by the Protection module.	inactive, active	active	[Control /SG /SG[1] /General settings]
t-Move ON	Time to move to the ON Position	0.01 - 100.00s	0.1s	[Control /SG /SG[1] /General settings]
t-Move OFF	Time to move to the OFF Position	0.01 - 100.00s	0.1s	[Control /SG /SG[1] /General settings]
t-Dwell	Dwell time	0 - 100.00s	0s	[Control /SG /SG[1] /General settings]

Controlled Circuit Breaker Input States

Name	*Description*	*Assignment via*
Aux ON-I	Module Input State: Position indicator/check-back signal of the CB (52a)	[Control /SG /SG[1] /Pos Indicatrs Wirng]
Aux OFF-I	Module input state: Position indicator/check-back signal of the CB (52b)	[Control /SG /SG[1] /Pos Indicatrs Wirng]
Ready-I	Module input state: CB ready	[Control /SG /SG[1] /Pos Indicatrs Wirng]
Sys-in-Sync-I	State of the module input: This signals has to become true within the synchronization time. If not, switching is unsuccessful.	[Control /SG /SG[1] /Synchron Switchg]

Name	*Description*	*Assignment via*
Removed-I	State of the module input: The withdrawable circuit breaker is Removed	[Control /SG /SG[1] /Pos Indicatrs Wirng]
Ack TripCmd-I	State of the module input: Acknowledgement Signal (only for automatic acknowledgement) Module input signal	[Control /SG /SG[1] /Trip Manager]
Interl ON1-I	State of the module input: Interlocking of the ON command	[Control /SG /SG[1] /Interlockings]
Interl ON2-I	State of the module input: Interlocking of the ON command	[Control /SG /SG[1] /Interlockings]
Interl ON3-I	State of the module input: Interlocking of the ON command	[Control /SG /SG[1] /Interlockings]
Interl OFF1-I	State of the module input: Interlocking of the OFF command	[Control /SG /SG[1] /Interlockings]
Interl OFF2-I	State of the module input: Interlocking of the OFF command	[Control /SG /SG[1] /Interlockings]
Interl OFF3-I	State of the module input: Interlocking of the OFF command	[Control /SG /SG[1] /Interlockings]
SCmd ON-I	State of the module input: Switching ON Command, e.g. the state of the Logics or the state of the digital input	[Control /SG /SG[1] /Ex ON/OFF Cmd]

Name	Description	Assignment via
SCmd OFF-I	State of the module input: Switching OFF Command, e.g. the state of the Logics or the state of the digital input	[Control /SG /SG[1] /Ex ON/OFF Cmd]

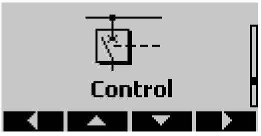
Signals of a Controlled Circuit Breaker

Signal	Description
SI SingleContactInd	Signal: The Position of the Switchgear is detected by one auxiliary contact (pole) only. Thus indeterminate and disturbed Positions cannot be detected.
Pos not ON	Signal: Pos not ON
Pos ON	Signal: Circuit Breaker is in ON-Position
Pos OFF	Signal: Circuit Breaker is in OFF-Position
Pos Indeterm	Signal: Circuit Breaker is in Indeterminate Position
Pos Disturb	Signal: Circuit Breaker Disturbed - Undefined Breaker Position. The Position Indicators contradict themselves. After expiring of a supervision timer this signal becomes true.
Pos	Signal: Circuit Breaker Position (0 = Indeterminate, 1 = OFF, 2 = ON, 3 = Disturbed)
Ready	Signal: Circuit breaker is ready for operation.
t-Dwell	Signal: Dwell time
Removed	Signal: The withdrawable circuit breaker is Removed
Interl ON	Signal: One or more IL_On inputs are active.
Interl OFF	Signal: One or more IL_Off inputs are active.
CES succesf	Signal: Command Execution Supervision: Switching command executed successfully.
CES Disturbed	Signal: Command Execution Supervision: Switching Command unsuccessful. Switchgear in disturbed position.
CES Fail TripCmd	Signal: Command Execution Supervision: Command execution failed because trip command is pending.
CES SwitchDir	Signal: Command Execution Supervision respectively Switching Direction Control: This signal becomes true, if a switch command is issued even though the switchgear is already in the requested position. Example: A switchgear that is already OFF should be switched OFF again (doubly). The same applies to CLOSE commands.
CES ON d OFF	Signal: Command Execution Supervision: On Command during a pending OFF Command.
CES SG not ready	Signal: Command Execution Supervision: Switchgear not ready
CES Fiel Interl	Signal: Command Execution Supervision: Switching Command not executed because of field interlocking.
CES SyncTimeout	Signal: Command Execution Supervision: Switching Command not executed. No Synchronization signal while t-sync was running.
CES SG removed	Signal: Command Execution Supervision: Switching Command unsuccessful, Switchgear removed.
Prot ON	Signal: ON Command issued by the Prot module
TripCmd	Signal: Trip Command
Ack TripCmd	Signal: Acknowledge Trip Command
ON incl Prot ON	Signal: The ON Command includes the ON Command issued by the Protection module.

Signal	*Description*
OFF incl TripCmd	Signal: The OFF Command includes the OFF Command issued by the Protection module.
Position Ind manipul	Signal: Position Indicators faked
SGwear Slow SG	Signal: Alarm, the circuit breaker (load-break switch) becomes slower
Res SGwear Sl SG	Signal: Resetting the slow Switchgear Alarm
ON Cmd	Signal: ON Command issued to the switchgear. Depending on the setting the signal may include the ON command of the Prot module.
OFF Cmd	Signal: OFF Command issued to the switchgear. Depending on the setting the signal may include the OFF command of the Prot module.
ON Cmd manual	Signal: ON Cmd manual
OFF Cmd manual	Signal: OFF Cmd manual
Sync ON request	Signal: Synchronous ON request

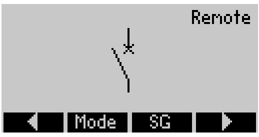
Control - Example: Switching of a Circuit Breaker

The following example shows how to switch a circuit breaker via the HMI at the device.



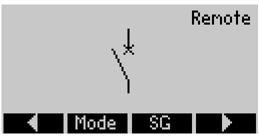
Change into the menu »Control« or alternatively push the »CTRL« button at the device front.

Change to the control page by pushing the »right arrow« softkey.

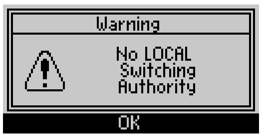


Information only: On the control page the current switchgear positions is displayed. By means of the softkey »Mode« it can be switched to the menu »General Settings«. In this menu switching authority and interlockings can be set.

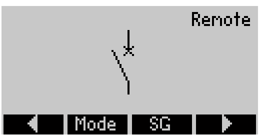
By means of the softkey »SG« it can be switched to the menu »SG«. In this menu specific settings for the switch gear can be done.



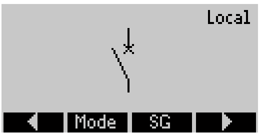
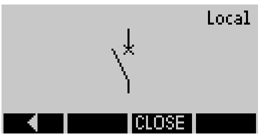
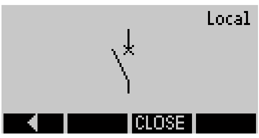
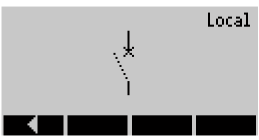
To execute a switching operation, change into the switching menu by pushing the right arrow softkey button.

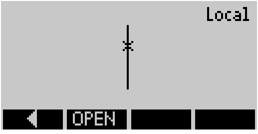


Executing a switching command via the devices HMI is only possible when the switching authority is set to »Local«. If no switching authority is given, this has to be set first to »Local« or »Local and Remote«.
With the softkey »OK« it can be switched back to the single line diagram page.



Pushing the softkey »Mode« leads to the menu »General Settings«.

	In this menu the switching authority can be changed.
	Select between »Local« or »Local and Remote«.
	Now it is possible to execute switching commands at the HMI.
	Push the »right arrow« softkey to get to the control page.
	The circuit breaker is opened, therefore it can be closed only. After pushing the softkey »CLOSE« a confirmation window appears.
	When you are sure to proceed with the switching operation, press the softkey »YES«.
	The switching command will be given to the circuit breaker. The display shows the intermediate position of the switchgear.

	It will be shown on the display when the switchgear reaches the new end position. Further possible switching operations (OPEN) will be displayed by softkeys.

	Notice: For the case, the switchgear does not reach the new end position within the set supervision time the following Warning appears on the display.

Protective Elements

Interconnection

Various state-of-the-art protective elements have been developed for the *HighPROTEC*. Due to the increasing role of distributed energy resources interconnection protection becomes more and more important. A new, sophisticated protection function package covers all protective elements for interconnection applications. This package can be found within menu [Interconnection].

These protective elements can be used flexible. They can be adapted easily by parameter settings to various international and local grid codes.

In the following an overview is given on this menu. Please refer for details on these protective elements to the corresponding chapters.

The Interconnection menu comprises:

A submenu with mains-decoupling elements. Depending on the grid codes that are to be taken into account various mains decoupling elements are mandatory (or forbidden). Within this menu, you have access to the following mains decoupling elements:

- ROCOF (df/dt) (please refer to chapter freqeuncy protection). This element is consistent with a Frequency Protection element, that is set to „df/dt“ within the Device Planning.
- Vector shift (delta phi) (please refer to chapter freqeuncy protection). This element is consistent with a Frequency Protection element, that is set to „delta phi“ within the Device Planning.
- Intertripping (please refer to chapter intertripping).

A submenu for Low Voltage Ride Through (please refer to the LVRT chapter).

A submenu for synchronization (please refer to the synchronization chapter).

NOTICE **The device offers also among other things for low voltage systems a voltage quality supervision based on the ten minutes sliding mean square measurement. (please refer to chapter Voltage Protection).**

V - Voltage Protection [27/59]

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

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 voltage elements are identically structured and can optionally be projected as over-, undervoltage or time dependent (polygon) 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«*

The following table shows the application options of the voltage protection element

Applications of the V-Protection Module	Setting in	Option
ANSI 27 Undervoltage protection	Device Planning menu Setting: V<	*Measuring Method*: Fundamental/TrueRMS Measuring Mode: Phase to ground, Phase-to-Phase
10 minutes sliding average supervision V<	Device Planning menu Setting: V<	*Measuring Method*: Umit Measuring Mode: Phase to ground, Phase-to-Phase
ANSI 59 Overvoltage protection	Device Planning menu Setting: V>	*Measuring Method*: Fundamental/TrueRMS Measuring Mode: Phase to ground, Phase-to-Phase
Sliding average supervision V>	Device Planning menu Setting: V>	*Measuring Method*: Vavg Measuring Mode: Phase to ground, Phase-to-Phase
ANSI 27(t) Voltage dependent undervoltage protection	Device Planning menu Setting: V(t)<	*Measuring Method*: Fundamental/TrueRMS Measuring Mode: Phase to ground, Phase-to-Phase

Measuring Method
For all protection elements it can be determined, whether the measurement is done on basis of the »*Fundamental*« or if »*TrueRMS*« measurement is used. In addition to that a sliding average supervision »*Vavg*« can be parametrized.

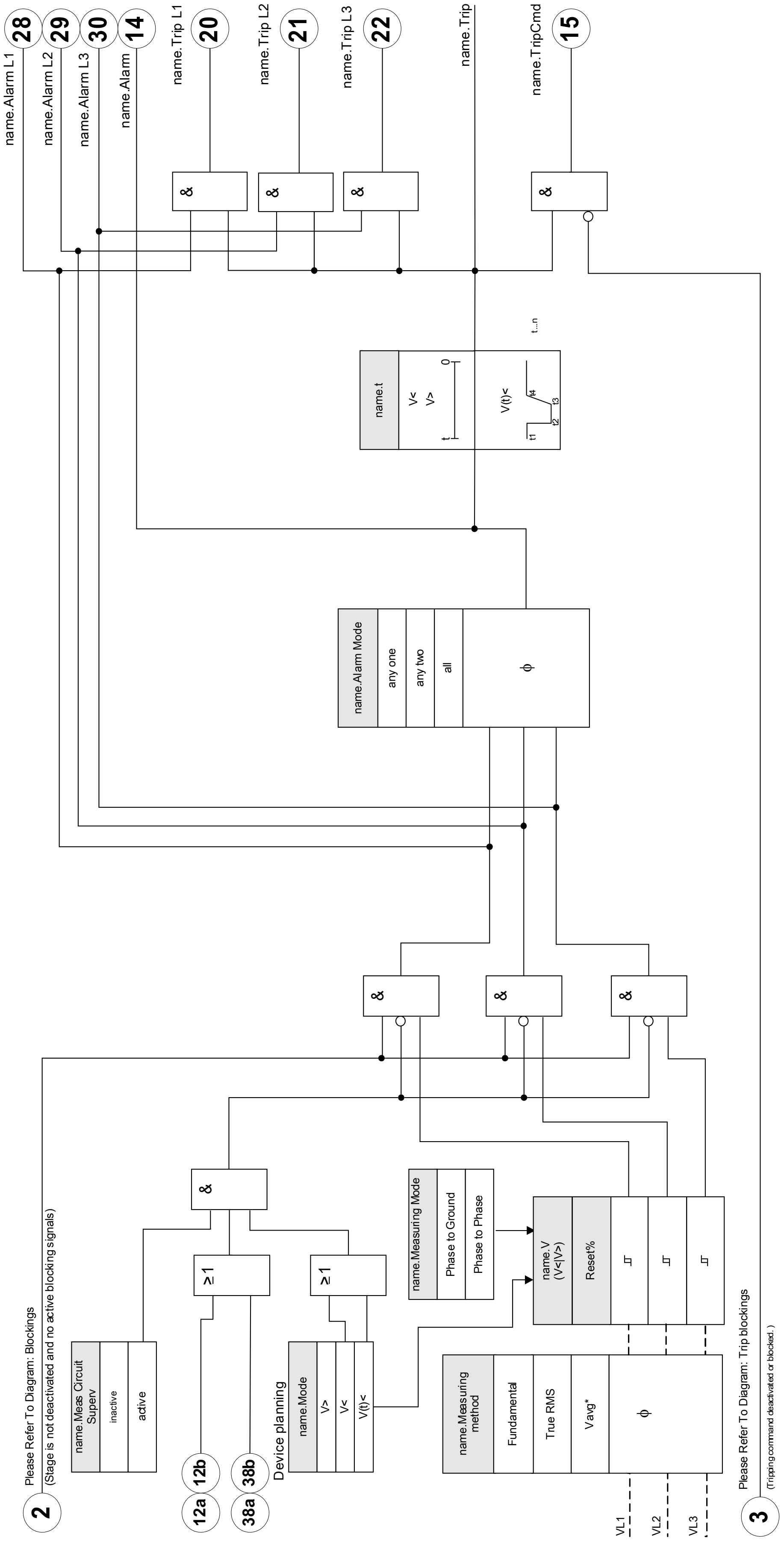
NOTICE **The required settings for the calculation of the “average value” of the “sliding average value supervision” have to be taken within menu [Device Para\Statistics\Vavg].**

Measuring Method
If the measuring inputs of the voltage measuring card is fed with "Phase-to-Ground" voltages, the Field Parameter »*VT con*« has to be set to »*Phase-to-Ground*«. In this case, the user has the option, to set the »*Measuring Mode*« of each phase voltage protection element to »*Phase-to-Ground*« or »*Phase-to-Phase*«. That means, he can determine for each phase voltage protection element if »*Vn=VTsec/SQRT(3)*« by setting »*Measuring-Mode = phase-to-ground*« or if »*Vn=VTsec*« by setting »*Measuring-Mode = Phase-to-Phase*«. CAUTION! If the measuring inputs of the voltage measuring card is fed with »*Phase-to-Phase*« voltages, the Field Parameter »*VT con*« has to be set to »*Phase-to-Phase*«. In this case the parameter »*Measuring Mode*« has to be set to »*Phase-to-Ground*«. In this case the device works always based on »*Phase-to-Phase*« voltages. In this case the parameter »*Measuring mode*« is internally set to »*Phase-to-Phase*«.

For each of the voltage protection elements it can be defined if it picks up when over- or undervoltage is detected in one of three, two of three or in all three phases. The dropout ratio is settable.

V[1]...[n]

name = V[1]...[n]



*Do not use this setting (Vavg) with V(t)-elements.

Device Planning Parameters of the Voltage Protection Module

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, V>, V<, V(t)<	V[1]: V> V[2]: V< V[3]: do not use V[4]: do not use V[5]: do not use V[6]: do not use	[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 V[5]: inactive V[6]: inactive	[Protection Para /<1..4> /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 /<1..4> /V-Prot /V[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<1..4> /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 /<1..4> /V-Prot /V[1]]
Measuring Mode	Measuring/Supervision Mode: Determines if the phase-to-phase or phase-to-earth voltages are to be supervisioned	Phase to Ground, Phase to Phase	Phase to Ground	[Protection Para /<1..4> /V-Prot /V[1]]
Measuring method	Measuring method: fundamental or rms	Fundamental, True RMS, Vavg	Fundamental	[Protection Para /<1..4> /V-Prot /V[1]]
Alarm Mode	Alarm criterion for the voltage protection stage.	any one, any two, all	any one	[Protection Para /<1..4> /V-Prot /V[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
V>	If the pickup value is exceeded, the module/element will be started. Definition of Vn: If the measuring inputs of the voltage measuring card is fed with "Phase-to-Ground" voltages, the Field Parameter "VT con" has to be set to "Phase-to-Ground". In this case, the user has the option, to set the "Measuring Mode" of each phase voltage protection element to "Phase-to-Ground" or "Phase-to-Phase". That means, he can determine for each phase voltage protection element if "Vn=VTsec/SQRT(3)" by setting "Measuring-Mode = phase-to-ground" or if "Vn=VTsec" by setting "Measuring-Mode = Phase-to-Phase". CAUTION! If the measuring inputs of the voltage measuring card is fed with "Phase-to-Phase" voltages, the Field Parameter "VT con" has to be set to "Phase-to-Phase". In this case the parameter "Measuring Mode" has to be set to "Phase-to-Ground". In this case the device works always based on "Phase-to-Phase" Voltages. In this case the parameter "Measuring mode" is internally set to "Phase-to-Phase". Only available if: Device planning: V.Mode = V> Or V>	0.01 - 1.50Vn	V[1]: 1.1Vn V[2]: 1.20Vn V[3]: 1.20Vn V[4]: 1.20Vn V[5]: 1.20Vn V[6]: 1.20Vn	[Protection Para /<1..4> /V-Prot /V[1]]
V> Reset%	Adjustable Drop Out Ratio Only available if: Device planning: V.Mode = V> Or V>	80 - 99%	97%	[Protection Para /<1..4> /V-Prot /V[1]]
V<	If the pickup value is exceeded, the module/element will be started. Definition of Vn: If the measuring inputs of the voltage measuring card is fed with "Phase-to-Ground" voltages, the Field Parameter "VT con" has to be set to "Phase-to-Ground". In this case, the user has the option, to set the "Measuring Mode" of each phase voltage protection element to "Phase-to-Ground" or "Phase-to-Phase". That means, he can determine for each phase voltage protection element if "Vn=VTsec/SQRT(3)" by setting "Measuring-Mode = phase-to-ground" or if "Vn=VTsec" by setting "Measuring-Mode = Phase-to-Phase". CAUTION! If the measuring inputs of the voltage measuring card is fed with "Phase-to-Phase" voltages, the Field Parameter "VT con" has to be set to "Phase-to-Phase". In this case the parameter "Measuring Mode" has to be set to "Phase-to-Ground". In this case the device works always based on "Phase-to-Phase" Voltages. In this case the parameter "Measuring mode" is internally set to "Phase-to-Phase". Only available if: Device planning: V.Mode = V<	0.01 - 1.50Vn	V[1]: 0.80Vn V[2]: 0.9Vn V[3]: 0.80Vn V[4]: 0.80Vn V[5]: 0.80Vn V[6]: 0.80Vn	[Protection Para /<1..4> /V-Prot /V[1]]
V< Reset%	Adjustable Drop Out Ratio Only available if: Device planning: V.Mode = V<	101 - 110%	103%	[Protection Para /<1..4> /V-Prot /V[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
t	Tripping delay Only available if: Device planning: V.Mode = V> Or V> Only available if: Device planning: V.Mode = V<	0.00 - 3000.00s	V[1]: 1s V[2]: 1s V[3]: 0.00s V[4]: 0.00s V[5]: 0.00s V[6]: 0.00s	[Protection Para /<1..4> /V-Prot /V[1]]
Meas Circuit Superv	Measuring Circuit Supervision Only available if: Device planning: V.Mode = V< Only available if: Device planning: V.Mode = V(t)<	inactive, active	inactive	[Protection Para /<1..4> /V-Prot /V[1]]
Vstart<	If the voltage falls below this Voltage, the Time Depending Voltage Protection will be started. Only available if: Device planning: V.Mode = V(t)<	0.00 - 1.50Vn	0.90Vn	[Protection Para /<1..4> /V-Prot /V[1]]
Vrecover>	A LVRT cycle will be terminated as soon as the voltage rises above this threshold Only available if: Device planning: V.Mode = V(t)<	0.10 - 1.50Vn	0.93Vn	[Protection Para /<1..4> /V-Prot /V[1]]
V(t)<1	Pickup value Only available if: Device planning: V.Mode = V(t)<	0.00 - 1.50Vn	0.00Vn	[Protection Para /<1..4> /V-Prot /V[1]]
t1	Tripping delay Only available if: Device planning: V.Mode = V(t)<	0.00 - 20.00s	0.00s	[Protection Para /<1..4> /V-Prot /V[1]]
V(t)<2	Pickup value Only available if: Device planning: V.Mode = V(t)<	0.00 - 1.50Vn	0.00Vn	[Protection Para /<1..4> /V-Prot /V[1]]
t2	Tripping delay Only available if: Device planning: V.Mode = V(t)<	0.00 - 20.00s	0.15s	[Protection Para /<1..4> /V-Prot /V[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
V(t)<3	Pickup value Only available if: Device planning: V.Mode = V(t)<	0.00 - 1.50Vn	V[1]: 0.70Vn V[2]: 0.70Vn V[3]: 0.70Vn V[4]: 0.30Vn V[5]: 0.30Vn V[6]: 0.30Vn	[Protection Para /<1..4> /V-Prot /V[1]]
t3	Tripping delay Only available if: Device planning: V.Mode = V(t)<	0.00 - 20.00s	0.15s	[Protection Para /<1..4> /V-Prot /V[1]]
V(t)<4	Pickup value Only available if: Device planning: V.Mode = V(t)<	0.00 - 1.50Vn	V[1]: 0.70Vn V[2]: 0.70Vn V[3]: 0.70Vn V[4]: 0.30Vn V[5]: 0.30Vn V[6]: 0.30Vn	[Protection Para /<1..4> /V-Prot /V[1]]
t4	Tripping delay Only available if: Device planning: V.Mode = V(t)<	0.00 - 20.00s	V[1]: 0.70s V[2]: 0.70s V[3]: 0.70s V[4]: 0.6s V[5]: 0.6s V[6]: 0.6s	[Protection Para /<1..4> /V-Prot /V[1]]
V(t)<5	Pickup value Only available if: Device planning: V.Mode = V(t)<	0.00 - 1.50Vn	0.90Vn	[Protection Para /<1..4> /V-Prot /V[1]]
t5	Tripping delay Only available if: Device planning: V.Mode = V(t)<	0.00 - 20.00s	1.50s	[Protection Para /<1..4> /V-Prot /V[1]]
V(t)<6	Pickup value Only available if: Device planning: V.Mode = V(t)<	0.00 - 1.50Vn	0.90Vn	[Protection Para /<1..4> /V-Prot /V[1]]
t6	Tripping delay Only available if: Device planning: V.Mode = V(t)<	0.00 - 20.00s	3.00s	[Protection Para /<1..4> /V-Prot /V[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
V(t)<7	Pickup value Only available if: Device planning: V.Mode = V(t)<	0.00 - 1.50Vn	0.90Vn	[Protection Para /<1..4> /V-Prot /V[1]]
t7	Tripping delay Only available if: Device planning: V.Mode = V(t)<	0.00 - 20.00s	3.00s	[Protection Para /<1..4> /V-Prot /V[1]]
V(t)<8	Pickup value Only available if: Device planning: V.Mode = V(t)<	0.00 - 1.50Vn	0.90Vn	[Protection Para /<1..4> /V-Prot /V[1]]
t8	Tripping delay Only available if: Device planning: V.Mode = V(t)<	0.00 - 20.00s	3.00s	[Protection Para /<1..4> /V-Prot /V[1]]
V(t)<9	Pickup value Only available if: Device planning: V.Mode = V(t)<	0.00 - 1.50Vn	0.90Vn	[Protection Para /<1..4> /V-Prot /V[1]]
t9	Tripping delay Only available if: Device planning: V.Mode = V(t)<	0.00 - 20.00s	3.00s	[Protection Para /<1..4> /V-Prot /V[1]]
V(t)<10	Pickup value Only available if: Device planning: V.Mode = V(t)<	0.00 - 1.50Vn	0.90Vn	[Protection Para /<1..4> /V-Prot /V[1]]
t10	Tripping delay Only available if: Device planning: V.Mode = V(t)<	0.00 - 20.00s	3.00s	[Protection Para /<1..4> /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)

Signal	*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: General Trip Phase L1
Trip L2	Signal: General Trip Phase L2
Trip L3	Signal: General Trip Phase L3
Trip	Signal: Trip
TripCmd	Signal: Trip Command

Commissioning: Overvoltage Protection [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 power factor 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 (e.g.) 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 [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 (e.g.) 103% of the trip value. At 103% of the trip value the relay is to fall back at the earliest.

VG, VX - Voltage Supervision [27A, 27TN/59N, 59A]

Available elements:
VG[1] ,VG[2]

NOTICE **All elements of the voltage supervision of the fourth measuring input are identically structured.**

This protective element can be used to (depending on device planning and setting)

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

- Supervision of another (auxiliary) voltage against overvoltage or undervoltage.

The following table shows the application options of the voltage protection element

Applications of the VG/VX-Protection Module	Setting in	Option
ANSI 59N/G Residual voltage protection (measured or calculated)	Device Planning menu Setting: V>	Criterion: Fundamental/TrueRMS VG Source: measured/calculated
ANSI 59A Supervision of an Auxiliary (additional) Voltage in relation to Overvoltage.	Device Planning menu Setting: V> Within the corresponding Parameter-Set: VG Source:measured	Criterion: Fundamental/TrueRMS
ANSI 27A Supervision of an Auxiliary (additional) Voltage in relation to Undervoltage.	Device Planning menu Setting: V< Within the corresponding Parameter-Set: VG Source:measured	Criterion: Fundamental/TrueRMS
ANSI 27TN/59N “Vx meas H3” Stator Ground Fault Protection Note: This option is available in some Generator Protection Relays only.	Device Planning menu Setting: V< Within the corresponding Parameter-Set: VX Source:measured	Criterion: VX meas H3 VX Source: measured

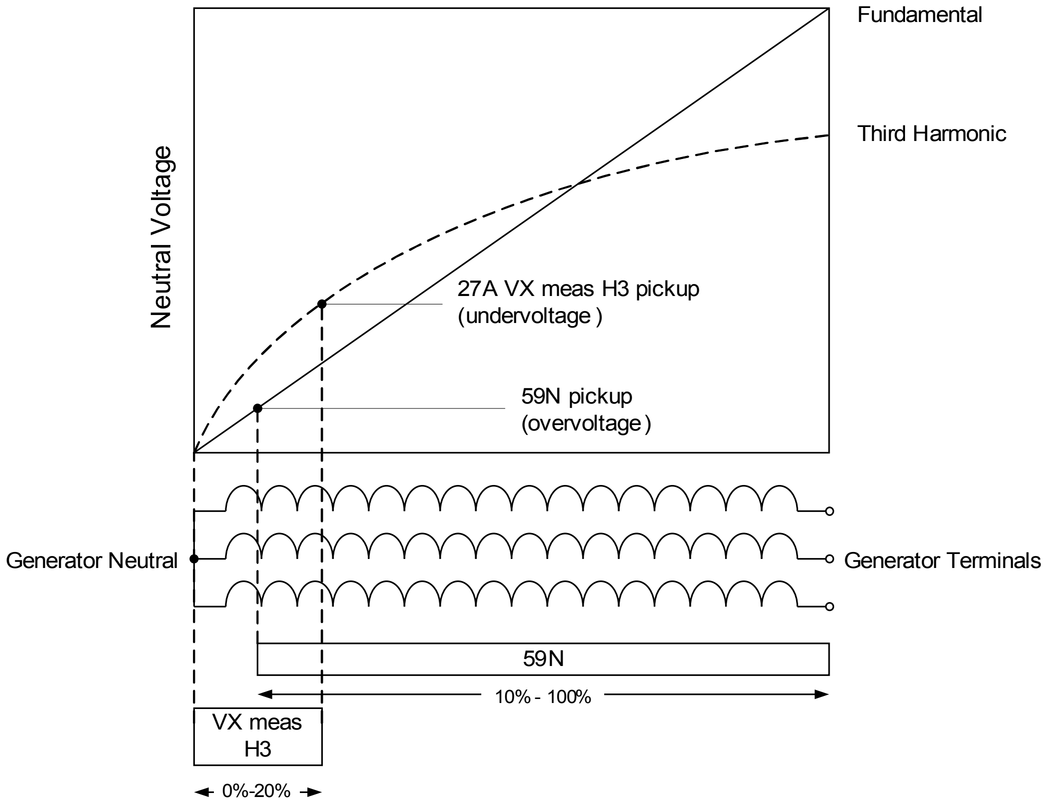
Measuring Mode
For all protection elements it can be determined, whether the measurement is done on basis of the »*Fundamental*« or if »*TrueRMS*« measurement is used.

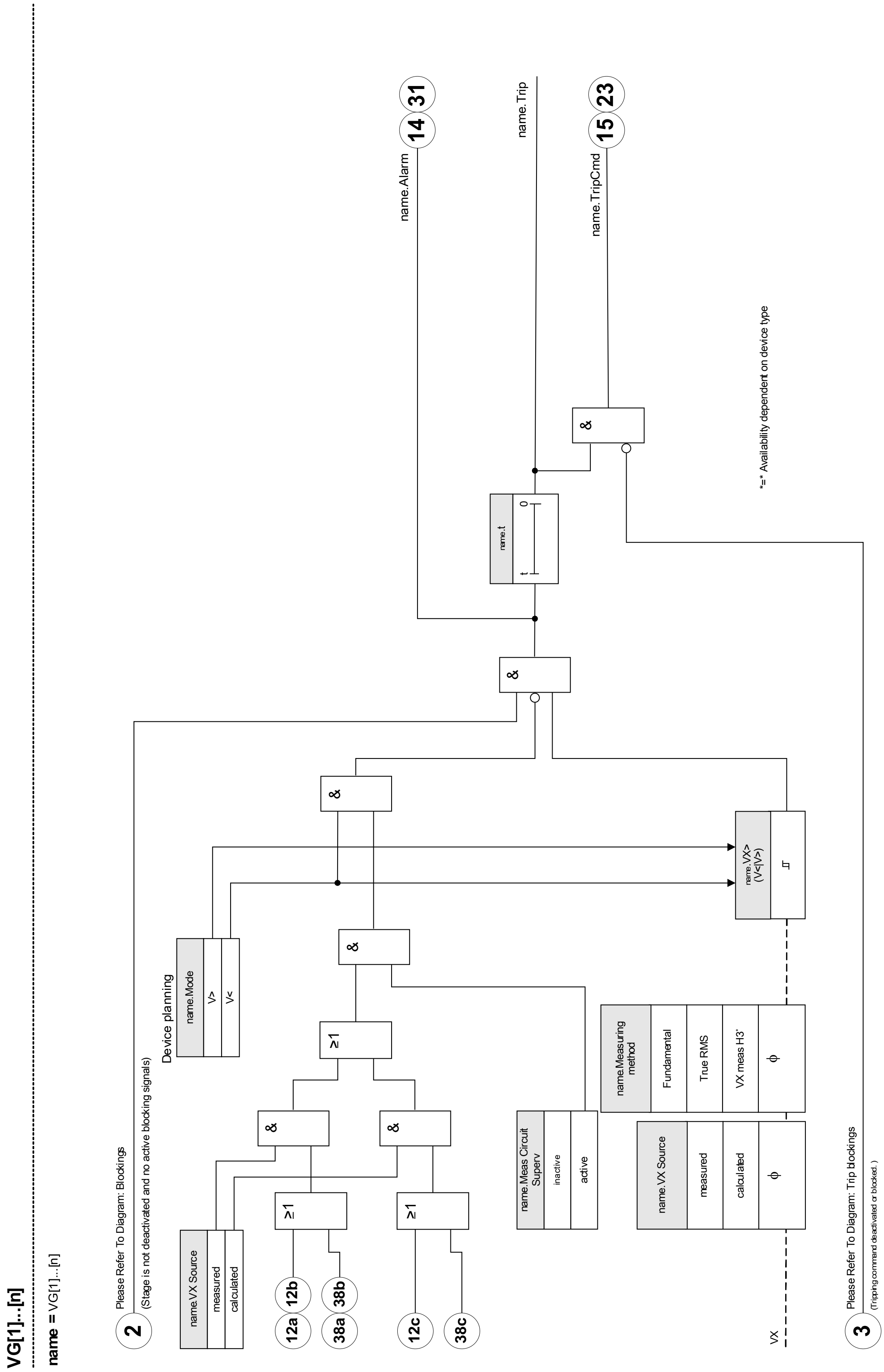
27TN/59N - 100% Stator Ground Fault Protecton *»VX meas H3«**

*=only available in Generator Protection Relays

With this setting the relay can detect stator ground faults at high impedance grounded generators near the machines stator neutral. With this criterion the *27A* element measures the 3rd harmonic of the connected voltage. It is able to detect ground faults, which occur between the stator neutral and up to approx. 20% of the winding towards the stator terminals. In combination with the 59N element, which detects ground faults which occur from the stator terminals down to approx. 10% of the stator winding towards the neutral, a 100% stator ground fault protection can be realized.

The following figure shows the neutral voltages of *27A* with measuring criterion »*VX meas H3*« (third harmonic) and of *59N*.





VG[1]..[n]
name = VG[1]...[n]
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
Device planning
name.Mode
V>
V<
name.VX Source
measured
calculated
12a
12b
38a
38b
12c
38c
≥1
&
name.Meas Circuit Superv
inactive
active
name.Measuring method
Fundamental
True RMS
VX meas H3*
name.VX Source
measured
calculated
VX
name.VX>
(V<|V>)
name.t
t
0
name.Alarm
14
31
name.Trip
name.TripCmd
15
23
Please Refer To Diagram: Trip blockings
(Tripping command deactivated or blocked.)
= Availability dependent on device type

Device Planning Parameters of the Residual Voltage Supervision Module

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, V>, V<	do not 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 /VG[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 /VG[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 /VG[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 /<1..4> /V-Prot /VG[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 /<1..4> /V-Prot /VG[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<1..4> /V-Prot /VG[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 /<1..4> /V-Prot /VG[1]]
VX Source	Selection if VG is measured or calculated (neutral voltage or residual voltage)	measured, calculated	measured	[Protection Para /<1..4> /V-Prot /VG[1]]
Measuring method	Measuring method: fundamental or rms	Fundamental, True RMS	Fundamental	[Protection Para /<1..4> /V-Prot /VG[1]]
VX>	If the pickup value is exceeded, the module/stage will be started. Only available if: Device planning: VG.Mode = V>	0.01 - 1.50Vn	1Vn	[Protection Para /<1..4> /V-Prot /VG[1]]
VG<	Undervoltage Threshold Only available if: Device planning: VG.Mode = V<	0.01 - 1.50Vn	0.8Vn	[Protection Para /<1..4> /V-Prot /VG[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
t	Tripping delay	0.00 - 300.00s	0.00s	[Protection Para /<1..4> /V-Prot /VG[1]]
Meas Circuit Superv	Measuring Circuit Supervision	inactive, active	inactive	[Protection Para /<1..4> /V-Prot /VG[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 /VG[1]]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /V-Prot /VG[1]]
ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command	[Protection Para /Global Prot Para /V-Prot /VG[1]]

Residual Voltage Supervision Module Signals (Output States)

Signal	*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 [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 latestly.

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 [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 *»VX Source=calculated«* is set within the corresponding parameter set.

Procedure

- Feed a three-phase, symmetrical voltage system (Vn) into the voltage measuring inputs of the relay.
- Set the limiting value of VX[x] to 90% Vn.
- Disconnect the phase voltage at two measuring inputs (symmetrical feeding at the secondary side has to be maintained).
- Now the »VX calc*«* measuring value has to be about 100% of the value Vn.
- Ascertain that the signal »VX.ALARM« or »VX.TRIP« is generated now.

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

f - Frequency [81O/U, 78, 81R]

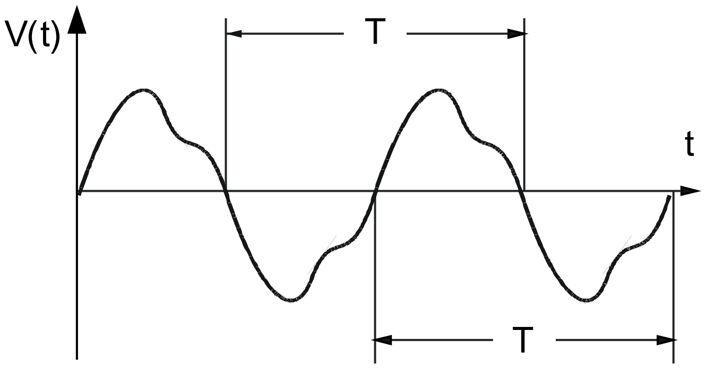
Available elements:
f[1] ,f[2] ,f[3] ,f[4] ,f[5] ,f[6]

NOTICE **All frequency protective elements are identically structured.**

Frequency - Measuring Principle

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.**

The measuring principle of the frequency supervision is based in general on the time measurement of complete cycles, whereby a new measurement is started at each zero passage. The influence of harmonics on the measuring result is thus minimized.



Frequency tripping is sometimes not desired by low measured voltages which for instance occur during alternator acceleration. All frequency supervision functions are blocked if the voltage is lower 0.15 times Vn.

Frequency Functions

Due to its various frequency functions, the device is very flexible. That makes it suitable for a wide range of applications, where frequency supervision is an important criterion.

In the *Device Planning* menu, the User can decide how to use each of the six frequency elements.

f[1] to *f[6]* can be assigned as:

- f< – Underfrequency;
- f> – Overfrequency;
- df/dt - Rate of Change of Frequency;
- f< + df/dt – Underfrequency and Rate of Change of Frequency;
- f> + df/dt - Overfrequency and Rate of Change of Frequency;
- f< + DF/DT – Underfrequency and absolute frequency change per definite time interval;
- f> + DF/DT - Overfrequency and absolute frequency change per definite time interval and
- delta phi - Vector Surge

f< – Underfrequency

This protection element provides a pickup threshold and a tripping delay. If the frequency falls below the set pickup threshold, an alarm will be issued instantaneously. If the frequency remains under the set pickup threshold until the tripping delay has elapsed, a tripping command will be issued.

With this setting, the frequency element protects electrical generators, consumers, or electrical operating equipment in general against underfrequency.

f> – Overfrequency

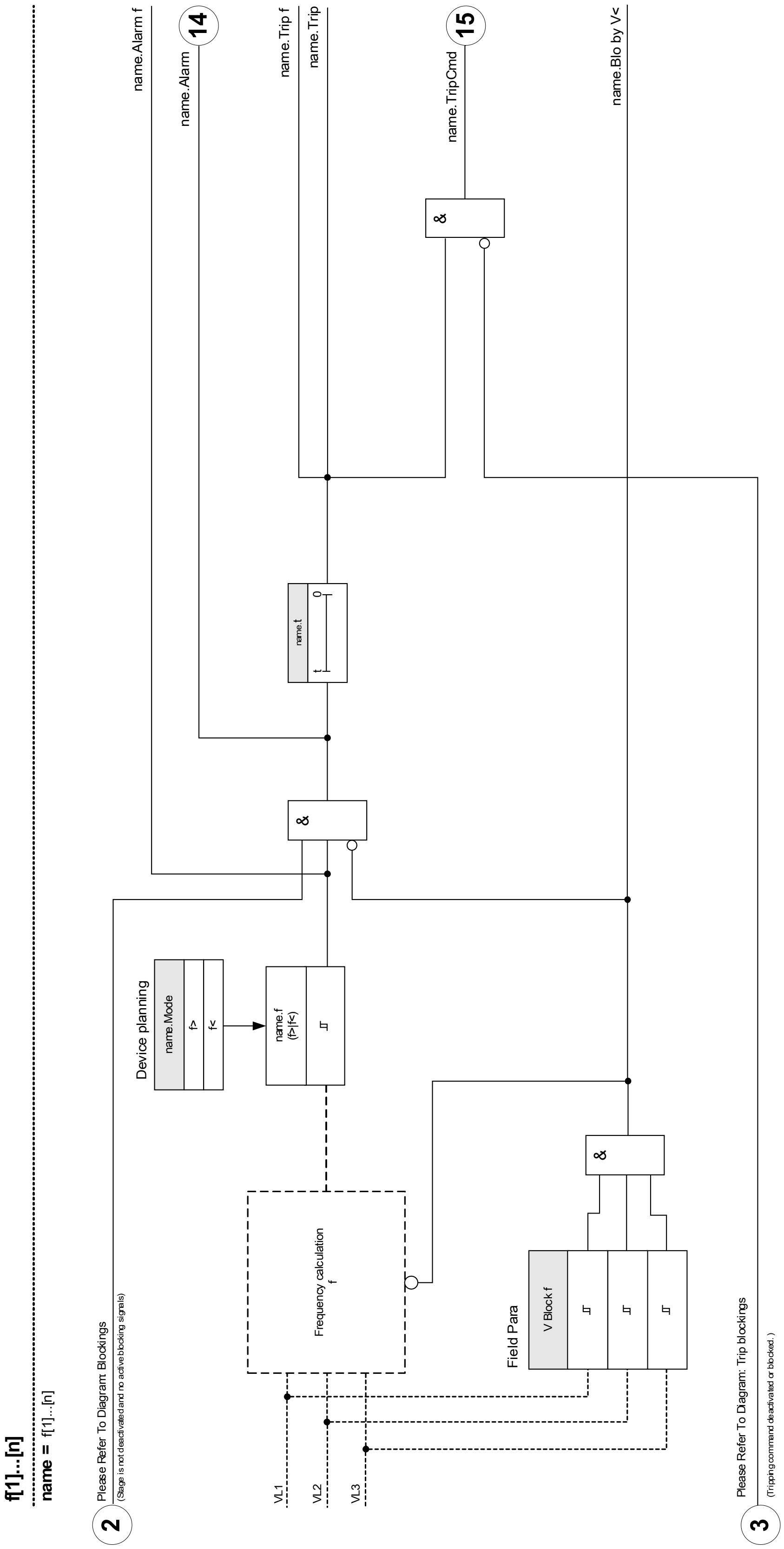
This protection element provides a pickup threshold and a tripping delay. If the frequency exceeds the set pickup threshold, an alarm will be issued instantaneously. If the frequency remains above the set tripping pickup until the tripping delay has elapsed, a tripping command will be issued.

With this setting the frequency element protects electrical generators, consumers, or electrical operating equipment in general against overfrequency.

Working Principle f< and f>

(Please refer to the block diagram on next page.)

The frequency element supervises the three voltages (depending on if the voltage transformers are wired in Star or Delta connection »*VL12*«, »*VL23*« und »*VL31« oder »VL1«, »VL2« und »VL3«)*. If all of the three phase voltages are e.g. below 15% Vn, the frequency calculation is blocked (settable via parameter »*V Block f*«). According to the frequency supervision mode set in the Device Planning (f< or f>), the phase voltages are compared to the set pickup threshold for over- or under-frequency. If in any of the phases, the frequency exceeds or falls below the set pickup threshold and if there are no blocking commands for the frequency element, an alarm is issued instantaneously and the tripping delay timer is started. When the frequency still exceeds or is below the set pickup threshold after the tripping delay timer has elapsed, a tripping command will be issued.


f[1]...[n]
name = f[1]...[n]
2
Please Refer To Diagram Blockings
(Stage is not deactivated and no active blocking signals)
VL1
VL2
VL3
Frequency calculation
f
Field Para
V Block f
Device planning
name.Mode
f>
f<
name.f
(f>|f<)
&
name.t
t
0
name.Alarm f
name.Alarm
14
name.Trip f
name.Trip
&
name.TripCmd
15
name.Blo by V<
&
3
Please Refer To Diagram: Trip blockings
(Tripping command deactivated or blocked.)

df/dt - Rate of Change of Frequency

Electrical generators running in parallel with the mains, (e. g. industrial internal power supply plants), should be separated from the mains when failure in the intra-system occurs for the following reasons:

- Damage to electrical generators must be prevented when mains voltage is recovering asynchronously, (e. g. after a short interruption).
- The industrial internal power supply must be maintained.

A reliable criterion of detecting mains failure is the measurement of the rate of change of frequency (df/dt). The precondition for this is a load flow via the mains coupling point. At mains failure the load flow change spontaneously leads to an increasing or decreasing frequency. At active power deficit of the internal power station, a linear drop of the frequency occurs and a linear increase occurs at power excess. Typical frequency gradients during application of "mains decoupling" are in the range of 0.5 Hz/s up to over 2 Hz/s.

The protective device detects the instantaneous frequency gradient (df/dt) of each mains voltage period. Through multiple evaluations of the frequency gradient in sequence the continuity of the directional change (sign of the frequency gradient) is determined. Because of this special measuring procedure a high safety in tripping and thus a high stability against transient processes, (e. g. switching procedure) are achieved.

The frequency gradient (rate of change of frequency [df/dt]) may have a negative or positive sign, depending on frequency increase (positive sign) or decrease (negative sign).

In the frequency parameter sets, the User can define the kind of df/dt mode:

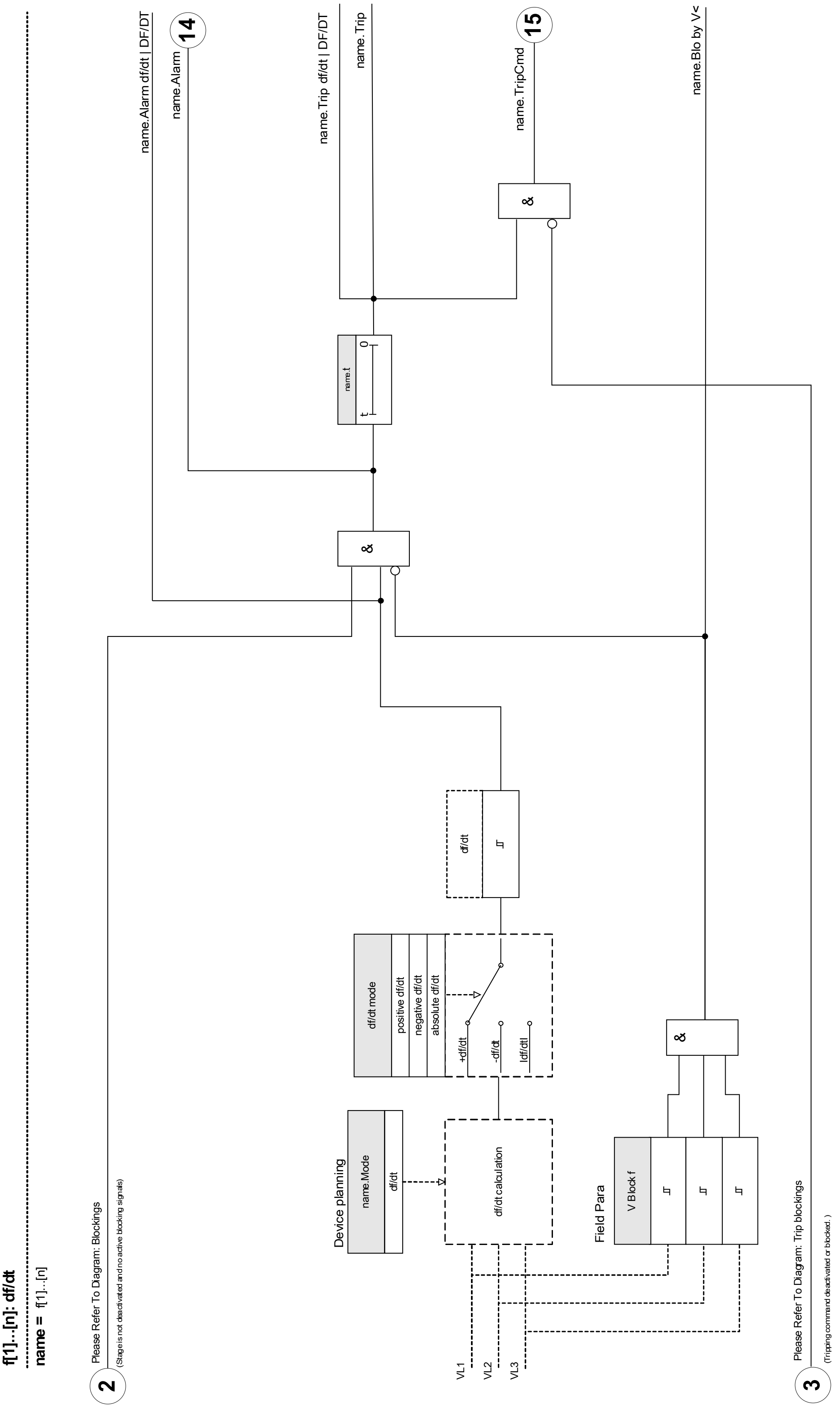
- Positive df/dt = the frequency element detects an increase in frequency
- Negative df/dt = the frequency element detects a decrease in frequency and
- Absolute df/dt (positive and negative) = the frequency element detects both, increase and decrease in frequency

This protection element provides a tripping threshold and a tripping delay. If the frequency gradient df/dt exceeds or falls below the set tripping threshold, an alarm will be issued instantaneously. If the frequency gradient remains still above/below the set tripping threshold until the tripping delay has elapsed, a tripping command will be issued.

Working Principle df/dt

(Please refer to the block diagram on next page)

The frequency element supervises the three voltages (depending on if the voltage transformers are wired in Star or Delta connection »*VL12*«, »*VL23*« und »*VL31« oder »VL1«, »VL2« und »VL3«).*
If any of the three phase voltages is e.g. below 15% Vn, the frequency calculation is blocked (settable via parameter »*V Block f*«). According to the frequency supervision mode set in the Device Planning (df/dt), the phase voltages are compared to the set frequency gradient (df/dt) threshold. If in any of the phases, the frequency gradient exceeds or falls below the set pickup threshold (acc. to the set df/dt mode) and if there are no blocking commands for the frequency element, an alarm is issued instantaneously and the tripping delay timer is started. When the frequency gradient still exceeds or is below the set pickup threshold after the tripping delay timer has elapsed, a tripping command will be issued.



f[1]...[n]: df/dt
name = f[1]...[n]
2
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
Device planning
name.Mode
df/dt
df/dt calculation
VL1
VL2
VL3
Field Para
V Block f
df/dt mode
positive df/dt
negative df/dt
absolute df/dt
+df/dt
-df/dt
|df/dt|
df/dt
&
name.t
t
0
name.Alarm df/dt | DF/DT
name.Alarm
14
name.Trip df/dt | DF/DT
name.Trip
name.TripCmd
15
name.Blo by V<
3
Please Refer To Diagram: Trip blockings
(Tripping command deactivated or blocked.)

f< and df/dt – Underfrequency and Rate of Change of Frequency

With this setting the frequency element supervises if the frequency falls below a set pickup threshold and if the frequency gradient exceeds a set threshold at the same time.

In the selected frequency parameter set f[X], an underfrequency pickup threshold f<, a frequency gradient df/dt and a tripping delay can be set.

Whereby:

- Positive df/dt = the frequency element detects an increase in frequency
- Negative df/dt = the frequency element detects a decrease in frequency and
- Absolute df/dt (positive and negative) = the frequency element detects both, increase and decrease in frequency

f> and df/dt – Overfrequency and Rate of Change of Frequency

With this setting the frequency element supervises if the frequency exceeds a set pickup threshold and if the frequency gradient exceeds a set threshold at the same time.

In the selected frequency parameter set f[X], an overfrequency pickup threshold f>, a frequency gradient df/dt and a tripping delay can be set.

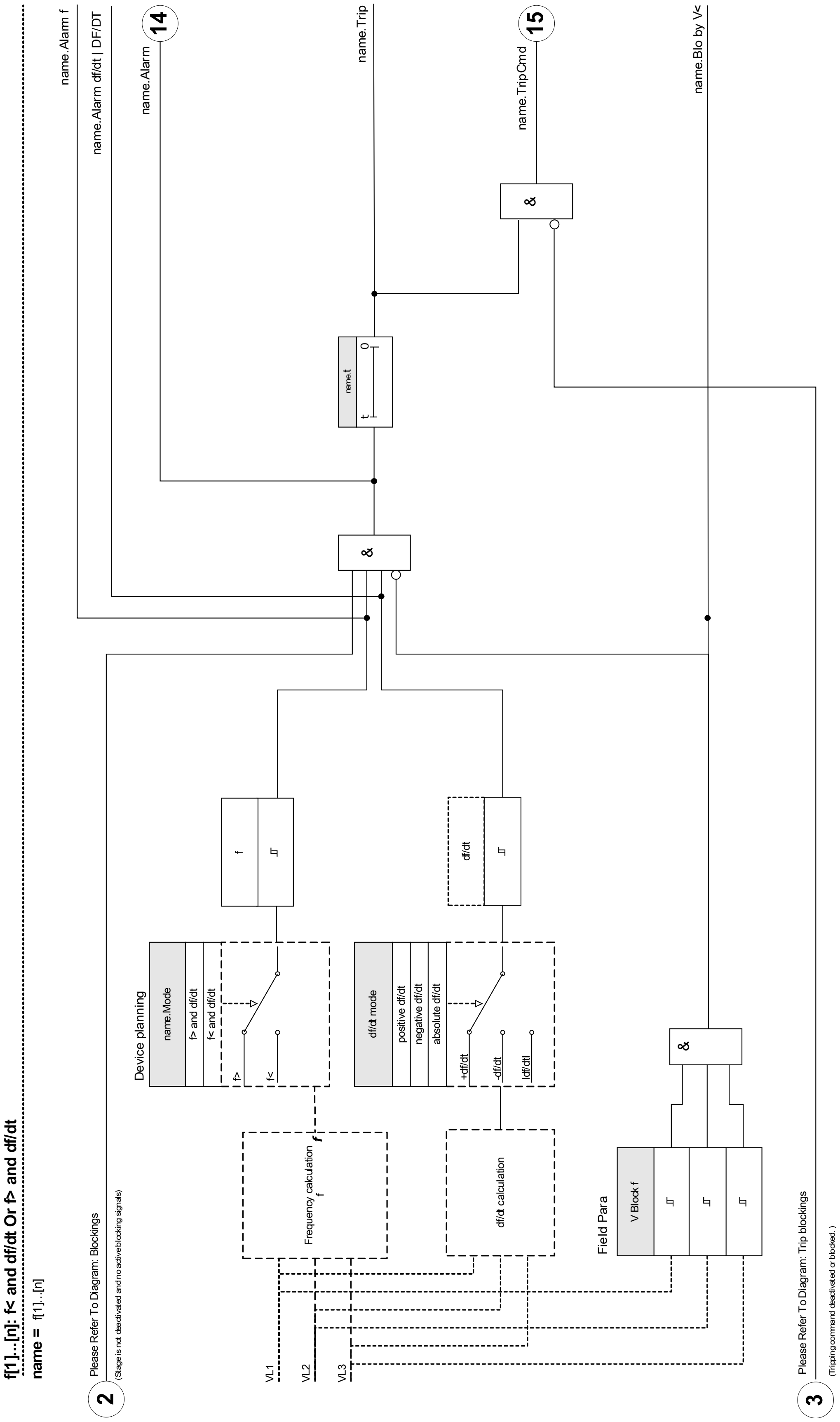
Whereby:

- Positive df/dt = the frequency element detects an increase in frequency
- Negative df/dt = the frequency element detects a decrease in frequency and
- Absolute df/dt (positive and negative) = the frequency element detects both, increase and decrease in frequency

Working Principle f< and df/dt | f> and df/dt

(Please refer to the block diagram on next page)

The frequency element supervises the three voltages (depending on if the voltage transformers are wired in Star or Delta connection »*VL12*«, »*VL23*« und »*VL31« oder »VL1«, »VL2« und »VL3«)*.
If any of the three phase voltages is e.g. below 15% Vn, the frequency calculation is blocked (settable via parameter »*V Block f*«). According to the frequency supervision mode set in the Device Planning (f< and df/dt or f> and dt/dt), the phase voltages are compared to the set frequency pickup threshold and the set frequency gradient (df/dt) threshold. If in any of the phases, both - the frequency and the frequency gradient exceed or fall below the set thresholds and if there are no blocking commands for the frequency element, an alarm is issued instantaneously and the tripping delay timer is started. When the frequency and the frequency gradient still exceed or are below the set threshold after the tripping delay timer has elapsed, a tripping command will be issued.



f[1]..[n]: f< and df/dt Or f> and df/dt
name = f[1]..[n]
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
2
VL1
VL2
VL3
Frequency calculation
f
f
df/dt calculation
Device planning
name.Mode
f> and df/dt
f< and df/dt
f>
f<
df/dt mode
positive df/dt
negative df/dt
absolute df/dt
+df/dt
-df/dt
|df/dt|
f
df/dt
Field Para
V Block f
&
&
name.t
t
0
&
name.Alarm f
name.Alarm df/dt | DF/DT
name.Alarm
14
name.Trip
name.TripCmd
15
name.Blo by V<
Please Refer To Diagram: Trip blockings
(Tripping command deactivated or blocked.)
3

f< and DF/DT – Underfrequency and DF/DT

With this setting the frequency element supervises the frequency and the absolute frequency difference during a definite time interval.

In the selected frequency parameter set f[X], an underfrequency pickup threshold f<, a threshold for the absolute frequency difference (frequency decrease) DF and supervision interval DT can be set.

f> and DF/DT – Overfrequency and DF/DT

With this setting the frequency element supervises the frequency and the absolute frequency difference during a definite time interval.

In the selected frequency parameter set f[X], an overfrequency pickup threshold f>, a threshold for the absolute frequency difference (frequency increase) DF and supervision interval DT can be set.

Working principle f< and DF/DT | f> and DF/DT

(please refer to block diagram on next page)

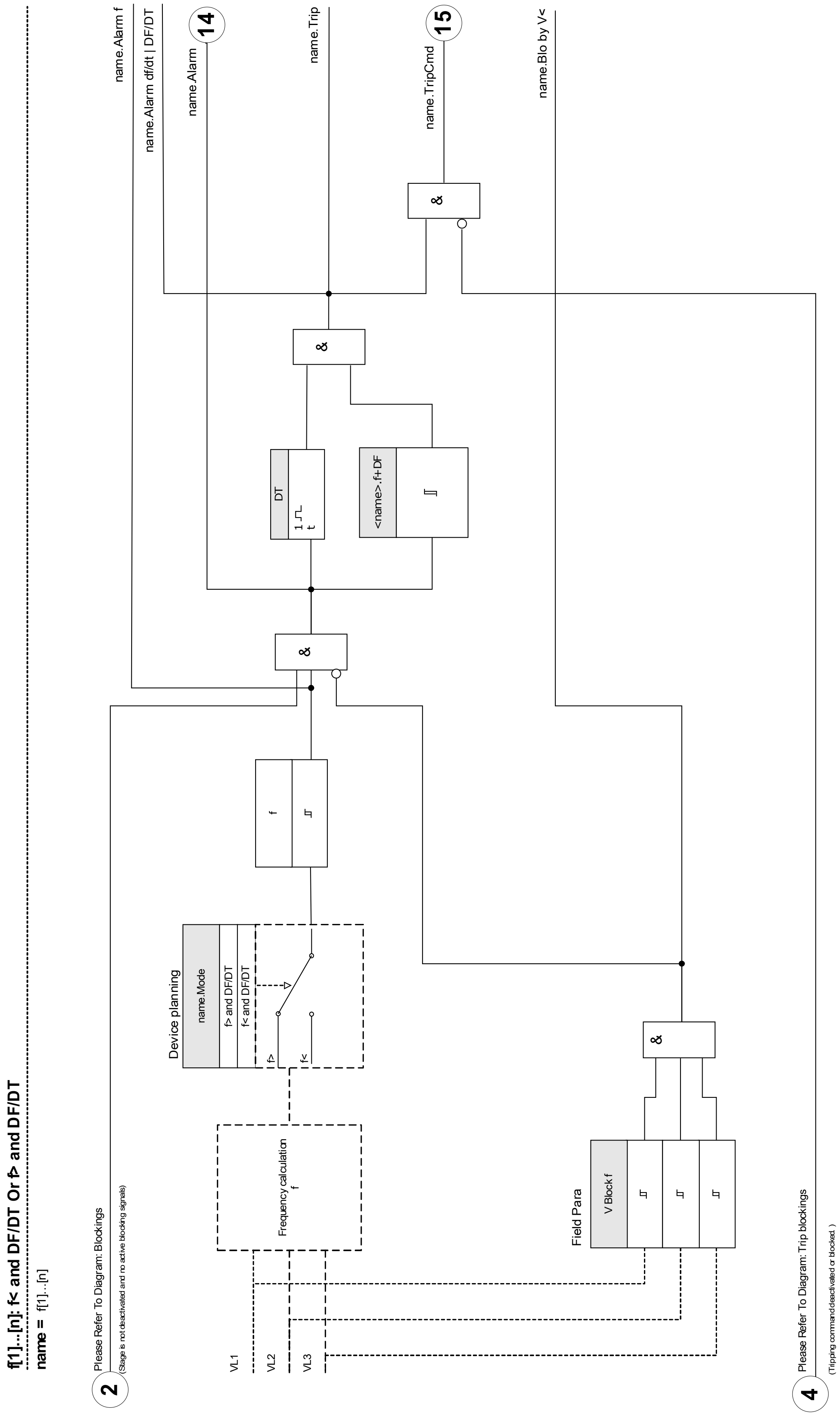
The frequency element supervises the three voltages (depending on if the voltage transformers are wired in Star or Delta connection »*VL12*«, »*VL23*« und »*VL31« oder »VL1«, »VL2« und »VL3«).*
If any of the three phase voltages is e.g. below 15% Vn, the frequency calculation is blocked (settable via parameter »*V Block f*«). According to the frequency supervision mode set in the Device Planning (f< and DF/DT or f> and DF/DT), the phase voltages are compared to the set frequency pickup threshold and the set frequency decrease or increase threshold DF.
If in any of the phases, the frequency exceeds or falls below the set pickup threshold and if there are no blocking commands for the frequency element, an alarm is issued instantaneously. At the same time the timer for the supervision interval DT is started. When, during the supervision interval DT, the frequency still exceeds or is below the set pickup threshold and the frequency decrease/increase reaches the set threshold DF, a tripping command will be issued.

Working Principle of DF/DT Function

(Please refer to f(t) diagram after the block diagram)

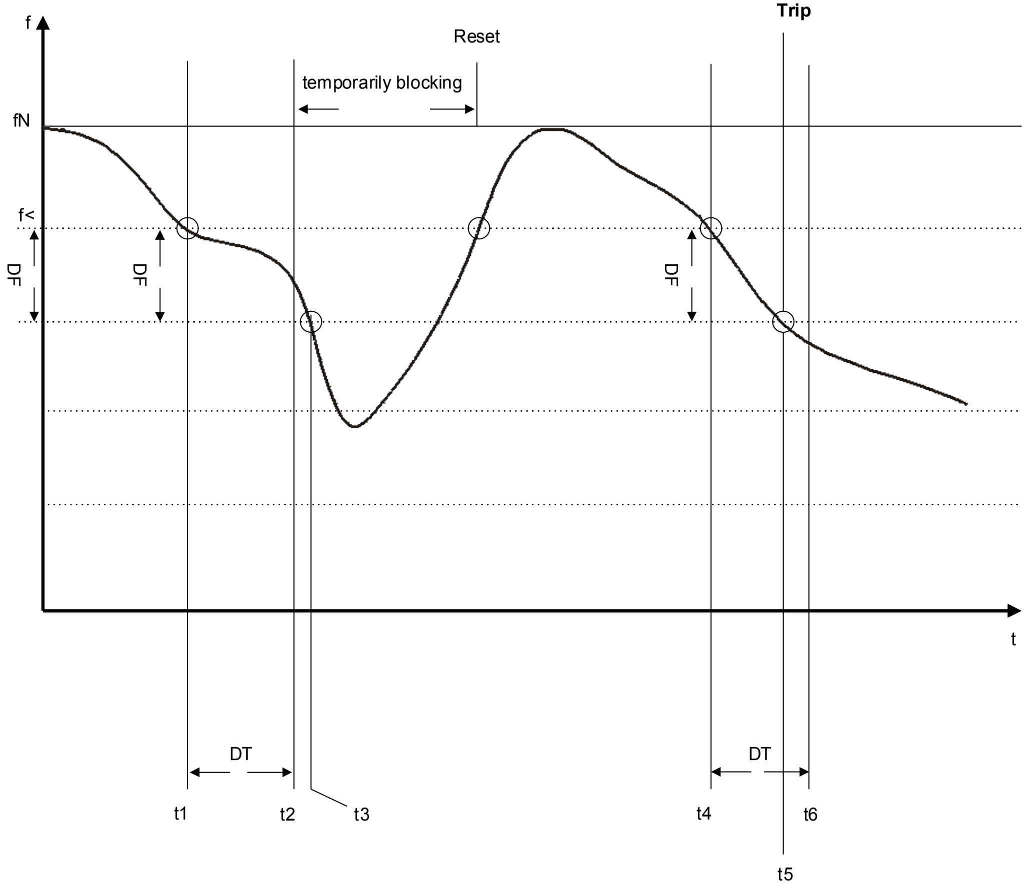
Case 1:
When the frequency falls below a set f< threshold at t1, the DF/DT element energizes. If the frequency difference (decrease) does not reach the set value DF before the time interval DT has expired, no trip will occur. The frequency element remains blocked until the frequency falls below the underfrequency threshold f< again.

Case 2:
When the frequency falls below a set f< threshold at t4, the DF/DT element energizes. If the frequency difference (decrease) reaches the set value DF before the time interval DT has expired (t5), a trip command is issued.


f[1]...[n]: f< and DF/DT Or f> and DF/DT
name = f[1]...[n]
2
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
VL1
VL2
VL3
Frequency calculation
f
Device planning
name.Mode
f> and DF/DT
f< and DF/DT
f>
f<
f
&
DT
1
t
<name>.f+DF
&
&
name.Alarm f
name.Alarm df/dt | DF/DT
name.Alarm
14
name.Trip
name.TripCmd
15
name.Blo by V<
Field Para
V Block f
&
4
Please Refer To Diagram: Trip blockings
(Tripping command deactivated or blocked.)

f[1]...[n]: f< and DF/DT

name = f[1]...[n]



Delta phi - Vector Surge

The vector surge supervision protects synchronous generators in mains parallel operation due to very fast decoupling in case of mains failure. Very dangerous are mains auto reclosings for synchronous generators. The mains voltage returning typically after 300 ms can hit the generator in asynchronous position. A very fast decoupling is also necessary in case of long time mains failures.

Generally there are two different applications:

Only mains parallel operation - no single operation:
In this application the vector surge supervision protects the generator by tripping the generator circuit breaker in case of mains failure.

Mains parallel operation and single operation:
For this application the vector surge supervision trips the mains circuit breaker. Here it is insured that the gen.-set is not blocked when it is required as an emergency set.

A very fast decoupling in case of mains failures for synchronous generators is very difficult. Voltage supervision units cannot be used because the synchronous alternator as well as the consumer impedance support the decreasing voltage.

In this situation the mains voltage drops only after some 100 ms below the pickup threshold of the voltage supervision and therefore a safe detection of mains auto reclosings is not possible with voltage supervision only.

Frequency supervision is partially unsuitable because only a highly loaded generator decreases its speed within 100 ms. Current relays detect a fault only when short-circuit type currents exist, but cannot avoid their development. Power relays are able to pickup within 200 ms, but they also cannot prevent the power rising to short-circuit values. Since power changes are also caused by sudden loaded alternators, the use of power relays can be problematic.

Whereas the vector surge supervision of the device detects mains failures within 60 ms without the restrictions described above because it is specially designed for applications where very fast decoupling from the mains is required. Adding the typical operating time of a circuit breaker or contactor, the total disconnection time remains below 150 ms.

Basic requirement for tripping of the generator/mains monitor is a change in load of more than 15 - 20% of the rated load. Slow changes of the system frequency, for instance at regulating processes (adjustment of speed regulator) do not cause the relay to trip.

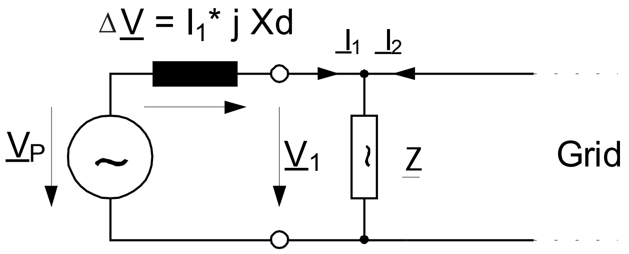
Trippings can also be caused by short-circuits within the grid, because a voltage vector surge higher than the preset value can occur. The magnitude of the voltage vector surge depends on the distance between the short-circuit and the generator. This function is also of advantage to the Power Utility Company because the mains short-circuit capacity and, consequently, the energy feeding the short-circuit is limited.

To prevent a possible false tripping, the vector surge measuring is blocked at a low input voltage e.g. <15% Vn (settable via parameter »*V Block f*«). The undervoltage lockout acts faster then the vector surge measurement.

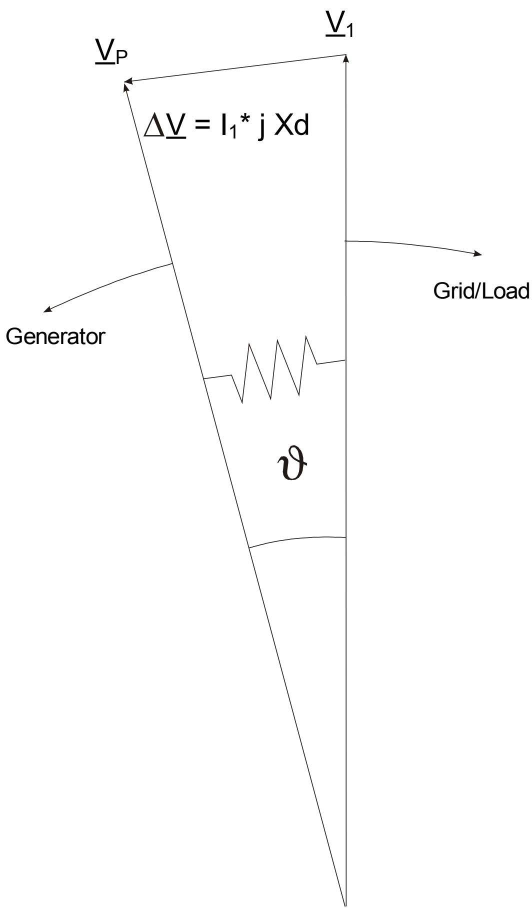
Vector surge tripping is blocked by a phase loss so that a VT fault (e. g.: faulty VTs fuse) does not cause false tripping.

Measuring Principle of Vector Surge Supervision

Equivalent circuit at synchronous generator in parallel with the mains.

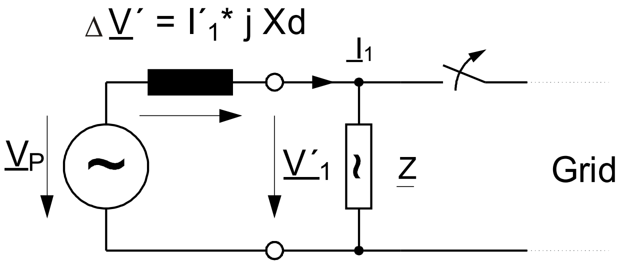


Voltage vectors at mains parallel operation.



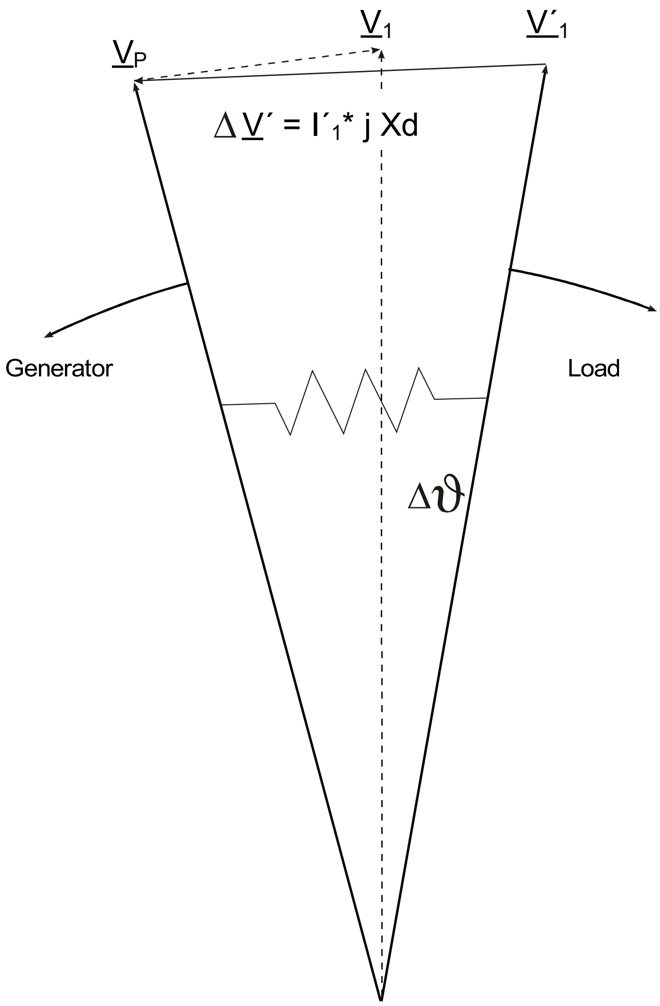
The rotor displacement angle between stator and rotor is dependent on the mechanical moving torque of the generator. The mechanical shaft power is balanced with the electrical fed mains power and, therefore the synchronous speed keeps constant.

Equivalent circuit at mains failure.

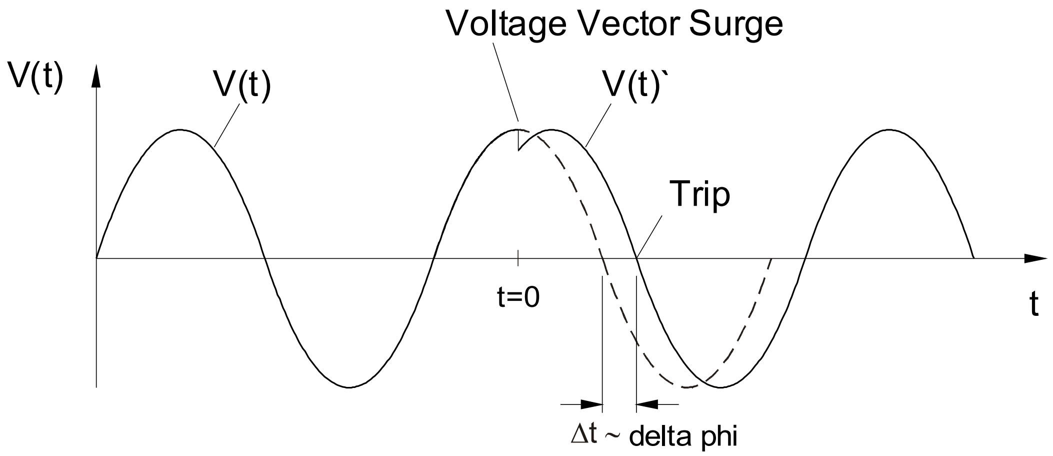


In case of mains failure or auto reclosing the generator suddenly feeds a very high consumer load. The rotor displacement angle is decreased repeatedly and the voltage vector V1 changes its direction (V1').

Voltage vectors at mains failure.



Voltage vector surge.



As shown in the voltage/time diagram the instantaneous value of the voltage jumps to another value and the phase position changes. This is called phase or vector surge.

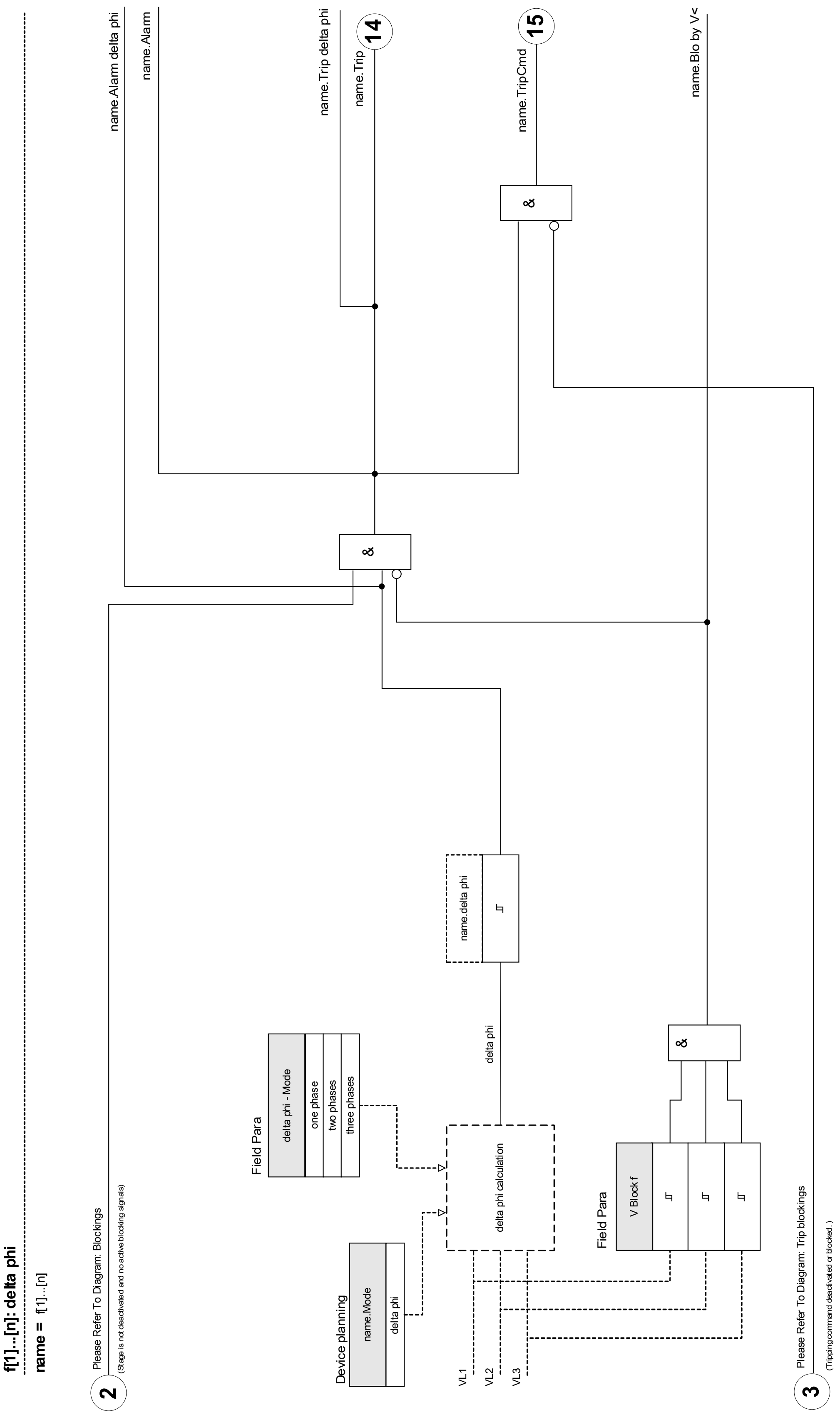
The relay measures the cycle duration. A new measuring is started at each zero passage. The measured cycle duration is internally compared with a reference time and from this the deviation of the cycle duration of the voltage signal is ascertained. In case of a vector surge as shown in the above graphic, the zero passage occurs either earlier or later. The established deviation of the cycle duration is in compliance with the vector surge angle.
If the vector surge angle exceeds the set value, the relay trips immediately.

Tripping of the vector surge is blocked in case of loss of one or more phases of the measuring voltage.

Working Principle delta phi

(Please refer to the block diagram on next page)

The frequency element supervises the three voltages (depending on if the voltage transformers are wired in Star or Delta connection »*VL12«*, »*VL23«* und »*VL31« oder »VL1«, »VL2« und »VL3«)*.
If any of the three phase voltages is e.g. below 15% Vn, the vector surge calculation is blocked (settable via parameter »*V Block f«*). According to the frequency supervision mode set in the Device Planning (delta phi), the phase voltages are compared to the set vector surge threshold. If in any of the phases, the vector surge exceeds the set threshold and if there are no blocking commands for the frequency element, an alarm and a trip command is issued instantaneously.



f[1]...[n]: delta phi
name = f[1]...[n]
2
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
Device planning
name.Mode
delta phi
Field Para
delta phi - Mode
one phase
two phases
three phases
delta phi calculation
VL1
VL2
VL3
delta phi
name.delta phi
Field Para
V Block f
&
&
&
name.Alarm delta phi
name.Alarm
name.Trip delta phi
name.Trip
14
name.TripCmd
15
name.Blo by V<
3
Please Refer To Diagram: Trip blockings
(Tripping command deactivated or blocked.)

Device Planning Parameters of the Frequency Protection Module

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, f<, f>, f< and df/dt, f> and df/dt, f< and DF/DT, f> and DF/DT, df/dt, delta phi	f[1]: f< f[2]: f> f[3]: do not use f[4]: do not use f[5]: do not use f[6]: do not use	[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 /<1..4> /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 /<1..4> /f-Prot /f[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<1..4> /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 /<1..4> /f-Prot /f[1]]
f>	Pickup value for overfrequency. Only available if: Device planning: f.Mode = f> Or f> and df/dt Or f> and DF/DT	40.00 - 69.95Hz	51.00Hz	[Protection Para /<1..4> /f-Prot /f[1]]
f<	Pickup value for underfrequency. Only available if: Device planning: f.Mode = f< Or f< and df/dt Or f< and DF/DT	40.00 - 69.95Hz	49.00Hz	[Protection Para /<1..4> /f-Prot /f[1]]
t	Tripping delay Only available if: Device planning: f.Mode = f< Or f>Or f> and df/dt Or f< and df/dt	0.00 - 3600.00s	1.00s	[Protection Para /<1..4> /f-Prot /f[1]]
df/dt	Measured value (calculated): Rate-of-frequency-change. Only available if: Device planning: f.Mode = df/dt Or f< and df/dt Or f> and df/dt	0.100 - 10.000Hz/s	1.000Hz/s	[Protection Para /<1..4> /f-Prot /f[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
t-df/dt	Trip delay df/dt	0.00 - 300.00s	1.00s	[Protection Para /<1..4> /f-Prot /f[1]]
DF	Frequency difference for the maximum admissible variation of the mean of the rate of frequency-change. This function is inactive if DF=0. Only available if: Device planning: f.Mode = f< and DF/DT Or f> and DF/DT	0.0 - 10.0Hz	1.00Hz	[Protection Para /<1..4> /f-Prot /f[1]]
DT	Time interval of the maximum admissible rate-of-frequency-change. Only available if: Device planning: f.Mode = f< and DF/DT Or f> and DF/DT	0.1 - 10.0s	1.00s	[Protection Para /<1..4> /f-Prot /f[1]]
df/dt mode	df/dt mode Only available if: Device planning: f.Mode = df/dt Or f< and df/dt Or f> and df/dt Only available if: Device planning: f.Mode = df/dt Or f< and df/dt Or f> and df/dt Only available if: Device planning: f.Mode = df/dt	absolute df/dt, positive df/dt, negative df/dt	absolute df/dt	[Protection Para /<1..4> /f-Prot /f[1]]
delta phi	Measured value (calculated): Vector surge Only available if: Device planning: f.Mode = delta phi	1 - 30°	10°	[Protection Para /<1..4> /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)

Signal	*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
Alarm df/dt | DF/DT	Alarm instantaneous or average value of the rate-of-frequency-change
Alarm delta phi	Signal: Alarm Vector Surge
Alarm	Signal: Alarm Frequency Protection (collective signal)
Trip f	Signal: Frequency has exceeded the limit.
Trip df/dt | DF/DT	Signal: Trip df/dt or DF/DT
Trip delta phi	Signal: Trip Vector Surge
Trip	Signal: Trip Frequency Protection (collective signal)
TripCmd	Signal: Trip Command

Commissioning: Overfrequency [f>]

Object to be tested
All configured overfrequency protection stages.

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

Procedure

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

Testing the trip delay
- Set the test voltage to nominal frequency and
- 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 99.95% of the trip value (or 0.05% fn). The relay must only fall back at 99.95% of the trip value at the earliest (or 0.05% fn).

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

Commissioning: Underfrequency [f<]

For all configured 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 100.05% of the trip value (or 0.05% fn). At 100.05% of the trip value the relay is to fall back at the earliest (or 0.05% fn).

Commissioning: df/dt - Rate of Change of Frequency

Object to be tested

All frequency protection stages that are projected as df/dt.

Necessary means

- Three-phase voltage source and
- Frequency generator that can generate and measure a linear, defined rate of change of frequency.

Procedure

Testing the threshold values

- Keep on increasing the rate of change of frequency until the respective element is activated.
- Note the value.

Testing the trip delay

- Set the test voltage to nominal frequency.
- Now apply a step change (sudden change) that is 1.5 times the setting value (example: apply 3 Hz per second if the setting value is 2 Hz per second) and
- Measure the tripping time at the relay output. Compare the measured tripping time to the configured tripping time.

Successful test result:

Permissible deviations/tolerances and dropout ratios can be taken from the Technical Data.

Commissioning: f< and -df/dt – underfrequency and Rate of Change of Frequency

Object to be tested:
All frequency protection stages that are projected as f< and -df/dt.

Necessary means:
- Three-phase voltage source and
- Frequency generator that can generate and measure a linear, defined rate of change of frequency.

Procedure:

Testing the threshold values
- Feed nominal voltage and nominal frequency to the device
- Decrease the frequency below the f< threshold and
- Apply a rate of change of frequency (step change) that is below the setting value (example apply -1 Hz per second if the setting value is -0.8 Hz per second). After the tripping delay is expired the relay has to trip.

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

Commissioning: f> and df/dt – overfrequency and Rate of Change of Frequency

Object to be tested
All frequency protection stages that are projected as f> and df/dt.

Necessary means
- Three-phase voltage source and.
- Frequency generator that can generate and measure a linear, defined rate of change of frequency.

Procedure

Testing the threshold values
- Feed nominal voltage and nominal frequency to the device.
- Increase the frequency above the f> threshold and.
- Apply a rate of change of frequency (step change) that is above the setting value (example apply 1 Hz per second if the setting value is 0.8 Hz per second). After the tripping delay is expired the relay has to trip.

Successful test result:
Permissible deviations/tolerances and dropout ratios can be taken from the Technical Data.

Commissioning: f< and DF/DT – Underfrequency and DF/DT

Object to be tested:
All frequency protection stages that are projected as f< and Df/Dt.

Necessary means:

- Three-phase voltage source and
- Frequency generator that can generate and measure a defined frequency change.

Procedure:

Testing the threshold values

- Feed nominal voltage and nominal frequency to the device:
- Decrease the frequency below the f< threshold and
- Apply a defined frequency change (step change) that is above the setting value (example: apply a frequency change of 1 Hz during the set time interval DT if the setting value DF is 0.8 Hz). The relay has to trip immediately.

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

Commissioning: f> and DF/DT – Overfrequency and DF/DT

Object to be tested:
All frequency protection stages that are projected as f> and Df/Dt.

Necessary means:

- Three-phase voltage source and.
- Frequency generator that can generate and measure a defined frequency change.

Procedure:

Testing the threshold values

- Feed nominal voltage and nominal frequency to the device:
- Increase the frequency above the f> threshold and
- Apply a defined frequency change (step change) that is above the setting value (example: apply a frequency change of 1 Hz during the set time interval DT if the setting value DF is 0.8 Hz). The relay has to trip immediately.

Successful test result:
Permissible deviations/tolerances and dropout ratios can be taken from the Technical Data.

Commissioning: delta phi - Vector Surge

Object to be tested:
All frequency protection stages that are projected as delta phi (vector surge).

Necessary means:
- Three-phase voltage source that can generate a definite step (sudden change) of the voltage pointers (phase shift).

Procedure:

Testing the threshold values
- Apply a vector surge (sudden change) that is 1.5 times the setting value (example: if the setting value is 10° apply 15°).

Successful test result:
Permissible deviations/tolerances and dropout ratio can be taken from the Technical Data.

V 012 – Voltage Asymmetry [47]

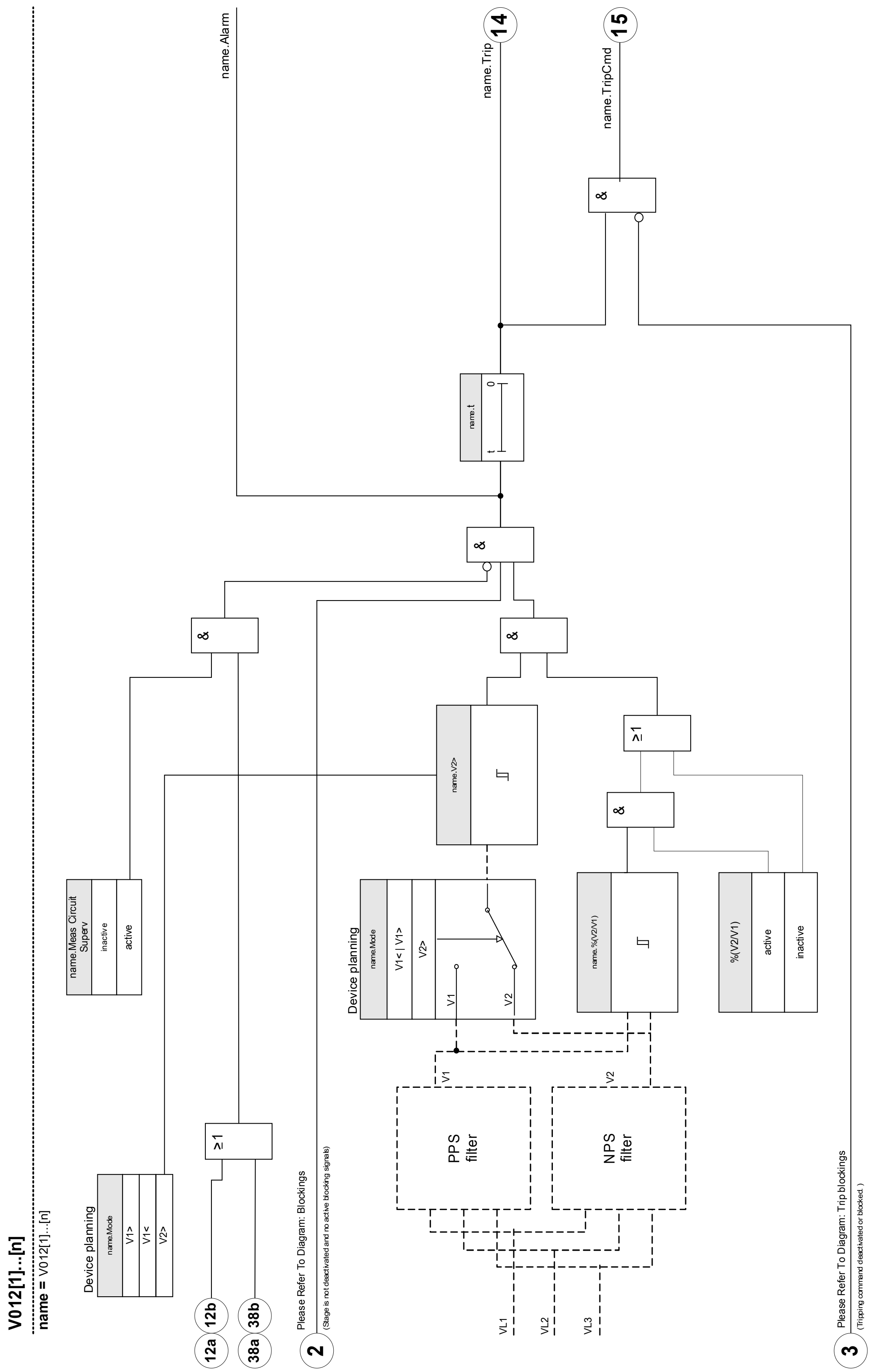
Available elements:
V012[1] ,V012[2] ,V012[3] ,V012[4] ,V012[5] ,V012[6]

Within the Device planning menu this module can be projected in order to supervise the positive phase sequence voltage for over- or undervoltage or the negative phase sequence system for overvoltage. This module is based on the 3-phase voltages.

The module is alarmed, if the threshold is exceeded. The module will trip, if the measured values remain for the duration of the delay timer above the threshold continuously.

In case that the negative phase sequence voltage is monitored, the threshold »*V2>*« can be combined with an additional percentage criterion »*%V2/V1*« (AND-connected) in order to prevent faulty tripping in case of a lack of voltage within the positive phase sequence system.

Application Options of the V 012 Module	Setting in	Option
ANSI 47 – Negative Sequence Overvoltage (Supervision of the Negative Phase Sequence System) Setting within the Device Planning (V2>)	Device Planning Menu	%V2/V1: The Module trips, if the threshold U2> **and** the ratio of negative to positive phase sequence voltage is exceeded (after the delay timer has expired). This criterion is to be activated and parametrized within the parameter set.
ANSI 59U1 Overvoltage within the Positive Phase Sequence System Setting within the Device Planning (V1>)	Device Planning Menu	-
ANSI 27U1 Undervoltage within the Positive Phase Sequence System Setting within the Device Planning (V1<)	Device Planning Menu	-


V012[1]..[n]
name = V012[1]...[n]
Device planning
name.Mode
V1>
V1<
V2>
12a
12b
38a
38b
≥1
name.Meas Circuit Superv
inactive
active
&
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
2
Device planning
name.Mode
V1< | V1>
V2>
V1
V2
name.V2>
PPS filter
NPS filter
VL1
VL2
VL3
name.%(V2/V1)
%(V2/V1)
active
inactive
&
≥1
&
&
name.Alarm
name.t
t
0
name.Trip
14
&
name.TripCmd
15
Please Refer To Diagram: Trip blockings
(Tripping command deactivated or blocked.)
3

Device planning parameters of the asymmetry module

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Unbalance Protection: Supervision of the Voltage System	do not use, V1>, V1<, V2>	do not use	[Device planning]

Global protection parameter of the asymmetry-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	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /V-Prot /V012[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 /V-Prot /V012[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 /V012[1]]

Parameter set parameters of the asymmetry module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<1..4> /V-Prot /V012[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 /<1..4> /V-Prot /V012[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<1..4> /V-Prot /V012[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 /<1..4> /V-Prot /V012[1]]
V1>	Positive Phase Sequence Overvoltage Only available if: Device planning: V012.Mode = V1>	0.01 - 1.50Vn	1.00Vn	[Protection Para /<1..4> /V-Prot /V012[1]]
V1<	Positive Phase Sequence Undervoltage Only available if: Device planning: V012.Mode = V1<	0.01 - 1.50Vn	1.00Vn	[Protection Para /<1..4> /V-Prot /V012[1]]
V2>	Negative Phase Sequence Overvoltage Only available if: Device planning: V012.Mode = V2>	0.01 - 1.50Vn	1.00Vn	[Protection Para /<1..4> /V-Prot /V012[1]]
%(V2/V1)	The %(V2/V1) setting is the unbalance trip pickup setting. It is defined by the ratio of negative sequence voltage to positive sequence voltage (% Unbalance=V2/V1). Phase sequence will be taken into account automatically.	inactive, active	inactive	[Protection Para /<1..4> /V-Prot /V012[1]]

Parameter	Description	Setting range	Default	Menu path
%(V2/V1)	The %(V2/V1) setting is the unbalance trip pickup setting. It is defined by the ratio of negative sequence voltage to positive sequence voltage (% Unbalance=V2/V1). Phase sequence will be taken into account automatically. Only available if: %(V2/V1) = use	2 - 40%	20%	[Protection Para /<1..4> /V-Prot /V012[1]]
t	Tripping delay	0.00 - 300.00s	0.00s	[Protection Para /<1..4> /V-Prot /V012[1]]
Meas Circuit Superv	Measuring Circuit Supervision	inactive, active	inactive	[Protection Para /<1..4> /V-Prot /V012[1]]

States of the inputs of the asymmetry module

Name	Description	Assignment via
ExBlo1-I	Module input state: External blocking1	[Protection Para /Global Prot Para /V-Prot /V012[1]]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /V-Prot /V012[1]]
ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command	[Protection Para /Global Prot Para /V-Prot /V012[1]]

Signals of the asymmetry module (states of the outputs)

Signal	*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 voltage asymmetry
Trip	Signal: Trip
TripCmd	Signal: Trip Command

Commissioning: Asymmetry Protection

Object to be tested
Test of the asymmetry protection elements.

Necessary means

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

Testing the tripping values (Example)

Set the pickup value for the voltage in the negative phase sequence to 0.5 Vn. Set the tripping delay to 1 s.

In order to generate a negative phase sequence voltage interchange the wiring of two phases (VL2 and VL3).

Testing the trip delay
Start the timer and abrupt change (switch) to 1.5 times of the set tripping value. Measure the trip delay.

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

Sync - Synchrocheck [25]

Available Elements:
Sync

WARNING **The synchrocheck function can be bypassed by external sources. In this case, synchronization has to be secured by other synchronizing systems before breaker closing!**

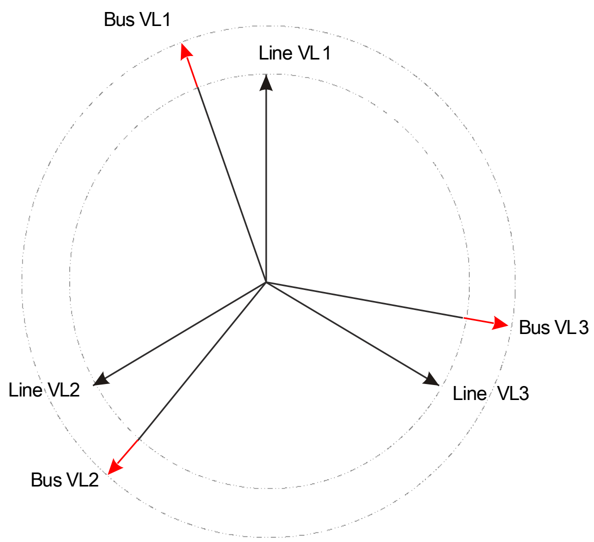
NOTICE The bus voltages are to be measured by the first three measuring inputs of the voltage measuring card (VL1/VL1-L2, VL2/VL2-L3, VL3/VL3-L1). The line voltage is to be measured by the fourth measuring input of the voltage measuring card (VX). In the menu [Field Para/Voltage transf/V Sync] the User has to define to which phase the fourth measuring input is compared.

Synchrocheck

The synchrocheck function is provided for the applications where a line has two-ended power sources. The synchrocheck function has the abilities to check voltage magnitude, angle differences, and frequency difference (slip frequency) between the bus and the line. If enabled, the synchrocheck may supervise the closing operation manually, automatically, or both. This function can be overridden by certain bus-line operation conditions and can be bypassed with an external source.

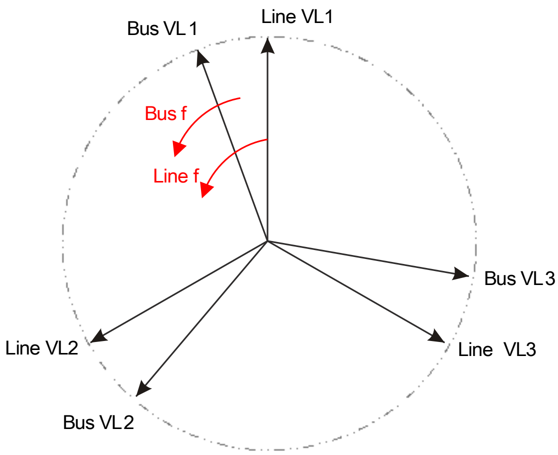
Voltage Difference ΔV

The first condition for paralleling two electrical systems is that their voltage phasors have the same magnitude. This can be controlled by the generator's AVR.

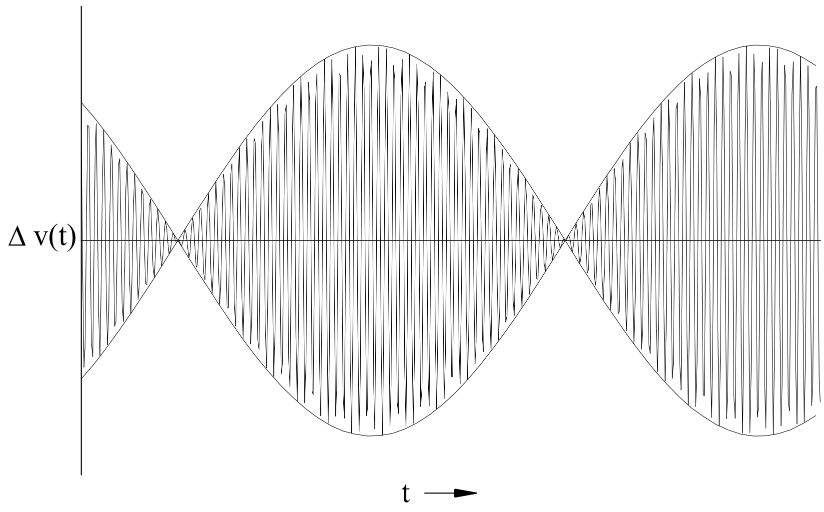


Frequency Difference (Slip Frequency) ΔF

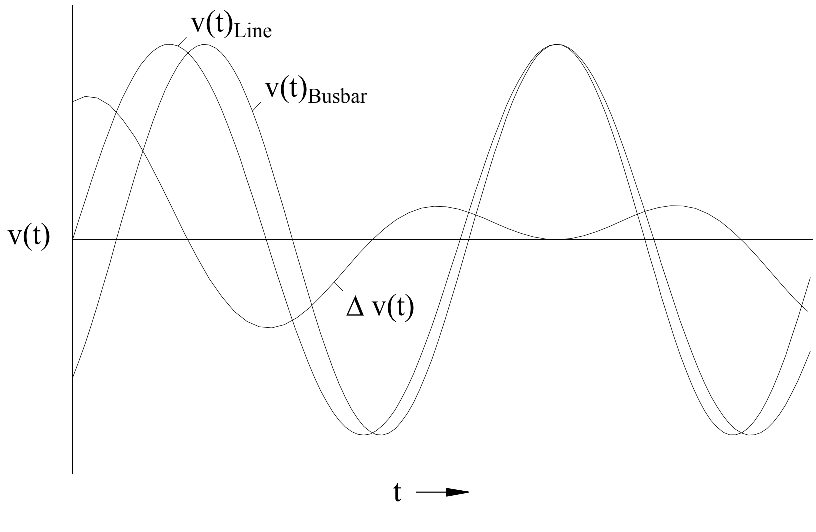
The second condition for paralleling two electrical systems is that their frequencies are nearly equal. This can be controlled by the generator's speed governor.



If the generator frequency f_{Bus} is not equal to the mains frequency f_{Line}, it results in a slip frequency $\Delta F = |f_{Bus} - f_{Line}|$ between the two system frequencies.

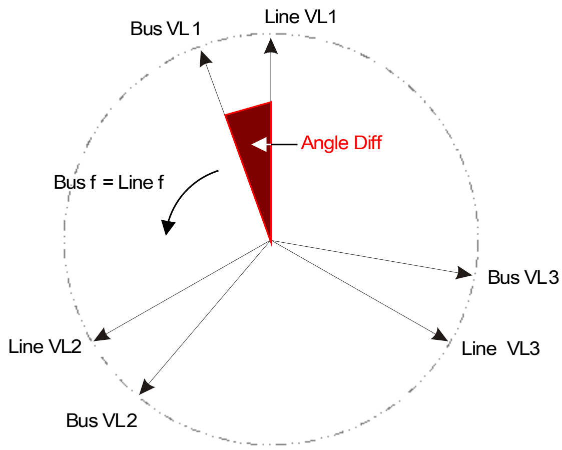


Voltage Curve with Enlarged Resolution.



Angular or Phase Difference.

Even if the frequency of both systems is exactly identical, usually an angular difference of the voltage phasors is the case.



At the instant of synchronization, the angular difference of the two systems should be nearly zero because, otherwise, unwanted load inrushes occur. Theoretically, the angular difference can be regulated to zero by giving short pulses to the speed governors. When paralleling generators with the grid, in practice, synchronization is requested as quick as possible and so usually a slight frequency difference is accepted. In such cases, the angular difference is not constant but changes with the slip frequency ΔF.

By taking the breaker closing time into consideration, a lead of the closing release impulse can be calculated in a way that breaker closing takes place at exactly the time when both systems are in angular conformity.

Basically the following applies:

Where large rotating masses are concerned, the frequency difference (slip frequency) of the two systems should possibly be nearly zero, because of the very high load inrushes at the instant of breaker closing. For smaller rotating masses, the frequency difference of the systems can be higher.

NOTICE

This sync-check cannot be used for two voltages that are shifted by a fixed angle (e.g because they are measured on the two sides of a block transformer of a generator).

Synchronization Modes

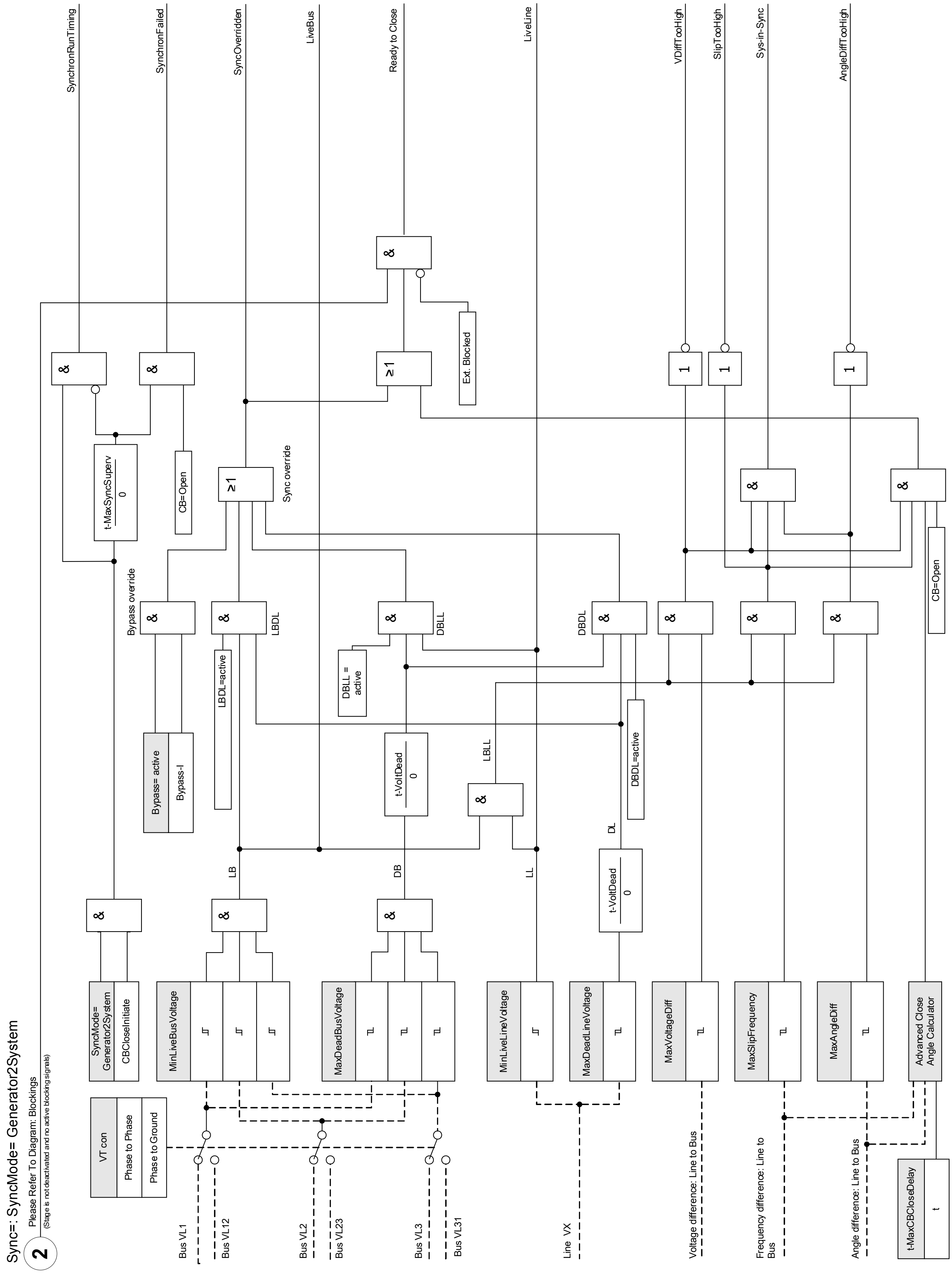
The synchrocheck module is able to check the synchronization of two electrical systems (system-to-system) or between a generator and an electrical system (generator-to-system). For paralleling two electrical systems, the station frequency, voltage and phase angle should be exactly the same as the utility grid. Whereas the synchronization of a generator to a system can be done with a certain slip-frequency, depending on the size of the generator used. Therefore the maximum breaker closing time has to be taken into consideration. With the set breaker closing time, the synchrocheck module is able to calculate the moment of synchronization and gives the paralleling release.

⚠ WARNING **When paralleling two systems, it has to be verified that the system-to-system mode is selected. Paralleling two systems in generator-to-system mode can cause severe damage!**

Working Principle Synchrocheck (Generator-to-System)

(Please refer to the block diagram on next page.)

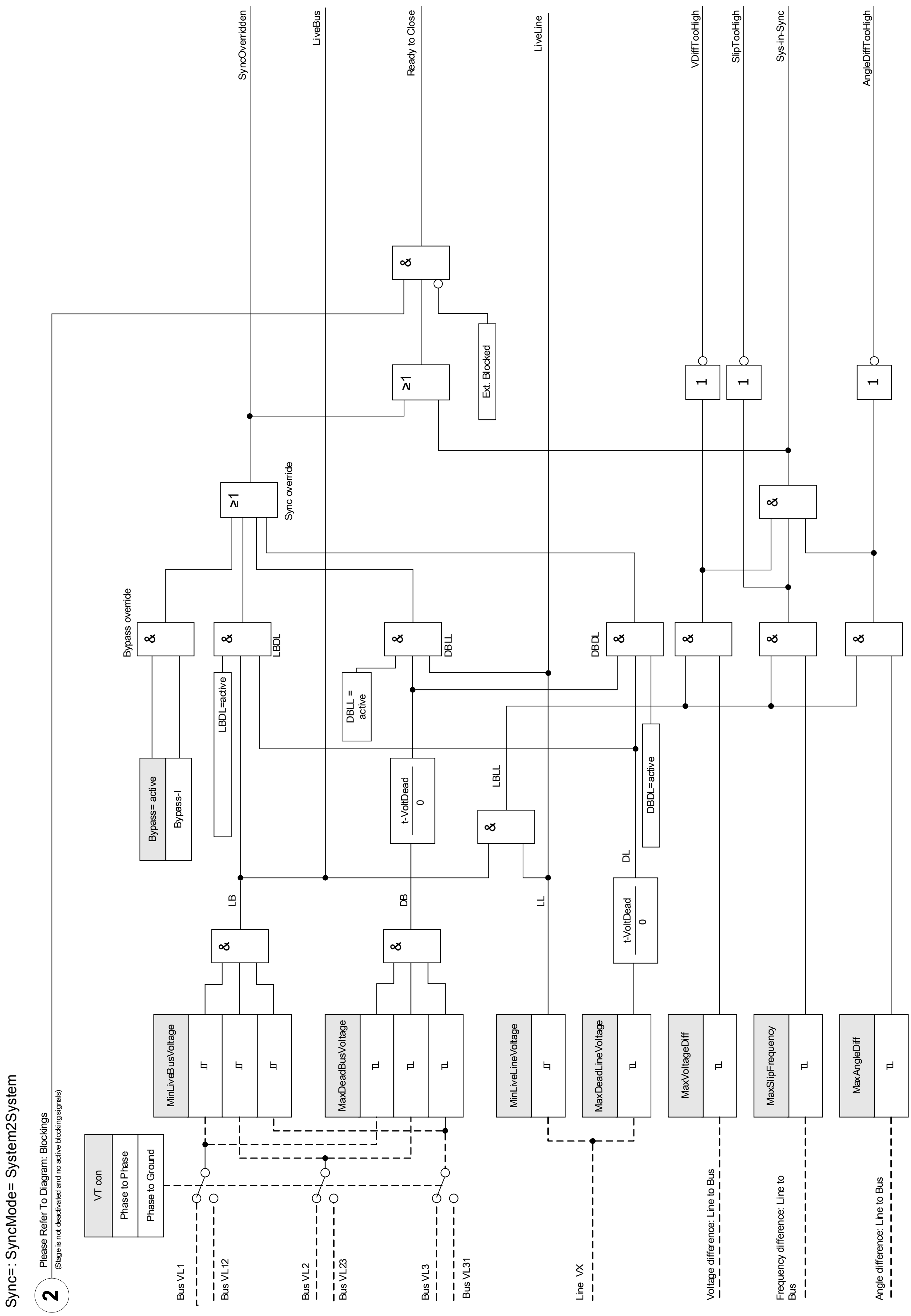
The synchrocheck element measures the three phase-to-neutral voltages »*VL1*«, »*VL2*«, and »*VL3*« or the three phase-to-phase voltages »*VL1-L2*«, »*VL2-L3*«, and »*VL3-L1*« of the generator busbar. The line voltage Vx is measured by the fourth voltage input. If all synchronous conditions are fulfilled (i. e.: ΔV [VoltageDiff], ΔF [SlipFrequency], and Δφ [AngleDiff]) are within the limits, a signal will be issued that both systems are synchronous. An advanced Close Angle Evaluator function takes the breaker closing time into consideration.


Sync=: SyncMode= Generator2System
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
VT con
Phase to Phase
Phase to Ground
Bus VL1
Bus VL12
Bus VL2
Bus VL23
Bus VL3
Bus VL31
Line VX
Voltage difference: Line to Bus
Frequency difference: Line to Bus
Angle difference: Line to Bus
t-MaxCBCloseDelay
t
SyncMode= Generator2System
CBCloseInitiate
MinLiveBusVoltage
MaxDeadBusVoltage
MinLiveLineVoltage
MaxDeadLineVoltage
MaxVoltageDiff
MaxSlipFrequency
MaxAngleDiff
Advanced Close Angle Calculator
LB
DB
LL
DL
t-VoltDead
0
Bypass= active
Bypass-I
LBDL=active
DBLL = active
DBDL=active
Bypass override
LBDL
DBLL
LBLL
DBDL
Sync override
t-MaxSyncSuperv
CB=Open
Ext. Blocked
SynchronRunTiming
SynchronFailed
SyncOverridden
LiveBus
Ready to Close
LiveLine
VDiffTooHigh
SlipTooHigh
Sys-in-Sync
AngleDiffTooHigh

Working Principle Synchrocheck (System-to-System)

(Please refer to the block diagram on next page.)

The synchrocheck function for two systems is very similar to the synchrocheck function for generator-to-system except there is no need to take the breaker closing time into account. The synchrocheck element measures the three phase-to-neutral voltages »*VL1*«, »*VL2*«, and »*VL3*« or the three phase-to-phase voltages »*VL1-L2*«, »*VL2-L3*«, and »*VL3-L1*« of the station voltage bus bar. The line voltage Vx is measured by the fourth voltage input. If all synchronous conditions are fulfilled (i. e.: ΔV [VoltageDiff], ΔF [SlipFrequency], and Δφ [AngleDiff]) are within the limits, a signal will be issued that both systems are synchronous.


Sync=: SyncMode= System2System
2
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
VT con
Phase to Phase
Phase to Ground
Bus VL1
Bus VL12
Bus VL2
Bus VL23
Bus VL3
Bus VL31
Line VX
Voltage difference: Line to Bus
Frequency difference: Line to Bus
Angle difference: Line to Bus
MinLiveBusVoltage
MaxDeadBusVoltage
MinLiveLineVoltage
MaxDeadLineVoltage
MaxVoltageDiff
MaxSlipFrequency
MaxAngleDiff
LB
DB
LL
DL
t-VoltDead
0
Bypass= active
Bypass-I
LBDL=active
DBLL =
active
DBDL=active
LBLL
Bypass override
LBDL
DBLL
DBDL
Sync override
&
≥1
1
Ext. Blocked
SyncOverridden
LiveBus
Ready to Close
LiveLine
VDiffTooHigh
SlipTooHigh
Sys-in-Sync
AngleDiffTooHigh

Synchrocheck Override Conditions

If enabled the following conditions can override the synchrocheck function:

•LBDL = Live Bus – Dead Line
•DBLL = Dead Bus – Live Line
•DBDL = Dead Bus – Dead Line

Also the synchrocheck function can be bypassed by an external source.

WARNING **When the synchrocheck function is overridden or bypassed, synchronization has to be secured by other synchronizing systems before breaker closing!**

Device Planning Parameters of the Synchrocheck Module

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

Global Protection Parameters of the Synchrocheck 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 /Intercon-Prot /Sync]
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 /Intercon-Prot /Sync]
Bypass	The Synchrocheck will be bypassed if the state of the assigned signal (logic input) becomes true.	1..n, DI-LogicList	-.-	[Protection Para /Global Prot Para /Intercon-Prot /Sync]
CB Pos Detect	Criterion by which the Circuit Breaker Switch Position is to be detected.	-.-, SG[1].Pos	SG[1].Pos	[Protection Para /Global Prot Para /Intercon-Prot /Sync]
CBCloseInitiate	Breaker Close Initiate with synchronism check from any control sources (e.g. HMI / SCADA). If the state of the assigned signal becomes true, a Breaker Close will be initiated (Trigger Source).	1..n, SyncRequestList	-.-	[Protection Para /Global Prot Para /Intercon-Prot /Sync]

Setting Group Parameters of the Synchrocheck Fault Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<1..4> /Intercon-Prot /Sync /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 /<1..4> /Intercon-Prot /Sync /General settings]
Bypass Fc	Allowing to bypass the Synchrocheck, if the state signal that is assigned to the parameter with the same name within the Global Parameters (logic input) becomes true.	inactive, active	inactive	[Protection Para /<1..4> /Intercon-Prot /Sync /General settings]
SyncMode	Synchrocheck mode: GENERATOR2SYSTEM = Synchronizing generator to system (breaker close initiate needed). SYSTEM2SYSTEM = SynchronCheck between two systems (Stand-Alone, no breaker info needed)	System2System, Generator2System	System2System	[Protection Para /<1..4> /Intercon-Prot /Sync /Mode / Times]
t-MaxCBCloseDelay	Maximum circuit breaker close time delay (Only used for GENERATOR-SYSTEM working mode and is critical for a correct synchronized switching) Only available if: SyncMode = System2System	0.00 - 300.00s	0.05s	[Protection Para /<1..4> /Intercon-Prot /Sync /Mode / Times]
t-MaxSyncSuperv	Synchron-Run timer: Max. time allowed for synchronizing process after a close initiate. Only used for GENERATOR2SYSTEM working mode. Only available if: SyncMode = System2System	0.00 - 3000.00s	30.00s	[Protection Para /<1..4> /Intercon-Prot /Sync /Mode / Times]
MinLiveBusVoltage	Minimum Live Bus voltage (Live bus detected, when all three phase bus voltages are above this limit).	0.10 - 1.50Vn	0.65Vn	[Protection Para /<1..4> /Intercon-Prot /Sync /DeadLiveVLevels]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
MaxDeadBusVoltage	Maximum Dead Bus voltage (Dead bus detected, when all three phase bus voltages are below this limit).	0.01 - 1.00Vn	0.03Vn	[Protection Para /<1..4> /Intercon-Prot /Sync /DeadLiveVLevels]
MinLiveLineVoltage	Minimum Live Line voltage (Live line detected, when line voltage above this limit).	0.10 - 1.50Vn	0.65Vn	[Protection Para /<1..4> /Intercon-Prot /Sync /DeadLiveVLevels]
MaxDeadLineVoltage	Maximum Dead Line voltage (Dead Line detected, when line voltage below this limit).	0.01 - 1.00Vn	0.03Vn	[Protection Para /<1..4> /Intercon-Prot /Sync /DeadLiveVLevels]
t-VoltDead	Voltage dead time (A Dead Bus/Line condition will be accepted only if the voltage falls below the set dead voltage levels longer than this time setting).	0.000 - 300.000s	0.167s	[Protection Para /<1..4> /Intercon-Prot /Sync /DeadLiveVLevels]
MaxVoltageDiff	Maximum voltage difference between bus and line voltage phasors (Delta V)for synchronism (Related to bus voltage secondary rating)	0.01 - 1.00Vn	0.24Vn	[Protection Para /<1..4> /Intercon-Prot /Sync /Conditions]
MaxSlipFrequency	Maximum frequency difference (Slip: Delta f) between bus and line voltage allowed for synchronism	0.01 - 2.00Hz	0.20Hz	[Protection Para /<1..4> /Intercon-Prot /Sync /Conditions]
MaxAngleDiff	Maximum phase angle difference (Delta-Phi in degree) between bus and line voltages allowed for synchronism	1 - 60°	20°	[Protection Para /<1..4> /Intercon-Prot /Sync /Conditions]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
DBDL	Enable/disable Dead-Bus AND Dead-Line synchronism overriding	inactive, active	inactive	[Protection Para /<1..4> /Intercon-Prot /Sync /Override]
DBLL	Enable/disable Dead-Bus AND Live-Line synchronism overriding	inactive, active	inactive	[Protection Para /<1..4> /Intercon-Prot /Sync /Override]
LBDL	Enable/disable Live-Bus AND Dead-Line synchronism overriding	inactive, active	inactive	[Protection Para /<1..4> /Intercon-Prot /Sync /Override]

Synchrocheck Module Input States

Name	*Description*	*Assignment via*
ExBlo1-I	Module input state: External blocking1	[Protection Para /Global Prot Para /Intercon-Prot /Sync]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /Intercon-Prot /Sync]
Bypass-I	State of the module input: Bypass	[Protection Para /Global Prot Para /Intercon-Prot /Sync]
CBCloseInitiate-I	State of the module input: Breaker Close Initiate with synchronism check from any control sources (e.g. HMI / SCADA). If the state of the assigned signal becomes true, a Breaker Close will be initiated (Trigger Source).	[Protection Para /Global Prot Para /Intercon-Prot /Sync]

Signals of the Synchrocheck Module (Output States)

Signal	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
LiveBus	Signal: Live-Bus flag: 1=Live-Bus, 0=Voltage is below the LiveBus threshold
LiveLine	Signal: Live Line flag: 1=Live-Line, 0=Voltage is below the LiveLine threshold
SynchronRunTiming	Signal: SynchronRunTiming
SynchronFailed	Signal: This signal indicates a failed synchronization. It is set for 5s when the circuit breaker is still open after the Synchron-Run-timer has timed out.
SyncOverridden	Signal:Synchronism Check is overridden because one of the Synchronism overriding conditions (DB/DL or ExtBypass) is met.
VDiffTooHigh	Signal: Voltage difference between bus and line too high.
SlipTooHigh	Signal: Frequency difference (slip frequency) between bus and line voltages too high.
AngleDiffTooHigh	Signal: Phase Angle difference between bus and line voltages too high.
Sys-in-Sync	Signal: Bus and line voltages are in synchronism according to the system synchronism criteria.
Ready to Close	Signal: Ready to Close

Values of the Syncrocheck

Value	*Description*	*Default*	*Size*	*Menu path*
Slip Freq	Slip frequency	0Hz	0 - 70.000Hz	[Operation /Measured values /Synchronism]
Volt Diff	Voltage difference between bus and line.	0V	0 - 500000.0V	[Operation /Measured values /Synchronism]
Angle Diff	Angle difference between bus and line voltages.	0°	-360.0 - 360.0°	[Operation /Measured values /Synchronism]
f Bus	Bus frequency	0Hz	0 - 70.000Hz	[Operation /Measured values /Synchronism]
f Line	Line frequency	0Hz	0 - 70.000Hz	[Operation /Measured values /Synchronism]
V Bus	Bus Voltage	0V	0 - 500000.0V	[Operation /Measured values /Synchronism]
V Line	Line Voltage	0V	0 - 500000.0V	[Operation /Measured values /Synchronism]
Angle Bus	Bus Angle (Reference)	0°	0 - 360°	[Operation /Measured values /Synchronism]
Angle Line	Line Angle	0°	0 - 360°	[Operation /Measured values /Synchronism]

Signals that Trigger a Synchrocheck

Name	*Description*
-.-	No assignment
SG[1].Sync ON request	Signal: Synchronous ON request
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

Name	*Description*
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
Logics.LE1.Gate Out	Signal: Output of the logic gate
Logics.LE1.Timer Out	Signal: Timer Output
Logics.LE1.Out	Signal: Latched Output (Q)
Logics.LE1.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE2.Gate Out	Signal: Output of the logic gate
Logics.LE2.Timer Out	Signal: Timer Output
Logics.LE2.Out	Signal: Latched Output (Q)
Logics.LE2.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE3.Gate Out	Signal: Output of the logic gate
Logics.LE3.Timer Out	Signal: Timer Output
Logics.LE3.Out	Signal: Latched Output (Q)
Logics.LE3.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE4.Gate Out	Signal: Output of the logic gate
Logics.LE4.Timer Out	Signal: Timer Output
Logics.LE4.Out	Signal: Latched Output (Q)
Logics.LE4.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE5.Gate Out	Signal: Output of the logic gate
Logics.LE5.Timer Out	Signal: Timer Output
Logics.LE5.Out	Signal: Latched Output (Q)
Logics.LE5.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE6.Gate Out	Signal: Output of the logic gate
Logics.LE6.Timer Out	Signal: Timer Output
Logics.LE6.Out	Signal: Latched Output (Q)
Logics.LE6.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE7.Gate Out	Signal: Output of the logic gate
Logics.LE7.Timer Out	Signal: Timer Output
Logics.LE7.Out	Signal: Latched Output (Q)
Logics.LE7.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE8.Gate Out	Signal: Output of the logic gate
Logics.LE8.Timer Out	Signal: Timer Output
Logics.LE8.Out	Signal: Latched Output (Q)
Logics.LE8.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE9.Gate Out	Signal: Output of the logic gate
Logics.LE9.Timer Out	Signal: Timer Output
Logics.LE9.Out	Signal: Latched Output (Q)
Logics.LE9.Out inverted	Signal: Negated Latched Output (Q NOT)

Name	*Description*
Logics.LE10.Gate Out	Signal: Output of the logic gate
Logics.LE10.Timer Out	Signal: Timer Output
Logics.LE10.Out	Signal: Latched Output (Q)
Logics.LE10.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE11.Gate Out	Signal: Output of the logic gate
Logics.LE11.Timer Out	Signal: Timer Output
Logics.LE11.Out	Signal: Latched Output (Q)
Logics.LE11.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE12.Gate Out	Signal: Output of the logic gate
Logics.LE12.Timer Out	Signal: Timer Output
Logics.LE12.Out	Signal: Latched Output (Q)
Logics.LE12.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE13.Gate Out	Signal: Output of the logic gate
Logics.LE13.Timer Out	Signal: Timer Output
Logics.LE13.Out	Signal: Latched Output (Q)
Logics.LE13.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE14.Gate Out	Signal: Output of the logic gate
Logics.LE14.Timer Out	Signal: Timer Output
Logics.LE14.Out	Signal: Latched Output (Q)
Logics.LE14.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE15.Gate Out	Signal: Output of the logic gate
Logics.LE15.Timer Out	Signal: Timer Output
Logics.LE15.Out	Signal: Latched Output (Q)
Logics.LE15.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE16.Gate Out	Signal: Output of the logic gate
Logics.LE16.Timer Out	Signal: Timer Output
Logics.LE16.Out	Signal: Latched Output (Q)
Logics.LE16.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE17.Gate Out	Signal: Output of the logic gate
Logics.LE17.Timer Out	Signal: Timer Output
Logics.LE17.Out	Signal: Latched Output (Q)
Logics.LE17.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE18.Gate Out	Signal: Output of the logic gate
Logics.LE18.Timer Out	Signal: Timer Output
Logics.LE18.Out	Signal: Latched Output (Q)
Logics.LE18.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE19.Gate Out	Signal: Output of the logic gate
Logics.LE19.Timer Out	Signal: Timer Output
Logics.LE19.Out	Signal: Latched Output (Q)
Logics.LE19.Out inverted	Signal: Negated Latched Output (Q NOT)

Name	*Description*
Logics.LE20.Gate Out	Signal: Output of the logic gate
Logics.LE20.Timer Out	Signal: Timer Output
Logics.LE20.Out	Signal: Latched Output (Q)
Logics.LE20.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE21.Gate Out	Signal: Output of the logic gate
Logics.LE21.Timer Out	Signal: Timer Output
Logics.LE21.Out	Signal: Latched Output (Q)
Logics.LE21.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE22.Gate Out	Signal: Output of the logic gate
Logics.LE22.Timer Out	Signal: Timer Output
Logics.LE22.Out	Signal: Latched Output (Q)
Logics.LE22.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE23.Gate Out	Signal: Output of the logic gate
Logics.LE23.Timer Out	Signal: Timer Output
Logics.LE23.Out	Signal: Latched Output (Q)
Logics.LE23.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE24.Gate Out	Signal: Output of the logic gate
Logics.LE24.Timer Out	Signal: Timer Output
Logics.LE24.Out	Signal: Latched Output (Q)
Logics.LE24.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE25.Gate Out	Signal: Output of the logic gate
Logics.LE25.Timer Out	Signal: Timer Output
Logics.LE25.Out	Signal: Latched Output (Q)
Logics.LE25.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE26.Gate Out	Signal: Output of the logic gate
Logics.LE26.Timer Out	Signal: Timer Output
Logics.LE26.Out	Signal: Latched Output (Q)
Logics.LE26.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE27.Gate Out	Signal: Output of the logic gate
Logics.LE27.Timer Out	Signal: Timer Output
Logics.LE27.Out	Signal: Latched Output (Q)
Logics.LE27.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE28.Gate Out	Signal: Output of the logic gate
Logics.LE28.Timer Out	Signal: Timer Output
Logics.LE28.Out	Signal: Latched Output (Q)
Logics.LE28.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE29.Gate Out	Signal: Output of the logic gate
Logics.LE29.Timer Out	Signal: Timer Output
Logics.LE29.Out	Signal: Latched Output (Q)
Logics.LE29.Out inverted	Signal: Negated Latched Output (Q NOT)

Name	*Description*
Logics.LE30.Gate Out	Signal: Output of the logic gate
Logics.LE30.Timer Out	Signal: Timer Output
Logics.LE30.Out	Signal: Latched Output (Q)
Logics.LE30.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE31.Gate Out	Signal: Output of the logic gate
Logics.LE31.Timer Out	Signal: Timer Output
Logics.LE31.Out	Signal: Latched Output (Q)
Logics.LE31.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE32.Gate Out	Signal: Output of the logic gate
Logics.LE32.Timer Out	Signal: Timer Output
Logics.LE32.Out	Signal: Latched Output (Q)
Logics.LE32.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE33.Gate Out	Signal: Output of the logic gate
Logics.LE33.Timer Out	Signal: Timer Output
Logics.LE33.Out	Signal: Latched Output (Q)
Logics.LE33.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE34.Gate Out	Signal: Output of the logic gate
Logics.LE34.Timer Out	Signal: Timer Output
Logics.LE34.Out	Signal: Latched Output (Q)
Logics.LE34.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE35.Gate Out	Signal: Output of the logic gate
Logics.LE35.Timer Out	Signal: Timer Output
Logics.LE35.Out	Signal: Latched Output (Q)
Logics.LE35.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE36.Gate Out	Signal: Output of the logic gate
Logics.LE36.Timer Out	Signal: Timer Output
Logics.LE36.Out	Signal: Latched Output (Q)
Logics.LE36.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE37.Gate Out	Signal: Output of the logic gate
Logics.LE37.Timer Out	Signal: Timer Output
Logics.LE37.Out	Signal: Latched Output (Q)
Logics.LE37.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE38.Gate Out	Signal: Output of the logic gate
Logics.LE38.Timer Out	Signal: Timer Output
Logics.LE38.Out	Signal: Latched Output (Q)
Logics.LE38.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE39.Gate Out	Signal: Output of the logic gate
Logics.LE39.Timer Out	Signal: Timer Output
Logics.LE39.Out	Signal: Latched Output (Q)
Logics.LE39.Out inverted	Signal: Negated Latched Output (Q NOT)

Name	*Description*
Logics.LE40.Gate Out	Signal: Output of the logic gate
Logics.LE40.Timer Out	Signal: Timer Output
Logics.LE40.Out	Signal: Latched Output (Q)
Logics.LE40.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE41.Gate Out	Signal: Output of the logic gate
Logics.LE41.Timer Out	Signal: Timer Output
Logics.LE41.Out	Signal: Latched Output (Q)
Logics.LE41.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE42.Gate Out	Signal: Output of the logic gate
Logics.LE42.Timer Out	Signal: Timer Output
Logics.LE42.Out	Signal: Latched Output (Q)
Logics.LE42.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE43.Gate Out	Signal: Output of the logic gate
Logics.LE43.Timer Out	Signal: Timer Output
Logics.LE43.Out	Signal: Latched Output (Q)
Logics.LE43.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE44.Gate Out	Signal: Output of the logic gate
Logics.LE44.Timer Out	Signal: Timer Output
Logics.LE44.Out	Signal: Latched Output (Q)
Logics.LE44.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE45.Gate Out	Signal: Output of the logic gate
Logics.LE45.Timer Out	Signal: Timer Output
Logics.LE45.Out	Signal: Latched Output (Q)
Logics.LE45.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE46.Gate Out	Signal: Output of the logic gate
Logics.LE46.Timer Out	Signal: Timer Output
Logics.LE46.Out	Signal: Latched Output (Q)
Logics.LE46.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE47.Gate Out	Signal: Output of the logic gate
Logics.LE47.Timer Out	Signal: Timer Output
Logics.LE47.Out	Signal: Latched Output (Q)
Logics.LE47.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE48.Gate Out	Signal: Output of the logic gate
Logics.LE48.Timer Out	Signal: Timer Output
Logics.LE48.Out	Signal: Latched Output (Q)
Logics.LE48.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE49.Gate Out	Signal: Output of the logic gate
Logics.LE49.Timer Out	Signal: Timer Output
Logics.LE49.Out	Signal: Latched Output (Q)
Logics.LE49.Out inverted	Signal: Negated Latched Output (Q NOT)

Name	*Description*
Logics.LE50.Gate Out	Signal: Output of the logic gate
Logics.LE50.Timer Out	Signal: Timer Output
Logics.LE50.Out	Signal: Latched Output (Q)
Logics.LE50.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE51.Gate Out	Signal: Output of the logic gate
Logics.LE51.Timer Out	Signal: Timer Output
Logics.LE51.Out	Signal: Latched Output (Q)
Logics.LE51.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE52.Gate Out	Signal: Output of the logic gate
Logics.LE52.Timer Out	Signal: Timer Output
Logics.LE52.Out	Signal: Latched Output (Q)
Logics.LE52.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE53.Gate Out	Signal: Output of the logic gate
Logics.LE53.Timer Out	Signal: Timer Output
Logics.LE53.Out	Signal: Latched Output (Q)
Logics.LE53.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE54.Gate Out	Signal: Output of the logic gate
Logics.LE54.Timer Out	Signal: Timer Output
Logics.LE54.Out	Signal: Latched Output (Q)
Logics.LE54.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE55.Gate Out	Signal: Output of the logic gate
Logics.LE55.Timer Out	Signal: Timer Output
Logics.LE55.Out	Signal: Latched Output (Q)
Logics.LE55.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE56.Gate Out	Signal: Output of the logic gate
Logics.LE56.Timer Out	Signal: Timer Output
Logics.LE56.Out	Signal: Latched Output (Q)
Logics.LE56.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE57.Gate Out	Signal: Output of the logic gate
Logics.LE57.Timer Out	Signal: Timer Output
Logics.LE57.Out	Signal: Latched Output (Q)
Logics.LE57.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE58.Gate Out	Signal: Output of the logic gate
Logics.LE58.Timer Out	Signal: Timer Output
Logics.LE58.Out	Signal: Latched Output (Q)
Logics.LE58.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE59.Gate Out	Signal: Output of the logic gate
Logics.LE59.Timer Out	Signal: Timer Output
Logics.LE59.Out	Signal: Latched Output (Q)
Logics.LE59.Out inverted	Signal: Negated Latched Output (Q NOT)

Name	*Description*
Logics.LE60.Gate Out	Signal: Output of the logic gate
Logics.LE60.Timer Out	Signal: Timer Output
Logics.LE60.Out	Signal: Latched Output (Q)
Logics.LE60.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE61.Gate Out	Signal: Output of the logic gate
Logics.LE61.Timer Out	Signal: Timer Output
Logics.LE61.Out	Signal: Latched Output (Q)
Logics.LE61.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE62.Gate Out	Signal: Output of the logic gate
Logics.LE62.Timer Out	Signal: Timer Output
Logics.LE62.Out	Signal: Latched Output (Q)
Logics.LE62.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE63.Gate Out	Signal: Output of the logic gate
Logics.LE63.Timer Out	Signal: Timer Output
Logics.LE63.Out	Signal: Latched Output (Q)
Logics.LE63.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE64.Gate Out	Signal: Output of the logic gate
Logics.LE64.Timer Out	Signal: Timer Output
Logics.LE64.Out	Signal: Latched Output (Q)
Logics.LE64.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE65.Gate Out	Signal: Output of the logic gate
Logics.LE65.Timer Out	Signal: Timer Output
Logics.LE65.Out	Signal: Latched Output (Q)
Logics.LE65.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE66.Gate Out	Signal: Output of the logic gate
Logics.LE66.Timer Out	Signal: Timer Output
Logics.LE66.Out	Signal: Latched Output (Q)
Logics.LE66.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE67.Gate Out	Signal: Output of the logic gate
Logics.LE67.Timer Out	Signal: Timer Output
Logics.LE67.Out	Signal: Latched Output (Q)
Logics.LE67.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE68.Gate Out	Signal: Output of the logic gate
Logics.LE68.Timer Out	Signal: Timer Output
Logics.LE68.Out	Signal: Latched Output (Q)
Logics.LE68.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE69.Gate Out	Signal: Output of the logic gate
Logics.LE69.Timer Out	Signal: Timer Output
Logics.LE69.Out	Signal: Latched Output (Q)
Logics.LE69.Out inverted	Signal: Negated Latched Output (Q NOT)

Name	*Description*
Logics.LE70.Gate Out	Signal: Output of the logic gate
Logics.LE70.Timer Out	Signal: Timer Output
Logics.LE70.Out	Signal: Latched Output (Q)
Logics.LE70.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE71.Gate Out	Signal: Output of the logic gate
Logics.LE71.Timer Out	Signal: Timer Output
Logics.LE71.Out	Signal: Latched Output (Q)
Logics.LE71.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE72.Gate Out	Signal: Output of the logic gate
Logics.LE72.Timer Out	Signal: Timer Output
Logics.LE72.Out	Signal: Latched Output (Q)
Logics.LE72.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE73.Gate Out	Signal: Output of the logic gate
Logics.LE73.Timer Out	Signal: Timer Output
Logics.LE73.Out	Signal: Latched Output (Q)
Logics.LE73.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE74.Gate Out	Signal: Output of the logic gate
Logics.LE74.Timer Out	Signal: Timer Output
Logics.LE74.Out	Signal: Latched Output (Q)
Logics.LE74.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE75.Gate Out	Signal: Output of the logic gate
Logics.LE75.Timer Out	Signal: Timer Output
Logics.LE75.Out	Signal: Latched Output (Q)
Logics.LE75.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE76.Gate Out	Signal: Output of the logic gate
Logics.LE76.Timer Out	Signal: Timer Output
Logics.LE76.Out	Signal: Latched Output (Q)
Logics.LE76.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE77.Gate Out	Signal: Output of the logic gate
Logics.LE77.Timer Out	Signal: Timer Output
Logics.LE77.Out	Signal: Latched Output (Q)
Logics.LE77.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE78.Gate Out	Signal: Output of the logic gate
Logics.LE78.Timer Out	Signal: Timer Output
Logics.LE78.Out	Signal: Latched Output (Q)
Logics.LE78.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE79.Gate Out	Signal: Output of the logic gate
Logics.LE79.Timer Out	Signal: Timer Output
Logics.LE79.Out	Signal: Latched Output (Q)
Logics.LE79.Out inverted	Signal: Negated Latched Output (Q NOT)

Name	Description
Logics.LE80.Gate Out	Signal: Output of the logic gate
Logics.LE80.Timer Out	Signal: Timer Output
Logics.LE80.Out	Signal: Latched Output (Q)
Logics.LE80.Out inverted	Signal: Negated Latched Output (Q NOT)

LVRT – Low Voltage Ride Through

Available Elements:

LVRT

Why LVRT? - Motivation for LVRT

The rapid development of distributed resources (DR) based on the renewable energy such as wind, solar and others has been changing the electric power system and concepts for its control, protection, metering and communication rapidly, too.

One of the important challenges for the interconnection between the DR and local electric power system (EPS) is the behaviour of the DR during disturbances within the electrical power system. Most of the disturbances within the EPS are characterized mainly by non-permanent system voltage collapses (voltage dip/sag) with different time durations.

According to traditional protection concepts a distributed energy resource should be tripped as fast as possible from the grid in case of a significant low voltage condition. This is no longer acceptable because of the continuous rising share of distributed energy resources within the energy market. Uncontrolled disconnecting significant parts of the power generation during disturbances within the grid endangers the system stability of the electrical power system.

It was reported[3] that during system fault with low voltage drops, a complete 5000 MW wind park (without LVRT capability) was decoupled from the electrical power system. The consequence was a dangerous system voltage and frequency instability.

Based on experiences like that, lots of electric utilities and state public utilities have issued interconnection standards which require Low-Voltage-Ride-Through (LVRT) capability during EPS disturbances.

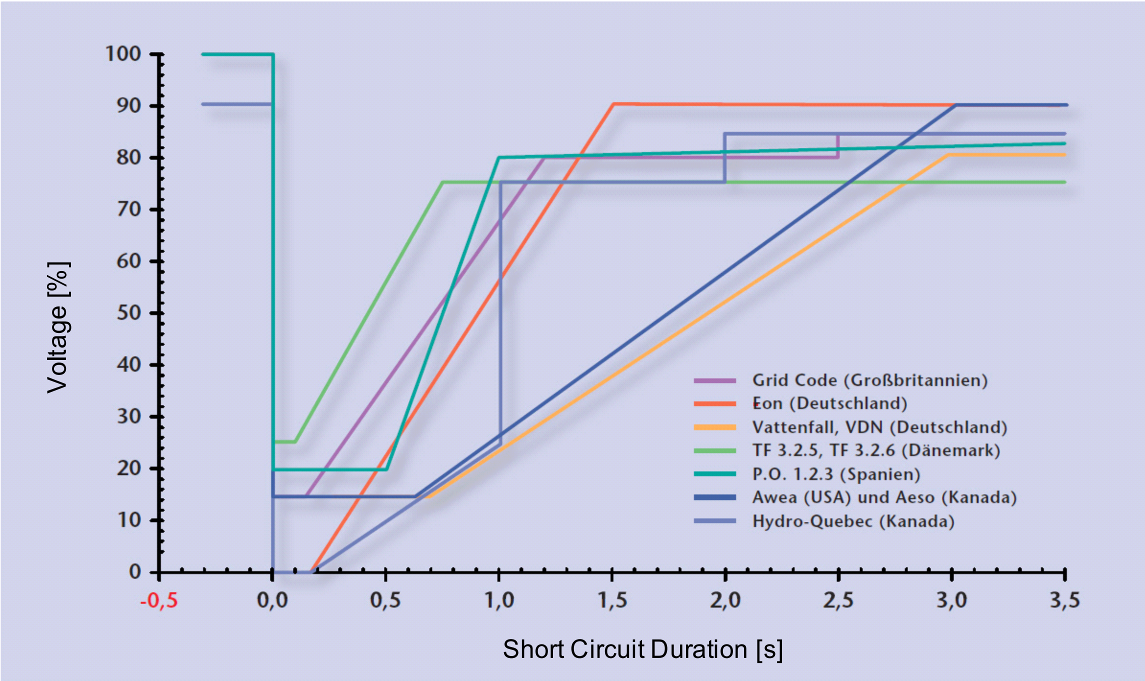
What does LVRT mean in detail?

It is no longer allowed to decouple/disconnect a DR from the grid just because of a non-permanent voltage dip. Protective relays and control units have to take this into account.
Instead of that, the distributed resource has to be able to ride through such disturbances according to a *LVRT* profile. The shape of this *LVRT* profile is very similar according to the different guidelines within different countries or local utilities. But they could differ in details.

By means of *LVRT* the system stability is improved in situations, when the contribution of DRs is needed mostly. The importance of *LVRT* will rise with the growing share of DRs within the electrical power system.

Based on the technical requirements mentioned above, a *LVRT* protection function was developed for the *HighPROTEC* product line which covers the *LVRT* profiles (capabilities) defined by all relevant national and local grid interconnection standards.

The following drawing shows details on the different *LVRT* standards in different countries. Please note, that the standards and hence the grid codes are in some countries still under development.



Source: eBWK Bd. 60 (2008) Nr. 4

Authors: Dipl.-Ing. Thomas Smolka, Dr.-Ing. Karl-Heinz Weck, Zertifizierungstelle der FGH e.V., Mannheim, sowie Dipl.-Ing. (FH) Matthias Bartsch, Enercon GmbH, Aurich.

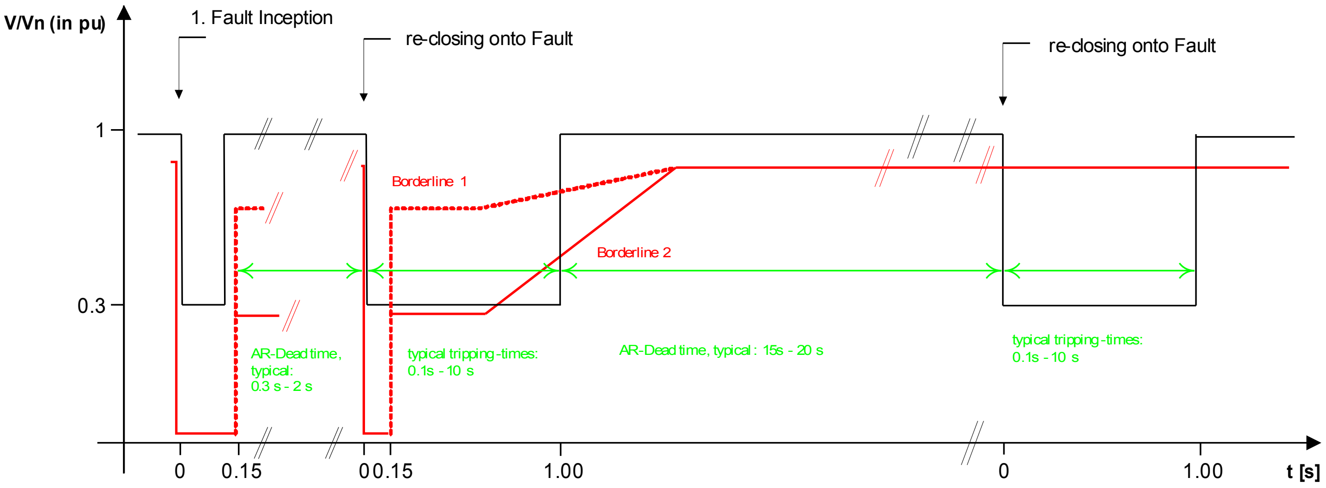
Functional Principle of the LVRT

From the grid operators point of view, a *LVRT* profile defines a voltage profile which a distributed generator, that is connected to the grid, should be able to ride through a low voltage event if the voltage at the point of common coupling remains above the *LVRT* borderline defined by the *LVRT* profile after a disturbance. The distributed generator is only allowed to disconnect from the grid if the voltage at the point of common coupling drops below the *LVRT* borderline. In other words, a LVRT protection function is a time-dependent voltage supervision according to a predefined voltage profile. The time-dependent voltage supervision will be started, as soon as the voltage at the point of common coupling falls below the start voltage level. The *LVRT* will be stopped, as soon as the voltage rises above the recover voltage level.

Auto Reclosure controlled LVRT

As already mentioned, the purpose of LVRT is to keep the DR connected to the grid in case of a non-permanent voltage dip/sag. For faults within the electrical power system by which auto-reclosing function is used to coordinate with the short circuit protections like overcurrent or distance protections, it is to expect that more than one voltage dips are coming one after another in a time period which is determined by the preset auto-reclosing dead times and protection relay operating times. Voltage dips/sags caused by the dead times of auto reclosings are non-permanent. Hence the protective device has to be able to detect voltage sags/dips in accordance with an auto reclosure and issues a trip command in that case that the voltage drops below the profile or that all parameterized auto reclosure shots were unsuccessful.

The following figure[1] depicts the voltage excursion by an unsuccessful two-shot Auto-Reclosing. According to some grid codes[1] it is obligated for a distributed generation to ride through a series of temporary voltage dips, but can be disconnected from the electrical power system immediately for a permanent fault. This kind of applications can be realized easily using the feature of »*AR-controlled LVRT*« in *LVRT* protection function.



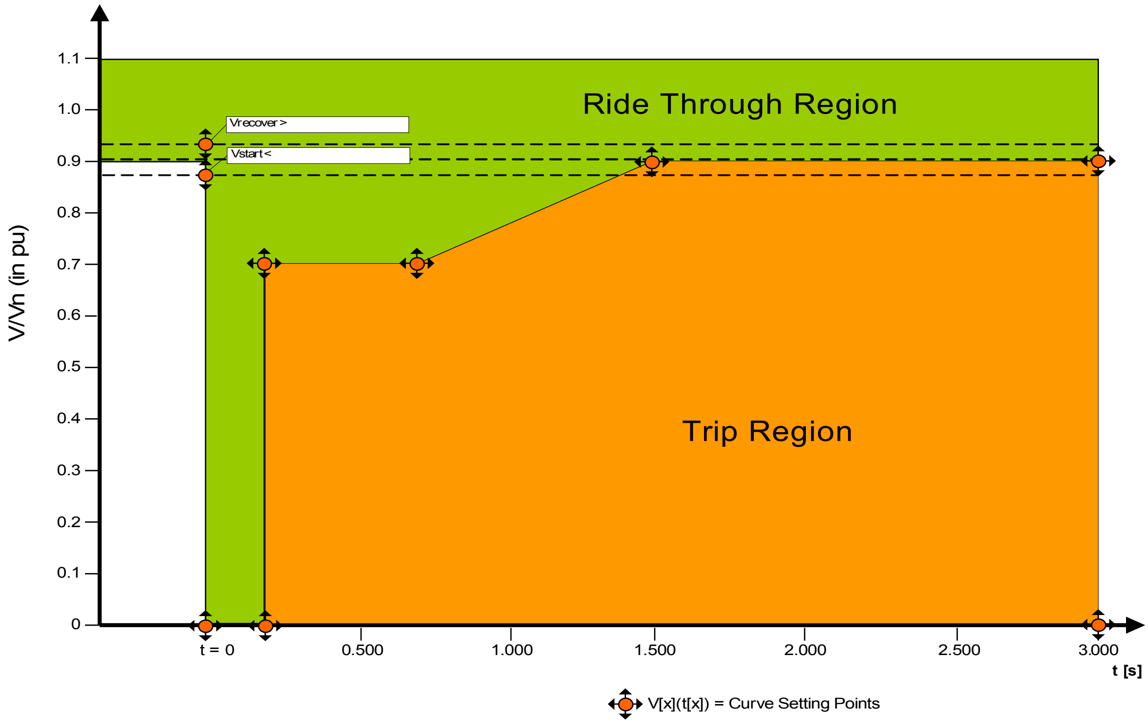
Source: Technische Richtlinie , Erzeugungsanlagen am Mittelspannungsnetz, Ausgabe Juni 2008, BDEW Bundesverband der Energie- und Wasserwirtschaft e.V. (Page 89).

Figure: Run of voltage curve during an unsuccessful two-shot auto reclosure

Functional Description of the LVRT

The *LVRT* element is designed for distributed generation resources that operate in parallel with the grid. It supervises system voltage disturbances by comparing them with a configurable voltage profile that is triggered once the system voltage falls below a configurable start value »*Vstart<*«.

Once triggered, the *LVRT* element supervises the system voltage consecutively and determines if the voltage excursion is above or below of the preset voltage profile. A trip signal is only issued if the voltage excursion exits the “Ride-Through” region and goes into the “Tripping” region.

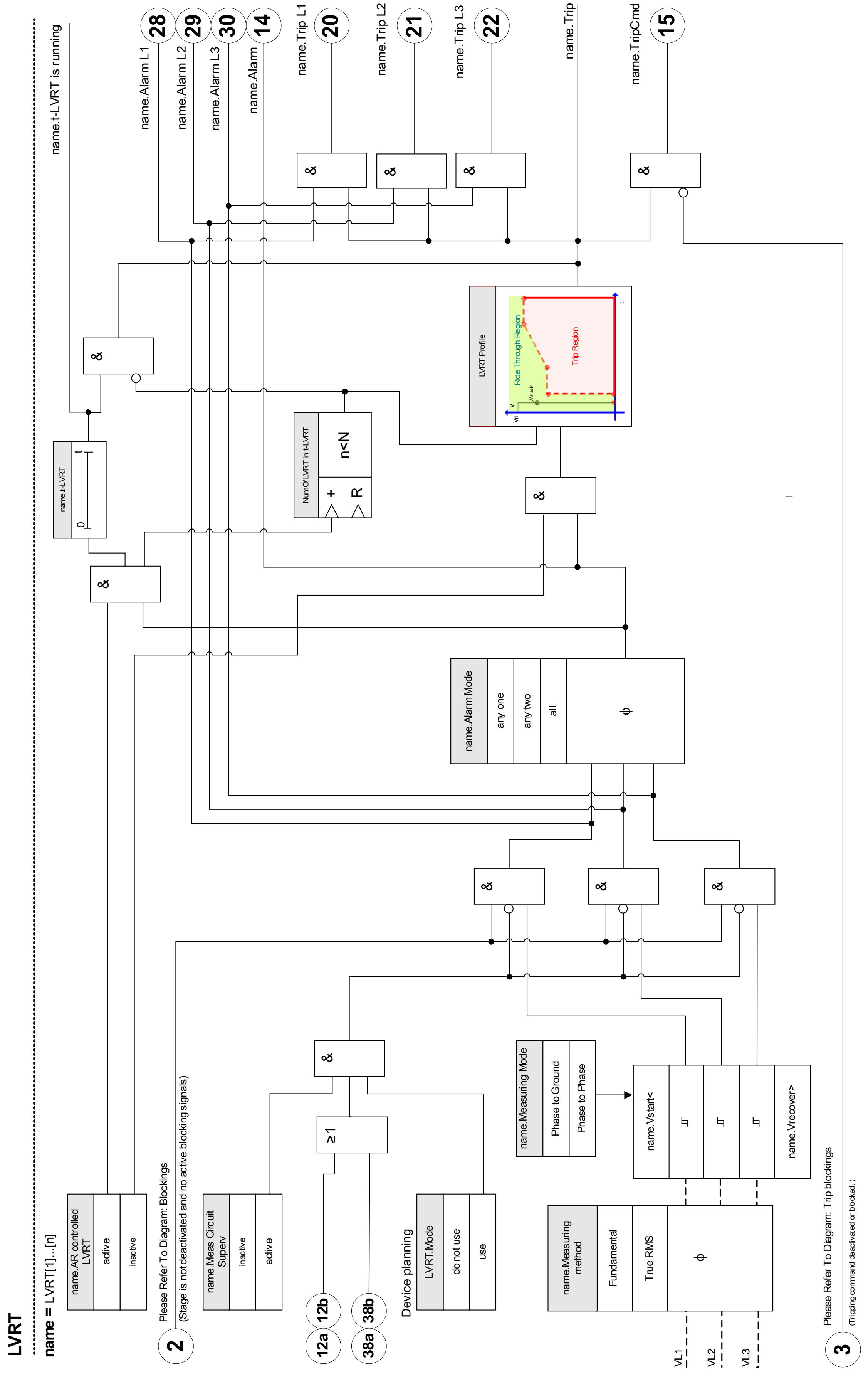


The *LVRT* element will change into standby again as soon as the system voltage recovers: That means, the voltage has risen above the preset recover voltage »*Vrecover*«.

Auto Reclosure controlled LVRT

In case that the *LVRT* should be able to ride through auto reclosures, the parameter »*ARControlledLVRT«* has to be set to »*active«*.

In order to supervise the Low Voltage Ride Through events during reclosure, the user has to set the supervision timer »tLVRT*« at least equal or greater than* the complete Multi-Shot AR-runtime. In addition to that the number of permitted *LVRTs* has to be set whichis usually the number of auto reclosure attempts. The actual *LVRT* supervision will be controlled to ride through the preset *LVRT* voltage pattern. By reaching the preset number of LVRT events »*NumberOfLVRT«*, the actual *LVRT* supervision assumes that the detected system fault is permanent, ignores the voltage profile and issues a tripping command instantaneously in order to disconnect the distributed resource from the electrical power system.



LVRT
name = LVRT[1]...[n]
name.AR controlled LVRT
active
inactive
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
2
name.Meas Circuit Superv
inactive
active
12a
12b
38a
38b
≥1
&
Device planning
LVRT.Mode
do not use
use
name.Measuring Mode
Phase to Ground
Phase to Phase
name.Measuring method
Fundamental
True RMS
VL1
VL2
VL3
name.Vstart<
name.Vrecover>
Please Refer To Diagram: Trip blockings
(Tripping command deactivated or blocked.)
3
name.t-LVRT
0
t
name.t-LVRT is running
NumOfLVRT in t-LVRT
+
R
n<N
name.Alarm Mode
any one
any two
all
LVRT Profile
Ride Through Region
Trip Region
Vn
V
Vstart
t
name.Alarm L1
28
name.Alarm L2
29
name.Alarm L3
30
name.Alarm
14
name.Trip L1
20
name.Trip L2
21
name.Trip L3
22
name.Trip
name.TripCmd
15

Device Planning Parameters of the Low-Voltage-Ride-Through

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

Setting Group Parameters of the Low-Voltage-Ride-Through

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<1..4> /Intercon-Prot /LVRT /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 /<1..4> /Intercon-Prot /LVRT /General settings]
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<1..4> /Intercon-Prot /LVRT /General settings]
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 /<1..4> /Intercon-Prot /LVRT /General settings]
Measuring Mode	Measuring/Supervision Mode: Determines if the phase-to-phase or phase-to-earth voltages are to be supervisioned	Phase to Ground, Phase to Phase	Phase to Ground	[Protection Para /<1..4> /Intercon-Prot /LVRT /General settings]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Measuring method	Measuring method: fundamental or rms	Fundamental, True RMS	Fundamental	[Protection Para /<1..4> /Intercon-Prot /LVRT /General settings]
Alarm Mode	Alarm criterion for the voltage protection stage.	any one, any two, all	any one	[Protection Para /<1..4> /Intercon-Prot /LVRT /General settings]
Meas Circuit Superv	Measuring Circuit Supervision Only available if: Device planning: LVRT.Mode = use	inactive, active	inactive	[Protection Para /<1..4> /Intercon-Prot /LVRT /General settings]
AR controlled LVRT	AR controlled Low Voltage Ride Through Only available if: Device planning: LVRT.Mode = use	inactive, active	inactive	[Protection Para /<1..4> /Intercon-Prot /LVRT /General settings]
Number of LVRT	Number of LVRT events, after that a disconnection of DR is allowed. Only available if: Device planning: LVRT.Mode = use Number of LVRT events, after that a disconnection of DR is allowed. Number of LVRT events, after that a disconnection of DR is allowed.	1 - 6	1	[Protection Para /<1..4> /Intercon-Prot /LVRT /General settings]
t-LVRT	This supervision timer will be started by a LVRT event if during this time a number of "AR-controlled Events" has been effective. This timer will be stopped, if the number permitted LVRT-Events is exceeded. Only available if: Device planning: LVRT.Mode = use This supervision timer will be started by a LVRT event if during this time a number of "AR-controlled Events" has been effective. This timer will be stopped, if the number permitted LVRT-Events is exceeded. This supervision timer will be started by a LVRT event if during this time a number of "AR-controlled Events" has been effective. This timer will be stopped, if the number permitted LVRT-Events is exceeded.	0.00 - 3000.00s	30.00s	[Protection Para /<1..4> /Intercon-Prot /LVRT /General settings]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Vstart<	A LVRT cycle will be started as soon as the voltage falls below this threshold Only available if: Device planning: LVRT.Mode = use	0.00 - 1.50Vn	0.90Vn	[Protection Para /<1..4> /Intercon-Prot /LVRT /LVRT Profile]
Vrecover>	A LVRT cycle will be terminated as soon as the voltage rises above this threshold Only available if: Device planning: LVRT.Mode = use	0.10 - 1.50Vn	0.93Vn	[Protection Para /<1..4> /Intercon-Prot /LVRT /LVRT Profile]
V(t1)	Point on curve Only available if: Device planning: LVRT.Mode = use	0.00 - 1.50Vn	0.00Vn	[Protection Para /<1..4> /Intercon-Prot /LVRT /LVRT Profile]
t1	Tripping delay Only available if: Device planning: LVRT.Mode = use	0.00 - 20.00s	0.00s	[Protection Para /<1..4> /Intercon-Prot /LVRT /LVRT Profile]
V(t2)	Point on curve Only available if: Device planning: LVRT.Mode = use	0.00 - 1.50Vn	0.00Vn	[Protection Para /<1..4> /Intercon-Prot /LVRT /LVRT Profile]
t2	Tripping delay Only available if: Device planning: LVRT.Mode = use	0.00 - 20.00s	0.15s	[Protection Para /<1..4> /Intercon-Prot /LVRT /LVRT Profile]
V(t3)	Point on curve Only available if: Device planning: LVRT.Mode = use	0.00 - 1.50Vn	0.70Vn	[Protection Para /<1..4> /Intercon-Prot /LVRT /LVRT Profile]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
t3	Tripping delay Only available if: Device planning: LVRT.Mode = use	0.00 - 20.00s	0.15s	[Protection Para /<1..4> /Intercon-Prot /LVRT /LVRT Profile]
V(t4)	Point on curve Only available if: Device planning: LVRT.Mode = use	0.00 - 1.50Vn	0.70Vn	[Protection Para /<1..4> /Intercon-Prot /LVRT /LVRT Profile]
t4	Tripping delay Only available if: Device planning: LVRT.Mode = use	0.00 - 20.00s	0.70s	[Protection Para /<1..4> /Intercon-Prot /LVRT /LVRT Profile]
V(t5)	Point on curve Only available if: Device planning: LVRT.Mode = use	0.00 - 1.50Vn	0.90Vn	[Protection Para /<1..4> /Intercon-Prot /LVRT /LVRT Profile]
t5	Tripping delay Only available if: Device planning: LVRT.Mode = use	0.00 - 20.00s	1.50s	[Protection Para /<1..4> /Intercon-Prot /LVRT /LVRT Profile]
V(t6)	Point on curve Only available if: Device planning: LVRT.Mode = use	0.00 - 1.50Vn	0.90Vn	[Protection Para /<1..4> /Intercon-Prot /LVRT /LVRT Profile]
t6	Tripping delay Only available if: Device planning: LVRT.Mode = use	0.00 - 20.00s	3.00s	[Protection Para /<1..4> /Intercon-Prot /LVRT /LVRT Profile]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
V(t7)	Point on curve Only available if: Device planning: LVRT.Mode = use	0.00 - 1.50Vn	0.90Vn	[Protection Para /<1..4> /Intercon-Prot /LVRT /LVRT Profile]
t7	Tripping delay Only available if: Device planning: LVRT.Mode = use	0.00 - 20.00s	3.00s	[Protection Para /<1..4> /Intercon-Prot /LVRT /LVRT Profile]
V(t8)	Point on curve Only available if: Device planning: LVRT.Mode = use	0.00 - 1.50Vn	0.90Vn	[Protection Para /<1..4> /Intercon-Prot /LVRT /LVRT Profile]
t8	Tripping delay Only available if: Device planning: LVRT.Mode = use	0.00 - 20.00s	3.00s	[Protection Para /<1..4> /Intercon-Prot /LVRT /LVRT Profile]
V(t9)	Point on curve Only available if: Device planning: LVRT.Mode = use	0.00 - 1.50Vn	0.90Vn	[Protection Para /<1..4> /Intercon-Prot /LVRT /LVRT Profile]
t9	Tripping delay Only available if: Device planning: LVRT.Mode = use	0.00 - 20.00s	3.00s	[Protection Para /<1..4> /Intercon-Prot /LVRT /LVRT Profile]
V(t10)	Point on curve Only available if: Device planning: LVRT.Mode = use	0.00 - 1.50Vn	0.90Vn	[Protection Para /<1..4> /Intercon-Prot /LVRT /LVRT Profile]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
t10	Tripping delay Only available if: Device planning: LVRT.Mode = use	0.00 - 20.00s	3.00s	[Protection Para /<1..4> /Intercon-Prot /LVRT /LVRT Profile]

General application notes on setting the LVRT

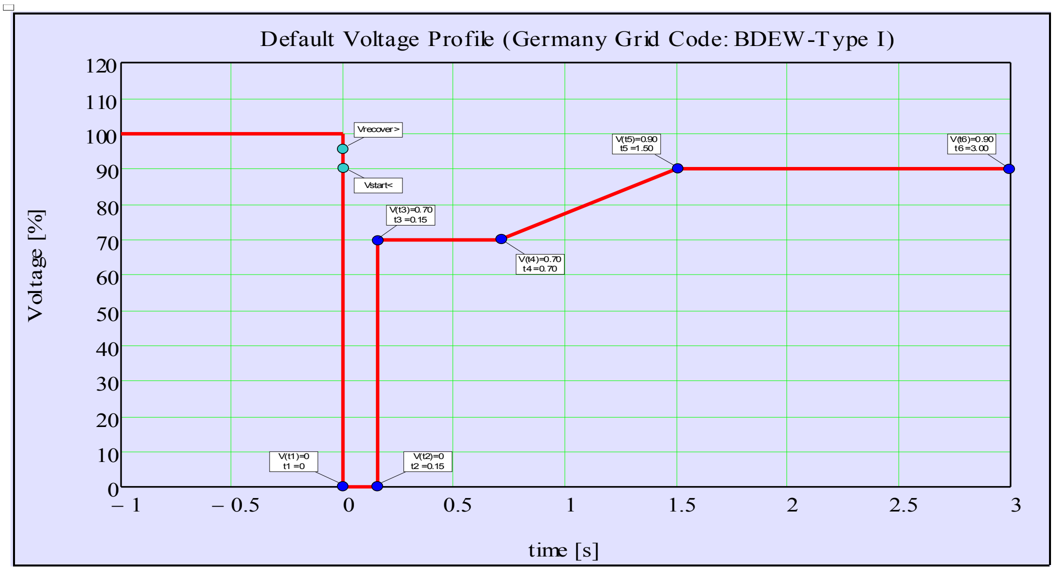
The LVRT menu comprises among other things the following parameters:

- By means of »*Vstart*«, the *LVRT* will be started (triggered).
- By menas of »*Vrecover*« the *LVRT* will detect the end of the disturbance.
- Please note, that the »*Vrecover*« should be greater than »*Vstart*«. If this is not the case, the internal plausibility supervision will set »*Vrecover*« to 103% of »*Vstart*«.
- »*Vk*«, »*tk*« are the set points for setting the *LVRT*-profile.

Special application notes on setting the LVRT-profile

- In many cases not all available setpoints are needed in order to build up the *LVRT*-profile.
- In case that not all available setpoints are used, the unused setpoints can be set to the same values as the last set point.
- Set points should be selected in a manner of left-to-right with time begin at t=0 (tk+1>tk).
- The voltage setpoints must be selected in a ascending manner (Vk+1>Vk).
- The voltage value for last used set point should be set greater than the starting voltage. If this is not the case, the starting voltage will be modified internally to the value of maximum voltage set value.

In general the factory default *LVRT*-profile is preset based on the Type-I curve from Germany Grid Code[1)] (BDEW 2008) as shown in the following drawing:



LVRT-Default Profile (BDEW-TypI)

Global Protection Parameters of the Low-Voltage-Ride-Through

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 /Intercon-Prot /LVRT]
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 /Intercon-Prot /LVRT]
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 /Intercon-Prot /LVRT]

Inputs of the Low-Voltage-Ride-Through

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

Signals (Output States) of the Low-Voltage-Ride-Through

Signal	*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: General Trip Phase L1
Trip L2	Signal: General Trip Phase L2
Trip L3	Signal: General Trip Phase L3
Trip	Signal: Trip
TripCmd	Signal: Trip Command
t-LVRT is running	Signal: t-LVRT is running

Counter Values of the Low-Voltage-Ride-Through

Value	*Description*	*Menu path*
NumOfLVRT in t-LVRT	LVRT counter during ongoing LVRT i.e. while supervision timer is running (t-LVRT)	[Operation /Count and RevData /LVRT]
Cr Tot Numb of LVRT	Counter Total number of LVRTs.	[Operation /Count and RevData /LVRT]
Cr Tot Numb of LVRT Trip	Counter Total number of LVRTs that caused a Trip.	[Operation /Count and RevData /LVRT]

Direct Commands of the Low-Voltage-Ride-Through

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Res LVRT Cr	Reset LVRT counter.	inactive, active	inactive	[Operation /Reset]

References:

[1] Technische Richtlinie „Erzeugungsanlagen am Mittelspannungsnetz – Richtlinie für Anschluss und Parallelbetrieb von Erzeugungsanlagen am Mittelspannungsnetz“, Juni 2008, BDEW, Berlin

[2]IEEE Std 1547™-2003, IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems.

[3]Title: Can China Wind Power meet the challenge of “Low-Voltage-Ride-Through” Date: 18.05.2011 Author: Shi Feng-Lei. http://energy.people.com.cn/GB/14667118.html.

Intertripping (Remote)

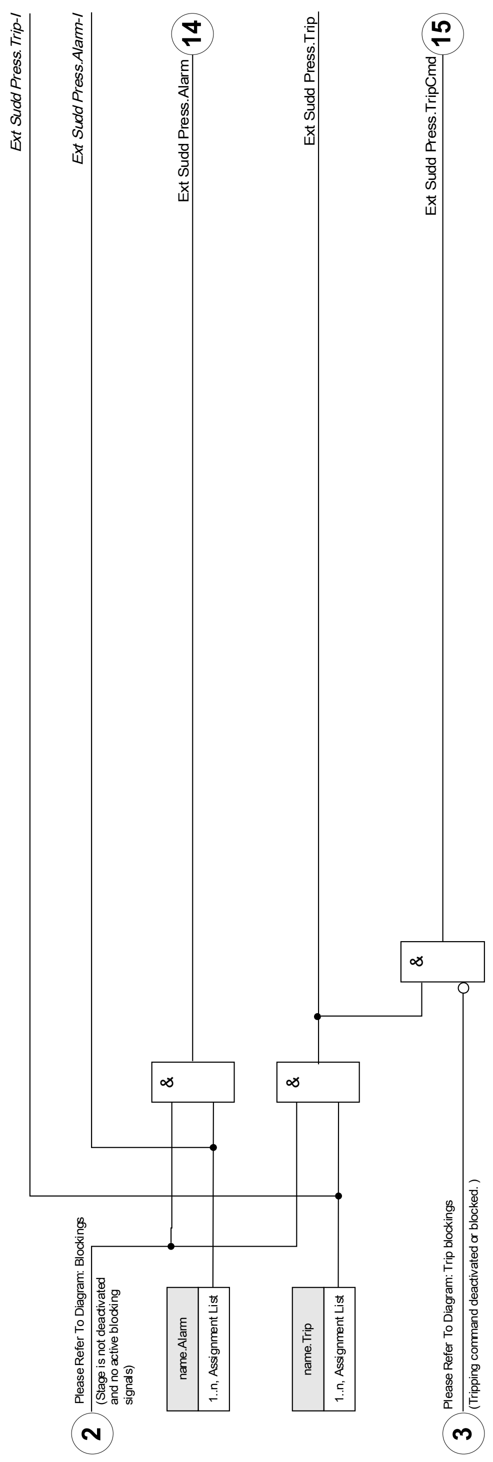
Elements:
Intertripping

NOTICE **All elements of the external protection are identically structured.**

This module enables intertripping (executing external trip commands)

name = Remote Trip

Remote Trip



Device Planning Parameters of the Intertripping Module

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

Global Protection Parameters of the Intertripping 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 /Intercon-Prot /Mains Decouplg /Intertripping]
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 /Intercon-Prot /Mains Decouplg /Intertripping]
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 /Intercon-Prot /Mains Decouplg /Intertripping]
Alarm	Assignment for External Alarm	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Intercon-Prot /Mains Decouplg /Intertripping]
Trip	External trip of the CB if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Intercon-Prot /Mains Decouplg /Intertripping]

Setting Group Parameters of the Intertripping Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<1..4> /Intercon-Prot /Mains Decouplg /Intertripping]
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 /<1..4> /Intercon-Prot /Mains Decouplg /Intertripping]
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<1..4> /Intercon-Prot /Mains Decouplg /Intertripping]
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 /<1..4> /Intercon-Prot /Mains Decouplg /Intertripping]

Intertripping Module Input States

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

Intertripping Module Signals (Output States)

Signal	*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
Trip	Signal: Trip
TripCmd	Signal: Trip Command

Commissioning: Intertripping

Object to be tested:
Test of the Intertripping (Remote) module.

Necessary means:
Dependent on the application.

Procedure:
Simulate the functionality of the Intertripping Trip (pickup, trip, blockings) by (de-)energizing of the digital inputs.

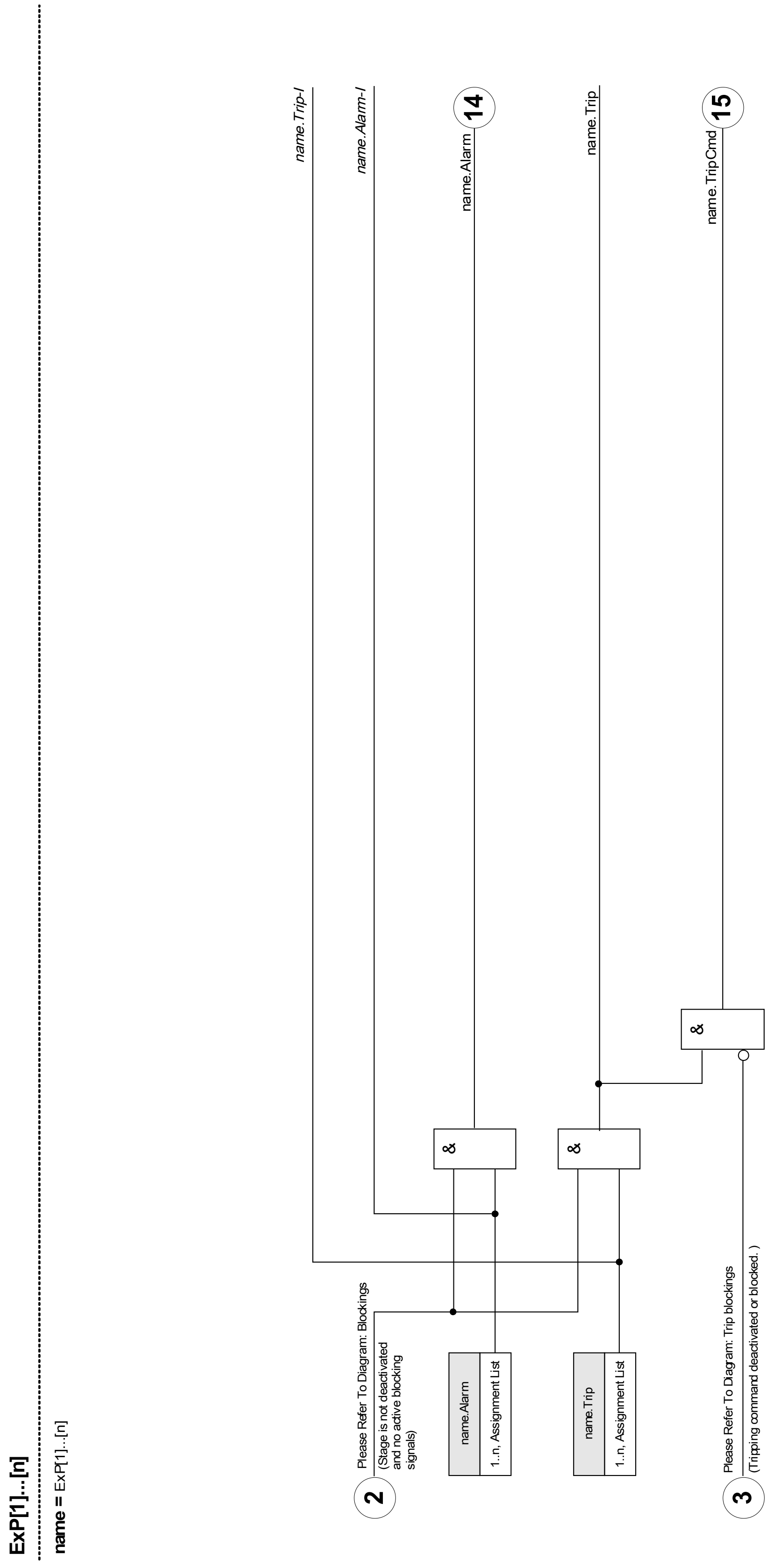
Successful test result:
All external pickups, external trips, and external blockings are correctly recognized and processed by the device.

ExP - 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]
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
name.Alarm
1..n, Assignment List
name.Trip
1..n, Assignment List
Please Refer To Diagram: Trip blockings
(Tripping command deactivated or blocked.)
&
&
&
name.Trip-I
name.Alarm-I
name.Alarm
name.Trip
name.TripCmd
2
3
14
15

Device Planning Parameters of the Module External Protection

Parameter	Description	Options	Default	Menu path
Mode	Mode	do not use, use	do not 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..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.	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 /<1..4> /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 /<1..4> /ExP /ExP[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<1..4> /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 /<1..4> /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: Alarm	[Protection Para /Global Prot Para /ExP /ExP[1]]
Trip-I	Module input state: Trip	[Protection Para /Global Prot Para /ExP /ExP[1]]

Module External Protection Signals (Output States)

Signal	*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
Trip	Signal: Trip
TripCmd	Signal: 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.

Supervision

CBF- Circuit Breaker Failure [50BF*/62BF]

*=only available in protective relays that offer current measurement.

Available elements:
CBF

Principle – General Use

The breaker failure (BF) protection is used to provide backup protection in the event that a breaker fails to operate properly during fault clearing. This signal is to be used to trip the upstream breaker (e.g. infeed of a busbar) either via an output relay or via Communication (SCADA). Depending on the ordered device and type there are different/multiple schemes available to detect a breaker failure.

Start/Trigger of the CBF Timer
A supervision timer »*t-CBF*« will be started, once the *CBF* module is triggered. Even if the Trigger signal drops again, this timer will continue to run. If the timer runs down/elapses (is not stopped), the module will issue a trip afterwards. This trip signal is to be used to trip the upstream breaker (backup).

Stopping the CBF
The timer will be stopped if the opening of the breaker is detected. Depending on the supervision scheme the timer will be stopped if the current falls below the current threshold or if the position signals indicate the open position of the breaker or a combination of both. The *CBF* module will remain within the state rejected until the trigger signal drops (falls back).

Detecting a Breaker Failure
Depending on the supervision scheme, the Circuit Breaker Failure signal (Trip) will be set if either:

- the current doesn´t fall below the threshold or
- the position signals indicate that the breaker is in the closed position or
- both.

Reject state of the CBFmodule
The *CBF* module will switch into the rejected state if the circuit breaker failure triggers are still active while the open position of the breaker has been detected successfully.

Readiness for Operation
The *CBF* module will switch back into the Stand-by if the trigger signals drop (fall back).

Locking
A locking signal will be issued simultaneously with the *CBF*-Signal (Trip). The locking signal is permanent. This signal has to be acknowledged at the HMI.

NOTICE

Note on devices that offer Wide Frequency Range measurement:

The supervision scheme 50BF will be blocked as soon as the frequency differs more than 5% from the nominal frequency. As long as the frequency differs more than 5% from the nominal frequency the supervision scheme “50BF and CB Pos” will work according to the “CB Pos” scheme.

Supervision Schemes

Up to three supvervision schemes are available depending on the ordered device type and variant in order to detect a circuit breaker failure.

*50BF**
A supervision timer will be started as soon as the *CBF*module is triggered by a trip signal. A breaker failure will be detected and a signal will be issued if the measured current does not fall below a set threshold while this timer runs down.

This supervision scheme is available within protective relays that offer current measurement.

CB Pos
A supervision timer will be started as soon as the *CBF* module is triggered by a trip signal. A breaker failure will be detected and a signal will be issued if the evaluation of the position indicators of the circuit breaker does not indicate that the breaker has been switched off sucessfully while this timer runs down.

This supervision scheme is available within all protective relays. This scheme is recommended if breaker failures have to be detected while there is no or not much load flow (small currents). This might e.g. be the case if overvoltage or overfrequency is supervisioned for a Gen-Set that is running in Stand-by.

*50 BF and LS Pos**
A supervision timer will be started as soon as the *CBF* module is triggered by a trip signal. A breaker failure will be detected and a signal will be issued if the measured current does not fall below a set threshold and if simultaneously the evaluation of the position indicators of the circuit breaker does not indicate that the breaker has been switched off sucessfully while this timer runs down.

This scheme is recommended if breaker failures have to be double checked. This scheme will issue a trip command to the upstream breaker even if position indicators indicate misleadingly (faulty) that the breaker has been opened or if the current measurement indicates misleadingly (faulty) that the breaker is now in the open position.

*=only available in protective relays that offer current measurement.

Trigger Modes

There are three trigger modes for the *CBF* module available. In addition to that, there are three assignable trigger inputs available that might trigger the *CBF* module even if they are not assigned within the breaker manager onto the breaker that is to be monitored.

•*All Trips*: All trip signals that are assigned to this breaker (within the trip manager) will start the *CBF* module (please refer also to section „Trigger signals of the Circuit Breaker Failure“).

•*Current Trips*: All current trips that are assigned to this breaker (within the trip manager) will start the *CBF* module (please refer also to section „Trigger signals of the Circuit Breaker Failure“).

•*External Trips*: All external trips that are assigned to this breaker (within the trip manager) will start the *CBF* module (please refer also to section „Trigger signals of the Circuit Breaker Failure“).

•In addition, the User can also select *none* (e.g.: if the User intends to use one of the three additional assignable trigger inputs).

NOTICE **Those trips can exclusively start the breaker failures that are assigned within the trip manager to the breaker that is to be supervised. In contrast to that the additional three triggers 1-3 will trigger the *CBF*module even if they are not assigned onto the breaker within the corresponding breaker manager.**

NOTICE **Select the winding side (Breaker, Winding) from which the measured currents should be taken in case this protective device provides more than one current measurement card.**

NOTICE **This Notice applies to protective devices that offer control functionality only! This protective element requires, that a switchgear (circuit breaker is assigned to it. It is allowed only to assign switchgears (circuit breaker) to this protective element, whose measuring transformers provide measuring data to the protective device.**

Breaker Failure Lockout

The signal of the Circuit Breaker Failure is latched. This signal can be used to block the breaker against a switching on attempt.

Tabular Summary

	Supervision Schemes Where? Within [Protection Para\Global Prot Para\Supervision\CBF]		
	LS Pos[2]	**50BF[3]**	**LS Pos und 50BF[4]**
Which breaker is to be monitored? Where to select? Within [Protection Para\Global Prot Para\Supervision\CBF]	Selection ot the breaker that is to be monitored. (In case that more than one breaker is available)	Selection ot the breaker that is to be monitored. (In case that more than one breaker is available)	Selection ot the breaker that is to be monitored. (In case that more than one breaker is available)
Trigger Modi (Who starts the CBF-timer*?*) Where to set? Within [Protection Para\Global Prot Para\Supervision\CBF]	All Trips[5] or All Current Trips[5] or External Trips[5] …and the breaker is in the closed position and the CBF module is within the stand-by state.	All Trips[5] or All Current Trips[5] or External Trips[5] ...and the CBF module is within the stand-by state.	All Trips[5] or All Current Trips[5] or External Trips[5] …and the breaker is in the closed position and the CBF module is within the stand-by state.
Who stopps the CBF-Timer? Once the timer has been stopped the CBF module will switch into the state „Rejected“. The module will switch back into the state „Stand-by“ if the trigger signals are dropped.	Position indicators indicate that the swichtgear (breaker) is in the open position.	Current is fallen below the I<-threshold[1].	Position indicators indicate that the swichtgear (breaker) is in the open position **and** current is fallen below the I<-threshold[1].
A Breaker Failure will be detected ...and a trip signal to the upstream breaker will be issued?	When the CBF-Timer has run down (elapsed).	When the CBF-Timer has run down (elapsed).	When the CBF-Timer has run down (elapsed).
When does the trip signal to the upstream breaker drops (falls back)?	If the position indicators indicate that the swichtgear (breaker) is in the open position **and** if the trigger signals are dropped (fallen back)	If the current is fallen below the I< **and** if the trigger signals are dropped (fallen back)	If the position indicators indicate that the swichtgear (breaker) is in the open position **and** if the current is fallen below the I< **and** if the trigger signals are dropped (fallen back)

[1] It is recommended to set the I< threshold to a value that is sligthly below the fault current that is expectable. By means of that it is possible to shorten the CBF supervision timer and hence reduce thermal and mechanical damage of the electrical equipment in case of a breaker failure. The lower the threshold, the longer the time that is needed to detect, that the breaker is in the open position, especially if there are transients/harmonics.

Note: Tripping delay of the *CBF* module = Minimum delay time (tripping time) of the backup protection!

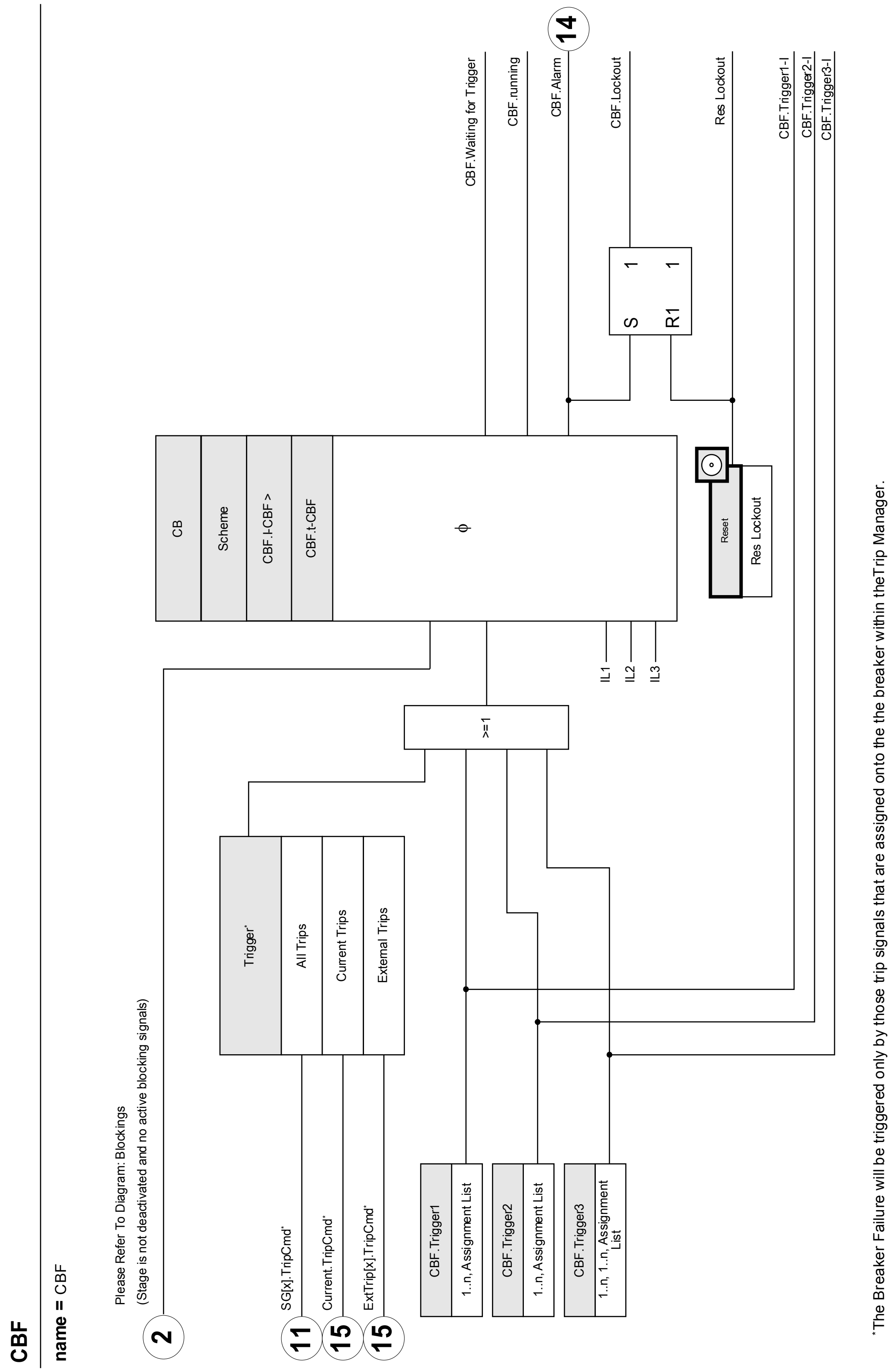
2), 3), 4)

Available in all devices with the corresponding software	Availalble in all devices that offer current measurement	Availalble in all devices that offer current measurement

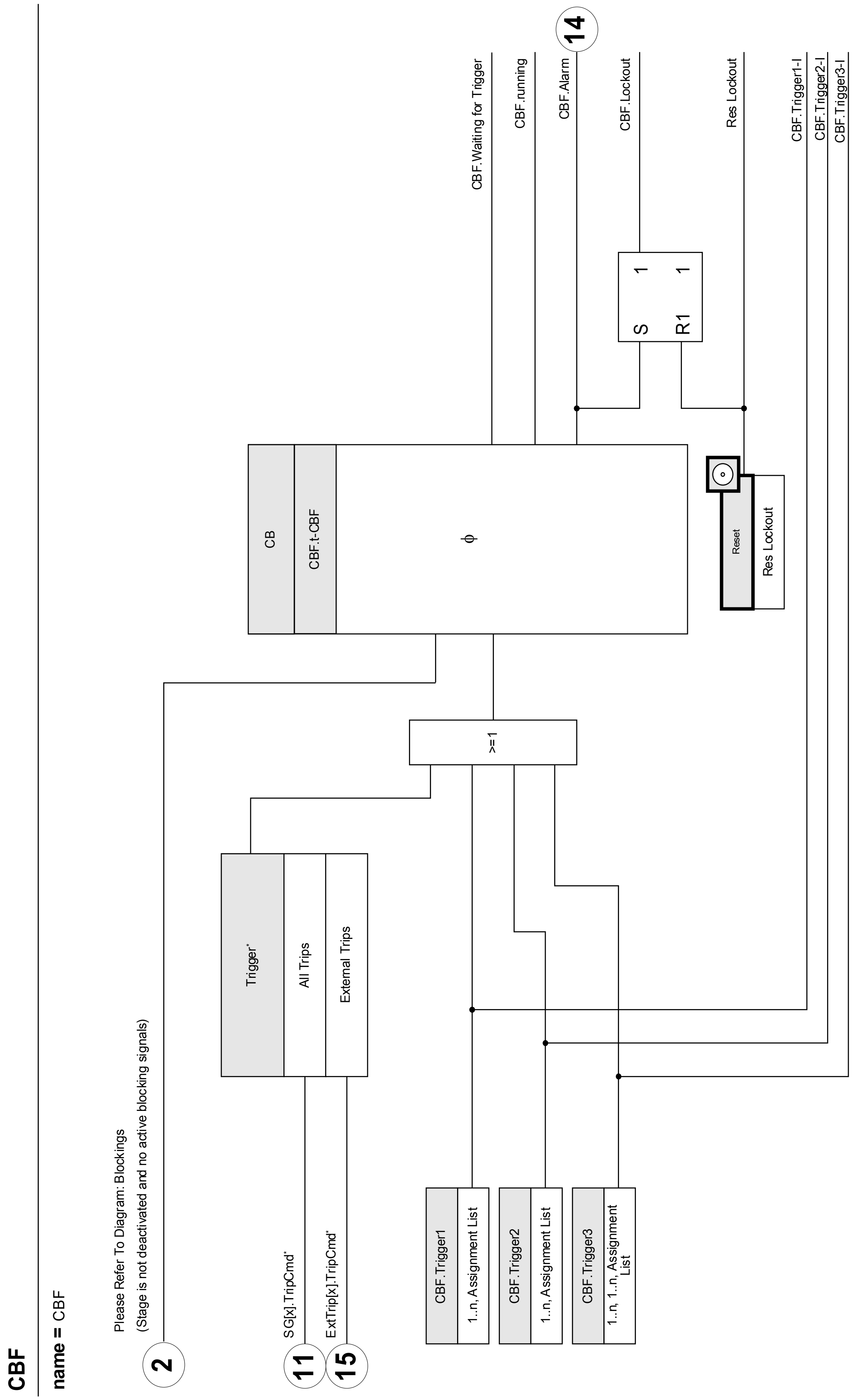
5)

Only if the signals are assigned onto the breaker within the breaker manager.

Circuit Breaker Failure Protection for devices that offer current measurement



Circuit Breaker Failure Protection for devices that offer voltage measurement only



*The Breaker Failure will be triggered only by those trip signals that are assigned onto the the breaker within theTrip Manager.

Device Planning Parameters of the CBF

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

Global Protection Parameters of the CBF

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]
Trigger	Determining the trigger mode for the Breaker Failure.	- . -, All Trips, External Trips	- . -	[Protection Para /Global Prot Para /Supervision /CBF]
Trigger1	Trigger that will start the CBF	Trigger	-.-	[Protection Para /Global Prot Para /Supervision /CBF]
Trigger2	Trigger that will start the CBF	Trigger	-.-	[Protection Para /Global Prot Para /Supervision /CBF]
Trigger3	Trigger that will start the CBF	Trigger	-.-	[Protection Para /Global Prot Para /Supervision /CBF]

Direct Commands of the CBF

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

Setting Group Parameters of the CBF

NOTICE

In order to prevent a faulty activation of the BF Module, the pickup (alarm) time must be greater than the sum of:

- **Operating time of the protective relay**
- **+The close-open time of the breaker (please refer to the technical data of the manufacturer of the breaker);**
- **+Drop off time (current- or position indicators)**
- **+Security margin.**

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<1..4> /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 /<1..4> /Supervision /CBF]
t-CBF	If the delay time is expired, an CBF alarm is given out.	0.00 - 10.00s	0.20s	[Protection Para /<1..4> /Supervision /CBF]

CBF 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]
Trigger1	Module Input: Trigger that will start the CBF	[Protection Para /Global Prot Para /Supervision /CBF]
Trigger2	Module Input: Trigger that will start the CBF	[Protection Para /Global Prot Para /Supervision /CBF]
Trigger3	Module Input: Trigger that will start the CBF	[Protection Para /Global Prot Para /Supervision /CBF]

CBF Signals (Output States)

Signal	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
Waiting for Trigger	Waiting for Trigger
running	Signal: CBF-Module started
Alarm	Signal: Circuit Breaker Failure
Lockout	Signal: Lockout
Res Lockout	Signal: Reset Lockout

Trigger signals of the Circuit Breaker Failure

*These trips will start the **CBF**module if »**All trips**« have been selected as the trigger event.*

Name	*Description*
-.-	No assignment
V[1].TripCmd	Signal: Trip Command
V[2].TripCmd	Signal: Trip Command
V[3].TripCmd	Signal: Trip Command
V[4].TripCmd	Signal: Trip Command
V[5].TripCmd	Signal: Trip Command
V[6].TripCmd	Signal: Trip Command
df/dt.TripCmd	Signal: Trip Command
delta phi.TripCmd	Signal: Trip Command
Intertripping.TripCmd	Signal: Trip Command
LVRT.TripCmd	Signal: Trip Command
VG[1].TripCmd	Signal: Trip Command
VG[2].TripCmd	Signal: Trip Command
V012[1].TripCmd	Signal: Trip Command
V012[2].TripCmd	Signal: Trip Command
V012[3].TripCmd	Signal: Trip Command
V012[4].TripCmd	Signal: Trip Command
V012[5].TripCmd	Signal: Trip Command
V012[6].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: Trip Command
ExP[2].TripCmd	Signal: Trip Command
ExP[3].TripCmd	Signal: Trip Command
ExP[4].TripCmd	Signal: Trip Command
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

Name	*Description*
DI Slot X1.DI 8	Signal: Digital Input
Logics.LE1.Gate Out	Signal: Output of the logic gate
Logics.LE1.Timer Out	Signal: Timer Output
Logics.LE1.Out	Signal: Latched Output (Q)
Logics.LE1.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE2.Gate Out	Signal: Output of the logic gate
Logics.LE2.Timer Out	Signal: Timer Output
Logics.LE2.Out	Signal: Latched Output (Q)
Logics.LE2.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE3.Gate Out	Signal: Output of the logic gate
Logics.LE3.Timer Out	Signal: Timer Output
Logics.LE3.Out	Signal: Latched Output (Q)
Logics.LE3.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE4.Gate Out	Signal: Output of the logic gate
Logics.LE4.Timer Out	Signal: Timer Output
Logics.LE4.Out	Signal: Latched Output (Q)
Logics.LE4.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE5.Gate Out	Signal: Output of the logic gate
Logics.LE5.Timer Out	Signal: Timer Output
Logics.LE5.Out	Signal: Latched Output (Q)
Logics.LE5.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE6.Gate Out	Signal: Output of the logic gate
Logics.LE6.Timer Out	Signal: Timer Output
Logics.LE6.Out	Signal: Latched Output (Q)
Logics.LE6.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE7.Gate Out	Signal: Output of the logic gate
Logics.LE7.Timer Out	Signal: Timer Output
Logics.LE7.Out	Signal: Latched Output (Q)
Logics.LE7.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE8.Gate Out	Signal: Output of the logic gate
Logics.LE8.Timer Out	Signal: Timer Output
Logics.LE8.Out	Signal: Latched Output (Q)
Logics.LE8.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE9.Gate Out	Signal: Output of the logic gate
Logics.LE9.Timer Out	Signal: Timer Output
Logics.LE9.Out	Signal: Latched Output (Q)
Logics.LE9.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE10.Gate Out	Signal: Output of the logic gate
Logics.LE10.Timer Out	Signal: Timer Output
Logics.LE10.Out	Signal: Latched Output (Q)

Name	*Description*
Logics.LE10.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE11.Gate Out	Signal: Output of the logic gate
Logics.LE11.Timer Out	Signal: Timer Output
Logics.LE11.Out	Signal: Latched Output (Q)
Logics.LE11.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE12.Gate Out	Signal: Output of the logic gate
Logics.LE12.Timer Out	Signal: Timer Output
Logics.LE12.Out	Signal: Latched Output (Q)
Logics.LE12.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE13.Gate Out	Signal: Output of the logic gate
Logics.LE13.Timer Out	Signal: Timer Output
Logics.LE13.Out	Signal: Latched Output (Q)
Logics.LE13.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE14.Gate Out	Signal: Output of the logic gate
Logics.LE14.Timer Out	Signal: Timer Output
Logics.LE14.Out	Signal: Latched Output (Q)
Logics.LE14.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE15.Gate Out	Signal: Output of the logic gate
Logics.LE15.Timer Out	Signal: Timer Output
Logics.LE15.Out	Signal: Latched Output (Q)
Logics.LE15.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE16.Gate Out	Signal: Output of the logic gate
Logics.LE16.Timer Out	Signal: Timer Output
Logics.LE16.Out	Signal: Latched Output (Q)
Logics.LE16.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE17.Gate Out	Signal: Output of the logic gate
Logics.LE17.Timer Out	Signal: Timer Output
Logics.LE17.Out	Signal: Latched Output (Q)
Logics.LE17.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE18.Gate Out	Signal: Output of the logic gate
Logics.LE18.Timer Out	Signal: Timer Output
Logics.LE18.Out	Signal: Latched Output (Q)
Logics.LE18.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE19.Gate Out	Signal: Output of the logic gate
Logics.LE19.Timer Out	Signal: Timer Output
Logics.LE19.Out	Signal: Latched Output (Q)
Logics.LE19.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE20.Gate Out	Signal: Output of the logic gate
Logics.LE20.Timer Out	Signal: Timer Output
Logics.LE20.Out	Signal: Latched Output (Q)

Name	*Description*
Logics.LE20.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE21.Gate Out	Signal: Output of the logic gate
Logics.LE21.Timer Out	Signal: Timer Output
Logics.LE21.Out	Signal: Latched Output (Q)
Logics.LE21.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE22.Gate Out	Signal: Output of the logic gate
Logics.LE22.Timer Out	Signal: Timer Output
Logics.LE22.Out	Signal: Latched Output (Q)
Logics.LE22.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE23.Gate Out	Signal: Output of the logic gate
Logics.LE23.Timer Out	Signal: Timer Output
Logics.LE23.Out	Signal: Latched Output (Q)
Logics.LE23.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE24.Gate Out	Signal: Output of the logic gate
Logics.LE24.Timer Out	Signal: Timer Output
Logics.LE24.Out	Signal: Latched Output (Q)
Logics.LE24.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE25.Gate Out	Signal: Output of the logic gate
Logics.LE25.Timer Out	Signal: Timer Output
Logics.LE25.Out	Signal: Latched Output (Q)
Logics.LE25.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE26.Gate Out	Signal: Output of the logic gate
Logics.LE26.Timer Out	Signal: Timer Output
Logics.LE26.Out	Signal: Latched Output (Q)
Logics.LE26.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE27.Gate Out	Signal: Output of the logic gate
Logics.LE27.Timer Out	Signal: Timer Output
Logics.LE27.Out	Signal: Latched Output (Q)
Logics.LE27.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE28.Gate Out	Signal: Output of the logic gate
Logics.LE28.Timer Out	Signal: Timer Output
Logics.LE28.Out	Signal: Latched Output (Q)
Logics.LE28.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE29.Gate Out	Signal: Output of the logic gate
Logics.LE29.Timer Out	Signal: Timer Output
Logics.LE29.Out	Signal: Latched Output (Q)
Logics.LE29.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE30.Gate Out	Signal: Output of the logic gate
Logics.LE30.Timer Out	Signal: Timer Output
Logics.LE30.Out	Signal: Latched Output (Q)

Name	*Description*
Logics.LE30.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE31.Gate Out	Signal: Output of the logic gate
Logics.LE31.Timer Out	Signal: Timer Output
Logics.LE31.Out	Signal: Latched Output (Q)
Logics.LE31.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE32.Gate Out	Signal: Output of the logic gate
Logics.LE32.Timer Out	Signal: Timer Output
Logics.LE32.Out	Signal: Latched Output (Q)
Logics.LE32.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE33.Gate Out	Signal: Output of the logic gate
Logics.LE33.Timer Out	Signal: Timer Output
Logics.LE33.Out	Signal: Latched Output (Q)
Logics.LE33.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE34.Gate Out	Signal: Output of the logic gate
Logics.LE34.Timer Out	Signal: Timer Output
Logics.LE34.Out	Signal: Latched Output (Q)
Logics.LE34.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE35.Gate Out	Signal: Output of the logic gate
Logics.LE35.Timer Out	Signal: Timer Output
Logics.LE35.Out	Signal: Latched Output (Q)
Logics.LE35.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE36.Gate Out	Signal: Output of the logic gate
Logics.LE36.Timer Out	Signal: Timer Output
Logics.LE36.Out	Signal: Latched Output (Q)
Logics.LE36.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE37.Gate Out	Signal: Output of the logic gate
Logics.LE37.Timer Out	Signal: Timer Output
Logics.LE37.Out	Signal: Latched Output (Q)
Logics.LE37.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE38.Gate Out	Signal: Output of the logic gate
Logics.LE38.Timer Out	Signal: Timer Output
Logics.LE38.Out	Signal: Latched Output (Q)
Logics.LE38.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE39.Gate Out	Signal: Output of the logic gate
Logics.LE39.Timer Out	Signal: Timer Output
Logics.LE39.Out	Signal: Latched Output (Q)
Logics.LE39.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE40.Gate Out	Signal: Output of the logic gate
Logics.LE40.Timer Out	Signal: Timer Output
Logics.LE40.Out	Signal: Latched Output (Q)

Name	*Description*
Logics.LE40.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE41.Gate Out	Signal: Output of the logic gate
Logics.LE41.Timer Out	Signal: Timer Output
Logics.LE41.Out	Signal: Latched Output (Q)
Logics.LE41.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE42.Gate Out	Signal: Output of the logic gate
Logics.LE42.Timer Out	Signal: Timer Output
Logics.LE42.Out	Signal: Latched Output (Q)
Logics.LE42.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE43.Gate Out	Signal: Output of the logic gate
Logics.LE43.Timer Out	Signal: Timer Output
Logics.LE43.Out	Signal: Latched Output (Q)
Logics.LE43.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE44.Gate Out	Signal: Output of the logic gate
Logics.LE44.Timer Out	Signal: Timer Output
Logics.LE44.Out	Signal: Latched Output (Q)
Logics.LE44.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE45.Gate Out	Signal: Output of the logic gate
Logics.LE45.Timer Out	Signal: Timer Output
Logics.LE45.Out	Signal: Latched Output (Q)
Logics.LE45.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE46.Gate Out	Signal: Output of the logic gate
Logics.LE46.Timer Out	Signal: Timer Output
Logics.LE46.Out	Signal: Latched Output (Q)
Logics.LE46.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE47.Gate Out	Signal: Output of the logic gate
Logics.LE47.Timer Out	Signal: Timer Output
Logics.LE47.Out	Signal: Latched Output (Q)
Logics.LE47.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE48.Gate Out	Signal: Output of the logic gate
Logics.LE48.Timer Out	Signal: Timer Output
Logics.LE48.Out	Signal: Latched Output (Q)
Logics.LE48.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE49.Gate Out	Signal: Output of the logic gate
Logics.LE49.Timer Out	Signal: Timer Output
Logics.LE49.Out	Signal: Latched Output (Q)
Logics.LE49.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE50.Gate Out	Signal: Output of the logic gate
Logics.LE50.Timer Out	Signal: Timer Output
Logics.LE50.Out	Signal: Latched Output (Q)

Name	*Description*
Logics.LE50.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE51.Gate Out	Signal: Output of the logic gate
Logics.LE51.Timer Out	Signal: Timer Output
Logics.LE51.Out	Signal: Latched Output (Q)
Logics.LE51.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE52.Gate Out	Signal: Output of the logic gate
Logics.LE52.Timer Out	Signal: Timer Output
Logics.LE52.Out	Signal: Latched Output (Q)
Logics.LE52.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE53.Gate Out	Signal: Output of the logic gate
Logics.LE53.Timer Out	Signal: Timer Output
Logics.LE53.Out	Signal: Latched Output (Q)
Logics.LE53.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE54.Gate Out	Signal: Output of the logic gate
Logics.LE54.Timer Out	Signal: Timer Output
Logics.LE54.Out	Signal: Latched Output (Q)
Logics.LE54.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE55.Gate Out	Signal: Output of the logic gate
Logics.LE55.Timer Out	Signal: Timer Output
Logics.LE55.Out	Signal: Latched Output (Q)
Logics.LE55.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE56.Gate Out	Signal: Output of the logic gate
Logics.LE56.Timer Out	Signal: Timer Output
Logics.LE56.Out	Signal: Latched Output (Q)
Logics.LE56.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE57.Gate Out	Signal: Output of the logic gate
Logics.LE57.Timer Out	Signal: Timer Output
Logics.LE57.Out	Signal: Latched Output (Q)
Logics.LE57.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE58.Gate Out	Signal: Output of the logic gate
Logics.LE58.Timer Out	Signal: Timer Output
Logics.LE58.Out	Signal: Latched Output (Q)
Logics.LE58.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE59.Gate Out	Signal: Output of the logic gate
Logics.LE59.Timer Out	Signal: Timer Output
Logics.LE59.Out	Signal: Latched Output (Q)
Logics.LE59.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE60.Gate Out	Signal: Output of the logic gate
Logics.LE60.Timer Out	Signal: Timer Output
Logics.LE60.Out	Signal: Latched Output (Q)

Name	*Description*
Logics.LE60.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE61.Gate Out	Signal: Output of the logic gate
Logics.LE61.Timer Out	Signal: Timer Output
Logics.LE61.Out	Signal: Latched Output (Q)
Logics.LE61.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE62.Gate Out	Signal: Output of the logic gate
Logics.LE62.Timer Out	Signal: Timer Output
Logics.LE62.Out	Signal: Latched Output (Q)
Logics.LE62.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE63.Gate Out	Signal: Output of the logic gate
Logics.LE63.Timer Out	Signal: Timer Output
Logics.LE63.Out	Signal: Latched Output (Q)
Logics.LE63.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE64.Gate Out	Signal: Output of the logic gate
Logics.LE64.Timer Out	Signal: Timer Output
Logics.LE64.Out	Signal: Latched Output (Q)
Logics.LE64.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE65.Gate Out	Signal: Output of the logic gate
Logics.LE65.Timer Out	Signal: Timer Output
Logics.LE65.Out	Signal: Latched Output (Q)
Logics.LE65.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE66.Gate Out	Signal: Output of the logic gate
Logics.LE66.Timer Out	Signal: Timer Output
Logics.LE66.Out	Signal: Latched Output (Q)
Logics.LE66.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE67.Gate Out	Signal: Output of the logic gate
Logics.LE67.Timer Out	Signal: Timer Output
Logics.LE67.Out	Signal: Latched Output (Q)
Logics.LE67.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE68.Gate Out	Signal: Output of the logic gate
Logics.LE68.Timer Out	Signal: Timer Output
Logics.LE68.Out	Signal: Latched Output (Q)
Logics.LE68.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE69.Gate Out	Signal: Output of the logic gate
Logics.LE69.Timer Out	Signal: Timer Output
Logics.LE69.Out	Signal: Latched Output (Q)
Logics.LE69.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE70.Gate Out	Signal: Output of the logic gate
Logics.LE70.Timer Out	Signal: Timer Output
Logics.LE70.Out	Signal: Latched Output (Q)

Name	*Description*
Logics.LE70.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE71.Gate Out	Signal: Output of the logic gate
Logics.LE71.Timer Out	Signal: Timer Output
Logics.LE71.Out	Signal: Latched Output (Q)
Logics.LE71.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE72.Gate Out	Signal: Output of the logic gate
Logics.LE72.Timer Out	Signal: Timer Output
Logics.LE72.Out	Signal: Latched Output (Q)
Logics.LE72.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE73.Gate Out	Signal: Output of the logic gate
Logics.LE73.Timer Out	Signal: Timer Output
Logics.LE73.Out	Signal: Latched Output (Q)
Logics.LE73.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE74.Gate Out	Signal: Output of the logic gate
Logics.LE74.Timer Out	Signal: Timer Output
Logics.LE74.Out	Signal: Latched Output (Q)
Logics.LE74.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE75.Gate Out	Signal: Output of the logic gate
Logics.LE75.Timer Out	Signal: Timer Output
Logics.LE75.Out	Signal: Latched Output (Q)
Logics.LE75.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE76.Gate Out	Signal: Output of the logic gate
Logics.LE76.Timer Out	Signal: Timer Output
Logics.LE76.Out	Signal: Latched Output (Q)
Logics.LE76.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE77.Gate Out	Signal: Output of the logic gate
Logics.LE77.Timer Out	Signal: Timer Output
Logics.LE77.Out	Signal: Latched Output (Q)
Logics.LE77.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE78.Gate Out	Signal: Output of the logic gate
Logics.LE78.Timer Out	Signal: Timer Output
Logics.LE78.Out	Signal: Latched Output (Q)
Logics.LE78.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE79.Gate Out	Signal: Output of the logic gate
Logics.LE79.Timer Out	Signal: Timer Output
Logics.LE79.Out	Signal: Latched Output (Q)
Logics.LE79.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE80.Gate Out	Signal: Output of the logic gate
Logics.LE80.Timer Out	Signal: Timer Output
Logics.LE80.Out	Signal: Latched Output (Q)

Name	Description
Logics.LE80.Out inverted	Signal: Negated Latched Output (Q NOT)

These trips will start the BF module if »All current« functions have been selected as the trigger event.

Name	Description
-.-	No assignment

These trips will start the BF module if »External trips« have been selected as the trigger event.

Name	Description
-.-	No assignment
Intertripping.TripCmd	Signal: Trip Command
ExP[1].TripCmd	Signal: Trip Command
ExP[2].TripCmd	Signal: Trip Command
ExP[3].TripCmd	Signal: Trip Command
ExP[4].TripCmd	Signal: Trip Command

Commissioning Example: Supervision Scheme 50BF

Object to Be Tested:

Test of the breaker failure protection (Supervision Scheme 50BF).

Necessary Means:

- Current source;
- Ammeter; and
- Timer.

NOTICE **When testing, the applied test current must always be higher than the tripping threshold *»I-CBF«*. If the test current falls below the threshold while the breaker is in the "Off" position, no pickup will be generated.**

Procedure (Single-Phase):
For testing the tripping time of the CBF protection, a test current has to be higher than the threshold value of one of the current protection modules that are assigned to trigger the CBF protection. The CBF trip delay can be measured from the time when one of the triggering inputs becomes active to the time when the CBF protection trip is asserted.

To avoid wiring errors, checked to make sure the breaker in the upstream system switches off.

The time, measured by the timer, should be in line with the specified tolerances.

Successful Test Result:
The actual times measured comply with the setpoint times. The breaker in the higher-level section switches off.

WARNING **Re-connect the control cable to the breaker!**

TCS - Trip Circuit Supervision [74TC]

Available elements:
TCS

The trip circuit monitoring is used for monitoring if the trip circuit is ready for operations. The monitoring can be fulfilled in two ways. The first assumes only »*Aux On (52a)*« is used in the trip circuit. The second assumes that, in addition to »*Aux On (52a)*, »*Aux Off(52b)*« is also used for the circuit monitoring.

With »*Aux On (52a)*, only in the trip circuit, the monitoring is only effective when the breaker is closed while if both »*Aux On (52a)*, and »*Aux Off(52b)*« are used, the trip circuit will be monitored all time as long as the control power is on.

Note that the digital inputs used for this purpose must be configured properly based on the trip circuit control voltage. If the trip circuit is detected broken, an alarm will be issued with a specified delay, which must be longer than the time when a trip contact is closed to the time when the breaker status is clearly recognized by the relay.

NOTICE **In Slot 1 has 2 digital inputs, each of which has a separate root (contact separation) for the trip circuit supervision.**

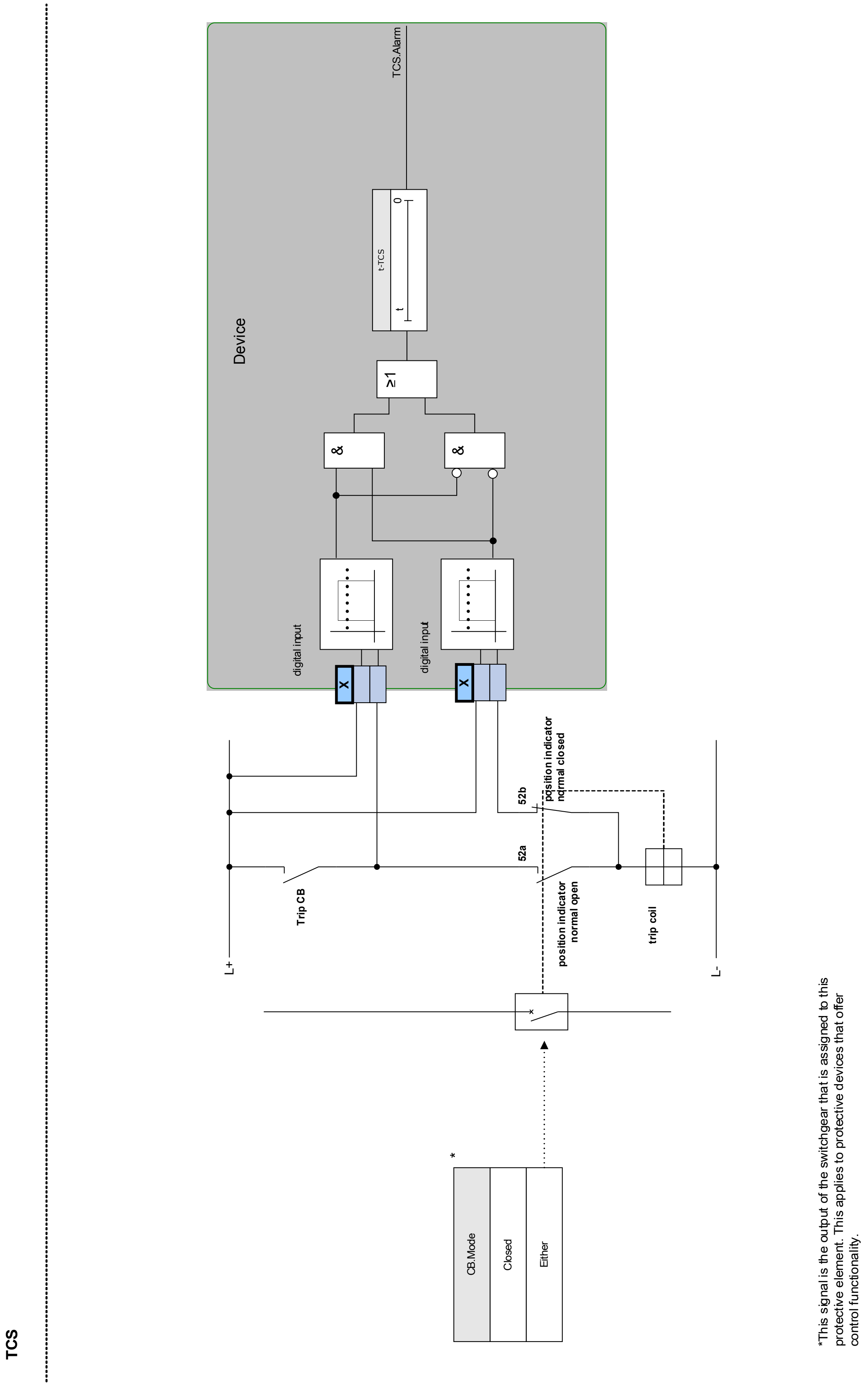
NOTICE **This Notice applies to protective devices that offer control functionality only! This protective element requires, that a switchgear (circuit breaker is assigned to it.**

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.

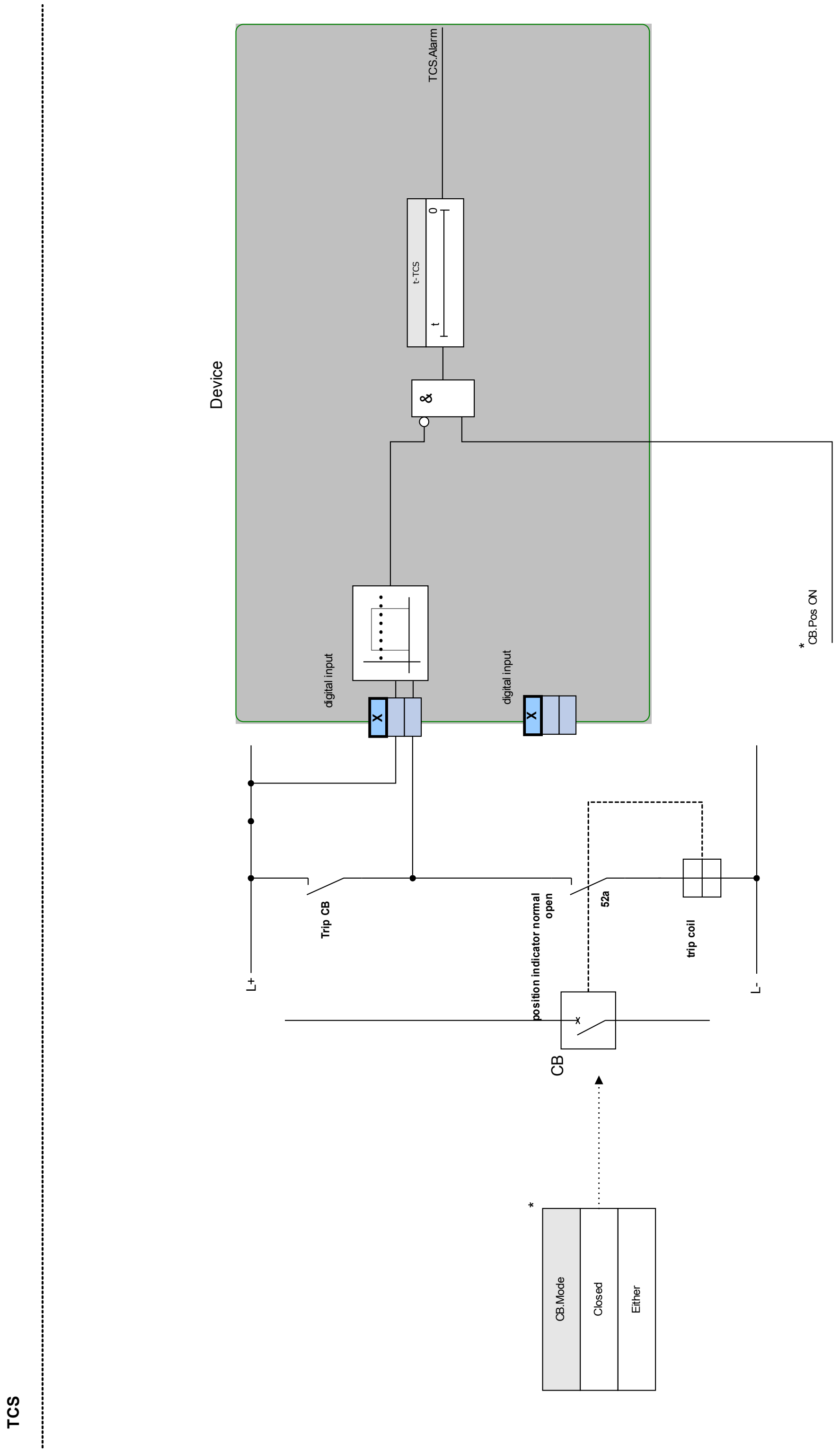
In order to identify a conductor failure in the trip circuit on the supply line or in the trip coil, the off-coil has to be looped-in to the supervision circuit.

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.



Connection example: Trip circuit supervision with one CB auxiliary contact (Aux On (52a)) only.



*This signal is the output of the switchgear that is assigned to this protective element. This applies to protective devices that offer control functionality.

Device Planning Parameters of the Trip Circuit Supervision

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

Global Protection Parameters of the Trip Circuit Supervision

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
CB Pos Detect	Criterion by which the Circuit Breaker Switch Position is to be detected.	-.-, SG[1].Pos	-.-	[Protection Para /Global Prot Para /Supervision /TCS]
Mode	Select if trip circuit is going to be monitored when the breaker is closed or when the breaker is either open or close.	Closed, Either	Closed	[Protection Para /Global Prot Para /Supervision /TCS]
Input 1	Select the input configured to monitor the trip coil when the breaker is closed.	1..n, Dig Inputs	-.-	[Protection Para /Global Prot Para /Supervision /TCS]
Input 2	Select the input configured to monitor the trip coil when the breaker is open. Only available if Mode set to “Either”. Only available if: Mode = Either	1..n, Dig Inputs	-.-	[Protection Para /Global Prot Para /Supervision /TCS]
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]

List of Digital Inputs

Name	*Description*
-.-	No assignment
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

Setting Group Parameters of the Trip Circuit Supervision

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<1..4> /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 /<1..4> /Supervision /TCS]
t-TCS	Tripping delay time of the Trip Circuit Supervision	0.10 - 10.00s	0.2s	[Protection Para /<1..4> /Supervision /TCS]

Trip Circuit Supervision Input States

Name	*Description*	*Assignment via*
Aux ON-I	Module Input State: Position indicator/check-back signal of the CB (52a)	[Protection Para /Global Prot Para /Supervision /TCS]
Aux OFF-I	Module input state: Position indicator/check-back signal of the CB (52b)	[Protection Para /Global Prot Para /Supervision /TCS]
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]
CB Pos Detect-I	Module input state: Criterion by which the Circuit Breaker Switch Position is to be detected.	[Protection Para /Global Prot Para /Supervision /TCS]

Trip Circuit Supervision Signals (Output States)

Signal	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
Alarm	Signal: Alarm Trip Circuit Supervision
Not Possible	Not possible because no state indicator assigned to the breaker.

Commissioning: Trip Circuit Supervision [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.

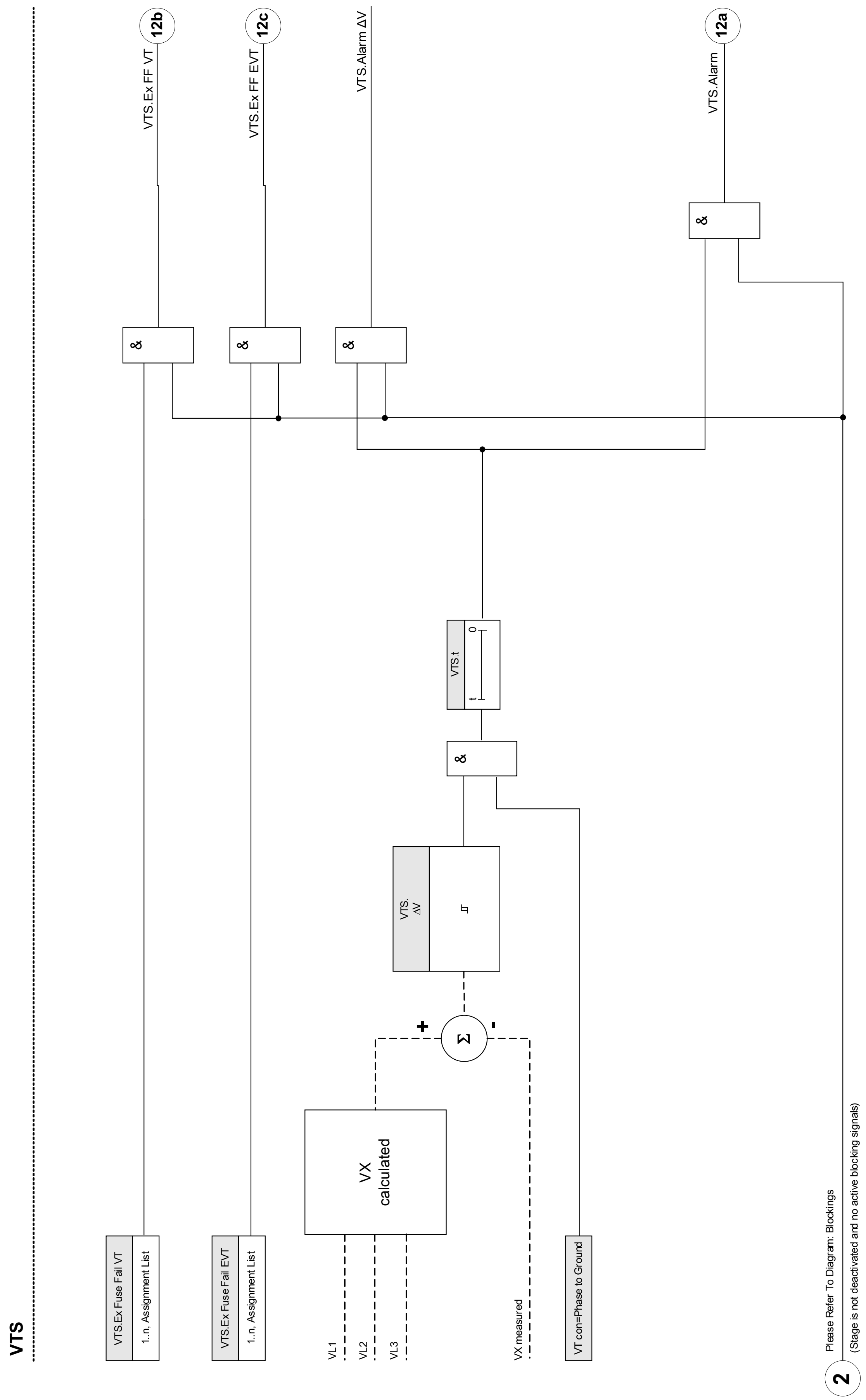
VTS - Voltage Transformer Supervision [60FL]

Available stages:
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.

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«*.


VTS
VTS.Ex Fuse Fail VT
1..n, Assignment List
VTS.Ex Fuse Fail EVT
1..n, Assignment List
VL1
VL2
VL3
VX calculated
VX measured
VT con=Phase to Ground
+
-
Σ
VTS.
ΔV
&
VTS.t
t
0
&
&
&
&
VTS.Ex FF VT
12b
VTS.Ex FF EVT
12c
VTS.Alarm ΔV
VTS.Alarm
12a
2
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)

Device Planning Parameters of the Voltage Transformer Module

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, use	do not 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 FF VT-I	State of the module input: Alarm Fuse Failure Voltage Transformers	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Supervision /VTS]
Ex FF EVT-I	State of the module input: Alarm Fuse Failure Earth Voltage Transformers	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 /<1..4> /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 /<1..4> /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 - 1.00Vn	0.50Vn	[Protection Para /<1..4> /Supervision /VTS]
Alarm delay	Alarm delay	0.1 - 9999.0s	1.0s	[Protection Para /<1..4> /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)

Signal	*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: Ex FF VT
Ex FF EVT	Signal: Alarm Fuse Failure Earth Voltage Transformers

Commissioning: Voltage Transformer Supervision (via DI)

Object to be tested
Check if the fuse failure signals are 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 corresponding digital input changes.
- Fuse failure signals that are assigned to LEDs, have to be indicated by the corresponding LED.

Commissioning: Voltage Transformer Failure [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«.*

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.
- 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.

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. 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.

The auxiliary voltage is monitored continuously. If the voltage of one of the different supply circuits falls below a certain threshold, a restart of the device is initiated. If the voltage staggers around the threshold, the device also starts again after several seconds. Additionally the level of all internal supply voltage groups are continuously monitored.

Independent of these separate monitoring functions, the intermediate voltage circuit is buffered until all important and relevant operational and fault-data have been saved and the device initiates a restart.

Error messages / -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:

Error messages / -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; internally for system-analysis purpose.
5.	Restart because of configuration changes.
6.	General failure: reboot.
7.	Reboot by SW-system abort (HOST-side); summary of several reboot reasons detected by software, i.e. wrong pointer, corrupted files etc.
8.	Reboot by watchdog timeout (HOST-side) - Signaling if the protection-class-task hangs.
9.	Reboot by system abort (DSP-side); summary of several reboot reasons detected by software, i.e. wrong pointer, DSP-side.
10.	Reboot by watchdog timeout (DSP-side) - Appears when DSP sequence needs too long for one cycle.
11.	Loss of auxiliary voltage or low voltage reboot after loss of auxiliary voltage or voltage dropping below reboot-level but not becoming zero.
12.	Faulty memory access: message of MMU (memory mapping unit) that prohibited memory access has occurred.

Programmable Logic

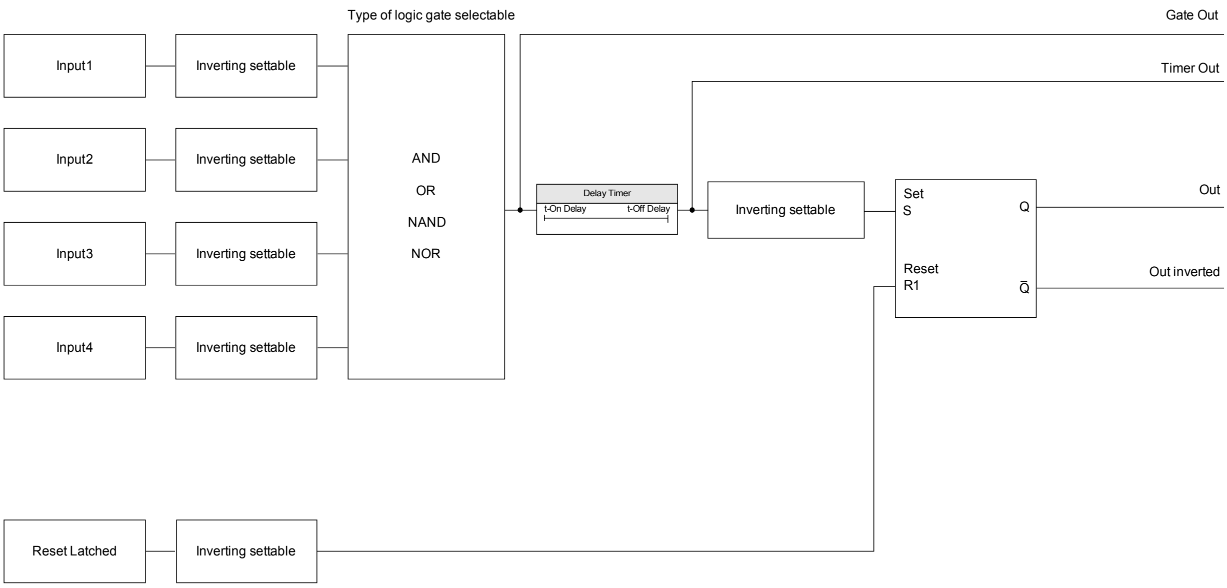
Available Elements (Equations):
Logics

General Description

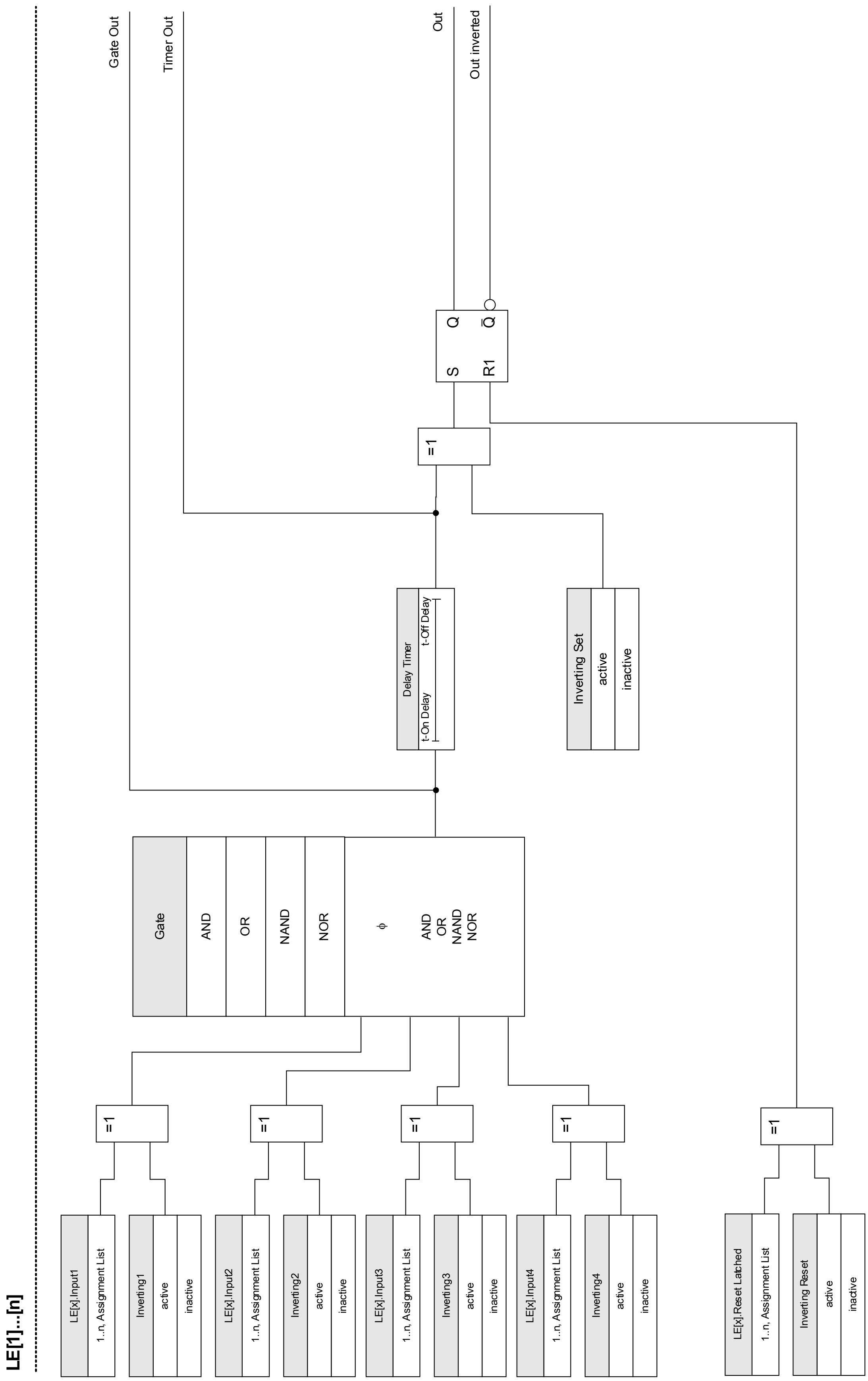
The Protective Relay includes programmable Logic Equations for programming output relays, blocking of protective functions and custom logic functions in the relay.

The logic provides control of the output relays based on the state of the inputs that can be choosen from the assignment list (protective function pickups, protective function states, breaker states, system alarms, and module inputs). The user can use the outputs signals of a Logic Equation as inputs in higher equations (e.g. the output signal of Logic Equation 10 might be used as an input of Logic Equation 11).

Principle Overview



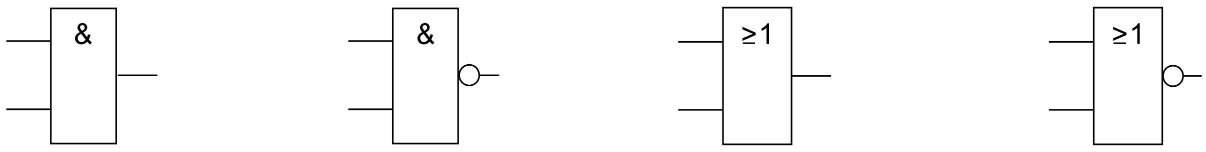
Detailed Overview – Overall Logic diagram



Available Gates (Operators)

Within the Logic Equation, the following Gates can be used:

Gate



AND NAND OR NOR

Input Signals

The user can assign up to 4 Input signals (from the assignment list) to the inputs of the gate.

As an option, each of the 4 input signals can be inverted (negated)

Timer Gate (On Delay and Off Delay)

The output of the gate can be delayed. The user has the option to set an On and an Off delay.

Latching

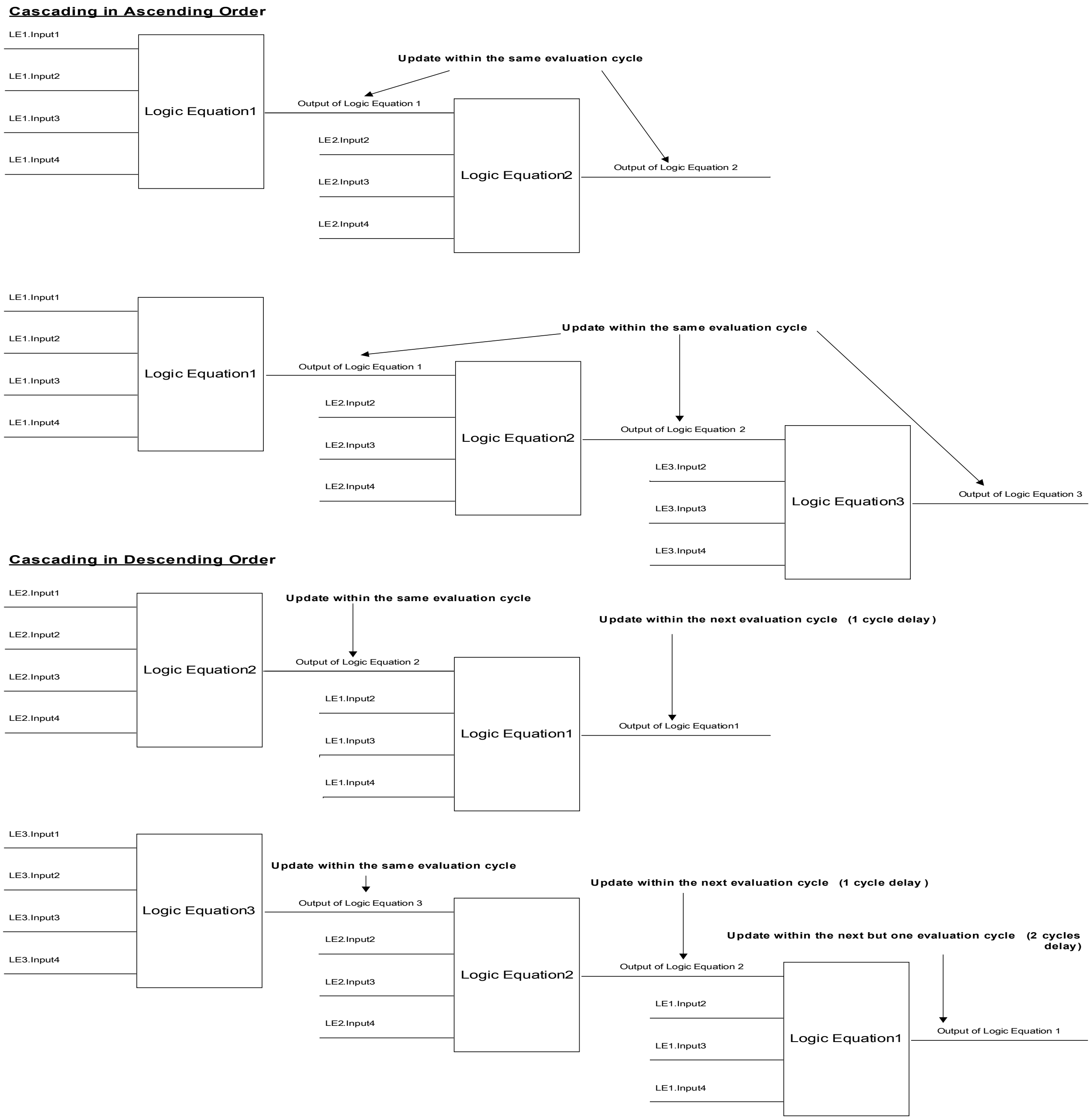
The timer issues two signals. An unlatched and a latched signal. The latched input can optionally be inverted.
In order to reset the latched signal the user has to assign an reset signal from the assignment list. The reset signal can also optionally be inverted.

Cascading Logical Outputs

The device will evaluate output states of the Logic Equations starting from Logic Equation 1 up to the Logic Equation with the highest number. This evaluation (device) cycle will be continuously repeated.

Cascading Logic Equations in an ascending sequence
Cascading in an ascending sequence means that the user uses the output signal of “Logic Equation **n**” as input of “Logic Equation **n+1**”. If the state of “Logic Equation **n**” changes, the state of the output of “Logic Equation **n+1**” will be updated within the same cycle.

Cascading Logic Equations in a descending sequence
Cascading in a descending sequence means that the user uses the output signal of “Logic Equation **n+1**” as input of “Logic Equation **n**”. If the output of “Logic Equation **n+1**” changes, this change of the feed back signal at the input of “Logic Equation **n**” will be delayed for one cycle.



Programmable Logic at the Panel

WARNING **WARNING improper use of Logic Equations might result in personal injury or damage the electrical equipment.**

Don´t use Logic Equations unless that you can ensure the safe functionality.

How to configure a Logic Equation?

- Call up menu [Logics/LE [x]]:
- Set the Input Signals (where necessary, invert them).
- If required, configure the timer (»*On delay«* and »*Off delay«*).
- If the latched output signal is used assign a reset signal to the reset input.
- Within the »status display«, the user can check the status of the logical inputs and outputs of the Logic Equation.

In case that Logic Equations should be cascaded the user has to be aware of timing delays (cycles) in case of descending sequences (Please refer to section: Cascading Logical Outputs).

By means the Status Display [Operation/Status Display] the logical states can be verified.]

Programmable Logic via Smart view

WARNING

WARNING improper use of Logic Equations might result in personal injury or damage the electrical equipment.

Don´t use Logic Equations unless that you can ensure the safe functionality.

NOTICE

It is recommended to configure the logic via Smart view.

How to configure a Logic Equation?

- Call up menu [Logics/LE [x]:
- Call up the Logic Editor
- Set the Input Signals (where necessary, invert them).
- If required, configure the timer (»*On delay*« and »*Off delay*«).
- If the latched output signal is used assign a reset signal to the reset input.
- Within the »status display«, the user can check the status of the logical inputs and outputs of the Logic Equation.

In case that Logic Equations should be cascaded the user has to be aware of timing delays (cycles) in case of descending sequences (Please refer to section: Cascading Logical Outputs).

By means the Status Display [Operation/Status Display] the logical states can be verified.]

Device Planning Parameters of the Programmable Logic

Parameter	*Description*	*Options*	*Default*	*Menu path*
No of Equations:	Number of required Logic Equations:	0, 5, 10, 20, 40, 80	20	[Device planning]

Global Protection Parameter of the Programmable Logic

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
LE1.Gate	Logic gate	AND, OR, NAND, NOR	AND	[Logics /LE 1]
LE1.Input1	Assignment of the Input Signal	1..n, Assignment List	-.-	[Logics /LE 1]
LE1.Inverting1	Inverting the input signals. Only available if an input signal has been assigned.	inactive, active	inactive	[Logics /LE 1]
LE1.Input2	Assignment of the Input Signal	1..n, Assignment List	-.-	[Logics /LE 1]
LE1.Inverting2	Inverting the input signals. Only available if an input signal has been assigned.	inactive, active	inactive	[Logics /LE 1]
LE1.Input3	Assignment of the Input Signal	1..n, Assignment List	-.-	[Logics /LE 1]
LE1.Inverting3	Inverting the input signals. Only available if an input signal has been assigned.	inactive, active	inactive	[Logics /LE 1]
LE1.Input4	Assignment of the Input Signal	1..n, Assignment List	-.-	[Logics /LE 1]
LE1.Inverting4	Inverting the input signals. Only available if an input signal has been assigned.	inactive, active	inactive	[Logics /LE 1]
LE1.t-On Delay	Switch On Delay	0.00 - 36000.00s	0.00s	[Logics /LE 1]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
LE1.t-Off Delay	Switch Off Delay	0.00 - 36000.00s	0.00s	[Logics /LE 1]
LE1.Reset Latched	Reset Signal for the Latching	1..n, Assignment List	-.-	[Logics /LE 1]
LE1.Inverting Reset	Inverting Reset Signal for the Latching	inactive, active	inactive	[Logics /LE 1]
LE1.Inverting Set	Inverting the Setting Signal for the Latching	inactive, active	inactive	[Logics /LE 1]

Programmable Logic Inputs

Name	*Description*	*Assignment via*
LE1.Gate In1-I	State of the module input: Assignment of the Input Signal	[Logics /LE 1]
LE1.Gate In2-I	State of the module input: Assignment of the Input Signal	[Logics /LE 1]
LE1.Gate In3-I	State of the module input: Assignment of the Input Signal	[Logics /LE 1]
LE1.Gate In4-I	State of the module input: Assignment of the Input Signal	[Logics /LE 1]
LE1.Reset Latch-I	State of the module input: Reset Signal for the Latching	[Logics /LE 1]

Programmable Logic Outputs

Signal	*Description*
LE1.Gate Out	Signal: Output of the logic gate
LE1.Timer Out	Signal: Timer Output
LE1.Out	Signal: Latched Output (Q)
LE1.Out inverted	Signal: Negated Latched Output (Q NOT)

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 functionality. 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 electrical 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.

Service and Commissioning Support

Within the service menu various functions support maintenance and commissioning of the device.

General

Within the menu [Service/General], the user can initiate a reboot of the device.

Forcing the Relay Output Contacts

NOTICE **The parameters, their defaults and setting ranges have to be taken from Relay Output Contacts section.**

Principle – General Use

DANGER **The User MUST ENSURE that the relay output contacts operate normally after the maintenance is completed. If the relay output contacts do not operate normally, the protective device WILL NOT provide protection.**

For commissioning purposes or for maintenance, relay output contacts can be set by force.

Within this mode [Service/Test Mode/Force OR/BO Slot X(2/5)], relay output contacts can be set by force:

- Permanent; or
- Via timeout.

If they are set with a timeout, they will only keep their “Force Position” as long as this timer runs. If the timer expires, the relay will operate normally. If they are set as Permanent, they will keep the “Force Position” continuously.

There are two options available:

- Forcing a single relay »*Force ORx«;* and
- Forcing an entire group of relay output contacts »*Force all Outs«*.

Forcing an entire group takes precedence over forcing a single relay output contact!

NOTICE **A relay output contact will NOT follow a force command as long as it is disarmed at the same time.**

NOTICE **A relay output contact will follow a force command:**

- **If it is not disarmed; and**
- **If the Direct Command is applied to the relay(s).**

Keep in mind, that the forcing of all relay output contacts (of the same assembly group) takes precedence over the force command of a single relay output contact.

Disarming the Relay Output Contacts

NOTICE **The parameters, their defaults, and setting ranges have to be taken from the Relay Output Contacts section.**

Principle – General Use

Within this mode [Service/Test Mode/DISARMED], entire groups of relay output contacts can be disabled. By means of this test mode, contact outputs switching actions of the relay output contacts are prevented. If the relay output contacts are disarmed, maintenance actions can be carried out without the risk of taking entire processes off-line.

DANGER **The User MUST ENSURE that the relay output contacts are ARMED AGAIN after the maintenance is complete. If they are not armed, the protective device WILL NOT provide protection.**

NOTICE **Zone Interlocking Output and the Supervision Contact cannot be disarmed.**

Within this mode [Service/Test Mode/DISARMED] entire groups of relay output contacts can be disarmed:

- Permanent; or
- Via timeout.

If they are set with a timeout, they will only keep their “Disarm Position” as long as this timer runs. If the timer expires, the relay output contacts will operate normally. If they are set Permanent, they will keep the “Disarm State” continuously.

NOTICE **A relay output contact <u>will NOT be disarmed as long as</u>:**

- **It´s latched (and not yet reset).**
- **As long as a running t-OFF-delay timer is not yet expired (hold time of a relay output contact).**
- **The Disarm Control is not set to active.**
- **The Direct Command is not applied.**

NOTICE **A relay output contact <u>will be disarmed</u> if it´s not latched and**

- **There is no running t-OFF-delay timer (hold time of a relay output contact) and**
- **The DISARM Control is set to active and**
- **The Direct Command Disarm is applied.**

Forcing RTDs*

* = Availability depends on ordered device.

NOTICE **The parameters, their defaults, and setting ranges have to be taken from RTD/UTRD section.**

Principle – General Use

DANGER **The User MUST ENSURE that the RTDs operate normally after the maintenance is completed. If the RTDs do not operate normally, the protective device WILL NOT provide protection.**

For commissioning purposes or for maintenance, RTD temperatures can be set by force.

Within this mode [Service/Test Mode/URTD], RTD temperatures can be set by force:

- Permanent; or
- Via timeout.

If they are set with a timeout, they will keep their “Forced Temperature” only as long as this timer runs. If the timer expires, the RTD will operate normally. If they are set as »*Permanent*«, they will keep the “Forced Temperature” continuously. This menu will show the measured values of the RTDs until the User activates the force mode by calling up the »*Function*«. As soon as the force mode is activated, the shown values will be frozen as long as this mode is active. Now the User can force RTD values. As soon as the force mode is deactivated, measured values will be shown again.

Forcing Analog Outputs*

* = Availability depends on ordered device.

NOTICE **The parameters, their defaults, and setting ranges have to be taken from Analog Output section.**

Principle – General Use

DANGER **The User MUST ENSURE that the Analog Outputs operate normally after maintenance is completed. Do not use this mode if forced Analog Outputs cause issues in external processes.**

For commissioning purposes or for maintenance, Analog Outputs can be set by force.

Within this mode [Service/Test Mode/Analog Output(x)], Analog Outputs can be set by force:

- Permanent; or
- Via timeout.

If they are set with a timeout, they will only keep their “Forced Value” as long as this timer runs. If the timer expires, the Analog Output will operate normally. If they are set as »*Permanent*«, they will keep the “Forced Value” continuously. This menu will show the current value that is assigned onto the Analog Output until the User activates the force mode by calling up the »*Function*«. As soon as the force mode is activated, the shown values will be frozen as long as this mode is active. Now the User can force Analog Output values. As soon as the force mode is deactivated, measured values will be shown again.

Forcing Analog Inputs*

* = Availability depends on ordered device.

NOTICE **The parameters, their defaults, and setting ranges have to be taken from Analog Inputs section.**

Principle – General Use

DANGER **The User MUST ENSURE that the Analog Inputs operate normally after maintenance is completed.**

For commissioning purposes or for maintenance, Analog Inputs can be set by force.

Within this mode [Service/Test Mode (Prot inhibit)/WARNING! Cont?/Analog Inputs], Analog Inputs can be set by force:

- Permanent; or
- Via timeout.

If they are set with a timeout, they will only keep their “Forced Value” as long as this timer runs. If the timer expires, the Analog Input will operate normally. If they are set as »*Permanent*«, they will keep the “Forced Value” continuously. This menu will show the current value that is fed to the Analog Input until the User activates the force mode by calling up the »*Function*«. As soon as the force mode is activated, the shown value will be frozen as long as this mode is active. Now the User can force the Analog Input value. As soon as the force mode is deactivated, measured value will be shown again.

Failure Simulator (Sequencer)*

Available Elements:
Sgen

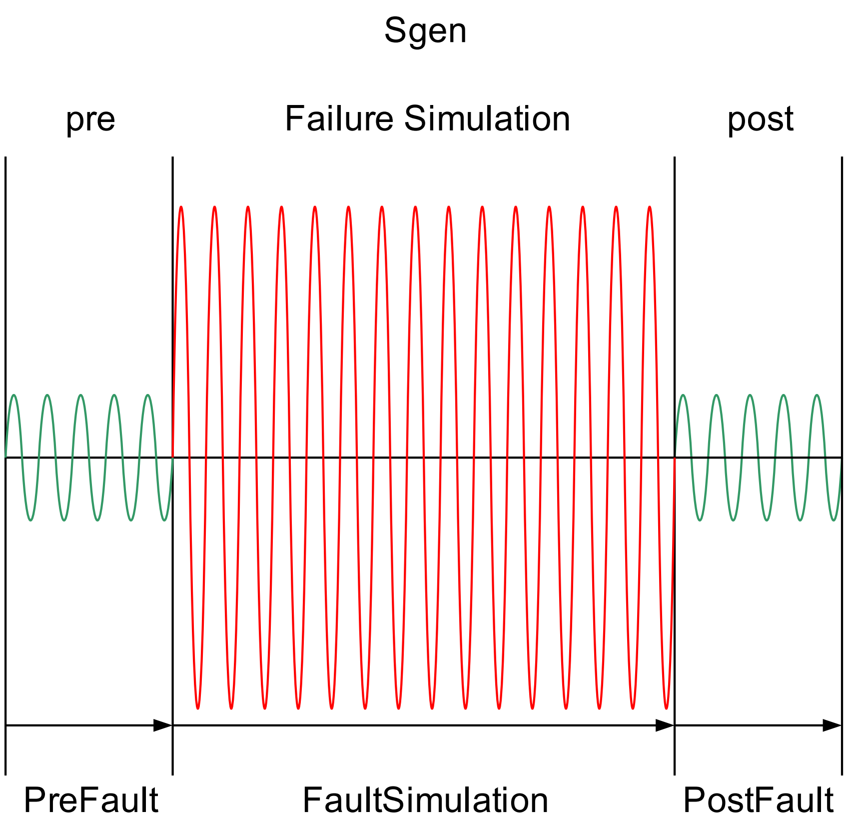
* = Availability depends on ordered device.

For commissioning support and in order to analyze failures, the protective device offers the option to simulate measuring quantities. The simulation menu can be found within the [Service/Test Mode/Sgen] menu.
The simulation cycle consists of three states:

- Pre-failure;
- Failure; and
- Post-failure State (Phase).

Within the [Service/Test Mode/Sgen/Configuration/Times] sub-menu, the duration of each phase can be set. In addition; the measuring quantities to be simulated can be determined (e.g.: voltages, currents, and the corresponding angles) for each phase (and ground).The simulation will be terminated, if a phase current exceeds 0.1 times In. A simulation can be restarted, five seconds after the current has fallen below 0.1 times In.

DANGER **Setting the device into the simulation mode means taking the protective device out of operation for the duration of the simulation. Do not use this feature during operation of the device if the User cannot guarantee that there is a running and properly working backup protection.**



The energy counters will be stopped while the failure simulator is running.

NOTICE **The simulation voltages are always phase to neutral voltages, irrespectively of the mains voltage transformers' connection method (Phase-to-phase / Wey / Open Delta).**

*Application Options of the Fault Simulator**:*

<table>
<tr><th>Stop Options</th><th>Cold Simulation (Option 1)</th><th>Hot Simulation (Option 2)</th></tr>
<tr><td>Do not stop

Run complete:
Pre Failure, Failure, Post Failure.

How To?: Call up [Service/Test Mode/Sgen /Process]
Ex Force Post = no assignment

Press/Call up Start Simulation.</td><td rowspan="3">Simulation without tripping the breaker:
Blocking protective Trips to the Breaker. That means verifying if the protective device generates a trip without energizing the trip coil of the breaker (similar to disarm the output relay).

How To?:
Call up [Service/Test Mode/Sgen /Process]
TripCmd Mode = No TripCmd</td><td rowspan="3">Simulation is authorized to trip the breaker:
How To?:
Call up [Service/Test Mode/Sgen /Process]
TripCmd Mode = With TripCmd</td></tr>
<tr><td>Stop by external signal

Force Post: As soon as this signal becomes true, the Fault Simulation will be forced to switch into the Post Failure mode.
How To?: Call up [Service/Test Mode/Sgen /Process]
Ex Force Post = Assigned Signal</td></tr>
<tr><td>Manual stop

As soon as this signal becomes true, the Fault Simulation will be terminated and the device changes back to normal operation.
How To?: Call up [Service/Test Mode/Sgen /Process]
Press/Call up Stop Simulation.</td></tr>
</table>

**Please note: Due to internal dependencies, the frequency of the simulation module is 0.16% greater than the rated one.

Device Planning Parameters of the Failure Simulator

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

Global Protection Parameter of the Failure Simulator

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
PreFault	Pre Fault Duration	0.00 - 300.00s	0.0s	[Service /Test (Prot inhibit) /Sgen /Configuration /Times]
FaultSimulation	Duration of Fault Simulation	0.00 - 10800.00s	0.0s	[Service /Test (Prot inhibit) /Sgen /Configuration /Times]
PostFault	PostFault	0.00 - 300.00s	0.0s	[Service /Test (Prot inhibit) /Sgen /Configuration /Times]
TripCmd Mode	Trip Command Mode	No TripCmd, With TripCmd	No TripCmd	[Service /Test (Prot inhibit) /Sgen /Process]
Ex Start Simulation	External Start of Fault Simulation (Using the test parameters)	1..n, Assignment List	-.-	[Service /Test (Prot inhibit) /Sgen /Process]
ExBlo	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	SG[1].Pos ON	[Service /Test (Prot inhibit) /Sgen /Process]

Parameter	Description	Setting range	Default	Menu path
Ex ForcePost	Force Post state. Abort simulation.	1..n, Assignment List	-.-	[Service /Test (Prot inhibit) /Sgen /Process]

Voltage Parameter of the Failure Simulator

Parameter	Description	Setting range	Default	Menu path
VL1	Voltage Fundamental Magnitude in Pre State: phase L1	0.00 - 1.50Vn	1.0Vn	[Service /Test (Prot inhibit) /Sgen /Configuration /PreFault /Voltage]
VL2	Voltage Fundamental Magnitude in Pre State: phase L2	0.00 - 1.50Vn	1.0Vn	[Service /Test (Prot inhibit) /Sgen /Configuration /PreFault /Voltage]
VL3	Voltage Fundamental Magnitude in Pre State: phase L3	0.00 - 1.50Vn	1.0Vn	[Service /Test (Prot inhibit) /Sgen /Configuration /PreFault /Voltage]
VX	Voltage Fundamental Magnitude in Pre State: VX	0.00 - 1.50Vn	0.0Vn	[Service /Test (Prot inhibit) /Sgen /Configuration /PreFault /Voltage]
phi VL1	Start Position respectively Start Angle of the Voltage Phasor during Pre-Phase:phase L1	-360 - 360°	0°	[Service /Test (Prot inhibit) /Sgen /Configuration /PreFault /Voltage]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
phi VL2	Start Position respectively Start Angle of the Voltage Phasor during Pre-Phase:phase L2	-360 - 360°	240°	[Service /Test (Prot inhibit) /Sgen /Configuration /PreFault /Voltage]
phi VL3	Start Position respectively Start Angle of the Voltage Phasor during Pre-Phase:phase L3	-360 - 360°	120°	[Service /Test (Prot inhibit) /Sgen /Configuration /PreFault /Voltage]
phi VX meas	Start Position respectively Start Angle of the Voltage Phasor during Pre-Phase: VX	-360 - 360°	0°	[Service /Test (Prot inhibit) /Sgen /Configuration /PreFault /Voltage]
VL1	Voltage Fundamental Magnitude in Fault State: phase L1	0.00 - 1.50Vn	0.5Vn	[Service /Test (Prot inhibit) /Sgen /Configuration /FaultSimulation /Voltage]
VL2	Voltage Fundamental Magnitude in Fault State: phase L2	0.00 - 1.50Vn	0.5Vn	[Service /Test (Prot inhibit) /Sgen /Configuration /FaultSimulation /Voltage]
VL3	Voltage Fundamental Magnitude in Fault State: phase L3	0.00 - 1.50Vn	0.5Vn	[Service /Test (Prot inhibit) /Sgen /Configuration /FaultSimulation /Voltage]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
VX	Voltage Fundamental Magnitude in Fault State: phase VX	0.00 - 1.50Vn	0.5Vn	[Service /Test (Prot inhibit) /Sgen /Configuration /FaultSimulation /Voltage]
phi VL1	Start Position respectively Start Angle of the Voltage Phasor during Fault-Phase:phase L1	-360 - 360°	0°	[Service /Test (Prot inhibit) /Sgen /Configuration /FaultSimulation /Voltage]
phi VL2	Start Position respectively Start Angle of the Voltage Phasor during Fault-Phase:phase L2	-360 - 360°	240°	[Service /Test (Prot inhibit) /Sgen /Configuration /FaultSimulation /Voltage]
phi VL3	Start Position respectively Start Angle of the Voltage Phasor during Fault-Phase:phase L3	-360 - 360°	120°	[Service /Test (Prot inhibit) /Sgen /Configuration /FaultSimulation /Voltage]
phi VX meas	Start Position respectively Start Angle of the Voltage Phasor during Fault-Phase: VX	-360 - 360°	0°	[Service /Test (Prot inhibit) /Sgen /Configuration /FaultSimulation /Voltage]
VL1	Voltage Fundamental Magnitude during Post phase: phase L1	0.00 - 1.50Vn	1.0Vn	[Service /Test (Prot inhibit) /Sgen /Configuration /PostFault /Voltage]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
VL2	Voltage Fundamental Magnitude during Post phase: phase L2	0.00 - 1.50Vn	1.0Vn	[Service /Test (Prot inhibit) /Sgen /Configuration /PostFault /Voltage]
VL3	Voltage Fundamental Magnitude during Post phase: phase L3	0.00 - 1.50Vn	1.0Vn	[Service /Test (Prot inhibit) /Sgen /Configuration /PostFault /Voltage]
VX	Voltage Fundamental Magnitude during Post phase: phase VX	0.00 - 1.50Vn	0.0Vn	[Service /Test (Prot inhibit) /Sgen /Configuration /PostFault /Voltage]
phi VL1	Start Position respectively Start Angle of the Voltage Phasor during Post phase: phase L1	-360 - 360°	0°	[Service /Test (Prot inhibit) /Sgen /Configuration /PostFault /Voltage]
phi VL2	Start Position respectively Start Angle of the Voltage Phasor during Post phase: phase L2	-360 - 360°	240°	[Service /Test (Prot inhibit) /Sgen /Configuration /PostFault /Voltage]
phi VL3	Start Position respectively Start Angle of the Voltage Phasor during Post phase: phase L3	-360 - 360°	120°	[Service /Test (Prot inhibit) /Sgen /Configuration /PostFault /Voltage]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
phi VX meas	Start Position respectively Start Angle of the Voltage Phasor during Post phase: phase VX	-360 - 360°	0°	[Service /Test (Prot inhibit) /Sgen /Configuration /PostFault /Voltage]

States of the Inputs of the Failure Simulator

Name	*Description*	*Assignment via*
Ex Start Simulation-I	State of the module input:External Start of Fault Simulation (Using the test parameters)	[Service /Test (Prot inhibit) /Sgen /Process]
ExBlo	Module input state: External blocking	[Service /Test (Prot inhibit) /Sgen /Process]
Ex ForcePost-I	State of the module input:Force Post state. Abort simulation.	[Service /Test (Prot inhibit) /Sgen /Process]

Signals of the Failure Simulator (States of the Outputs)

Signal	*Description*
Running	Signal; Measuring value simulation is running
State	Signal: Wave generation states: 0=Off, 1=PreFault, 2=Fault, 3=PostFault, 4=InitReset

Direct Commands of the Failure Simulator

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Start Simulation	Start Fault Simulation (Using the test parameters)	inactive, active	inactive	[Service /Test (Prot inhibit) /Sgen /Process]
Stop Simulation	Stopp Fault Simulation (Using the test parameters)	inactive, active	inactive	[Service /Test (Prot inhibit) /Sgen /Process]

Failure Simulator Values

Value	*Description*	*Default*	*Size*	*Menu path*
State	Wave generation states: 0=Off, 1=PreFault, 2=Fault, 3=PostFault, 4=InitReset	Off	Off, PreFault, FaultSimulation, PostFault, Init Res	[Service /Test (Prot inhibit) /Sgen /State]

Technical Data

NOTICE

Use Copper conductors only, 75°C.
Conductor size AWG 14 [2.5 mm^2].

Climatic Environmental Conditions

Storage Temperature:	Operating Temperature:
-30°C up to +70°C (-22°F to 158°F)	-20°C up to +60°C (-4°F to 140°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.

Degree of Protection EN 60529

HMI front panel with seal	IP54
HMI front panel without seal	IP50
Rear side terminals	IP20

Routine Test

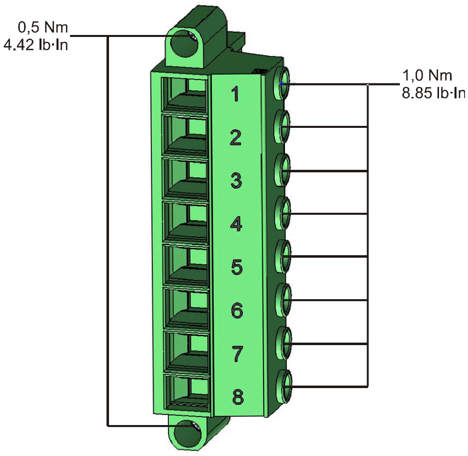
Insulation test acc. to IEC60255-5:	All tests to be carried out against earth and other input- and output circuits
Aux. voltage supply, digital inputs, current measuring inputs, signal relay outputs:	2.5 kV (eff) / 50 Hz
Voltage measuring inputs:	3.0 kV (eff) / 50 Hz
All wire-bound communication interfaces:	1.5 kV DC

Housing

Housing B1: height/-width (7 Pushbottons/Door Mounting)	173 mm (6.811”)/ 141.5 mm (5.570”)
Housing B1: height/-width (8 Pushbottons/Door Mounting)	183 mm (7.205”)/ 141.5 mm (5.570”)
Housing B1: height/-width (7 and 8 Pushbottons/19”)	173 mm (6.811” / 4U)/ 141.5 mm (5.570” / 28 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 are allowed)
Weight:	Approx. 2.4 kg

Voltage and Residual Voltage Measurement

The following Technical Data are valid for 8-pole (large) voltage measurement terminals.



Nominal voltages:	60 - 520 V (can be configured)
Max. measuring range:	800 V AC
Continuous loading capacity:	800 V AC
Power consumption:	at Vn = 100 V S = 22 mVA at Vn = 110 V S = 25 mVA at Vn = 230 V S = 110 mVA at Vn = 400 V S = 330 mVA
Frequency range:	50 Hz or 60 Hz ±10%
Terminals:	Screw-type terminals

Frequency Measurement

Nominal frequencies:	50 Hz / 60 Hz

Voltage Supply

Aux. Voltage:	24V - 270 V DC/48 - 230 V AC (-20/+10%) ≂
Buffer time in case of supply failure:	>= 50 ms at minimal aux. voltage Note: communication could be interrupted **After this time has elapsed, the device switches off.**
Max. permissible making current:	18 A peak value for <0.25 ms 12 A peak value for <1 ms

The voltage supply must be protected by a fuse of:

- 2,5 A time-lag miniature fuse 5x20 mm (approx. 1/5” x 0.8”) according to IEC 60127
- 3,5 A time-lag miniature fuse 6,3x32 mm (approx. 1/4” x 1 1/4”) according to UL 248-14

Power Consumption

Power supply range:	Power consumption in idle mode	Max. power consumption
24-270 V DC:	7 W	10 W
48-230 V AC (for frequencies of 50-60 Hz):	7 W / 13 VA	10 W / 17 VA

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 B1:	8

Front Interface RS232

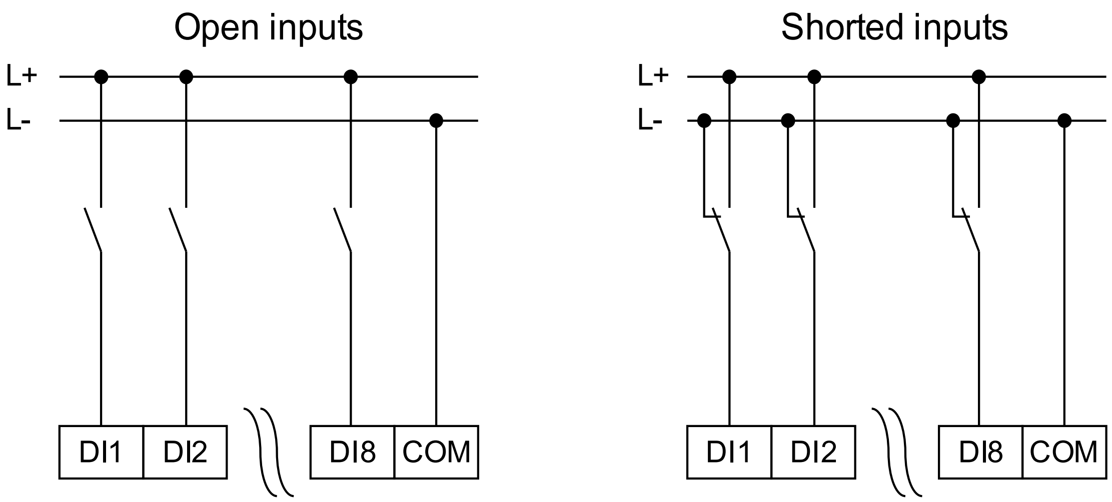
Baud rates:	115200 Baud
Handshake:	RTS and CTS
Connection:	9-pole D-Sub plug

Real Time Clock

Running reserve of the real time clock: 1 year min.

Digital Inputs

Max. input voltage:	300 V DC/259 V AC
Input current:	DC <4 mA AC <16 mA
Reaction time:	<20 ms
Fallback Time:	
Shorted inputs	<30 ms
Open inputs	<90 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

Binary Output Relays

Continuous current:	5 A AC/DC
Max. Switch-on current:	25 A AC/DC for 4 s
	30 A / 230 Vac according to ANSI IEEE Std C37.90-2005
	30 A / 250 Vdc according to ANSI IEEE Std C37.90-2005
Max. breaking current:	5 A AC up to 240 V AC
	5 A DC up to 30 V (resistive)
	0.3 A DC at 250 V (resistive)
Max. switching voltage:	250 V AC/250 V DC
Switching capacity:	1250 VA
Contact type:	1 changeover contact or normally open or normally closed
Terminals:	Screw-type terminals

Time Synchronization IRIG

Nominal input voltage:	5 V
Connection:	Screw-type terminals (twisted pair)

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)

CAUTION **In case that the RS485 interface is realized via terminals, the communication cable has to be shielded.**

Fibre Optic*

Master/Slave:	Slave
Connection:	ST-Plug
Wavelength	820 nm

URTD-Interface*

Connection:	Versatile Link

*availability depends on device

Boot phase

After switching on the power supply the protection will be available in approximately 8 seconds. After approximately 65 seconds the boot phase is completed (HMI and Communication initialized).

Standards

Approvals

- GOST-R
- UL- File No.: E217753
- CSA File No.: 251990**
- CEI 0-16* (Tested by EuroTest Laboratori S.r.l, Italy)*

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

* = applies to MRU4

** = applies to (MRA4, MRU4, MRI4, MRDT4, MRM4)

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
Class 3	Communication cables to earth	2 kV
Electrical discharge immunity test		
IEC 60255-22-2 IEC 61000-4-2 class 3	Air discharge	8 kV
	Contact discharge	6 kV
Radiated radio-frequency electromagnetic field immunity test		
IEC 61000-4-3	26 MHz – 80 MHz	10 V/m
ANSI C37.90.2	80 MHz – 1 GHz	35 V/m
	1 GHz – 3 GHz	10 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	30 A/m
	3 sec	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	20/060/56
IEC 60721-3-1	Classification of ambient conditions (Storage)	1K5/1B1/1C1L/1S1/1M2 but min. -30°C
IEC 60721-3-2	Classification of ambient conditions (Transportation)	2K4/2B1/2C1/2S1/2M2 but min. -30°C
IEC 60721-3-3	Classification of ambient conditions (Stationary use at weather protected locations)	3K6/3B1/3C1/3S1/3M2 but min. -20°C/max +60°C

Test Ad: Cold		
IEC 60068-2-1	Temperature	-20°C
	test duration	16 h

Test Ad: Cold		
CEI 0-16* (IEC 60068-2-1)	Temperature	-25°C
	test duration	16 h

Test Bd: Dry Heat		
IEC 60068-2-2	Temperature	60°C
	Relative humidity	<50%
	test duration	72 h

Test Bd: Dry Heat		
CEI 0-16* (IEC 60068-2-2)	Temperature	70°C
	Relative humidity	<50%
	test duration	72 h

Test Db: Damp Heat (cyclic)		
IEC 60068-2-30	Temperature	60°C
	Relative humidity	95%
	Cycles (12 + 12-hour)	2

* applies to MRU4 only

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

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.Blo TripCmd	Signal: Trip Command blocked
Prot.ExBlo TripCmd	Signal: External Blocking of the Trip Command
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: General Trip L1
Prot.Trip L2	Signal: General Trip L2
Prot.Trip L3	Signal: General Trip L3
Prot.Trip G	Signal: General Trip Ground fault
Prot.Trip	Signal: General Trip
Prot.Res Fault a Mains No	Signal: Resetting of fault number and number of grid faults.
Prot.ExBlo1-I	Module input state: External blocking1
Prot.ExBlo2-I	Module input state: External blocking2
Prot.ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
Ctrl.Local	Switching Authority: Local
Ctrl.Remote	Switching Authority: Remote
Ctrl.NonInterl	Non-Interlocking is active
Ctrl.SG Indeterm	Minimum one Switchgear is moving (Position cannot be determined).
Ctrl.SG Disturb	Minimum one Switchgear is disturbed.
Ctrl.NonInterl-I	Non-Interlocking
SG[1].SI SingleContactInd	Signal: The Position of the Switchgear is detected by one auxiliary contact (pole) only. Thus indeterminate and disturbed Positions cannot be detected.
SG[1].Pos not ON	Signal: Pos not ON
SG[1].Pos ON	Signal: Circuit Breaker is in ON-Position
SG[1].Pos OFF	Signal: Circuit Breaker is in OFF-Position
SG[1].Pos Indeterm	Signal: Circuit Breaker is in Indeterminate Position
SG[1].Pos Disturb	Signal: Circuit Breaker Disturbed - Undefined Breaker Position. The Position Indicators contradict themselves. After expiring of a supervision timer this signal becomes true.
SG[1].Ready	Signal: Circuit breaker is ready for operation.
SG[1].t-Dwell	Signal: Dwell time

Name	Description
SG[1].Removed	Signal: The withdrawable circuit breaker is Removed
SG[1].Interl ON	Signal: One or more IL_On inputs are active.
SG[1].Interl OFF	Signal: One or more IL_Off inputs are active.
SG[1].CES succesf	Signal: Command Execution Supervision: Switching command executed successfully.
SG[1].CES Disturbed	Signal: Command Execution Supervision: Switching Command unsuccessful. Switchgear in disturbed position.
SG[1].CES Fail TripCmd	Signal: Command Execution Supervision: Command execution failed because trip command is pending.
SG[1].CES SwitchDir	Signal: Command Execution Supervision respectively Switching Direction Control: This signal becomes true, if a switch command is issued even though the switchgear is already in the requested position. Example: A switchgear that is already OFF should be switched OFF again (doubly). The same applies to CLOSE commands.
SG[1].CES ON d OFF	Signal: Command Execution Supervision: On Command during a pending OFF Command.
SG[1].CES SG not ready	Signal: Command Execution Supervision: Switchgear not ready
SG[1].CES Fiel Interl	Signal: Command Execution Supervision: Switching Command not executed because of field interlocking.
SG[1].CES SyncTimeout	Signal: Command Execution Supervision: Switching Command not executed. No Synchronization signal while t-sync was running.
SG[1].CES SG removed	Signal: Command Execution Supervision: Switching Command unsuccessful, Switchgear removed.
SG[1].Prot ON	Signal: ON Command issued by the Prot module
SG[1].TripCmd	Signal: Trip Command
SG[1].Ack TripCmd	Signal: Acknowledge Trip Command
SG[1].ON incl Prot ON	Signal: The ON Command includes the ON Command issued by the Protection module.
SG[1].OFF incl TripCmd	Signal: The OFF Command includes the OFF Command issued by the Protection module.
SG[1].Position Ind manipul	Signal: Position Indicators faked
SG[1].SGwear Slow SG	Signal: Alarm, the circuit breaker (load-break switch) becomes slower
SG[1].Res SGwear Sl SG	Signal: Resetting the slow Switchgear Alarm
SG[1].ON Cmd	Signal: ON Command issued to the switchgear. Depending on the setting the signal may include the ON command of the Prot module.
SG[1].OFF Cmd	Signal: OFF Command issued to the switchgear. Depending on the setting the signal may include the OFF command of the Prot module.
SG[1].ON Cmd manual	Signal: ON Cmd manual
SG[1].OFF Cmd manual	Signal: OFF Cmd manual
SG[1].Sync ON request	Signal: Synchronous ON request
SG[1].Aux ON-I	Module Input State: Position indicator/check-back signal of the CB (52a)
SG[1].Aux OFF-I	Module input state: Position indicator/check-back signal of the CB (52b)
SG[1].Ready-I	Module input state: CB ready
SG[1].Sys-in-Sync-I	State of the module input: This signals has to become true within the synchronization time. If not, switching is unsuccessful.
SG[1].Removed-I	State of the module input: The withdrawable circuit breaker is Removed
SG[1].Ack TripCmd-I	State of the module input: Acknowledgement Signal (only for automatic acknowledgement) Module input signal
SG[1].Interl ON1-I	State of the module input: Interlocking of the ON command
SG[1].Interl ON2-I	State of the module input: Interlocking of the ON command
SG[1].Interl ON3-I	State of the module input: Interlocking of the ON command

Name	*Description*
SG[1].Interl OFF1-I	State of the module input: Interlocking of the OFF command
SG[1].Interl OFF2-I	State of the module input: Interlocking of the OFF command
SG[1].Interl OFF3-I	State of the module input: Interlocking of the OFF command
SG[1].SCmd ON-I	State of the module input: Switching ON Command, e.g. the state of the Logics or the state of the digital input
SG[1].SCmd OFF-I	State of the module input: Switching OFF Command, e.g. the state of the Logics or the state of the digital input
SG[1].Operations Alarm	Signal: Service Alarm, too many Operations
SG[1].Res TripCmd Cr	Signal: Resetting of the Counter: total number of trip commands
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
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: General Trip Phase L1
V[1].Trip L2	Signal: General Trip Phase L2
V[1].Trip L3	Signal: General Trip Phase 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: General Trip Phase L1
V[2].Trip L2	Signal: General Trip Phase L2
V[2].Trip L3	Signal: General Trip Phase 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

Name	Description
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: General Trip Phase L1
V[3].Trip L2	Signal: General Trip Phase L2
V[3].Trip L3	Signal: General Trip Phase L3
V[3].Trip	Signal: Trip
V[3].TripCmd	Signal: Trip Command
V[3].ExBlo1-I	Module input state: External blocking1
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: General Trip Phase L1
V[4].Trip L2	Signal: General Trip Phase L2
V[4].Trip L3	Signal: General Trip Phase 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
V[5].active	Signal: active
V[5].ExBlo	Signal: External Blocking
V[5].Blo TripCmd	Signal: Trip Command blocked
V[5].ExBlo TripCmd	Signal: External Blocking of the Trip Command
V[5].Alarm L1	Signal: Alarm L1
V[5].Alarm L2	Signal: Alarm L2
V[5].Alarm L3	Signal: Alarm L3

Name	*Description*
V[5].Alarm	Signal: Alarm voltage stage
V[5].Trip L1	Signal: General Trip Phase L1
V[5].Trip L2	Signal: General Trip Phase L2
V[5].Trip L3	Signal: General Trip Phase L3
V[5].Trip	Signal: Trip
V[5].TripCmd	Signal: Trip Command
V[5].ExBlo1-I	Module input state: External blocking1
V[5].ExBlo2-I	Module input state: External blocking2
V[5].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
V[6].active	Signal: active
V[6].ExBlo	Signal: External Blocking
V[6].Blo TripCmd	Signal: Trip Command blocked
V[6].ExBlo TripCmd	Signal: External Blocking of the Trip Command
V[6].Alarm L1	Signal: Alarm L1
V[6].Alarm L2	Signal: Alarm L2
V[6].Alarm L3	Signal: Alarm L3
V[6].Alarm	Signal: Alarm voltage stage
V[6].Trip L1	Signal: General Trip Phase L1
V[6].Trip L2	Signal: General Trip Phase L2
V[6].Trip L3	Signal: General Trip Phase L3
V[6].Trip	Signal: Trip
V[6].TripCmd	Signal: Trip Command
V[6].ExBlo1-I	Module input state: External blocking1
V[6].ExBlo2-I	Module input state: External blocking2
V[6].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
df/dt.active	Signal: active
df/dt.ExBlo	Signal: External Blocking
df/dt.Blo by V<	Signal: Module is blocked by undervoltage.
df/dt.Blo TripCmd	Signal: Trip Command blocked
df/dt.ExBlo TripCmd	Signal: External Blocking of the Trip Command
df/dt.Alarm	Signal: Alarm Frequency Protection (collective signal)
df/dt.Trip	Signal: Trip Frequency Protection (collective signal)
df/dt.TripCmd	Signal: Trip Command
df/dt.ExBlo1-I	Module input state: External blocking1
df/dt.ExBlo2-I	Module input state: External blocking2
df/dt.ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
delta phi.active	Signal: active
delta phi.ExBlo	Signal: External Blocking
delta phi.Blo by V<	Signal: Module is blocked by undervoltage.
delta phi.Blo TripCmd	Signal: Trip Command blocked

Name	*Description*
delta phi.ExBlo TripCmd	Signal: External Blocking of the Trip Command
delta phi.Alarm	Signal: Alarm Frequency Protection (collective signal)
delta phi.Trip	Signal: Trip Frequency Protection (collective signal)
delta phi.TripCmd	Signal: Trip Command
delta phi.ExBlo1-I	Module input state: External blocking1
delta phi.ExBlo2-I	Module input state: External blocking2
delta phi.ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
Intertripping.active	Signal: active
Intertripping.ExBlo	Signal: External Blocking
Intertripping.Blo TripCmd	Signal: Trip Command blocked
Intertripping.ExBlo TripCmd	Signal: External Blocking of the Trip Command
Intertripping.Alarm	Signal: Alarm
Intertripping.Trip	Signal: Trip
Intertripping.TripCmd	Signal: Trip Command
Intertripping.ExBlo1-I	Module input state: External blocking1
Intertripping.ExBlo2-I	Module input state: External blocking2
Intertripping.ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
Intertripping.Alarm-I	Module input state: Alarm
Intertripping.Trip-I	Module input state: Trip
LVRT.active	Signal: active
LVRT.ExBlo	Signal: External Blocking
LVRT.Blo TripCmd	Signal: Trip Command blocked
LVRT.ExBlo TripCmd	Signal: External Blocking of the Trip Command
LVRT.Alarm L1	Signal: Alarm L1
LVRT.Alarm L2	Signal: Alarm L2
LVRT.Alarm L3	Signal: Alarm L3
LVRT.Alarm	Signal: Alarm voltage stage
LVRT.Trip L1	Signal: General Trip Phase L1
LVRT.Trip L2	Signal: General Trip Phase L2
LVRT.Trip L3	Signal: General Trip Phase L3
LVRT.Trip	Signal: Trip
LVRT.TripCmd	Signal: Trip Command
LVRT.t-LVRT is running	Signal: t-LVRT is running
LVRT.ExBlo1-I	Module input state: External blocking1
LVRT.ExBlo2-I	Module input state: External blocking2
LVRT.ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
VG[1].active	Signal: active
VG[1].ExBlo	Signal: External Blocking
VG[1].Blo TripCmd	Signal: Trip Command blocked
VG[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command

Name	*Description*
VG[1].Alarm	Signal: Alarm Residual Voltage Supervision-stage
VG[1].Trip	Signal: Trip
VG[1].TripCmd	Signal: Trip Command
VG[1].ExBlo1-I	Module input state: External blocking1
VG[1].ExBlo2-I	Module input state: External blocking2
VG[1].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
VG[2].active	Signal: active
VG[2].ExBlo	Signal: External Blocking
VG[2].Blo TripCmd	Signal: Trip Command blocked
VG[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
VG[2].Alarm	Signal: Alarm Residual Voltage Supervision-stage
VG[2].Trip	Signal: Trip
VG[2].TripCmd	Signal: Trip Command
VG[2].ExBlo1-I	Module input state: External blocking1
VG[2].ExBlo2-I	Module input state: External blocking2
VG[2].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
V012[1].active	Signal: active
V012[1].ExBlo	Signal: External Blocking
V012[1].Blo TripCmd	Signal: Trip Command blocked
V012[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
V012[1].Alarm	Signal: Alarm voltage asymmetry
V012[1].Trip	Signal: Trip
V012[1].TripCmd	Signal: Trip Command
V012[1].ExBlo1-I	Module input state: External blocking1
V012[1].ExBlo2-I	Module input state: External blocking2
V012[1].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
V012[2].active	Signal: active
V012[2].ExBlo	Signal: External Blocking
V012[2].Blo TripCmd	Signal: Trip Command blocked
V012[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
V012[2].Alarm	Signal: Alarm voltage asymmetry
V012[2].Trip	Signal: Trip
V012[2].TripCmd	Signal: Trip Command
V012[2].ExBlo1-I	Module input state: External blocking1
V012[2].ExBlo2-I	Module input state: External blocking2
V012[2].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
V012[3].active	Signal: active
V012[3].ExBlo	Signal: External Blocking
V012[3].Blo TripCmd	Signal: Trip Command blocked
V012[3].ExBlo TripCmd	Signal: External Blocking of the Trip Command

Name	*Description*
V012[3].Alarm	Signal: Alarm voltage asymmetry
V012[3].Trip	Signal: Trip
V012[3].TripCmd	Signal: Trip Command
V012[3].ExBlo1-I	Module input state: External blocking1
V012[3].ExBlo2-I	Module input state: External blocking2
V012[3].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
V012[4].active	Signal: active
V012[4].ExBlo	Signal: External Blocking
V012[4].Blo TripCmd	Signal: Trip Command blocked
V012[4].ExBlo TripCmd	Signal: External Blocking of the Trip Command
V012[4].Alarm	Signal: Alarm voltage asymmetry
V012[4].Trip	Signal: Trip
V012[4].TripCmd	Signal: Trip Command
V012[4].ExBlo1-I	Module input state: External blocking1
V012[4].ExBlo2-I	Module input state: External blocking2
V012[4].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
V012[5].active	Signal: active
V012[5].ExBlo	Signal: External Blocking
V012[5].Blo TripCmd	Signal: Trip Command blocked
V012[5].ExBlo TripCmd	Signal: External Blocking of the Trip Command
V012[5].Alarm	Signal: Alarm voltage asymmetry
V012[5].Trip	Signal: Trip
V012[5].TripCmd	Signal: Trip Command
V012[5].ExBlo1-I	Module input state: External blocking1
V012[5].ExBlo2-I	Module input state: External blocking2
V012[5].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
V012[6].active	Signal: active
V012[6].ExBlo	Signal: External Blocking
V012[6].Blo TripCmd	Signal: Trip Command blocked
V012[6].ExBlo TripCmd	Signal: External Blocking of the Trip Command
V012[6].Alarm	Signal: Alarm voltage asymmetry
V012[6].Trip	Signal: Trip
V012[6].TripCmd	Signal: Trip Command
V012[6].ExBlo1-I	Module input state: External blocking1
V012[6].ExBlo2-I	Module input state: External blocking2
V012[6].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.
f[1].Blo TripCmd	Signal: Trip Command blocked

Name	*Description*
f[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
f[1].Alarm f	Signal: Alarm Frequency Protection
f[1].Alarm df/dt | DF/DT	Alarm instantaneous or average value of the rate-of-frequency-change
f[1].Alarm delta phi	Signal: Alarm Vector Surge
f[1].Alarm	Signal: Alarm Frequency Protection (collective signal)
f[1].Trip f	Signal: Frequency has exceeded the limit.
f[1].Trip df/dt | DF/DT	Signal: Trip df/dt or DF/DT
f[1].Trip delta phi	Signal: Trip Vector Surge
f[1].Trip	Signal: Trip Frequency Protection (collective signal)
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].Alarm df/dt | DF/DT	Alarm instantaneous or average value of the rate-of-frequency-change
f[2].Alarm delta phi	Signal: Alarm Vector Surge
f[2].Alarm	Signal: Alarm Frequency Protection (collective signal)
f[2].Trip f	Signal: Frequency has exceeded the limit.
f[2].Trip df/dt | DF/DT	Signal: Trip df/dt or DF/DT
f[2].Trip delta phi	Signal: Trip Vector Surge
f[2].Trip	Signal: Trip Frequency Protection (collective signal)
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].Alarm df/dt | DF/DT	Alarm instantaneous or average value of the rate-of-frequency-change
f[3].Alarm delta phi	Signal: Alarm Vector Surge
f[3].Alarm	Signal: Alarm Frequency Protection (collective signal)
f[3].Trip f	Signal: Frequency has exceeded the limit.

Name	*Description*
f[3].Trip df/dt | DF/DT	Signal: Trip df/dt or DF/DT
f[3].Trip delta phi	Signal: Trip Vector Surge
f[3].Trip	Signal: Trip Frequency Protection (collective signal)
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].Alarm df/dt | DF/DT	Alarm instantaneous or average value of the rate-of-frequency-change
f[4].Alarm delta phi	Signal: Alarm Vector Surge
f[4].Alarm	Signal: Alarm Frequency Protection (collective signal)
f[4].Trip f	Signal: Frequency has exceeded the limit.
f[4].Trip df/dt | DF/DT	Signal: Trip df/dt or DF/DT
f[4].Trip delta phi	Signal: Trip Vector Surge
f[4].Trip	Signal: Trip Frequency Protection (collective signal)
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
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].Alarm df/dt | DF/DT	Alarm instantaneous or average value of the rate-of-frequency-change
f[5].Alarm delta phi	Signal: Alarm Vector Surge
f[5].Alarm	Signal: Alarm Frequency Protection (collective signal)
f[5].Trip f	Signal: Frequency has exceeded the limit.
f[5].Trip df/dt | DF/DT	Signal: Trip df/dt or DF/DT
f[5].Trip delta phi	Signal: Trip Vector Surge
f[5].Trip	Signal: Trip Frequency Protection (collective signal)
f[5].TripCmd	Signal: Trip Command
f[5].ExBlo1-I	Module input state: External blocking1
f[5].ExBlo2-I	Module input state: External blocking2

Name	*Description*
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].Alarm df/dt | DF/DT	Alarm instantaneous or average value of the rate-of-frequency-change
f[6].Alarm delta phi	Signal: Alarm Vector Surge
f[6].Alarm	Signal: Alarm Frequency Protection (collective signal)
f[6].Trip f	Signal: Frequency has exceeded the limit.
f[6].Trip df/dt | DF/DT	Signal: Trip df/dt or DF/DT
f[6].Trip delta phi	Signal: Trip Vector Surge
f[6].Trip	Signal: Trip Frequency Protection (collective signal)
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
Sync.active	Signal: active
Sync.ExBlo	Signal: External Blocking
Sync.LiveBus	Signal: Live-Bus flag: 1=Live-Bus, 0=Voltage is below the LiveBus threshold
Sync.LiveLine	Signal: Live Line flag: 1=Live-Line, 0=Voltage is below the LiveLine threshold
Sync.SynchronRunTiming	Signal: SynchronRunTiming
Sync.SynchronFailed	Signal: This signal indicates a failed synchronization. It is set for 5s when the circuit breaker is still open after the Synchron-Run-timer has timed out.
Sync.SyncOverridden	Signal:Synchronism Check is overridden because one of the Synchronism overriding conditions (DB/DL or ExtBypass) is met.
Sync.VDiffTooHigh	Signal: Voltage difference between bus and line too high.
Sync.SlipTooHigh	Signal: Frequency difference (slip frequency) between bus and line voltages too high.
Sync.AngleDiffTooHigh	Signal: Phase Angle difference between bus and line voltages too high.
Sync.Sys-in-Sync	Signal: Bus and line voltages are in synchronism according to the system synchronism criteria.
Sync.Ready to Close	Signal: Ready to Close
Sync.ExBlo1-I	Module input state: External blocking1
Sync.ExBlo2-I	Module input state: External blocking2
Sync.Bypass-I	State of the module input: Bypass
Sync.CBCloseInitiate-I	State of the module input: Breaker Close Initiate with synchronism check from any control sources (e.g. HMI / SCADA). If the state of the assigned signal becomes true, a Breaker Close will be initiated (Trigger Source).
ExP[1].active	Signal: active
ExP[1].ExBlo	Signal: External Blocking
ExP[1].Blo TripCmd	Signal: Trip Command blocked

Name	*Description*
ExP[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
ExP[1].Alarm	Signal: Alarm
ExP[1].Trip	Signal: Trip
ExP[1].TripCmd	Signal: 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: Alarm
ExP[1].Trip-I	Module input state: 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: Alarm
ExP[2].Trip	Signal: Trip
ExP[2].TripCmd	Signal: 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: Alarm
ExP[2].Trip-I	Module input state: Trip
ExP[3].active	Signal: active
ExP[3].ExBlo	Signal: External Blocking
ExP[3].Blo TripCmd	Signal: Trip Command blocked
ExP[3].ExBlo TripCmd	Signal: External Blocking of the Trip Command
ExP[3].Alarm	Signal: Alarm
ExP[3].Trip	Signal: Trip
ExP[3].TripCmd	Signal: 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: Alarm
ExP[3].Trip-I	Module input state: 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: Alarm
ExP[4].Trip	Signal: Trip
ExP[4].TripCmd	Signal: Trip Command

Name	*Description*
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: Alarm
ExP[4].Trip-I	Module input state: Trip
CBF.active	Signal: active
CBF.ExBlo	Signal: External Blocking
CBF.Waiting for Trigger	Waiting for Trigger
CBF.running	Signal: CBF-Module started
CBF.Alarm	Signal: Circuit Breaker Failure
CBF.Lockout	Signal: Lockout
CBF.Res Lockout	Signal: Reset Lockout
CBF.ExBlo1-I	Module input state: External blocking1
CBF.ExBlo2-I	Module input state: External blocking2
CBF.Trigger1	Module Input: Trigger that will start the CBF
CBF.Trigger2	Module Input: Trigger that will start the CBF
CBF.Trigger3	Module Input: Trigger that will start the CBF
TCS.active	Signal: active
TCS.ExBlo	Signal: External Blocking
TCS.Alarm	Signal: Alarm Trip Circuit Supervision
TCS.Not Possible	Not possible because no state indicator assigned to the breaker.
TCS.Aux ON-I	Module Input State: Position indicator/check-back signal of the CB (52a)
TCS.Aux OFF-I	Module input state: Position indicator/check-back signal of the CB (52b)
TCS.ExBlo1-I	Module input state: External blocking1
TCS.ExBlo2-I	Module input state: External blocking2
VTS.active	Signal: active
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: Ex FF VT
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

Name	*Description*
DI Slot X1.DI 6	Signal: Digital Input
DI Slot X1.DI 7	Signal: Digital Input
DI Slot X1.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.DISARMED!	Signal: CAUTION! RELAYS DISARMED in order to safely perform maintenance while eliminating the risk of taking an entire process off-line. (Note: The Self Supervision Contact cannot be disarmed). YOU MUST ENSURE that the relays are ARMED AGAIN after maintenance
BO Slot X2.Outs forced	Signal: The State of at least one Relay Output has been set by force. That means that the state of at least one Relay is forced and hence does not show the state of the assigned signals.
Event rec.Res all records	Signal: All records deleted
Disturb rec.recording	Signal: Recording
Disturb rec.memory full	Signal: Memory full
Disturb rec.Clear fail	Signal: Clear failure in memory
Disturb rec.Res all records	Signal: All records deleted
Disturb rec.Res rec	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.Res rec	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:
Trend rec.Hand Reset	Hand Reset
Modbus.Transmission	Signal: SCADA active
Modbus.Scada Cmd 1	Scada Command

Name	*Description*
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
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
IEC61850.VirtInp1	Signal: Virtual Input (IEC61850 GGIO Ind)
IEC61850.VirtInp2	Signal: Virtual Input (IEC61850 GGIO Ind)
IEC61850.VirtInp3	Signal: Virtual Input (IEC61850 GGIO Ind)
IEC61850.VirtInp4	Signal: Virtual Input (IEC61850 GGIO Ind)
IEC61850.VirtInp5	Signal: Virtual Input (IEC61850 GGIO Ind)
IEC61850.VirtInp6	Signal: Virtual Input (IEC61850 GGIO Ind)
IEC61850.VirtInp7	Signal: Virtual Input (IEC61850 GGIO Ind)
IEC61850.VirtInp8	Signal: Virtual Input (IEC61850 GGIO Ind)
IEC61850.VirtInp9	Signal: Virtual Input (IEC61850 GGIO Ind)
IEC61850.VirtInp10	Signal: Virtual Input (IEC61850 GGIO Ind)
IEC61850.VirtInp11	Signal: Virtual Input (IEC61850 GGIO Ind)
IEC61850.VirtInp12	Signal: Virtual Input (IEC61850 GGIO Ind)
IEC61850.VirtInp13	Signal: Virtual Input (IEC61850 GGIO Ind)
IEC61850.VirtInp14	Signal: Virtual Input (IEC61850 GGIO Ind)
IEC61850.VirtInp15	Signal: Virtual Input (IEC61850 GGIO Ind)
IEC61850.VirtInp16	Signal: Virtual Input (IEC61850 GGIO Ind)
IEC61850.VirtOut1-I	Module input state: Binary state of the Virtual Output (GGIO)
IEC61850.VirtOut2-I	Module input state: Binary state of the Virtual Output (GGIO)
IEC61850.VirtOut3-I	Module input state: Binary state of the Virtual Output (GGIO)
IEC61850.VirtOut4-I	Module input state: Binary state of the Virtual Output (GGIO)
IEC61850.VirtOut5-I	Module input state: Binary state of the Virtual Output (GGIO)
IEC61850.VirtOut6-I	Module input state: Binary state of the Virtual Output (GGIO)
IEC61850.VirtOut7-I	Module input state: Binary state of the Virtual Output (GGIO)
IEC61850.VirtOut8-I	Module input state: Binary state of the Virtual Output (GGIO)
IEC61850.VirtOut9-I	Module input state: Binary state of the Virtual Output (GGIO)

Name	*Description*
IEC61850.VirtOut10-I	Module input state: Binary state of the Virtual Output (GGIO)
IEC61850.VirtOut11-I	Module input state: Binary state of the Virtual Output (GGIO)
IEC61850.VirtOut12-I	Module input state: Binary state of the Virtual Output (GGIO)
IEC61850.VirtOut13-I	Module input state: Binary state of the Virtual Output (GGIO)
IEC61850.VirtOut14-I	Module input state: Binary state of the Virtual Output (GGIO)
IEC61850.VirtOut15-I	Module input state: Binary state of the Virtual Output (GGIO)
IEC61850.VirtOut16-I	Module input state: Binary state of the Virtual Output (GGIO)
IEC 103.Scada Cmd 1	Scada Command
IEC 103.Scada Cmd 2	Scada Command
IEC 103.Scada Cmd 3	Scada Command
IEC 103.Scada Cmd 4	Scada Command
IEC 103.Scada Cmd 5	Scada Command
IEC 103.Scada Cmd 6	Scada Command
IEC 103.Scada Cmd 7	Scada Command
IEC 103.Scada Cmd 8	Scada Command
IEC 103.Scada Cmd 9	Scada Command
IEC 103.Scada Cmd 10	Scada Command
IEC 103.Transmission	Signal: SCADA active
IEC 103.Fail phy Interf	Failure in the physical interface
IEC 103.Failure Event lost	Failure event lost
Profibus.Data OK	Data within the Input field are OK (Yes=1)
Profibus.SubModul Err	Assignable Signal, Failure in Sub-Module, Communication Failure.
Profibus.Connection active	Connection active
Profibus.Scada Cmd 1	Scada Command
Profibus.Scada Cmd 2	Scada Command
Profibus.Scada Cmd 3	Scada Command
Profibus.Scada Cmd 4	Scada Command
Profibus.Scada Cmd 5	Scada Command
Profibus.Scada Cmd 6	Scada Command
Profibus.Scada Cmd 7	Scada Command
Profibus.Scada Cmd 8	Scada Command
Profibus.Scada Cmd 9	Scada Command
Profibus.Scada Cmd 10	Scada Command
Profibus.Scada Cmd 11	Scada Command
Profibus.Scada Cmd 12	Scada Command
Profibus.Scada Cmd 13	Scada Command
Profibus.Scada Cmd 14	Scada Command
Profibus.Scada Cmd 15	Scada Command
Profibus.Scada Cmd 16	Scada Command
IRIG-B.active	Signal: active

Name	*Description*
IRIG-B.inverted	Signal: IRIG-B inverted
IRIG-B.Control Signal1	Signal: IRIG-B Control Signal
IRIG-B.Control Signal2	Signal: IRIG-B Control Signal
IRIG-B.Control Signal4	Signal: IRIG-B Control Signal
IRIG-B.Control Signal5	Signal: IRIG-B Control Signal
IRIG-B.Control Signal6	Signal: IRIG-B Control Signal
IRIG-B.Control Signal7	Signal: IRIG-B Control Signal
IRIG-B.Control Signal8	Signal: IRIG-B Control Signal
IRIG-B.Control Signal9	Signal: IRIG-B Control Signal
IRIG-B.Control Signal10	Signal: IRIG-B Control Signal
IRIG-B.Control Signal11	Signal: IRIG-B Control Signal
IRIG-B.Control Signal12	Signal: IRIG-B Control Signal
IRIG-B.Control Signal13	Signal: IRIG-B Control Signal
IRIG-B.Control Signal14	Signal: IRIG-B Control Signal
IRIG-B.Control Signal15	Signal: IRIG-B Control Signal
IRIG-B.Control Signal16	Signal: IRIG-B Control Signal
IRIG-B.Control Signal17	Signal: IRIG-B Control Signal
IRIG-B.Control Signal18	Signal: IRIG-B Control Signal
SNTP.SNTP active	Signal: If there is no valid SNTP signal for 120 sec, SNTP is regarded as inactive.
Statistics.ResFc all	Signal: Resetting of all Statistic values (Current Demand, Power Demand, Min, Max)
Statistics.ResFc Vavg	Signal: Resetting of the sliding average calculation.
Statistics.ResFc Max	Signal: Resetting of all Maximum values
Statistics.ResFc Min	Signal: Resetting of all Minimum values
Statistics.StartFc Vavg-I	State of the module input: (StartFunc3_h)
SysA.active	Signal: active
SysA.ExBlo	Signal: External Blocking
SysA.Alarm V THD	Signal: Alarm Total Harmonic Distortion Voltage
SysA.Trip V THD	Signal: Trip Total Harmonic Distortion Voltage
SysA.ExBlo-I	Module input state: External blocking
Logics.LE1.Gate Out	Signal: Output of the logic gate
Logics.LE1.Timer Out	Signal: Timer Output
Logics.LE1.Out	Signal: Latched Output (Q)
Logics.LE1.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE1.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE1.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE1.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE1.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE1.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE2.Gate Out	Signal: Output of the logic gate
Logics.LE2.Timer Out	Signal: Timer Output

Name	*Description*
Logics.LE2.Out	Signal: Latched Output (Q)
Logics.LE2.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE2.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE2.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE2.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE2.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE2.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE3.Gate Out	Signal: Output of the logic gate
Logics.LE3.Timer Out	Signal: Timer Output
Logics.LE3.Out	Signal: Latched Output (Q)
Logics.LE3.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE3.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE3.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE3.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE3.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE3.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE4.Gate Out	Signal: Output of the logic gate
Logics.LE4.Timer Out	Signal: Timer Output
Logics.LE4.Out	Signal: Latched Output (Q)
Logics.LE4.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE4.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE4.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE4.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE4.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE4.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE5.Gate Out	Signal: Output of the logic gate
Logics.LE5.Timer Out	Signal: Timer Output
Logics.LE5.Out	Signal: Latched Output (Q)
Logics.LE5.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE5.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE5.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE5.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE5.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE5.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE6.Gate Out	Signal: Output of the logic gate
Logics.LE6.Timer Out	Signal: Timer Output
Logics.LE6.Out	Signal: Latched Output (Q)
Logics.LE6.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE6.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE6.Gate In2-I	State of the module input: Assignment of the Input Signal

Name	Description
Logics.LE6.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE6.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE6.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE7.Gate Out	Signal: Output of the logic gate
Logics.LE7.Timer Out	Signal: Timer Output
Logics.LE7.Out	Signal: Latched Output (Q)
Logics.LE7.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE7.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE7.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE7.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE7.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE7.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE8.Gate Out	Signal: Output of the logic gate
Logics.LE8.Timer Out	Signal: Timer Output
Logics.LE8.Out	Signal: Latched Output (Q)
Logics.LE8.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE8.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE8.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE8.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE8.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE8.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE9.Gate Out	Signal: Output of the logic gate
Logics.LE9.Timer Out	Signal: Timer Output
Logics.LE9.Out	Signal: Latched Output (Q)
Logics.LE9.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE9.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE9.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE9.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE9.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE9.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE10.Gate Out	Signal: Output of the logic gate
Logics.LE10.Timer Out	Signal: Timer Output
Logics.LE10.Out	Signal: Latched Output (Q)
Logics.LE10.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE10.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE10.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE10.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE10.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE10.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE11.Gate Out	Signal: Output of the logic gate

Name	*Description*
Logics.LE11.Timer Out	Signal: Timer Output
Logics.LE11.Out	Signal: Latched Output (Q)
Logics.LE11.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE11.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE11.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE11.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE11.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE11.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE12.Gate Out	Signal: Output of the logic gate
Logics.LE12.Timer Out	Signal: Timer Output
Logics.LE12.Out	Signal: Latched Output (Q)
Logics.LE12.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE12.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE12.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE12.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE12.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE12.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE13.Gate Out	Signal: Output of the logic gate
Logics.LE13.Timer Out	Signal: Timer Output
Logics.LE13.Out	Signal: Latched Output (Q)
Logics.LE13.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE13.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE13.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE13.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE13.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE13.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE14.Gate Out	Signal: Output of the logic gate
Logics.LE14.Timer Out	Signal: Timer Output
Logics.LE14.Out	Signal: Latched Output (Q)
Logics.LE14.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE14.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE14.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE14.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE14.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE14.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE15.Gate Out	Signal: Output of the logic gate
Logics.LE15.Timer Out	Signal: Timer Output
Logics.LE15.Out	Signal: Latched Output (Q)
Logics.LE15.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE15.Gate In1-I	State of the module input: Assignment of the Input Signal

Name	Description
Logics.LE15.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE15.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE15.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE15.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE16.Gate Out	Signal: Output of the logic gate
Logics.LE16.Timer Out	Signal: Timer Output
Logics.LE16.Out	Signal: Latched Output (Q)
Logics.LE16.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE16.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE16.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE16.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE16.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE16.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE17.Gate Out	Signal: Output of the logic gate
Logics.LE17.Timer Out	Signal: Timer Output
Logics.LE17.Out	Signal: Latched Output (Q)
Logics.LE17.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE17.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE17.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE17.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE17.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE17.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE18.Gate Out	Signal: Output of the logic gate
Logics.LE18.Timer Out	Signal: Timer Output
Logics.LE18.Out	Signal: Latched Output (Q)
Logics.LE18.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE18.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE18.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE18.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE18.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE18.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE19.Gate Out	Signal: Output of the logic gate
Logics.LE19.Timer Out	Signal: Timer Output
Logics.LE19.Out	Signal: Latched Output (Q)
Logics.LE19.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE19.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE19.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE19.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE19.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE19.Reset Latch-I	State of the module input: Reset Signal for the Latching

Name	*Description*
Logics.LE20.Gate Out	Signal: Output of the logic gate
Logics.LE20.Timer Out	Signal: Timer Output
Logics.LE20.Out	Signal: Latched Output (Q)
Logics.LE20.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE20.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE20.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE20.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE20.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE20.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE21.Gate Out	Signal: Output of the logic gate
Logics.LE21.Timer Out	Signal: Timer Output
Logics.LE21.Out	Signal: Latched Output (Q)
Logics.LE21.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE21.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE21.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE21.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE21.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE21.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE22.Gate Out	Signal: Output of the logic gate
Logics.LE22.Timer Out	Signal: Timer Output
Logics.LE22.Out	Signal: Latched Output (Q)
Logics.LE22.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE22.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE22.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE22.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE22.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE22.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE23.Gate Out	Signal: Output of the logic gate
Logics.LE23.Timer Out	Signal: Timer Output
Logics.LE23.Out	Signal: Latched Output (Q)
Logics.LE23.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE23.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE23.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE23.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE23.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE23.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE24.Gate Out	Signal: Output of the logic gate
Logics.LE24.Timer Out	Signal: Timer Output
Logics.LE24.Out	Signal: Latched Output (Q)
Logics.LE24.Out inverted	Signal: Negated Latched Output (Q NOT)

Name	*Description*
Logics.LE24.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE24.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE24.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE24.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE24.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE25.Gate Out	Signal: Output of the logic gate
Logics.LE25.Timer Out	Signal: Timer Output
Logics.LE25.Out	Signal: Latched Output (Q)
Logics.LE25.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE25.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE25.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE25.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE25.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE25.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE26.Gate Out	Signal: Output of the logic gate
Logics.LE26.Timer Out	Signal: Timer Output
Logics.LE26.Out	Signal: Latched Output (Q)
Logics.LE26.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE26.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE26.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE26.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE26.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE26.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE27.Gate Out	Signal: Output of the logic gate
Logics.LE27.Timer Out	Signal: Timer Output
Logics.LE27.Out	Signal: Latched Output (Q)
Logics.LE27.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE27.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE27.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE27.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE27.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE27.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE28.Gate Out	Signal: Output of the logic gate
Logics.LE28.Timer Out	Signal: Timer Output
Logics.LE28.Out	Signal: Latched Output (Q)
Logics.LE28.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE28.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE28.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE28.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE28.Gate In4-I	State of the module input: Assignment of the Input Signal

Name	Description
Logics.LE28.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE29.Gate Out	Signal: Output of the logic gate
Logics.LE29.Timer Out	Signal: Timer Output
Logics.LE29.Out	Signal: Latched Output (Q)
Logics.LE29.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE29.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE29.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE29.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE29.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE29.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE30.Gate Out	Signal: Output of the logic gate
Logics.LE30.Timer Out	Signal: Timer Output
Logics.LE30.Out	Signal: Latched Output (Q)
Logics.LE30.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE30.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE30.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE30.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE30.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE30.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE31.Gate Out	Signal: Output of the logic gate
Logics.LE31.Timer Out	Signal: Timer Output
Logics.LE31.Out	Signal: Latched Output (Q)
Logics.LE31.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE31.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE31.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE31.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE31.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE31.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE32.Gate Out	Signal: Output of the logic gate
Logics.LE32.Timer Out	Signal: Timer Output
Logics.LE32.Out	Signal: Latched Output (Q)
Logics.LE32.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE32.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE32.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE32.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE32.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE32.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE33.Gate Out	Signal: Output of the logic gate
Logics.LE33.Timer Out	Signal: Timer Output
Logics.LE33.Out	Signal: Latched Output (Q)

Name	*Description*
Logics.LE33.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE33.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE33.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE33.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE33.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE33.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE34.Gate Out	Signal: Output of the logic gate
Logics.LE34.Timer Out	Signal: Timer Output
Logics.LE34.Out	Signal: Latched Output (Q)
Logics.LE34.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE34.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE34.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE34.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE34.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE34.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE35.Gate Out	Signal: Output of the logic gate
Logics.LE35.Timer Out	Signal: Timer Output
Logics.LE35.Out	Signal: Latched Output (Q)
Logics.LE35.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE35.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE35.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE35.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE35.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE35.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE36.Gate Out	Signal: Output of the logic gate
Logics.LE36.Timer Out	Signal: Timer Output
Logics.LE36.Out	Signal: Latched Output (Q)
Logics.LE36.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE36.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE36.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE36.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE36.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE36.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE37.Gate Out	Signal: Output of the logic gate
Logics.LE37.Timer Out	Signal: Timer Output
Logics.LE37.Out	Signal: Latched Output (Q)
Logics.LE37.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE37.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE37.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE37.Gate In3-I	State of the module input: Assignment of the Input Signal

Name	*Description*
Logics.LE37.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE37.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE38.Gate Out	Signal: Output of the logic gate
Logics.LE38.Timer Out	Signal: Timer Output
Logics.LE38.Out	Signal: Latched Output (Q)
Logics.LE38.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE38.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE38.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE38.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE38.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE38.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE39.Gate Out	Signal: Output of the logic gate
Logics.LE39.Timer Out	Signal: Timer Output
Logics.LE39.Out	Signal: Latched Output (Q)
Logics.LE39.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE39.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE39.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE39.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE39.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE39.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE40.Gate Out	Signal: Output of the logic gate
Logics.LE40.Timer Out	Signal: Timer Output
Logics.LE40.Out	Signal: Latched Output (Q)
Logics.LE40.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE40.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE40.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE40.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE40.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE40.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE41.Gate Out	Signal: Output of the logic gate
Logics.LE41.Timer Out	Signal: Timer Output
Logics.LE41.Out	Signal: Latched Output (Q)
Logics.LE41.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE41.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE41.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE41.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE41.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE41.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE42.Gate Out	Signal: Output of the logic gate
Logics.LE42.Timer Out	Signal: Timer Output

Name	*Description*
Logics.LE42.Out	Signal: Latched Output (Q)
Logics.LE42.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE42.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE42.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE42.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE42.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE42.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE43.Gate Out	Signal: Output of the logic gate
Logics.LE43.Timer Out	Signal: Timer Output
Logics.LE43.Out	Signal: Latched Output (Q)
Logics.LE43.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE43.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE43.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE43.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE43.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE43.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE44.Gate Out	Signal: Output of the logic gate
Logics.LE44.Timer Out	Signal: Timer Output
Logics.LE44.Out	Signal: Latched Output (Q)
Logics.LE44.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE44.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE44.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE44.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE44.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE44.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE45.Gate Out	Signal: Output of the logic gate
Logics.LE45.Timer Out	Signal: Timer Output
Logics.LE45.Out	Signal: Latched Output (Q)
Logics.LE45.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE45.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE45.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE45.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE45.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE45.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE46.Gate Out	Signal: Output of the logic gate
Logics.LE46.Timer Out	Signal: Timer Output
Logics.LE46.Out	Signal: Latched Output (Q)
Logics.LE46.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE46.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE46.Gate In2-I	State of the module input: Assignment of the Input Signal

Name	*Description*
Logics.LE46.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE46.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE46.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE47.Gate Out	Signal: Output of the logic gate
Logics.LE47.Timer Out	Signal: Timer Output
Logics.LE47.Out	Signal: Latched Output (Q)
Logics.LE47.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE47.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE47.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE47.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE47.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE47.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE48.Gate Out	Signal: Output of the logic gate
Logics.LE48.Timer Out	Signal: Timer Output
Logics.LE48.Out	Signal: Latched Output (Q)
Logics.LE48.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE48.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE48.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE48.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE48.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE48.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE49.Gate Out	Signal: Output of the logic gate
Logics.LE49.Timer Out	Signal: Timer Output
Logics.LE49.Out	Signal: Latched Output (Q)
Logics.LE49.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE49.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE49.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE49.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE49.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE49.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE50.Gate Out	Signal: Output of the logic gate
Logics.LE50.Timer Out	Signal: Timer Output
Logics.LE50.Out	Signal: Latched Output (Q)
Logics.LE50.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE50.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE50.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE50.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE50.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE50.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE51.Gate Out	Signal: Output of the logic gate

Name	*Description*
Logics.LE51.Timer Out	Signal: Timer Output
Logics.LE51.Out	Signal: Latched Output (Q)
Logics.LE51.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE51.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE51.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE51.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE51.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE51.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE52.Gate Out	Signal: Output of the logic gate
Logics.LE52.Timer Out	Signal: Timer Output
Logics.LE52.Out	Signal: Latched Output (Q)
Logics.LE52.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE52.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE52.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE52.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE52.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE52.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE53.Gate Out	Signal: Output of the logic gate
Logics.LE53.Timer Out	Signal: Timer Output
Logics.LE53.Out	Signal: Latched Output (Q)
Logics.LE53.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE53.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE53.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE53.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE53.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE53.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE54.Gate Out	Signal: Output of the logic gate
Logics.LE54.Timer Out	Signal: Timer Output
Logics.LE54.Out	Signal: Latched Output (Q)
Logics.LE54.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE54.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE54.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE54.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE54.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE54.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE55.Gate Out	Signal: Output of the logic gate
Logics.LE55.Timer Out	Signal: Timer Output
Logics.LE55.Out	Signal: Latched Output (Q)
Logics.LE55.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE55.Gate In1-I	State of the module input: Assignment of the Input Signal

Name	*Description*
Logics.LE55.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE55.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE55.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE55.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE56.Gate Out	Signal: Output of the logic gate
Logics.LE56.Timer Out	Signal: Timer Output
Logics.LE56.Out	Signal: Latched Output (Q)
Logics.LE56.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE56.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE56.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE56.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE56.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE56.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE57.Gate Out	Signal: Output of the logic gate
Logics.LE57.Timer Out	Signal: Timer Output
Logics.LE57.Out	Signal: Latched Output (Q)
Logics.LE57.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE57.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE57.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE57.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE57.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE57.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE58.Gate Out	Signal: Output of the logic gate
Logics.LE58.Timer Out	Signal: Timer Output
Logics.LE58.Out	Signal: Latched Output (Q)
Logics.LE58.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE58.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE58.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE58.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE58.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE58.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE59.Gate Out	Signal: Output of the logic gate
Logics.LE59.Timer Out	Signal: Timer Output
Logics.LE59.Out	Signal: Latched Output (Q)
Logics.LE59.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE59.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE59.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE59.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE59.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE59.Reset Latch-I	State of the module input: Reset Signal for the Latching

Name	*Description*
Logics.LE60.Gate Out	Signal: Output of the logic gate
Logics.LE60.Timer Out	Signal: Timer Output
Logics.LE60.Out	Signal: Latched Output (Q)
Logics.LE60.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE60.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE60.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE60.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE60.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE60.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE61.Gate Out	Signal: Output of the logic gate
Logics.LE61.Timer Out	Signal: Timer Output
Logics.LE61.Out	Signal: Latched Output (Q)
Logics.LE61.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE61.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE61.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE61.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE61.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE61.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE62.Gate Out	Signal: Output of the logic gate
Logics.LE62.Timer Out	Signal: Timer Output
Logics.LE62.Out	Signal: Latched Output (Q)
Logics.LE62.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE62.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE62.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE62.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE62.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE62.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE63.Gate Out	Signal: Output of the logic gate
Logics.LE63.Timer Out	Signal: Timer Output
Logics.LE63.Out	Signal: Latched Output (Q)
Logics.LE63.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE63.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE63.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE63.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE63.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE63.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE64.Gate Out	Signal: Output of the logic gate
Logics.LE64.Timer Out	Signal: Timer Output
Logics.LE64.Out	Signal: Latched Output (Q)
Logics.LE64.Out inverted	Signal: Negated Latched Output (Q NOT)

Name	*Description*
Logics.LE64.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE64.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE64.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE64.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE64.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE65.Gate Out	Signal: Output of the logic gate
Logics.LE65.Timer Out	Signal: Timer Output
Logics.LE65.Out	Signal: Latched Output (Q)
Logics.LE65.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE65.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE65.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE65.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE65.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE65.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE66.Gate Out	Signal: Output of the logic gate
Logics.LE66.Timer Out	Signal: Timer Output
Logics.LE66.Out	Signal: Latched Output (Q)
Logics.LE66.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE66.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE66.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE66.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE66.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE66.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE67.Gate Out	Signal: Output of the logic gate
Logics.LE67.Timer Out	Signal: Timer Output
Logics.LE67.Out	Signal: Latched Output (Q)
Logics.LE67.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE67.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE67.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE67.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE67.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE67.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE68.Gate Out	Signal: Output of the logic gate
Logics.LE68.Timer Out	Signal: Timer Output
Logics.LE68.Out	Signal: Latched Output (Q)
Logics.LE68.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE68.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE68.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE68.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE68.Gate In4-I	State of the module input: Assignment of the Input Signal

Name	*Description*
Logics.LE68.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE69.Gate Out	Signal: Output of the logic gate
Logics.LE69.Timer Out	Signal: Timer Output
Logics.LE69.Out	Signal: Latched Output (Q)
Logics.LE69.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE69.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE69.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE69.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE69.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE69.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE70.Gate Out	Signal: Output of the logic gate
Logics.LE70.Timer Out	Signal: Timer Output
Logics.LE70.Out	Signal: Latched Output (Q)
Logics.LE70.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE70.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE70.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE70.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE70.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE70.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE71.Gate Out	Signal: Output of the logic gate
Logics.LE71.Timer Out	Signal: Timer Output
Logics.LE71.Out	Signal: Latched Output (Q)
Logics.LE71.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE71.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE71.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE71.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE71.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE71.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE72.Gate Out	Signal: Output of the logic gate
Logics.LE72.Timer Out	Signal: Timer Output
Logics.LE72.Out	Signal: Latched Output (Q)
Logics.LE72.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE72.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE72.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE72.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE72.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE72.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE73.Gate Out	Signal: Output of the logic gate
Logics.LE73.Timer Out	Signal: Timer Output
Logics.LE73.Out	Signal: Latched Output (Q)

Name	*Description*
Logics.LE73.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE73.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE73.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE73.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE73.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE73.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE74.Gate Out	Signal: Output of the logic gate
Logics.LE74.Timer Out	Signal: Timer Output
Logics.LE74.Out	Signal: Latched Output (Q)
Logics.LE74.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE74.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE74.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE74.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE74.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE74.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE75.Gate Out	Signal: Output of the logic gate
Logics.LE75.Timer Out	Signal: Timer Output
Logics.LE75.Out	Signal: Latched Output (Q)
Logics.LE75.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE75.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE75.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE75.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE75.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE75.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE76.Gate Out	Signal: Output of the logic gate
Logics.LE76.Timer Out	Signal: Timer Output
Logics.LE76.Out	Signal: Latched Output (Q)
Logics.LE76.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE76.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE76.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE76.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE76.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE76.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE77.Gate Out	Signal: Output of the logic gate
Logics.LE77.Timer Out	Signal: Timer Output
Logics.LE77.Out	Signal: Latched Output (Q)
Logics.LE77.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE77.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE77.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE77.Gate In3-I	State of the module input: Assignment of the Input Signal

Name	*Description*
Logics.LE77.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE77.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE78.Gate Out	Signal: Output of the logic gate
Logics.LE78.Timer Out	Signal: Timer Output
Logics.LE78.Out	Signal: Latched Output (Q)
Logics.LE78.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE78.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE78.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE78.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE78.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE78.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE79.Gate Out	Signal: Output of the logic gate
Logics.LE79.Timer Out	Signal: Timer Output
Logics.LE79.Out	Signal: Latched Output (Q)
Logics.LE79.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE79.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE79.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE79.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE79.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE79.Reset Latch-I	State of the module input: Reset Signal for the Latching
Logics.LE80.Gate Out	Signal: Output of the logic gate
Logics.LE80.Timer Out	Signal: Timer Output
Logics.LE80.Out	Signal: Latched Output (Q)
Logics.LE80.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE80.Gate In1-I	State of the module input: Assignment of the Input Signal
Logics.LE80.Gate In2-I	State of the module input: Assignment of the Input Signal
Logics.LE80.Gate In3-I	State of the module input: Assignment of the Input Signal
Logics.LE80.Gate In4-I	State of the module input: Assignment of the Input Signal
Logics.LE80.Reset Latch-I	State of the module input: Reset Signal for the Latching
Sgen.Running	Signal; Measuring value simulation is running
Sgen.Ex Start Simulation-I	State of the module input:External Start of Fault Simulation (Using the test parameters)
Sgen.ExBlo	Module input state: External blocking
Sgen.Ex ForcePost-I	State of the module input:Force Post state. Abort simulation.
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.PSS manual	Signal: Manual Switch over of a Parameter Set
Sys.PSS via Scada	Signal: Parameter Set Switch via Scada
Sys.PSS via Inp fct	Signal: Parameter Set Switch via input function

Name	*Description*
Sys.min 1 param changed	Signal: At least one parameter has been changed
Sys.Setting Lock Bypass	Signal: Short-period unlock of the Setting Lock
Sys.Ack LED	Signal: LEDs acknowledgement
Sys.Ack BO	Signal: Acknowledgement of the Binary Outputs
Sys.Ack Scada	Signal: Acknowledge Scada
Sys.Ack TripCmd	Signal: Reset Trip Command
Sys.Ack LED-HMI	Signal: LEDs acknowledgement :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 :SCADA
Sys.Ack BO-Sca	Signal: Acknowledgement of the Binary Outputs :SCADA
Sys.Ack Counter-Sca	Signal: Reset of all Counters :SCADA
Sys.Ack Scada-Sca	Signal: Acknowledge Scada :SCADA
Sys.Ack TripCmd-Sca	Signal: Reset Trip Command :SCADA
Sys.Res OperationsCr	Signal:: Res OperationsCr
Sys.Res AlarmCr	Signal:: Res AlarmCr
Sys.Res TripCmdCr	Signal:: Res TripCmdCr
Sys.Res TotalCr	Signal:: Res TotalCr
Sys.Ack LED-I	Module input state: LEDs acknowledgement by digital input
Sys.Ack BO-I	Module input state: Acknowledgement of the binary Output Relays
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.
Sys.Lock Settings-I	State of the module input: No parameters can be changed as long as this input is true. The parameter settings are locked.

Signals of the Digital Inputs and Logic

The following list comprises the signals of the Digital Inputs and the Logic. This list is used in various protective elements.

Name	*Description*
-.-	No assignment
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
Logics.LE1.Gate Out	Signal: Output of the logic gate
Logics.LE1.Timer Out	Signal: Timer Output
Logics.LE1.Out	Signal: Latched Output (Q)
Logics.LE1.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE2.Gate Out	Signal: Output of the logic gate
Logics.LE2.Timer Out	Signal: Timer Output
Logics.LE2.Out	Signal: Latched Output (Q)
Logics.LE2.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE3.Gate Out	Signal: Output of the logic gate
Logics.LE3.Timer Out	Signal: Timer Output
Logics.LE3.Out	Signal: Latched Output (Q)
Logics.LE3.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE4.Gate Out	Signal: Output of the logic gate
Logics.LE4.Timer Out	Signal: Timer Output
Logics.LE4.Out	Signal: Latched Output (Q)
Logics.LE4.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE5.Gate Out	Signal: Output of the logic gate
Logics.LE5.Timer Out	Signal: Timer Output
Logics.LE5.Out	Signal: Latched Output (Q)
Logics.LE5.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE6.Gate Out	Signal: Output of the logic gate
Logics.LE6.Timer Out	Signal: Timer Output
Logics.LE6.Out	Signal: Latched Output (Q)
Logics.LE6.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE7.Gate Out	Signal: Output of the logic gate
Logics.LE7.Timer Out	Signal: Timer Output
Logics.LE7.Out	Signal: Latched Output (Q)

Name	*Description*
Logics.LE7.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE8.Gate Out	Signal: Output of the logic gate
Logics.LE8.Timer Out	Signal: Timer Output
Logics.LE8.Out	Signal: Latched Output (Q)
Logics.LE8.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE9.Gate Out	Signal: Output of the logic gate
Logics.LE9.Timer Out	Signal: Timer Output
Logics.LE9.Out	Signal: Latched Output (Q)
Logics.LE9.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE10.Gate Out	Signal: Output of the logic gate
Logics.LE10.Timer Out	Signal: Timer Output
Logics.LE10.Out	Signal: Latched Output (Q)
Logics.LE10.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE11.Gate Out	Signal: Output of the logic gate
Logics.LE11.Timer Out	Signal: Timer Output
Logics.LE11.Out	Signal: Latched Output (Q)
Logics.LE11.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE12.Gate Out	Signal: Output of the logic gate
Logics.LE12.Timer Out	Signal: Timer Output
Logics.LE12.Out	Signal: Latched Output (Q)
Logics.LE12.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE13.Gate Out	Signal: Output of the logic gate
Logics.LE13.Timer Out	Signal: Timer Output
Logics.LE13.Out	Signal: Latched Output (Q)
Logics.LE13.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE14.Gate Out	Signal: Output of the logic gate
Logics.LE14.Timer Out	Signal: Timer Output
Logics.LE14.Out	Signal: Latched Output (Q)
Logics.LE14.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE15.Gate Out	Signal: Output of the logic gate
Logics.LE15.Timer Out	Signal: Timer Output
Logics.LE15.Out	Signal: Latched Output (Q)
Logics.LE15.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE16.Gate Out	Signal: Output of the logic gate
Logics.LE16.Timer Out	Signal: Timer Output
Logics.LE16.Out	Signal: Latched Output (Q)
Logics.LE16.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE17.Gate Out	Signal: Output of the logic gate
Logics.LE17.Timer Out	Signal: Timer Output
Logics.LE17.Out	Signal: Latched Output (Q)

Name	Description
Logics.LE17.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE18.Gate Out	Signal: Output of the logic gate
Logics.LE18.Timer Out	Signal: Timer Output
Logics.LE18.Out	Signal: Latched Output (Q)
Logics.LE18.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE19.Gate Out	Signal: Output of the logic gate
Logics.LE19.Timer Out	Signal: Timer Output
Logics.LE19.Out	Signal: Latched Output (Q)
Logics.LE19.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE20.Gate Out	Signal: Output of the logic gate
Logics.LE20.Timer Out	Signal: Timer Output
Logics.LE20.Out	Signal: Latched Output (Q)
Logics.LE20.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE21.Gate Out	Signal: Output of the logic gate
Logics.LE21.Timer Out	Signal: Timer Output
Logics.LE21.Out	Signal: Latched Output (Q)
Logics.LE21.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE22.Gate Out	Signal: Output of the logic gate
Logics.LE22.Timer Out	Signal: Timer Output
Logics.LE22.Out	Signal: Latched Output (Q)
Logics.LE22.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE23.Gate Out	Signal: Output of the logic gate
Logics.LE23.Timer Out	Signal: Timer Output
Logics.LE23.Out	Signal: Latched Output (Q)
Logics.LE23.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE24.Gate Out	Signal: Output of the logic gate
Logics.LE24.Timer Out	Signal: Timer Output
Logics.LE24.Out	Signal: Latched Output (Q)
Logics.LE24.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE25.Gate Out	Signal: Output of the logic gate
Logics.LE25.Timer Out	Signal: Timer Output
Logics.LE25.Out	Signal: Latched Output (Q)
Logics.LE25.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE26.Gate Out	Signal: Output of the logic gate
Logics.LE26.Timer Out	Signal: Timer Output
Logics.LE26.Out	Signal: Latched Output (Q)
Logics.LE26.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE27.Gate Out	Signal: Output of the logic gate
Logics.LE27.Timer Out	Signal: Timer Output
Logics.LE27.Out	Signal: Latched Output (Q)

Name	*Description*
Logics.LE27.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE28.Gate Out	Signal: Output of the logic gate
Logics.LE28.Timer Out	Signal: Timer Output
Logics.LE28.Out	Signal: Latched Output (Q)
Logics.LE28.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE29.Gate Out	Signal: Output of the logic gate
Logics.LE29.Timer Out	Signal: Timer Output
Logics.LE29.Out	Signal: Latched Output (Q)
Logics.LE29.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE30.Gate Out	Signal: Output of the logic gate
Logics.LE30.Timer Out	Signal: Timer Output
Logics.LE30.Out	Signal: Latched Output (Q)
Logics.LE30.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE31.Gate Out	Signal: Output of the logic gate
Logics.LE31.Timer Out	Signal: Timer Output
Logics.LE31.Out	Signal: Latched Output (Q)
Logics.LE31.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE32.Gate Out	Signal: Output of the logic gate
Logics.LE32.Timer Out	Signal: Timer Output
Logics.LE32.Out	Signal: Latched Output (Q)
Logics.LE32.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE33.Gate Out	Signal: Output of the logic gate
Logics.LE33.Timer Out	Signal: Timer Output
Logics.LE33.Out	Signal: Latched Output (Q)
Logics.LE33.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE34.Gate Out	Signal: Output of the logic gate
Logics.LE34.Timer Out	Signal: Timer Output
Logics.LE34.Out	Signal: Latched Output (Q)
Logics.LE34.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE35.Gate Out	Signal: Output of the logic gate
Logics.LE35.Timer Out	Signal: Timer Output
Logics.LE35.Out	Signal: Latched Output (Q)
Logics.LE35.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE36.Gate Out	Signal: Output of the logic gate
Logics.LE36.Timer Out	Signal: Timer Output
Logics.LE36.Out	Signal: Latched Output (Q)
Logics.LE36.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE37.Gate Out	Signal: Output of the logic gate
Logics.LE37.Timer Out	Signal: Timer Output
Logics.LE37.Out	Signal: Latched Output (Q)

Name	*Description*
Logics.LE37.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE38.Gate Out	Signal: Output of the logic gate
Logics.LE38.Timer Out	Signal: Timer Output
Logics.LE38.Out	Signal: Latched Output (Q)
Logics.LE38.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE39.Gate Out	Signal: Output of the logic gate
Logics.LE39.Timer Out	Signal: Timer Output
Logics.LE39.Out	Signal: Latched Output (Q)
Logics.LE39.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE40.Gate Out	Signal: Output of the logic gate
Logics.LE40.Timer Out	Signal: Timer Output
Logics.LE40.Out	Signal: Latched Output (Q)
Logics.LE40.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE41.Gate Out	Signal: Output of the logic gate
Logics.LE41.Timer Out	Signal: Timer Output
Logics.LE41.Out	Signal: Latched Output (Q)
Logics.LE41.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE42.Gate Out	Signal: Output of the logic gate
Logics.LE42.Timer Out	Signal: Timer Output
Logics.LE42.Out	Signal: Latched Output (Q)
Logics.LE42.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE43.Gate Out	Signal: Output of the logic gate
Logics.LE43.Timer Out	Signal: Timer Output
Logics.LE43.Out	Signal: Latched Output (Q)
Logics.LE43.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE44.Gate Out	Signal: Output of the logic gate
Logics.LE44.Timer Out	Signal: Timer Output
Logics.LE44.Out	Signal: Latched Output (Q)
Logics.LE44.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE45.Gate Out	Signal: Output of the logic gate
Logics.LE45.Timer Out	Signal: Timer Output
Logics.LE45.Out	Signal: Latched Output (Q)
Logics.LE45.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE46.Gate Out	Signal: Output of the logic gate
Logics.LE46.Timer Out	Signal: Timer Output
Logics.LE46.Out	Signal: Latched Output (Q)
Logics.LE46.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE47.Gate Out	Signal: Output of the logic gate
Logics.LE47.Timer Out	Signal: Timer Output
Logics.LE47.Out	Signal: Latched Output (Q)

Name	*Description*
Logics.LE47.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE48.Gate Out	Signal: Output of the logic gate
Logics.LE48.Timer Out	Signal: Timer Output
Logics.LE48.Out	Signal: Latched Output (Q)
Logics.LE48.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE49.Gate Out	Signal: Output of the logic gate
Logics.LE49.Timer Out	Signal: Timer Output
Logics.LE49.Out	Signal: Latched Output (Q)
Logics.LE49.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE50.Gate Out	Signal: Output of the logic gate
Logics.LE50.Timer Out	Signal: Timer Output
Logics.LE50.Out	Signal: Latched Output (Q)
Logics.LE50.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE51.Gate Out	Signal: Output of the logic gate
Logics.LE51.Timer Out	Signal: Timer Output
Logics.LE51.Out	Signal: Latched Output (Q)
Logics.LE51.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE52.Gate Out	Signal: Output of the logic gate
Logics.LE52.Timer Out	Signal: Timer Output
Logics.LE52.Out	Signal: Latched Output (Q)
Logics.LE52.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE53.Gate Out	Signal: Output of the logic gate
Logics.LE53.Timer Out	Signal: Timer Output
Logics.LE53.Out	Signal: Latched Output (Q)
Logics.LE53.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE54.Gate Out	Signal: Output of the logic gate
Logics.LE54.Timer Out	Signal: Timer Output
Logics.LE54.Out	Signal: Latched Output (Q)
Logics.LE54.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE55.Gate Out	Signal: Output of the logic gate
Logics.LE55.Timer Out	Signal: Timer Output
Logics.LE55.Out	Signal: Latched Output (Q)
Logics.LE55.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE56.Gate Out	Signal: Output of the logic gate
Logics.LE56.Timer Out	Signal: Timer Output
Logics.LE56.Out	Signal: Latched Output (Q)
Logics.LE56.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE57.Gate Out	Signal: Output of the logic gate
Logics.LE57.Timer Out	Signal: Timer Output
Logics.LE57.Out	Signal: Latched Output (Q)

Name	*Description*
Logics.LE57.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE58.Gate Out	Signal: Output of the logic gate
Logics.LE58.Timer Out	Signal: Timer Output
Logics.LE58.Out	Signal: Latched Output (Q)
Logics.LE58.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE59.Gate Out	Signal: Output of the logic gate
Logics.LE59.Timer Out	Signal: Timer Output
Logics.LE59.Out	Signal: Latched Output (Q)
Logics.LE59.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE60.Gate Out	Signal: Output of the logic gate
Logics.LE60.Timer Out	Signal: Timer Output
Logics.LE60.Out	Signal: Latched Output (Q)
Logics.LE60.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE61.Gate Out	Signal: Output of the logic gate
Logics.LE61.Timer Out	Signal: Timer Output
Logics.LE61.Out	Signal: Latched Output (Q)
Logics.LE61.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE62.Gate Out	Signal: Output of the logic gate
Logics.LE62.Timer Out	Signal: Timer Output
Logics.LE62.Out	Signal: Latched Output (Q)
Logics.LE62.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE63.Gate Out	Signal: Output of the logic gate
Logics.LE63.Timer Out	Signal: Timer Output
Logics.LE63.Out	Signal: Latched Output (Q)
Logics.LE63.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE64.Gate Out	Signal: Output of the logic gate
Logics.LE64.Timer Out	Signal: Timer Output
Logics.LE64.Out	Signal: Latched Output (Q)
Logics.LE64.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE65.Gate Out	Signal: Output of the logic gate
Logics.LE65.Timer Out	Signal: Timer Output
Logics.LE65.Out	Signal: Latched Output (Q)
Logics.LE65.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE66.Gate Out	Signal: Output of the logic gate
Logics.LE66.Timer Out	Signal: Timer Output
Logics.LE66.Out	Signal: Latched Output (Q)
Logics.LE66.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE67.Gate Out	Signal: Output of the logic gate
Logics.LE67.Timer Out	Signal: Timer Output
Logics.LE67.Out	Signal: Latched Output (Q)

Name	*Description*
Logics.LE67.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE68.Gate Out	Signal: Output of the logic gate
Logics.LE68.Timer Out	Signal: Timer Output
Logics.LE68.Out	Signal: Latched Output (Q)
Logics.LE68.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE69.Gate Out	Signal: Output of the logic gate
Logics.LE69.Timer Out	Signal: Timer Output
Logics.LE69.Out	Signal: Latched Output (Q)
Logics.LE69.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE70.Gate Out	Signal: Output of the logic gate
Logics.LE70.Timer Out	Signal: Timer Output
Logics.LE70.Out	Signal: Latched Output (Q)
Logics.LE70.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE71.Gate Out	Signal: Output of the logic gate
Logics.LE71.Timer Out	Signal: Timer Output
Logics.LE71.Out	Signal: Latched Output (Q)
Logics.LE71.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE72.Gate Out	Signal: Output of the logic gate
Logics.LE72.Timer Out	Signal: Timer Output
Logics.LE72.Out	Signal: Latched Output (Q)
Logics.LE72.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE73.Gate Out	Signal: Output of the logic gate
Logics.LE73.Timer Out	Signal: Timer Output
Logics.LE73.Out	Signal: Latched Output (Q)
Logics.LE73.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE74.Gate Out	Signal: Output of the logic gate
Logics.LE74.Timer Out	Signal: Timer Output
Logics.LE74.Out	Signal: Latched Output (Q)
Logics.LE74.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE75.Gate Out	Signal: Output of the logic gate
Logics.LE75.Timer Out	Signal: Timer Output
Logics.LE75.Out	Signal: Latched Output (Q)
Logics.LE75.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE76.Gate Out	Signal: Output of the logic gate
Logics.LE76.Timer Out	Signal: Timer Output
Logics.LE76.Out	Signal: Latched Output (Q)
Logics.LE76.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE77.Gate Out	Signal: Output of the logic gate
Logics.LE77.Timer Out	Signal: Timer Output
Logics.LE77.Out	Signal: Latched Output (Q)

Name	*Description*
Logics.LE77.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE78.Gate Out	Signal: Output of the logic gate
Logics.LE78.Timer Out	Signal: Timer Output
Logics.LE78.Out	Signal: Latched Output (Q)
Logics.LE78.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE79.Gate Out	Signal: Output of the logic gate
Logics.LE79.Timer Out	Signal: Timer Output
Logics.LE79.Out	Signal: Latched Output (Q)
Logics.LE79.Out inverted	Signal: Negated Latched Output (Q NOT)
Logics.LE80.Gate Out	Signal: Output of the logic gate
Logics.LE80.Timer Out	Signal: Timer Output
Logics.LE80.Out	Signal: Latched Output (Q)
Logics.LE80.Out inverted	Signal: Negated Latched Output (Q NOT)

Specifications

Specifications of the Real Time Clock

Resolution:	1 ms
Tolerance:	<1 minute / month (+20°C [68°F]) <±1ms if synchronized via IRIG-B

Time Synchronisation Tolerances

The different protocols for time synchronisation vary in their accuracy:

Used Protocol	***Time drift over one month***	***Deviation to time generator***
Without time synchronization	<1 min (+20°C)	Time drifts
IRIG-B	Dependent on the time drift of the time generator	<±1 ms
SNTP	Dependent on the time drift of the time generator	<±1 ms
IEC60870-5-103	Dependent on the time drift of the time generator	<±1 ms
Modbus TCP	Dependent on the time drift of the time generator	Dependent on the network load
Modbus RTU	Dependent on the time drift of the time generator	<±1 ms

Specifications of the Measured Value Acquisition
Phase-to-ground and Residual Voltage Measurement

Frequency Range:	50 Hz / 60 Hz ± 10%
Accuracy for measured values:	Class 0.5
Amplitude error for V<Vn:	±0.5% of rated voltage or ±0.5 V
Amplitude error for V>Vn:	±0.5% of measured voltage or ±0.5 V
Accuracy for calculated values:	Class 1.0
Amplitude error for V<Vn:	±1.0% of rated voltage or ±1.0 V
Amplitude error for V>Vn:	±1.0% of calculated voltage or ±1.0 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 configured nominal frequency
Temperature influence:	<±1% within the range of 0°C up to +60°C

Frequency measurement

Nominal frequency:	50 Hz / 60 Hz
Precision:	±0.05% of fn within the range of 40-70 Hz at voltages >50 V
Voltage dependency:	frequency acquisition of 5 V – 800 V

Protection Elements Accuracy

NOTICE **The tripping delay relates to the time between alarm and trip.**
The accuracy of the operating time relates to the time between fault entry and the time when the protection element is picked-up.

Reference conditions for all Protection Elements: sine wave, at rated frequency, THD < 1%

Voltage Protection: ***V[x]***	***Accuracy***
Pickup	±1.5% of the setting value or 1% Vn
Dropout Ratio	97% or 0.5% Vn for V> 103% or 0.5% Vn for V<
t	DEFT ±1% or ±10 ms
Operating Time Starting from V higher than 1.1 x pickup value for V> or V lower than 0.9 x pickup value for V<	<35 ms
Disengaging Time	<45 ms

Residual Voltage Protection: ***VG[x]***	***Accuracy***
Pickup	±1.5% of the setting value or 1% Vn
Dropout Ratio	97% or 0.5% Vn for VG> 103% or 0.5% Vn for VG<
t	DEFT ±1% or ±10 ms
Operating Time Starting from V higher than 1.1 x pickup value for VG> or V lower than 0.9 x pickup value for VG<	<35 ms
Disengaging Time	<45 ms

Low Voltage Ride Through Protection: ***LVRT***	***Accuracy***
Voltage Pickup (Start)	±1.5% of the setting value or 1% Vn
Voltage Dropout Ratio (Recover)	Adjustable, at least 0.5% Vn
Tripping time delay	±1% from settings or ±10 ms
Operating Time Starting from V lower than 0.9 x pickup value	<35 ms
Disengaging Time	<45 ms

Voltage unbalance: ***V012[x]***	***Accuracy*** *1)
Threshold	±2% of the setting value or 1% Vn
Dropout Ratio	97% or 0.5% x Vn for V1> or V2> 103% or 0.5% x Vn for V1<
%(V2/V1)	±1%
t	DEFT ±1% or ±10 ms
Operating Time	<60 ms
Disengaging Time	<40 ms

[1] Negative-sequence voltage V2 must be ≥ 0.01 x Vn, V1 must be ≥ 0.1 x Vn.

Over Frequency Protection: ***f>[x]***	***Accuracy*** [*1)]
f>	±10 mHz at fn
Dropout ratio	99.95% or 0.05% fn
t	±1% or ±10 ms
Operating time Starting from f higher than f> + 0.02 Hz + 0.1 Hz + 2.0 Hz	 < 100 ms typically 70 ms typically 50 ms
Disengaging time	<120 ms

[1] Accuracy is given for rated frequency fn±10%

Under Frequency Protection: ***f<[x]***	***Accuracy*** [*1)]
f<	±10 mHz at fn
Dropout ratio	100.05% or 0.05% fn
t	±1% or ±10 ms
Operating time Starting from f lower than f< - 0.02 Hz - 0.1 Hz - 2.0 Hz	 < 100 ms typically 70 ms typically 50 ms
Disengaging time	<120 ms
V Block f	±1.5% of the setting value or 1% Vn
Dropout ratio	103% or 0.5% Vn

[1] Accuracy is given for rated frequency fn±10%

Rate of Change of Frequency: ***df/dt***	***Accuracy*** [*1)]
df/dt	±0.1 Hz/s [2]
t	±1% or ±10 ms
Operating time Starting from fn and df/dt > pickup + 0.1 Hz/s At df/dt > 2-times pick up At df/dt > 5-times pick up	 < 200 ms typically <100 ms typically < 70 ms
Disengaging time	<120 ms

[1] Accuracy is given for rated frequency fn±10%
[2] 10% additional tolerance per Hz deviation from nominal frequency fn (e.g. at 45Hz, tolerance is 0.15Hz/s).

Rate of Change of Frequency: ***DF/DT***	***Accuracy***
DF	±20 mHz at fn
DT	±1% or ±10 ms

Vector surge: ***delta phi***	***Accuracy***
delta phi	±0.5° [1-30°] at Vn and fn
Operating time	<40 ms

Trip Circuit Supervision: ***TCS***	***Accuracy***
t-TCS	±1% or ±10 ms

Voltage Transformer Supervision: VTS	***Accuracy***
ΔV	±2% of the setting value or 1.5% Vn
Dropout Ratio	94%
Alarm delay	±1% or ± 10 ms

Abbreviations, and Acronyms

The following abbreviations and acronyms are used in this manual.

°C	Degrees Celsius
°F	Degrees Fahrenheit
A	Ampere(s), Amp(s)
AC	Alternating current
Ack.	Acknowledge
AND	Logical gate (The output becomes true if all Input signals are true.)
ANSI	American National Standards Institute
avg.	Average
AWG	American wire gauge
BF	Circuit breaker failure
Bkr	Breaker
Blo	Blocking(s)
BO	Binary output relay
BO1	1st binary output relay
BO2	2nd binary output relay
BO3	3rd binary output relay
calc	Calculated
CB	Circuit breaker
CBF	Module Circuit Breaker Failure protection
CD	Compact disk
Char	Curve shape
CLPU	Cold Load Pickup Module
Cmd.	Command
CMN	Common input
COM	Common input
Comm	Communication
Cr.	Counter(s)
CSA	Canadian Standards Association
CT	Control transformer
Ctrl.	Control
CTS	Current Transformer Supervision
CTS	Current transformer supervision
d	Day
D-Sub-Plug	Communication interface
DC	Direct current
DEFT	Definite time characteristic (Tripping time does not depend on the height of the current.)
delta phi	Vector surge
df/dt	Rate-of-frequency-change
DI	Digital Input
Diagn Cr	Diagnosis counter(s)
Diagn.	Diagnosis

DIN	Deutsche Industrie Norm
dir	Directional
EINV	Extremely inverse tripping characteristic
EMC	Electromagnetic compatibility
EN	Europäische Norm
err. / Err.	Error
EVTcon	Parameter determines if the residual voltage is measured or calculated.
Ex	External
Ex Oil Temp	External Oil Temperature
ExBlo	External blocking(s)
ExP	External Protection - Module
ExP	External protection
Ext Sudd Press	Sudden Pressure
Ext Temp Superv	External Temperature Supervision
f	Frequency Protection Module
Fc	Function (Enable or disable functionality = allow or disallow.)
FIFO	First in first out
FIFO Principal	First in first out
fund	Fundamental (ground wave)
gn	Acceleration of the earth in vertical direction (9.81 m/s2)
GND	Ground
h	Hour
HMI	Human machine interface (Front of the protective relay)
HTL	Manufacturer internal product designation
Hz	Hertz
I	Phase Overcurrent Stage
I	Fault current
I	Current
I-BF	Tripping threshold
I0	Zero current (symmetrical components)
I1	Positive sequence current (symmetrical components)
I2	Negative sequence current (symmetrical components)
I2>	Unbalanced Load-Stage
I2T	Thermal Characteristic
I4T	Thermal Characteristic
IA	Phase A current
IB	Phase B current
IC	Phase C current
IC's	Manufacturer internal product designation
Id	Differential Protection Module
IdG	Restricted Ground Fault Differential Protection Module
IdGH	Restricted Ground Fault Highset Protection Module
IdH	High-Set Differential Protection Module
IEC	International Electrotechnical Commission
IEC61850	IEC61850

IEEE	Institute of Electrical and Electronics Engineers
IG	Earth current protection - Stage
IG	Ground current
IG	Fault current
IGnom	Nominal ground current
IH1	1st harmonic
IH2	Module Inrush
IH2	2nd harmonic
in.	Inch
incl.	Include, including
InEn	Inadvertent Energization
Info.	Information
Interl.	Interlocking
Intertripping	Intertripping
INV	Inverse characteristic (The tripping time will be calculated depending on the height of the current)
IR	Calculated ground current
IRIG	Input for time synchronization (Clock)
IRIG-B	IRIG-B-Module
IT	Thermal Characteristic
IX	4th measuring input of the current measuring assembly group (either ground or neutral current)
J	Joule
kg	Kilogram
kHz	Kilohertz
kV	Kilovolt(s)
kVdc or kVDC	Kilovolt(s) direct current
I/In	Ratio of current to nominal current.
L1	Phase A
L2	Phase B
L3	Phase C
lb-in	Pound-inch
LED	Light emitting diode
LINV	Long time inverse tripping characteristic
LoE-Z1	Loss of Excitation
LoE-Z2	Loss of Excitation
Logics	Logic
LOP	Loss of Potential
LV	Low voltage
LVRT	Low Voltage Ride Through
m	Meter
mA	Milliampere(s), Milliamp(s)
man.	Manual
max.	Maximum
meas	Measured
min.	Minimum

min.	Minute
MINV	Moderately Inverse Tripping Characteristic
MK	Manufacturer Internal Product Designation Code
mm	Millimeter
MMU	Memory mapping unit
ms	Milli-second(s)
MV	Medium voltage
mVA	Milli volt amperes (Power)
N.C.	Not connected
N.O.	Normal open (Contact)
NINV	Normal inverse tripping characteristic
Nm	Newton-meter
No	Number
Nom.	Nominal
NT	Manufacturer internal product designation code
P	Reverse Active Power
Para.	Parameter
PC	Personal computer
PCB	Printed circuit board
PE	Protected Earth
PF	Power Factor - Module
Ph	Phase
PQS	Power Protection - Module
pri	Primary
PROT or Prot	Protection Module (Master Module)
PS1	Parameter set 1
PS2	Parameter set 2
PS3	Parameter set 3
PS4	Parameter set 4
PSet	Parameter set
PSS	Parameter set switch (Switching from one parameter set to another)
Q	Reverse Reactive Power
Q->&V<	Undervoltage and Reactive Power Direction Protection
R	Reset
rec.	Record
rel	Relative
res	Reset
ResetFct	Reset function
RevData	Review data
RMS	Root mean square
Rst	Reset
RTD	Temperature Protection Module
s	Second
SC	Supervision contact
Sca	SCADA

SCADA	Communication module
sec	Second(s)
sec	Secondary
Sgen	Sine wave generator
Sig.	Signal
SNTP	SNTP-Module
SOTF	Switch Onto Fault - Module
StartFct	Start function
Sum	Summation
SW	Software
Sync	Synchrocheck
Sys.	System
t	Tripping delay
t or t.	Time
Tcmd	Trip command
TCP/IP	Communication protocol
TCS	Trip circuit supervision
ThR	Thermal replica module
TI	Manufacturer internal product designation code
TripCmd	Trip command
txt	Text
UL	Underwriters Laboratories
UMZ	DEFT (definite time tripping characteristic)
USB	Universal serial bus
V	Voltage-stage
V	Volts
V/f>	Overexcitation
V012	Symmetrical Components: Supervision of the Positive Phase Sequence or Negative Phase Sequence
Vac / V ac	Volts alternating current
Vdc / V dc	Volts direct current
VDE	Verband Deutscher Elektrotechnik
VDEW	Verband der Elektrizitätswirtschaft
VE	Residual voltage
VG	Residual voltage-Stage
VINV	Very inverse tripping characteristic
VTS	Voltage transformer supervision
W	Watt(s)
WDC	Watch dog contact (supervision contact)
www	World wide web
XCT	4th current measuring input (ground or neutral current)
XInv	Inverse characteristic

List of ANSI Codes

ANSI	Functions
14	Underspeed
24	Overexcitation Protection (Volts per Hertz)
25	Synchronizing or Synchronism-check via 4th measuring channel of voltage measurement card
27	Undervoltage Protection
27(t)	Undervoltage (time dependent) Protection
27A	Undervoltage Protection (Auxiliar) via 4th measuring channel of voltage measurement card
27N	Neutral Undervoltage via 4th measuring channel of voltage measurement card
27TN	Third Harmonic Neutral Undervoltage via 4th measuring channel of voltage measurement card
32	Directional Power Protection
32F	Forward Power Protection
32R	Reverse Power Protection
37	Undercurrent / Under Power
38	Temperature Protection (optional via Interface/external Box)
40	Loss of Excitation / Loss of Field
46	Unbalanced Current Protection
46G	Unbalanced Generator Current Protection
47	Unbalanced Voltage Protection
48	Incomplete Sequence (Start-up time Supervison)
49	Thermal Protection
49M	Thermal Motor Protection
49R	Thermal Rotor Protection
49S	Thermal Stator Protection
50BF	Breaker Failure
50	Overcurrent (instantaneous)
50P	Phase Overcurrent (instantaneous)
50N	Neutral Overcurrent (instantaneous)
50Ns	Sensitive Neutral Overcurrent (instantaneous)
51	Overcurrent
51P	Phase Overcurrent
51N	Neutral Overcurrent
51Ns	Sensitive Neutral Overcurrent
51LR	Locked Rotor
51LRS	Locked Rotor Start (during start sequence)
51C	Voltage Controlled Overcurrent (via adaptive Parameters)
51Q	Negative Phase Sequence Overcurrent (multiple trip characteristics)
51V	Voltage Restrained Overcurrent
55	Power Factor Protection
59	Overvoltage Protection
59TN	Third Harmonic Neutral Overvoltage via 4th measuring channel of voltage measurement card
59A	Overvoltage Protection via 4th (Auxiliar) measuring channel of voltage measurement card
59N	Neutral Overvoltage Protection
60FL	Voltage Transformer Supervision
60L	Current Transformer Supervision
64REF	Restricted Ground Fault Protection
66	Starts per h (Start Inhibit)
67	Directional Overcurrent
67N	Directional Neutral Overcurrent
67Ns	Sensitive Directional Neutral Overcurrent
74TC	Trip Circuit Supervision

ANSI	Functions
78V	Vector Surge Protection
79	Auto Reclosure
81	Frequency Protection
81U	Underfrequency Protection
81O	Overfrequency Protection
81R	ROCOF (df/dt)
86	Lock Out
87B	Busbar Differential Protection
87G	Generator Differential Protection
87GP	Generator Phase Differential Protection
87GN	Generator Ground Differential Protection
87M	Motor Differential Protection
87T	Transformer Differential Protection
87TP	Transformer Phase Differential Protection
87TN	Transformer Ground Differential Protection
87U	Unit Differential Protection (protected zone includes generator and step-up transformer)
87UP	Unit Phase Differential Protection (protected zone includes generator and step-up transformer)

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