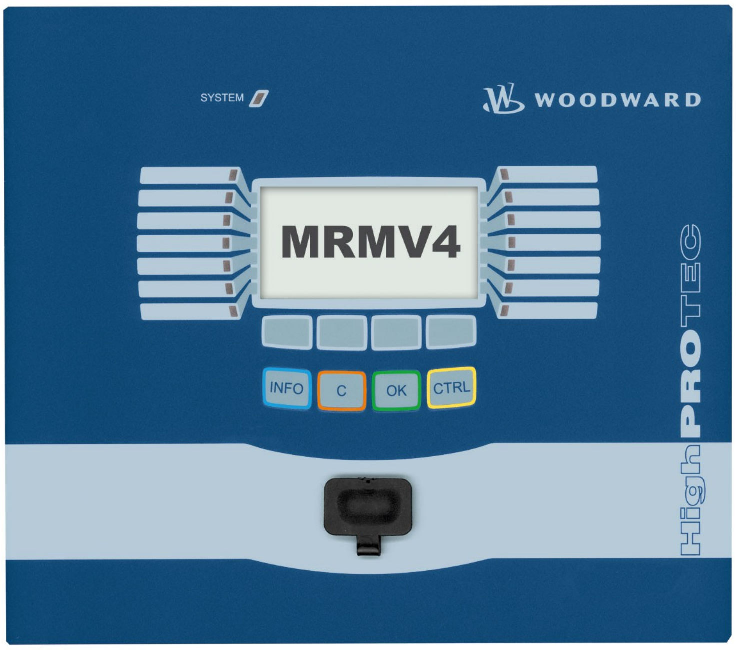
WOODWARD

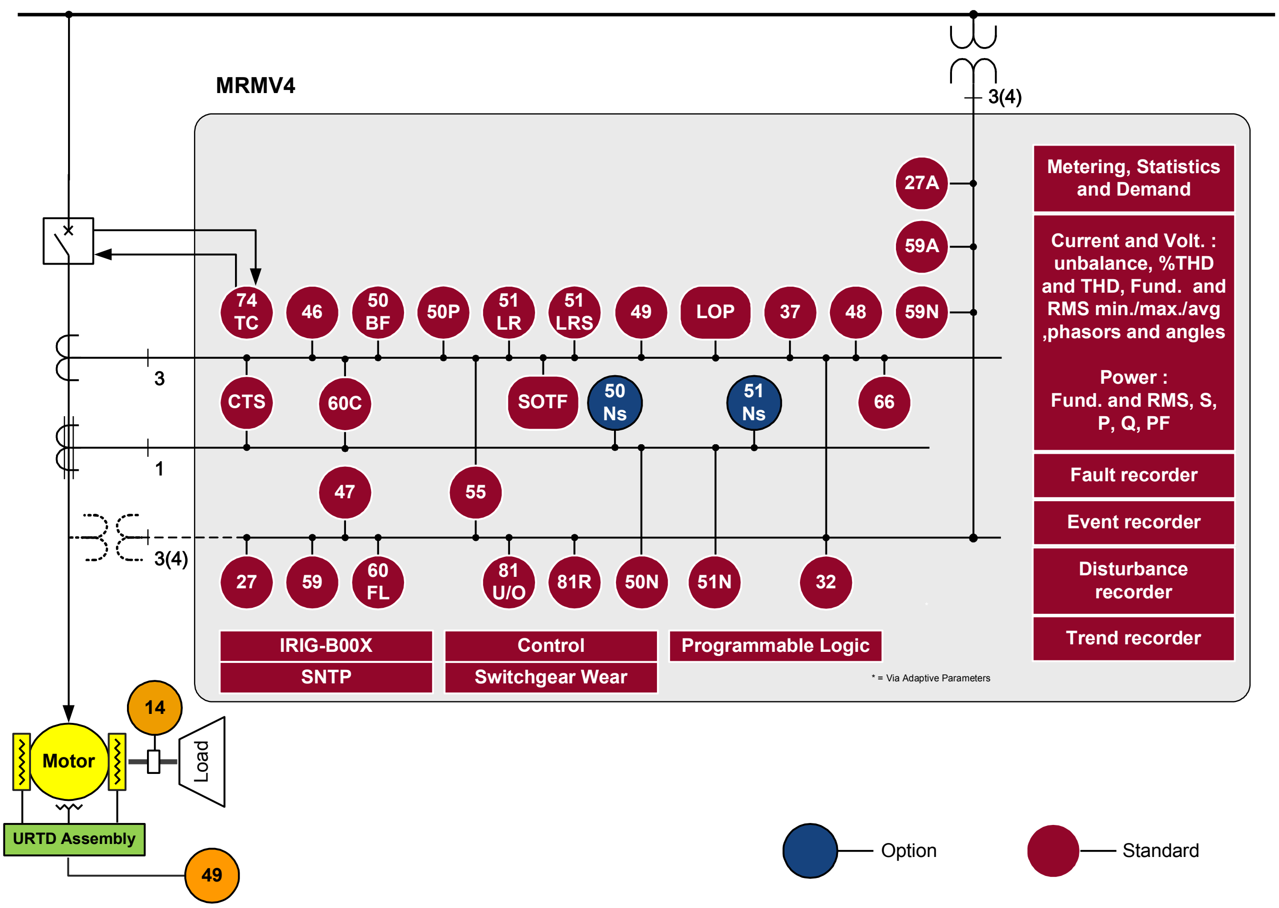


MRMV4
HighPROTEC

Motor Protection

Device Manual DOK-HB-MRMV4E, Rev. A

MRMV4 Functional Overview



Order Code

Motor Protection	MRMV4-		0		

Analog Output	RTD	Remote Interface	Digital inputs	Binary output relays	Housing	Large display	
4		X	8	7	B2	-	**A**
4		X	8	13	B2	-	**C**

Hardware variants	
Phase current 1 A/5 A, earth current 1 A/5 A	**0**
Phase current 1 A/5 A, sensitive earth current 1 A/5 A	**1**

Housing and mounting	
Door mounting	**A**
Door mounting 19" (flush mounting)	**B**

Communication protocol	
Protocol/without protocol	**A**
RS485/terminals, Modbus RTU, IEC60870-5-103	**B**
Ethernet 100 MB/RJ45 connector, Modbus TCP	**C**
Fibre optic, Profibus-DP	**D**
RS485/D-SUB, Profibus-DP	**E**
Fibre optic, Modbus RTU, IEC60870-5-103	**F**
RS485/D-SUB, Modbus RTU, IEC60870-5-103	**G**
Ethernet 100 MB/RJ45 connector, IEC 61850	**H**

ANSI: 50, 51, 50N, 51N, 51V, 51C, 27, 59, 59N, 32F, 37F, 32Q, 37Q, 37QR, 32S, 37S, 37R, 37, 46, 47, 48, 49M, 49R, 55, 60FL, 60L, 66, 78, 81U/O, 81R, 86, 50BF, 51LR, 51LRS, 50J 59TN, 27TN, 74TC.

This manual applies to devices (version):

Version 2.0.f

Build: 15003

manually adapted to 2.0.u

Build: 21155

Table of Contents

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.

Woodward reserves the right to update any portion of this publication at any time. Information provided by Woodward is believed to be correct and reliable. However, no responsibility is assumed by Woodward unless otherwise expressly undertaken.

Scope of Delivery

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

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

Storage

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

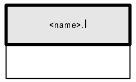
Important Information

WARNING

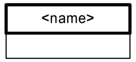
In line with the customer's requirement the devices are combined in a modular way (in compliance with the order code). The terminal assignment of the device can be found on the top of the device (wiring diagram).

Symbols

Setting value:

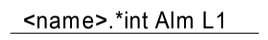


Device planning:

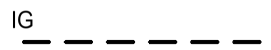


Signal:

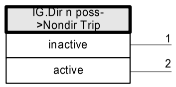
internal message



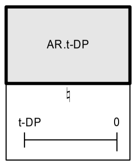
Measured values:



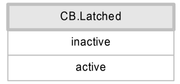
Functional description: If the setting value "IG.Block at VG=0" is set to "inactive" the output 1 is active and output 2 is inactive. If the setting value "IG.Block at VG=0" is set to "active" the output 2 is active and the output 1 is inactive.



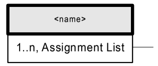
"⁝"=Elements with complex functions "gray-box".



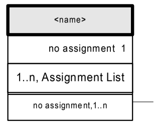
Option/features to be realised in the future



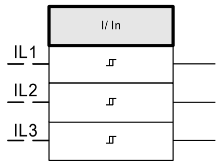
Parameter of a Module-Input with a SelectionList/DropDown. An (1..n) signal/output from the list or a pre-defined value can be selected.



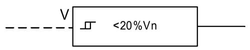
Parameter of a Module-Input (with special values): An (1..n) output from the list will be assigned to the input "<name>.identifier". If the parameter is set to "ItemNull", an "active"-signal will be given out.

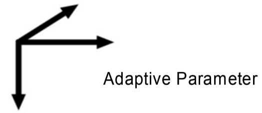


Limit value monitoring with three analogue input values. Compares 3 analogue values with the set limit; output values are three different binary values as a result of the comparision. If the analogue signal exceeds the limit I/In the corresponding output signal becomes "1".

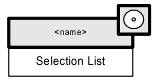


Limit value monitoring (Compared to a fixed value). Compares a value with the fixed set limit; output value is binary as a result of the comparision. If the signal exceeds the limit the corresponding output signal becomes "1".

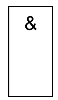




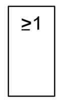
Direct Command



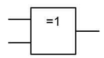
And



Or



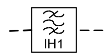
Exclusive-OR



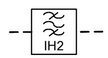
Negated input

Negated output

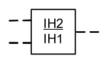
Band-pass (filter)
IH1



Band-pass (filter)
IH2



Quotient of analogue values

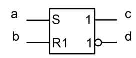


Analog values

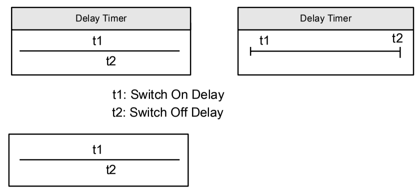
Analogue values
comparator

RS flip-flop

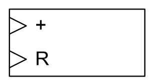
a b	c d
0 0	Unchanged
0 1	0 1
1 0	1 0
1 1	0 1



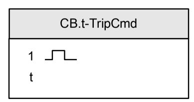
Time stage: A "1" at the input starts the stage. If the time <name>.t is expired the output becomes "1" too. The time stage will be reset by "0" at the input. Thus the output will be set to "0" at the same time.



Edge triggered counter
+ increment
R Reset

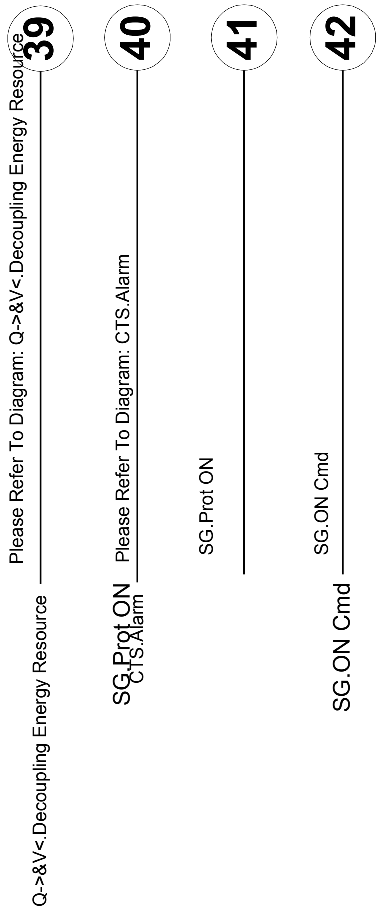


Time stage minimum pulse width: The pulse width <name>.t will be started if a "1" is feed to the input. By starting <name>.t the output becomes "1". If the time is expired, the output becomes "0" independent from the input signal.




Output Signal
2
2
Input Signal
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

Signal	Description	No.
name.Trip L1	Each trip of an active, trip authorized protection module will lead to a general trip.	20
name.Trip L2	Each trip of an active, trip authorized protection module will lead to a general trip.	21
name.Trip L3	Each trip of an active, trip authorized protection module will lead to a general trip.	22
name.Trip	Each trip of an active, trip authorized protection module will lead to a general trip.	23
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).	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 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).	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 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).	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	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 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).	28
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).	29
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).	30
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).	31
Prot.Blo TripCmd		32
CB.Pos	Please Refer To Diagram: CB.CB Manager	33
CB.Pos ON	Please Refer To Diagram: CB.CB Manager	34
CB.Pos OFF	Please Refer To Diagram: CB.CB Manager	35
CB.Pos Indeterm	Please Refer To Diagram: CB.CB Manager	36
CB.Pos Disturb	Please Refer To Diagram: CB.CB Manager	37
LOP.LOP Blo	Please Refer To Diagram: LOP.LOP Blo	38a
LOP.Ex FF VT	Please Refer To Diagram: LOP.Ex FF VT	38b
LOP.Ex FF EVT	Please Refer To Diagram: LOP.Ex FF EVT	38c


39
Please Refer To Diagram: Q->&V<.Decoupling Energy Resource
Q->&V<.Decoupling Energy Resource
40
Please Refer To Diagram: CTS.Alarm
SG.Prot ON
CTS.Alarm
41
SG.Prot ON
42
SG.ON Cmd
SG.ON Cmd

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.

<u>*Module and Instance (Element) names are displayed italic and underlined.*</u>

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

1	2	3	Image References (Squares)

Load Reference Arrow System

In general, the "Load Reference Arrow System" is used for loads (consumed energy) and the "Generator Reference System" is used for generators (generated energy).

Within the HighPROTEC the "Load Reference Arrow System" is used exclusively.

This applies to directions and phase angles. The phase angle is definded as the angle from the current phasor to the voltage phasor. Current and voltage arrows are to be counted positive in the direction of the arrow. The advantage of determining the load reference arrow system as the standard is that it is not necessary to change the direction of the current arrow if there is a transition from motor to generator.

Device

MRMV4

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 | 7 binary output relays, »C« 8 digital inputs | 13 binary output relays	8 digital inputs | 7 binary output relays	[MRM4]
Hardware Variant 2	Optional Hardware Extension	»0« Phase Current 5A/1A, Ground Current 5A/1A, »1« Phase Current 5A/1A, Sensitive Ground Current 5A/1A	Phase Current 5A/1A, Ground Current 5A/1A	[MRM4]

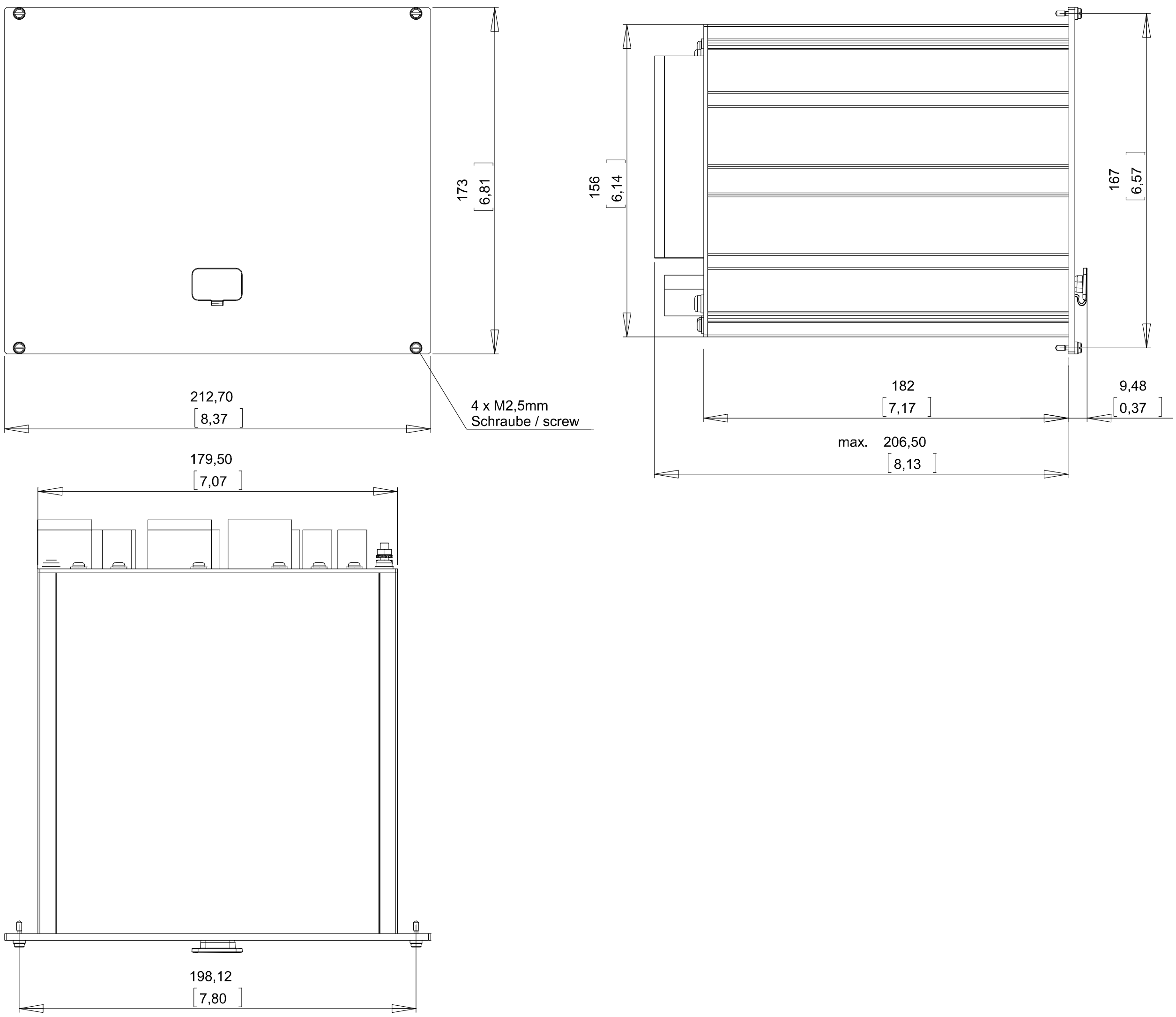
Parameter	*Description*	*Options*	*Default*	*Menu path*
Housing	Mounting form	»A« Flush mounting, »B« 19 inch mounting (semi-flush), »H« Customized Version 1	Flush mounting	[MRM4]
Communication	Communication	»A« Without, »B« RS 485: Modbus RTU | IEC 60870-5-103, »C« Ethernet: Modbus TCP, »D« Fiber Optics: 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	[MRM4]

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 B2 Housing (19” Devices)

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

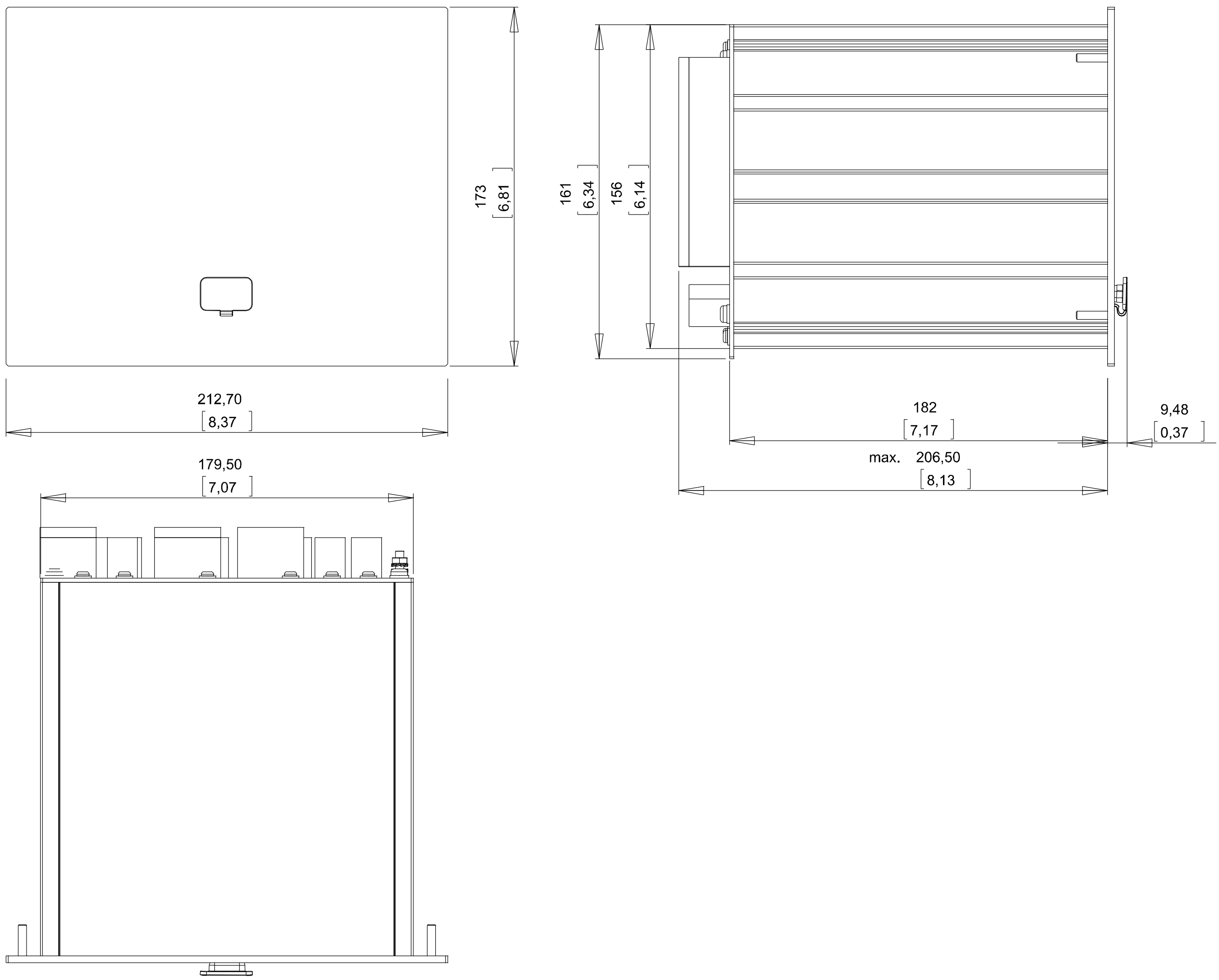
The power supply card needs a separate ground connection (2.5 mm^2 /

AWG 14) at terminal X1 (0.56-0.79 Nm [5-7 In-lb]).

Three-Side-View - 7-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 7 pushbuttons at the front side of the HMI.
(INFO-, C-, OK-Pushbutton and 4 Softkeys [Pushbuttons]).



3-Side-View B2 Housing (Devices with 7 Softkeys)

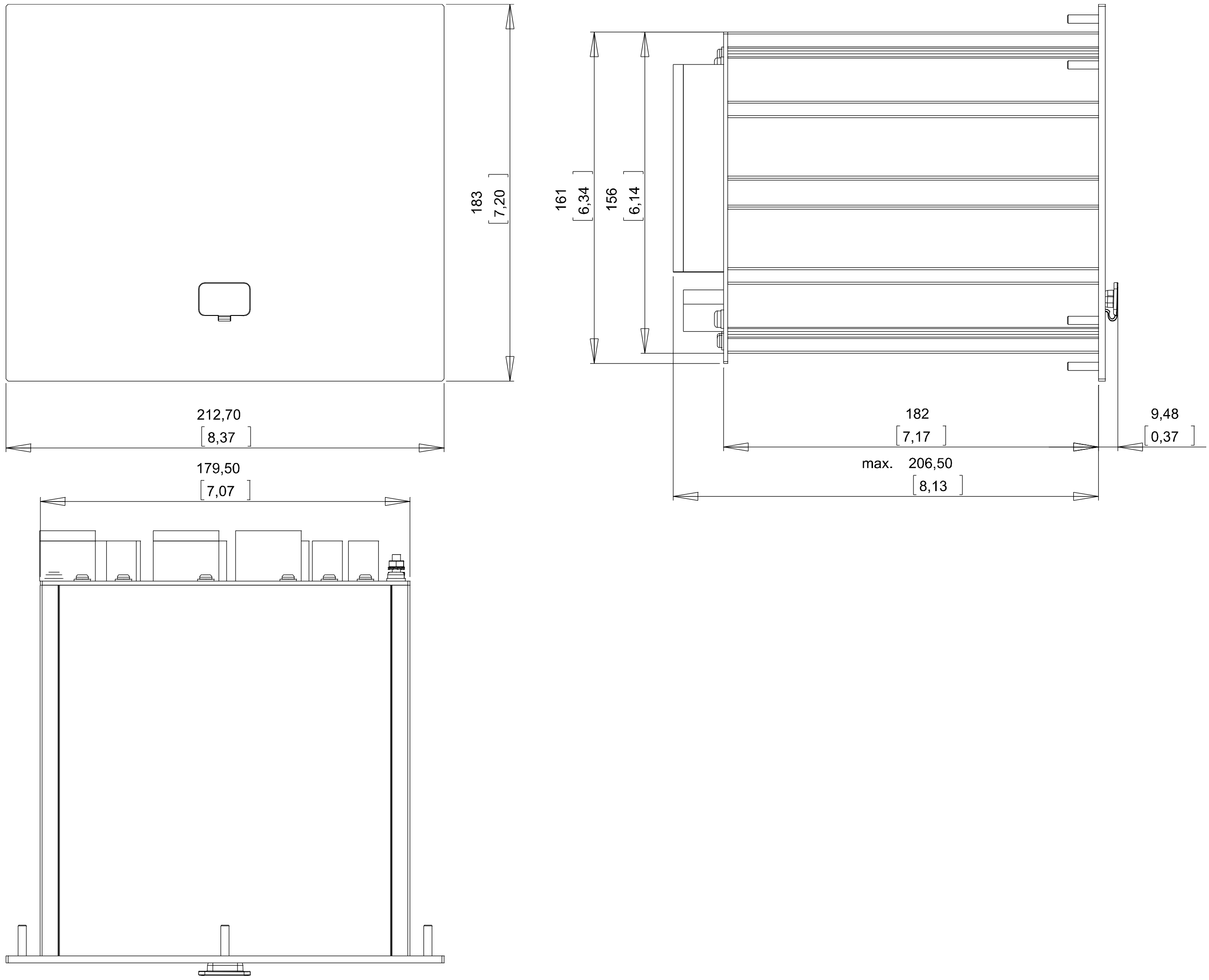
WARNING **The housing must be carefully earthed. Connect a ground cable (4 to 6 mm^2 / AWG 12-10) / 1,7 Nm [15 In-lb]) to the housing, using the screw, which is marked with the ground symbol (at the rear side of the device).**

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 In-lb]).

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 B2 Housing (Devices with 8 Softkeys)

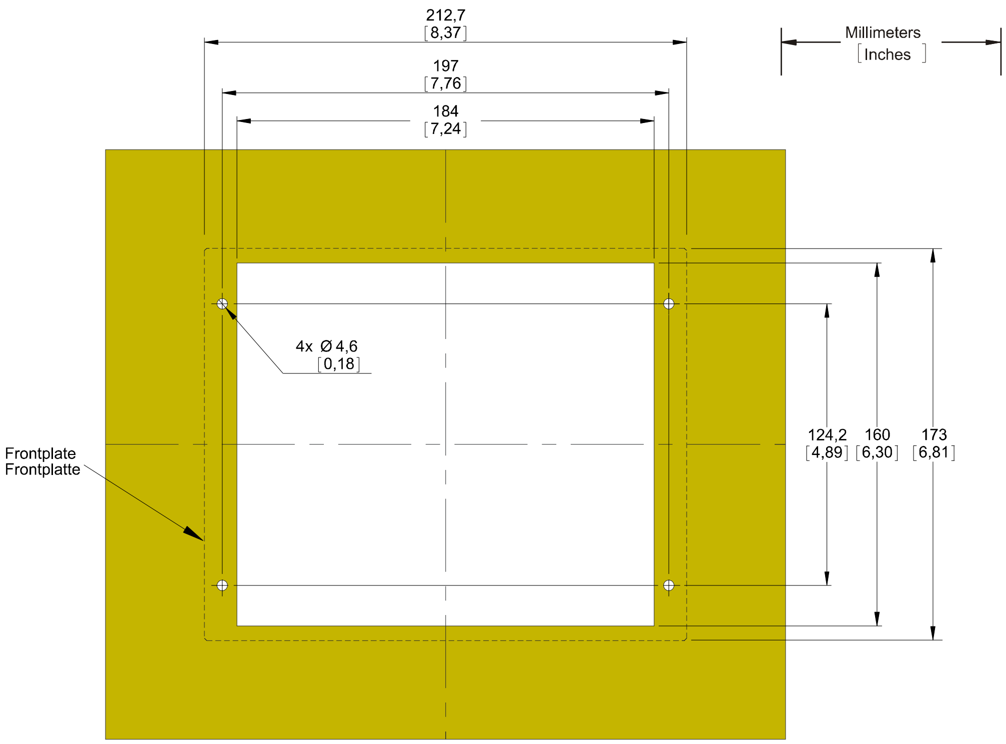
WARNING **The housing must be carefully earthed. Connect a ground cable (4 to 6 mm^2 / AWG 12-10) / 1,7 Nm [15 In-lb]) to the housing, using the screw, which is marked with the ground symbol (at the rear side of the device).**

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 In-lb]).

Installation Diagram 7-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 7 pushbuttons at the front side of the HMI.
(INFO-, C-, OK-Pushbutton and 4 Softkeys [Pushbuttons]).



B2 Housing Door Cut-out (7-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 In-lb]) to the housing, using the screw, which is marked with the ground symbol (at the rear side of the device).**

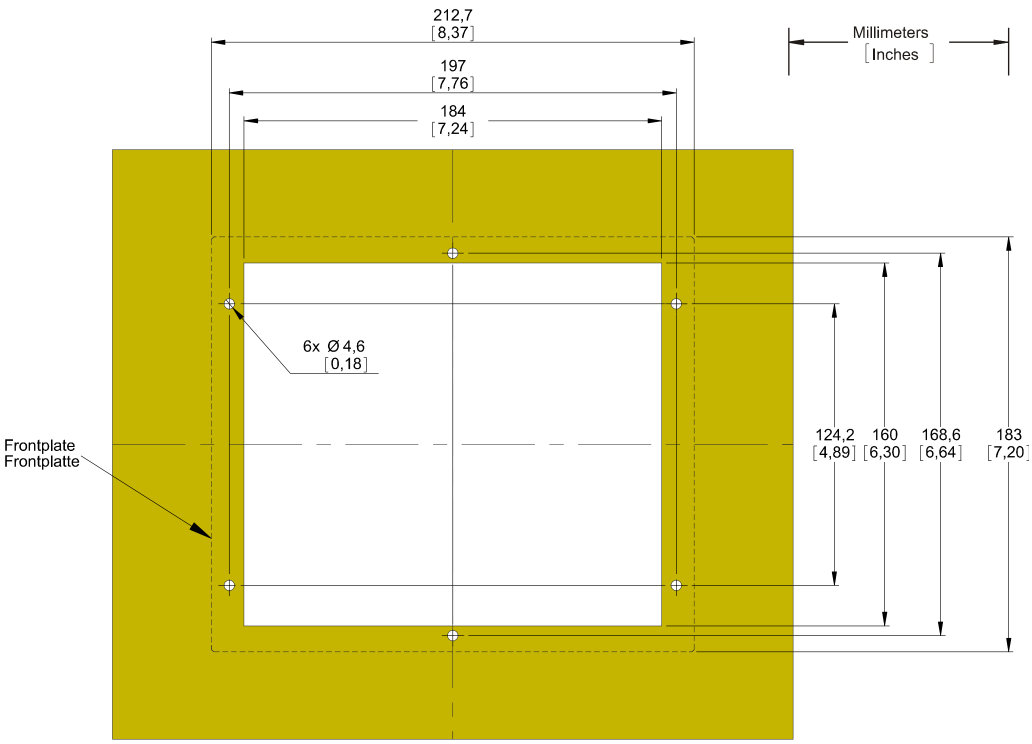
The power supply card needs a separate ground connection (2.5 mm^2 / AWG 14) at terminal X1 (0.56-0.79 Nm [5-7 In-lb]).

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 In-lb]). Overtightening the mounting nuts could due to personal injury or damage the relay.

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]).



B2 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 In-lb]) to the housing, using the screw, which is marked with the ground symbol (at the rear side of the device).**

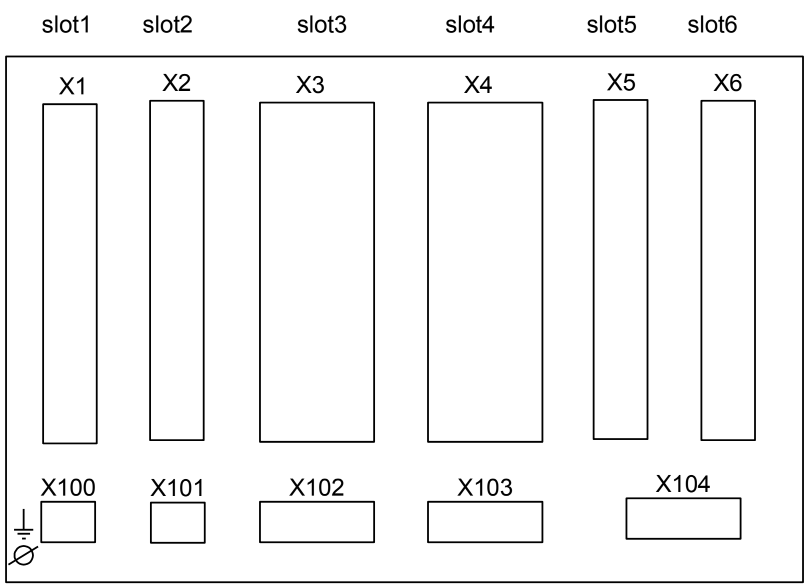
The power supply card needs a separate ground connection (2.5 mm^2 / AWG 14) at terminal X1 (0.56-0.79 Nm [5-7 In-lb]).

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 In-lb]). Overtightening the mounting nuts could due to personal injury or damage the relay.

Assembly Groups

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

Middle Housing B2



Rear view of B2 housing

Grounding

WARNING **The housing must be carefully grounded. Connect a ground cable (4 to 6 mm^2 / AWG 12-10) / 1,7 Nm [15 In-lb]) 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 In-lb]).

CAUTION The devices are very sensitive to electro-static discharges.

Legend for Wiring Diagrams

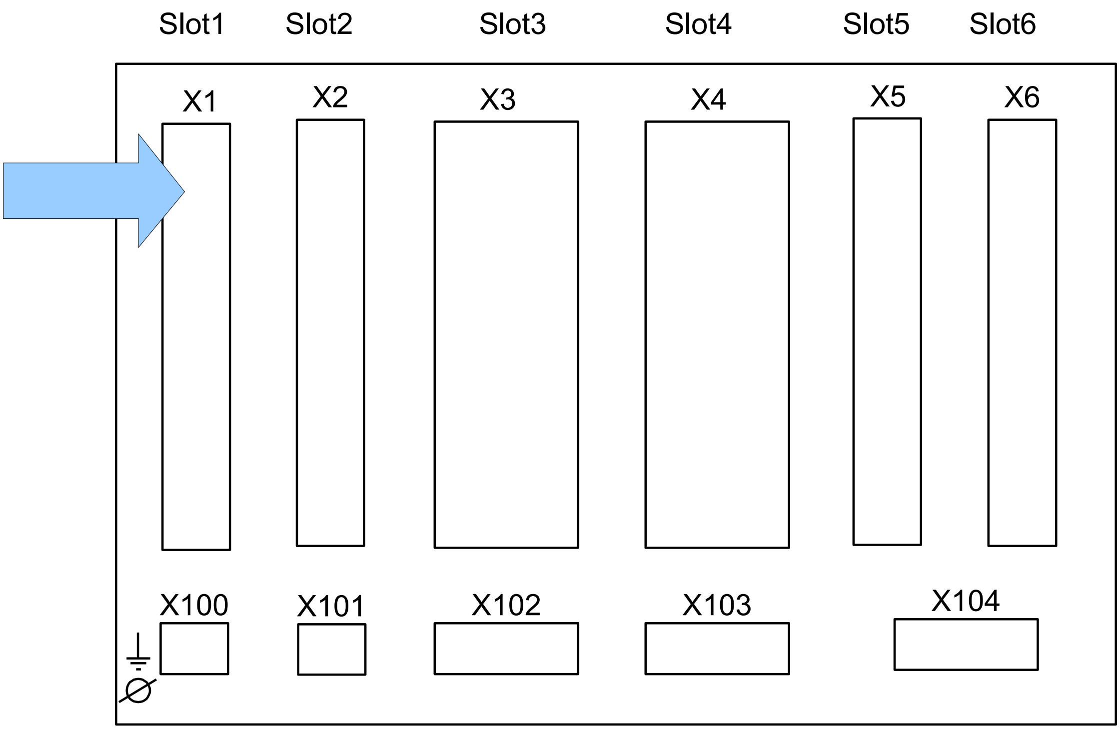
In this legend designations of various device types are listed, e. g. transformer protection, motor protection, generator protection, etc. Therefor it can occur that you will not find each designation on the wiring diagram of your device.

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.

Designation	Meaning
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 **Make sure, that the tightening torque is 0.56-0.79 Nm [5-7 In-lb].**

This assembly group comprises:

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

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.**

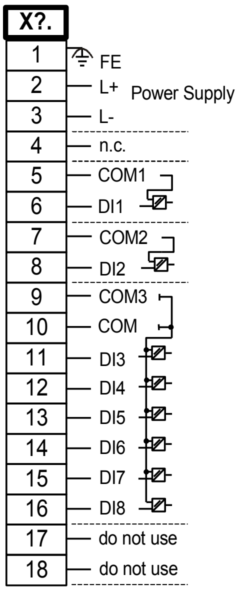
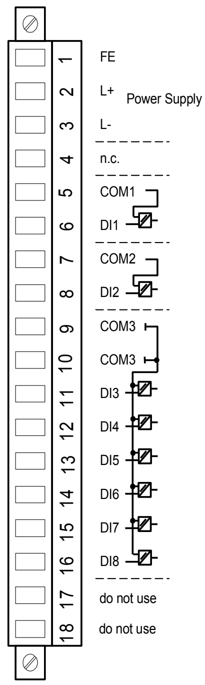
The digital inputs are provided with different switching thresholds (can be parameterized) (two AC and five DC input ranges). For the six grouped (connected to common potential) inputs and the two non-grouped inputs the following switching levels can be defined:

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

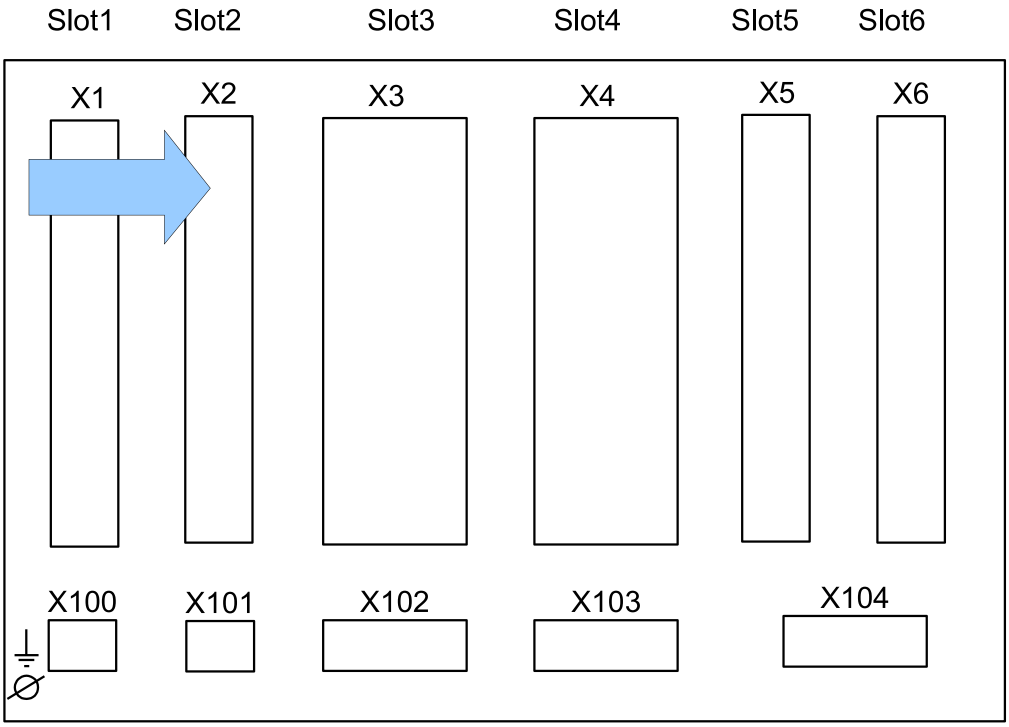
If a voltage >80% of the set switching threshold is applied at the digital input, the state change is recognized (physically “1”). If the voltage is below 40% of the set switching threshold, the device detects physically “0”.

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

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

Terminals

Electro-mechanical assignment
DI-8P X 

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.**

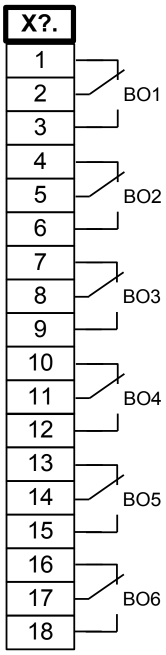
Binary Output Relays

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

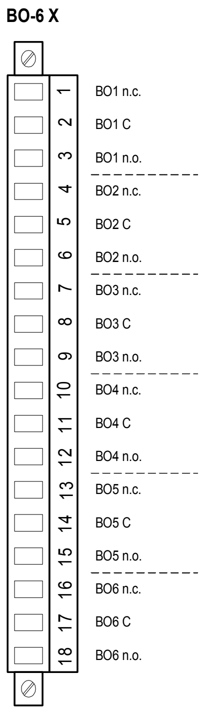
WARNING **Make sure that the tightening torque is 0.56-0.79 Nm [5-7 In-lb].**

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

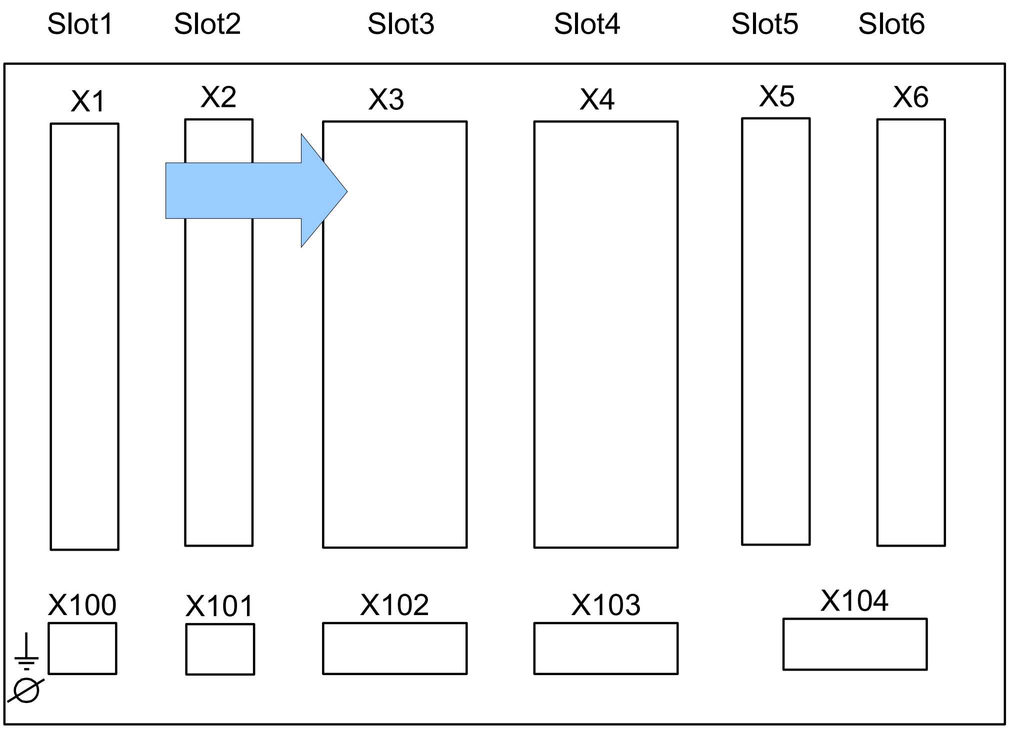
Terminals



Electro-mechanical assignment



Slot X3: Current Transformer Measuring Inputs



Rear side of the device (Slots)

This slot contains the current transformer measuring inputs. Depending on the order code, this might be a standard current measuring card or a sensitive ground current measuring card.

Available assembly groups in this slot:

- **(TI-4 X3):** Standard ground current measuring card.
- (**TIS-4 X3):** Sensitive Ground current measuring card. The Technical data of the sensitive ground measuring input deviate are different to the Technical Data of the phase current measuring inputs. Please refer to the Technical Data.

TI X- Standard Phase and Ground Current Measuring Input Card

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

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

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

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

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

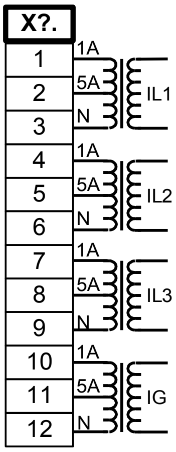
DANGER The current measuring inputs may exclusively be connected to current measuring transformers (with galvanic separation).

WARNING

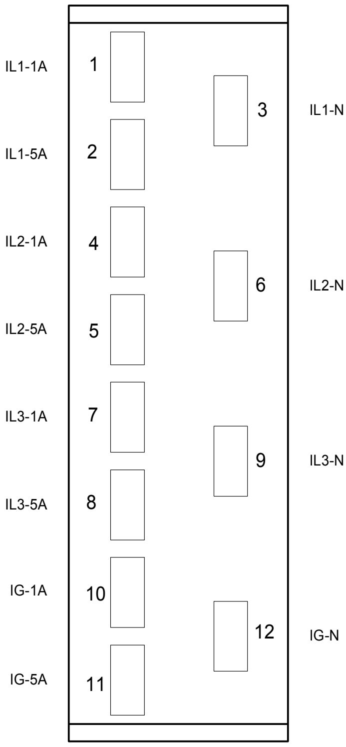
- Do not interchange the inputs (1 A/5 A)
- Make sure the transformation ratios and the power of the CTs are correctly rated. If the rating of the CTs is not right (overrated), then the normal operational conditions may not be recognized. The pickup value of the measuring unit amounts approx. 3% of the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

WARNING **Make sure, that the tightening torque is 2 Nm [17.7 In-lb].**

Terminals



Electro-mechanical assignment



TIS X – Phase and Sensitive Ground Current Measuring Card

The device is provided with 4 current measuring inputs: three for measuring the phase currents and one for measuring of the earth current. The sensitive Ground current Input has different technical data. Please refer to chapter Technical Data.

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

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

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

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

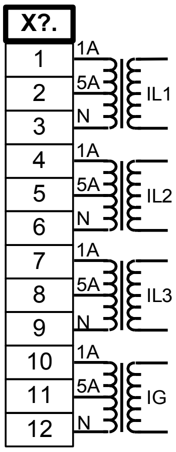
DANGER The current measuring inputs may exclusively be connected to current measuring transformers (with galvanic separation).

WARNING

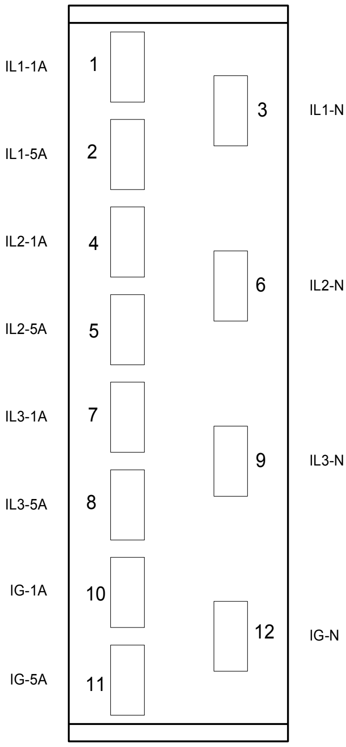
- Do not interchange the inputs (1 A/5 A)
- Make sure the transformation ratios and the power of the CTs are correctly rated. If the rating of the CTs is not right (overrated), then the normal operational conditions may not be recognized. The pickup value of the measuring unit amounts approx. 3% of the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

WARNING Make sure, that the tightening torque is 2 Nm [17.7 In-lb].

Terminals



Electro-mechanical assignment



Current Transformers (CT)

Check the installation direction.

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

DANGER **The current measuring inputs may exclusively be connected to current measuring transformers (with galvanic separation).**

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

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.**

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

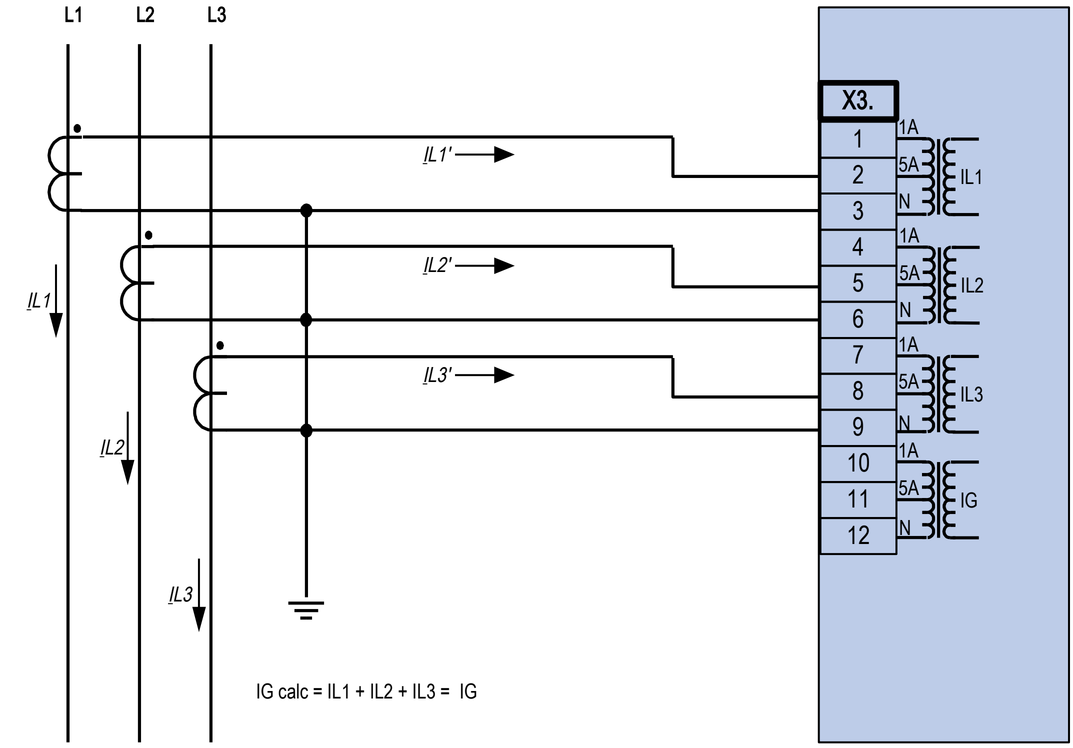
Sensitive Ground Current Measurement

The proper use of sensitive current measuring inputs is the measurement of small currents like they could occur in isolated and high resistance grounded networks.

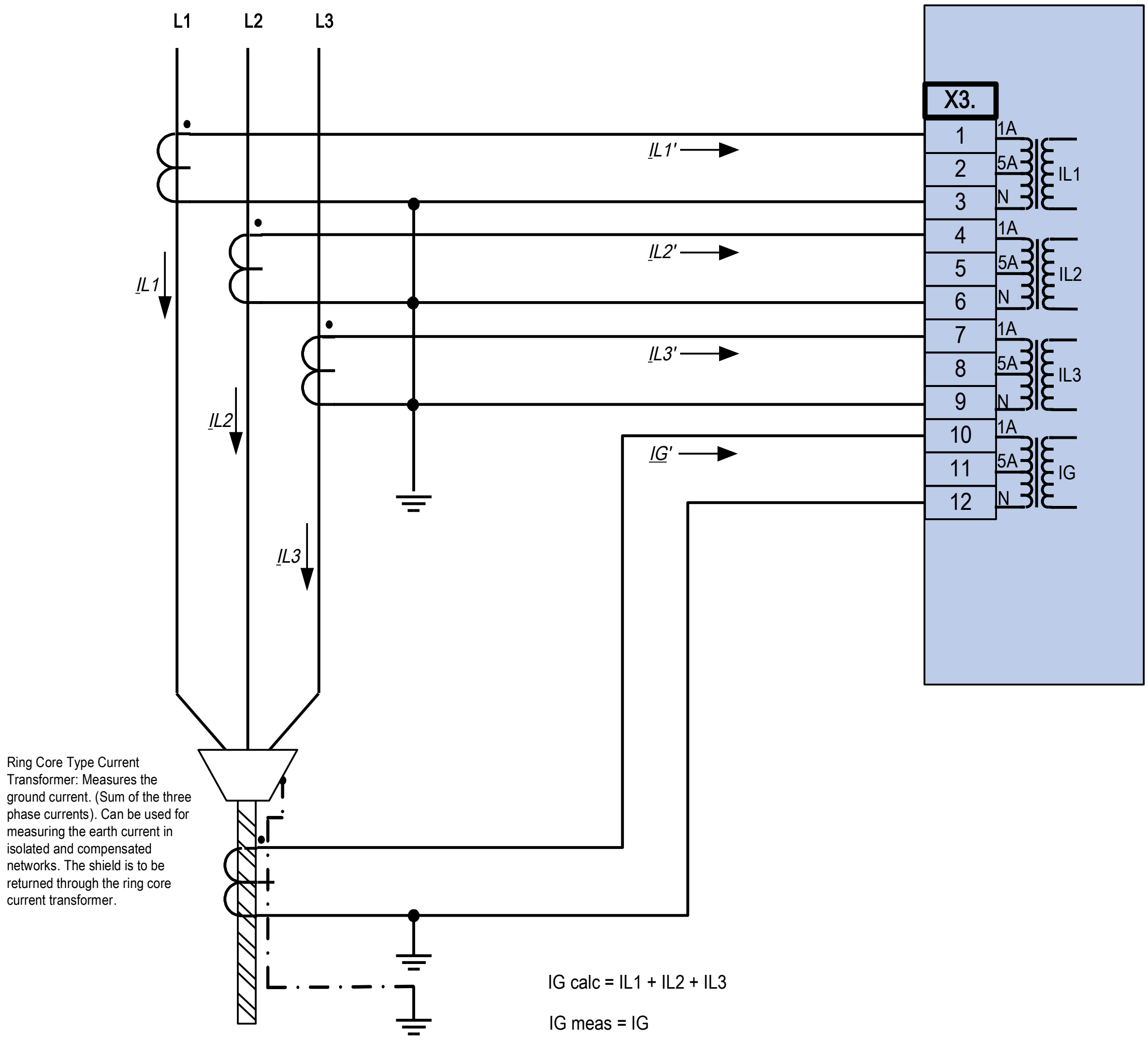
Due to the sensitiveness of these measuring inputs don´t use them for the measurement of ground short circuit currents like they occur in solidly earthed networks.

If a sensitive measuring input should be used for the measurement of ground short circuit currents, it has to be ensured, that the measuring currents are transformed by a matching transformer according to the technical data of the protective device.

Current Transformer Connection Examples



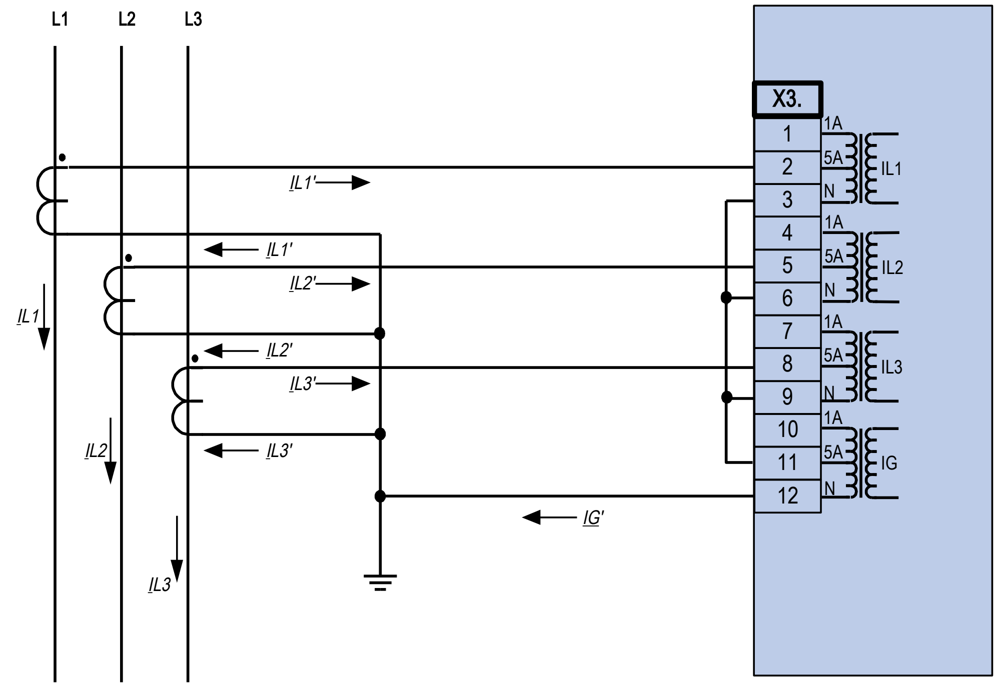
Three phase current measurement; In secondary = 5 A.



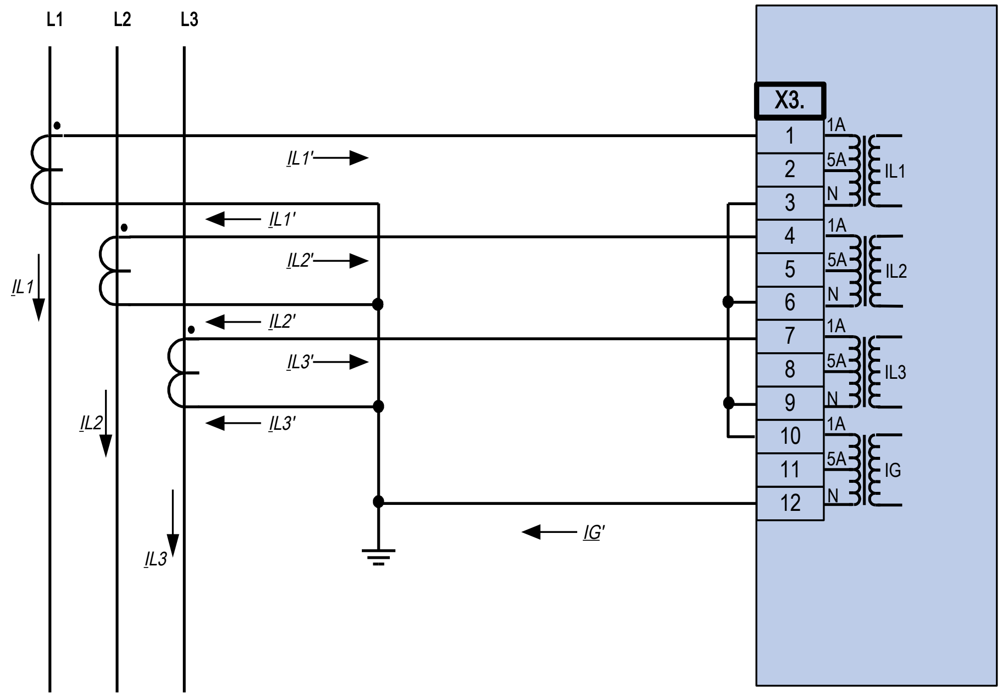
Three phase current measurement; In secondary = 1 A.
Earth-current measuring via cable-type current transformer ; IGnom secondary = 1 A.

Warning!

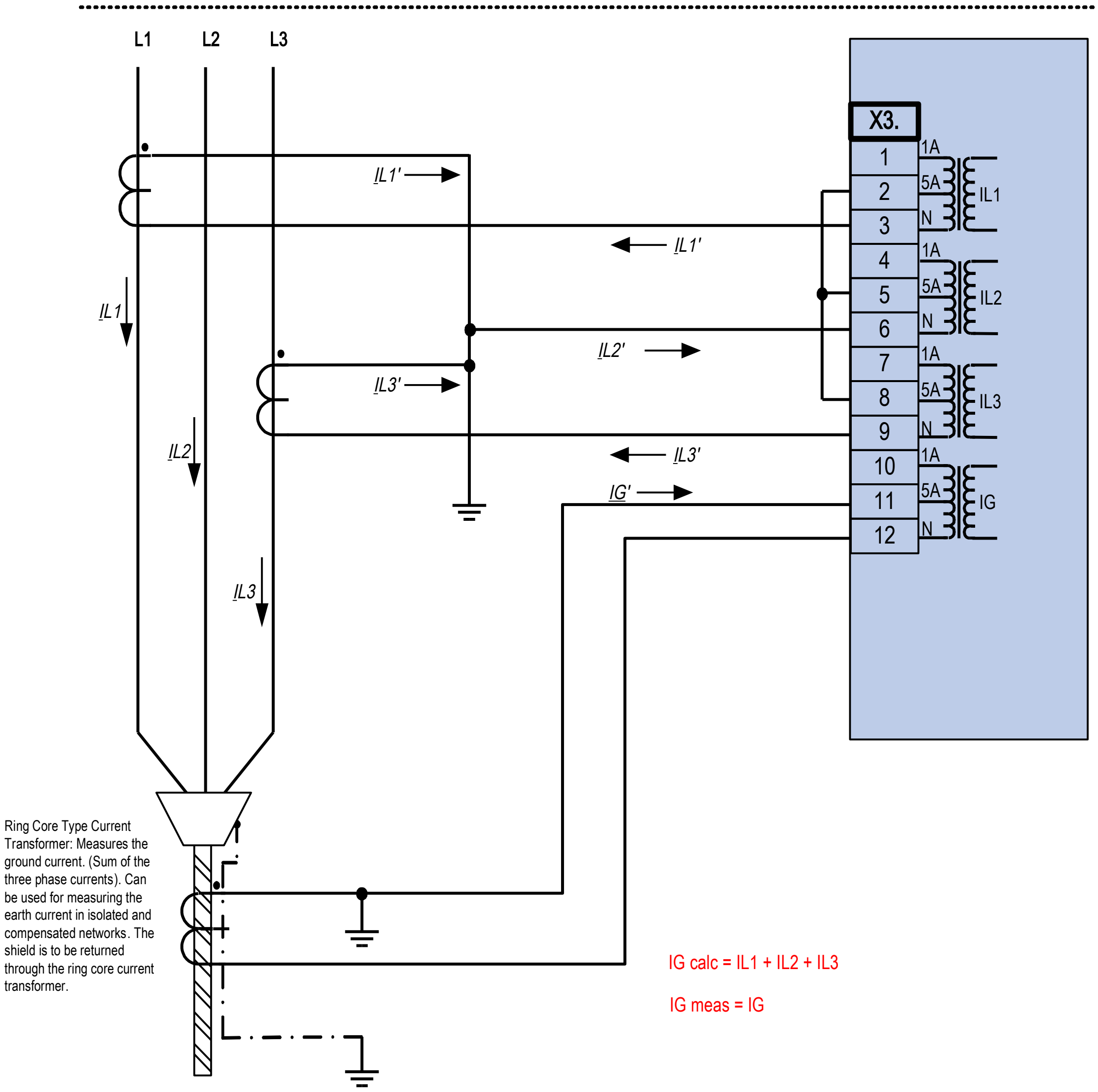
The shielding at the dismantled end of the line has to be put through the cable-type current transformer and has to be grounded at the cable side.



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

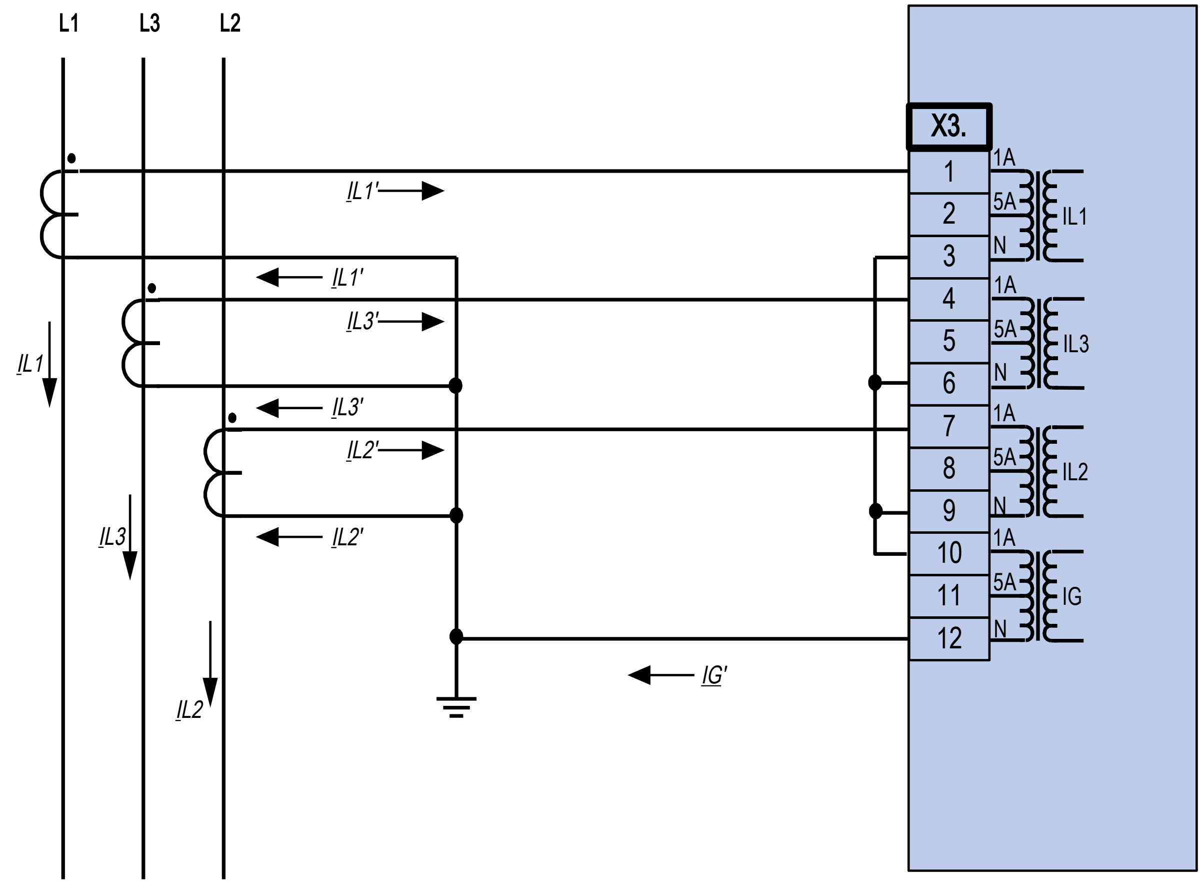


Three phase current measurement; In secondary = 1 A.
Earth-current measuring via Holmgreen-connection; IGnom secondary = 1 A.



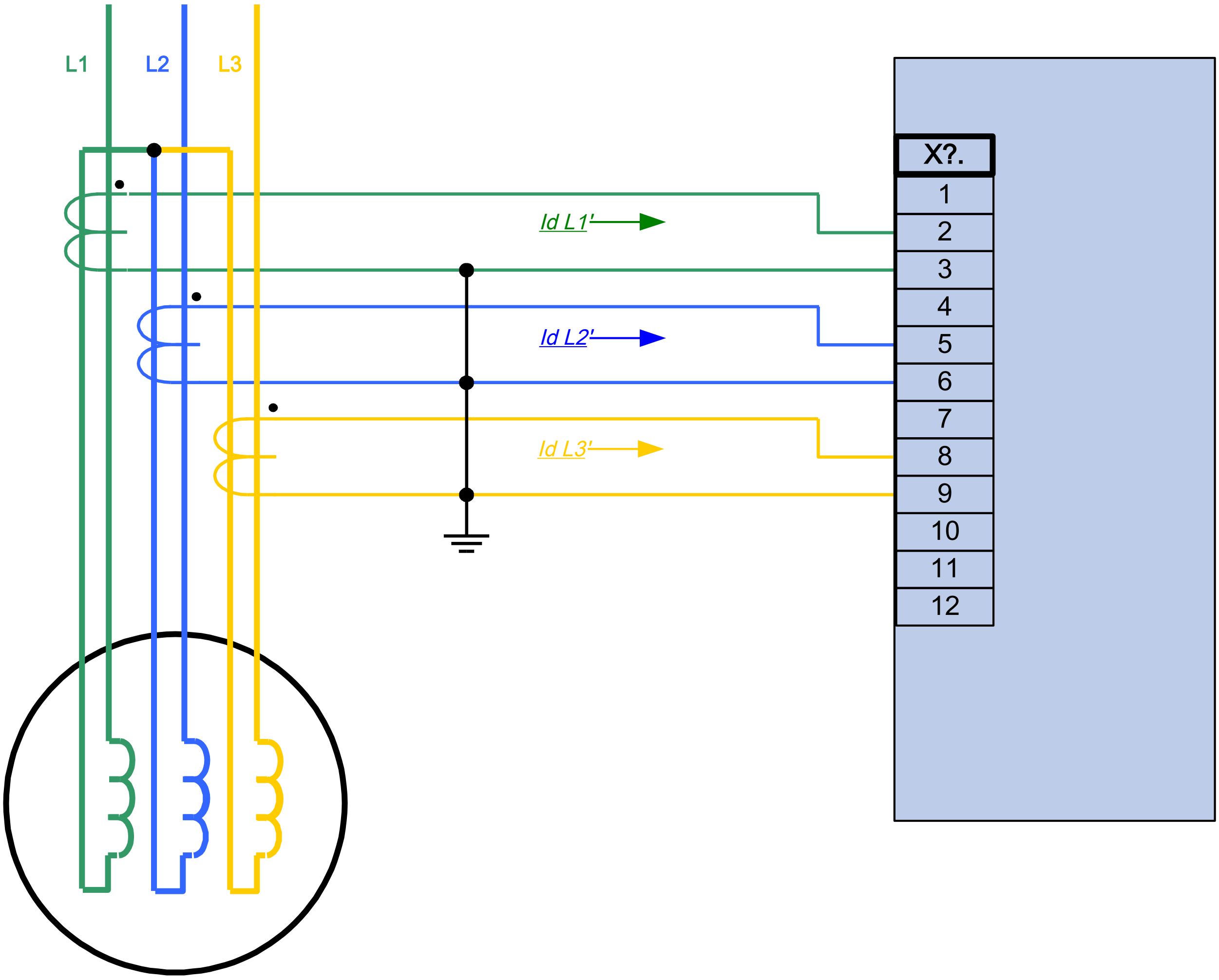
Two phase current measurement (Open Delta); In secondary = 5 A.
Earth-current measuring via cable-type current transformer ; IGnom secondary = 5 A.

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

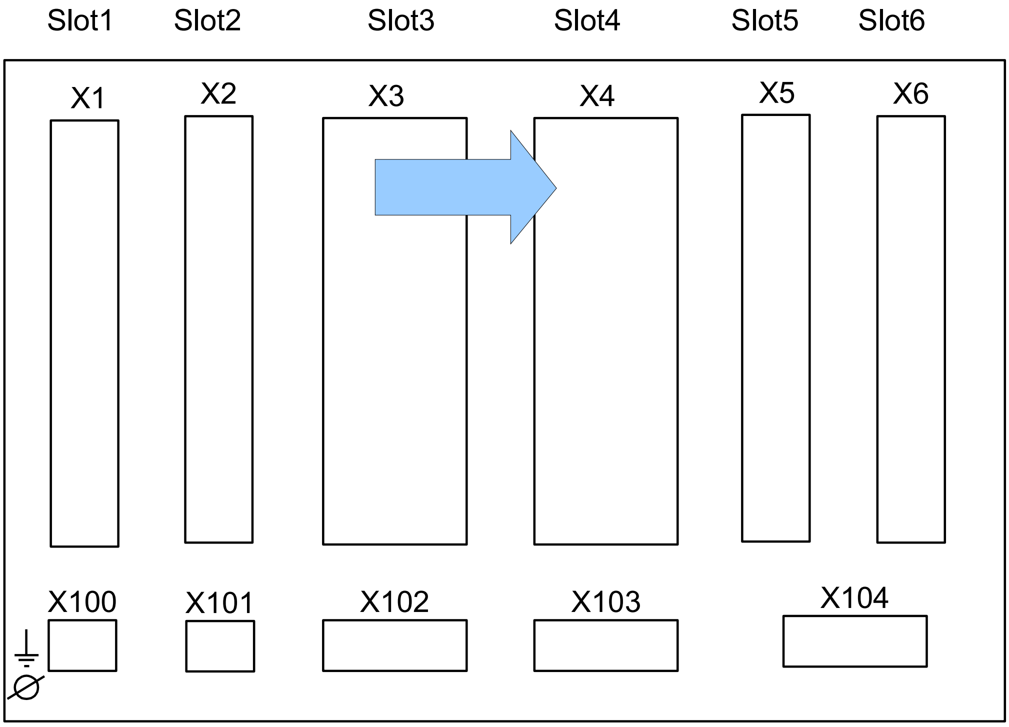


Three phase current measurement; In secondary = 1 A.
Earth-current measuring via Holmgreen-connection; IGnom secondary = 1 A.

Differential Protection Variant for Electrical Machinery (Availability depends on ordered device)



Slot X4: 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)

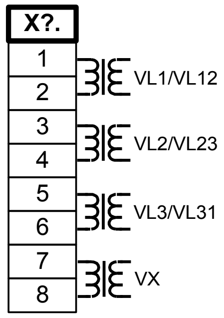
WARNING **Make sure that the tightening torque is 1.2-1-6 Nm [11-15 In-lb].**

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

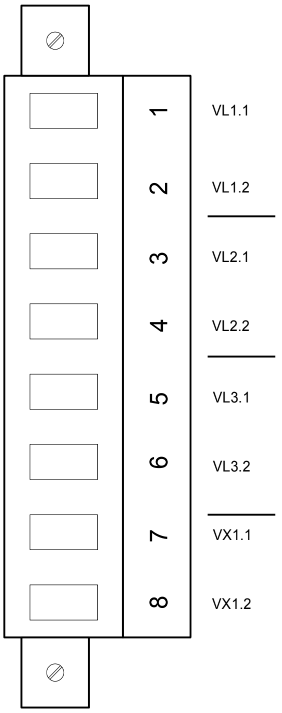
For the V-connection the parameter »VT con« has to be set to »phase-to-phase«.

Please refer to the Technical Data.

Terminal Marking



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.

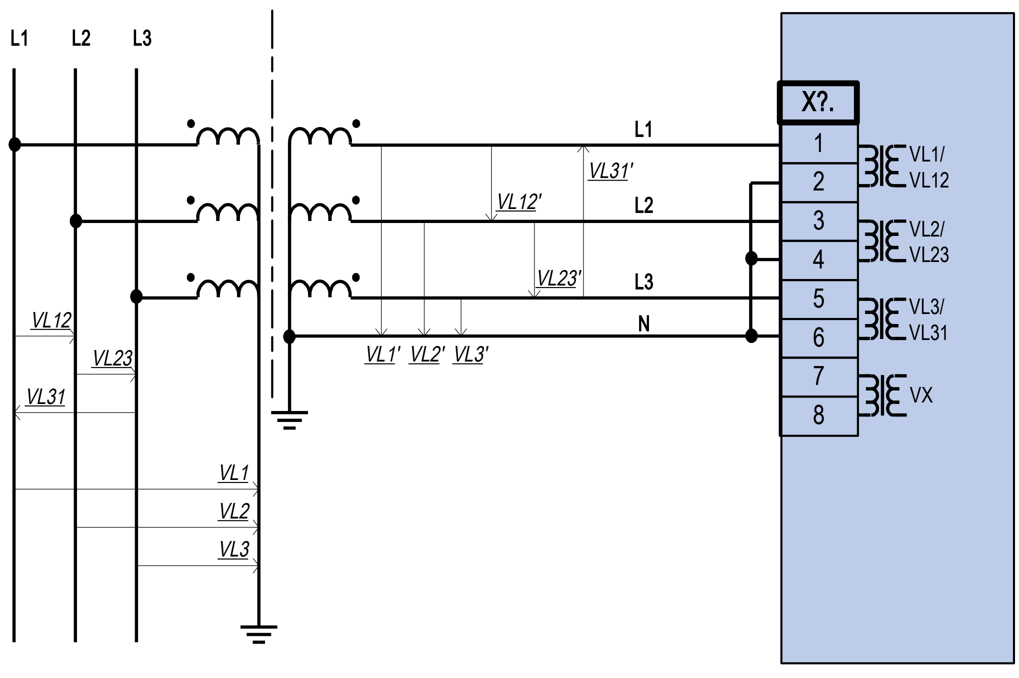
NOTICE **Take connection of the measuring transformers (star connection/open delta connection) duly into account.**

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

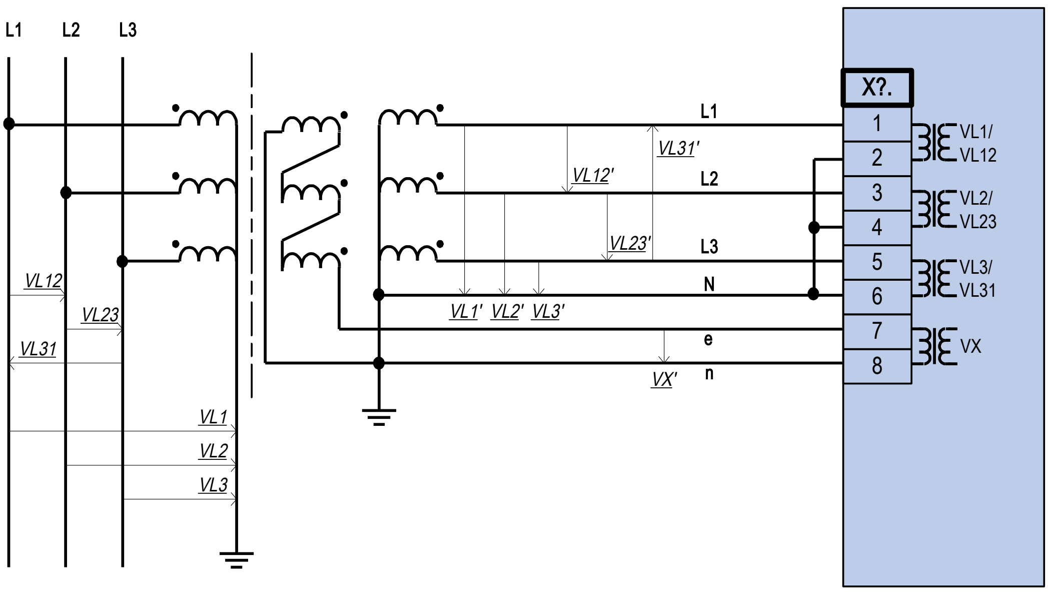
Compare the values shown in the device display with the readings of the measuring instruments. The deviation must be according to the technical data.

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.**

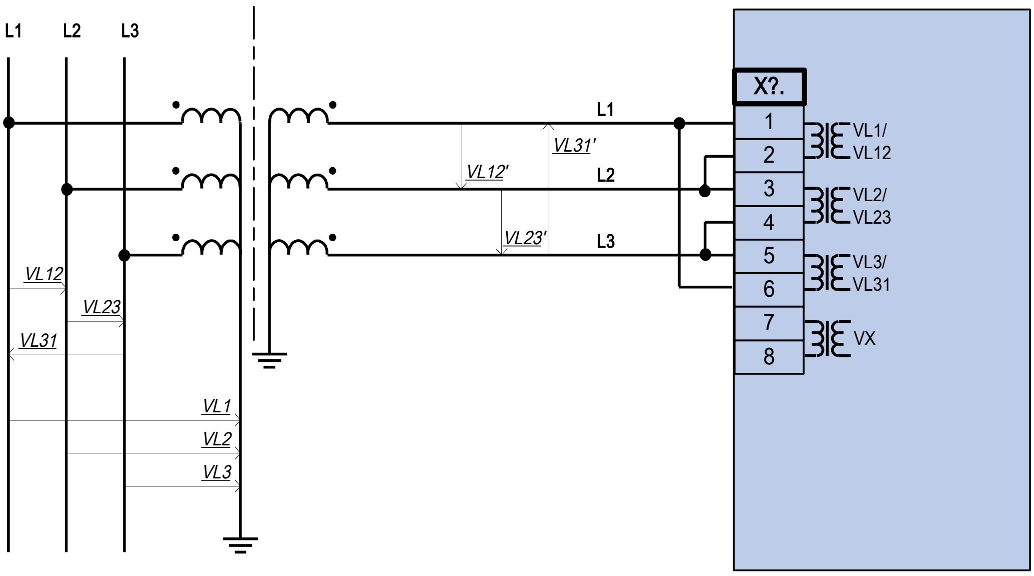
Wiring Examples of the Voltage Transformers



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

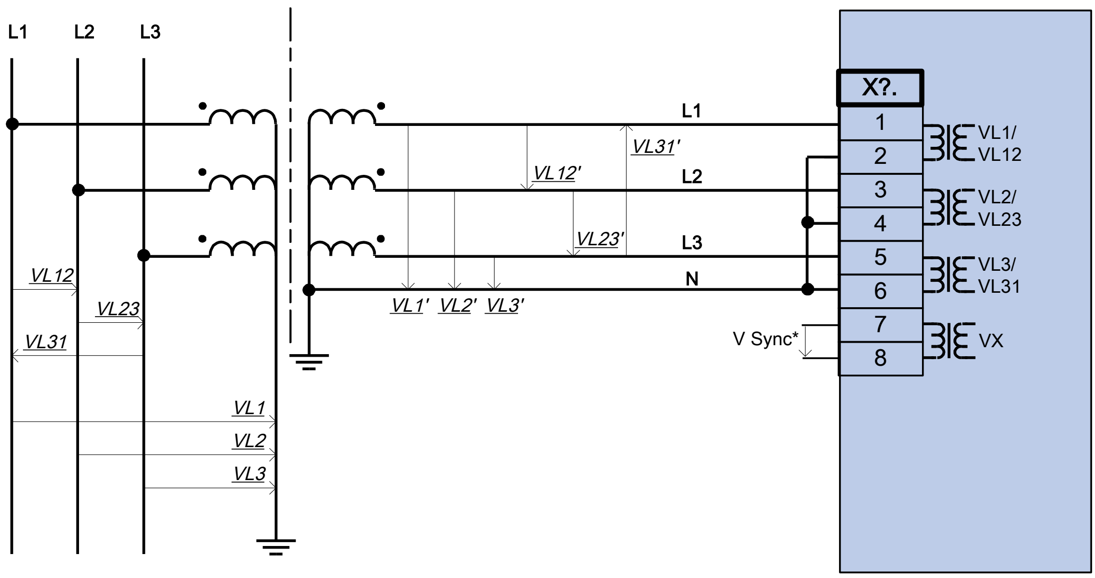


Three-phase voltage measurement - wiring of the measurement inputs: "star-connection"
Measurement of the residual voltage VG via auxilliary windings (e-n) "broken delta"



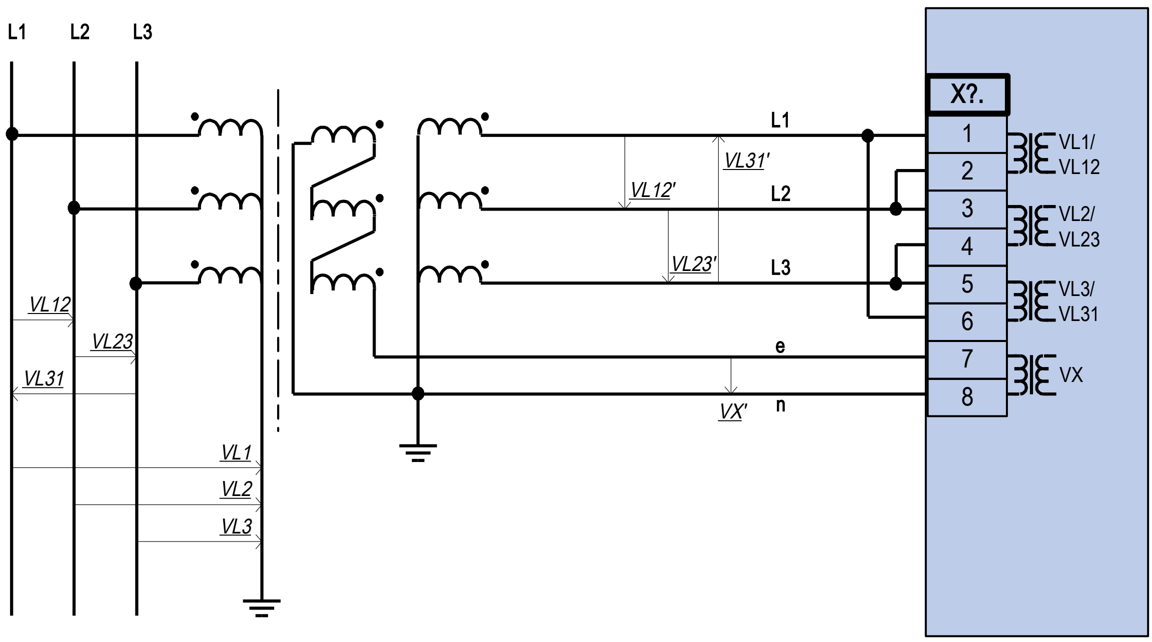
Three-phase voltage measurement - wiring of the measurement inputs: "open delta"

Notice!
Calculation of the residual voltage VG is not possible

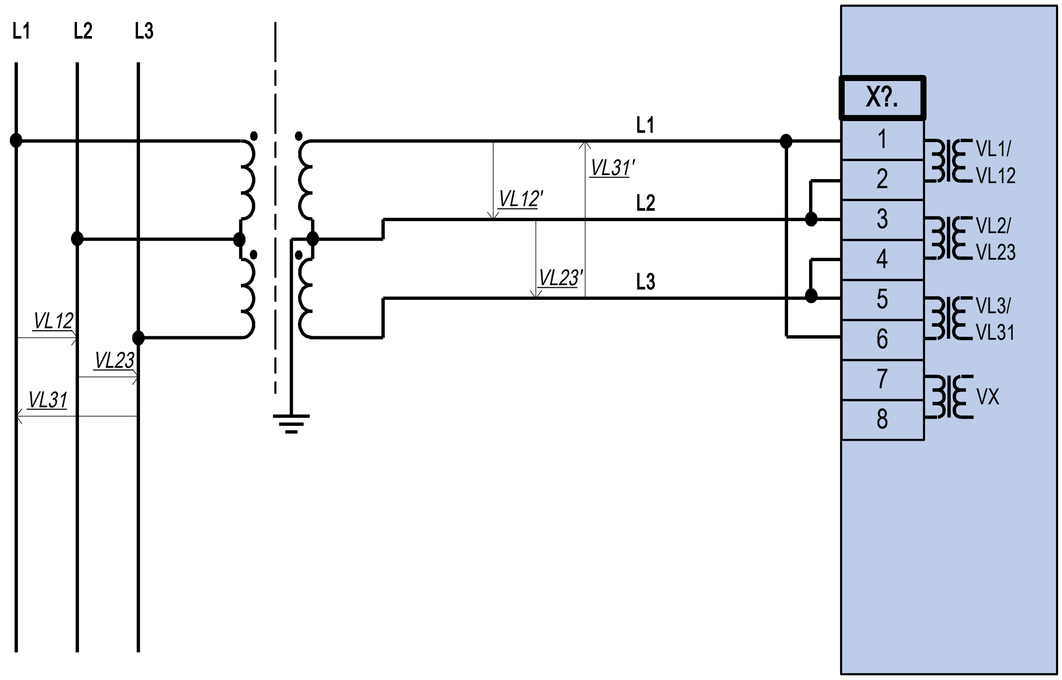


= Availability dependent on device type

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

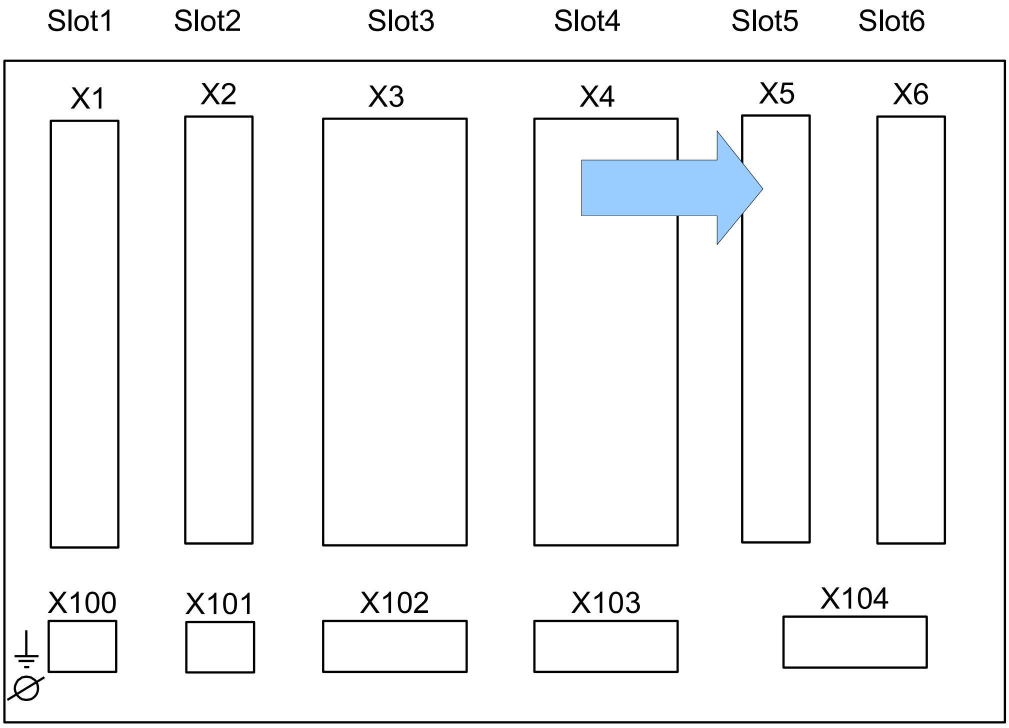


Three-phase voltage measurement - wiring of the measurement inputs: "open delta" Measurement of the residual voltage VG via auxilliary windings (e-n) "broken delta"



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

Slot X5: Analog 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 X5):** Assembly Group with 6 Relay Outputs. The Relay Output Card is identical with the one on Slot X2.

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

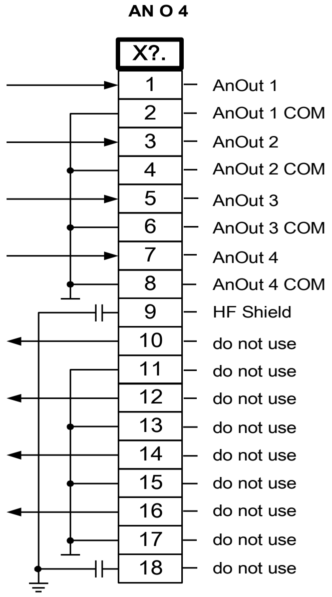
4A0 X - Analog Outputs

WARNING **Make sure that the tightening torque is 0.56-0.79 Nm [5-7 In-lb].**

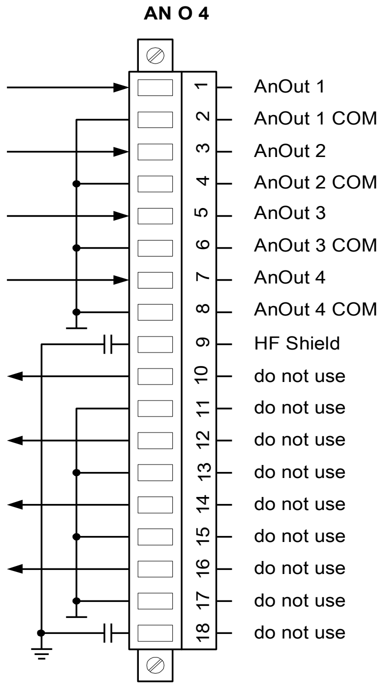
There are 4 Analog Output channels that are configurable to either output 0-20 mA, 4-20 mA, or 0-10 V. Each of the 4 channels can be independently programmed to either of these three output modes.

For details on the Analog Output, please refer to the Technical Data.

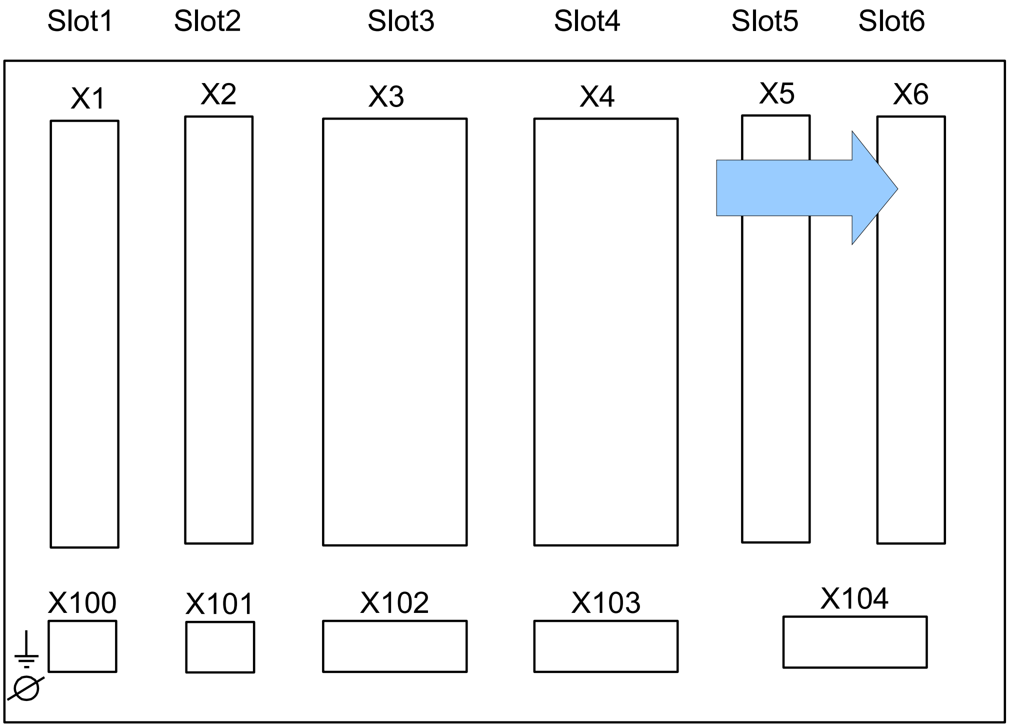
Terminals



Electro-mechanical assignment



Slot X6: Output Relays



Rear side of the device (Slots)

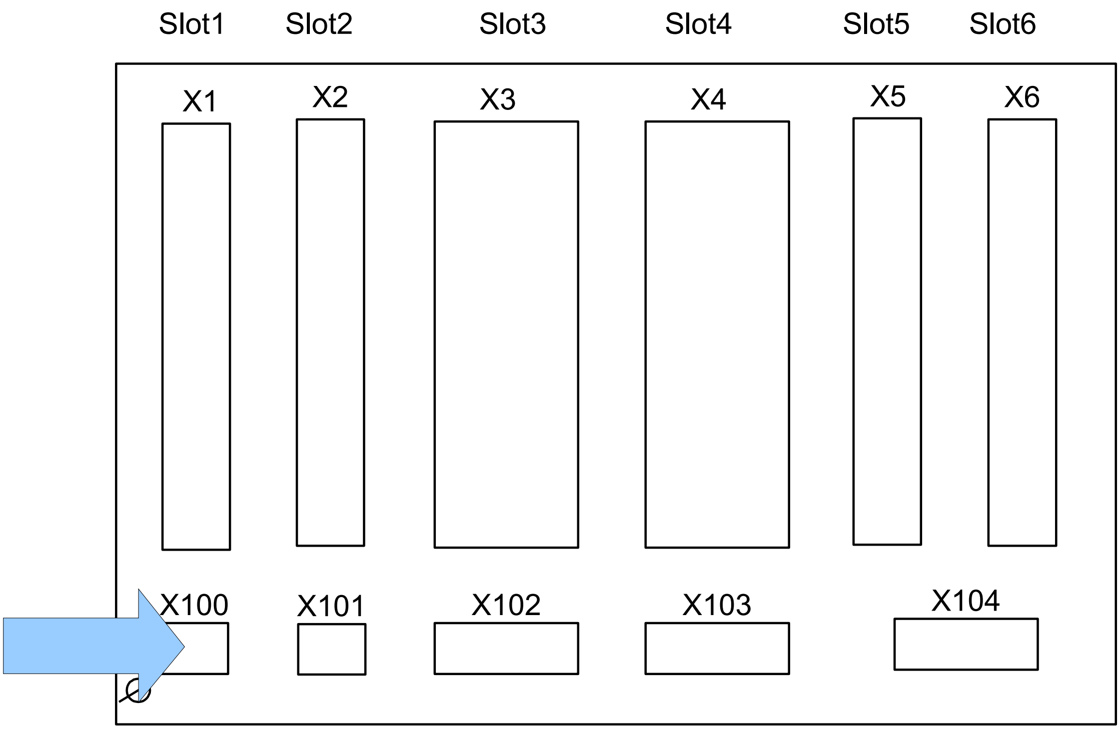
The type of card in this slot is dependent on the ordered device type. The different variants have a different scope of functions.

Available assembly groups in this slot:

- **(RO-6 X6):** Assembly Group with 6 Relay Outputs.

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

Slot X100: Ethernet Interface

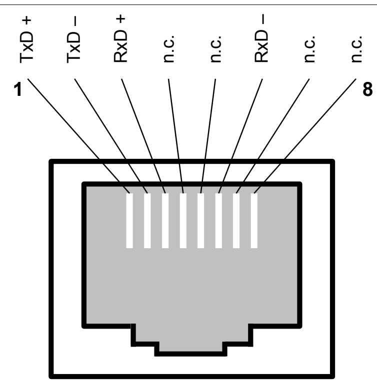


Rear side of the device (Slots)

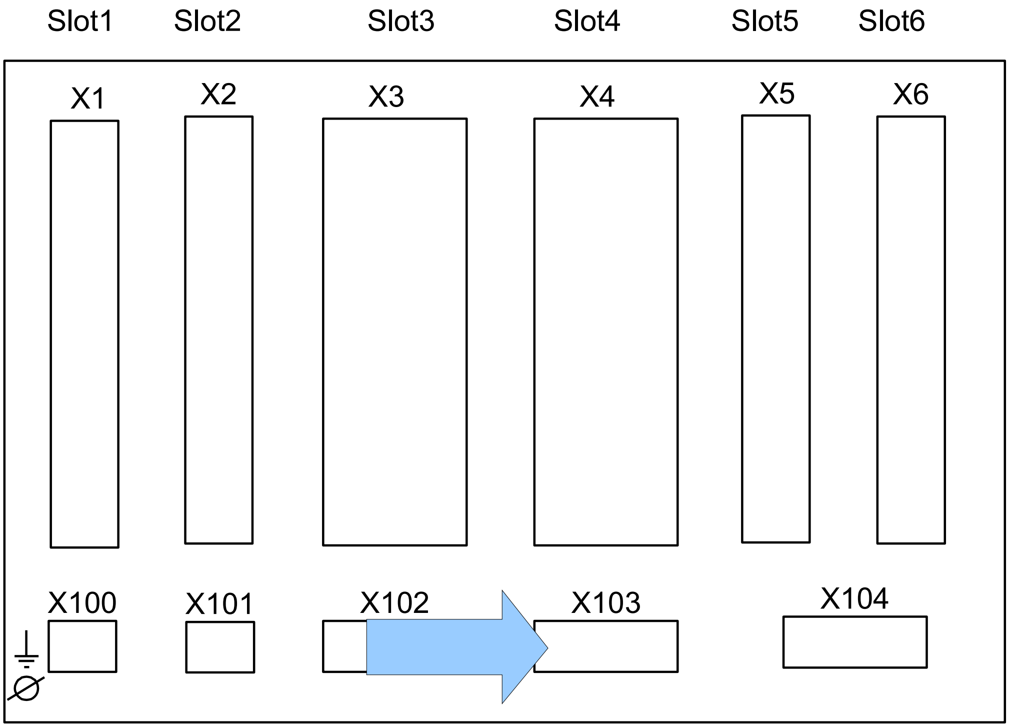
An Ethernet interface may be available depending on the device type ordered.

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

Ethernet - RJ45

Terminals


Slot 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

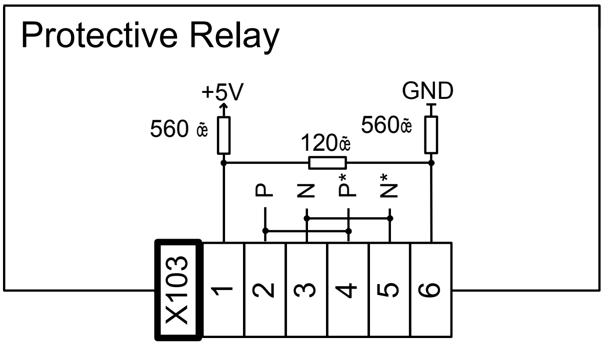
NOTICE **The available combinations can be gathered from the ordering code.**

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

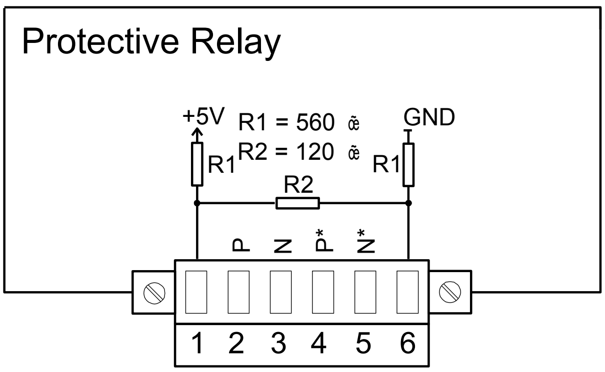
WARNING **There are two different versions of the RS485 interface. By means of the wiring diagram on the top of your device, you have to find out which version is built in your device (Type1 or Type2).**

WARNING **Make sure that the tightening torque is 0.22-0.45 Nm [2-4 In-lb].**

RS485 – Type 1 (see wiring diagram)



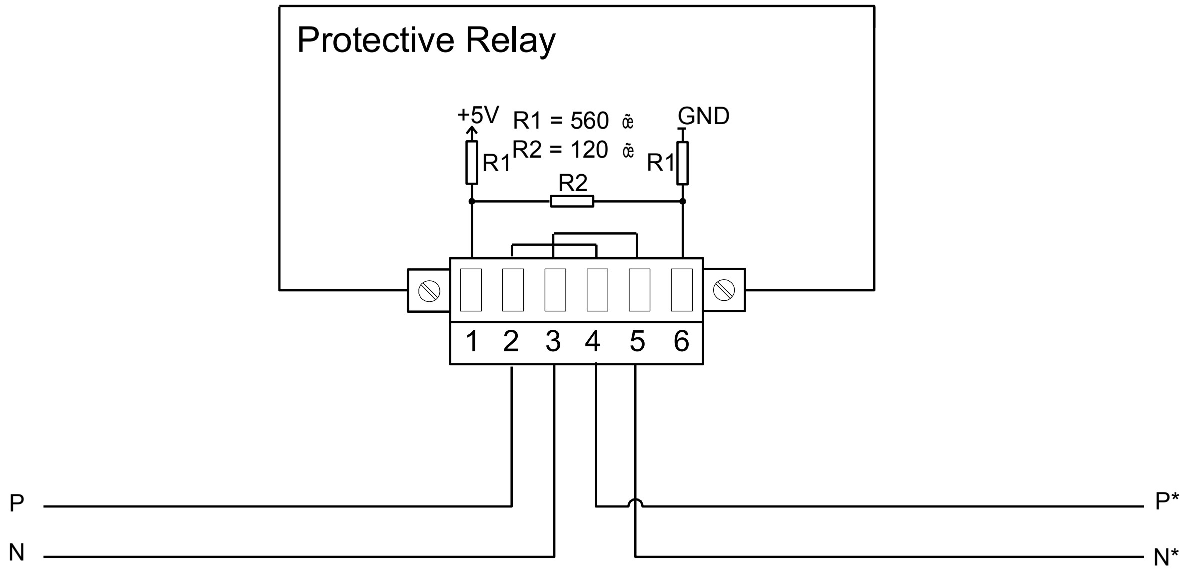
Electro-mechanical assignment Type 1 (see wiring diagram)



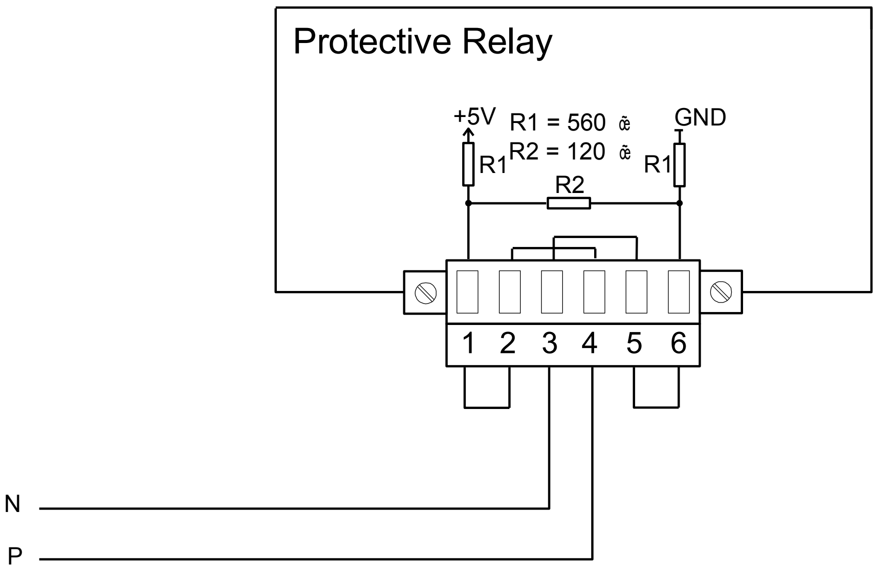
NOTICE The Modbus® / IEC 60870-5-103 connection cable must be shielded. The shielding has to be fixed at the screw which is marked with the ground symbol at the rear side of the device.

The communication is Halfduplex.

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



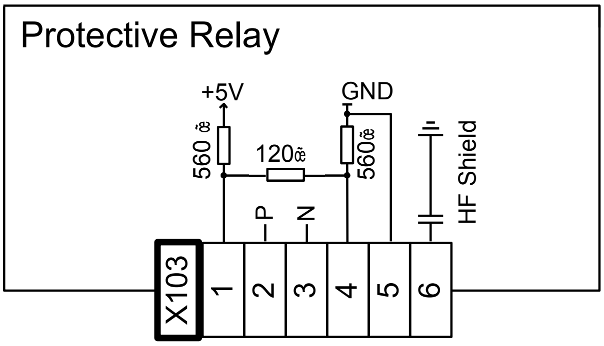
Type 1 Wiring example, Device at the End of the BUS (using the integrated Terminal Resistor)



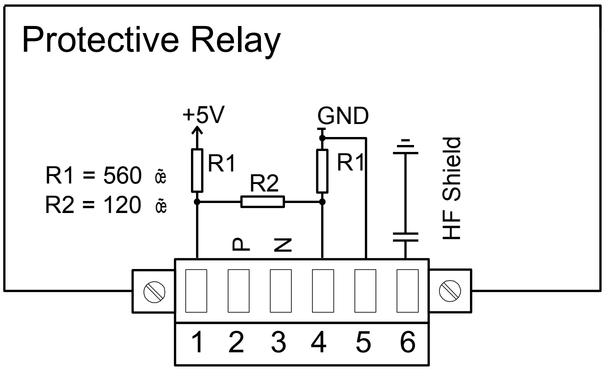
WARNING **There are two different versions of the RS485 interface. By means of the wiring diagram on the top of your device, you have to find out which version is built in your device (Type1 or Type2).**

WARNING **Make sure that the tightening torque is 0.22-0.45 Nm [2-4 In-lb].**

RS485 – Type 2 (see wiring diagram)



Electro-mechanical assignment Type 2 (see wiring diagram)

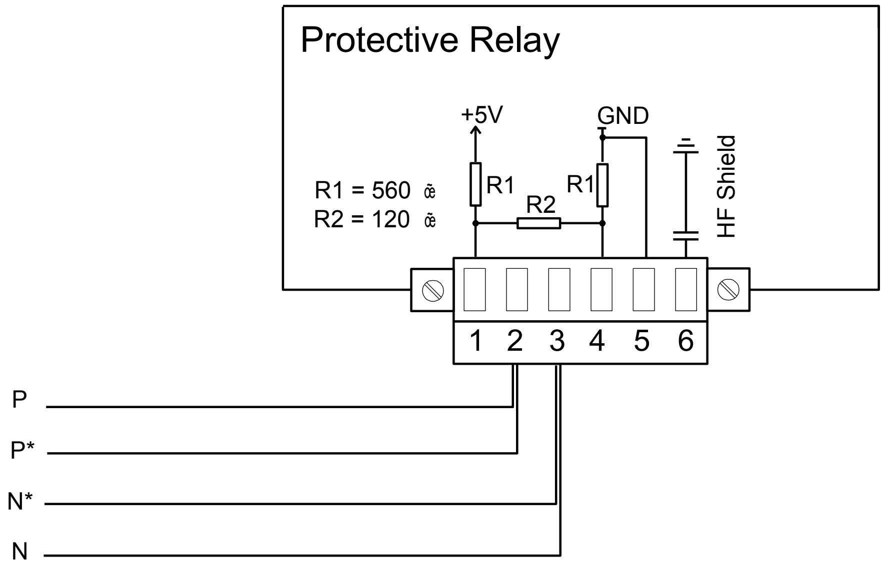


NOTICE

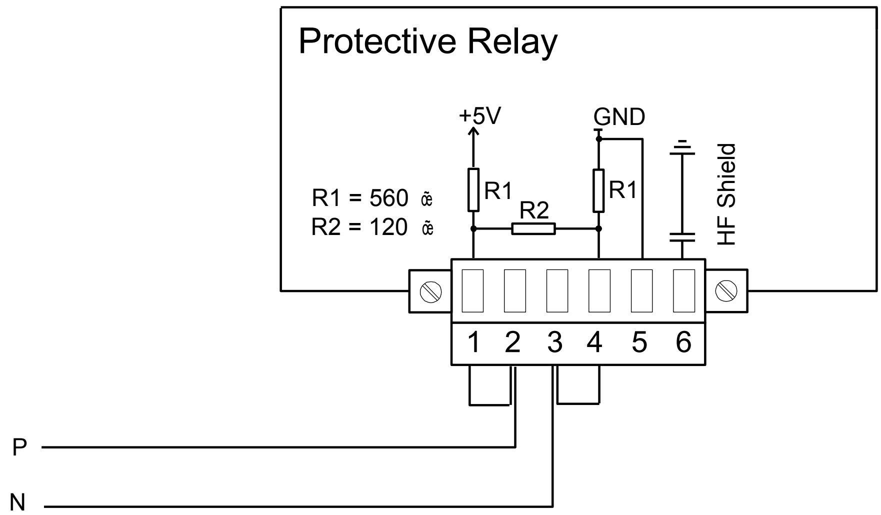
The Modbus® / IEC 60870-5-103 connection cable must be shielded. The shielding has to be fixed at the screw which is marked with the ground symbol at the rear side of the device.

The communication is Halfduplex.

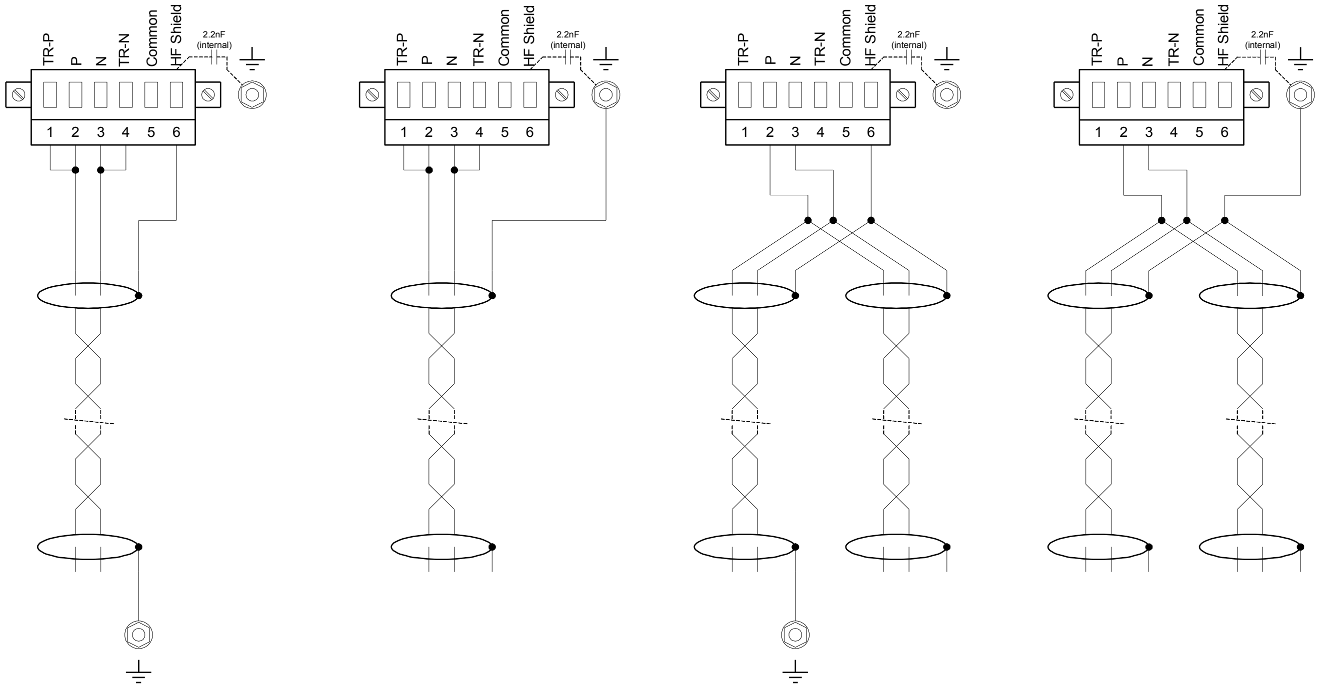
Type 2 Wiring example, Device in the Middle of the BUS



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



Type 2 Shielding Options (2-wire + Shield)



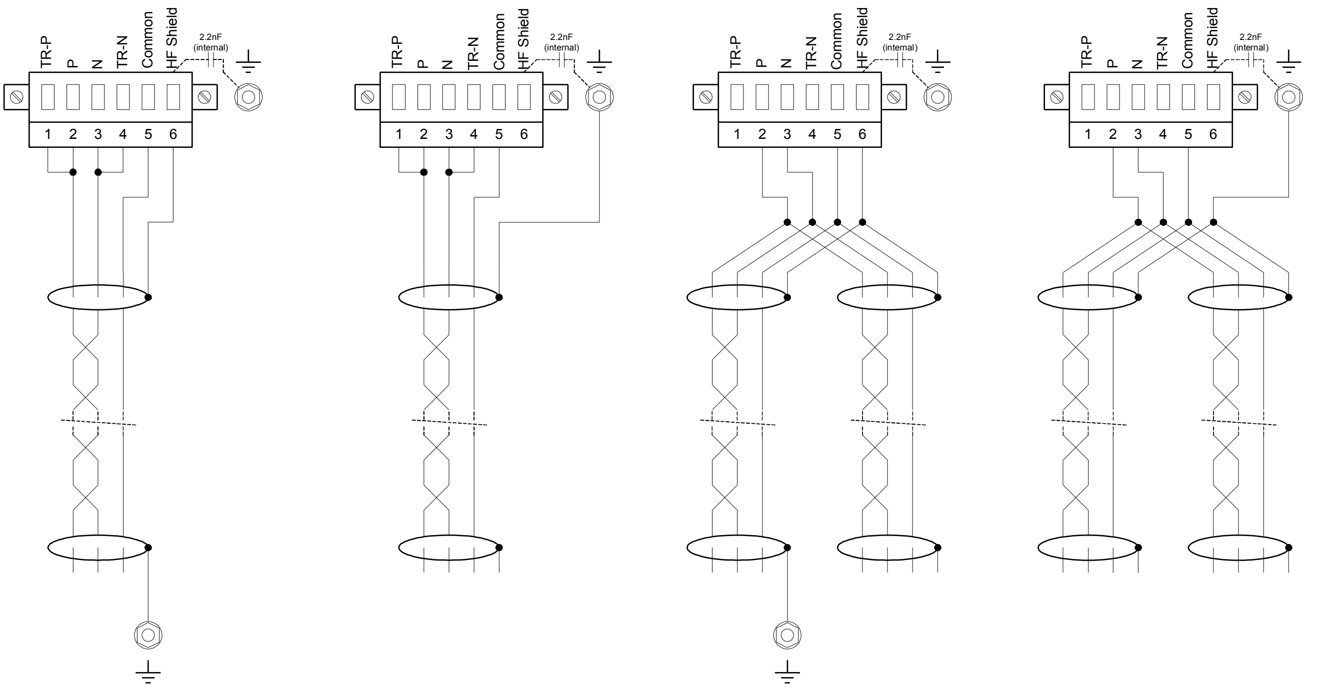
Shield at bus master side connected to earth termination resistors used

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

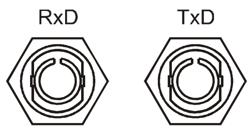
Shield at bus device side connected to earth termination resistors used

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

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

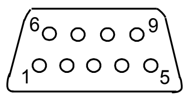
Profibus DP/ Modbus® RTU / IEC 60870-5-103 via fibre optic

Fibre Optic



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

D-SUB



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

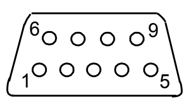
6 VP: pos. Potential of the aux voltage supply

8 RxD TxD - N: Low-Level

NOTICE

Profibus DP via D-SUB

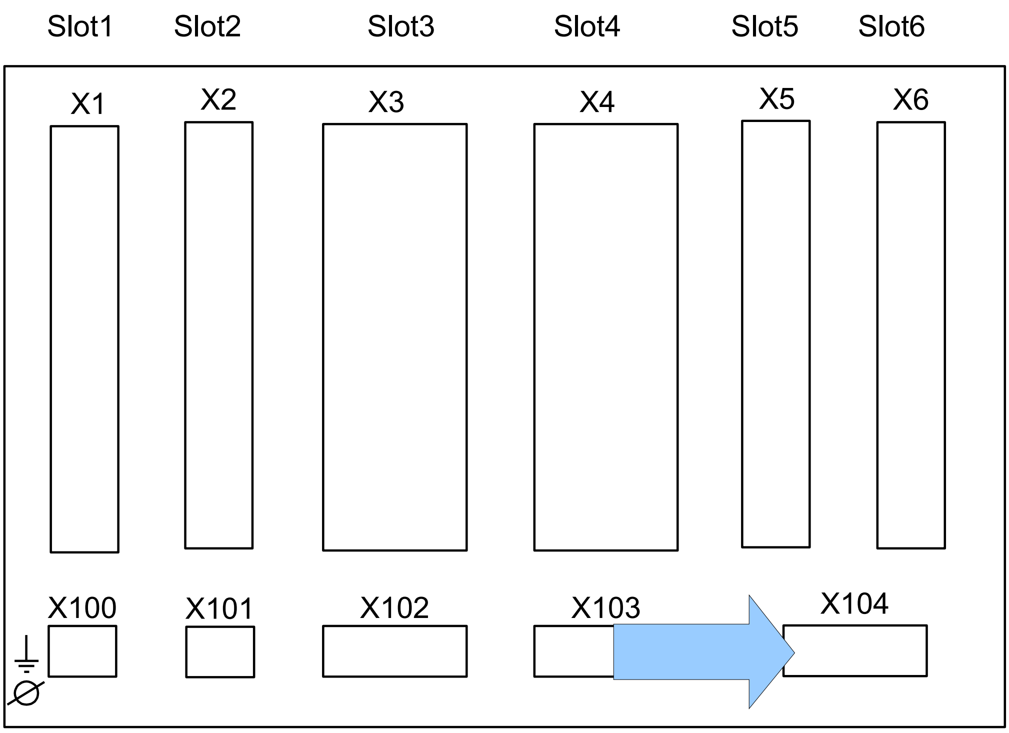
D-SUB



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.**

Slot X104: IRIG-B00X and Supervision Contact



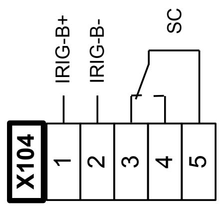
Rear side of the device (Slots)

This comprises the IRIG-B00X and the System contact (Supervision Contact).

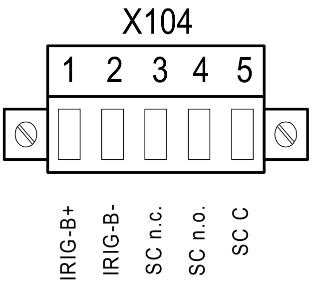
System Contact and IRIG-B00X

WARNING **Make sure that the tightening torque is 0.56-0.79 Nm [5-7 In-lb].**

Terminal



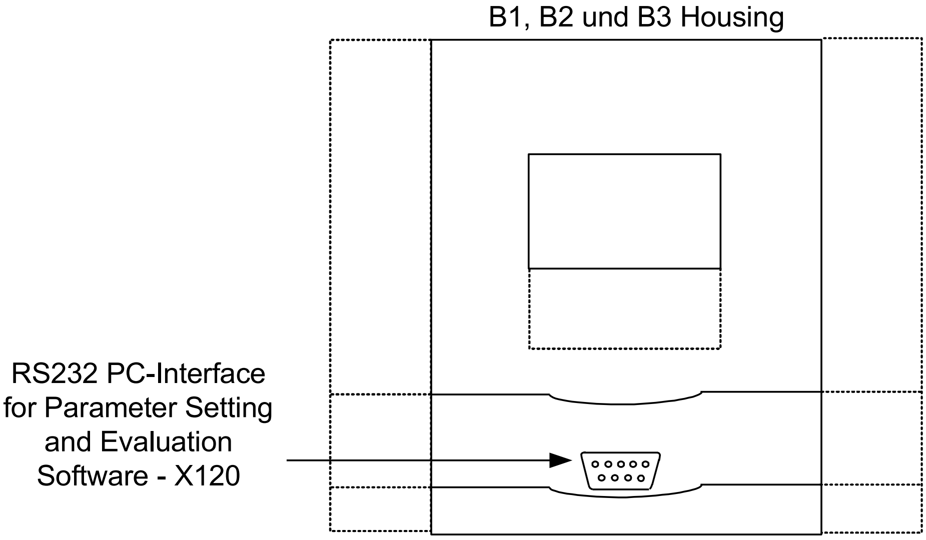
Electro-mechanical assignment

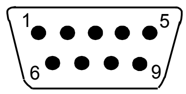


The *System-OK contact (SC relay)* cannot be configured. The system contact is a changeover contact that picks up when the device is free from internal faults. While the device is booting up, the *System OK relay (SC)* remains dropped-off (unenergized). As soon as the system is properly started (and protection is active), the System Contact picks up and the assigned LED is activated accordingly (please refer to the Self Supervision chapter).

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.**

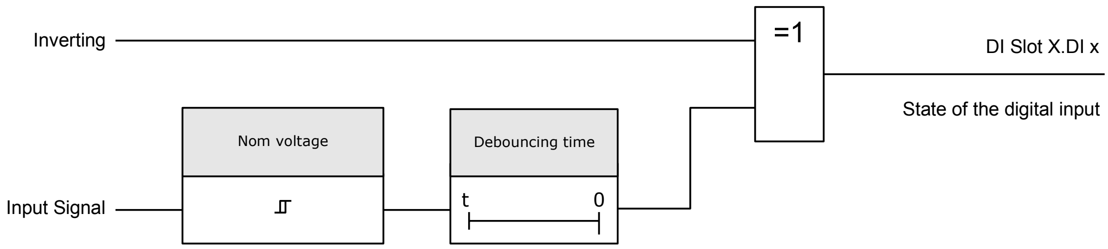
Input, Output, and LED Settings

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]
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]

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

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

Output Relays Settings

BO Slot X2 ,BO Slot X5

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

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

- Up to 7 signals from the »assignment list« (OR-connected)
- Each of the assigned signals can be inverted.
- The (collective) state of the binary output relay can be inverted (open or closed circuit current principle)
- 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.

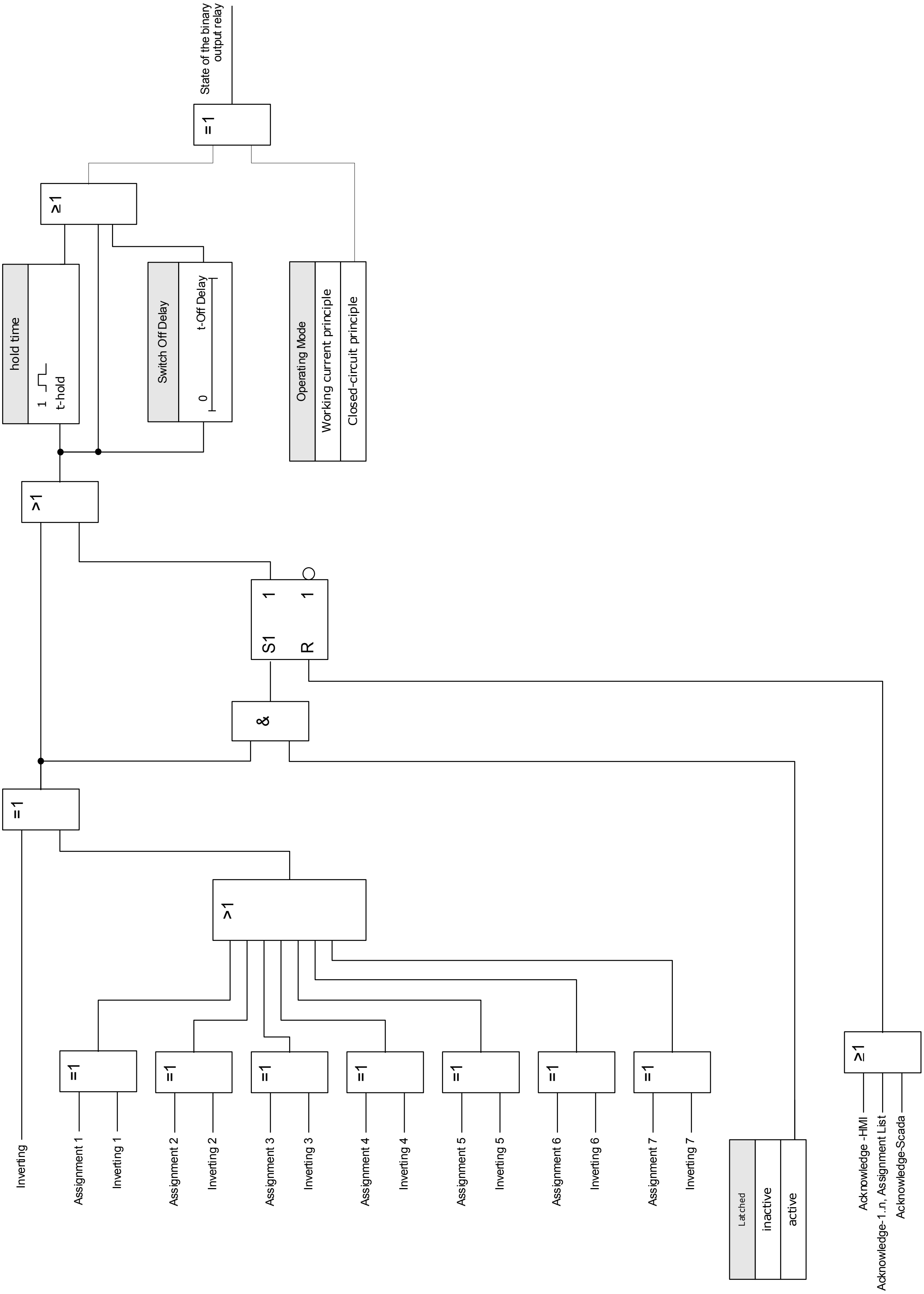
Acknowledgment options

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
t-Off Delay
0
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
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-6 X

Direct Commands of OR-6 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 Mode (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 Mode (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 Mode (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 Mode (Prot inhibit) /Force OR /BO Slot X2]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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 Mode (Prot inhibit) /Force OR /BO Slot X2]
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 Mode (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 Mode (Prot inhibit) /Force OR /BO Slot X2]
Force OR6	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 Mode (Prot inhibit) /Force OR /BO Slot X2]

Device Parameters of the Binary Output Relays on OR-6 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	BO Slot X2: active BO Slot X5: inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 1]

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 1]
Inverting	Inverting of the Binary Output Relay.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
Assignment 1	Assignment	1..n, Assignment List	BO Slot X2: SG.TripCmd BO Slot X5: -.-	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
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]

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 1]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
Assignment 6	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
Inverting 6	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 1]
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 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 2]

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 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]
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	BO Slot X2: Prot.Alarm BO Slot X5: -.-	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO Slot X2 /BO 2]

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 2]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 2]
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]

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 3]
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	BO Slot X2: SG.ON Cmd BO Slot X5: -.-	[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]

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 3]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 3]
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]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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]
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 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	BO Slot X2: SG.OFF Cmd BO Slot X5: -.-	[Device Para /Binary Outputs /BO Slot X2 /BO 4]

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 4]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 4]
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]

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

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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
Assignment 6	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
Inverting 6	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 5]
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]
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 6]
t-Off Delay	Switch Off Delay	0.00 - 300.00s	0.00s	[Device Para /Binary Outputs /BO Slot X2 /BO 6]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Latched	Defines whether the Relay Output will be latched when it picks up.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Acknowledgement	Acknowledgement Signal - An acknowledgement signal (that acknowledges the corresponding binary output relay) can be assigned to each output relay. The acknowledgement-signal is only effective if the parameter "Latched" is set to active. Only available if: Latched = active	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Inverting	Inverting of the Binary Output Relay.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Assignment 1	Assignment	1..n, Assignment List	BO Slot X2: ThR.Alarm Timeout BO Slot X5: -.-	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO Slot X2 /BO 6]

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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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 Mode (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 Mode (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 Mode (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 Mode (Prot inhibit) /Force OR /BO Slot X2]

Input States of the Binary Output Relays on OR-6 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]
BO6.1	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
BO6.2	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
BO6.3	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
BO6.4	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 6]
BO6.5	Module input state: Assignment	[Device Para /Binary Outputs /BO Slot X2 /BO 6]

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

Signals of the Binary Output Relays on OR-6 X

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

Configuration of the Analog Outputs

Available Elements:
Analog Input[1] ,Analog Input[2] ,Analog Input[3] ,Analog Input[4]

The Analog Outputs can be programmed to output for three different ranges of either »*0- 20mA*«, »*4- 20 mA*«, or »*0-10 Volts*«.

These outputs can be configured by the User to represent the status of User programmed parameters that are available from the relay. The User will find the configuration menu for this feature under the [Device Para/ Analog Outputs] menu option. Here the User can define to which parameter the output will correlate.

Once the assignment has been made, the User can select the expected range of the parameter that will correlate to the analog output. The User will be required to enter a »*Range min*«, and »*Range max*«. The »*Range min*« will determine the value at which value the transmission will start. Likewise, the »*Range max*« value will determine the value that will result in the end value of the transmission.

Global Protection Parameters of the Analog Outputs

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment	Assignment	1..n, AnalogOutputList	-.-	[Device Para /Analog Outputs /Analog Input[1]]
Range	Adjustable range	0...20mA, 4...20mA, 0...10V	0...20mA	[Device Para /Analog Outputs /Analog Input[1]]
Range max	Adjustable range maximum. The analog quantities that should be fed to the analog outputs are per unit quantities. Please see section "Measurement Display" within the manual.	0 - 200	0	[Device Para /Analog Outputs /Analog Input[1]]
Range min	Adjustable range minimum. The analog quantities that should be fed to the analog outputs are per unit quantities. Please see section "Measurement Display" within the manual.	0 - 200	0	[Device Para /Analog Outputs /Analog Input[1]]
Force Mode	For commissioning purposes or for maintenance, Analog Outputs can be set by force. By means of this function the normal Analog Outputs can be overwritten (forced).	permanent, Timeout	permanent	[Service /Test Mode (Prot inhibit) /Analog Outputs /Analog Input[1]]
t-Timeout Force	The Analog Output Value will be set by force for the duration of this time. That means for the duration of this time the Analog Output does not show the value of the signals that are assigned on it. Only available if: Force Mode = active	0.00 - 300.00s	0.03s	[Service /Test Mode (Prot inhibit) /Analog Outputs /Analog Input[1]]

Direct Commands of the Analog Outputs

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Service /Test Mode (Prot inhibit) /Analog Outputs /Analog Input[1]]
Force Value	By means of this function the Analog Output Value can be overwritten (forced).	0.00 - 100.00%	0%	[Service /Test Mode (Prot inhibit) /Analog Outputs /Analog Input[1]]

Signals of the Analog Outputs

Name	*Description*
active	active

List of the Analog Outputs

Name	*Description*
-.-	No assignment
-.	
Voltage.f	Measured value: Frequency
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.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.V1	Measured value (calculated): Symmetrical components positive phase sequence voltage(fundamental)
Voltage.V2	Measured value (calculated): Symmetrical components negative phase sequence voltage(fundamental)
Voltage.% VL12 THD	Measured value (calculated): V12 Total Harmonic Distortion / Ground wave
Voltage.% VL23 THD	Measured value (calculated): V23 Total Harmonic Distortion / Ground wave
Voltage.% VL31 THD	Measured value (calculated): V31 Total Harmonic Distortion / Ground wave

Name	*Description*
Voltage.% VL1 THD	Measured value (calculated): VL1 Total Harmonic Distortion / Ground wave
Voltage.% VL2 THD	Measured value (calculated): VL2 Total Harmonic Distortion / Ground wave
Voltage.% VL3 THD	Measured value (calculated): VL3 Total Harmonic Distortion / Ground wave
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
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
Current.IL1 RMS	Measured value: Phase current (RMS)
Current.IL2 RMS	Measured value: Phase current (RMS)
Current.IL3 RMS	Measured value: Phase current (RMS)
Current.IG meas RMS	Measured value (measured): IG (RMS)
Current.IG calc RMS	Measured value (calculated): IG (RMS)
Current.I1	Measured value (calculated): Positive phase sequence current (fundamental)
Current.I2	Measured value (calculated): Unbalanced load current (fundamental)
Current.%IL1 THD	Measured value (calculated): IL1 Total Harmonic Distortion
Current.%IL2 THD	Measured value (calculated): IL2 Total Harmonic Distortion
Current.%IL3 THD	Measured value (calculated): IL3 Total Harmonic Distortion
Current.IL1 THD	Measured value (calculated): IL1 Total Harmonic Current
Current.IL2 THD	Measured value (calculated): IL2 Total Harmonic Current
Current.IL3 THD	Measured value (calculated): IL3 Total Harmonic Current
MStart.IL1 Ib	Measured value: Phase current as percentage of Ib
MStart.IL2 Ib	Measured value: Phase current as percentage of Ib
MStart.IL3 Ib	Measured value: Phase current as percentage of Ib
MStart.I3 P (%Ib) avg	Average RMS current of all 3 phases as percentages of Ib
MStart.I3P Fla Demand	RMS current of all 3 phases calculated in a fixed demand window as percentages of Ib
ThR.I2T Used	Thermal capacity used.
ThR.I2T Remained	Thermal capacity remained.
RTD.HottestWindingTemp	Hottest motor winding temperature in degrees C.
URTD.Windg1	Winding 1
URTD.Windg2	Winding 2
URTD.Windg3	Winding 3
URTD.Windg4	Winding 4
URTD.Windg5	Winding 5
URTD.Windg6	Winding 6

Name	*Description*
URTD.MotBear1	Motor Bearing 1
URTD.MotBear2	Motor Bearing 2
URTD.LoadBear1	Load Bearing 1
URTD.LoadBear2	Load Bearing 2
URTD.Aux1	Auxiliary1
URTD.Aux2	Auxiliary2
URTD.RTD Max	Maximum temperature of all channels.

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.

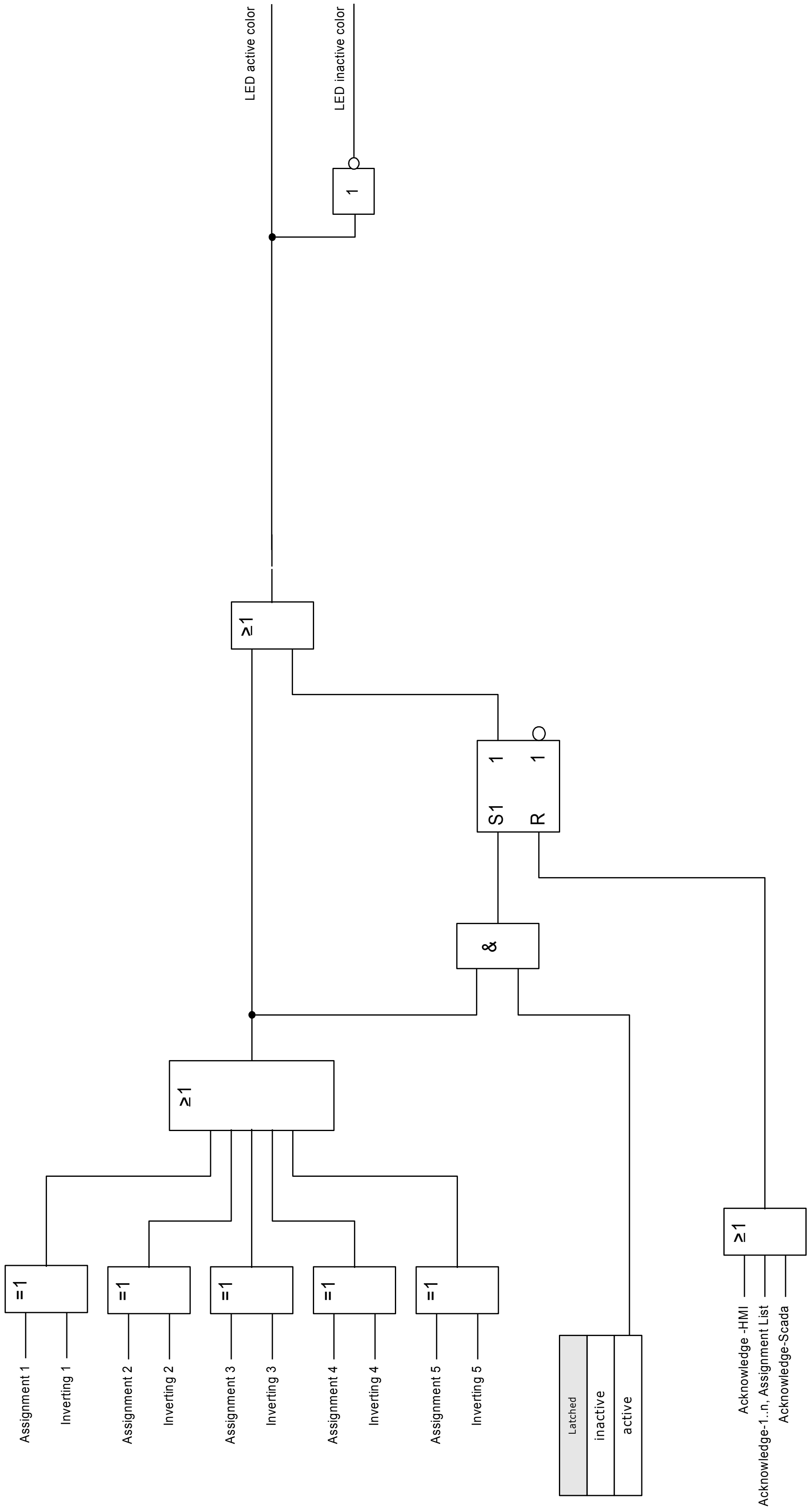
Acknowledgment options

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 ,LEDs group B

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Latched	Defines whether the LED will be latched when it picks up.	inactive, active	LEDs group A: active LEDs group B: inactive	[Device Para /LEDs /LEDs group A /LED 1]
Ack signal	Acknowledgement signal for the LED. If latching is set to active the LED can only be acknowledged if those signals that initiated the setting are no longer present. Dependency Only available if: Latched = active	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 1]
LED active color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	green, red, red flash, green flash, -	red	[Device Para /LEDs /LEDs group A /LED 1]
LED inactive color	The LED lights up in this color if the state of the OR-assignment of the signals is untrue.	green, red, red flash, green flash, -	-	[Device Para /LEDs /LEDs group A /LED 1]
Assignment 1	Assignment	1..n, Assignment List	LEDs group A: SG.TripCmd LEDs group B: -.-	[Device Para /LEDs /LEDs group A /LED 1]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 1]

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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Ack signal	Acknowledgement signal for the LED. If latching is set to active the LED can only be acknowledged if those signals that initiated the setting are no longer present. Only available if: Latched = active	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 2]
LED active color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	green, red, red flash, green flash, -	red	[Device Para /LEDs /LEDs group A /LED 2]
LED inactive color	The LED lights up in this color if the state of the OR-assignment of the signals is untrue.	green, red, red flash, green flash, -	-	[Device Para /LEDs /LEDs group A /LED 2]
Assignment 1	Assignment	1..n, Assignment List	LEDs group A: Prot.Alarm LEDs group B: -.-	[Device Para /LEDs /LEDs group A /LED 2]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 2]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 2]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 2]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 2]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 2]

Parameter	Description	Setting range	Default	Menu path
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 2]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 2]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 2]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 2]
Latched	Defines whether the LED will be latched when it picks up.	inactive, active	LEDs group A: active LEDs group B: inactive	[Device Para /LEDs /LEDs group A /LED 3]
Ack signal	Acknowledgement signal for the LED. If latching is set to active the LED can only be acknowledged if those signals that initiated the setting are no longer present. Only available if: Latched = active	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 3]
LED active color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	green, red, red flash, green flash, -	red	[Device Para /LEDs /LEDs group A /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 /LEDs group A /LED 3]
Assignment 1	Assignment	1..n, Assignment List	LEDs group A: ThR.Alarm LEDs group B: -.-	[Device Para /LEDs /LEDs group A /LED 3]

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

Parameter	Description	Setting range	Default	Menu path
Latched	Defines whether the LED will be latched when it picks up.	inactive, active	LEDs group A: active LEDs group B: inactive	[Device Para /LEDs /LEDs group A /LED 4]
Ack signal	Acknowledgement signal for the LED. If latching is set to active the LED can only be acknowledged if those signals that initiated the setting are no longer present. Only available if: Latched = active	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 4]
LED active color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	green, red, red flash, green flash, -	red	[Device Para /LEDs /LEDs group A /LED 4]
LED inactive color	The LED lights up in this color if the state of the OR-assignment of the signals is untrue.	green, red, red flash, green flash, -	-	[Device Para /LEDs /LEDs group A /LED 4]
Assignment 1	Assignment	1..n, Assignment List	LEDs group A: MStart.Blo LEDs group B: -.-	[Device Para /LEDs /LEDs group A /LED 4]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 4]
Assignment 2	Assignment	1..n, Assignment List	LEDs group A: MStart.TripPhaseReverse LEDs group B: -.-	[Device Para /LEDs /LEDs group A /LED 4]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 4]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 4]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 4]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 4]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 4]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 4]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 4]
Latched	Defines whether the LED will be latched when it picks up.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 5]
Ack signal	Acknowledgement signal for the LED. If latching is set to active the LED can only be acknowledged if those signals that initiated the setting are no longer present. Only available if: Latched = active	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 5]
LED active color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	green, red, red flash, green flash, -	LEDs group A: red flash LEDs group B: red	[Device Para /LEDs /LEDs group A /LED 5]
LED inactive color	The LED lights up in this color if the state of the OR-assignment of the signals is untrue.	green, red, red flash, green flash, -	-	[Device Para /LEDs /LEDs group A /LED 5]

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

Parameter	Description	Setting range	Default	Menu path
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 5]
Latched	Defines whether the LED will be latched when it picks up.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /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 /LEDs group A /LED 6]
LED active color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	green, red, red flash, green flash, -	red	[Device Para /LEDs /LEDs group A /LED 6]
LED inactive color	The LED lights up in this color if the state of the OR-assignment of the signals is untrue.	green, red, red flash, green flash, -	-	[Device Para /LEDs /LEDs group A /LED 6]
Assignment 1	Assignment	1..n, Assignment List	LEDs group A: MStart.Run LEDs group B: -.-	[Device Para /LEDs /LEDs group A /LED 6]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 6]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 6]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 6]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 6]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 6]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 6]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 6]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 6]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 6]
Latched	Defines whether the LED will be latched when it picks up.	inactive, active	inactive	[Device Para /LEDs /LEDs group A /LED 7]
Ack signal	Acknowledgement signal for the LED. If latching is set to active the LED can only be acknowledged if those signals that initiated the setting are no longer present. Only available if: Latched = active	1..n, Assignment List	-.-	[Device Para /LEDs /LEDs group A /LED 7]
LED active color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	green, red, red flash, green flash, -	LEDs group A: green LEDs group B: red	[Device Para /LEDs /LEDs group A /LED 7]

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

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

LED Module Input States

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

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

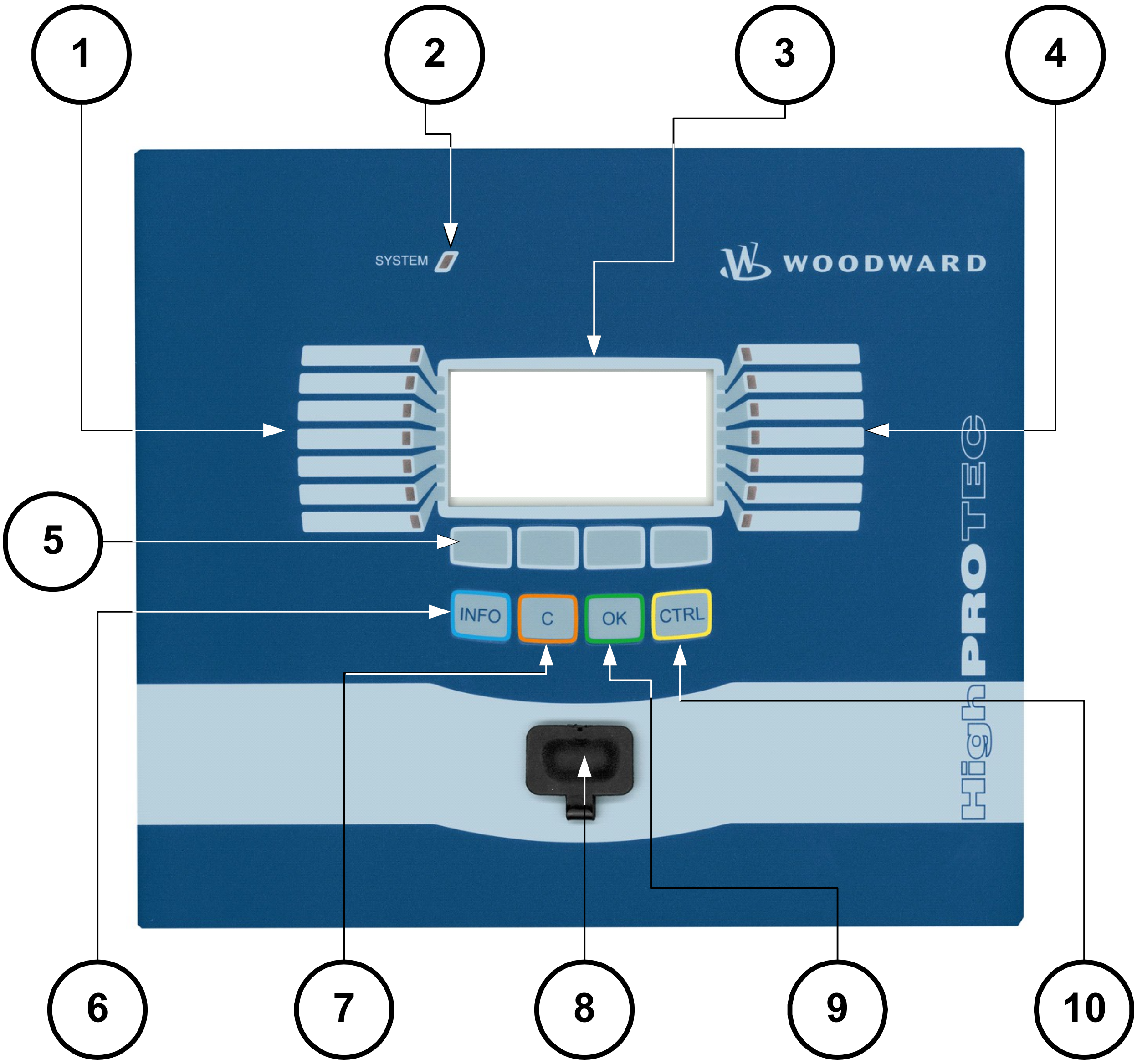
Name	*Description*	*Assignment via*
LED3.4	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 3]
LED3.5	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 3]
Acknow Sig 3	Module input state: Acknowledgement Signal (only for automatic acknowledgement)	[Device Para /LEDs /LEDs group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

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

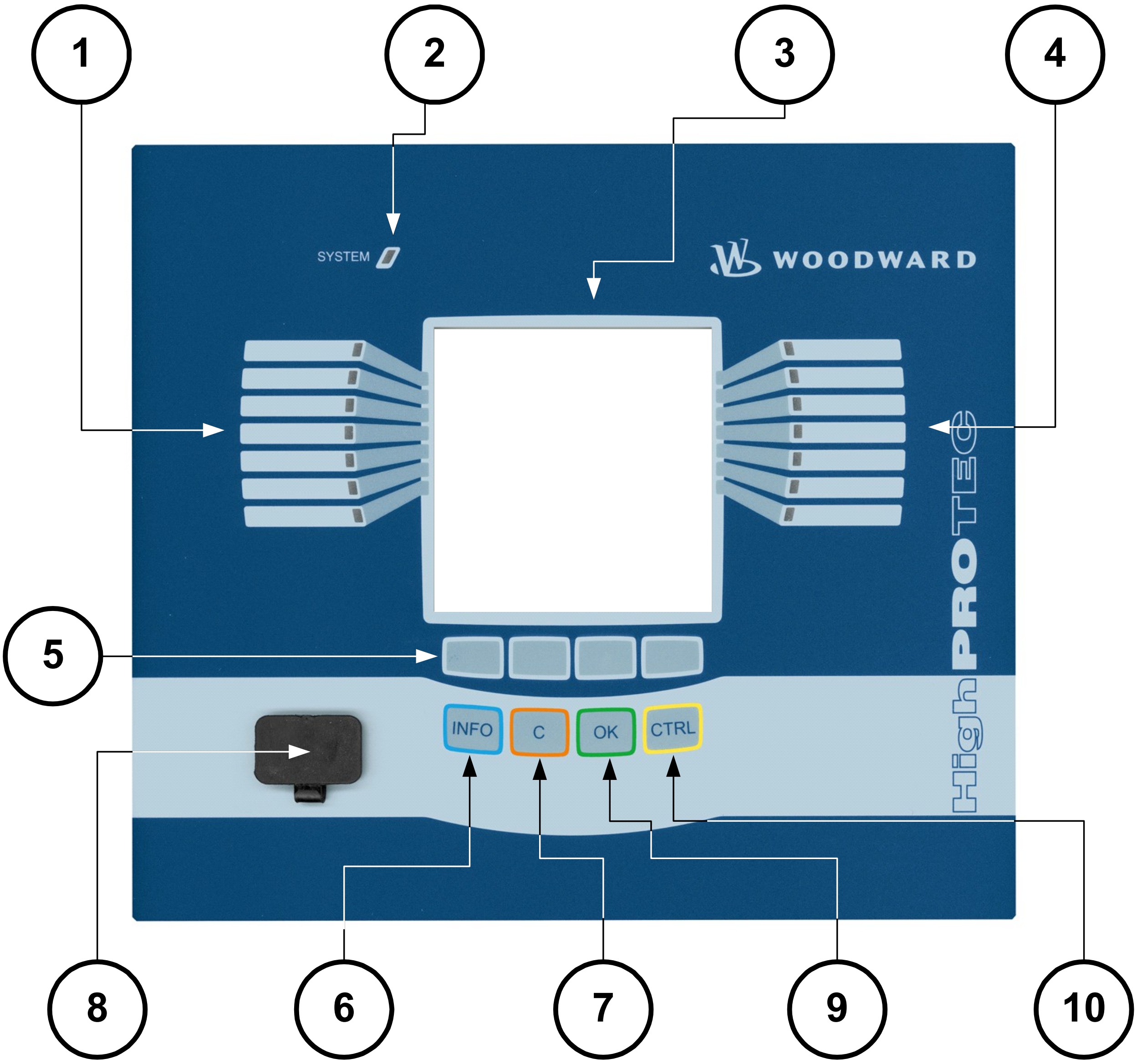
Name	*Description*	*Assignment via*
LED6.4	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 6]
LED6.5	Module input state: LED	[Device Para /LEDs /LEDs group A /LED 6]
Acknow Sig 6	Module input state: Acknowledgement Signal (only for automatic acknowledgement)	[Device Para /LEDs /LEDs group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

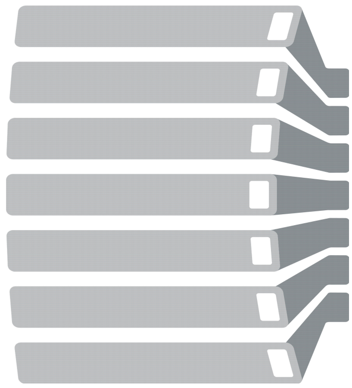
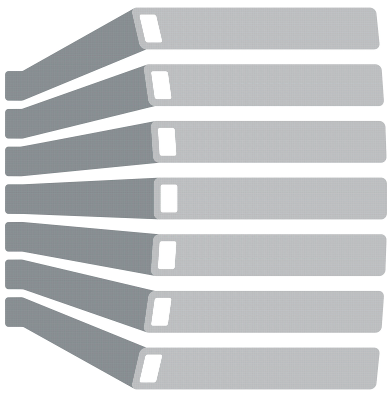
Navigation - Operation

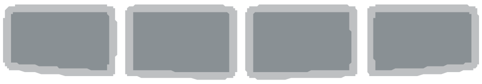
The following illustration applies to protective devices with a small display:



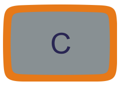
The following illustration applies to protective devices with a large display:



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

5		Softkeys	The function of the »SOFTKEYS« are contextual. On the bottom line of the display the present function is displayed/symbolized. Possible functions are: ■ Navigation ■ Parameter decrement/increment. ■ Scrolling up/down a menu page ■ Moving to a digit ■ Change into the parameter setting mode »wrench symbol«.

6		INFO Key (Signals/Messages)	Looking through the present LED assignment. The direct select key can be actuated at any time. If the INFO key is actuated once, the »LEFT LED SIGNALS« are inserted, if the INFO key is actuated again, the »RIGHT LED SIGNALS« are inserted. 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«*	For future applications

*=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).

Softkey	*Description*
-	■ 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.
X	■ Via »SOFTKEY« »delete« data will be deleted.

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

Smart View Keyboard Commands

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

Key	***Description***
↑	Moving up within the navigation tree or parameter list.
↓	Moving down within the navigation tree or parameter list.
←	Collapse the tree item or select a folder on a higher level.
→	Expands the tree item or selects a subfolder.
Numpad +	Expands the tree item.
Numpad -	Collapses the tree item.
Home	Moves to the top of the active window.
End	Moves to the bottom of the active window.
Ctrl+O	Opens the file opening dialog. Browsing through the file system for an existing device file.
Ctrl+N	Creates a new parameter file file by means of a template.
Ctrl+S	Saves actual loaded parameter file.
F1	Displays the online help information.

F2	Load Device Data
F5	Reloads the displayed data of a device.

Key	***Description***
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 2000 or compatible (e.g. 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].

Deinstalling 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 2000

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

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

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

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

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

Setting up/Configuring the connection

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

NOTICE

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

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

Set up a Connection via Serial Interface under Windows XP

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

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

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

Setting up/Configuring the connection

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

Set up a Connection via Serial Interface under Windows Vista 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 »Device Connection«.
- 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).
- **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 (XP and Windows 2000)

- 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 »WINDOWS 2000 is running on your computer and a serial interface for direct connection to another computer has not been established so far, the following problem can arise:

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

To solve this problem, you need administration rights.

Please proceed as follows:

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

NOTICE

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

On this warning you can react as follows:

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

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

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

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

Smart View Persistent 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

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.

Current - Measured Values

Current

If the device is not equipped with an voltage measuring card the first measuring input on the first current measuring card (slot with the lowest number) will be used as the reference angle (»*IL1*«).

Value	*Description*	*Menu path*
IL1	Measured value: Phase current (fundamental)	[Operation /Measured values /Current]
IL2	Measured value: Phase current (fundamental)	[Operation /Measured values /Current]
IL3	Measured value: Phase current (fundamental)	[Operation /Measured values /Current]
IG meas	Measured value (measured): IG (fundamental)	[Operation /Measured values /Current]
IG calc	Measured value (calculated): IG (fundamental)	[Operation /Measured values /Current]
I0	Measured value (calculated): Zero current (fundamental)	[Operation /Measured values /Current]
I1	Measured value (calculated): Positive phase sequence current (fundamental)	[Operation /Measured values /Current]
I2	Measured value (calculated): Unbalanced load current (fundamental)	[Operation /Measured values /Current]
Phi IL1	Measured value (calculated): Angle of Phasor IL1	[Operation /Measured values /Current]
Phi IL2	Measured value (calculated): Angle of Phasor IL2	[Operation /Measured values /Current]
Phi IL3	Measured value (calculated): Angle of Phasor IL3	[Operation /Measured values /Current]

Phi IG meas	Measured value (calculated): Angle of Phasor IG meas	[Operation /Measured values /Current]
Phi IG calc	Measured value (calculated): Angle of Phasor IG meas	[Operation /Measured values /Current]
IL1 RMS	Measured value: Phase current (RMS)	[Operation /Measured values /Current RMS]
IL2 RMS	Measured value: Phase current (RMS)	[Operation /Measured values /Current RMS]
IL3 RMS	Measured value: Phase current (RMS)	[Operation /Measured values /Current RMS]
IG meas RMS	Measured value (measured): IG (RMS)	[Operation /Measured values /Current RMS]
IG calc RMS	Measured value (calculated): IG (RMS)	[Operation /Measured values /Current RMS]
%IL1 THD	Measured value (calculated): IL1 Total Harmonic Distortion	[Operation /Measured values /Current RMS]
%IL2 THD	Measured value (calculated): IL2 Total Harmonic Distortion	[Operation /Measured values /Current RMS]
%IL3 THD	Measured value (calculated): IL3 Total Harmonic Distortion	[Operation /Measured values /Current RMS]
IL1 THD	Measured value (calculated): IL1 Total Harmonic Current	[Operation /Measured values /Current RMS]
IL2 THD	Measured value (calculated): IL2 Total Harmonic Current	[Operation /Measured values /Current RMS]
IL3 THD	Measured value (calculated): IL3 Total Harmonic Current	[Operation /Measured values /Current RMS]

%(I2/I1)	Measured value (calculated): I2/I1, phase sequence will be taken into account automatically.	[Operation /Measured values /Current]

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]

Value	*Description*	*Menu path*
phi VL1	Measured value (calculated): Angle of Phasor VL1	[Operation /Measured values /Voltage]
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]

Value	*Description*	*Menu path*
phi VL2	Measured value (calculated): Angle of Phasor VL2	[Operation /Measured values /Voltage]
% VL1 THD	Measured value (calculated): VL1 Total Harmonic Distortion / Ground wave	[Operation /Measured values /Voltage RMS]
% 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]

Power - Measured Values

Value	*Description*	*Menu path*
S	Measured Value (Calculated): Apparent power (fundamental)	[Operation /Measured values /Power]
P	Measured value (calculated): Active power (P- = Fed Active Power, P+ = Consumpted Active Power) (fundamental)	[Operation /Measured values /Power]
Q	Measured value (calculated): Reactive power (Q- = Fed Reactive Power, Q+ = Consumpted Reactive Power) (fundamental)	[Operation /Measured values /Power]
cos phi	Measured value (calculated): Power factor	[Operation /Measured values /Power]
Wp+	Positive Active Power is consumed active energy	[Operation /Measured values /Energy]
Wp-	Negative Active Power (Fed Energy)	[Operation /Measured values /Energy]
Wq+	Positive Reactive Power is consumed Reactive Energy	[Operation /Measured values /Energy]
Wq-	Negative Reactive Power (Fed Energy)	[Operation /Measured values /Energy]
Ws Net	Absolute Apparent Power Hours	[Operation /Measured values /Energy]
Wp Net	Absolute Active Power Hours	[Operation /Measured values /Energy]
Wq Net	Absolute Reactive Power Hours	[Operation /Measured values /Energy]
Start Date/Time	Energy counters run since... (Date and time of last reset)	[Operation /Measured values /Energy]

Value	*Description*	*Menu path*
S RMS	Measured Value (Calculated): Apparent power (RMS)	[Operation /Measured values /Power RMS]
P RMS	Measured value (calculated): Active power (P- = Fed Active Power, P+ = Consumpted Active Power) (RMS)	[Operation /Measured values /Power RMS]
Q RMS	Measured value (calculated): Reactive power (Q- = Fed Reactive Power, Q+ = Consumpted Reactive Power) (RMS)	[Operation /Measured values /Power RMS]
cos phi RMS	Measured value (calculated): Power factor	[Operation /Measured values /Power RMS]
P 1	Measured value (calculated): Active power in positive sequence system (P- = Fed Active Power, P+ = Consumpted Active Power)	[Operation /Measured values /Power]
Q 1	Measured value (calculated): Reactive power in positive sequence system (Q- = Fed Reactive Power, Q+ = Consumpted Reactive Power)	[Operation /Measured values /Power]

Energy Counter

PQSCr

Global Parameters of the Energy Counter Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
S, P, Q Cutoff Level	The Active/Reactive/Apparent Power shown in the Display or within the PC Software will be displayed as zero, if the absolute value of the corresponding Power falls below this Cutoff Level. This parameter has no impact on recorders.	0.0 - 0.100Sn	0.005Sn	[Device Para /Measurem Display]

Direct Commands of the Energy Counter Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Res all Energy Cr	Reset of all Energy Counters	inactive, active	inactive	[Operation /Reset/Acknowledge /Reset]

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

Name	*Description*
Cr Oflw Ws Net	Signal: Counter Overflow Ws Net
Cr Oflw Wp Net	Signal: Counter Overflow Wp Net
Cr Oflw Wp+	Signal: Counter Overflow Wp+
Cr Oflw Wp-	Signal: Counter Overflow Wp-
Cr Oflw Wq Net	Signal: Counter Overflow Wq Net
Cr Oflw Wq+	Signal: Counter Overflow Wq+
Cr Oflw Wq-	Signal: Counter Overflow Wq-
Ws Net Res Cr	Signal: Ws Net Reset Counter
Wp Net Res Cr	Signal: Wp Net Reset Counter
Wp+ Res Cr	Signal: Wp+ Reset Counter
Wp- Res Cr	Signal: Wp- Reset Counter
Wq Net Res Cr	Signal: Wq Net Reset Counter
Wq+ Res Cr	Signal: Wq+ Reset Counter
Wq- Res Cr	Signal: Wq- Reset Counter
Res all Energy Cr	Signal: Reset of all Energy Counters
Cr OflwW Ws Net	Signal: Counter Ws Net will overflow soon
Cr OflwW Wp Net	Signal: Counter Wp Net will overflow soon
Cr OflwW Wp+	Signal: Counter Wp+ will overflow soon
Cr OflwW Wp-	Signal: Counter Wp- will overflow soon

Name	*Description*
Cr OflwW Wq Net	Signal: Counter Wq Net will overflow soon
Cr OflwW Wq+	Signal: Counter Wq+ will overflow soon
Cr OflwW Wq-	Signal: Counter Wq- will overflow soon

Statistics

Statistics

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

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

Read-out Statistics

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

Statistics to Be Read-out Via Smart View

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

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

Statistics (Configuration)

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

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

Fixed duration:

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

Start function (flexible duration):

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

Statistics (Configuration) via Smart View

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

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

Direct Commands

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ResFc all	Resetting of all Statistic values (Current Demand, Power Demand, Min, Max)	inactive, active	inactive	[Operation /Reset/Acknowledge /Reset]
ResFc I Demand	Resetting of Statistics - Current Demand (avg, peak avg)	inactive, active	inactive	[Operation /Reset/Acknowledge /Reset]
ResFc P Demand	Resetting of Statistics - Power Demand (avg, peak avg)	inactive, active	inactive	[Operation /Reset/Acknowledge /Reset]
ResFc Min	Resetting of all Minimum values	inactive, active	inactive	[Operation /Reset/Acknowledge /Reset]

Parameter	Description	Setting range	Default	Menu path
ResFc Max	Resetting of all Maximum values	inactive, active	inactive	[Operation /Reset/Acknowledge /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]
Min Max Definition	Definition of the time base that is used for calculating the minimum and maximum values.	Sliding window, Peak values	Sliding window	[Device Para /Statistics /Min / Max]
Start I Demand via:	Start Current demand by:	Duration, StartFct	Duration	[Device Para /Statistics /Demand /Current Demand]
Start I Demand Fc	Start of the calculation, if the assigned signal becomes true. Only available if: Start I Demand via: = StartFct	1..n, Assignment List	-.-	[Device Para /Statistics /Demand /Current Demand]
ResFc I Demand	Resetting of Statistics - Current Demand (avg, peak avg)	1..n, Assignment List	-.-	[Device Para /Statistics /Demand /Current Demand]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Duration I Demand	Recording time Only available if: Start I Demand via: = Duration	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	15 s	[Device Para /Statistics /Demand /Current Demand]
Window I Demand	Window configuration	sliding, fixed	sliding	[Device Para /Statistics /Demand /Current Demand]
Start P Demand via:	Start Active Power demand by:	Duration, StartFct	Duration	[Device Para /Statistics /Demand /Power Demand]
Start P Demand 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 /Demand /Power Demand]
ResFc P Demand	Resetting of Statistics - Power Demand (avg, peak avg)	1..n, Assignment List	-.-	[Device Para /Statistics /Demand /Power Demand]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Duration P Demand	Recording time Only available if: Start P Demand via: = Duration	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	15 s	[Device Para /Statistics /Demand /Power Demand]
Window P Demand	Window configuration	siding, fixed	sliding	[Device Para /Statistics /Demand /Power Demand]

States of the Inputs of the Statistics Module

Name	*Description*	*Assignment via*
StartFc 1-I	State of the module input: Start of Statistics 1	[Device Para /Statistics /Demand /Current Demand]
StartFc 2-I	State of the module input: Start of Statistics 2	[Device Para /Statistics /Demand /Power Demand]
ResFc I Demand-I	State of the module input: Resetting of Statistics - Current Demand (avg, peak avg)	[Device Para /Statistics /Demand /Current Demand]
ResFc P Demand-I	State of the module input: Resetting of Statistics - Power Demand (avg, peak avg)	[Device Para /Statistics /Demand /Power Demand]
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

Name	*Description*
ResFc all	Signal: Resetting of all Statistic values (Current Demand, Power Demand, Min, Max)
ResFc I Demand	Signal: Resetting of Statistics - Current Demand (avg, peak avg)
ResFc P Demand	Signal: Resetting of Statistics - Power Demand (avg, peak avg)
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*
MeasPointNo	Each measuring point that is taken over by the statistics increments this counter. By means of this counter, the User can check whether the statistics are alive and if data are being acquired.	[Operation /Count and RevData /Statistics]
MeasPointNo2	Each measuring point that is taken over by the statistics increments this counter. By means of this counter, the User can check whether the statistics are alive and if data are being acquired.	[Operation /Count and RevData /Statistics]
Res Cr I Demand	Number of resets since last booting. The timestamp shows date and time of the last reset.	[Operation /Statistics /Demand /Current Demand]
Res Cr P Demand	Number of resets since last booting. The timestamp shows date and time of the last reset.	[Operation /Statistics /Demand /Power Demand]
Res Cr Min values	Number of resets since last booting. The timestamp shows date and time of the last reset.	[Operation /Statistics /Min /Power]
Res Cr Max values	Number of resets since last booting. The timestamp shows date and time of the last reset.	[Operation /Statistics /Max /Power]

Current - Statistic Values

Value	*Description*	*Menu path*
I1 max	Maximum value positive phase sequence current (fundamental)	[Operation /Statistics /Max /Current]
I1 min	Minimum value positive phase sequence current (fundamental)	[Operation /Statistics /Min /Current]

Value	*Description*	*Menu path*
I2 max	Maximum value unbalanced load (fundamental)	[Operation /Statistics /Max /Current]
I2 min	Minimum value unbalanced load current (fundamental)	[Operation /Statistics /Min /Current]
IL1 max RMS	IL1 maximum value (RMS)	[Operation /Statistics /Max /Current]
IL1 avg RMS	IL1 average value (RMS)	[Operation /Statistics /Demand /Current Demand]
IL1 min RMS	IL1 minimum value (RMS)	[Operation /Statistics /Min /Current]
IL2 max RMS	IL2 maximum value (RMS)	[Operation /Statistics /Max /Current]
IL2 avg RMS	IL2 average value (RMS)	[Operation /Statistics /Demand /Current Demand]
IL2 min RMS	IL2 minimum value (RMS)	[Operation /Statistics /Min /Current]
IL3 max RMS	IL3 maximum value (RMS)	[Operation /Statistics /Max /Current]

Value	*Description*	*Menu path*
IL3 avg RMS	IL3 average value (RMS)	[Operation /Statistics /Demand /Current Demand]
IL3 min RMS	IL3 minimum value (RMS)	[Operation /Statistics /Min /Current]
IG meas max RMS	Measured value: IG maximum value (RMS)	[Operation /Statistics /Max /Current]
IG meas min RMS	Measured value: IG minimum value (RMS)	[Operation /Statistics /Min /Current]
IG calc max RMS	Measured value (calculated):IG maximum value (RMS)	[Operation /Statistics /Max /Current]
IG calc min RMS	Measured value (calculated):IG minimum value (RMS)	[Operation /Statistics /Min /Current]
%(I2/I1) max	Measured value (calculated): I2/I1 maximum value, phase sequence will be taken into account automatically	[Operation /Statistics /Max /Current]
%(I2/I1) min	%(I2/I1) min	[Operation /Statistics /Min /Current]
IL1 Peak demand	IL1 Peak value, RMS value	[Operation /Statistics /Demand /Current Demand]

Value	*Description*	*Menu path*
IL2 Peak demand	IL2 Peak value, RMS value	[Operation /Statistics /Demand /Current Demand]
IL3 Peak demand	IL3 Peak value, RMS value	[Operation /Statistics /Demand /Current Demand]

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]

Value	*Description*	*Menu path*
VL12 max RMS	VL12 maximum value (RMS)	[Operation /Statistics /Max /Voltage]
VL12 min RMS	VL12 minimum value (RMS)	[Operation /Statistics /Min /Voltage]
VL23 max RMS	VL23 maximum value (RMS)	[Operation /Statistics /Max /Voltage]
VL23 min RMS	VL23 minimum value (RMS)	[Operation /Statistics /Min /Voltage]
VL31 max RMS	VL31 maximum value (RMS)	[Operation /Statistics /Max /Voltage]
VL31 min RMS	VL31 minimum value (RMS)	[Operation /Statistics /Min /Voltage]
VL1 max RMS	VL1 maximum value (RMS)	[Operation /Statistics /Max /Voltage]
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 min RMS	VL2 minimum value (RMS)	[Operation /Statistics /Min /Voltage]
VL3 max RMS	VL3 maximum value (RMS)	[Operation /Statistics /Max /Voltage]
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]
%(V2/V1) min	Measured value (calculated):V2/V1 minimum value , phase sequence will be taken into account automatically	[Operation /Statistics /Min /Voltage]

Power - Statistic Values

Value	*Description*	*Menu path*
cos phi max	Maximum value of the power factor	[Operation /Statistics /Max /Power]
cos phi min	Minimum value of the power factor	[Operation /Statistics /Min /Power]
S max	Maximum value of the apparent power	[Operation /Statistics /Max /Power]
S avg	Average of the apparent power	[Operation /Statistics /Demand /Power Demand]
S min	Minimum value of the apparent power	[Operation /Statistics /Min /Power]
P max	Maximum value of the active power	[Operation /Statistics /Max /Power]
P avg	Average of the active power	[Operation /Statistics /Demand /Power Demand]
P min	Minimum value of the active power	[Operation /Statistics /Min /Power]
Q max	Maximum value of the reactive power	[Operation /Statistics /Max /Power]

Value	*Description*	*Menu path*
Q avg	Average of the reactive power	[Operation /Statistics /Demand /Power Demand]
Q min	Minimum value of the reactive power	[Operation /Statistics /Min /Power]
cos phi max RMS	Maximum value of the power factor	[Operation /Statistics /Max /Power]
cos phi min RMS	Minimum value of the power factor	[Operation /Statistics /Min /Power]
VA Peak demand	VA Peak value, RMS value	[Operation /Statistics /Demand /Power Demand]
Watt Peak demand	WATTS Peak value, RMS value	[Operation /Statistics /Demand /Power Demand]
VAr Peak demand	VARs Peak value, RMS value	[Operation /Statistics /Demand /Power Demand]

System Alarms

Available Elements:
SysA

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:

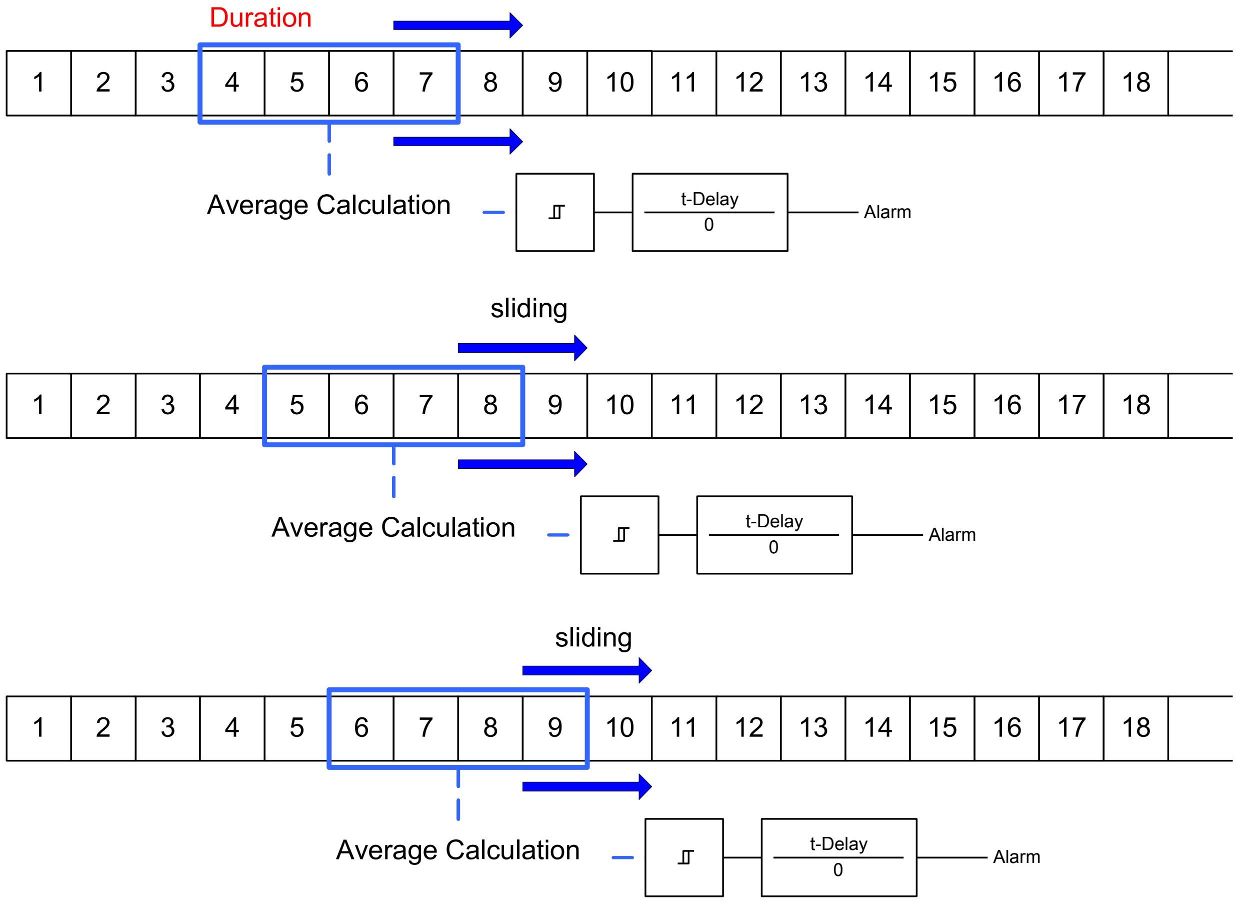
- Set the trigger source to »*Duration«*.
- Select a time base for the »*window«*.
- Determine if the window is »*fixed«* or »*sliding*«.
- If applicable assign a reset signal.

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

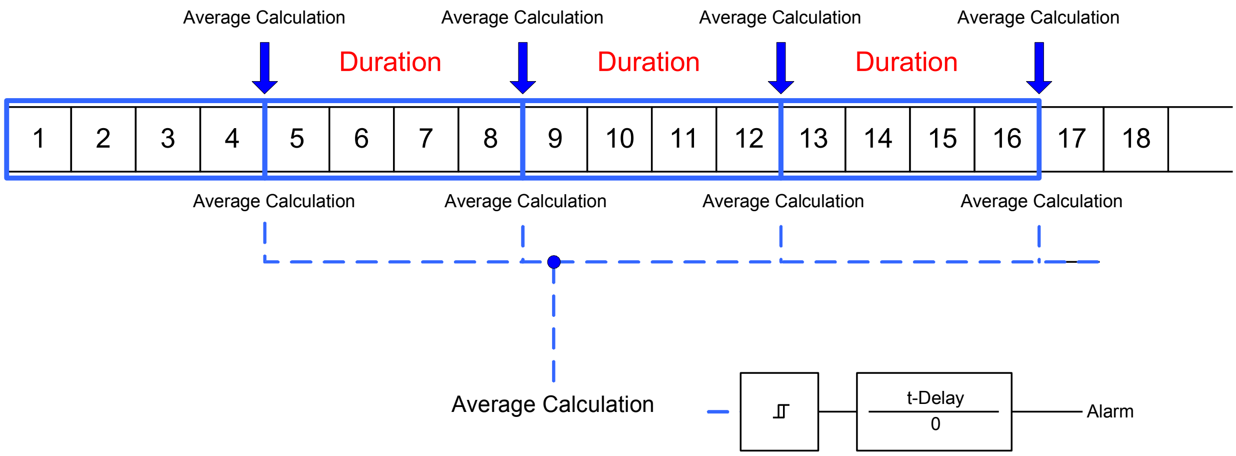
Example for a fixed window: If the range is set for 15 minutes, the protective device calculates the average current or power over the past 15 minutes and updates the value every 15 minutes.

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)

Name	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
Alarm Watt Power	Signal: Alarm permitted Active Power exceeded
Alarm VAr Power	Signal: Alarm permitted Reactive Power exceeded
Alarm VA Power	Signal: Alarm permitted Apparent Power exceeded
Alarm Watt Demand	Signal: Alarm averaged Active Power exceeded
Alarm VAr Demand	Signal: Alarm averaged Reactive Power exceeded
Alarm VA Demand	Signal: Alarm averaged Apparent Power exceeded
Alm Current Demd	Signal: Alarm averaged demand current
Alarm I THD	Signal: Alarm Total Harmonic Distortion Current
Alarm V THD	Signal: Alarm Total Harmonic Distortion Voltage
Trip Watt Power	Signal: Trip permitted Active Power exceeded
Trip VAr Power	Signal: Trip permitted Reactive Power exceeded
Trip VA Power	Signal: Trip permitted Apparent Power exceeded
Trip Watt Demand	Signal: Trip averaged Active Power exceeded
Trip VAr Demand	Signal: Trip averaged Reactive Power exceeded
Trip VA Demand	Signal: Trip averaged Apparent Power exceeded
Trip Current Demand	Signal: Trip averaged demand current
Trip I THD	Signal: Trip Total Harmonic Distortion Current
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 /Power /Watt]
Threshold	Threshold (to be entered as primary value)	1 - 40000000kW	10000kW	[SysA /Power /Watt]
t-Delay	Tripping Delay	0 - 60min	0min	[SysA /Power /Watt]
Alarm	Alarm	inactive, active	inactive	[SysA /Power /VAr]
Threshold	Threshold (to be entered as primary value)	1 - 40000000kVAr	10000kVAr	[SysA /Power /VAr]
t-Delay	Tripping Delay	0 - 60min	0min	[SysA /Power /VAr]
Alarm	Alarm	inactive, active	inactive	[SysA /Power /VA]
Threshold	Threshold (to be entered as primary value)	1 - 40000000kVA	10000kVA	[SysA /Power /VA]
t-Delay	Tripping Delay	0 - 60min	0min	[SysA /Power /VA]
Alarm	Alarm	inactive, active	inactive	[SysA /Demand /Power Demand /Watt Demand]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Threshold	Threshold (to be entered as primary value)	1 - 40000000kW	10000kW	[SysA /Demand /Power Demand /Watt Demand]
t-Delay	Tripping Delay	0 - 60min	0min	[SysA /Demand /Power Demand /Watt Demand]
Alarm	Alarm	inactive, active	inactive	[SysA /Demand /Power Demand /VAr Demand]
Threshold	Threshold (to be entered as primary value)	1 - 40000000kVAr	20000kVAr	[SysA /Demand /Power Demand /VAr Demand]
t-Delay	Tripping Delay	0 - 60min	0min	[SysA /Demand /Power Demand /VAr Demand]
Alarm	Alarm	inactive, active	inactive	[SysA /Demand /Power Demand /VA Demand]
Threshold	Threshold (to be entered as primary value)	1 - 40000000kVA	20000kVA	[SysA /Demand /Power Demand /VA Demand]
t-Delay	Tripping Delay	0 - 60min	0min	[SysA /Demand /Power Demand /VA Demand]
Alarm	Alarm	inactive, active	inactive	[SysA /Demand /Current Demand]
Threshold	Threshold (to be entered as primary value)	10 - 500000A	500A	[SysA /Demand /Current Demand]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
t-Delay	Tripping Delay	0 - 60min	0min	[SysA /Demand /Current Demand]
Alarm	Alarm	inactive, active	inactive	[SysA /THD /I THD]
Threshold	Threshold (to be entered as primary value)	1 - 500000A	500A	[SysA /THD /I THD]
t-Delay	Tripping Delay	0 - 3600s	0s	[SysA /THD /I THD]
Alarm	Alarm	inactive, active	inactive	[SysA /THD /U THD]
Threshold	Threshold (to be entered as primary value)	1 - 500000V	10000V	[SysA /THD /U THD]
t-Delay	Tripping Delay	0 - 3600s	0s	[SysA /THD /U 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*	

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.

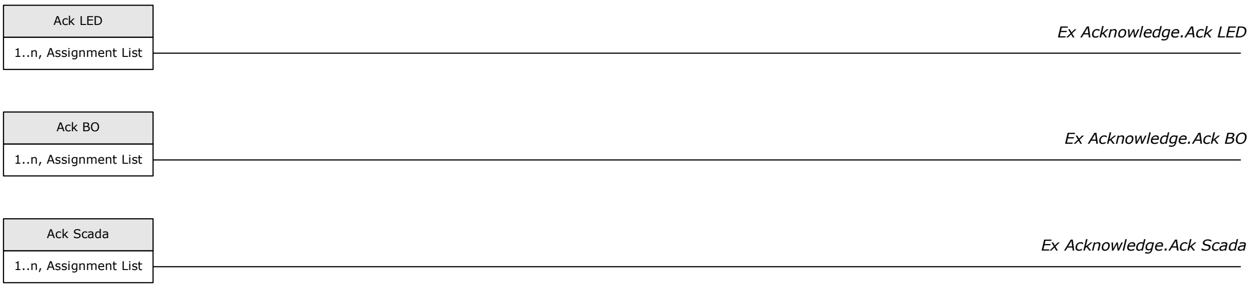
Manual Acknowledgment Via Smart View

- 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...).

- 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

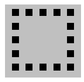
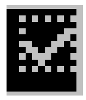
WARNING **This Function will reset the device to the factory defaults.**
All records will be deleted and and the measured values and counters will be reset. The operation hours counter will be kept.

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	30 - 60	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	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.

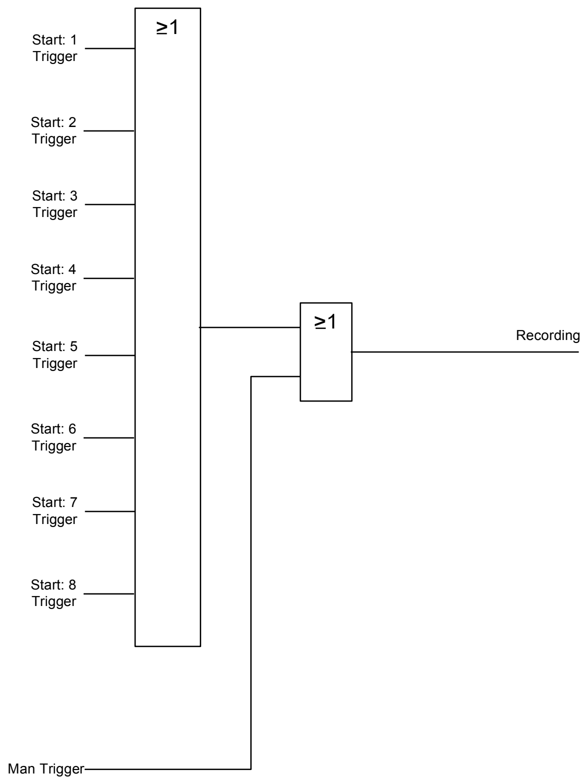
The disturbance recorder can be parameterized in the menu *»Device Parameter/Recorder/Disturb rec«*.

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"



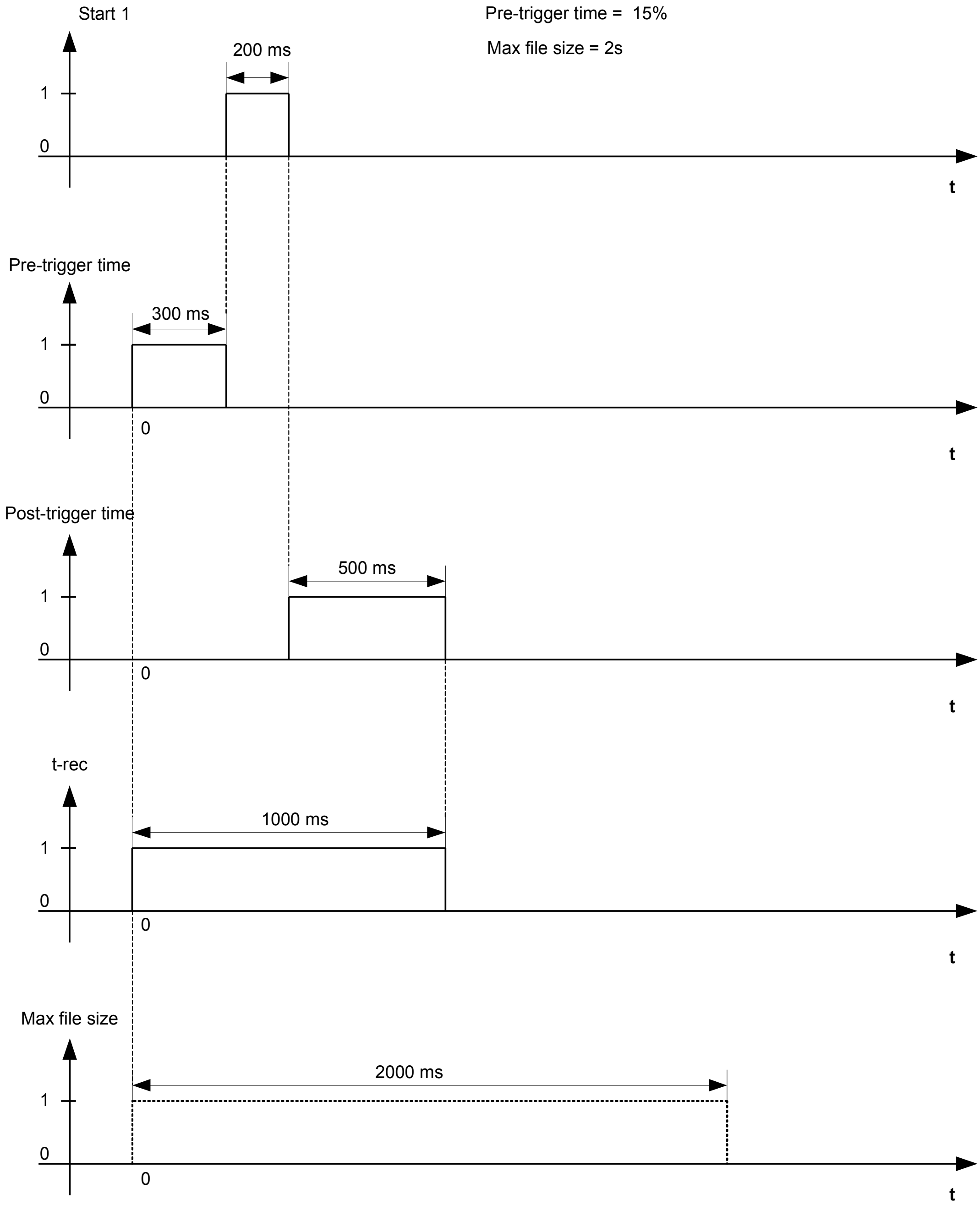
Example
The disturbance recorder is started by the general activation facility. After the fault has been cancelled (+ follow-up time), the recording process is stopped (but after 10s at the latest).

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

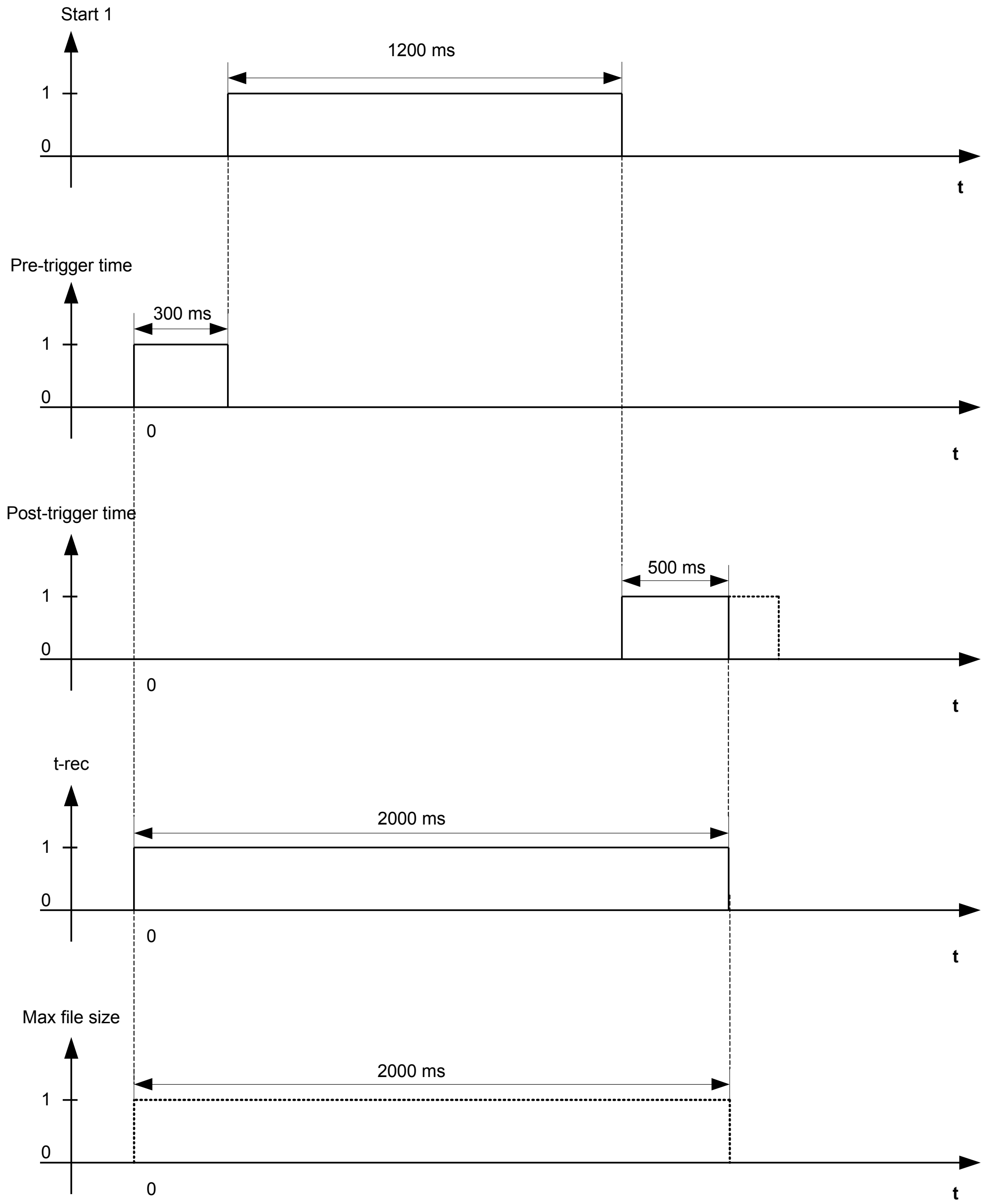
t-rec < Max file size



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/Acknowledg e /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]

Parameter	Description	Setting range	Default	Menu path
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]
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]

Name	*Description*	*Assignment via*
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

Name	*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]

Value	Description	Default	Size	Menu path
Error code	Error code	OK	OK, Write err, Clear fail, Calculation err, File not found, Auto overwriting off	[Operation /Status display /Recorders /Disturb rec]

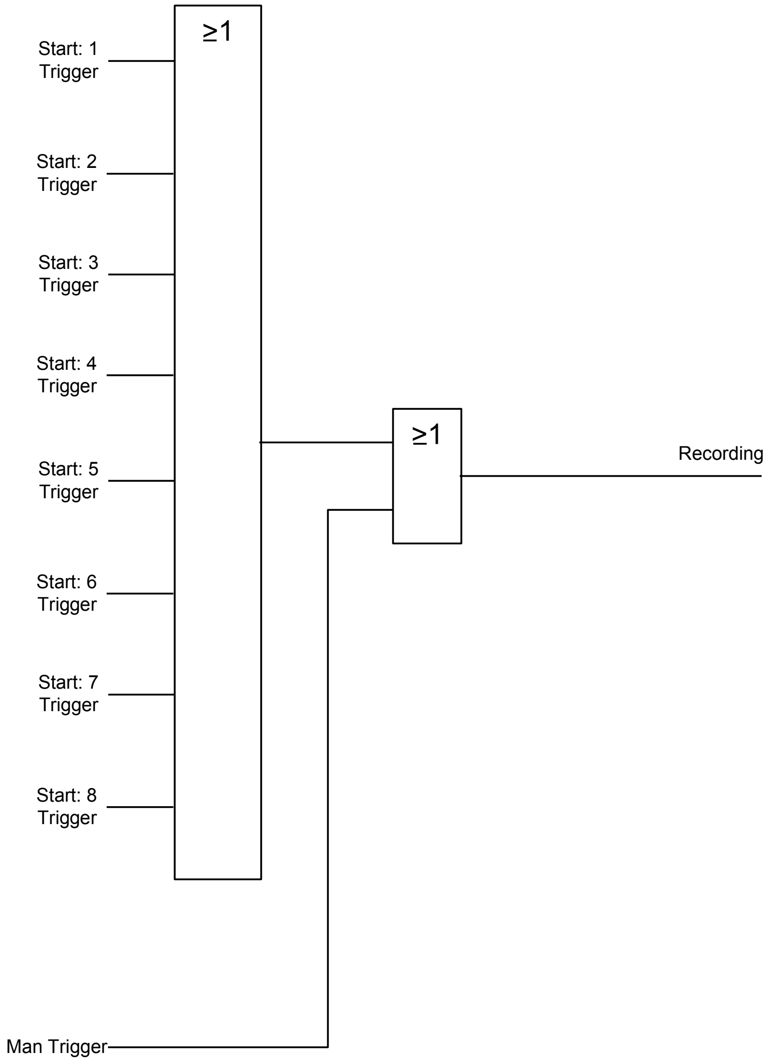
Fault Recorder

Fault rec

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

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

Up to 8 signals to trigger the fault recorder can be selected from 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/Acknowledge /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.Alarm	[Device Para /Recorders /Fault rec]
Start: 2	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Fault rec]
Start: 3	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Fault rec]
Start: 4	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Fault rec]
Start: 5	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Fault rec]
Start: 6	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Fault rec]
Start: 7	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Fault rec]
Start: 8	Start recording if the assigned signal is true.	1..n, Assignment List	-.-	[Device Para /Recorders /Fault rec]

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

Name	*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 ".ErTr". 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«*.

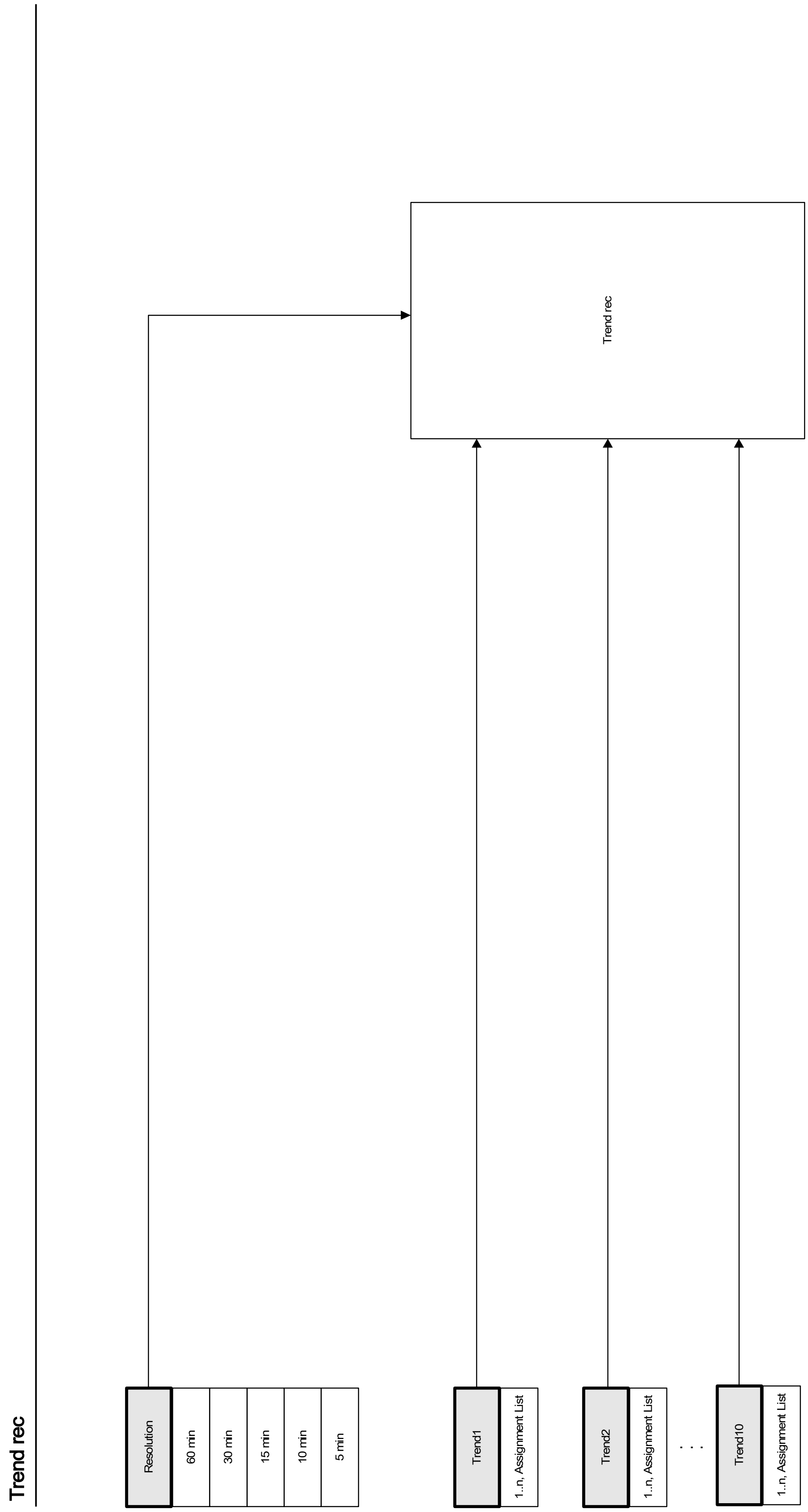
To remove a channel from view, the User must select the Trend Data to be removed in the »*Displayed Channels«* menu tree, then click on the right mouse button to bring up the menu options. Here, the User will find the »Remove« menu option that, when selected, will remove the trend data.

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	Current.IL1 RMS	[Device Para /Recorders /Trend rec]
Trend2	Observed Value2	1..n, TrendRecList	Current.IL2 RMS	[Device Para /Recorders /Trend rec]
Trend3	Observed Value3	1..n, TrendRecList	Current.IL3 RMS	[Device Para /Recorders /Trend rec]
Trend4	Observed Value4	1..n, TrendRecList	Current.IG meas RMS	[Device Para /Recorders /Trend rec]
Trend5	Observed Value5	1..n, TrendRecList	Voltage.VL1 RMS	[Device Para /Recorders /Trend rec]
Trend6	Observed Value6	1..n, TrendRecList	Voltage.VL2 RMS	[Device Para /Recorders /Trend rec]
Trend7	Observed Value7	1..n, TrendRecList	Voltage.VL3 RMS	[Device Para /Recorders /Trend rec]
Trend8	Observed Value8	1..n, TrendRecList	Voltage.VX meas RMS	[Device Para /Recorders /Trend rec]
Trend9	Observed Value9	1..n, TrendRecList	-.-	[Device Para /Recorders /Trend rec]
Trend10	Observed Value10	1..n, TrendRecList	-.-	[Device Para /Recorders /Trend rec]

Trend Recorder Signals (Output States)

Name	*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/Acknowledge /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.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)
Voltage.V2	Measured value (calculated): Symmetrical components negative phase sequence voltage(fundamental)
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
Current.IL1 RMS	Measured value: Phase current (RMS)
Current.IL2 RMS	Measured value: Phase current (RMS)

Name	*Description*
Current.IL3 RMS	Measured value: Phase current (RMS)
Current.IL1 RMS	Measured value: Phase current (RMS)
Current.IL2 RMS	Measured value: Phase current (RMS)
Current.IL3 RMS	Measured value: Phase current (RMS)
Current.IG meas RMS	Measured value (measured): IG (RMS)
Current.IG calc RMS	Measured value (calculated): IG (RMS)
Current.I0	Measured value (calculated): Zero current (fundamental)
Current.I1	Measured value (calculated): Positive phase sequence current (fundamental)
Current.I2	Measured value (calculated): Unbalanced load current (fundamental)
Current.IL1 THD	Measured value (calculated): IL1 Total Harmonic Current
Current.IL2 THD	Measured value (calculated): IL2 Total Harmonic Current
Current.IL3 THD	Measured value (calculated): IL3 Total Harmonic Current
Current.%(I2/I1)	Measured value (calculated): I2/I1, phase sequence will be taken into account automatically.
Current.%(I2/I1) max	Measured value (calculated): I2/I1 maximum value, phase sequence will be taken into account automatically
MStart.IL1 Ib	Measured value: Phase current as percentage of Ib
ThR.I2T Used	Thermal capacity used.
RTD.HottestWindingTemp	Hottest motor winding temperature in degrees C.
RTD.Hottest MotBearTemp	Hottest motor bearing temperature in degrees C.
RTD.Hottest LoadBearTemp	Hottest load bearing temperature in degrees C.
RTD.Hottest Aux Temp	Hottest Auxiliary temperature in degrees C.
URTD.Windg1	Winding 1
URTD.Windg1 max	Winding1 Maximum Value
URTD.Windg2	Winding 2
URTD.Windg2 max	Winding2 Maximum Value
URTD.Windg3	Winding 3
URTD.Windg3 max	Winding3 Maximum Value
URTD.Windg4	Winding 4
URTD.Windg4 max	Winding4 Maximum Value
URTD.Windg5	Winding 5
URTD.Windg5 max	Winding5 Maximum Value
URTD.Windg6	Winding 6
URTD.Windg6 max	Winding6 Maximum Value
URTD.MotBear1	Motor Bearing 1
URTD.MotBear1 max	Motor Bearing1 Maximum Value
URTD.MotBear2	Motor Bearing 2
URTD.MotBear2 max	Motor Bearing2 Maximum Value
URTD.LoadBear1	Load Bearing 1

Name	*Description*
URTD.LoadBear1 max	Load Bearing1 Maximum Value
URTD.LoadBear2	Load Bearing 2
URTD.LoadBear2 max	Load Bearing2 Maximum Value
URTD.Aux1	Auxiliary1
URTD.Aux1 max	Auxiliary1 Maximum Value
URTD.Aux2	Auxiliary2
URTD.Aux2 max	Auxiliary2 Maximum Value
URTD.RTD Max	Maximum temperature of all channels.
PQSCr.cos phi	Measured value (calculated): Power factor
PQSCr.cos phi RMS	Measured value (calculated): Power factor

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/Acknowledge /Reset]

Event Recorder Signals

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

Motor Start Recorder

Available Elements:
Start rec

This feature provides information recorded at the time of each start of the motor. The Motor Start Recorder can register up to 5 motor starts. If there is no more memory free, the oldest record will be overwritten (FIFO).

A record comprises summary data and analogue channels. The available list depends on the ordered device. The summary data of a Motor Start Record can be viewed by means of *Smart View* or via the front panel interface of the relay. Examples for the content of a summary :

- Date of the Motor Start.
- Record number.
- Maximum RMS phase current of each phase at the time of start.
- Current unbalance.
- Single or two speed motor setting.
- Start times (The elapsed time from start to current below the transition current; time from start to run or incomplete sequence …).
- Thermal capacity used (I2T Used.; and
- Successful starts.

Via *Smart View* you can also print the summary data or export the data into a file.

You can display the analogue channels by means of *Data Visualizer*. Examples for recorded analogue channels:

- Phase currents.
- Unbalance current.
- Used Thermal capacity.
- Temperatures measured by the URTD (if a URTD box is installed and connected to the relay).

Summary Data of the Start Recorder

Analyse the Summary Data of a motor start :

- Call up the »*main menu«.*
- Call up the submenu [Operation/Recorders/Start rec].
- Select a record.
- Analyse the Summary Data.

Summary Data of the Start Recorder via *Smart View*

- In case *Smart View* is not running - please start it.
- In device data has not been loaded yet - click »Receive Data From The Device« within the menu »Device«.
- Double click the »Operation« icon in the navigation tree.
- Double click the »Start rec« icon within the »Operation/Recorders« menu.
- Within the active window all saved records are shown in tabular form.
- Click the »Receive Summary Data« icon in order to download the selected record and analyse the summary by means of *Smart View*.
- Click the »Refresh Start Recorder« icon for updating the list of available records.

NOTICE

Via the push-button »Print« you start the print menu and you can export the Summary Data into a file. Please proceed as follows:

- **Call up the data as described above.**
- **Click the »Receive Summary Data« icon.**
- **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.**

Analogue Channels Via *DataVisualizer*

- In case *Smart View* is not running - please start it.
- If the device data has not been loaded yet - click »Receive Data From The Device« within menu »Device«.
- Double click the »Operation« icon in the navigation tree.
- Double click the »Start rec« icon within the [Operation/Recorders] menu.
- Within the active window all saved records are shown in tabular form.
- Double click onto a record or click the »Receive Start Reorder« in order to download the selected record from the protective device and save it to a local hard drive and display the analogue channels within *DataVisualizer*.
- Click the »Refresh Start Recorder« icon for updating the list of available records.

Deleting Start Records via *Smart View*

By means of *Smart View* individual or all records can be deleted.

- Call up menu [Operation/Recorders/Start rec].
- Click on the »Delete Start Recorder« icon for deleting the selected record. Click on the »Delete All Start Recorder« icon in order to delete all records.

Global Protection Parameters of the Motor Start Recorder

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Resolution	Resolution (recording frequency)	50ms, 100ms, 1s	50ms	[Device Para /Recorders /Start rec]

Motor Start Recorder Module Input States

Name	*Description*
MotorStart	Module input state: Start of recorder
MotorRun	Module input state: Motor is in run mode
Motor Speed2	Module input state: Motor operates in speed 2
ITransit	Module input state: Motor operations transition on current

Motor Start Recorder Signals (Output States)

Name	*Description*
Storing	Signal: Data are saved

Direct Commands of the Motor Start Recorder

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ClearStartRec	Delete all start recorder records	inactive, active	inactive	[Operation /Reset/Acknowledge /Reset]
ClearStatistic Rec	Delete all statistic recorder records (start trending)	inactive, active	inactive	[Operation /Reset/Acknowledge /Reset]

Statistic Recorder

The Statistic Recorder shows motor specific statistical data on a monthly base. The Statistic Recorder can record up to 24 monthly reports. The reports are power fail safe stored.

In order to view information from the Statistic Recorder, the User has to select [Operation/Recorder/Statisticrec] from the menu tree.

By double clicking on the »Date of Record« statistics information can be viewed such as the number of starts, the number of successful starts, the average start time, the »*average I2T*« value during any start, and the average of all maximum currents value seen during each start.

History Function

The History function, accessible under the Operations menu, can be utilized as a counter or log of specific occurrences monitored by the device. The types of occurrence that can be recorded include:

- Operations (OperationsCr);
- Alarms (AlarmCr);
- Trips (TripCr); and
- Totals (TotalCr).

To View the History Records at the HMI

- Call up menu »Operation«.

- Navigate to the menu item »History« by means of the Softkeys »down«. Enter this menu by means of the Softkey »right«.

- Scroll down by means of the Softkey »down« within this list up to that menu you want to change in. Enter this submenu by pressing the Softkey »right«.

- Scroll down by means of the Softkey »down« within this list up to that counter/entry that you want to take a look at. Call up details of this counter by means of pressing the Softkey »right«.

To Reset the History Records at the HMI

- Call up menu »Operation«.
- Navigate to the menu item »Reset/Acknowledge« by means of the Softkeys »down«. Enter this menu by means of the Softkey »right«.
- Navigate to that group of counters/entries that you want to reset by means of the Softkeys »down«. Enter this menu by means of the Softkey »right«.
- In order to reset that group of counters, press the Softkey »*Parameter Setting*«. Enter your password.
- Confirm the dialog »Excecute?« by means of Softkey »Yes«.

To View the History Records with 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 »History« icon within the »OPERATION« menu.
- Double click within menu »History« onto that group of counters you want to take a look at.
- In the window the details are shown in tabular form.

To Reset the History Records with 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 »Reset/Acknowledge« icon within the »OPERATION« menu.
- Double click the »History« icon.
- Double click within this menu onto that group of counters, that are to be reset. Enter, if necessary your password.

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 (in preparation)
- State of device
- Time and date
- State of the device’s digital inputs
- Protection-/State alarms

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

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

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

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

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.

Device Planning Parameters of the Modbus®

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	RTU, TCP	RTU	[Device planning]

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/Acknowledge /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]

Parameter	Description	Setting range	Default	Menu path
Physical Settings	Digit 1: Number of bits. Digit 2: E=even parity, O=odd parity, N=no parity. Digit 3: Number of stop bits. More information on the parity: It is possible that the last data bit is followed by a parity bit which is used for recognition of communication errors. The parity bit ensures that with even parity ("EVEN") always an even number of bits with valence "1" or with odd parity ("ODD") an odd number of "1" valence bits are transmitted. But it is also possible to transmit no parity bits (here the setting is "Parity = None"). More information on the stop-bits: The end of a data byte is terminated by the stop-bits. Only available if:Device planning = RTU	8E1, 8O1, 8N1, 8N2	8E1	[Device Para /Modbus]
t-call	If there is no request telegram sent from Scada to the device after expiry of this time - the device concludes a communication failure within the Scada system.	1 - 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.

Name	Description
Transmission	Signal: SCADA active
Scada Cmd 1	Scada Command
Scada Cmd 2	Scada Command
Scada Cmd 3	Scada Command
Scada Cmd 4	Scada Command
Scada Cmd 5	Scada Command
Scada Cmd 6	Scada Command
Scada Cmd 7	Scada Command

Name	Description
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]

Value	*Description*	*Default*	*Size*	*Menu path*
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

Profibus

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/Acknowledge /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]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 1-16]

Parameter	Description	Setting range	Default	Menu path
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]
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]

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

Parameter	Description	Setting range	Default	Menu path
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]
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]

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

Parameter	Description	Setting range	Default	Menu path
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]
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]

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.	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]

Name	*Description*	*Assignment via*
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]
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]

Name	*Description*	*Assignment via*
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]
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)

Name	*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

Name	Description
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]

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)

Name	*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

Name	*Description*
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

<u>IEC61850</u>

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.

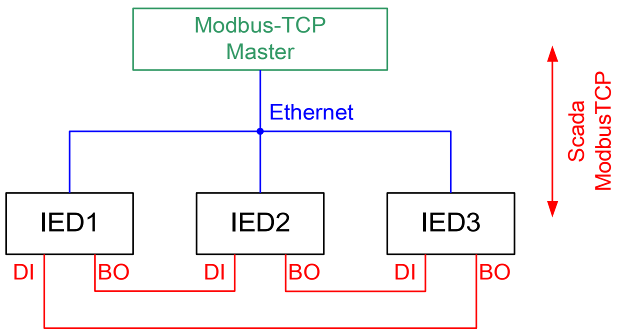
In a conventional substation the individual IEDs (Intelligent Electronic Devices) communicate in vertically direction with the higher level control center via SCADA. The horizontal communication is exclusively realized by wiring output relays (OR) and digital inputs (DI) among each other.

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

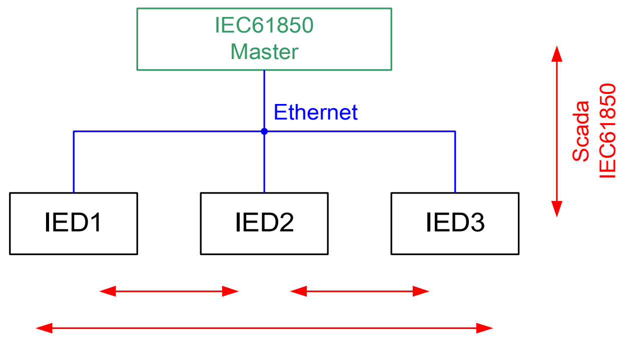
IEDs.

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/Acknowledge /Reset]

Global Protection 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]
VirtualOutput 1	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]
VirtualOutput 2	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]
VirtualOutput 3	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]
VirtualOutput 4	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]
VirtualOutput 5	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]
VirtualOutput 6	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]
VirtualOutput 7	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]
VirtualOutput 8	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]
VirtualOutput 9	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]
VirtualOutput 10	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]
VirtualOutput 11	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]
VirtualOutput 12	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
VirtualOutput 13	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]
VirtualOutput 14	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]
VirtualOutput 15	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]
VirtualOutput 16	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]

Name	*Description*	*Assignment via*
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)

Name	*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]

Value	*Description*	*Default*	*Size*	*Menu path*
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]
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

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

NOTICE **Use only one communication protocol for time synchronisation at the same time. Otherwise the correct function of the system clock cannot be guaranteed.**

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.

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

DST offset	Difference to wintertime	-180 - 180min	60min	[Device Para /Time /Timezone]
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]

DST offset	Difference to wintertime	-180 - 180min	60min	[Device Para /Time /Timezone]
Summertime h	Hour of clock change summertime Only available if: DST manual = active	0 - 23h	2h	[Device Para /Time /Timezone]
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]

DST offset	Difference to wintertime	-180 - 180min	60min	[Device Para /Time /Timezone]
Wintertime min	Minute of clock change wintertime Only available if: DST manual = active	0 - 59min	0min	[Device Para /Time /Timezone]

DST offset	Difference to wintertime	-180 - 180min	60min	[Device Para /Time /Timezone]
Time Zones	Time Zones	UTC+14 Kiritimati, UTC+13 Rawaki, UTC+12.75 Chatham Island, UTC+12 Wellington, UTC+11.5 Kingston, 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 Kathmandu, UTC+5.5 New Delhi, 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. Noronha, UTC-3 Buenos Aires, UTC-3.5 St. John's, UTC-4 Santiago, UTC-5 New York, UTC-6 Chicago, UTC-7 Salt Lake City, UTC-8 Los Angeles, UTC-9 Anchorage, UTC-9.5 Taiohae, UTC-10 Honolulu,	UTC+0 London	[Device Para /Time /Timezone]

DST offset	Difference to wintertime	-180 - 180min	60min	[Device Para /Time /Timezone]
TimeSync	Time synchronisation	-, IRIG-B, SNTP, Modbus, IEC60870-5-103	-	[Device Para /Time /TimeSync /TimeSync]

SNTP

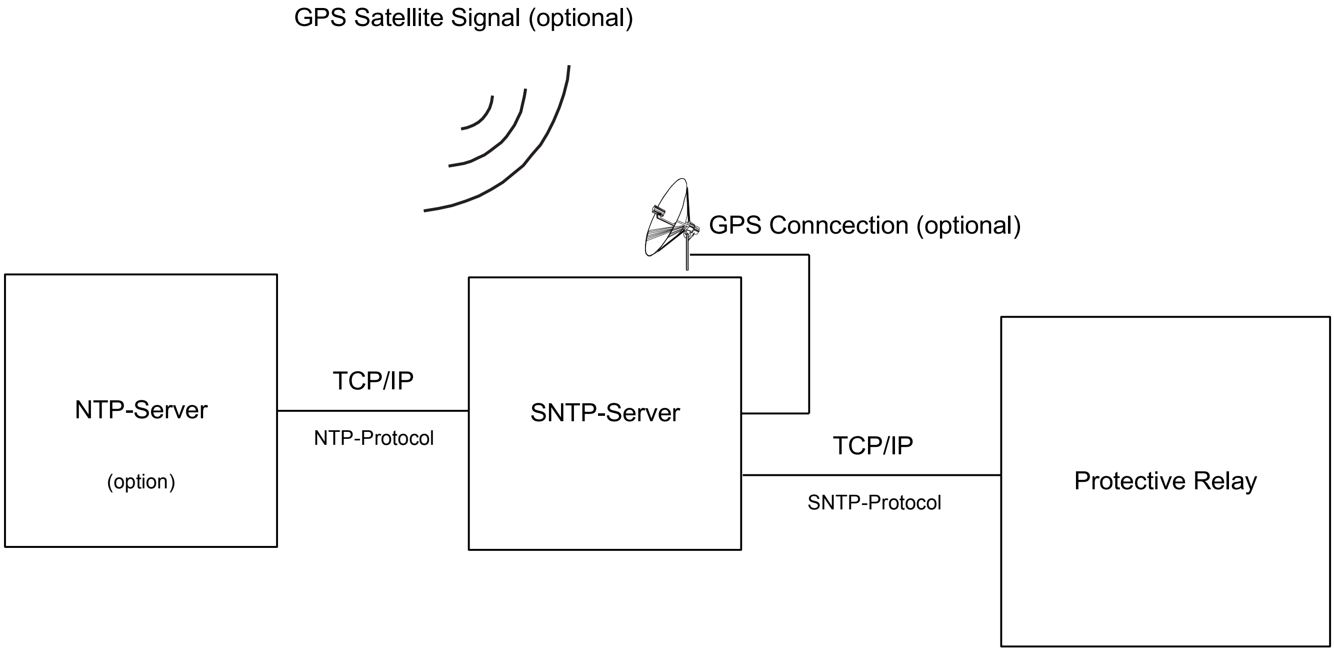
SNTP

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/Time Sync.]:

- 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 Sync./Sntp]:

- 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/Time Sync./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/Acknowledge /Reset]

Global Protection Parameters of the SNTP

Server1	Server 1	inactive, active	inactive	[Device Para /TimeSync /SNTP /IP Server1]
IP Byte1	IP1.IP2.IP3.IP4	0 - 255	0	[Device Para /TimeSync /SNTP /IP Server1]
IP Byte2	IP1.IP2.IP3.IP4	0 - 255	0	[Device Para /TimeSync /SNTP /IP Server1]
IP Byte3	IP1.IP2.IP3.IP4	0 - 255	0	[Device Para /TimeSync /SNTP /IP Server1]
IP Byte4	IP1.IP2.IP3.IP4	0 - 255	0	[Device Para /TimeSync /SNTP /IP Server1]
Server2	Server 2	inactive, active	inactive	[Device Para /TimeSync /SNTP /IP Server2]

Server1	Server 1	inactive, active	inactive	[Device Para /TimeSync /SNTP /IP Server1]
IP Byte1	IP1.IP2.IP3.IP4	0 - 255	0	[Device Para /TimeSync /SNTP /IP Server2]
IP Byte2	IP1.IP2.IP3.IP4	0 - 255	0	[Device Para /TimeSync /SNTP /IP Server2]
IP Byte3	IP1.IP2.IP3.IP4	0 - 255	0	[Device Para /TimeSync /SNTP /IP Server2]
IP Byte4	IP1.IP2.IP3.IP4	0 - 255	0	[Device Para /TimeSync /SNTP /IP Server2]

Signals of the SNTP

Name	*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]

Value	*Description*	*Default*	*Size*	*Menu path*
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]
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”.

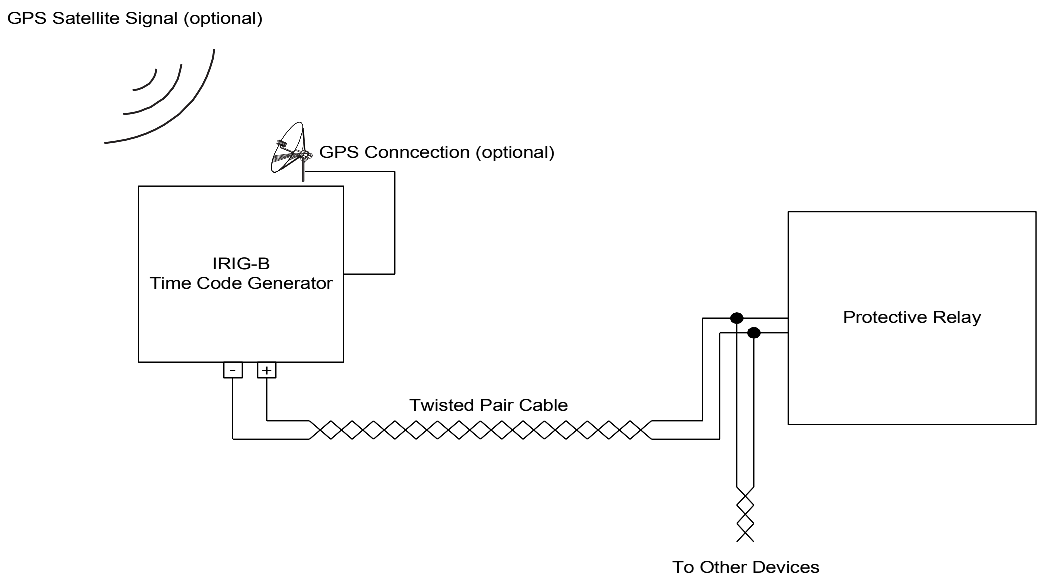
If you are using an IRIG time code that does not support the “year information” (IRIG-B000, IRIG-B001, IRIG-B002, IRIG-B003), you have to set the “year” manually within the device. In these cases the correct year information is a precondition for a properly working IRIG-B.

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/ TimeSync/ IRIG-B]:

- 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/Acknowledge /Reset]

Global Protection Parameters of the IRIG-B00X

Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Device Para /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 /TimeSync /IRIG-B]

Signals of the IRIG-B00X (Output States)

Name	*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 Device 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 Device 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 Device 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 you 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 Device 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 Device 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

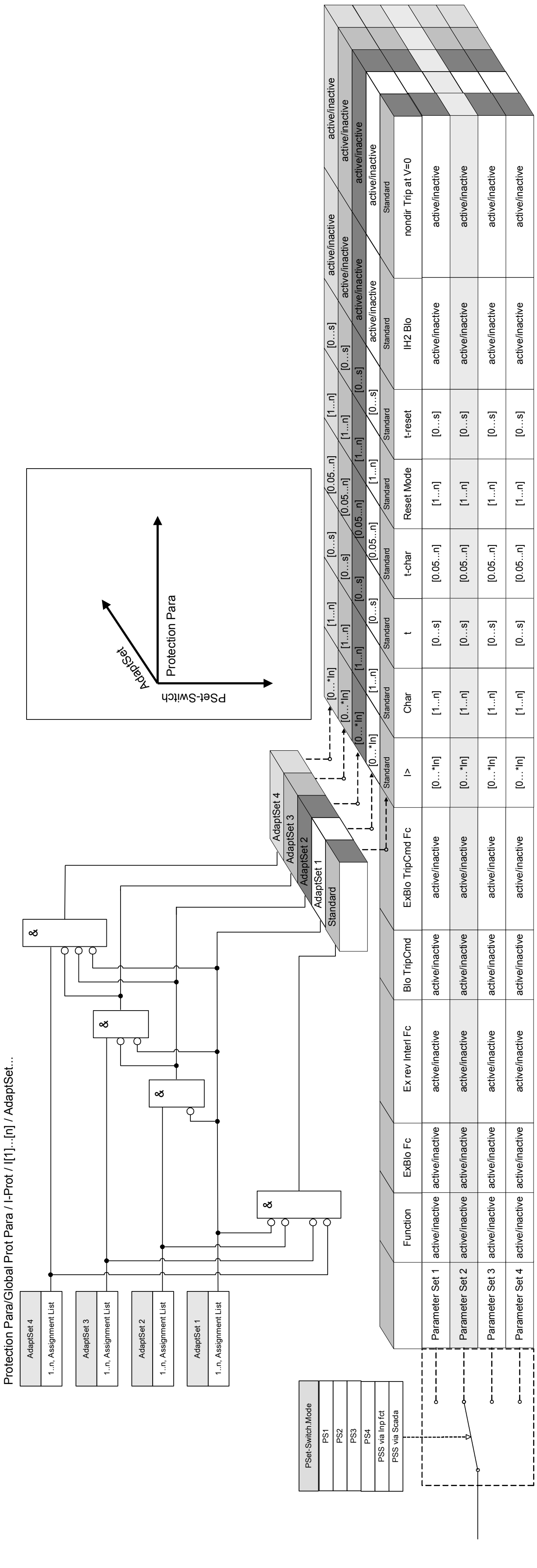
Signals are part of the Device Parameter Tree. The state of the signal is context-dependent.

- ***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 Device Parameter Tree.
By means of ***Adaptive Parameter Sets*** you can temporarily modify 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.

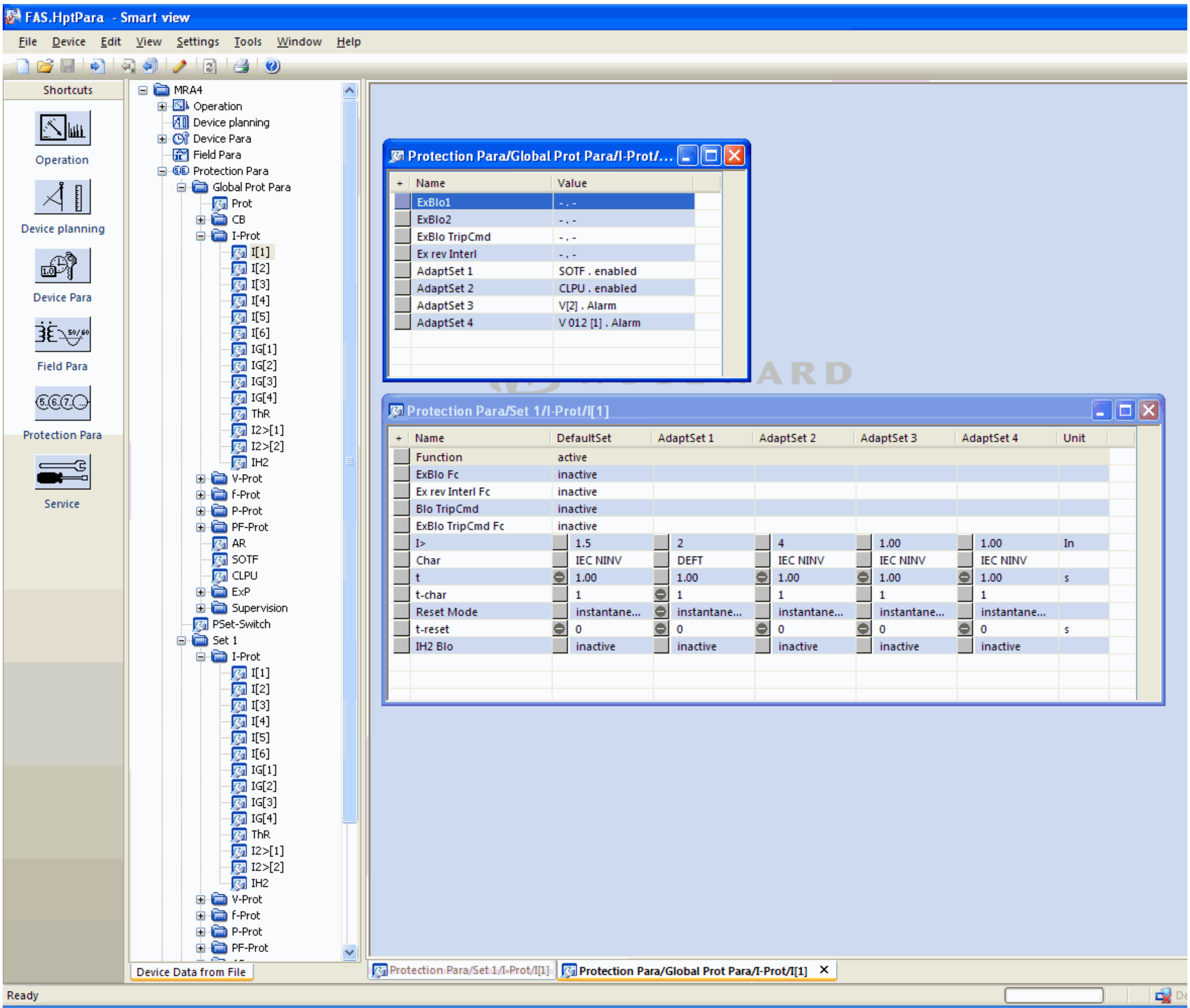
For some protection elements such as time overcurrent and instantaneous overcurrent (50P, 51P, 50G, 51G…), besides the “default” setting there exist another 4 “alternative” settings for pickup value, curve type, time dial, reset mode set values which can dynamically be switched-over by means of the configurable 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 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
VG[1].Alarm	Signal: Alarm Residual Voltage Supervision-stage
VG[2].Alarm	Signal: Alarm Residual Voltage Supervision-stage
V 012 [1].Alarm	Signal: Alarm voltage asymmetry
V 012 [2].Alarm	Signal: Alarm voltage asymmetry
V 012 [3].Alarm	Signal: Alarm voltage asymmetry
V 012 [4].Alarm	Signal: Alarm voltage asymmetry
V 012 [5].Alarm	Signal: Alarm voltage asymmetry
V 012 [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
SOTF.enabled	Signal: Switch Onto Fault enabled. This Signal can be used to modify Overcurrent Protection Settings.
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

Name	*Description*
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

Name	*Description*
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

Name	*Description*
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

Name	*Description*
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

Name	*Description*
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

Name	*Description*
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

Name	*Description*
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

Name	*Description*
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)

Operational Modes (access authorization)

Operational Mode – »Display Only«

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

Operation Mode – »Parameter Setting and Planning«

In this mode you are able to:

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

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

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

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

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

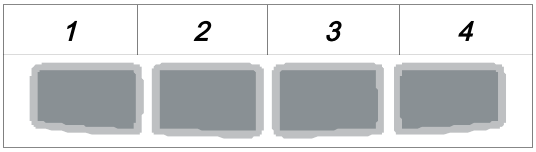
NOTICE **As long as you are within the parameter setting mode a wrench icon will be shown in the upper right corner of the display.**

6. For saving the altered parameter:
   - press the »OK« key,
   - confirm by pressing the softkey »Yes«.
7. Then the device changes into mode »Display Only«.

Password

Password Entry at the Panel

Passwords can be entered by way of the softkeys.



Example: For password (3244) press successively:

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

Password Changes

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

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

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

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

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

Password Forgotten

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«*.

Changing of Parameters - Example

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

Now you can:

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

To save parameter changes immediately,

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

To change additional parameters and save afterwards,

- move to other parameters and change them

NOTICE

A star symbol in front of the changed parameters indicates that the modifications have only temporarily been saved, they are not yet finally stored and adopted by the device.

In order to make things easier to follow, especially where complex parameter changes are involved, on every superior/higher-ranking menu level the intended change of the parameter is indicated by the star symbol (star trace). This makes it possible to control or follow from the main menu level at any time where parameter changes have been made and have not finally been saved.

In addition to the star trace to the temporarily saved parameter changes, a general parameter changing symbol is faded-in at the left corner of the display, and so it is possible from each point of the menu tree to see that there are parameter changes still not adopted by the device.

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

NOTICE

Plausibility check: In order to prevent obvious wrong settings the device monitors constantly all temporarily saved parameter changes. If the device

detects an implausibility, this is indicated by a question mark in front of the respective parameter.

In order to make things easier to follow, especially where complex parameter changes are involved, on every superior/higher-ranking menu level, above the temporarily saved parameters an invalidity is indicated by the question mark (plausibility trace). This makes it possible to control or follow from the main menu level at any time where implausibilities are intended to be saved.

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

Changing of Parameters When Using the Smart View - Example

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

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

NOTICE

A star symbol in front of the changed parameters indicates that the alterations have only temporarily been saved. They are not yet finally stored and adopted by the software/device.

In order to make things easier to follow, especially where complex parameter changes are involved, on every superior/higher menu level, the intended change of the parameter is indicated by the star symbol (star trace). This makes it possible to control or follow from the main menu level at any time where parameter changes have been made and have not finally been saved.

NOTICE

Plausibility check: In order to prevent obvious wrong settings the software monitors constantly all temporarily saved parameter changes. If it detects an implausibility, this is indicated by a question mark in front of the respective parameter.

In order to make things easier to follow, especially where complex parameter changes are involved, on every superior/higher menu level above of the temporarily saved parameters, an implausibility is indicated by a question mark (plausibility trace). This makes it possible to control or follow from the main menu level at any time where implausibilities exist.

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

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

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

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

NOTICE

Once you have entered the parameter setting password, Smart View wont ask you again for the password for at least 10 minutes. This time 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 universally valid, that means that they are valid independent of the protection parameter sets.

- Setting Group Parameters: *»Set1..4«*: The protection parameters that you set within a parameter set are only valid, if the parameter set where you set them is switched to active.

Setting Groups

Setting Group Switch

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

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

Option	***Setting Group Switch***
Manual Selection	Switch over, if another setting group is chosen manually within the menu »Protection Para/P-Set Switch«.

Option	***Setting Group 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.**

Setting Group Switch Via Smart View

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

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

Copying Setting Groups (Parameter Sets) Via Smart View

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

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

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

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

- In case *Smart View* is not running – please start it.
- Open an (offline) parameter file of a device or load data of a connected device.
- By way of precaution, save (the relevant) device parameters [File\Save as].
- Select »Copy Parameter Sets« out of the menu “Edit”.
- Then define both, source and destination of the parameter sets to be copied (source = copy from; destination: copy to).
- Mouse click on »OK« to start copy procedure.
- The copied parameter set is now cached (not yet saved!).
- Then, modify the copied parameter set(s), if applicable.

- Assign a new file name to the revised device parameter file and save it on your hard disk (backup copy).
- To transfer the modified parameters back to the device, click on menu item »Device« and select »Transfer All Parameters into the Device«.

Comparing Setting Groups Via Smart View

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

Comparing Parameter Files Via Smart View

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

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

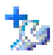
Converting Parameter Files Via Smart View

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

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

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

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

Added parameter:	
Deleted parameter:	

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 /Reset/Acknowledge /Acknowledge]
Ack BO	All acknowledgeable binary output relays will be acknowledged.	inactive, active	inactive	[Operation /Reset/Acknowledge /Acknowledge]
Ack Scada	SCADA will be acknowledged.	inactive, active	inactive	[Operation /Reset/Acknowledge /Acknowledge]
Ack BO LED Scd TCmd	Reset the binary output relays, LEDs, SCADA and the Trip Command.	inactive, active	inactive	[Operation /Reset/Acknowledge /Acknowledge]
Res OperationsCr	Reset all counters in history group operations	inactive, active	inactive	[Operation /Reset/Acknowledge /History]
Res AlarmCr	Reset all counters in history group alarms	inactive, active	inactive	[Operation /Reset/Acknowledge /History]

Parameter	Description	Setting range	Default	Menu path
Res TripCr	Reset all counters in history group trips	inactive, active	inactive	[Operation /Reset/Acknowledge /History]
Res TotalCr	Reset all counters in history group total	inactive, active	inactive	[Operation /Reset/Acknowledge /History]
Res All	Reset of all Counters	inactive, active	inactive	[Operation /Reset/Acknowledge /History]
Reboot	Rebooting the device.	no, yes	no	[Service /General]

CAUTION

CAUTION, rebooting the device manually will release the Supervision Contact.

Global Protection Parameters of the System

Parameter	Description	Setting range	Default	Menu path
PSet-Switch	Switching Parameter Set	PS1, PS2, PS3, PS4, 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, DI-LogicList	-.-	[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, DI-LogicList	-.-	[Protection Para /PSet-Switch]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
PS3: activated by	This Setting Group will be the active one if: The Parameter Setting Group Switch is set to "Switch via Input" and the other three input functions are inactive at the same time. In case that there is more than one input function active, no Parameter Setting Group Switch will be executed. In case 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, DI-LogicList	-.-	[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, DI-LogicList	-.-	[Protection Para /PSet-Switch]
Ack LED	All acknowledgeable LEDs will be acknowledged if the state of the assigned signal becomes true.	1..n, Assignment List	-.-	[Device Para /Ex Acknowledge]
Ack BO	All acknowledgeable binary output relays will be acknowledged if the state of the assigned signal becomes true.	1..n, Assignment List	-.-	[Device Para /Ex Acknowledge]
Ack Scada	SCADA will be acknowledged if the state of the assigned signal becomes true.	1..n, Assignment List	-.-	[Device Para /Ex Acknowledge]
Scaling	Display of the measured values as primary, secondary or per unit values	Per unit values, Primary values, Secondary values	Per unit values	[Device Para /Measurem Display]

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]

System Module Signals

Name	*Description*
Reboot	Signal: Rebooting the device: 1=Restart initiated by power supply; 2=Restart initiated by the user; 3=Set on defaults (Super Reset); 4=Restart by the debugger; 5=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 to 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
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 TripCr	Signal:: Res TripCr
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]
Hours Counter	Hours Counter	[Operation /History /TotalCr]

Field Parameters

Field Para

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

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 – Current Related

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
CT pri	Nominal current of the primary side of the current transformers.	1 - 50000A	10A	[Field Para /Current transf]
CT sec	Nominal current of the secondary side of the current transformers.	1A, 5A	1A	[Field Para /Current transf]
CT dir	Protection functions with directional feature can only work properly if the connection of the current transformers is free of wiring errors. If all current transformers are connected to the device with an incorrect polarity, the wiring error can be compensated by this parameter. This parameter turns the current vectors by 180 degrees.	0°, 180°	0°	[Field Para /Current transf]
ECT pri	This parameter defines the primary nominal current of the connected earth current transformer. If the earth current is measured via the Holmgreen connection, the primary value of the phase current transformer must be entered here.	1 - 50000A	50A	[Field Para /Current transf]
ECT sec	This parameter defines the secondary nominal current of the connected earth current transformer. If the earth current is done via the Holmgreen connection, the primary value of the phase current transformer must be entered here.	1A, 5A	1A	[Field Para /Current transf]
ECT dir	Earth fault protection with directional feature depends also on the correct wiring of the earth current transformer. An incorrect polarity/wiring can be corrected by means of the settings "0°" or "180°". The operator has the possibility of turning the current vector by 180 degrees (change of sign) without modification of the wiring. This means, that – in terms of figures - the determined current indicator was turned by 180° by the device.	0°, 180°	0°	[Field Para /Current transf]

Parameter	Description	Setting range	Default	Menu path
IL1, IL2, IL3 Cutoff Level	The Current shown in the Display or within the PC Software will be displayed as zero, if the Current falls below this Cutoff Level. This parameter has no impact on recorders.	0.0 - 0.100In	0.005In	[Device Para /Measurem Display]
IG meas Cutoff Level	The measured Earth Current shown in the Display or within the PC Software will be displayed as zero, if the measured Earth Current falls below this Cutoff Level. This parameter has no impact on recorders.	0.0 - 0.100In	0.005In	[Device Para /Measurem Display]
IG calc Cutoff Level	The calculated Earth Current shown in the Display or within the PC Software will be displayed as zero, if the calculated Earth Current falls below this Cutoff Level. This parameter has no impact on recorders.	0.0 - 0.100In	0.005In	[Device Para /Measurem Display]
I012 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 - 0.100In	0.005In	[Device Para /Measurem Display]

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 transf]
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 - 520V	100V	[Field Para /Voltage transf]
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 transf]
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 transf]
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 - 520V	100V	[Field Para /Voltage transf]
V Block f	Threshold for the release of the frequency stages	0.15 - 1.00Vn	0.5Vn	[Field Para /General settings]

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]
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

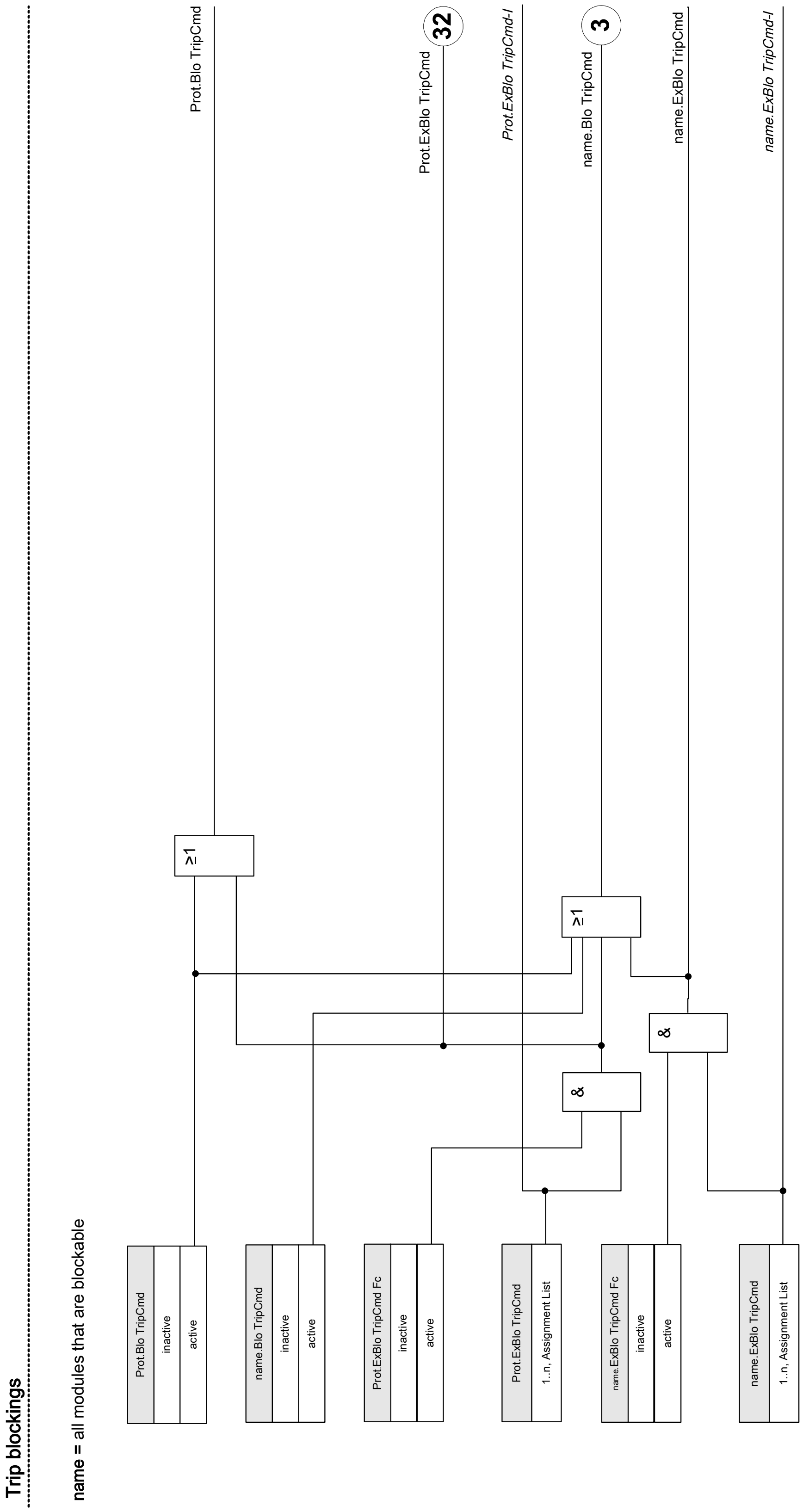
- In order to establish a temporary blockage of a protection module, the parameter *»ExBlo Fc«* of the module has to be set to *»active«*. This gives the permission: »This module can be blocked«.
- Within the general protection parameters a signal has to be additionally chosen from the »ASSIGNMENT LIST«.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

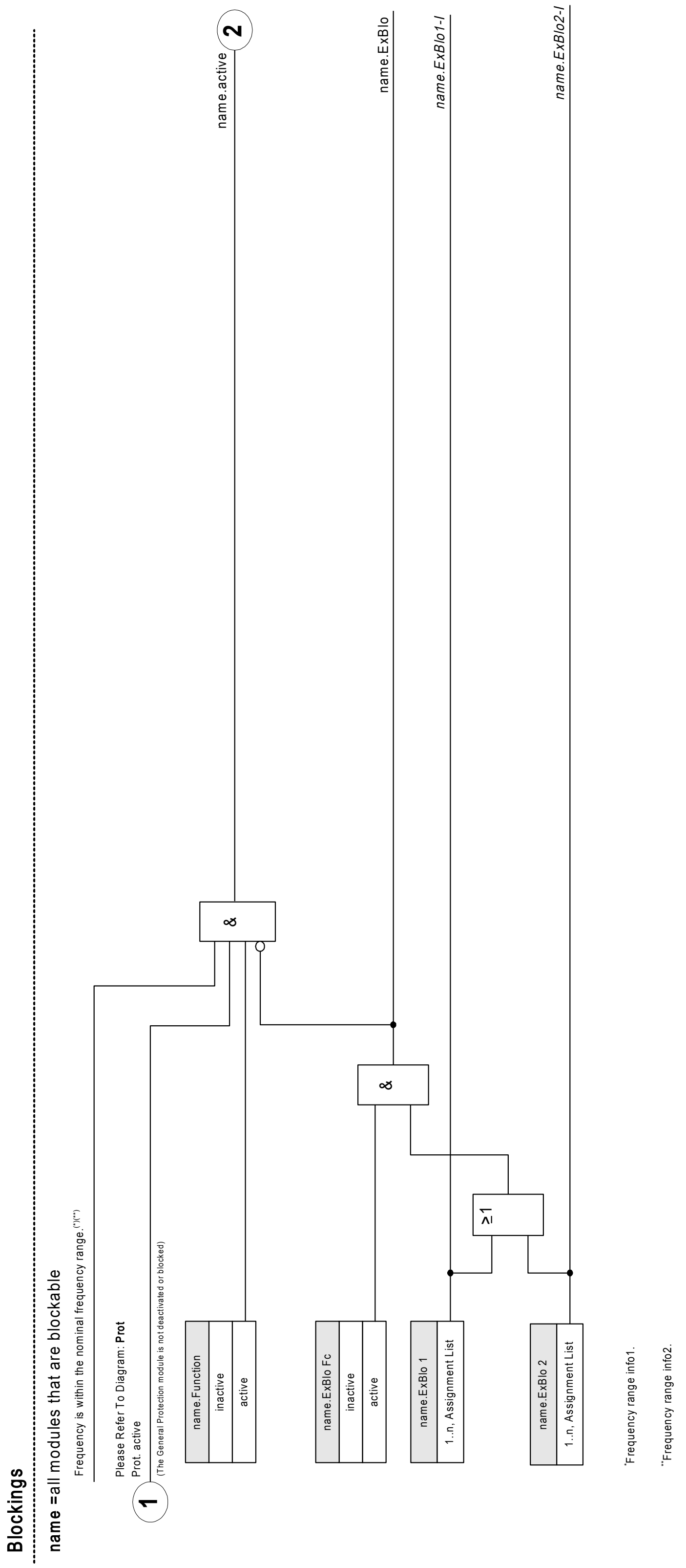
- In order to establish a temporary blockage of a protection stage, the parameter *»ExBlo TripCmd Fc«* of the module has to be set to *»active«*. This gives the permission: »The tripping command of this stage can be blocked«.
- Within the general protection parameters, a signal has to be chosen additionally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

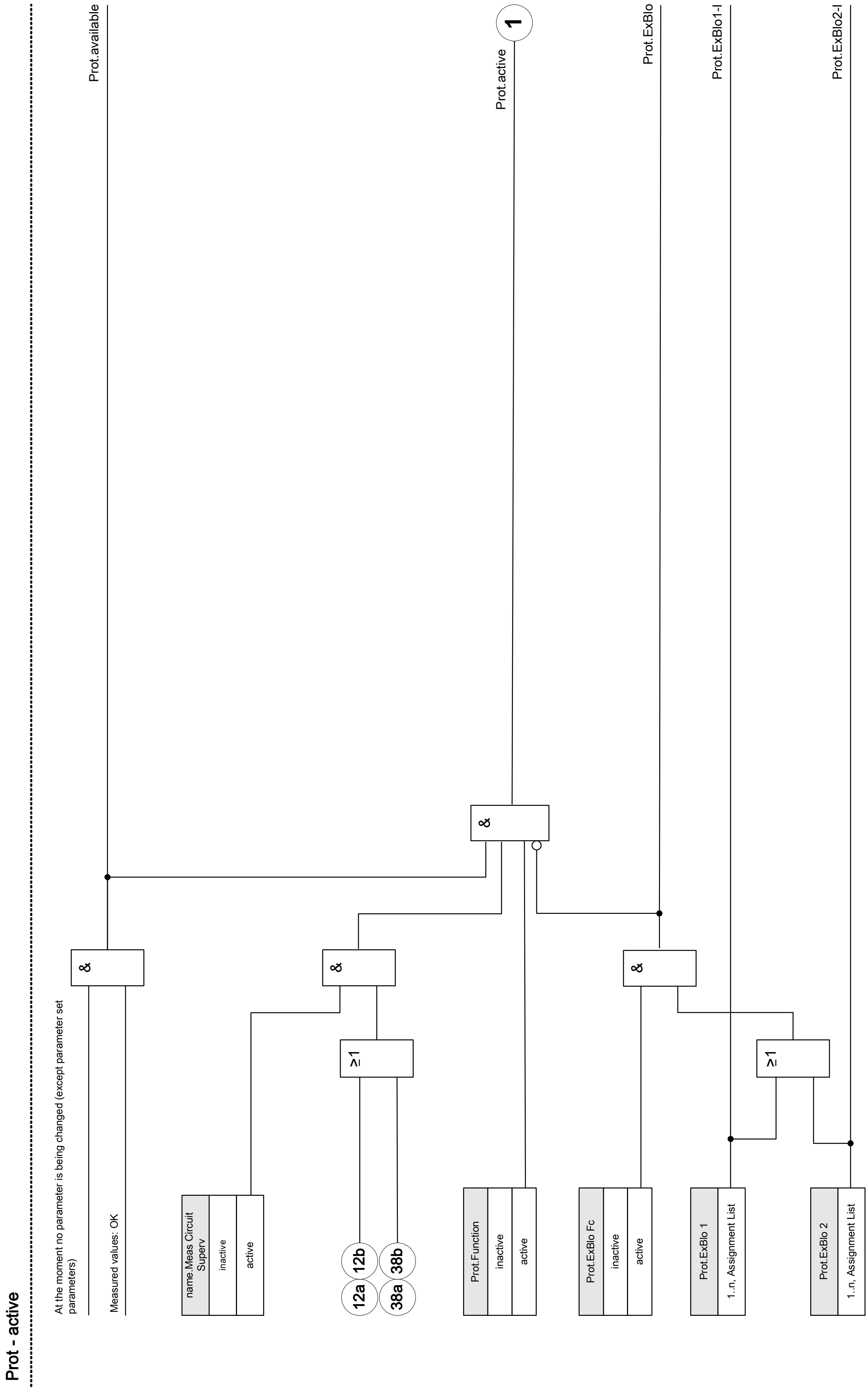


Activate, Deactivate Respectively Block Temporarily Protection Functions

The following diagram applies to all protective elements except: Phase current, Earth current and Q->&V< protection elements.

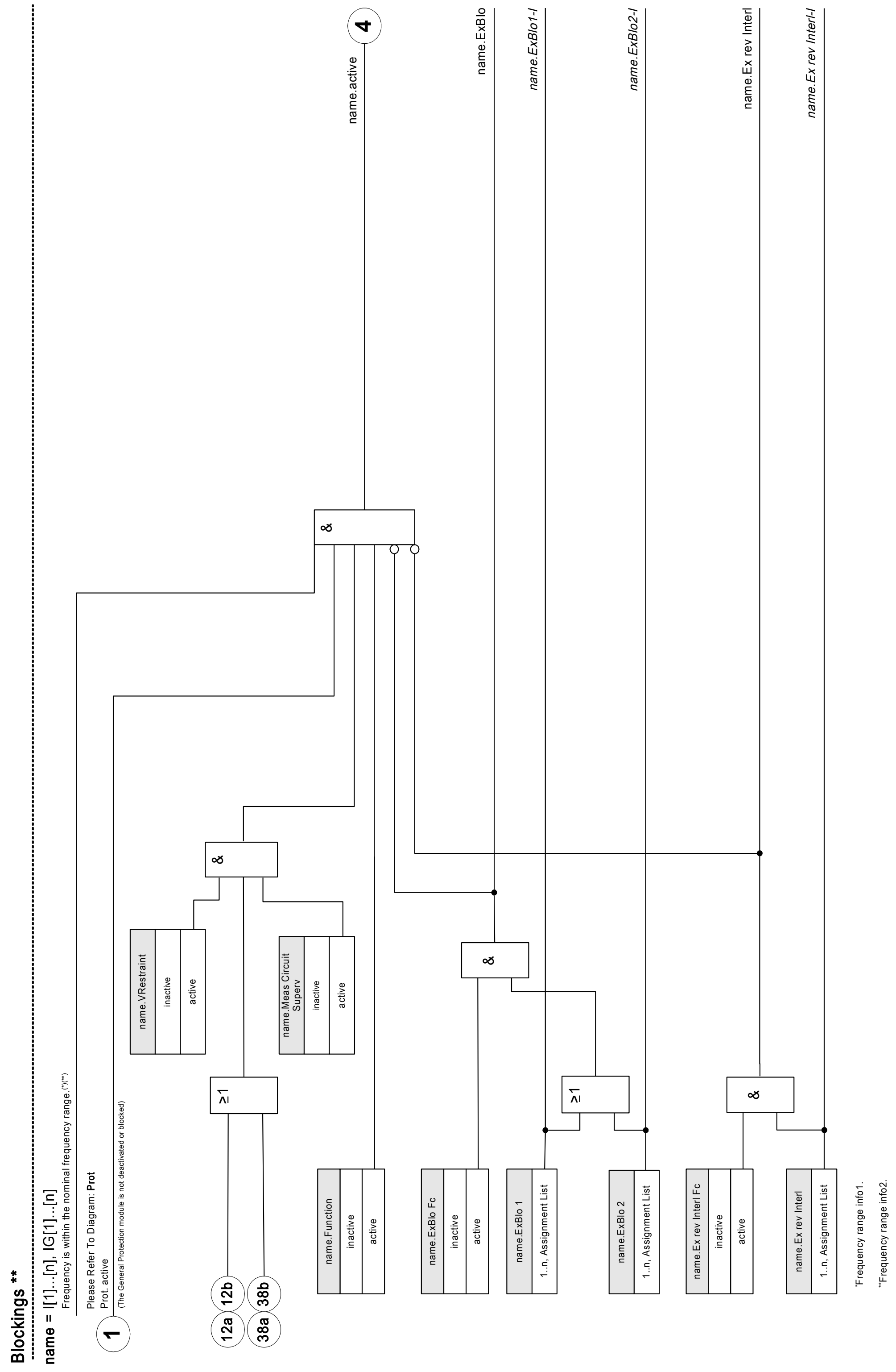


The following diagram is applies to the Q->&V< Protection:

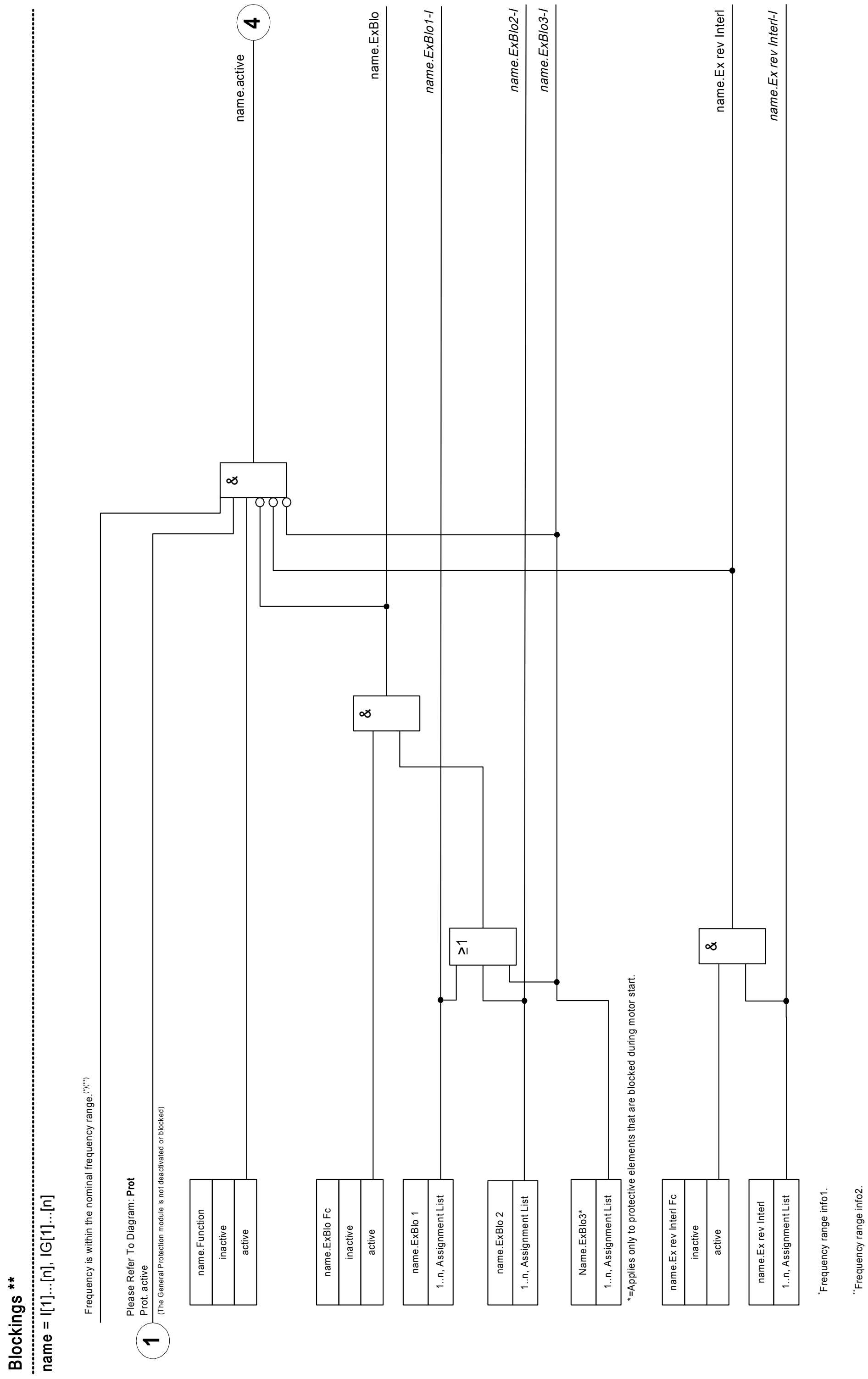


Current protective functions cannot only be blocked permanently (»*function = inactive*«) or temporarily by any blocking signal from the »assignment list«, but also by *»reverse Interlocking«*.

The following diagram applies to voltage restraint phase current elements (51V):

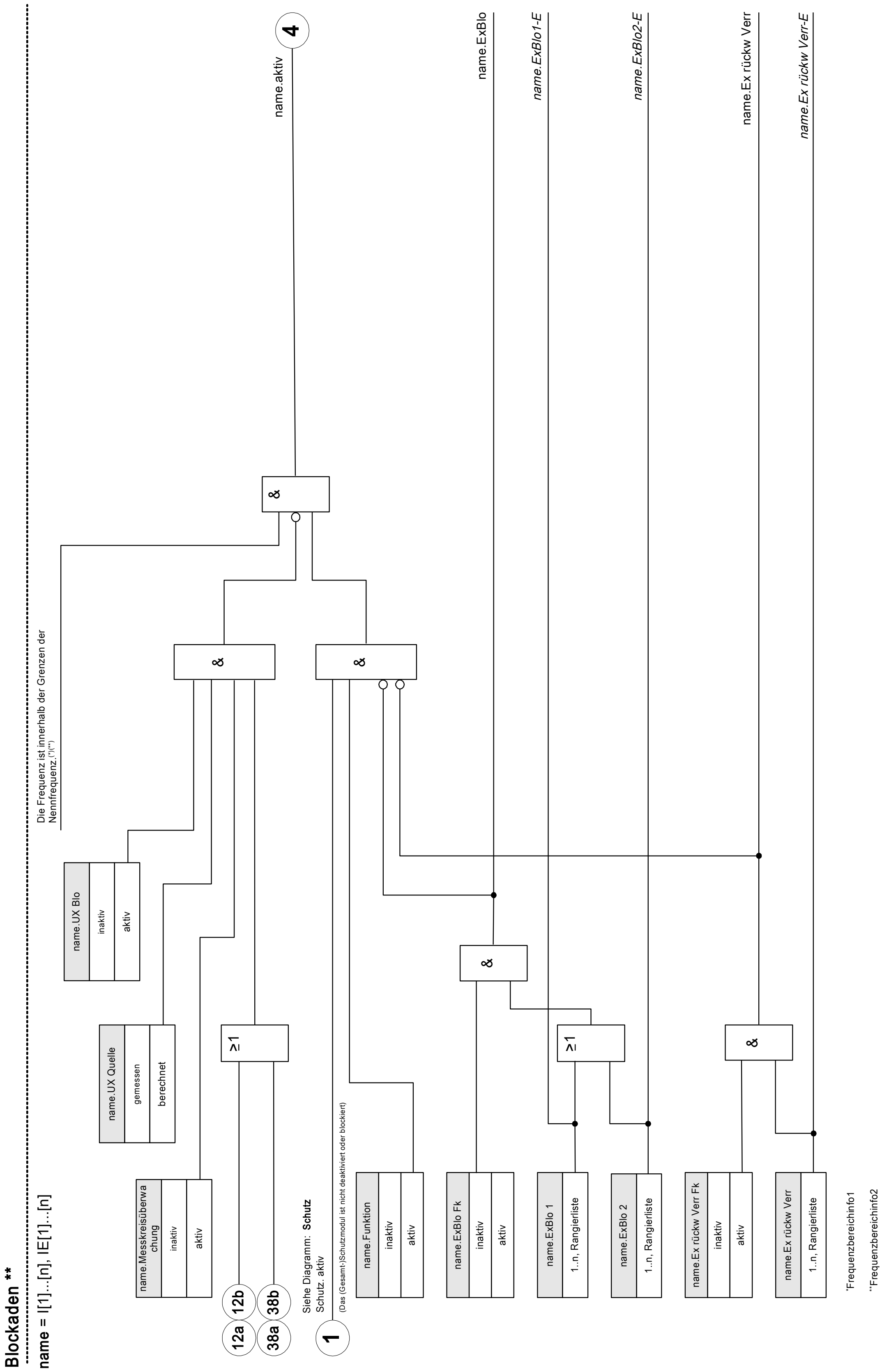


The following diagram applies to all other phase current elements:



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

The following diagram applies to earth current elements:



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

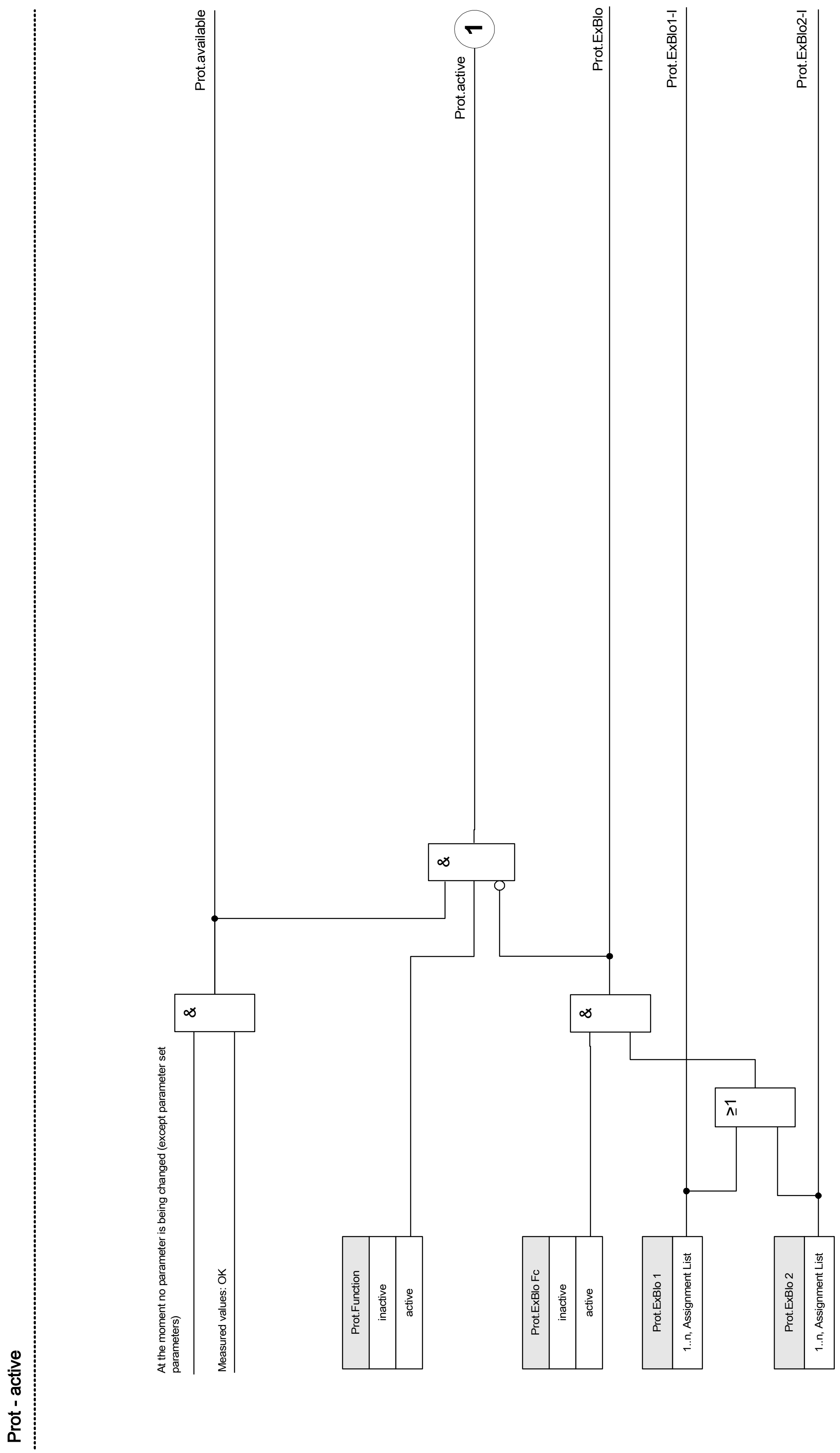
If in module *»Protection«* the parameter *»Function«* is set on »inactive« or in case the module is blocked, then the complete protective function of the device does not work anymore.

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

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«***

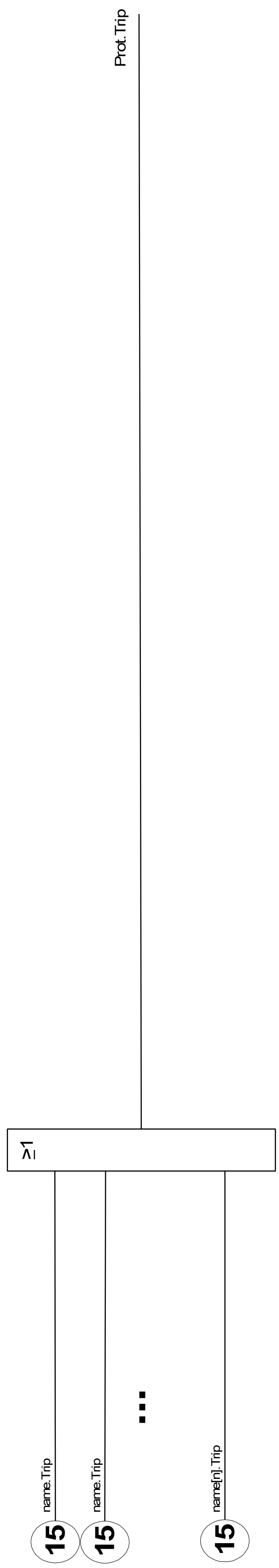
If a protection module is activated respectively issues a trip command to the CB two alarm signals will be created:

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«.

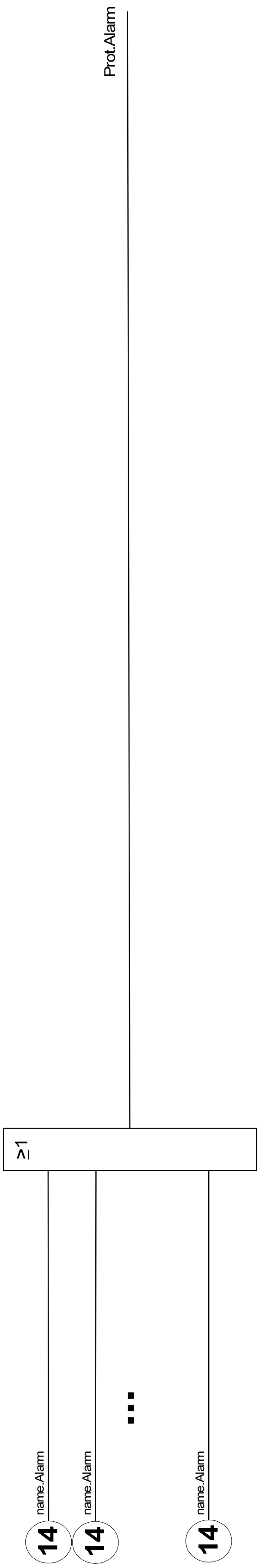
Prot.Trip

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).

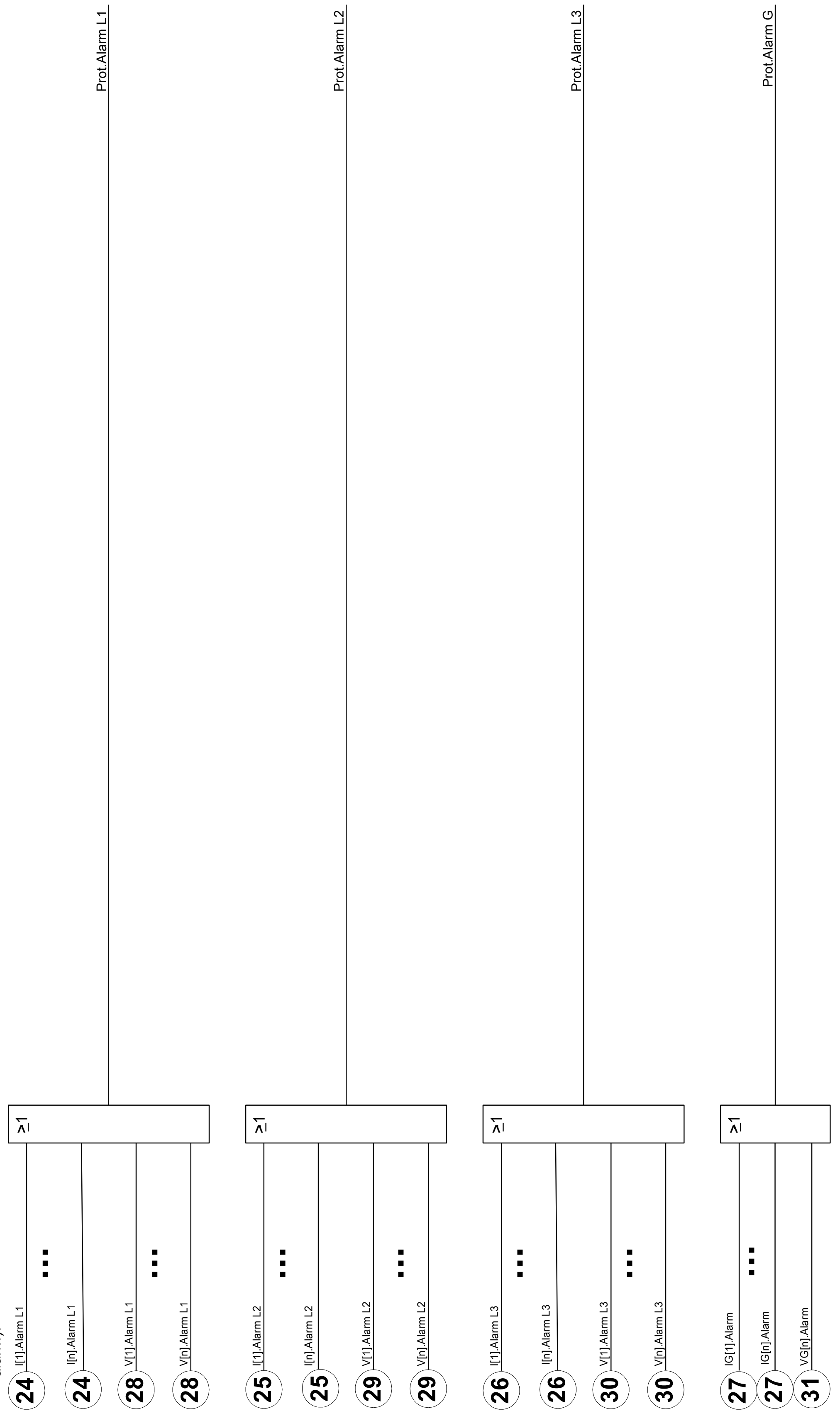


Prot.Trip

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/Acknowledge /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)

Name	*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

Name	*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

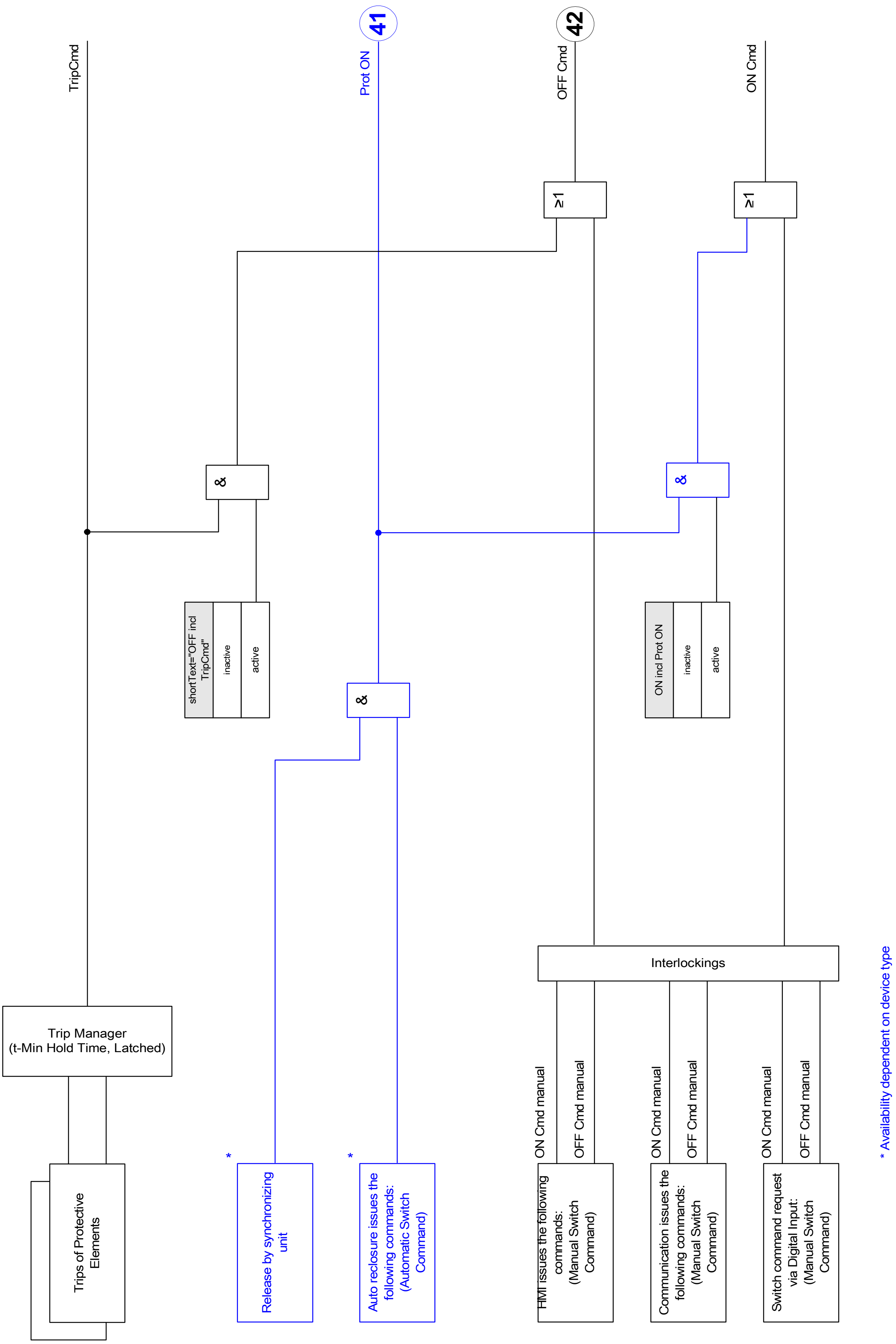
To avoid faulty operations, interlockings have to be provided. This can be realised mechanically, or electrically within the menu [Control/Bkr/General Settings] .

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.

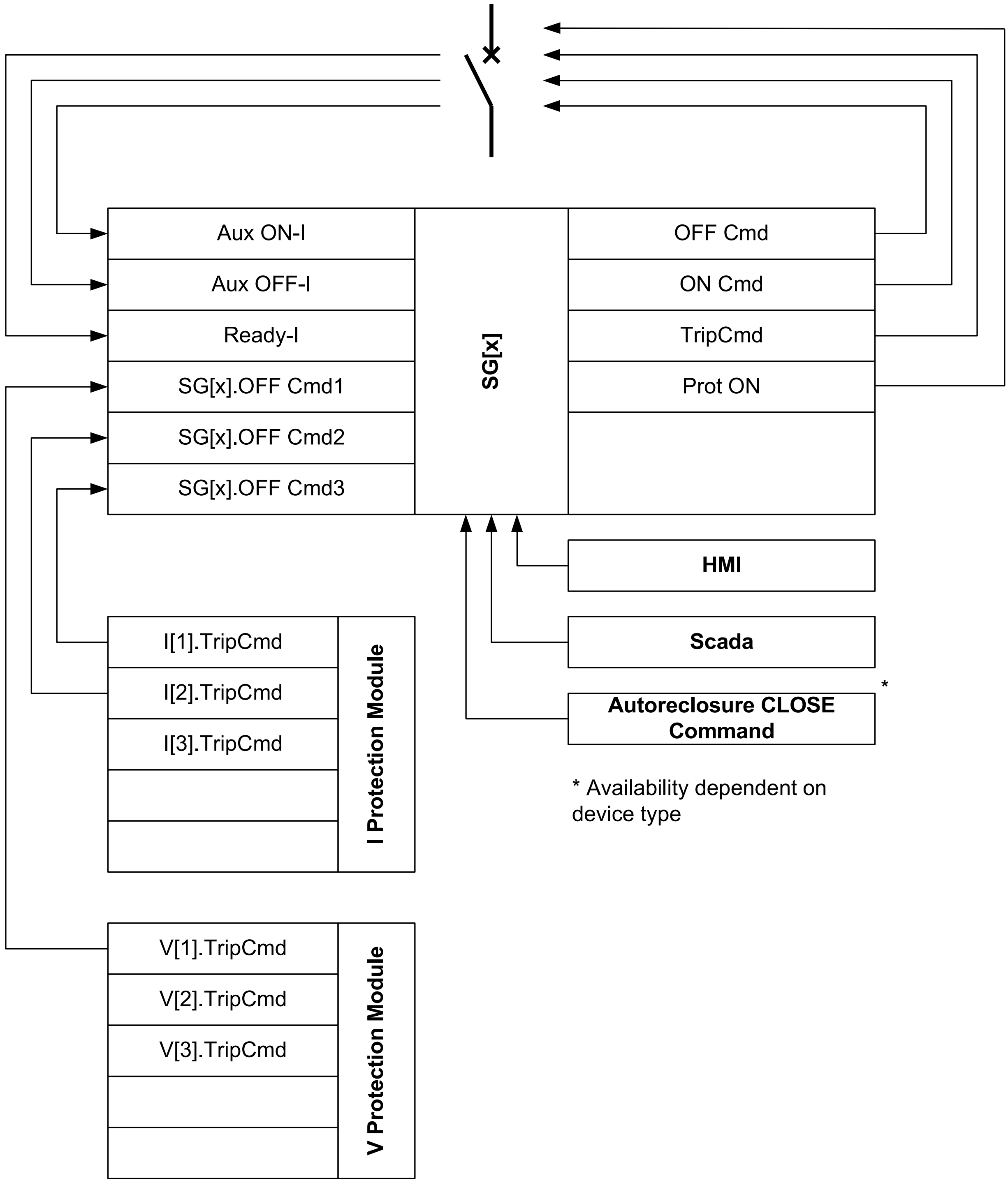
*=availability depends on ordered device.

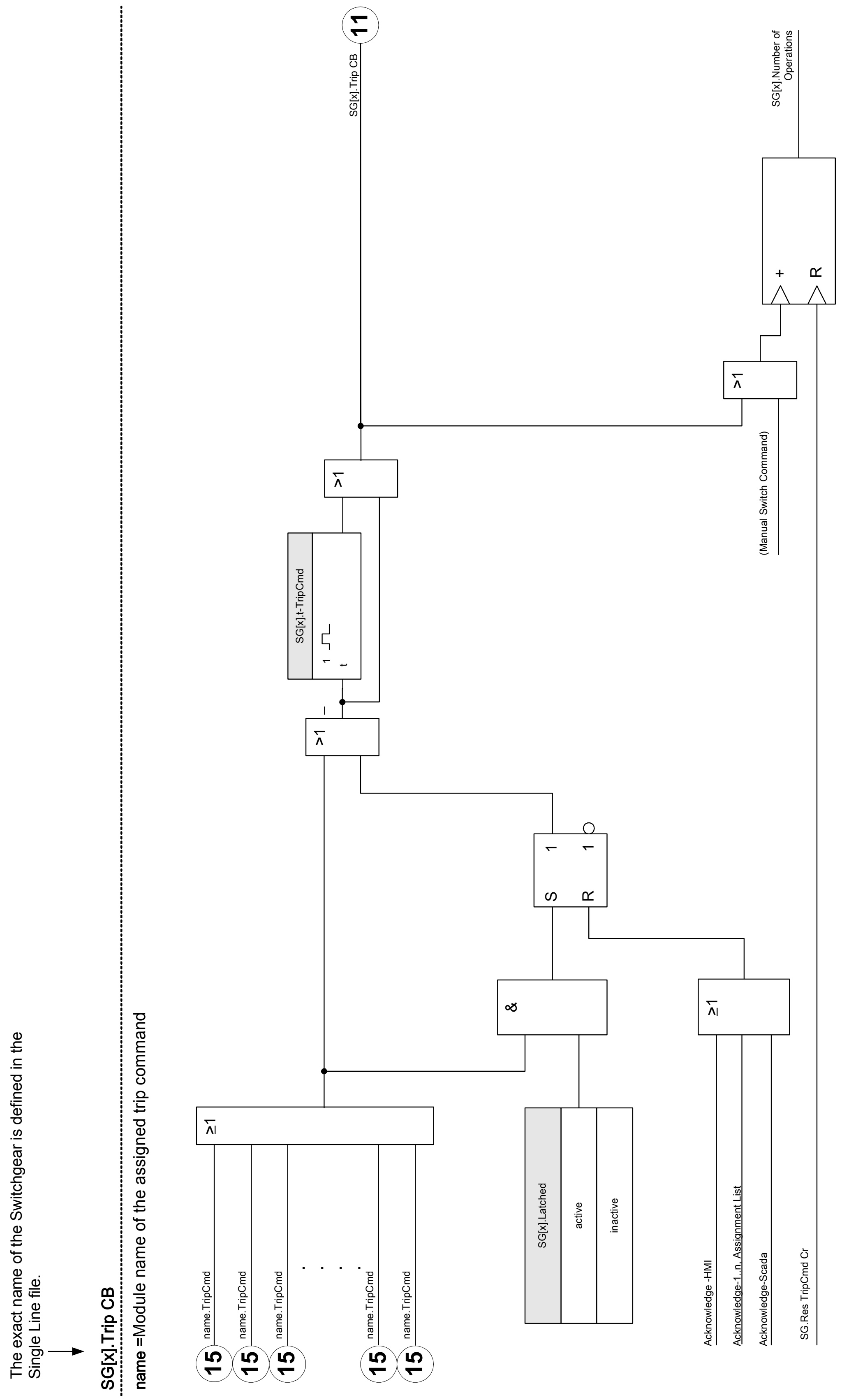

TripCmd
Prot ON
41
OFF Cmd
42
ON Cmd
≥1
≥1
&
&
&
shortText="OFF incl TripCmd"
inactive
active
ON incl Prot ON
inactive
active
Interlockings
Trip Manager
(t-Min Hold Time, Latched)
Trips of Protective Elements
*
Release by synchronizing unit
*
Auto reclosure issues the following commands: (Automatic Switch 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
&
S
R
1
1
Acknowledge -HMI
Acknowledge-1..n, Assignment List
Acknowledge-Scada
SG.Res TripCmd Cr
SG[x].t-TripCmd
>1
SG[x].Trip CB
11
(Manual Switch Command)
+
R
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*

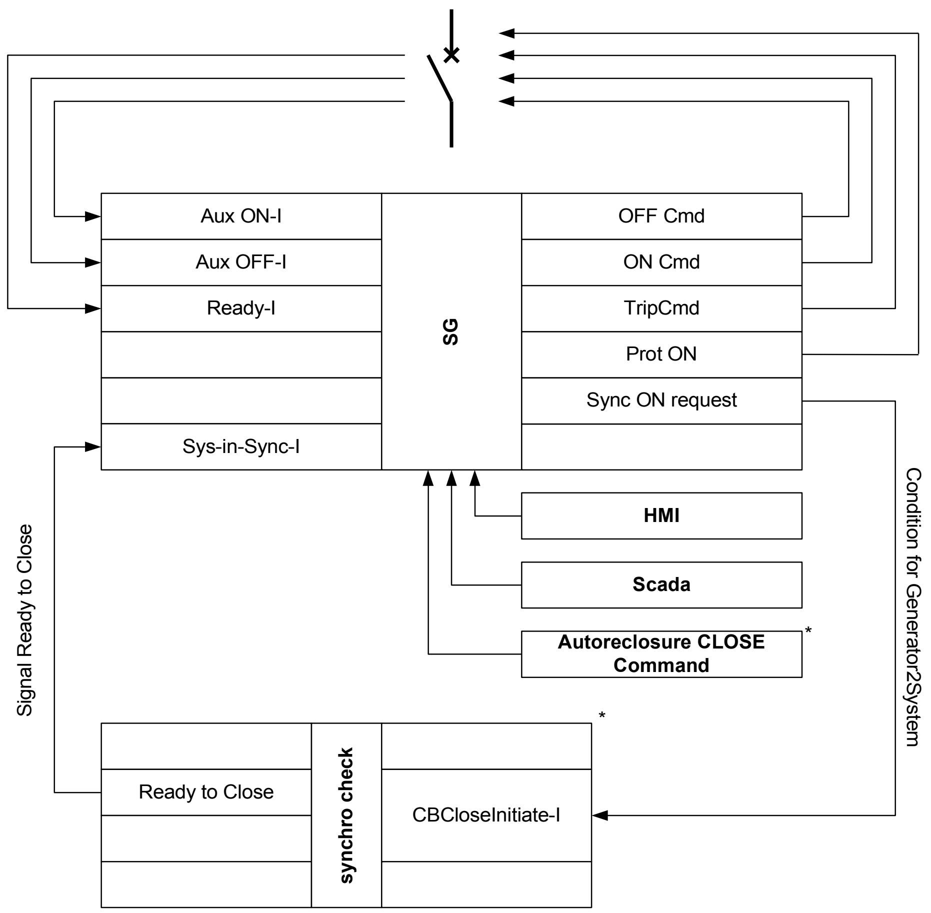
*=availability depends on ordered device type

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.



* Availability dependent on device type

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.

Switchgear Wear

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.

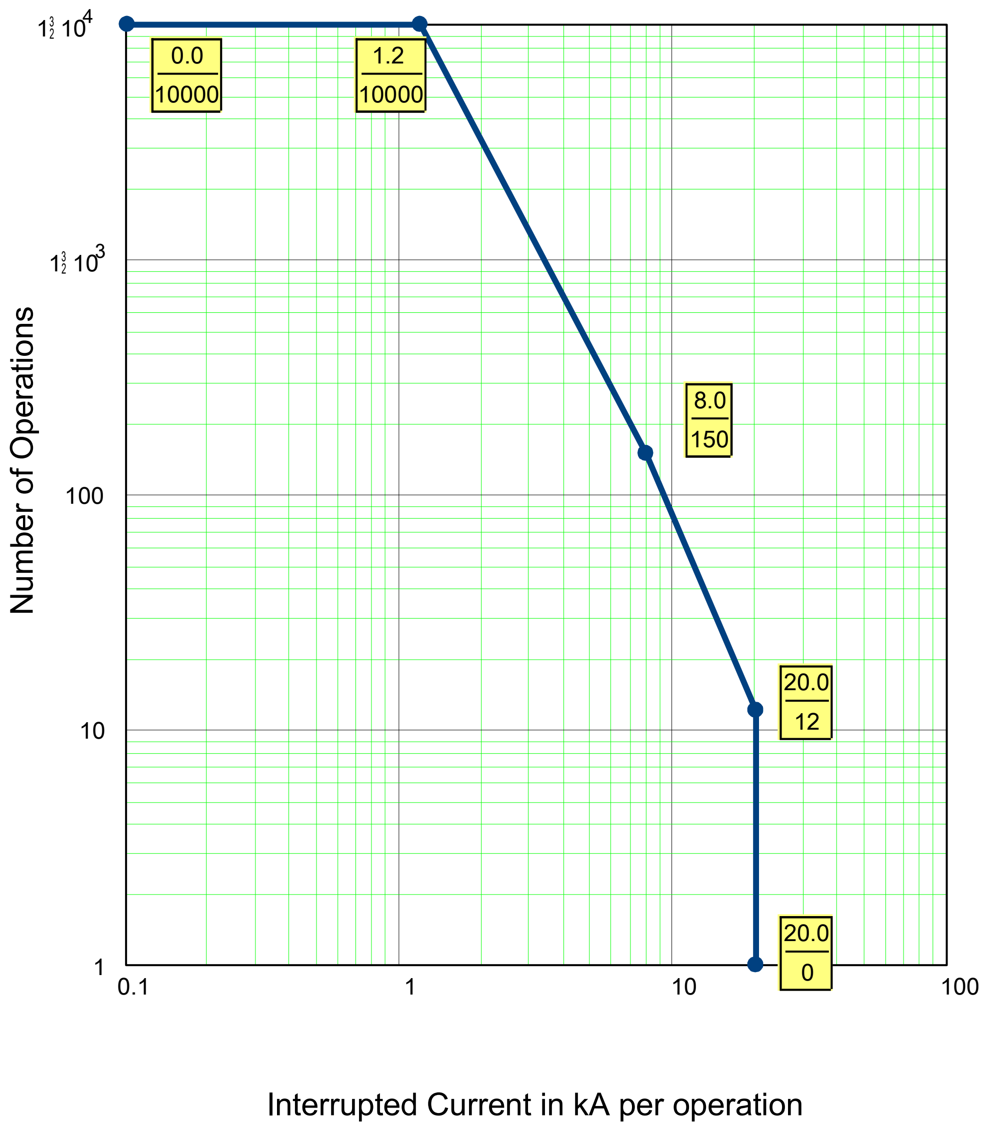
Switchgear Wear Curve

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.

Breaker Maintenance Curve for a typical 25kV Breaker



Global Protection Parameters of the Breaker Wear Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Operations Alarm	Service Alarm, too many Operations	1 - 100000	9999	[Control /SG /SG Wear]
Isum Intr Alarm	Alarm, the Sum (Limit) of interrupting currents has been exceeded.	0.00 - 2000.00kA	100.00kA	[Control /SG /SG Wear]
Isum Intr ph Alm	Alarm, the per hour Sum (Limit) of interrupting currents has been exceeded.	0.00 - 2000.00kA	100.00kA	[Control /SG /SG Wear]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
SGwear Curve Fc	The Circuit Breaker (load-break switch) Wear Curve defines the maximum allowed CLOSE/OPEN cycles depending on the brake currents. If the circuit breaker maintenance curve is exceeded, an alarm will be issued. The breaker maintenance curve is to be taken from the technical data sheet of the breaker manufactor. By means of the available points this curve is to be replicated.	inactive, active	inactive	[Control /SG /SG Wear]
WearLevel Alarm	Threshold for the Alarm Only available if:SGwear Curve Fc = active	0.00 - 100.00%	80.00%	[Control /SG /SG Wear]
WearLevel Lockout	Threshold for the Lockout Level Only available if:SGwear Curve Fc = active	0.00 - 100.00%	95.00%	[Control /SG /SG Wear]
Current1	Interrupted Current Level #1 Only available if:SGwear Curve Fc = active	0.00 - 2000.00kA	0.00kA	[Control /SG /SG Wear]
Count1	Open Counts Allowed #1 Only available if:SGwear Curve Fc = active	1 - 32000	10000	[Control /SG /SG Wear]
Current2	Interrupted Current Level #2 Only available if:SGwear Curve Fc = active	0.00 - 2000.00kA	1.20kA	[Control /SG /SG Wear]
Count2	Open Counts Allowed #2 Only available if:SGwear Curve Fc = active	1 - 32000	10000	[Control /SG /SG Wear]
Current3	Interrupted Current Level #3 Only available if:SGwear Curve Fc = active	0.00 - 2000.00kA	8.00kA	[Control /SG /SG Wear]
Count3	Open Counts Allowed #3 Only available if:SGwear Curve Fc = active	1 - 32000	150	[Control /SG /SG Wear]
Current4	Interrupted Current Level #4 Only available if:SGwear Curve Fc = active	0.00 - 2000.00kA	20.00kA	[Control /SG /SG Wear]
Count4	Open Counts Allowed #4 Only available if:SGwear Curve Fc = active	1 - 32000	12	[Control /SG /SG Wear]
Current5	Interrupted Current Level #5 Only available if:SGwear Curve Fc = active	0.00 - 2000.00kA	20.00kA	[Control /SG /SG Wear]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Count5	Open Counts Allowed #5 Only available if:SGwear Curve Fc = active	1 - 32000	1	[Control /SG /SG Wear]
Current6	Interrupted Current Level #6 Only available if:SGwear Curve Fc = active	0.00 - 2000.00kA	20.00kA	[Control /SG /SG Wear]
Count6	Open Counts Allowed #6 Only available if:SGwear Curve Fc = active	1 - 32000	1	[Control /SG /SG Wear]
Current7	Interrupted Current Level #7 Only available if:SGwear Curve Fc = active	0.00 - 2000.00kA	20.00kA	[Control /SG /SG Wear]
Count7	Open Counts Allowed #7 Only available if:SGwear Curve Fc = active	1 - 32000	1	[Control /SG /SG Wear]
Current8	Interrupted Current Level #8 Only available if:SGwear Curve Fc = active	0.00 - 2000.00kA	20.00kA	[Control /SG /SG Wear]
Count8	Open Counts Allowed #8 Only available if:SGwear Curve Fc = active	1 - 32000	1	[Control /SG /SG Wear]
Current9	Interrupted Current Level #9 Only available if:SGwear Curve Fc = active	0.00 - 2000.00kA	20.00kA	[Control /SG /SG Wear]
Count9	Open Counts Allowed #9 Only available if:SGwear Curve Fc = active	1 - 32000	1	[Control /SG /SG Wear]
Current10	Interrupted Current Level #10 Only available if:SGwear Curve Fc = active	0.00 - 2000.00kA	20.00kA	[Control /SG /SG Wear]
Count10	Open Counts Allowed #10 Only available if:SGwear Curve Fc = active	1 - 32000	1	[Control /SG /SG Wear]

Breaker Wear Signals (Output States)

Name	*Description*
Operations Alarm	Signal: Service Alarm, too many Operations
Isum Intr trip: IL1	Signal: Maximum permissible Summation of the interrupting (tripping) currents exceeded: IL1
Isum Intr trip: IL2	Signal: Maximum permissible Summation of the interrupting (tripping) currents exceeded: IL2
Isum Intr trip: IL3	Signal: Maximum permissible Summation of the interrupting (tripping) currents exceeded: IL3
Isum Intr trip	Signal: Maximum permissible Summation of the interrupting (tripping) currents exceeded in at least one phase.
Res TripCmd Cr	Signal: Resetting of the Counter: total number of trip commands
Res Sum trip	Signal: Reset summation of the tripping currents
WearLevel Alarm	Signal: Threshold for the Alarm
WearLevel Lockout	Signal: Threshold for the Lockout Level
Res SGwear Curve	Signal: Res SGwear Curve
Isum Intr ph Alm	Signal: Isum Intr ph Alm
Res Isum Intr ph Alm	Signal: Res Isum Intr ph Alm

Breaker Wear Counter Values

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

Breaker Wear Values

Value	*Description*	*Default*	*Size*	*Menu path*
Sum trip IL1	Summation of the tripping currents phase	0.00A	0.00 - 1000.00A	[Operation /Count and RevData /Ctrl /SG]
Sum trip IL2	Summation of the tripping currents phase	0.00A	0.00 - 1000.00A	[Operation /Count and RevData /Ctrl /SG]

Value	Description	Default	Size	Menu path
Sum trip IL3	Summation of the tripping currents phase	0.00A	0.00 - 1000.00A	[Operation /Count and RevData /Ctrl /SG]
Isum Intr per hour	Sum per hour of interrupting currents.	0.00kA	0.00 - 1000.00kA	[Operation /Count and RevData /Ctrl /SG]
SG OPEN capacity	Used capacity. 100% means, that the switchgear is to be maintenanced.	0.0%	0.0 - 100.0%	[Operation /Count and RevData /Ctrl /SG]

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/Acknowledge /Reset]
Res Sum trip	Reset summation of the tripping currents	inactive, active	inactive	[Operation /Reset/Acknowledge /Reset]
Res Isum Intr per hour	Reset of the Sum per hour of interrupting currents.	inactive, active	inactive	[Operation /Reset/Acknowledge /Reset]
Res CB OPEN capacity	Resetting of the CB OPEN capacity. 100% means, that the circuit breaker is to be maintenanced.	inactive, active	inactive	[Operation /Reset/Acknowledge /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

Name	*Description*
Local	Switching Authority: Local
Remote	Switching Authority: Remote
NonInterl	Non-Interlocking is active
CES SAuthority	Command Execution Supervision: Switching Command not executed. No switching authority.
CES DoubleOperating	Command Execution Supervision: A second switch command is in conflict with a pending one.
No. of rej. com. because Locked by ParaSystem	No. of rej. com. because Locked by ParaSystem

Assignable Trip Commands (Trip Manager)

Name	*Description*
-.-	No assignment
MStart.TripCmd	Signal: Trip Command
I[1].TripCmd	Signal: Trip Command
I[2].TripCmd	Signal: Trip Command
I[3].TripCmd	Signal: Trip Command
I[4].TripCmd	Signal: Trip Command
I[5].TripCmd	Signal: Trip Command
I[6].TripCmd	Signal: Trip Command
IG[1].TripCmd	Signal: Trip Command
IG[2].TripCmd	Signal: Trip Command
IG[3].TripCmd	Signal: Trip Command
IG[4].TripCmd	Signal: Trip Command
I2>[1].TripCmd	Signal: Trip Command
I2>[2].TripCmd	Signal: Trip Command
ThR.TripCmd	Signal: Trip Command
Jam[1].TripCmd	Signal: Trip Command
Jam[2].TripCmd	Signal: Trip Command
I<[1].TripCmd	Signal: Trip Command
I<[2].TripCmd	Signal: Trip Command
I<[3].TripCmd	Signal: Trip Command
RTD.TripCmd	Signal: Trip Command
V[1].TripCmd	Signal: Trip Command
V[2].TripCmd	Signal: Trip Command
V[3].TripCmd	Signal: Trip Command
V[4].TripCmd	Signal: Trip Command
V[5].TripCmd	Signal: Trip Command

Name	*Description*
V[6].TripCmd	Signal: Trip Command
VG[1].TripCmd	Signal: Trip Command
VG[2].TripCmd	Signal: Trip Command
V 012 [1].TripCmd	Signal: Trip Command
V 012 [2].TripCmd	Signal: Trip Command
V 012 [3].TripCmd	Signal: Trip Command
V 012 [4].TripCmd	Signal: Trip Command
V 012 [5].TripCmd	Signal: Trip Command
V 012 [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
PQS [1].TripCmd	Signal: Trip Command
PQS [2].TripCmd	Signal: Trip Command
PQS [3].TripCmd	Signal: Trip Command
PQS [4].TripCmd	Signal: Trip Command
PQS [5].TripCmd	Signal: Trip Command
PQS [6].TripCmd	Signal: Trip Command
PF[1].TripCmd	Signal: Trip Command
PF[2].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

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 /General settings]
Res SGwear Sl SG	Resetting the slow Switchgear Alarm	inactive, active	inactive	[Operation /Reset/Acknowledge /Reset]
Ack TripCmd	Acknowledge Trip Command	inactive, active	inactive	[Operation /Reset/Acknowledge /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).	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, DI Slot X1.DI 5, DI Slot X1.DI 6, DI Slot X1.DI 7, DI Slot X1.DI 8	DI Slot X1.DI 1	[Control /SG /Pos Indicators wiring]
Aux OFF	The CB is in OFF-position if the state of the assigned signal is true (52b).	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, DI Slot X1.DI 5, DI Slot X1.DI 6, DI Slot X1.DI 7, DI Slot X1.DI 8	DI Slot X1.DI 2	[Control /SG /Pos Indicators wiring]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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.	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, DI Slot X1.DI 5, DI Slot X1.DI 6, DI Slot X1.DI 7, DI Slot X1.DI 8	-.-	[Control /SG /Pos Indicators wiring]
Interl ON1	Interlocking of the ON command	1..n, Assignment List	-.-	[Control /SG /Interlockings]
Interl ON2	Interlocking of the ON command	1..n, Assignment List	-.-	[Control /SG /Interlockings]
Interl ON3	Interlocking of the ON command	1..n, Assignment List	-.-	[Control /SG /Interlockings]
Interl OFF1	Interlocking of the OFF command	1..n, Assignment List	-.-	[Control /SG /Interlockings]
Interl OFF2	Interlocking of the OFF command	1..n, Assignment List	-.-	[Control /SG /Interlockings]
Interl OFF3	Interlocking of the OFF command	1..n, Assignment List	-.-	[Control /SG /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 /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 /Ex ON/OFF Cmd]
t-TripCmd	Minimum hold time of the OFF-command (circuit breaker, load break switch)	0 - 300.00s	0.2s	[Control /SG /Trip Manager]
Latched	Defines whether the Binary Output Relay will be Latched when it picks up.	inactive, active	inactive	[Control /SG /Trip Manager]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Ack TripCmd	Ack TripCmd	1..n, Assignment List	-.-	[Control /SG /Trip Manager]
Off Cmd1	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	I[1].TripCmd	[Control /SG /Trip Manager]
Off Cmd2	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	I[2].TripCmd	[Control /SG /Trip Manager]
Off Cmd3	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	I2>[1].TripCmd	[Control /SG /Trip Manager]
Off Cmd4	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	V[1].TripCmd	[Control /SG /Trip Manager]
Off Cmd5	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	V[2].TripCmd	[Control /SG /Trip Manager]
Off Cmd6	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	f[1].TripCmd	[Control /SG /Trip Manager]
Off Cmd7	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	f[2].TripCmd	[Control /SG /Trip Manager]
Off Cmd8	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	PQS [1].TripCmd	[Control /SG /Trip Manager]
Off Cmd9	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	MStart.TripCmd	[Control /SG /Trip Manager]
Off Cmd10	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	ThR.TripCmd	[Control /SG /Trip Manager]
Off Cmd11	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	Jam[1].TripCmd	[Control /SG /Trip Manager]
Off Cmd12	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	I<[1].TripCmd	[Control /SG /Trip Manager]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Off Cmd13	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	PQS [1].TripCmd	[Control /SG /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 /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 /Trip Manager]
Off Cmd16	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /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 /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 /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 /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 /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 /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 /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 /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 /Trip Manager]
Off Cmd25	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Off Cmd26	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /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 /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 /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 /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 /Trip Manager]
Off Cmd31	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd32	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd33	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd34	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd35	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd36	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd37	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd38	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Off Cmd39	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd40	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd41	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd42	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd43	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd44	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd45	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd46	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd47	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd48	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd49	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd50	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd51	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Off Cmd52	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd53	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd54	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd55	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd56	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd57	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd58	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd59	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd60	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd61	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd62	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd63	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
Off Cmd64	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Off Cmd65	Off Command to the Circuit Breaker if the state of the assigned signal becomes true.	1..n, Trip Cmds	-.-	[Control /SG /Trip Manager]
ON incl Prot ON	The ON Command includes the ON Command issued by the Protection module.	inactive, active	active	[Control /SG /General settings]
OFF incl TripCmd	The OFF Command includes the OFF Command issued by the Protection module.	inactive, active	active	[Control /SG /General settings]
t-Move ON	Time to move to the ON Position	0.01 - 100.00s	0.1s	[Control /SG /General settings]
t-Move OFF	Time to move to the OFF Position	0.01 - 100.00s	0.1s	[Control /SG /General settings]
t-Dwell	Dwell time	0 - 100.00s	0s	[Control /SG /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 /Pos Indicators wiring]
Aux OFF-I	Module input state: Position indicator/check-back signal of the CB (52b)	[Control /SG /Pos Indicators wiring]
Ready-I	Module input state: CB ready	[Control /SG /Pos Indicators wiring]
Ack TripCmd-I	State of the module input: Acknowledgement Signal (only for automatic acknowledgement) Module input signal	[Control /SG /Trip Manager]

Name	*Description*	*Assignment via*
Interl ON1-I	State of the module input: Interlocking of the ON command	[Control /SG /Interlockings]
Interl ON2-I	State of the module input: Interlocking of the ON command	[Control /SG /Interlockings]
Interl ON3-I	State of the module input: Interlocking of the ON command	[Control /SG /Interlockings]
Interl OFF1-I	State of the module input: Interlocking of the OFF command	[Control /SG /Interlockings]
Interl OFF2-I	State of the module input: Interlocking of the OFF command	[Control /SG /Interlockings]
Interl OFF3-I	State of the module input: Interlocking of the OFF command	[Control /SG /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 /Ex ON/OFF Cmd]
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 /Ex ON/OFF Cmd]

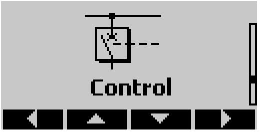
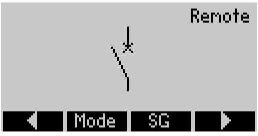
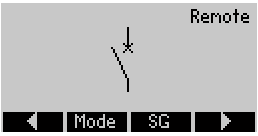
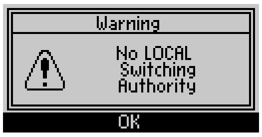
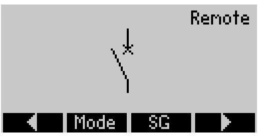
Signals of a Controlled Circuit Breaker

Name	*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.

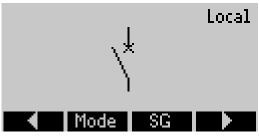
Name	*Description*
t-Dwell	Signal: Dwell time
Interl ON	Signal: One or more IL_On inputs are active.
Interl OFF	Signal: One or more IL_Off inputs are active.
CES succesf	Command Execution Supervision: Switching command executed successfully.
CES Disturbed	Command Execution Supervision: Switching Command unsuccessful. Switchgear in disturbed position.
CES Fail TripCmd	Command Execution Supervision: Trip command not executed.
CES SwitchgDir	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	Command Execution Supervision: On Command during a pending OFF Command.
CES SG not ready	Command Execution Supervision: Switchgear not ready
CES Fiel Interl	Command Execution Supervision: Switching Command not executed because of field interlocking.
CES SyncTimeout	Command Execution Supervision: Switching Command not excecuted. No Synchronization signal while t-sync was running.
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.
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

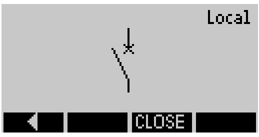
The following example shows how to switch a circuit breaker via the HMI at the device.

	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.

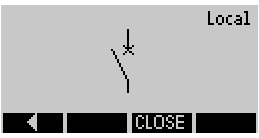
Select between »Local« or »Local and Remote«.



Now it is possible to execute switching commands at the HMI.

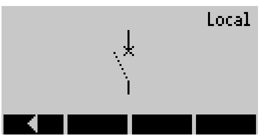


Push the »right arrow« softkey to get to the control page.

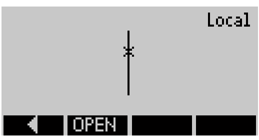


The circuit breaker is opened, therefore it can be closed only.
After pushing the softkey »CLOSE« a confirmation window appears.

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

MStart - Motor Starting and Control [48,66]

Available elements:
MStart

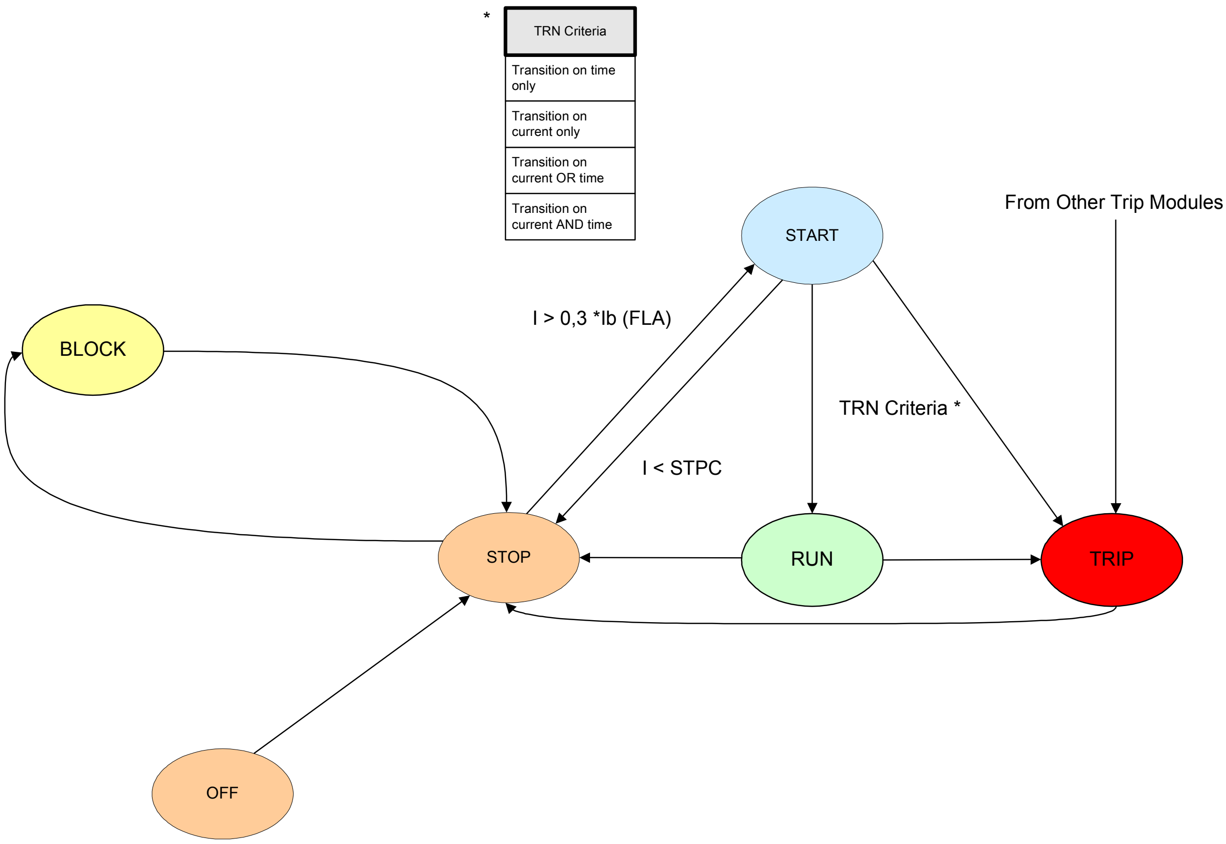
General – Principle Use

The motor start control logic is the core control and protective function for a motor protection device. The logic comprises:

- Motor Operation States,
- Motor Start Control
- Motor Start Blockings
- Motor Start / Transition Trips
- Motor Cold Warm Detection
- Emergency Override.

Motor Operation States

Motor Operation States



The basic motor operation states can be classified as four states that include:

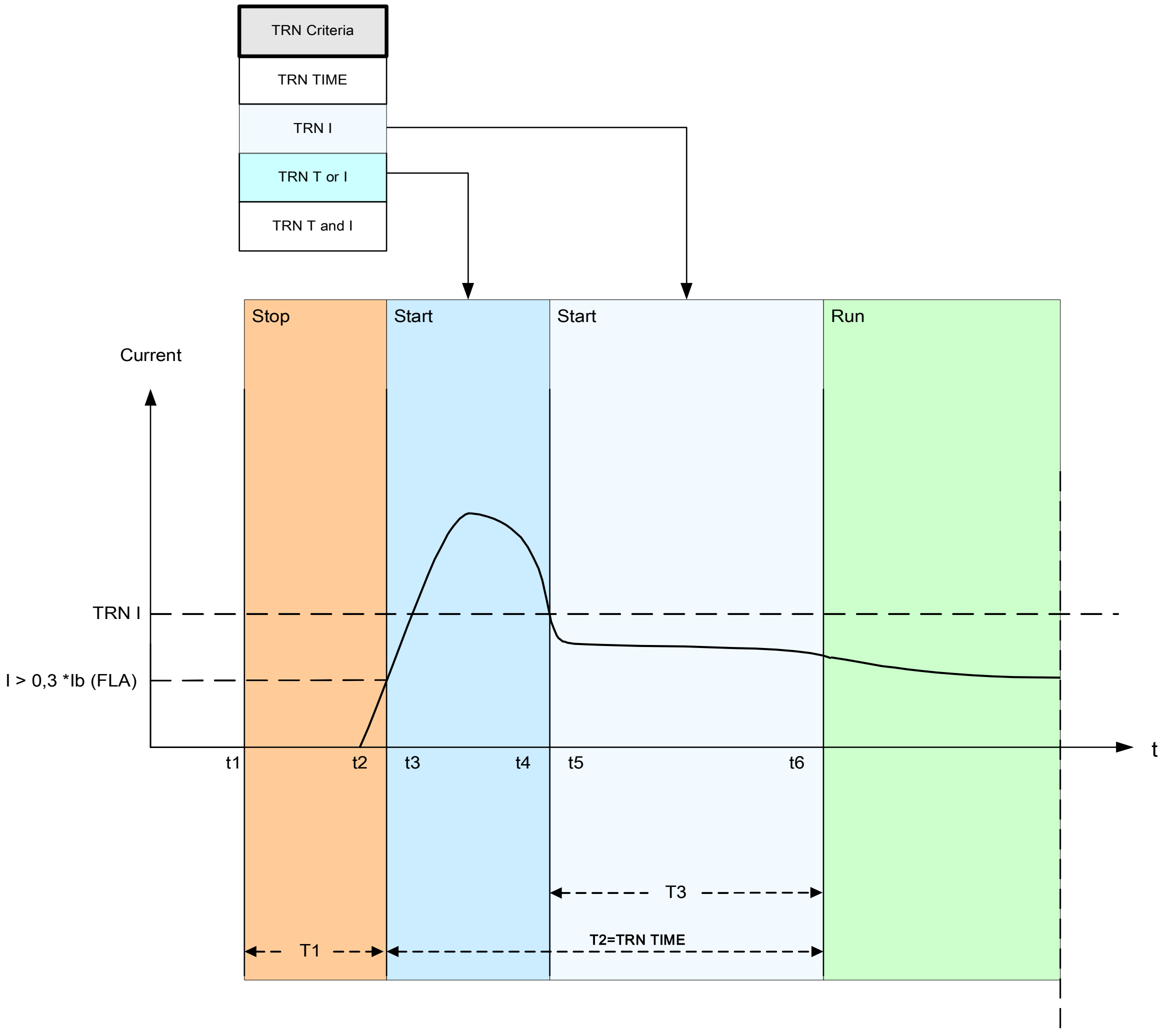
1. Start cycle;
2. Run cycle;
3. Stop cycle; and
4. Trip state.

Under normal conditions, the motor operations should go through »stop«, »start«, »run«, and »stop« cycles that are referred to as a complete operation sequence; while under certain abnormal conditions, the motor could go from »start« to »stop«, or »start« to »trip«, or »run« to »trip«.

If other protection trips occur at either the »start« or »run« cycle, the motor will be forced to go to »trip« mode. After motor currents are terminated, the motor will go into the »stop« cycle.

Start Control

The parameters for the Start Control have to be set within menu [Protection Para\MStart\StartControl]



T1 : Stop Cycle

t4 – t3 : Start Cycle if TRNC is select

t6 – t3 : Start Cycle if TRNT is select

The Start Control Module drawing shows an example of how the protective device reacts to a normal operating-cycle current profile. Initially, the motor is stopped and the current is zero. As long as the protective device is not in a »trip« state, it permits contactor energization by closing its trip contact in series with the contactor. The contactor is energized by the operator or process control system through a normal two-wire or three-wire motor control scheme, external to the protective device. The protective device declares a motor start when it senses a motor current that exceeds 30% of the »*Ib*« (FLA) setting. Meanwhile, the transition timer »*TRNT*« begins to run. The protective device also monitors the large starting current, noting when the current falls below the transition level »*TRNC*«.

The Start to Run transition is based on the setting »*TRN Criteria*«, which has four transition behaviors for the User to select:

- TRN T - Transition to RUN after time setting TRNT only. Current is ignored.
- TRN C - Transition when starting current drops below the setting only. If the time set in TRNT expires before the current transition, the motor trips.
- TRN T or C - Transition on time or current, whichever comes first.
- TRN T and C - Transition on time and current. Both must occur, and the current must drop below the setting before the time delay expires. If the timer expires before the current falls below the set transition level, the motor trips.

If there is no transition trip, the protective device relay declares a successful transition to »RUN« cycle and the corresponding transition signal(s) (current or time, or both, depending on the settings and motor current) is set. The transition signal(s) is the part of the global output list, which can be assigned to any module input or relay output. If it is assigned to a relay output, it can control a reduced-voltage starter, switching to full running voltage.

Even if the transition control output contact is not used, the transition function can provide clear indications of the actual state of the motor (»START« versus »RUN«) on the front panel display and via data communications. A good way to do this is to use the settings of TRN Criteria = TRN T or C and TRNC = 130% of »*Ib*« (FLA). Modify the latter, if needed, to lie at a transition value between the starting current and post-start maximum load current. Set the transition timer well beyond the normal start time to avoid a transition trip.

Start Delays

The parameters for the Start Delays have to be set within menu [Protection Para\MStart\Start Delay Timer].

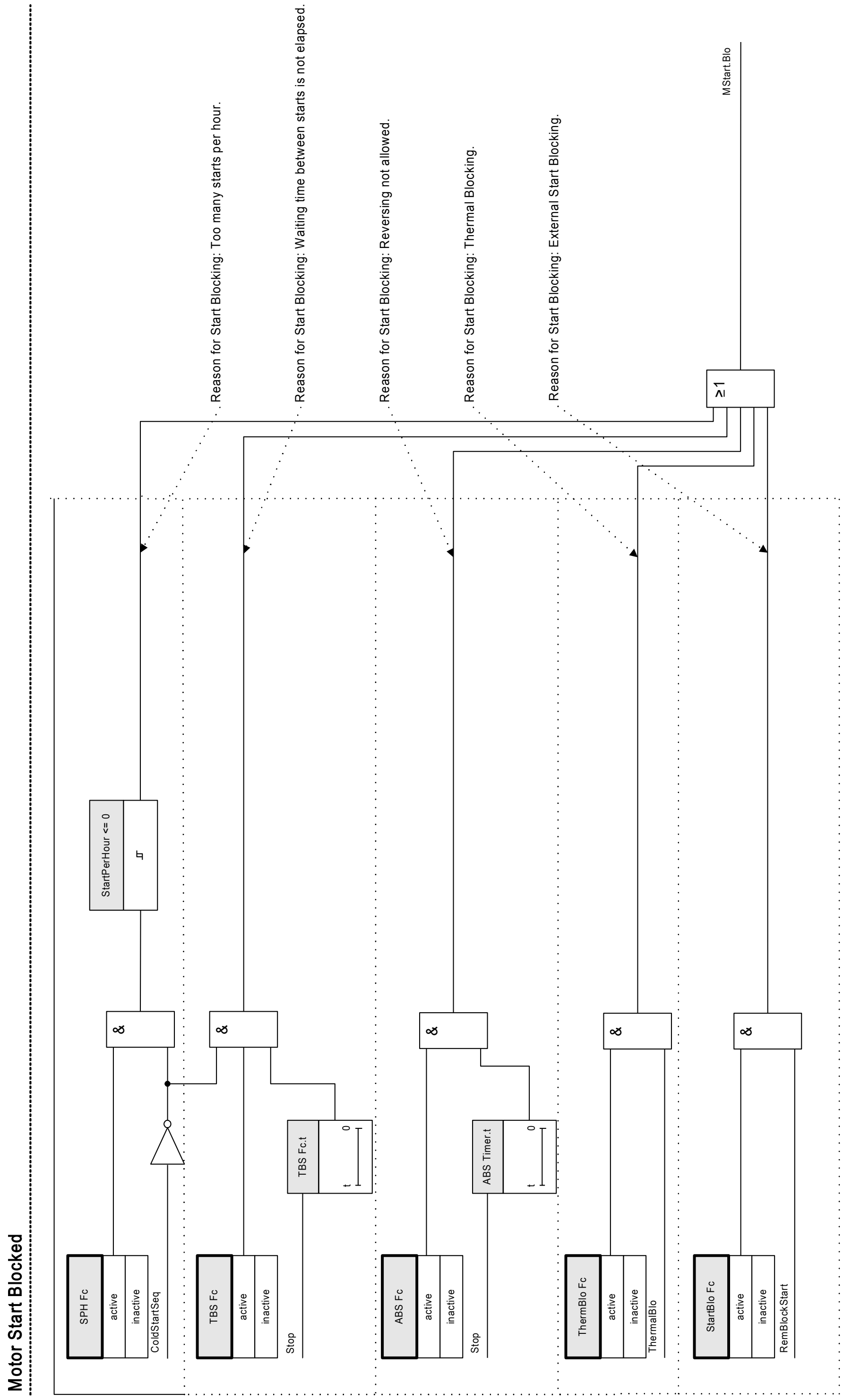
When the protective device declares a »START«, all start timers of the enabled functions begin to time. Each of these timers blocks the respective function until the set delay expires. These start timers are affected by transitions - they run for the set time, which may be less than or greater than the time of transition. These start delay timers include:

- IOC (Instantaneous overcurrent start delay);
- GOC (Ground fault start delay);
- UnderLoad (Underload trip and alarm start delay);
- IUnbalance (Current unbalance trip and alarm start delay);
- JAM (Jam trip and alarm start delay); and
- Generic1 to Generic5 (Generic start delay).

Note that the generic start delays are not tied to anything, and they can be used to block anything at the User’s choice.

Motor Start Blocked

A Motor Start can be blocked by certain events, if any of the following conditions are noted - motor starts limit, starting frequency, thermal and mechanical constraints. The User may choose to use the states to block the motor from starting or use it as an alarm or indication.



Blocking Conditions

The reasons for a Motor Start Blocking are as follows:

The Motor Start will be blocked due to:

- There are too many starts per hour (if configured).
- The waiting time between starts is not elapsed (if configured).
- If the Anti Backspin protection detects a reversing of the motor (reversing not allowed, if configured).
- The thermal model blocks the motor (if configured).
- External Blocking becomes active (if configured).

When any of Anti-Backspin, thermal, and external blocks are on, the »*MStart.Blo«* signal will be set. The »*TBS«* and »SPH« can turn on the »*MStart.Blo«* signal only if the motor is not in a cold start sequence; »*NOCS«* block can not cause the »*MStart.Blo«* signal to be set.

Start Limits

Because motor starting consumes a considerable amount of thermal energy compared to its normal load conditions, the number of starts in a given time period must be monitored and controlled. The protective device has three functions that contribute to the start limits monitoring. These are:

- TBS (Time between Starts);
- SPH (Starts per Hour); and
- NOCS (Number of Cold Starts).

Most motors can tolerate some number of consecutive cold starts before the time between starts is enforced. The protective device treats a start as the first in a sequence of cold starts if the motor has been stopped for at least the time period that is the greatest of »*one hour«* and »*TBS*«. Subsequent starts are treated as additional cold starts in the same sequence, only if they run no more than ten minutes, until the set number of cold starts is reached. Once the motor is in the cold starting sequence, it will ignore »*TBS«* and »*SPH*« limits. The cold start sequence will be terminated if the motor has run for more than ten minutes for a cold start before it exhausts »*NOCS*«, then starts after this are subject to time and count limits imposed by »*TBS«* and »*SPH«*. If the motor reaches the »*NOCS«* limit in a cold start sequence, »*NOCS«* block signal will be set and »*TBS«* will start to time. When »*TBS«* reaches its limit while the »NOCS« block signal is still set, the cold start sequence will be terminated and the »*NOCS«* block will be released. Meanwhile, the »*SPH«* will start to count at the last start in the complete cold start sequence.

Stop Cycle

The run cycle continues until the motor current level falls below the Stop Current Threshold setting current on all three phases. Then a stop is declared. The start limits (also referred as Jogging start limits) and the anti-backspin time delay (ABS) are checked. If blocking conditions exist, the protective device can be configured to block a motor from starting. Remaining jogging block times are displayed and counted down, indicating how long to wait. If there are no such starting block conditions in effect, the protective device is ready for a new start.

Anti-Backspin Delay Time (ABS)

»ABS« sets the time in seconds before a motor restart is permitted after a trip or stop condition. This function can be set to »*inactive«*.

This function is used with a motor driving a pump working into a head, or any other load that tends to spin in a reverse direction (backspin) when the motor is de-energized. It blocks starting during the time when the motor might be rotating in reverse following a trip. Also, this function may be used simply to set idle time (time between stop and start) before a restart is permitted.

External Start Blocking

A motor can be blocked through a digital input. If this feature is enabled, the User must make sure that both the Motor Start and Digital Input modules are configured properly.

Thermal Block

Besides the previously mentioned start monitoring and controlling means, the motor can be blocked if the thermal capacity used exceeds the alarm level. It is the User's choice to turn on or off this feature and set an appropriate alarm level in the thermal model module.

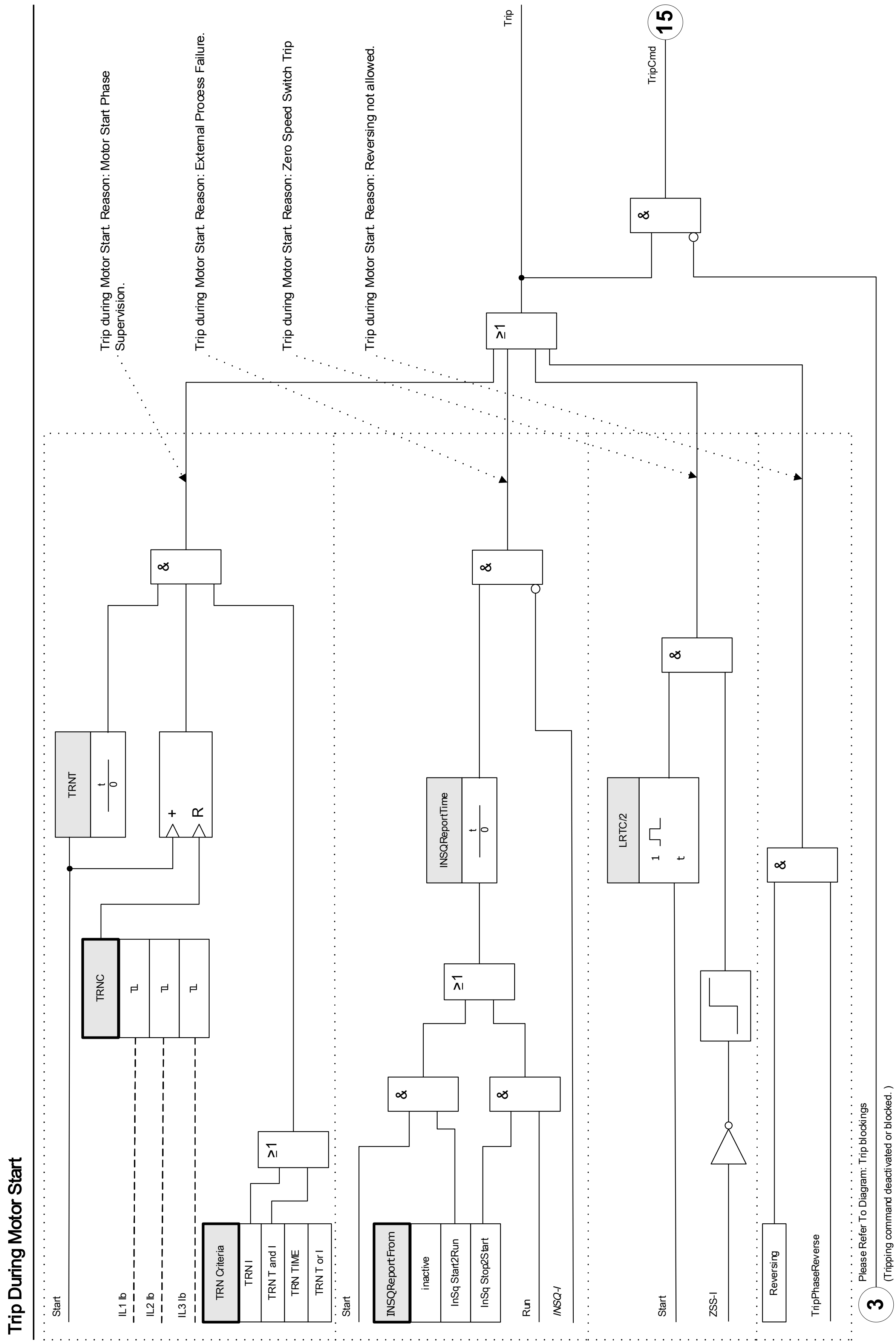
Forced Starting

It is recommended that the User wires the »MSTART.BLO« output to the motor trip circuit for preventing the motor from starting under these blocked conditions. If the User chooses not to do this for their applications, a Forced Starting signal will be set when the motor is started with the blocked conditions. This signal can only be reset manually though *Smart View* or from the front panel (please refer to section Emergency Override).

Motor Start / Transition Trips

The Motor will be tripped during the start phase, in case that:

- The Start Control detects an unsuccessful Start. (Please see section Start Control Module)
- There is an Incomplete Start Sequence. The device detects via an digital input, that the external process is not properly started.
- If a reverse direction is detected but reversing is not allowed.
- If case of a Zero Speed Switch failure.


Trip During Motor Start
Start
IL1 Ib
IL2 Ib
IL3 Ib
TRN Criteria
TRN I
TRN T and I
TRN TIME
TRN T or I
≥1
TRNC
TRNT
t
0
+
R
&
Trip during Motor Start. Reason: Motor Start Phase Supervision.
Trip during Motor Start. Reason: External Process Failure.
Trip during Motor Start. Reason: Zero Speed Switch Trip
Trip during Motor Start. Reason: Reversing not allowed.
Start
INSQReport From
inactive
InSq Start2Run
InSq Stop2Start
Run
INSQ-I
INSQReportTime
LRTC/2
1
Start
ZSS-I
Reversing
TripPhaseReverse
Trip
TripCmd
15
3
Please Refer To Diagram: Trip blockings
(Tripping command deactivated or blocked.)

Incomplete Sequence Report Back Time (INSQ)

The incomplete sequence function requires a report back contact (via digital input) from the process that the motor runs - any indication that the process has started to operate as expected some time after the motor start. If the process does not start up correctly, the contact does not close within the expected time. If a problem develops later on, the report back contact opens. In either case, the open contact state indicates that the motor should be tripped.

To use this function, set a time limit for report back here and define the start of report back timing. Connect the report-back contact to one of the protective device Digital Inputs. If this input is not energized before the set time expires, the relay will trip for incomplete sequence.

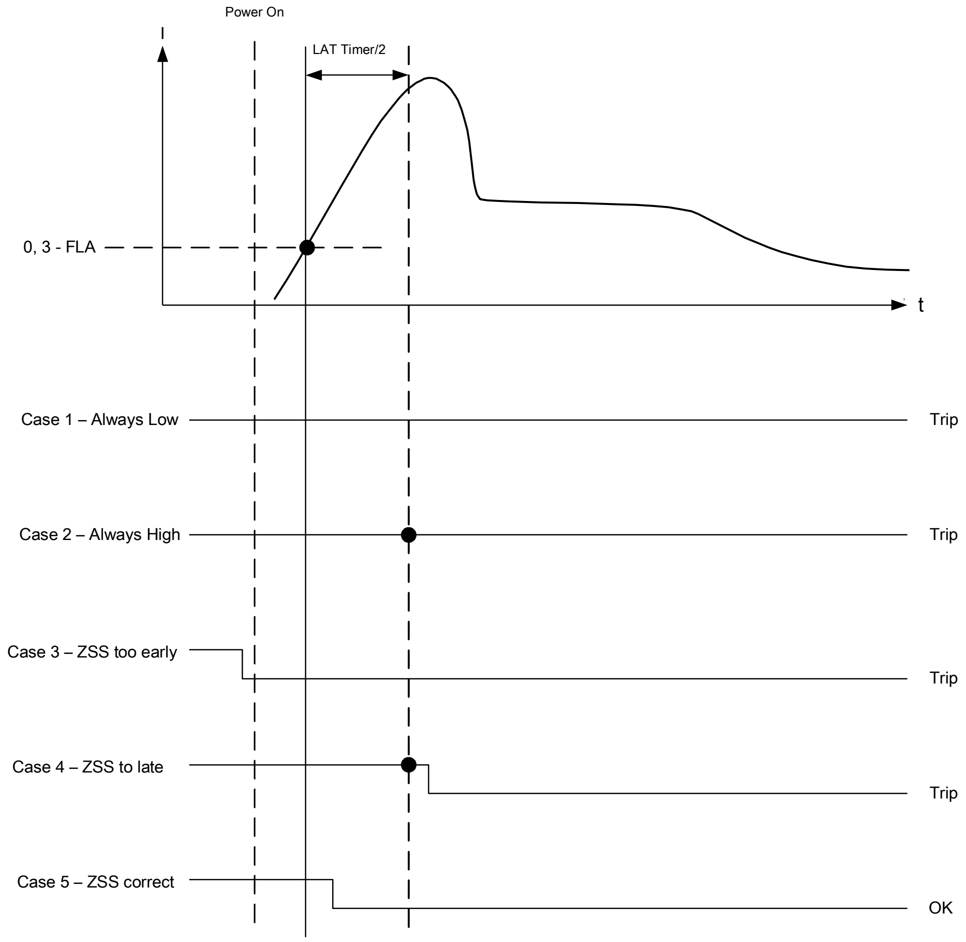
Note that the input must be energized continuously after the time delay has expired to hold off this trip.

Zero Speed Switch (ZSS ON or OFF)

ZSS enables the function that verifies if the motor begins to physically spin after a start. It requires a zero-speed switch (digital switch) on the motor, which is closed at rest and opens as the rotor reaches (5%-10%) its normal speed. Connect the zero-speed switch contact to one of the protective device Digital Inputs. If the contact fails to open within »*LRT/2*« (one-half of locked-rotor time) after a start, the relay trips with a zero-speed switch trip message.

This protection is always useful, but is essential if the Long Acceleration Time (LAT) function setting is used.

With ZSS being enabled and being mapped to one of the digital inputs, the protective device checks the ZSS input status at the very moment it sees a start - it wants to sense the initially closed zero-speed switch, which opens shortly thereafter as the motor spins. If it fails to find the closed contact, it trips immediately. Check the wiring and contact for problems.


Power On
LAT Timer/2
0, 3 - FLA
t
Case 1 – Always Low
Trip
Case 2 – Always High
Trip
Case 3 – ZSS too early
Trip
Case 4 – ZSS to late
Trip
Case 5 – ZSS correct
OK

Long Acceleration Time (LAT)

When the LAT function is enabled, the »*LAT*« timer is used to set a time interval during which the motor is permitted to accelerate a high-inertia load, which is longer than the locked-rotor time. This function can be (and usually should be) set to »*inactive*«. If the thermal-model accumulator bucket fills to 100% during the long acceleration time, it is limited to that value and the thermal trip is held off until the LAT timer expires. By then, the thermal bucket level must have decreased (thermal model cooled) below 100% or the motor trips.

The LAT function should be used but not limited only on motors with a zero-speed switch (a normally-closed contact that opens when the motor actually begins to spin). Connect the zero-speed switch contact to one of the protective device Digital Inputs. The Zero-Speed Switch function must be enabled (ZSS ON). The protective device requires the zero-speed switch to open within LRT/2 (one-half of locked-rotor time) after a start, or the motor is tripped by the ZSS function. This protects a completely stalled motor from being damaged when the LAT timer blocks the locked-rotor thermal trip.

CAUTION

The long acceleration time (LAT) function can block the critical LRC-LRT rotor thermal protection during a start and destroy the motor. Turn LAT OFF unless absolutely needed and the motor's suitability for this starting duty has been confirmed. Use only with zero speed switch function ZSS ON and switch input connected to protect a stalled motor.

The User can temporarily defeat the I2t thermal protection limit after a start by setting a Long Acceleration Time delay. This can be a dangerous setting that blocks thermal tripping and holds the bucket at a 100% level if the load takes a long time to reach running speed. An example is a motor spinning a large centrifuge. In using LAT, the User can take advantage of the partial cooling from airflow produced by the motor spinning at below-normal speed, as compared to unfanned heating of a locked rotor. The motor must be rated for this severe starting duty. Also, the User must ensure that the motor actually has begun to spin well before the locked-rotor time has expired. This is accomplished by connecting a zero-speed switch to a Digital Input and turning on ZSS function. The zero-speed switch is a contact that is closed when the motor is at rest, and opens as the motor begins to spin, usually at 5-10% of running speed. If ZSS is set to ON and the protective device relay does not sense the contact open in one-half the locked-rotor time setting, it trips the motor.

WARNING

Turn OFF LAT unless the application specifically demands it. Use a zero speed switch with LAT. Using an LAT setting greater than locked rotor time without a zero speed switch temporarily defeats thermal protection and damages the motor if the rotor actually is locked.

If »*LAT*« is used, check the settings of transition time »*TRNT*« and jam start delay to be sure they are coordinated with the prolonged starting cycle.

Anti-Backspin Delay Time (ABS)

»ABS« sets the time in seconds before a motor restart is permitted after a trip or stop condition. This function can be set to »*inactive*«.

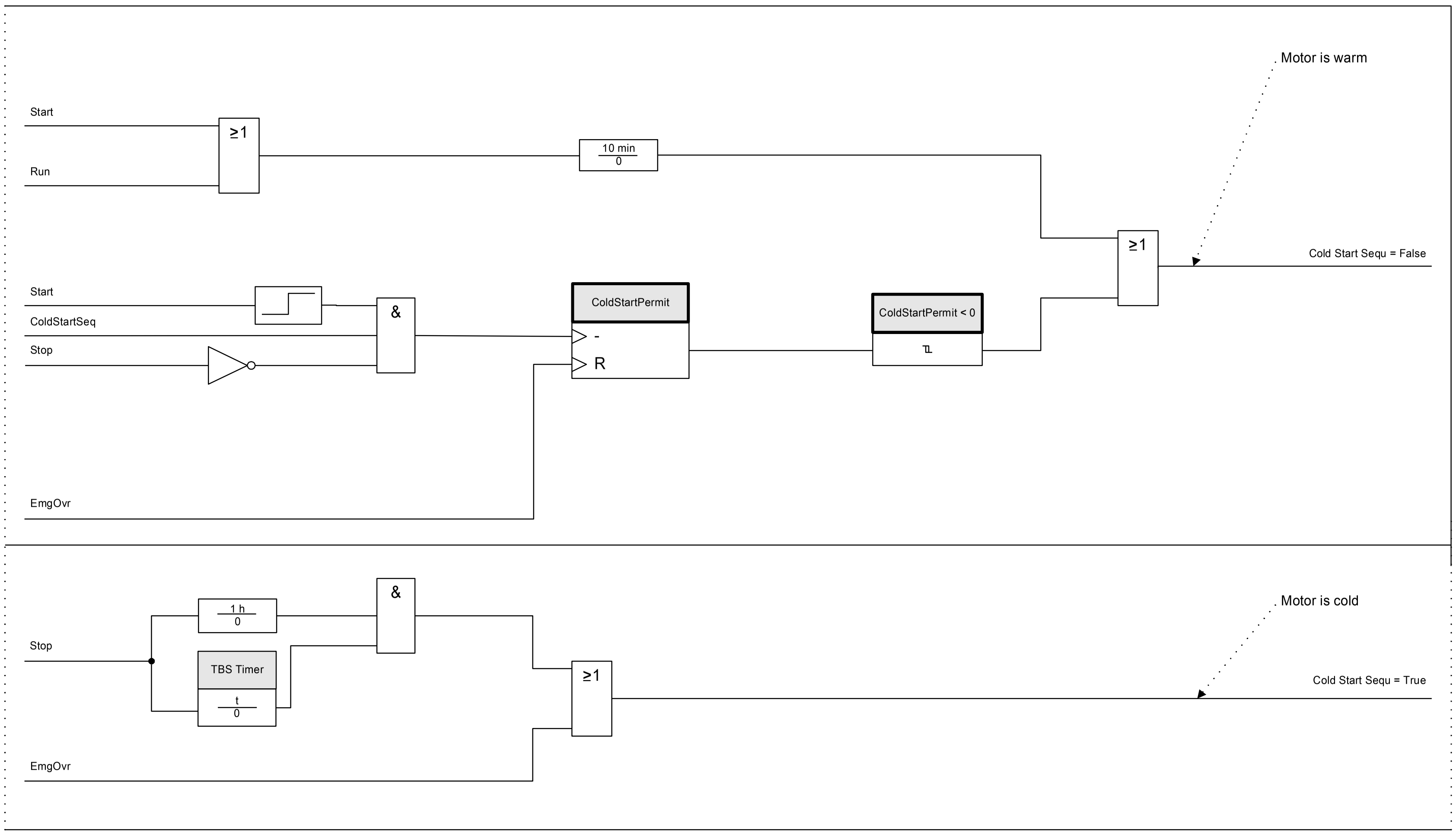
This function is used with a motor driving a pump working into a head, or any other load that tends to spin in a reverse direction (backspin) when the motor is de-energized. It blocks starting during the time when the motor might be rotating in reverse following a trip. Also, this function may be used simply to set idle time (time between stop and start) before a restart is permitted.

Motor Cold Warm Detection

The motor will be considered as cold (»COLD SEQU = TRUE«) after being in the »stop« mode for more than one hour if the time between starts timer is set to a lower value than 1 hour.

Else, the motor will fall back into the »cold« state if the time between starts timer is elapsed. By means of the Emergency Override function, the motor can be forced to switch to the cold state.

Motor Cold Warm Detection



Emergency Override

The Emergency Override function can be enabled or disabled in the following menu [Protection Para\Global Prot Para\MStart\Start Control\EMGOVR]. Also it can be determined whether this function can be executed by a DI or by a softkey at the HMI or both.

If enabled, an emergency override can be executed by pushing the »*Emrg Override*« Softkey at the front panel. In any case, an emergency override can be performed by a remote contact connected to any one of the digital inputs programmed as »*EMG OVR*«, or via front panel under [Operations\Reset\EMGOVR] menu. The as-shipped setting is disabled.

Emergency override allows a panic restart of a tripped motor without completely disabling protection. When the override request is received, the thermal-model accumulator bucket is drained to its initial level of 40°C (104°F). Cold starts are fully restored.

The motor protection is now in the state it would be in if the motor had been standing for a long time prior to the moment of the override. This allows an immediate restart of the motor. The override can also delay an impending thermal trip of a running motor. The emergency override action is counted in the history record, and noted with its time tag in the logbook record.

CAUTION

The emergency override function clears and restarts all protective functions of the protective device. Using this function can damage the motor. Use it only for true emergencies, when it is known what caused the trip. Override permits the risk of motor damage to avoid an even more dangerous process situation caused by the tripping of the motor.

Global Protection Parameters of the Motor Start Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Reversing	Reversing or non reversing starter. This option will affect the sequence current calculations.	inactive, active	inactive	[Field Para /Motor Nominal Values]
Ib	Full load current (amperes). Set to maximum stator continuous RMS current primary (actual motor winding) amperes in each phase. Use motor nameplate or manufacturers data. Note that the ratio Ib/CT prim must lie between 0.25 and 1.5 in order to have reliable motor protection.	10 - 6000A	10A	[Field Para /Motor Nominal Values]
LRC	Set to the locked-rotor current (the current the motor draws when stalled), in times of Ib. Use motor nameplate or manufacturers data.	3.00 - 12.00Ib	3.00Ib	[Field Para /Motor Nominal Values]
LRTC	Specifies how long a locked-rotor or stall condition can be maintained before the motor is damaged, in seconds, for a cold start. Use motor nameplate or manufacturers data.	1 - 120s	1s	[Field Para /Motor Nominal Values]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
STPC	Stop current threshold, in percent of Ib, if the actual current is below the threshold for at least 300 milliseconds. If a stop state occurs, the jogging functions Starts per Hour Allowed (SPH), Time Between Starts (TBS) and Anti-Backspin (ABS) are enforced. All phases of the current must be below this level before a stop will be declared.	0.02 - 0.20Ib	0.02Ib	[Field Para /Motor Nominal Values]
k-Factor	The k-Factor is to be calculated by the maximum allowed continuous current over the rated current transformer current (e.g. 1.2 times rated motor current over rated transformer current).	0.25 - 1.50	0.85	[Field Para /Motor Nominal Values]
RemStartBlo Fc	StartBlo Fc	inactive, active	inactive	[Protection Para /Global Prot Para /MStart /Start Control]
ThermBlo Fc	ThermBlo Fc	inactive, active	inactive	[Protection Para /Global Prot Para /MStart /Start Control]
TRN Criteria	Start transition criterion	TRN I, TRN TIME, TRN T and I, TRN T or I	TRN T and I	[Protection Para /Global Prot Para /MStart /Start Control]
TRNT	Motor start transition time limit Only available if: TRN Criteria = TRN T and I Or TRN Criteria = TRN TIME	0 - 1200s	10s	[Protection Para /Global Prot Para /MStart /Start Control]
TRNC	Motor start transitions current level in Ib% Only available if: TRN Criteria = TRN T and I Or TRN Criteria = TRN I	0.10 - 3.00Ib	1.30Ib	[Protection Para /Global Prot Para /MStart /Start Control]
NOCS	Number of cold starts limit	1 - 5	1	[Protection Para /Global Prot Para /MStart /Start Control]
TBS Fc	Time Between Starts on/off	inactive, active	inactive	[Protection Para /Global Prot Para /MStart /Start Control]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
TBS Timer	Time Between Starts Limit Only available if: TBS Fc = active	1 - 240min	60min	[Protection Para /Global Prot Para /MStart /Start Control]
SPH Fc	Starts Per Hour	inactive, active	inactive	[Protection Para /Global Prot Para /MStart /Start Control]
SPH	SPH Only available if: SPH Fc = active	1 - 10	1	[Protection Para /Global Prot Para /MStart /Start Control]
INSQReportFrom	INcomplete SeQuence report time starting point	inactive, InSq Start2Run, InSq Stop2Start	inactive	[Protection Para /Global Prot Para /MStart /Start Control]
INSQReportTime	INSQ Report back time Only available if: INSQReportFrom = active	1 - 240s	1s	[Protection Para /Global Prot Para /MStart /Start Control]
LAT Fc	Long Time Acceleration Timer	inactive, active	inactive	[Protection Para /Global Prot Para /MStart /Start Control]
LAT Timer	Large motors with a high inertia may experience starting currents that exceed the locked rotor current and time. The protective relay has logic and provisions for a zero speed switch input to differentiate between a stall and start condition. If the motor is spinning then the relay will not trip on the normal locked rotor time allowing the motor to start. Only available if: LAT Fc = active	1 - 1200s	1200s	[Protection Para /Global Prot Para /MStart /Start Control]
ABS Fc	For certain applications, such as pumping a fluid up a pipe, the motor may be driven backward for a period of time after it stops. The protective relay provides an anti-backspin timer to prevent starting the motor while it is spinning in the reverse direction. The timer begins counting from the moment a stop is declared by the relay.	inactive, active	inactive	[Protection Para /Global Prot Para /MStart /Start Control]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ABS Timer	For certain applications, such as pumping a fluid up a pipe, the motor may be driven backward for a period of time after it stops. The protective relay provides an anti-backspin timer to prevent starting the motor while it is spinning in the reverse direction. The timer begins counting from the moment a stop is declared by the relay. Only available if: ABS Fc = active	1 - 3600s	3600s	[Protection Para /Global Prot Para /MStart /Start Control]
ZSS	Zero Speed Switch	inactive, active	inactive	[Protection Para /Global Prot Para /MStart /Start Control]
EMGOVR	Emergency override options. Signal has to be active in order to release the thermal capacity of the motor. Please notice that by doing this you run the risk of damaging the motor. “EMGOVR” has to be set to “DI” or “DI or UI” for this input to take effect.	inactive, DI, HMI, DI or HMI	inactive	[Protection Para /Global Prot Para /MStart /Start Control]
RemStartBlock	Start Motor Signal Only available if: StartBlo Fc = active	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, DI Slot X1.DI 5, DI Slot X1.DI 6, DI Slot X1.DI 7, DI Slot X1.DI 8	-.-	[Protection Para /Global Prot Para /MStart /Motor Inputs]
EmgOvr	Emergency Override. Signal has to be active in order to release the thermal capacity of the motor. Please notice that by doing this you run the risk of damaging the motor. “EMGOVR” has to be set to “DI” or “DI or UI” for this input to take effect	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, DI Slot X1.DI 5, DI Slot X1.DI 6, DI Slot X1.DI 7, DI Slot X1.DI 8	-.-	[Protection Para /Global Prot Para /MStart /Motor Inputs]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
INSQ	INcomplete SeQuence	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, DI Slot X1.DI 5, DI Slot X1.DI 6, DI Slot X1.DI 7, DI Slot X1.DI 8	-.-	[Protection Para /Global Prot Para /MStart /Motor Inputs]
ZSS	Zero Speed Switch Only available if: ZSS = active	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, DI Slot X1.DI 5, DI Slot X1.DI 6, DI Slot X1.DI 7, DI Slot X1.DI 8	-.-	[Protection Para /Global Prot Para /MStart /Motor Inputs]
STPC Blo	With this setting a Digital Input keeps the Motor in the RUN mode, even when the motor current drops below STPC (motor stop current).	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, DI Slot X1.DI 5, DI Slot X1.DI 6, DI Slot X1.DI 7, DI Slot X1.DI 8	-.-	[Protection Para /Global Prot Para /MStart /Motor Inputs]
t-Blo-IOC	Phase Overcurrent Start Delay.Phase Overcurrent elements are blocked for the time programmed under this parameter, while the motor is starting.	0.03 - 1.00s	0.05s	[Protection Para /Global Prot Para /MStart /Start Delay Timer]
t-Blo-GOC	Ground Overcurrent Start Delay. Ground Overcurrent elements are blocked for the time programmed under this parameter, while the motor is starting	0.03 - 1.00s	0.08s	[Protection Para /Global Prot Para /MStart /Start Delay Timer]
t-Blo-I<	Underload Start Delay. 37[x] elements are blocked for the time programmed under this parameter, while the motor is starting	0 - 1200s	60s	[Protection Para /Global Prot Para /MStart /Start Delay Timer]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
t-Blo-IUnbalance	Current Unbalance Start Delay. 46[x] elements are blocked for the time programmed under this parameter, while the motor is starting	0.03 - 1200.00s	10.00s	[Protection Para /Global Prot Para /MStart /Start Delay Timer]
t-Blo-JAM	Jam Start Delay. 50J[x] elements are blocked for the time programmed under this parameter, while the motor is starting	0.03 - 1200.00s	60.00s	[Protection Para /Global Prot Para /MStart /Start Delay Timer]
t-Blo-V012	Voltage Unbalance Start Delay. These elements are blocked for the time programmed under this parameter, while the motor is starting.	0 - 1200s	1s	[Protection Para /Global Prot Para /MStart /Start Delay Timer]
t-Blo-Undervoltage	Undervoltage Start Delay. These elements are blocked for the time programmed under this parameter, while the motor is starting	0 - 1200s	1s	[Protection Para /Global Prot Para /MStart /Start Delay Timer]
t-Blo-Overvoltage	Overvoltage Start Delay. These elements are blocked for the time programmed under this parameter, while the motor is starting	0 - 1200s	1s	[Protection Para /Global Prot Para /MStart /Start Delay Timer]
t-Blo-Power	Power Start Delay. These elements are blocked for the time programmed under this parameter, while the motor is starting	0.03 - 1200.00s	0.03s	[Protection Para /Global Prot Para /MStart /Start Delay Timer]
t-Blo-PowerFactor	Power Factor Start Delay. These elements are blocked for the time programmed under this parameter, while the motor is starting	0.03 - 1200.00s	0.03s	[Protection Para /Global Prot Para /MStart /Start Delay Timer]
t-Blo-Frequency	Frequency Start Delay. These elements are blocked for the time programmed under this parameter, while the motor is starting	0 - 1200s	1s	[Protection Para /Global Prot Para /MStart /Start Delay Timer]
t-Blo-Generic1	t-Blo-Generic1	0 - 1200s	0s	[Protection Para /Global Prot Para /MStart /Start Delay Timer]

Parameter	Description	Setting range	Default	Menu path
t-Blo-Generic2	t-Blo-Generic2	0 - 1200s	0s	[Protection Para /Global Prot Para /MStart /Start Delay Timer]
t-Blo-Generic3	t-Blo-Generic3	0 - 1200s	0s	[Protection Para /Global Prot Para /MStart /Start Delay Timer]
t-Blo-Generic4	t-Blo-Generic4	0 - 1200s	0s	[Protection Para /Global Prot Para /MStart /Start Delay Timer]
t-Blo-Generic5	t-Blo-Generic5	0 - 1200s	0s	[Protection Para /Global Prot Para /MStart /Start Delay Timer]

Motor Start Module Input States

Name	Description	Assignment via
RemStartBlock-I	State of the module input: Start Motor Signal	[Protection Para /Global Prot Para /MStart /Motor Inputs]
EmgOvr-I	State of the module input: Emergency Override. Signal has to be active in order to release the thermal capacity of the motor. Please notice that by doing this you run the risk of damaging the motor. “EMGOVR” has to be set to “DI” or “DI or UI” for this input to take effect	[Protection Para /Global Prot Para /MStart /Motor Inputs]
INSQ-I	State of the module input: INcomplete SeQuence	[Protection Para /Global Prot Para /MStart /Motor Inputs]
ZSS-I	State of the module input: Zero Speed Switch	[Protection Para /Global Prot Para /MStart /Motor Inputs]

Name	Description	Assignment via
STPC-I	State of the module input: With this setting a Digital Input keeps the Motor in the RUN mode, even when the motor current drops below STPC (motor stop current).	[Protection Para /Global Prot Para /MStart /Motor Inputs]

Motor Start Module Signals (Output States)

Name	Description
active	Signal: active
Blo TripCmd	Signal: Trip Command blocked
Trip	Signal: Trip
TripCmd	Signal: Trip Command
Start	Signal: Motor is in start mode
Run	Signal: Motor is in run mode
Stop	Signal: Motor is in stop mode
Blo	Signal: Motor is blocked for starting or transition to Run mode
NOCSBlocked	Signal: Motor is prohibited to start due to number of cold start limits
SPHBlocked	Signal: Motor is prohibited to start due to starts per hour limits
SPHBlockAlarm	Signal: Motor is prohibited to start due to starts per hour limits, would come active in the next stop
TBSBlocked	Signal: Motor is prohibited to start due to time between starts limits
ThermalBlo	Signal: Thermal block
RemBlockStart	Signal: Motor is prohibited to start due to external blocking through digital input DI
TransitionTrip	Signal: Start transition fail trip
ZSSTrip	Signal: Zero speed trip (possible locked rotor)
INSQSP2STFaill	Signal: Fail to transit from stop to start based on reported back time
INSQSt2RunFail	Signal: Fail to transit from start to run based on reported back time
LATBlock	Signal: Long acceleration timer enforced
ColdStartSeq	Signal: Motor cold start sequence flag
ForcedStart	Signal: Motor being forced to start
TripPhaseReverse	Signal: Relay tripped because of phase reverse detection
EmergOverrideDI	Signal: Emergency override start blocking through digital input DI
EmergOverrideUI	Signal: Emergency override start blocking through front panel
ABSActive	Signal: Anti-backspin is active. For certain applications, such as pumping a fluid up a pipe, the motor may be driven backward for a period of time after it stops. The anti-backspin timer prevents starting the motor while it is spinning in the reverse direction.
Blo-GOCStart	Signal: Ground Instantaneous Overcurrent Start Delay. GOC (Instantaneous Overcurrent) elements are blocked for the time programmed under this parameter

Name	*Description*
Blo-IOCStart	Signal: Phase Instantaneous Overcurrent Start Delay. IOC (Instantaneous Overcurrent) elements are blocked for the time programmed under this parameter
Blo-I<Start	Signal: Underload Start Delay. Underload(Instantaneous Overcurrent) elements are blocked for the time programmed under this parameter
Blo-JamStart	Signal: JAM Start Delay. JAM(Instantaneous Overcurrent) elements are blocked for the time programmed under this parameter
Blo-UnbalStart	Signal: Motor start block current unbalance signal
Blo-Generic1	Generic Start Delay. This value can be used to block any protective element.1
Blo-Generic2	Generic Start Delay. This value can be used to block any protective element.2
Blo-Generic3	Generic Start Delay. This value can be used to block any protective element.3
Blo-Generic4	Generic Start Delay. This value can be used to block any protective element.4
Blo-Generic5	Generic Start Delay. This value can be used to block any protective element.5
I_Transit	Signal: Current transition signal
T_Transit	Signal: Time transition signal
StartMotorCmd	Signal: Start motor command
MotorStopBlo	Signal: Motor stop block other protection functions
Rotating forward	Signal: Rotation Direction forward
Rotating backward	Signal: Rotation Direction reverse
Blo-VUnbal Start	Signal: Motor start block voltage unbalance signal.
Blo-UnderV Start	Signal: Undervoltage Start Delay. Undervoltage elements are blocked for the time programmed under this parameter
Block-OverVStart	Signal: Overvoltage Start Delay. Overvoltage elements are blocked for the time programmed under this parameter
Blo-PowerStart	Signal: Power Start Delay. Power elements are blocked for the time programmed under this parameter
Blo-PFacStart	Signal: Power Factor Start Delay. Power Factor elements are blocked for the time programmed under this parameter
Blo-FrqStart	Signal: Frequency Start Delay. Frequency elements are blocked for the time programmed under this parameter

Direct Commands of the Motor Start Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
EmergOver2UI	Emergency override through front display Only available if: EMGOVR = active	inactive, active	inactive	[Operation /Reset/Acknowledge /EMGOVR]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
RstForcedStart	Reset Forced Start flag	inactive, active	inactive	[Operation /Reset/Acknowledge /Reset]

Motor Start Module Counter Values

Value	*Description*	*Default*	*Size*	*Menu path*
WaitTimeStarts	Wait time between starts remained	0s	0 - 9999999999s	[Operation /Measured values /Motor]
ColdStartPermit	Number of cold starts remaining	0	0 - 9999999999	[Operation /Measured values /Motor]
StartPerHour	StartPerHour	0	0 - 9999999999	[Operation /Measured values /Motor]
AntiBackSpin	Anti-BackspinTimer	0s	0 - 9999999999s	[Operation /Measured values /Motor]
IL1 Ib	Measured value: Phase current as percentage of Ib	0Ib	0 - 1000Ib	[Operation /Measured values /Current RMS]
IL2 Ib	Measured value: Phase current as percentage of Ib	0Ib	0 - 1000Ib	[Operation /Measured values /Current RMS]
IL3 Ib	Measured value: Phase current as percentage of Ib	0Ib	0 - 1000Ib	[Operation /Measured values /Current RMS]
I3 P (%Ib) avg	Average RMS current of all 3 phases as percentages of Ib	0Ib	0 - 1000Ib	[Operation /Measured values /Current RMS]
OCNT	Motor Operation count since last reset.	0	0 - 65535	[Operation /History /OperationsCr]
HighestStartI	Highest starting phase current. The time stamp indicates the point in time when the maximum current has occurred.	0A	0 - 99999999A	[Operation /History /OperationsCr]

Value	Description	Default	Size	Menu path
HighestRunI	Highest running phase current. The time stamp indicates the point in time when the maximum current has occurred.	0A	0 - 999999A	[Operation /History /OperationsCr]
nEmrgOvr	Number of emergency overrides since last reset.	0	0 - 65535	[Operation /History /OperationsCr]
nISQT	Number of incomplete sequence trips since last reset.	0	0 - 65535	[Operation /History /TripCr]
nSPHBlocks	Number of start per hour blocks since last reset.	0	0 - 65535	[Operation /History /TripCr]
nTBSBlocks	Number of time between start blocks since last reset.	0	0 - 65535	[Operation /History /TripCr]
nTRNTrips	Number of transition trips since last reset.	0	0 - 65535	[Operation /History /TripCr]
nZSWTrips	Number of zero speed switch trips since last reset.	0	0 - 65535	[Operation /History /TripCr]
nRevTrips	Number of reverse spinning trips since last reset.	0	0 - 65535	[Operation /History /TripCr]
TOCS	Total Motor Operation count since last reset.	0	0 - 65535	[Operation /History /TotalCr]

Motor Start Module Values

Value	Description	Menu path
I3 PRMS avg	Average RMS current of all 3 phases	[Operation /Measured values /Current RMS]
RunTime	Motor Operation time since last reset.	[Operation /History /OperationsCr]

Value	*Description*	*Menu path*
Highest%I2/I1	Highest %I2/I1 value since last reset. The time stamp indicates the point in time when the maximum unbalanced load has occurred.	[Operation /History /OperationsCr]
TRunTime	Motor Operation (Motor run time) time since last reset.	[Operation /History /TotalCr]

Motor Start Module Statistics

Value	*Description*	*Menu path*
IL1 max Ib	IL1 maximum value as percentage of Ib	[Operation /Statistics /Max /Current]
IL1 avg Ib	IL1 average value as percentage of Ib	[Operation /Statistics /Demand /Current Demand]
IL1 min Ib	IL1 minimum value as percentage of Ib	[Operation /Statistics /Min /Current]
IL2 max Ib	IL2 maximum value as percentage of Ib	[Operation /Statistics /Max /Current]
IL2 avg Ib	IL2 average value as percentage of Ib	[Operation /Statistics /Demand /Current Demand]
IL2 min Ib	IL2 minimum value as percentage of Ib	[Operation /Statistics /Min /Current]
IL3 max Ib	IL3 maximum value as percentage of Ib	[Operation /Statistics /Max /Current]

Value	*Description*	*Menu path*
IL3 avg Ib	IL3 average value as percentage of Ib	[Operation /Statistics /Demand /Current Demand]
IL3 min Ib	IL3 minimum value as percentage of Ib	[Operation /Statistics /Min /Current]
I3P Fla Demand	RMS current of all 3 phases calculated in a fixed demand window as percentages of Ib	[Operation /Statistics /Demand /Current Demand]

Protection Elements that Might Be Blocked by the Motor Start Module

These protection elements can be blocked during the motor start.

Name	*Description*
-.-	No assignment
MStart.Blo-GOCStart	Signal: Ground Instantaneous Overcurrent Start Delay. GOC (Instantaneous Overcurrent) elements are blocked for the time programmed under this parameter
MStart.Blo-IOCStart	Signal: Phase Instantaneous Overcurrent Start Delay. IOC (Instantaneous Overcurrent) elements are blocked for the time programmed under this parameter
MStart.Blo-I<Start	Signal: Underload Start Delay. Underload(Instantaneous Overcurrent) elements are blocked for the time programmed under this parameter
MStart.Blo-JamStart	Signal: JAM Start Delay. JAM(Instantaneous Overcurrent) elements are blocked for the time programmed under this parameter
MStart.Blo-UnbalStart	Signal: Motor start block current unbalance signal
MStart.Blo-Generic1	Generic Start Delay. This value can be used to block any protective element.1
MStart.Blo-Generic2	Generic Start Delay. This value can be used to block any protective element.2
MStart.Blo-Generic3	Generic Start Delay. This value can be used to block any protective element.3
MStart.Blo-Generic4	Generic Start Delay. This value can be used to block any protective element.4
MStart.Blo-Generic5	Generic Start Delay. This value can be used to block any protective element.5
MStart.Blo-VUnbal Start	Signal: Motor start block voltage unbalance signal.
MStart.Blo-UnderV Start	Signal: Undervoltage Start Delay. Undervoltage elements are blocked for the time programmed under this parameter
MStart.Block-OverVStart	Signal: Overvoltage Start Delay. Overvoltage elements are blocked for the time programmed under this parameter
MStart.Blo-PowerStart	Signal: Power Start Delay. Power elements are blocked for the time programmed under this parameter
MStart.Blo-PFacStart	Signal: Power Factor Start Delay. Power Factor elements are blocked for the time programmed under this parameter
MStart.Blo-FrqStart	Signal: Frequency Start Delay. Frequency elements are blocked for the time programmed under this parameter

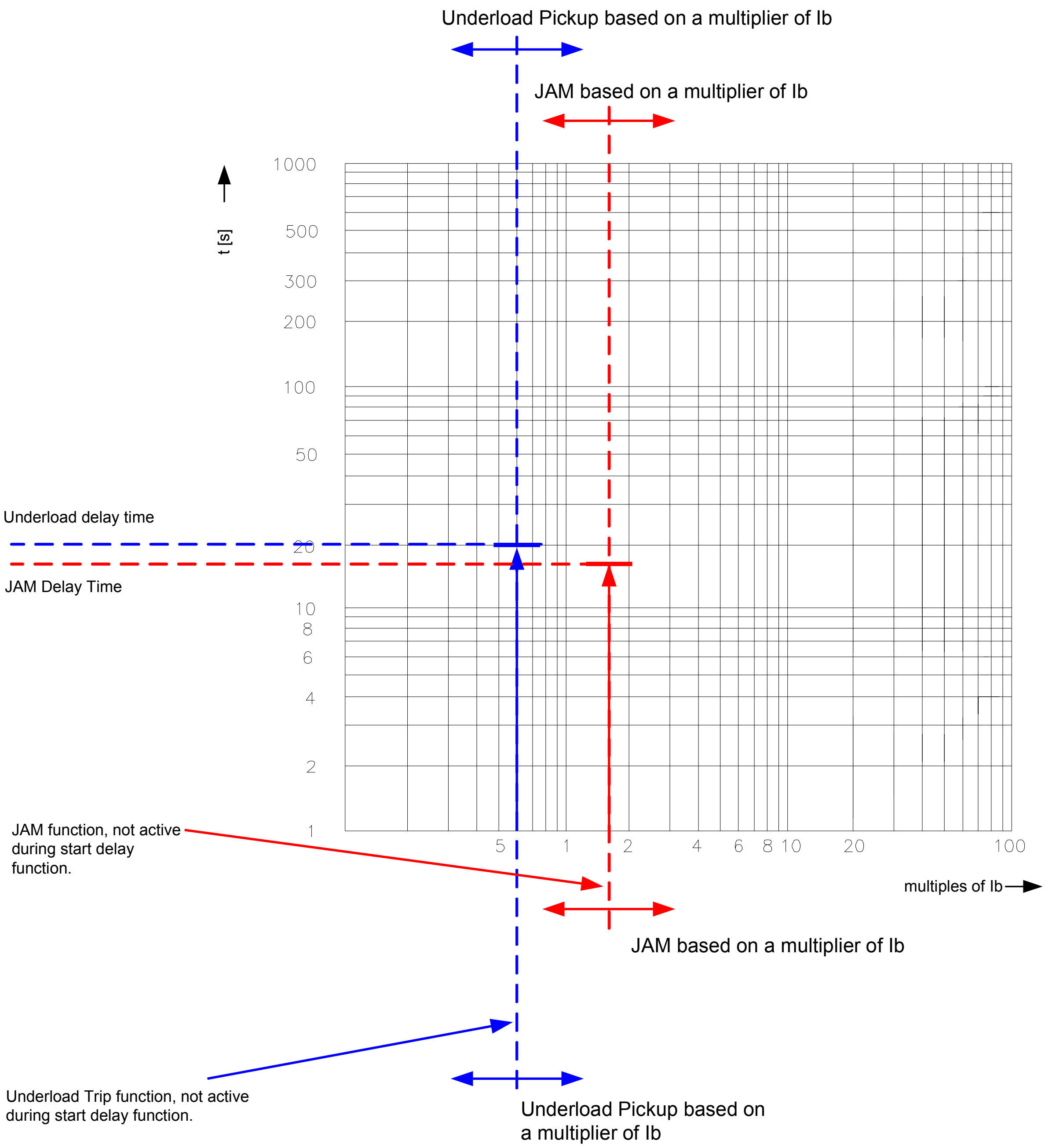
JAM [51LR]

Elements
Jam[1] ,Jam[2]

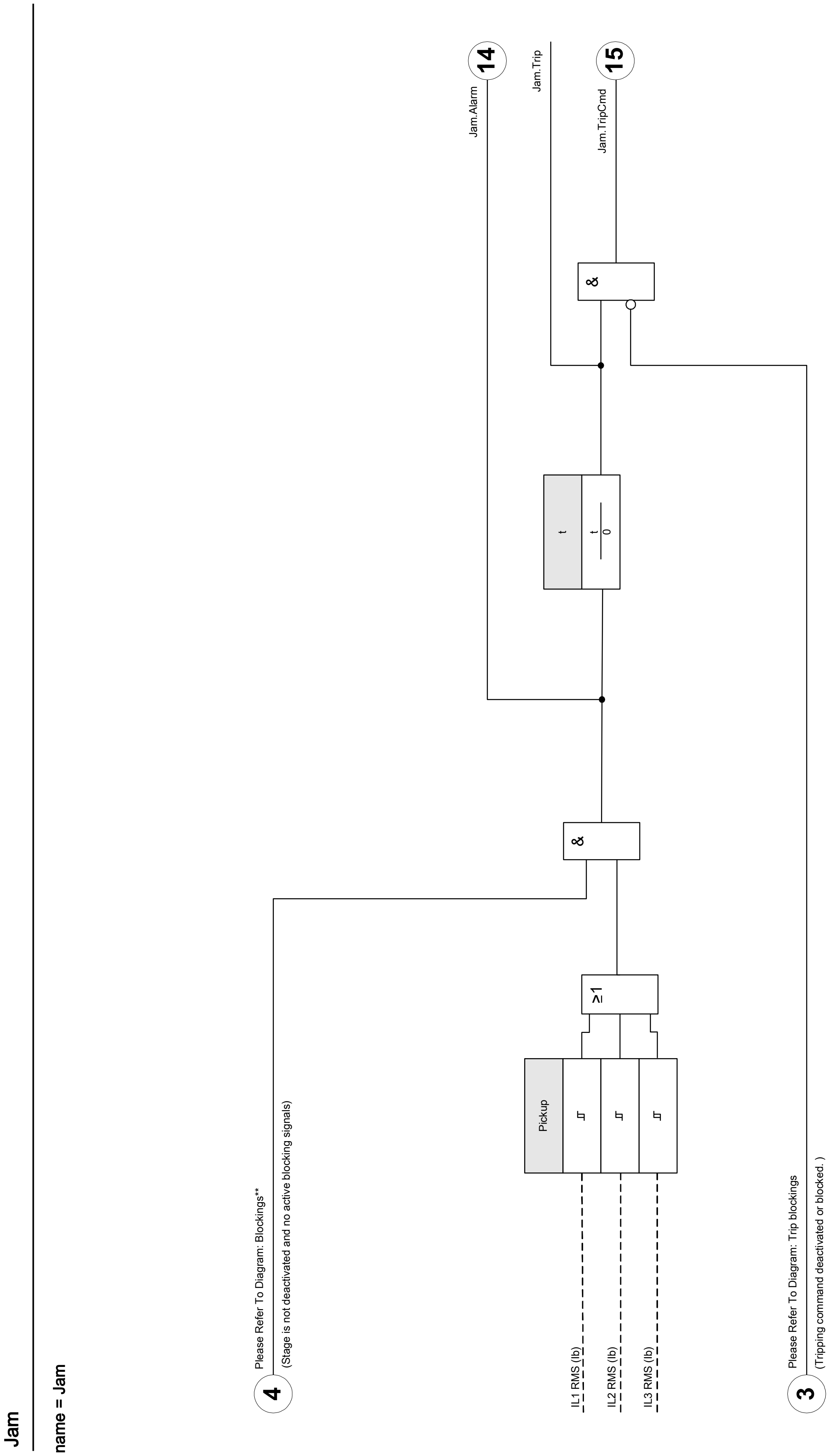
Functional Description

When the motor is running, a current increase above normal load may be an indication of a malfunction in the load. *JAM* protection recognizes mechanical problems, such as broken drive gears. Refer to the *JAM* protection limit (the right vertical line in the “Underload and JAM Trip Function” curve example). In this curve example, the JAM trip is set at 150% of Ib (FLA).

Underload and JAM Trip Function:



The protective device issues an alarm when the pickup is exceeded. If the timer has elapsed, a trip signal will be issued. In the “Underload and JAM Trip Function” curve, the »Trip« settings are represented by vertical lines, well above the normal load current. This curve also applies to JAM setting configured as an alarm element (blocked trip command). The trips are held off by the delay timer »*t«* . Use the start delay to block tripping and alarming until the motor current drops to continuous load level. Use run delays to avoid nuisance alarms or trips for load transients.


Jam
name = Jam
4
Please Refer To Diagram: Blockings**
(Stage is not deactivated and no active blocking signals)
IL1 RMS (Ib)
IL2 RMS (Ib)
IL3 RMS (Ib)
Pickup
≥1
&
t
t
0
Jam.Alarm
14
Jam.Trip
&
Jam.TripCmd
15
3
Please Refer To Diagram: Trip blockings
(Tripping command deactivated or blocked.)

Device Planning Parameters for JAM Protection

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, use	Jam[1]: use Jam[2]: do not use	[Device planning]

Global Protection Parameters for JAM 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 /JAM-Prot /Jam[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 /JAM-Prot /Jam[1]]
ExBlo3	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, Trip Cmds	MStart.Blo-JamStart	[Protection Para /Global Prot Para /JAM-Prot /Jam[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 /JAM-Prot /Jam[1]]
Ex rev Interl	External blocking of the module by external reverse interlocking, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /JAM-Prot /Jam[1]]

Setting Group Parameters for JAM Protection

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<n> /JAM-Prot /Jam[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /JAM-Prot /Jam[1]]
Ex rev Interl Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "Ex rev Interl Fc = active".	inactive, active	inactive	[Protection Para /<n> /JAM-Prot /Jam[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	active	[Protection Para /<n> /JAM-Prot /Jam[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo TripCmd Fc=active".	inactive, active	inactive	[Protection Para /<n> /JAM-Prot /Jam[1]]
Pickup	JAM based on a multiplier of Ib	1.00 - 12.00Ib	Jam[1]: 5Ib Jam[2]: 10.00Ib	[Protection Para /<n> /JAM-Prot /Jam[1]]
t	Tripping delay	0.0 - 1200.0s	Jam[1]: 10.0s Jam[2]: 2.0s	[Protection Para /<n> /JAM-Prot /Jam[1]]

JAM Protection Module Input States

Name	*Description*	*Assignment via*
ExBlo1-I	Module input state: External blocking1	[Protection Para /Global Prot Para /JAM-Prot /Jam[1]]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /JAM-Prot /Jam[1]]

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

JAM Protection Signals (Output States)

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

JAM Protection Values

Value	*Description*	*Default*	*Size*	*Menu path*
NumberOfAlarms	Number of alarms since last reset.	0	0 - 9999999999	[Operation /History /AlarmCr]
NumberOfTrips	Number of trips since last reset	0	0 - 9999999999	[Operation /History /TripCr]

Commissioning: JAM [51LR]

Object to be tested:

- Testing the pick-up value for JAM protection
- Testing the trip delay
- Testing the fallback ratio

Necessary means:

- 3-phase current source
- Ammemeter
- Timer for measuring of the tripping time

Procedure

Testing the threshold values(single-phase):

Feed in a testing current significantly smaller than the pick-up value. For testing the threshold values and fallback values, the test current has to be increased until the relay is energized. When comparing the displayed values with those of the ammeter, the deviation must be within the permissible tolerances.

Testing the tripping delay:

For testing the trip delay, a timer is to be connected to the contact of the associated trip relay. Feed in a testing current significantly smaller than the pick-up value, the test current has to be increased suddenly above the threshold value. The timer is started when the limiting value of the tripping current exceeded the threshold and the operating time is elapsed and it is stopped when the relay trips.

Testing the fallback ratio:

Enlarge the measuring quantity to less than 97% of the trip value. The realy must only fall back at 98% of the trip value at the earliest.

Successful test result:

The measured tripping delays, threshold values and fallback ratio comply with those values, specified in the adjustment list. Permissible deviations/tolerances can be found under Technical data.

MLS - Mechanical Load Shedding

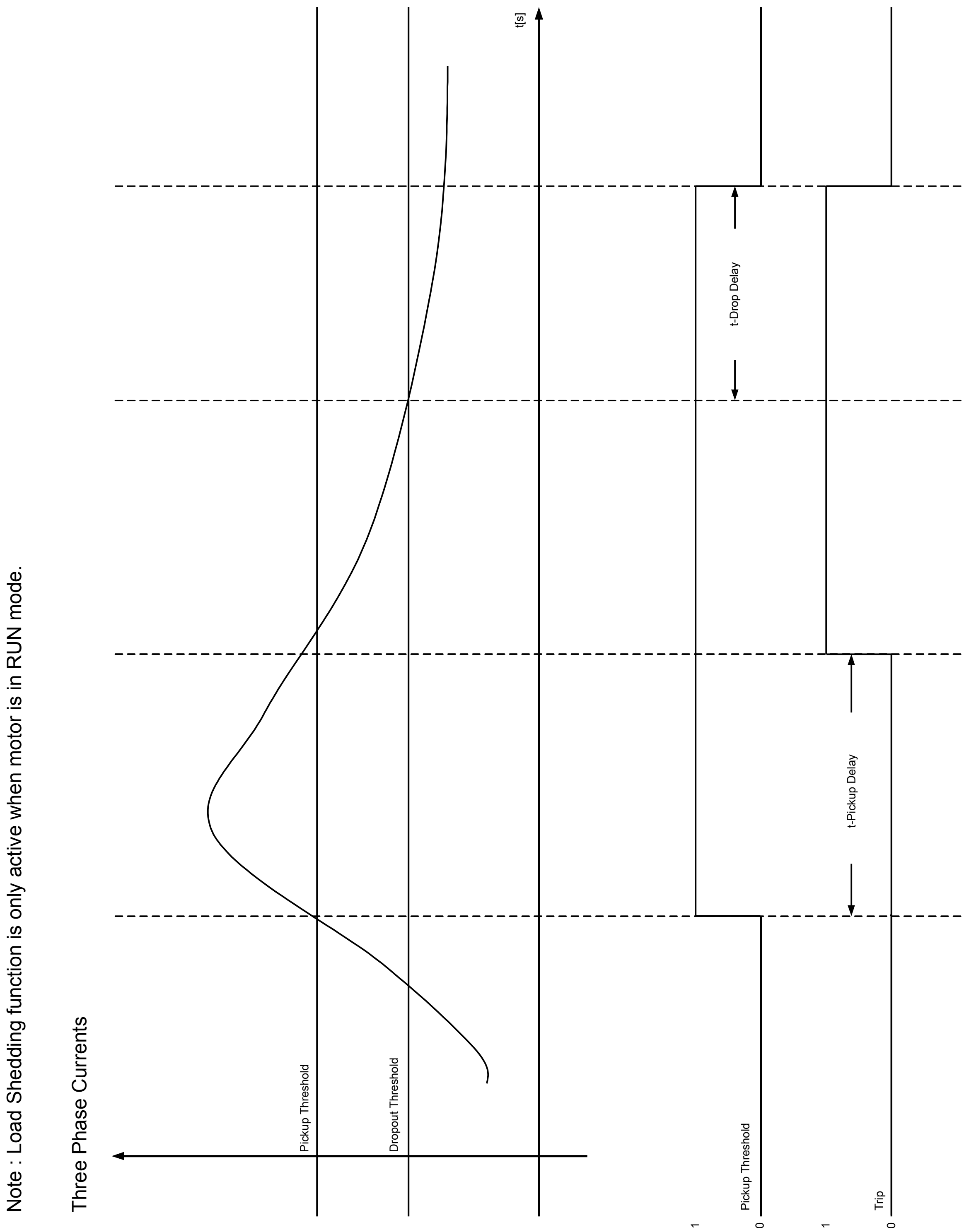
Available elements:
MLS

Functional Description

In some applications, the protective device can forestall a JAM alarm or trip, or a thermal trip, by sending a signal to the process to reduce loading. The load-shedding function, if enabled, closes or opens a relay contact to shed process load when the motor load current goes above the Load-shed threshold, for a time exceeding the »*t-Pickup Delay*«. This could, for example, be connected to stop flow of material into the driven process until the load current falls below the threshold, for the time determined by the »*t-Drop Delay*«.

Set the load-shed drop current comfortably below the JAM trip level. It may be useful to set it below the Ultimate Trip Current, particularly if Remote Temperature Detection is not used.

The load shed function, is active only during the »RUN« state of the motor.


Note : Load Shedding function is only active when motor is in RUN mode.
Three Phase Currents
Pickup Threshold
Dropout Threshold
t[s]
t-Drop Delay
t-Pickup Delay
Pickup Threshold
Trip
1
0
1
0

Device Planning Parameters of the Load Shedding

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

Global Protection Parameters of the Load Shedding

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 /MLS]
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 /MLS]

Setting Group Parameters of the Load Shedding

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<n> /MLS]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /MLS]
Pickup Threshold	Mechanical load shedding pickup current as multiplier of Ib	0.50 - 1.50Ib	0.90Ib	[Protection Para /<n> /MLS]
t-Pickup Delay	Trip delay time	0.0 - 5.0s	1.0s	[Protection Para /<n> /MLS]
Dropout Threshold	Mechanical load reclosure current (Dropout of Load shedding) as multiplier of Ib	0.50 - 1.50Ib	0.50Ib	[Protection Para /<n> /MLS]
t-Drop Delay	Dropout delay time	0.0 - 5.0s	1.0s	[Protection Para /<n> /MLS]

Load Shedding Input States

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

Load Shedding Signals (Output States)

Name	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
Alarm	Signal: Alarm
Trip	Signal: Trip

Commissioning: Mechanical Load Shedding

Object to be tested:

- Testing the pick-up and drop-out tresholds
- Testing the delay times

Necessary means:

- 3-phase current source
- Ammemeter
- Timer for measuring of the tripping times

Procedure:

Testing the threshold values (three-phase)
This test is only possible, if the motor is in run mode.

Testing pick-up threshold
The drop-out delay time should be 0s for this test.
Feed in a testing current significantly lower than the threshold of the mechanical load shedding. The test current has to be increased until the relay is energized. When comparing the measured values with those of the ammeter, the deviation must be within the permissible tolerances.

Testing drop-out threshold
For testing the drop-out threshold the testing current has to be significantly greater than the pick-up threshold value. The test current has to be decreased until the relay is falls back. When comparing the measured values with those of the ammeter, the deviation must be within the permissible tolerances.

Testing the delay times:

This test is only possible, if the motor is in run mode.

Testing the trip delay
For testing the pick-up delay , a timer is to be connected to the contact of the associated trip relay. Feed in a testing current significantly lower than the pick-up value, the test current has to be increased suddenly above the threshold. The timer is started when the limiting value of the tripping current exceeded the threshold and it is stopped when the relay trips and the operating time is elapsed .

Testing the drop-out delay
For testing the drop-out threshold, the testing current has to be significantly greater than the pick-up threshold. A timer is to be connected to the contact of the associated trip relay. The test current has to be decreased suddenly below the drop-out threshold. The timer has to be started when the limiting value of the tripping current falls below the threshold and it has to be stopped when the relay falls back.

Successful test result:

The measured tripping delays and threshold values comply with those values, specified in the adjustment list. Permissible deviations/tolerances can be found under Technical data.

LRC - Locked Rotor During Start

Functional Description

The Locked-rotor protection function is an integral part of the thermal model and is used to protect the motor in the event that the motor fails to start or accelerate after being energized. The heating in the motor during this period of time can be significantly higher than the heating at rated current, ranging from 10 to 50 times the normal rated heating. The time that a motor can remain at a standstill after being energized varies with the applied voltage and has an I^2T limit.

When determining the heat in the motor during this period of time, both the negative and positive sequence currents are used in the equation that approximates the heat generated in a locked rotor condition. The heat can be approximated by the equation:

$$I^2_H = I_1^2 + K\, I_2^2$$

where :

I_1	=	the per unit stator positive sequence current;
K	=	weighting factor for the value of I_2 resulting from the disproportionate heating caused by the negative sequence current component due to skin effect in the rotor bar; and
I_2	=	per unit stator negative sequence current.

Settings for the Locked Rotor Current can be found under the [Field Parameters]. The LRC value is a multiplier of Ib (FLA).

RTD - Temperature Protection [23]

Elements:
RTD

General – Principle Use

The Resistance-based Temperature Detector (RTD) protection module uses temperature data that are provided by a Universal Resistance-based Temperature Detector (URTD) module (please refer to the URTD Module section).

The protective device provides tripping and alarming functions based on the direct temperature measurements read from the URTD device that has 11 temperature sensor channels. Each channel will have one trip function without an intended delay and one alarm function with a delay.

The “trip” function has only a threshold setting. The trip threshold is usually set close to the thermal capacity. As soon as the thermal capacity used reaches the trip threshold, the Device will trip with no delay.

Each individual »Alarm Function« has a threshold setting range and can be individually enabled or disabled. It also has a timeout delay. The timeout flag will be set when the thermal capacity used has been above the alarm threshold for the timeout delay. The alarm threshold can be set much lower than the trip threshold. Therefore, when the thermal capacity used reaches the alarm level, it will not impose immediate danger to the electrical equipment. Both the alarm (pickup) and timeout alarm flags are part of the products Relay Output assignment list, so it is the user’s choice to use alarm pickup or timeout for their applications. The dropout ratio for both trip and alarm is 0.99.

Besides each individual RTD protection/alarm function, there are also group RTD protection/alarm functions. These RTD groups behave very much like the individual RTD functions described above, but they have independent thresholds and timeout delays. In any group, any member of the group can trigger the trip or alarm when it exceeds their thresholds.

Moreover, this protective device adds another level of flexibility that allows the user to form two RTD trip groups that can be any combinations of the 11 RTD trip outputs.

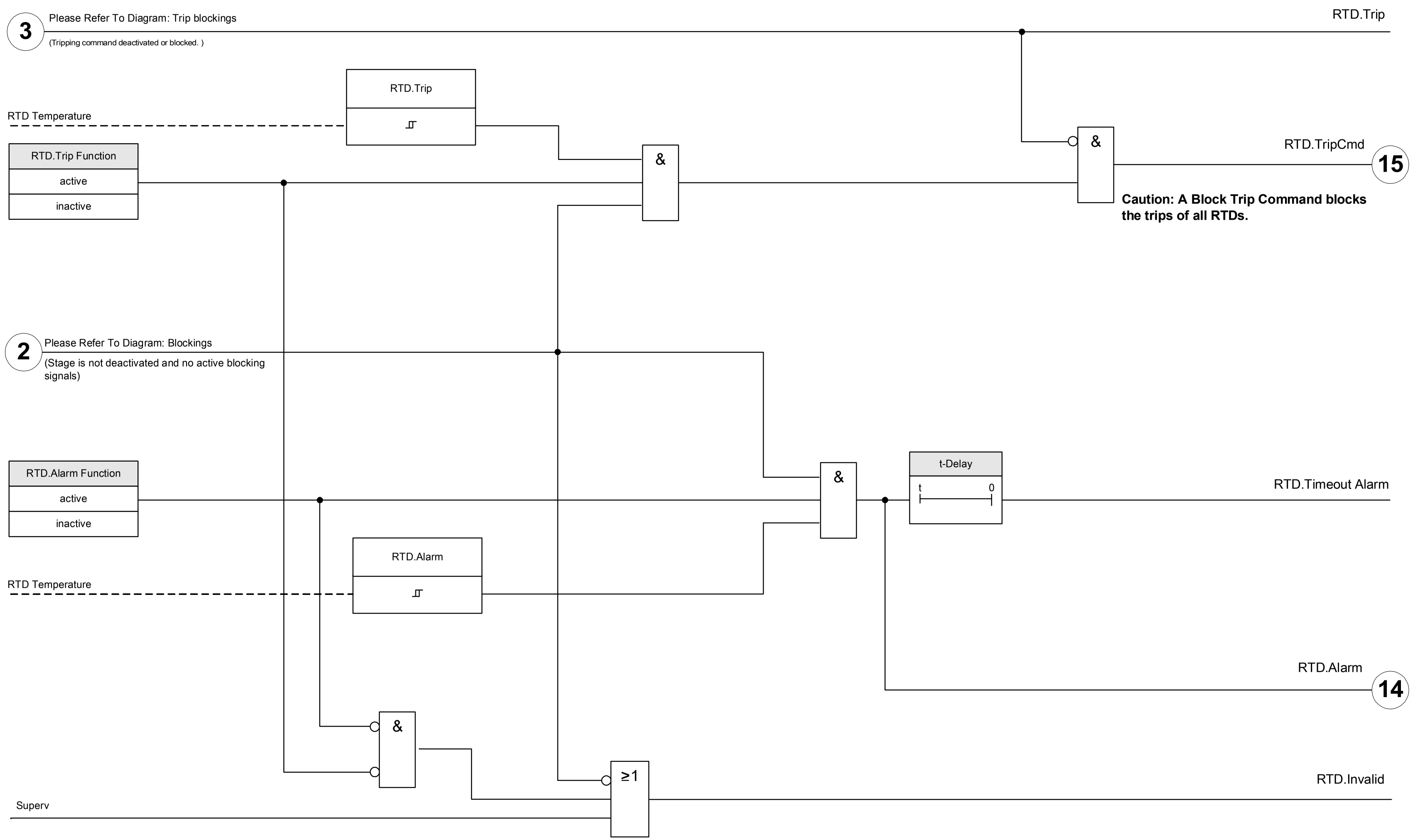
The entire function can be turned off or on, or individual channels can be turned off or on.

NOTICE **Consult the URTD Module Instruction Leaflet for complete instructions.**

RTD

Each Channel (RTD):

W1L1, W1L2, W1L3, W2L1, W2L2,W2L3, Amb1, Amb2, Aux1, Aux2, Aux3



Device Planning Parameters of the RTD Temperature Protection Module

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

Global Protection Parameters of the RTD Temperature 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 /Temp-Prot /RTD]
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 /Temp-Prot /RTD]
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 /Temp-Prot /RTD]
Developper only: wd	all channels from 0 to "Group1MaxChannel" are members of group 1	0 - 12	6	[Protection Para /Global Prot Para /Temp-Prot /RTD]
Developper only: mb	all channels from "Group1MaxChannel" to "Group2MaxChannel" are members of group 2	0 - 12	8	[Protection Para /Global Prot Para /Temp-Prot /RTD]
Developper only: lb	all channels from "Group2MaxChannel" to "Group3MaxChannel" are members of group 3	0 - 12	10	[Protection Para /Global Prot Para /Temp-Prot /RTD]

Setting Group Parameters of the RTD Temperature Protection Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<n> /Temp-Prot /RTD /General settings]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /Temp-Prot /RTD /General settings]
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<n> /Temp-Prot /RTD /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 /<n> /Temp-Prot /RTD /General settings]
Windg 1 Alarm Function	Winding 1 Alarm Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /Windg 1]
Windg 1 Trip Function	Winding 1 Trip Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /Windg 1]
Windg 1 Alarm	Winding 1 Threshold for Temperature Alarm Only available if: Device planning: Alarm Function = use	0 - 200°C	80°C	[Protection Para /<n> /Temp-Prot /RTD /Windg 1]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Windg 1 t-Delay	Winding 1 If this time is expired a Temperature Alarm will be generated. Only available if: Device planning: Alarm Function = use	0 - 360min	1min	[Protection Para /<n> /Temp-Prot /RTD /Windg 1]
Windg 1 Trip	Winding 1 Threshold for Temperature Trip Only available if: Device planning: Trip Function = use	0 - 200°C	100°C	[Protection Para /<n> /Temp-Prot /RTD /Windg 1]
Windg 2 Alarm Function	Winding 2 Alarm Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /Windg 2]
Windg 2 Trip Function	Winding 2 Trip Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /Windg 2]
Windg 2 Alarm	Winding 2 Threshold for Temperature Alarm Only available if: Device planning: Alarm Function = use	0 - 200°C	80°C	[Protection Para /<n> /Temp-Prot /RTD /Windg 2]
Windg 2 t-Delay	Winding 2 If this time is expired a Temperature Alarm will be generated. Only available if: Device planning: Alarm Function = use	0 - 360min	1min	[Protection Para /<n> /Temp-Prot /RTD /Windg 2]
Windg 2 Trip	Winding 2 Threshold for Temperature Trip Only available if: Device planning: Trip Function = use	0 - 200°C	100°C	[Protection Para /<n> /Temp-Prot /RTD /Windg 2]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Windg 3 Alarm Function	Winding 3 Alarm Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /Windg 3]
Windg 3 Trip Function	Winding 3 Trip Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /Windg 3]
Windg 3 Alarm	Winding 3 Threshold for Temperature Alarm Only available if: Device planning: Alarm Function = use	0 - 200°C	80°C	[Protection Para /<n> /Temp-Prot /RTD /Windg 3]
Windg 3 t-Delay	Winding 3 If this time is expired a Temperature Alarm will be generated. Only available if: Device planning: Alarm Function = use	0 - 360min	1min	[Protection Para /<n> /Temp-Prot /RTD /Windg 3]
Windg 3 Trip	Winding 3 Threshold for Temperature Trip Only available if: Device planning: Trip Function = use	0 - 200°C	100°C	[Protection Para /<n> /Temp-Prot /RTD /Windg 3]
Windg 4 Alarm Function	Winding 4 Alarm Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /Windg 4]
Windg 4 Trip Function	Winding 4 Trip Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /Windg 4]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Windg 4 Alarm	Winding 4 Threshold for Temperature Alarm Only available if: Device planning: Alarm Function = use	0 - 200°C	80°C	[Protection Para /<n> /Temp-Prot /RTD /Windg 4]
Windg 4 t-Delay	Winding 4 If this time is expired a Temperature Alarm will be generated. Only available if: Device planning: Alarm Function = use	0 - 360min	1min	[Protection Para /<n> /Temp-Prot /RTD /Windg 4]
Windg 4 Trip	Winding 4 Threshold for Temperature Trip Only available if: Device planning: Trip Function = use	0 - 200°C	100°C	[Protection Para /<n> /Temp-Prot /RTD /Windg 4]
Windg 5 Alarm Function	Winding 5 Alarm Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /Windg 5]
Windg 5 Trip Function	Winding 5 Trip Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /Windg 5]
Windg 5 Alarm	Winding 5 Threshold for Temperature Alarm Only available if: Device planning: Alarm Function = use	0 - 200°C	80°C	[Protection Para /<n> /Temp-Prot /RTD /Windg 5]
Windg 5 t-Delay	Winding 5 If this time is expired a Temperature Alarm will be generated. Only available if: Device planning: Alarm Function = use	0 - 360min	1min	[Protection Para /<n> /Temp-Prot /RTD /Windg 5]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Windg 5 Trip	Winding 5 Threshold for Temperature Trip Only available if: Device planning: Trip Function = use	0 - 200°C	100°C	[Protection Para /<n> /Temp-Prot /RTD /Windg 5]
Windg 6 Alarm Function	Winding 6 Alarm Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /Windg 6]
Windg 6 Trip Function	Winding 6 Trip Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /Windg 6]
Windg 6 Alarm	Winding 6 Threshold for Temperature Alarm Only available if: Device planning: Alarm Function = use	0 - 200°C	80°C	[Protection Para /<n> /Temp-Prot /RTD /Windg 6]
Windg 6 t-Delay	Winding 6 If this time is expired a Temperature Alarm will be generated. Only available if: Device planning: Alarm Function = use	0 - 360min	1min	[Protection Para /<n> /Temp-Prot /RTD /Windg 6]
Windg 6 Trip	Winding 6 Threshold for Temperature Trip Only available if: Device planning: Trip Function = use	0 - 200°C	100°C	[Protection Para /<n> /Temp-Prot /RTD /Windg 6]
MotBear 1 Alarm Function	Motor Bearing 1 Alarm Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /MotBear 1]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
MotBear 1 Trip Function	Motor Bearing 1 Trip Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /MotBear 1]
MotBear 1 Alarm	Motor Bearing 1 Threshold for Temperature Alarm Only available if: Device planning: Alarm Function = use	0 - 200°C	80°C	[Protection Para /<n> /Temp-Prot /RTD /MotBear 1]
MotBear 1 t-Delay	Motor Bearing 1 If this time is expired a Temperature Alarm will be generated. Only available if: Device planning: Alarm Function = use	0 - 360min	1min	[Protection Para /<n> /Temp-Prot /RTD /MotBear 1]
MotBear 1 Trip	Motor Bearing 1 Threshold for Temperature Trip Only available if: Device planning: Trip Function = use	0 - 200°C	100°C	[Protection Para /<n> /Temp-Prot /RTD /MotBear 1]
MotBear 2 Alarm Function	Motor Bearing 2 Alarm Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /MotBear 2]
MotBear 2 Trip Function	Motor Bearing 2 Trip Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /MotBear 2]
MotBear 2 Alarm	Motor Bearing 2 Threshold for Temperature Alarm Only available if: Device planning: Alarm Function = use	0 - 200°C	80°C	[Protection Para /<n> /Temp-Prot /RTD /MotBear 2]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
MotBear 2 t-Delay	Motor Bearing 2 If this time is expired a Temperature Alarm will be generated. Only available if: Device planning: Alarm Function = use	0 - 360min	1min	[Protection Para /<n> /Temp-Prot /RTD /MotBear 2]
MotBear 2 Trip	Motor Bearing 2 Threshold for Temperature Trip Only available if: Device planning: Trip Function = use	0 - 200°C	100°C	[Protection Para /<n> /Temp-Prot /RTD /MotBear 2]
LoadBear 1 Alarm Function	Load Bearing 1 Alarm Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /LoadBear 1]
LoadBear 1 Trip Function	Load Bearing 1 Trip Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /LoadBear 1]
LoadBear 1 Alarm	Load Bearing 1 Threshold for Temperature Alarm Only available if: Device planning: Alarm Function = use	0 - 200°C	80°C	[Protection Para /<n> /Temp-Prot /RTD /LoadBear 1]
LoadBear 1 t-Delay	Load Bearing 1 If this time is expired a Temperature Alarm will be generated. Only available if: Device planning: Alarm Function = use	0 - 360min	1min	[Protection Para /<n> /Temp-Prot /RTD /LoadBear 1]
LoadBear 1 Trip	Load Bearing 1 Threshold for Temperature Trip Only available if: Device planning: Trip Function = use	0 - 200°C	80°C	[Protection Para /<n> /Temp-Prot /RTD /LoadBear 1]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
LoadBear 2 Alarm Function	Load Bearing 2 Alarm Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /LoadBear 2]
LoadBear 2 LoadBear	Load Bearing 2 Trip Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /LoadBear 2]
LoadBear 2 Alarm	Load Bearing 2 Threshold for Temperature Alarm Only available if: Device planning: Alarm Function = use	0 - 200°C	80°C	[Protection Para /<n> /Temp-Prot /RTD /LoadBear 2]
LoadBear 2 t-Delay	Load Bearing 2 If this time is expired a Temperature Alarm will be generated. Only available if: Device planning: Alarm Function = use	0 - 360min	1min	[Protection Para /<n> /Temp-Prot /RTD /LoadBear 2]
LoadBear 2 Trip	Load Bearing 2 Threshold for Temperature Trip Only available if: Device planning: Trip Function = use	0 - 200°C	80°C	[Protection Para /<n> /Temp-Prot /RTD /LoadBear 2]
Aux1 Alarm Function	Auxiliary Alarm Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /Aux 1]
Aux1 Trip Function	Auxiliary Trip Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /Aux 1]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Aux1 Alarm	Auxiliary Threshold for Temperature Alarm Only available if: Device planning: Alarm Function1 = use Only available if: Device planning: Alarm Function2 = use	0 - 200°C	80°C	[Protection Para /<n> /Temp-Prot /RTD /Aux 1]
Aux1 t-Delay	Auxiliary If this time is expired a Temperature Alarm will be generated. Only available if: Device planning: Alarm Function1 = use Only available if: Device planning: Alarm Function2 = use	0 - 360min	1min	[Protection Para /<n> /Temp-Prot /RTD /Aux 1]
Aux1 Trip	Auxiliary Threshold for Temperature Trip Only available if: Device planning: Trip Function2 = use Only available if: Device planning: Trip Function2 = use	0 - 200°C	100°C	[Protection Para /<n> /Temp-Prot /RTD /Aux 1]
Aux2 Alarm Function	Auxiliary 2 Alarm Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /Aux 2]
Aux2 Trip Function	Auxiliary 2 Trip Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /Aux 2]
Aux2 Alarm	Auxiliary 2 Threshold for Temperature Alarm	0 - 200°C	105°C	[Protection Para /<n> /Temp-Prot /RTD /Aux 2]
Aux2 t-Delay	Auxiliary 2 If this time is expired a Temperature Alarm will be generated.	0 - 360min	1min	[Protection Para /<n> /Temp-Prot /RTD /Aux 2]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Aux2 Trip	Auxiliary 2 Threshold for Temperature Trip	0 - 200°C	110°C	[Protection Para /<n> /Temp-Prot /RTD /Aux 2]
Windg Alarm Function	Winding Alarm Function	inactive, active	inactive	[Protection Para /<n> /Temp-Prot /RTD /Windg]
Windg Trip Function	Winding Trip Function	inactive, active	inactive	[Protection Para /<n> /Temp-Prot /RTD /Windg]
Windg Alarm	Winding Threshold for Temperature Alarm Only available if: Device planning: Alarm Function = use	0 - 200°C	80°C	[Protection Para /<n> /Temp-Prot /RTD /Windg]
Windg t-Delay	Winding If this time is expired a Temperature Alarm will be generated. Only available if: Device planning: Alarm Function = use	0 - 360min	1min	[Protection Para /<n> /Temp-Prot /RTD /Windg]
Windg Trip	Winding Threshold for Temperature Trip Only available if: Device planning: Trip Function = use	0 - 200°C	100°C	[Protection Para /<n> /Temp-Prot /RTD /Windg]
MotBear Alarm Function	Motor Bearing Alarm Function	inactive, active	inactive	[Protection Para /<n> /Temp-Prot /RTD /MotBear]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
MotBear Trip Function	Motor Bearing Trip Function	inactive, active	inactive	[Protection Para /<n> /Temp-Prot /RTD /MotBear]
MotBear Alarm	Motor Bearing Threshold for Temperature Alarm Only available if: Device planning: Alarm Function = use	0 - 200°C	80°C	[Protection Para /<n> /Temp-Prot /RTD /MotBear]
MotBear t-Delay	Motor Bearing If this time is expired a Temperature Alarm will be generated. Only available if: Device planning: Alarm Function = use	0 - 360min	1min	[Protection Para /<n> /Temp-Prot /RTD /MotBear]
MotBear Trip	Motor Bearing Threshold for Temperature Trip Only available if: Device planning: Trip Function = use	0 - 200°C	100°C	[Protection Para /<n> /Temp-Prot /RTD /MotBear]
LoadBear Alarm Function	Load Bearing Alarm Function	inactive, active	inactive	[Protection Para /<n> /Temp-Prot /RTD /LoadBear]
LoadBear Trip Function	Load Bearing Trip Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /LoadBear]
LoadBear Alarm	Load Bearing Threshold for Temperature Alarm Only available if: Device planning: Alarm Function = use Only available if: Device planning: Alarm Function = use	0 - 200°C	80°C	[Protection Para /<n> /Temp-Prot /RTD /LoadBear]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
LoadBear t-Delay	Load Bearing If this time is expired a Temperature Alarm will be generated. Only available if: Device planning: Alarm Function = use Only available if: Device planning: Alarm Function = use	0 - 360min	1min	[Protection Para /<n> /Temp-Prot /RTD /LoadBear]
LoadBear Trip	Load Bearing Threshold for Temperature Trip Only available if: Device planning: Trip Function = use Only available if: Device planning: Aux = use	0 - 200°C	80°C	[Protection Para /<n> /Temp-Prot /RTD /LoadBear]
Aux Alarm Function	Auxiliary Alarm Function	inactive, active	inactive	[Protection Para /<n> /Temp-Prot /RTD /Aux]
Aux Trip Function	Auxiliary Trip Function	inactive, active	inactive	[Protection Para /<n> /Temp-Prot /RTD /Aux]
Aux Alarm	Auxiliary Threshold for Temperature Alarm	0 - 200°C	80°C	[Protection Para /<n> /Temp-Prot /RTD /Aux]
Aux t-Delay	Auxiliary If this time is expired a Temperature Alarm will be generated.	0 - 360min	1min	[Protection Para /<n> /Temp-Prot /RTD /Aux]
Aux Trip	Auxiliary Threshold for Temperature Trip	0 - 200°C	100°C	[Protection Para /<n> /Temp-Prot /RTD /Aux]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<n> /Temp-Prot /RTD /Voting1]
Voting 1	Voting: This parameter defines how many of the selected channels must be over its threshold level for getting a voting trip	1 - 11	1	[Protection Para /<n> /Temp-Prot /RTD /Voting1]
Windg 1	Winding 1	no, yes	yes	[Protection Para /<n> /Temp-Prot /RTD /Voting1]
Windg 2	Winding 2	no, yes	yes	[Protection Para /<n> /Temp-Prot /RTD /Voting1]
Windg 3	Winding 3	no, yes	yes	[Protection Para /<n> /Temp-Prot /RTD /Voting1]
Windg 4	Winding 4	no, yes	yes	[Protection Para /<n> /Temp-Prot /RTD /Voting1]
Windg 5	Winding 5	no, yes	yes	[Protection Para /<n> /Temp-Prot /RTD /Voting1]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Windg 6	Winding 6	no, yes	yes	[Protection Para /<n> /Temp-Prot /RTD /Voting1]
MotBear 1	Motor Bearing 1	no, yes	no	[Protection Para /<n> /Temp-Prot /RTD /Voting1]
MotBear 2	Motor Bearing 2	no, yes	no	[Protection Para /<n> /Temp-Prot /RTD /Voting1]
LoadBear 1	Load Bearing 1	no, yes	no	[Protection Para /<n> /Temp-Prot /RTD /Voting1]
LoadBear 2	Load Bearing 2	no, yes	no	[Protection Para /<n> /Temp-Prot /RTD /Voting1]
Aux1	Auxiliary1	no, yes	no	[Protection Para /<n> /Temp-Prot /RTD /Voting1]
Aux2	Auxiliary2	no, yes	no	[Protection Para /<n> /Temp-Prot /RTD /Voting1]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<n> /Temp-Prot /RTD /Voting2]
Voting 2	Voting: This parameter defines how many of the selected channels must be over its threshold level for getting a voting trip	1 - 11	1	[Protection Para /<n> /Temp-Prot /RTD /Voting2]
Windg 1	Winding 1	no, yes	no	[Protection Para /<n> /Temp-Prot /RTD /Voting2]
Windg 2	Winding 2	no, yes	no	[Protection Para /<n> /Temp-Prot /RTD /Voting2]
Windg 3	Winding 3	no, yes	no	[Protection Para /<n> /Temp-Prot /RTD /Voting2]
Windg 4	Winding 4	no, yes	no	[Protection Para /<n> /Temp-Prot /RTD /Voting2]
Windg 5	Winding 5	no, yes	no	[Protection Para /<n> /Temp-Prot /RTD /Voting2]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Windg 6	Winding 6	no, yes	no	[Protection Para /<n> /Temp-Prot /RTD /Voting2]
MotBear 1	Motor Bearing 1	no, yes	no	[Protection Para /<n> /Temp-Prot /RTD /Voting2]
MotBear 2	Motor Bearing 2	no, yes	no	[Protection Para /<n> /Temp-Prot /RTD /Voting2]
LoadBear 1	Load Bearing 1	no, yes	no	[Protection Para /<n> /Temp-Prot /RTD /Voting2]
LoadBear 2	Load Bearing 2	no, yes	no	[Protection Para /<n> /Temp-Prot /RTD /Voting2]
Aux1	Auxiliary1	no, yes	no	[Protection Para /<n> /Temp-Prot /RTD /Voting2]
Aux2	Auxiliary2	no, yes	no	[Protection Para /<n> /Temp-Prot /RTD /Voting2]

RTD Temperature Protection Module Input States

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

RTD Temperature Protection Module Signals (Output States)

Name	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Alarm	Alarm RTD Temperature Protection
Trip	Signal: Trip
TripCmd	Signal: Trip Command
Windg 1 Trip	Winding 1 Signal: Trip
Windg 1 Alarm	Winding 1 Alarm RTD Temperature Protection
Windg 1 Timeout Alarm	Winding 1 Timeout Alarm
Windg 1 Invalid	Winding 1 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
Windg 2 Trip	Winding 2 Signal: Trip
Windg 2 Alarm	Winding 2 Alarm RTD Temperature Protection
Windg 2 Timeout Alarm	Winding 2 Timeout Alarm
Windg 2 Invalid	Winding 2 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
Windg 3 Trip	Winding 3 Signal: Trip
Windg 3 Alarm	Winding 3 Alarm RTD Temperature Protection
Windg 3 Timeout Alarm	Winding 3 Timeout Alarm
Windg 3 Invalid	Winding 3 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
Windg 4 Trip	Winding 4 Signal: Trip

Name	*Description*
Windg 4 Alarm	Winding 4 Alarm RTD Temperature Protection
Windg 4 Timeout Alarm	Winding 4 Timeout Alarm
Windg 4 Invalid	Winding 4 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
Windg 5 Trip	Winding 5 Signal: Trip
Windg 5 Alarm	Winding 5 Alarm RTD Temperature Protection
Windg 5 Timeout Alarm	Winding 5 Timeout Alarm
Windg 5 Invalid	Winding 5 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
Windg 6 Trip	Winding 6 Signal: Trip
Windg 6 Alarm	Winding 6 Alarm RTD Temperature Protection
Windg 6 Timeout Alarm	Winding 6 Timeout Alarm
Windg 6 Invalid	Winding 6 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
MotBear 1 Trip	Motor Bearing 1 Signal: Trip
MotBear 1 Alarm	Motor Bearing 1 Alarm RTD Temperature Protection
MotBear 1 Timeout Alarm	Motor Bearing 1 Timeout Alarm
MotBear 1 Invalid	Motor Bearing 1 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
MotBear 2 Trip	Motor Bearing 2 Signal: Trip
MotBear 2 Alarm	Motor Bearing 2 Alarm RTD Temperature Protection
MotBear 2 Timeout Alarm	Motor Bearing 2 Timeout Alarm
MotBear 2 Invalid	Motor Bearing 2 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
LoadBear 1 Trip	Load Bearing 1 Signal: Trip
LoadBear 1 Alarm	Load Bearing 1 Alarm RTD Temperature Protection
LoadBear 1 Timeout Alarm	Load Bearing 1 Timeout Alarm
LoadBear 1 Invalid	Load Bearing 1 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
LoadBear 2 Trip	Load Bearing 2 Signal: Trip
LoadBear 2 Alarm	Load Bearing 2 Alarm RTD Temperature Protection
LoadBear 2 Timeout Alarm	Load Bearing 2 Timeout Alarm
LoadBear 2 Invalid	Load Bearing 2 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
Aux1 Trip	Auxiliary 1 Signal: Trip
Aux1 Alarm	Auxiliary 1 Alarm RTD Temperature Protection
Aux1 Timeout Alarm	Auxiliary 1 Timeout Alarm
Aux1 Invalid	Auxiliary 1 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
Aux2 Trip	Auxiliary 2 Signal: Trip
Aux2 Alarm	Auxiliary 2 Alarm RTD Temperature Protection
Aux2 Timeout Alarm	Auxiliary 2 Timeout Alarm

Name	Description
Aux2 Invalid	Auxiliary 2 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
Trip WD Group	Trip all Windings
Alarm WD Group	Alarm all Windings
TimeoutAlmWDGrp	Timeout Alarm all Windings
Windg Group Invalid	Winding Group Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
Trip MB Group	Trip all Motor Bearings
Alarm MB Group	Alarm all Motor Bearings
TimeoutAlmMBGrp	Timeout Alarm all Motor Bearings
MotBear Group Invalid	Motor Bearing Group Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
Trip LB Group	Trip all Load Bearings
Alarm LB Group	Alarm all Load Bearings
TimeoutAlmLBGrp	Timeout Alarm all Load Bearings
LoadBear Group Invalid	Load Bearing Group Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
Trip Any Group	Trip Any Group
Alarm Any Group	Alarm Any Group
TimeoutAlmAnyGrp	Timeout Alarm Any Group
Trip Group 1	Trip Group 1
Trip Group 2	Trip Group 2
Timeout Alarm	Alarm timeout expired
Trip Aux Group	Trip Auxiliary Group
Alarm Aux Group	Alarm Auxiliary Group
TimeoutAlmAuxGrp	Timeout Alarm Auxiliary Group
AuxGrpInvalid	Invalid Auxiliary Group

RTD Temperature Protection Module Counter Values

Value	Description	Default	Size	Menu path
HighestWdTemp	Highest motor winding temperature in degrees.	0°C	0 - 250°C	[Operation /History /OperationsCr]
HighestMbTemp	Highest motor bearing temperature in degrees.	0°C	0 - 250°C	[Operation /History /OperationsCr]
HighestLbTemp	Highest load bearing temperature in degrees.	0°C	0 - 250°C	[Operation /History /OperationsCr]

Value	*Description*	*Default*	*Size*	*Menu path*
HighestAuxTemp	Highest Auxiliary temperature in degrees.	0°C	0 - 250°C	[Operation /History /OperationsCr]
nWdAlarms	Number of winding temperature alarms since last reset.	0	0 - 65535	[Operation /History /AlarmCr]
nMbAlarms	Number of motor bearing temperature alarms since last reset.	0	0 - 65535	[Operation /History /AlarmCr]
nLbAlarms	Number of load bearing temperature alarms since last reset.	0	0 - 65535	[Operation /History /AlarmCr]
nAuxAlarms	Number of auilary temperature alarms since last reset.	0	0 - 65535	[Operation /History /AlarmCr]
nWdTrips	Number of winding temperature trips since last reset.	0	0 - 65535	[Operation /History /TripCr]
nMbTrips	Number of motor bearing temperature trips since last reset.	0	0 - 65535	[Operation /History /TripCr]
nLbTrips	Number of load bearing temperature trips since last reset.	0	0 - 65535	[Operation /History /TripCr]
nAuxTrips	Number of auilary temperature trips since last reset.	0	0 - 65535	[Operation /History /TripCr]
nChannelFails	Number of RTD channel failures.	0	0 - 65535	[Operation /History /AlarmCr]

URTD Module Interface

*=Availability on request

<u>URTD</u>

Principle – General Use

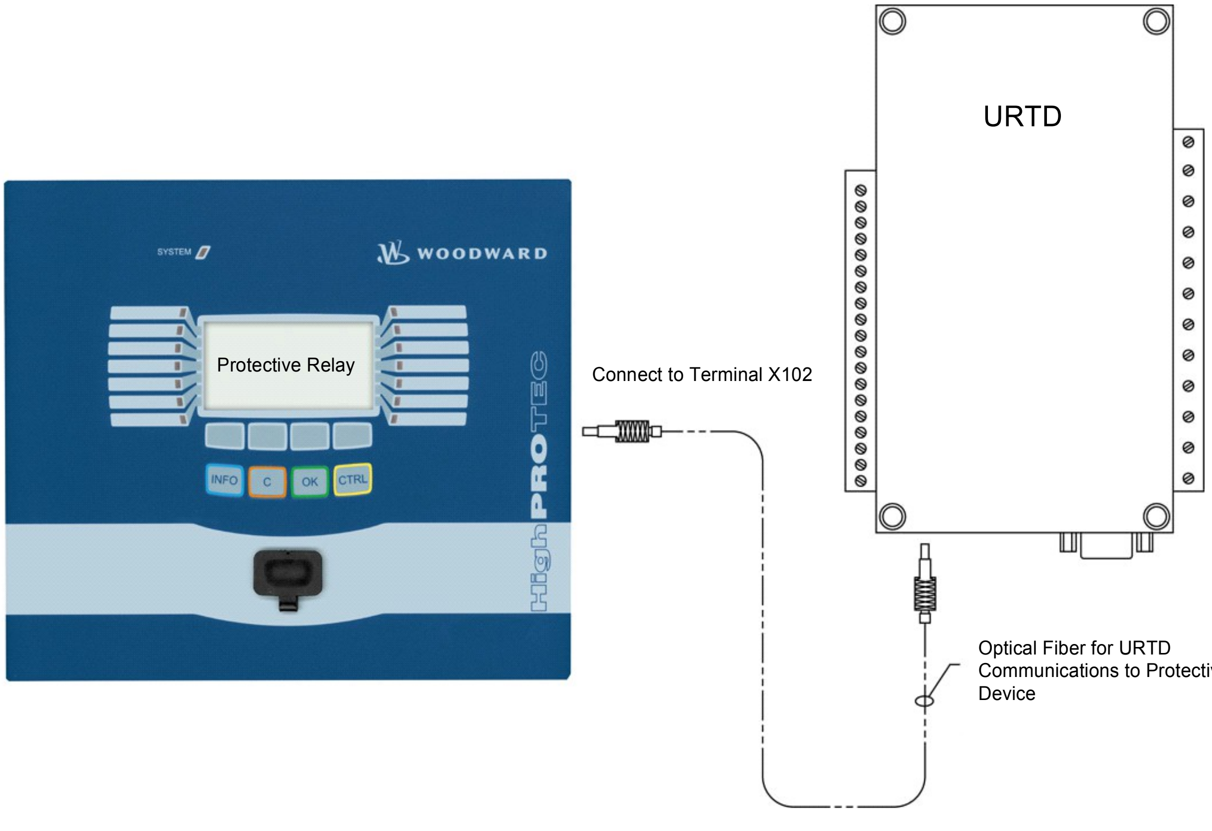
The optional Universal Resistance-based Temperature Detector (URTD) Module provides temperature data to the protective device from up to 11 RTDs embedded in the motor, generator, transformer, or cable connector and driven equipment. The temperature data will be shown as measured values and statistics in the Operating Data menu. In addition, each channel will be monitored. The measured data provided by the URTD Module can also be used for temperature protection.

The URTD conveys multiplexed temperature data back to the relay via a single optical fiber. The URTD may be mounted remotely from the protective device. The fiber optic connector is located on the **X102** terminal of the protective device.

Consider the benefit of mounting the URTD module away from the protective device and as close to the protected equipment as possible. The big bundle of RTD wires to the protected equipment becomes much shorter. The URTD may be placed up to 400 ft (121.9 m) from the protective device with the optical fiber connection. Note that the URTD will require 120 Vac power (6 VA) at its remote location.

URTD Module Fiber Optic Connection to the Protective Device

Connect a source of 120 Vac only to the power terminals of connector J3 on the URTD module. Connect either terminal 16 or terminal 32 (but not both) to a non-current-carrying safety ground.



The figure above shows the fiber optic connections between the URTD Module and the protective device. The protective device supports the optical fiber connection.

Preassembled plastic optical fibers with connectors can be ordered from any distributor of optical fiber products. In addition, these same distributors offer long rolls of cable with connectors that can be installed in the field. Some distributors will make custom lengths to order.

NOTICE **Surplus length of a pre-cut fiber does not cause a problems. Simply coil and tie the excess fiber at a convenient point. Avoid high tie pressure. Bending radius of the fiber should be greater than 2 in. (50.8 mm).**

The fiber termination at the URTD simply snaps into or out of the connector. To connect the fiber termination at the protective device, push the plug of the fiber optic onto the device interface then turn it until it “snaps”.

CAUTION **The protective device has various power supply options. If it is not 120 Vac, the power supply cannot be shared with the URTD Module.**

NOTICE **Consult the URTD Module Instruction Leaflet for complete instructions.**

Device Planning Parameters of the URTD Module

Direct Commands of the URTD Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, ctive	inactive	[Service /Test Mode (Prot inhibit) /URTD]
Force Windg1	Force Winding 1	0 - 200°C	0°C	[Service /Test Mode (Prot inhibit) /URTD]
Force Windg2	Force Winding 2	0 - 200°C	0°C	[Service /Test Mode (Prot inhibit) /URTD]
Force Windg3	Force Winding 3	0 - 200°C	0°C	[Service /Test Mode (Prot inhibit) /URTD]
Force Windg4	Force Winding 4	0 - 200°C	0°C	[Service /Test Mode (Prot inhibit) /URTD]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Force Windg5	Force Winding 5	0 - 200°C	0°C	[Service /Test Mode (Prot inhibit) /URTD]
Force Windg6	Force Winding 6	0 - 200°C	0°C	[Service /Test Mode (Prot inhibit) /URTD]
Force MotBear1	Force Motor Bearing 1	0 - 200°C	0°C	[Service /Test Mode (Prot inhibit) /URTD]
Force MotBear2	Force Motor Bearing 2	0 - 200°C	0°C	[Service /Test Mode (Prot inhibit) /URTD]
Force LoadBear1	Force Load Bearing 1	0 - 200°C	0°C	[Service /Test Mode (Prot inhibit) /URTD]
Force LoadBear2	Force Load Bearing 2	0 - 200°C	0°C	[Service /Test Mode (Prot inhibit) /URTD]
Force Aux1	Force Auxiliary1	0 - 200°C	0°C	[Service /Test Mode (Prot inhibit) /URTD]
Force Aux2	Force Auxiliary2	0 - 200°C	0°C	[Service /Test Mode (Prot inhibit) /URTD]

Global Protection Parameters of the URTD Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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 Mode (Prot inhibit) /URTD]
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 Mode (Prot inhibit) /URTD]

URTD Signals (Output States)

Name	*Description*
Windg1 Superv	Signal: Supervision Channel Windg1
Windg2 Superv	Signal: Supervision Channel Windg2
Windg3 Superv	Signal: Supervision Channel Windg3
Windg4 Superv	Signal: Supervision Channel Windg4
Windg5 Superv	Signal: Supervision Channel Windg5
Windg6 Superv	Signal: Supervision Channel Windg6
MotBear1 Superv	Signal: Supervision Channel MotBear1
MotBear2 Superv	Signal: Supervision Channel MotBear2
LoadBear1 Superv	Signal: Supervision Channel LoadBear1
LoadBear2 Superv	Signal: Supervision Channel LoadBear2
Aux1 Superv	Signal: Supervision Channel Aux1
Aux2 Superv	Signal: Supervision Channel Aux2
Superv	Signal: URTD Supervision Channel
active	Signal: URTD active
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.

URTD Module Statistics

Value	*Description*	*Menu path*
Windg1 max	Winding1 Maximum Value	[Operation /Statistics /Max /URTD]
Windg1 min	Winding1 Minimum Value	[Operation /Statistics /Min /URTD]
Windg2 max	Winding2 Maximum Value	[Operation /Statistics /Max /URTD]
Windg2 min	Winding2 Minimum Value	[Operation /Statistics /Min /URTD]
Windg3 max	Winding3 Maximum Value	[Operation /Statistics /Max /URTD]
Windg3 min	Winding3 Minimum Value	[Operation /Statistics /Min /URTD]
Windg4 max	Winding4 Maximum Value	[Operation /Statistics /Max /URTD]
Windg4 min	Winding4 Minimum Value	[Operation /Statistics /Min /URTD]
Windg5 max	Winding5 Maximum Value	[Operation /Statistics /Max /URTD]

Value	*Description*	*Menu path*
Windg5 min	Winding5 Minimum Value	[Operation /Statistics /Min /URTD]
Windg6 max	Winding6 Maximum Value	[Operation /Statistics /Max /URTD]
Windg6 min	Winding6 Minimum Value	[Operation /Statistics /Min /URTD]
MotBear1 max	Motor Bearing1 Maximum Value	[Operation /Statistics /Max /URTD]
MotBear1 min	Motor Bearing1 Minimum Value	[Operation /Statistics /Min /URTD]
MotBear2 max	Motor Bearing2 Maximum Value	[Operation /Statistics /Max /URTD]
MotBear2 min	Motor Bearing2 Minimum Value	[Operation /Statistics /Min /URTD]
LoadBear1 max	Load Bearing1 Maximum Value	[Operation /Statistics /Max /URTD]
LoadBear1 min	Load Bearing1 Minimum Value	[Operation /Statistics /Min /URTD]

Value	*Description*	*Menu path*
LoadBear2 max	Load Bearing2 Maximum Value	[Operation /Statistics /Max /URTD]
LoadBear2 min	Load Bearing2 Minimum Value	[Operation /Statistics /Min /URTD]
Aux1 max	Auxiliary1 Maximum Value	[Operation /Statistics /Max /URTD]
Aux1 min	Auxiliary1 Minimum Value	[Operation /Statistics /Min /URTD]
Aux2 max	Auxiliary2 Maximum Value	[Operation /Statistics /Max /URTD]
Aux2 min	Auxiliary2 Minimum Value	[Operation /Statistics /Min /URTD]

URTD Measured Values

Value	*Description*	*Menu path*
Windg1	Winding 1	[Operation /Measured values /URTD]
Windg2	Winding 2	[Operation /Measured values /URTD]
Windg3	Winding 3	[Operation /Measured values /URTD]

Value	*Description*	*Menu path*
Windg4	Winding 4	[Operation /Measured values /URTD]
Windg5	Winding 5	[Operation /Measured values /URTD]
Windg6	Winding 6	[Operation /Measured values /URTD]
MotBear1	Motor Bearing 1	[Operation /Measured values /URTD]
MotBear2	Motor Bearing 2	[Operation /Measured values /URTD]
LoadBear1	Load Bearing 1	[Operation /Measured values /URTD]
LoadBear2	Load Bearing 2	[Operation /Measured values /URTD]
Aux1	Auxiliary1	[Operation /Measured values /URTD]
Aux2	Auxiliary2	[Operation /Measured values /URTD]

Theta - Thermal Model [49M, 49R]

Available Elements:
ThR

General – Principle Use

Thermal Protection and Alarm

This protective device provides a thermal model. The thermal model can work with or without the URTD. The RTD-based direct temperature trips and alarms are independent of the thermal model. Without the URTD, meaning the URTD is not connected to the protective device or it is connected but not configured for the thermal protection trips, the thermal model protection will be solely based on the following settings:

1. Ib Full Load Ampere (FLA);
2. Locked Rotor Current (LRC);
3. Maximum Allowable Stall Time (Tc);
4. UTC (Ultimate Trip Current) or k-Factor;
5. Thermal Model Trip Threshold if enabled;
6. Trip Delay;
7. Thermal Model Alarm Threshold if enabled; and
8. Alarm Delay.

The first four settings (1-4) dictate the maximum allowable thermal limit curve of the protected equipment, and the last four settings (6-9) define the thermal trip and alarm curves relative to the thermal limit curve.

Mathematically, the thermal limit curve can be expressed as the following:

$$Trip\,Time = \frac{I_{LR}^2 * T_{LR}}{I_{ef}^2} \quad \text{when} \quad I_{ef} > k_{Factor} * I_b$$

If the direct stator temperature measurements are available, the thermal replica model will be modified to include the heat loss between stator and rotor. As a result, the motor will be able to run longer under overload conditions. The heat loss serves as a cooling. At some point, the cooling effect will cancel the heat increment so that the thermal capacity used will reach some steady-state level that may be below the trip or alarm limit. This equivalently raises the »*k-factor*« and shifts the trip curve right.

If the thermal capacity used is held at a level that is below the trip threshold, the thermal model will not trip. To prevent the protected equipment from overheating, the direct temperature trip function must be enabled. Keep in mind that in order for the stator temperature to be effective in the thermal replica model, the following conditions must be met:

- Some RTD channels must be configured to measure the winding temperatures; and
- These RTD channels must be enabled for trip.

In addition, at least one of these winding temperatures must be valid.

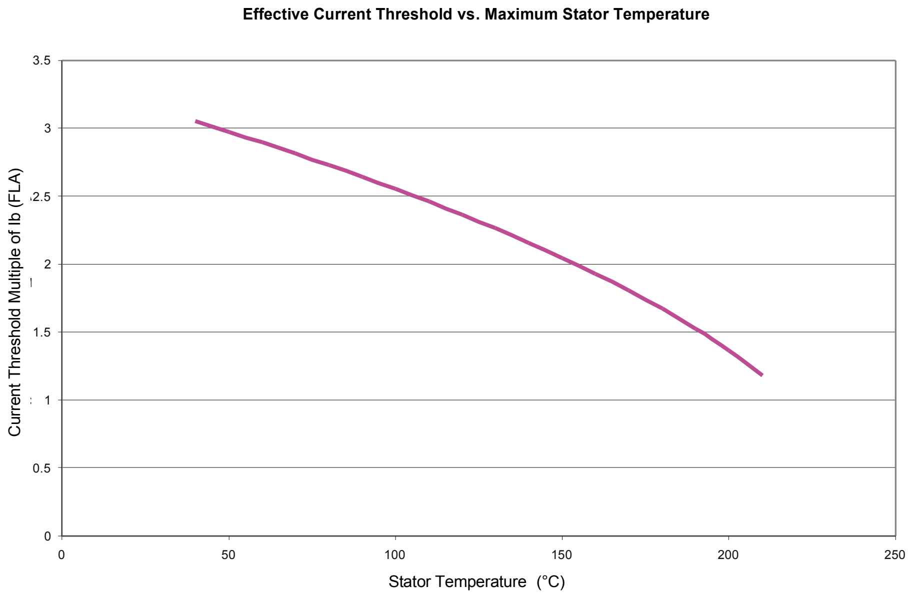
Knowing the maximum steady stator temperature Θ_S (°C), the thermal capacity used can be estimated by the following formula.

$$TC_{Used}\% = \left(\frac{\Theta_S}{240} + \frac{I_{ef}^2 * 50}{I_{LR}^2 * T_{LR}}\right) \quad \text{when} \quad I_{ef} > Ith * FLA$$

Take for example, ILR = 6 * FLA, TLR = 15, and thermal trip level of 100%. The relationship between the effective current threshold and the stator temperature can be seen in the Stator Temperature Effect on Current Threshold Curve.

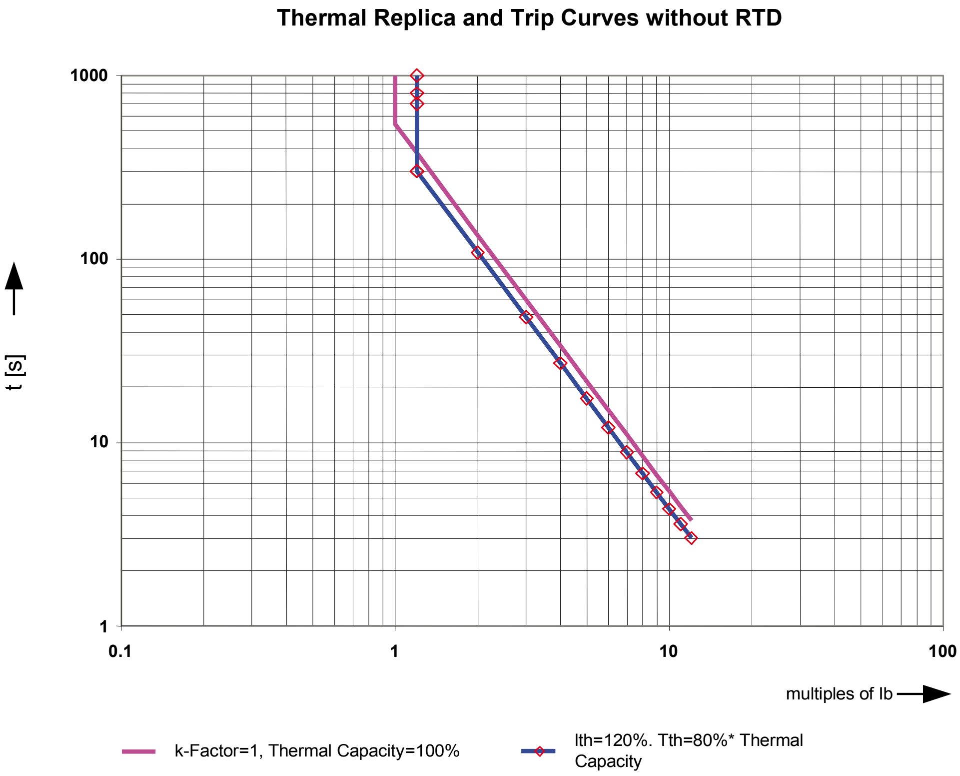
Stator Temperature Effect on Current Threshold Curve

From the graph, it is seen that the lower the stator temperature, the higher the effective current threshold.

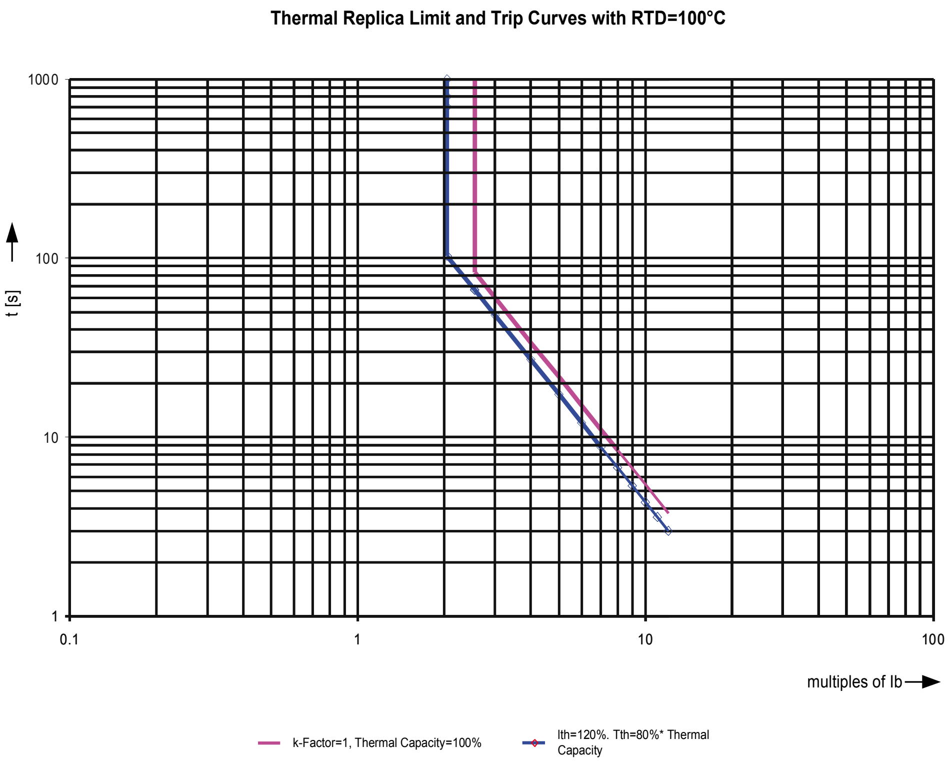


Without stator temperature, given the current threshold of 1.0 * Ib (FLA) and 2.0 * Ib (FLA) of the stator phase current, the thermal model will use the full thermal capacity in 139.54 seconds. However, if the stator temperature is known as 100°C (212°F), the effective ultimate trip current threshold is raised to 2.55 * Ib (FLA) and the thermal capacity used will reach a steady state of 77.5%. As a result, the thermal model will never trip under this condition. From this example, it can be seen that the stator RTD could keep the motor running under overload condition. In this case, the appropriate direct stator temperature trip function must be enabled.

In the Thermal Replica Model Trip Curves with and without RTD, the unmarked lines are the thermal limit curves and the marked lines are the trip curves. From the curve without RTD, it can be seen that one can change the thermal current threshold to shift the upper portion of the trip curve right to allow the motor to run at a higher overload condition than is specified with the service factor. From the curve with RTD, it can be seen that the stator RTD pushes the effective thermal current threshold to 2.55 * Ib (FLA) on the thermal limit curve (unmarked line). The marked line is the trip curve with 80% thermal capacity trip threshold, so actual effective thermal current threshold for the trip curve is about 2.05 * Ib (FLA). Although in this case, the thermal current threshold is set to 1.50 * Ib (FLA), it is effectively raised to a higher level with the stator RTD. Keep in mind that thermal limit and trip curves shown are based on the example above. They will vary with other sets of the settings.



Thermal Replica and Trip Curves without RTD
1000
100
10
1
t [s]
0.1
1
10
100
multiples of Ib
k-Factor=1, Thermal Capacity=100%
Ith=120%. Tth=80%* Thermal Capacity



Thermal Replica Limit and Trip Curves with RTD=100°C
1000
100
10
1
t [s]
0.1
1
10
100
multiples of Ib
k-Factor=1, Thermal Capacity=100%
Ith=120%. Tth=80%* Thermal Capacity

Global Protection Parameters of the Thermal Model

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /ThR]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /ThR]
ExBlo TripCmd	External blocking of the Trip Command of the module/the stage, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /ThR]
Use RTD values	Take RTD values into account for the calculation of the Thermal Model.__	inactive, active	inactive	[Protection Para /Global Prot Para /I-Prot /ThR]
K2	This value represents the negative sequence current weighting factor of the motor.	0.10 - 10.00	6.01	[Protection Para /Global Prot Para /I-Prot /ThR]
τ-cool	Cooling time constant	5 - 240	60	[Protection Para /Global Prot Para /I-Prot /ThR]

Setting Group Parameters of the Thermal Model

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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<n> /I-Prot /ThR]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo TripCmd Fc=active".	inactive, active	inactive	[Protection Para /<n> /I-Prot /ThR]
Trip Function	Turn on or off the trip function	inactive, active	active	[Protection Para /<n> /I-Prot /ThR]
Trip Threshold	Trip threshold at which the thermal model will trip, based on percentage of thermal capacity used. This value should typically always be set at 0.99 Only available if: Trip Function = active	0.60 - 0.99	0.99	[Protection Para /<n> /I-Prot /ThR]
t-Trip Delay	Thermal capacity used trip delay Only available if: Trip Function = active	0.0 - 3600.0s	0.0s	[Protection Para /<n> /I-Prot /ThR]
Alarm Function	Turn on or off the alarm function	inactive, active	active	[Protection Para /<n> /I-Prot /ThR]
Alarm Threshold	Alarm threshold at which the thermal model will trip, based on percentage of thermal capacity used Only available if: Alarm Function = active	0.60 - 0.99	0.70	[Protection Para /<n> /I-Prot /ThR]
t-Alarm Delay	Thermal capacity used alarm delay Only available if: Alarm Function = active	1 - 360min	1min	[Protection Para /<n> /I-Prot /ThR]

Thermal Model Module Input States

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

Thermal Model Module Signals (Output States)

Name	*Description*
Alarm Pickup	Signal: Alarm Pickup
Alarm Timeout	Signal: Alarm Timeout
RTD effective	RTD effective
Load above SF	Load above Service Factor
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

Direct Commands of the Thermal Model Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Res I2T Used	Reset thermal capacity used.	inactive, active	inactive	[Operation /Reset/Acknowledge /Reset]

Thermal Model Module Counter Values

Value	*Description*	*Default*	*Size*	*Menu path*
I2T Used	Thermal capacity used.	0%	0 - 1000%	[Operation /Measured values /ThR]
I2T Remained	Thermal capacity remained.	0%	0 - 1000%	[Operation /Measured values /ThR]
NumberOfTrips	Number of trips since last reset	0	0 - 65535	[Operation /History /TripCr]
NumberOfAlarms	Number of alarms since last reset.	0	0 - 65535	[Operation /History /AlarmCr]

UTC - Ultimate Trip Current

Functional Description

The Ultimate Trip Current (UTC) sets the current level at which a trip eventually occurs and is settable to a value as a multiples of »*Ib*« (Full Load Amps (FLA)). This value represents the vertical line on the upper portion of the non-RTD as shown in the protection trip curve labeled “Motor Protection Curve Example 2 (without RTD)”. The ultimate trip current setting in this example is at 1 times the of »*Ib*« (FLA).

The user has to set the k-Factor which can be calculated by the following formula:

$$k_{Factor} = \frac{UTC}{CT_{PRI}} = \frac{Overload_{factor} * I_b}{CT_{PRI}}$$

Please note that the settings for k-Factor and Ib have to be set within the *Field Parameter* menu.

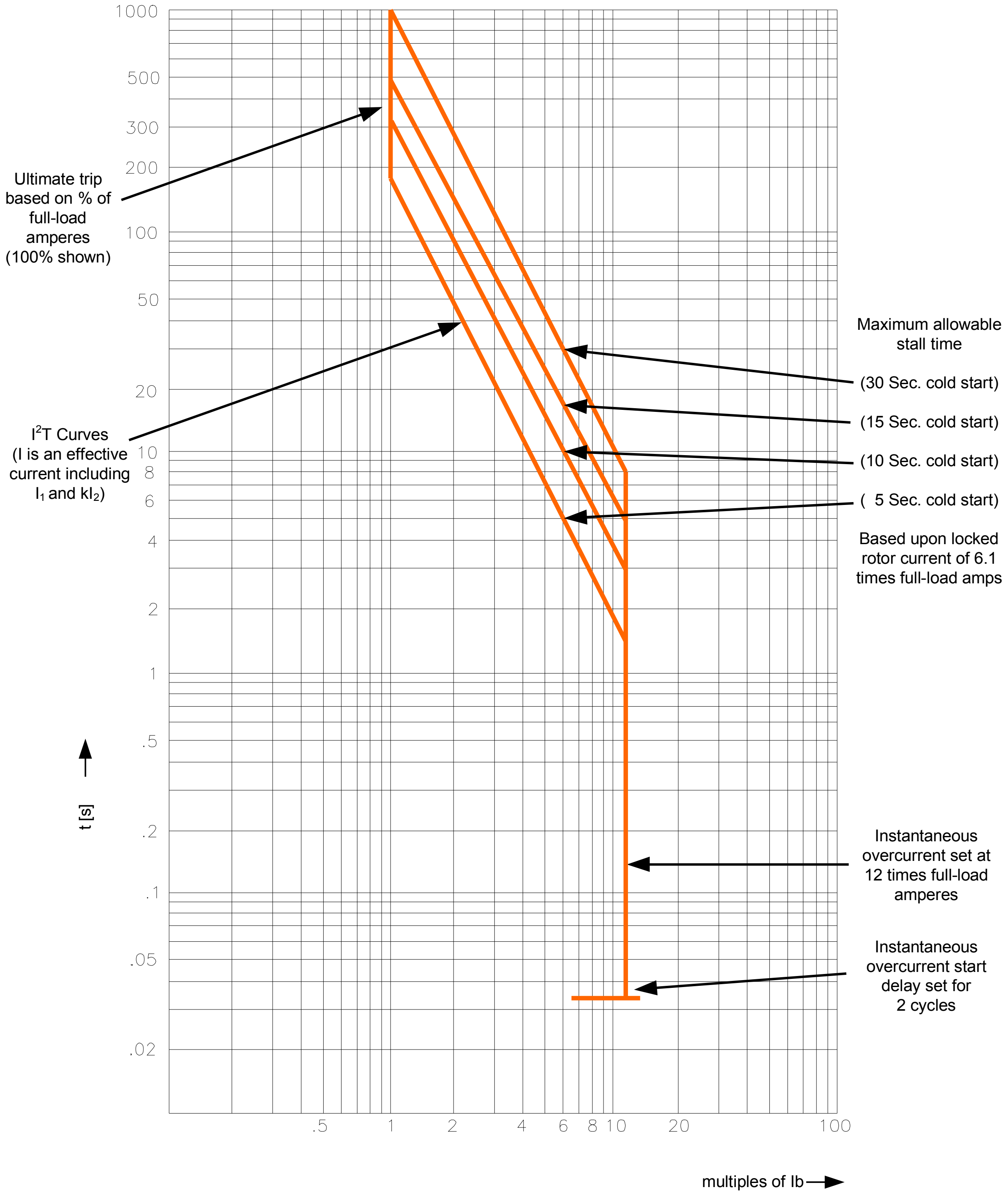
For normal use, set »*UTC*« to the »*k-Factor«* times 100%. The »*k-Factor*« is found on the motor nameplate or in the manufacturer’s data. Note that the relay does not trip at the moment the current goes above »*UTC«* during motor running. Instead, it models the gradual stator heating for currents above »*UTC*« , and trips only after some time has passed. The trip time depends on a variety of setting and operating factors, including the motor nameplate data contained in other setting values.

Use a conservative value. In this case, a lower value of »UTC« than that dictated by the »*k-Factor*« if the motor ambient temperatures may rise above 40ºC (104ºF) and the optional *URTD* Module is not used, otherwise stator insulation damage or loss of motor life may occur. Also, consider lowering the »*UTC*« value if the motor is suitably rated, yet additional safety is critical for the application.

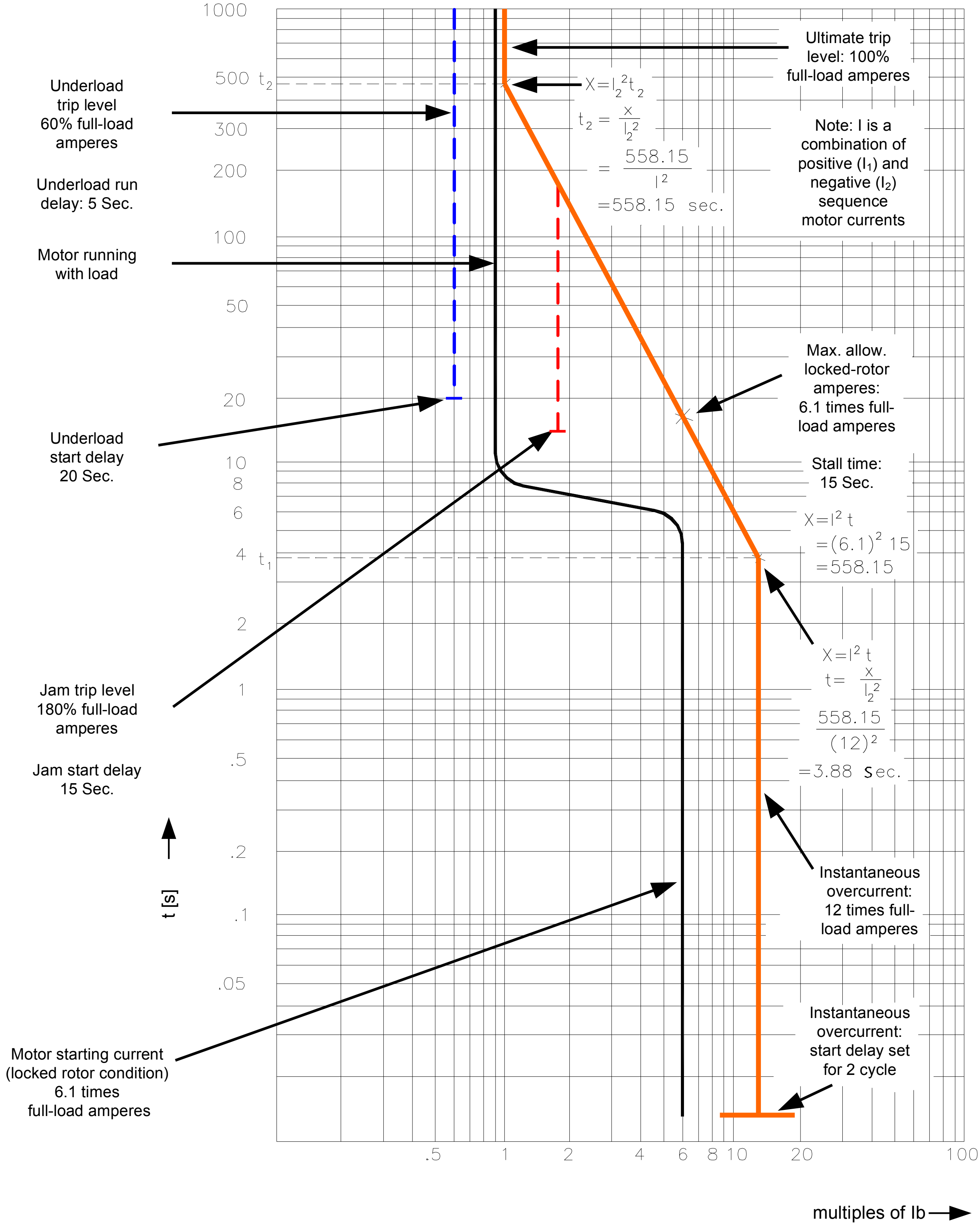
CAUTION **If UTC is set above 100% times the service factor, motor damage could result.**

Motor Protection Curves

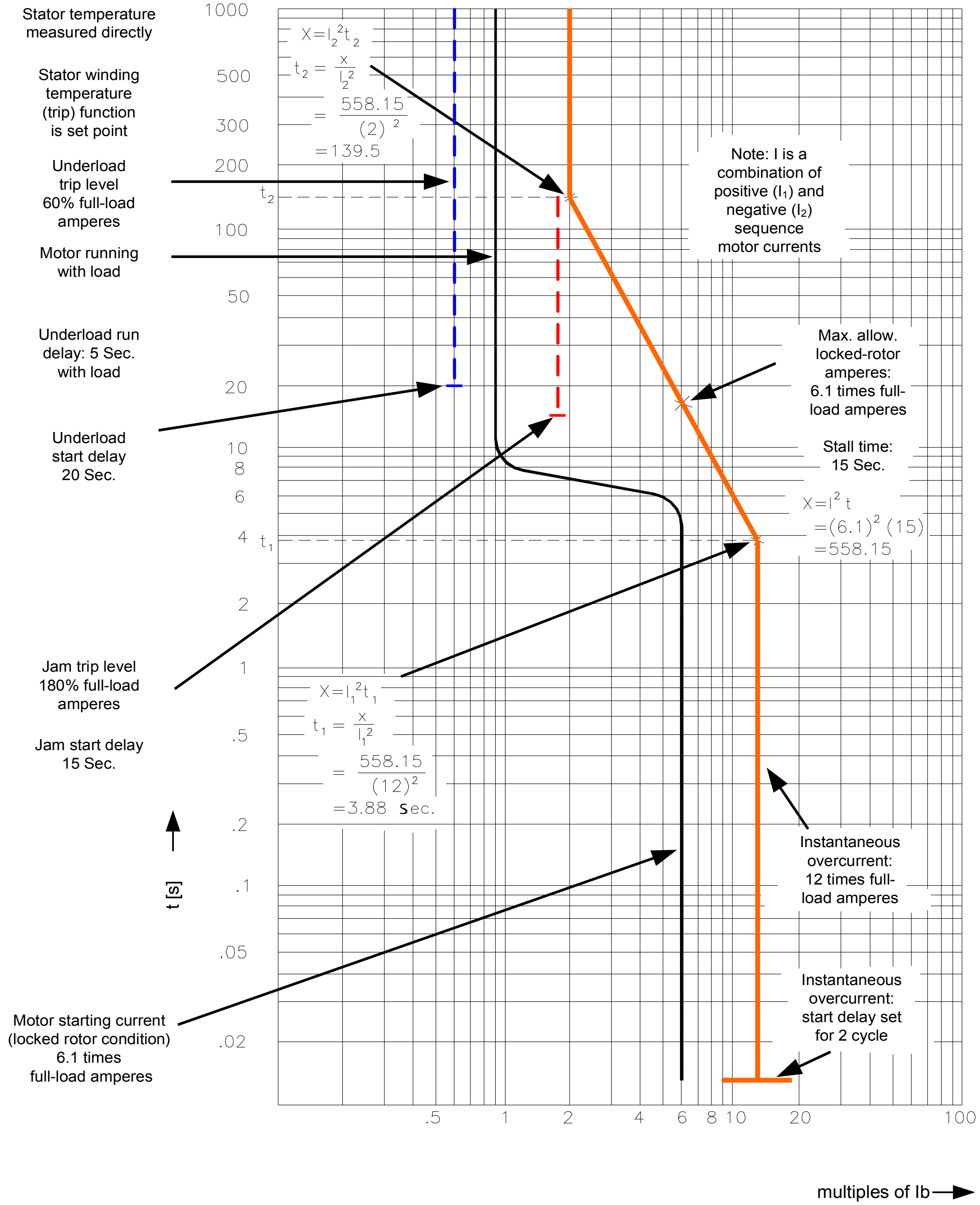
Motor Protection Curve (Example 1)



Motor Protection Curve (Example 2 - without RTDs)



Motor Protection Curve (Example 3 - with RTDs)



I< - Undercurrent [37]

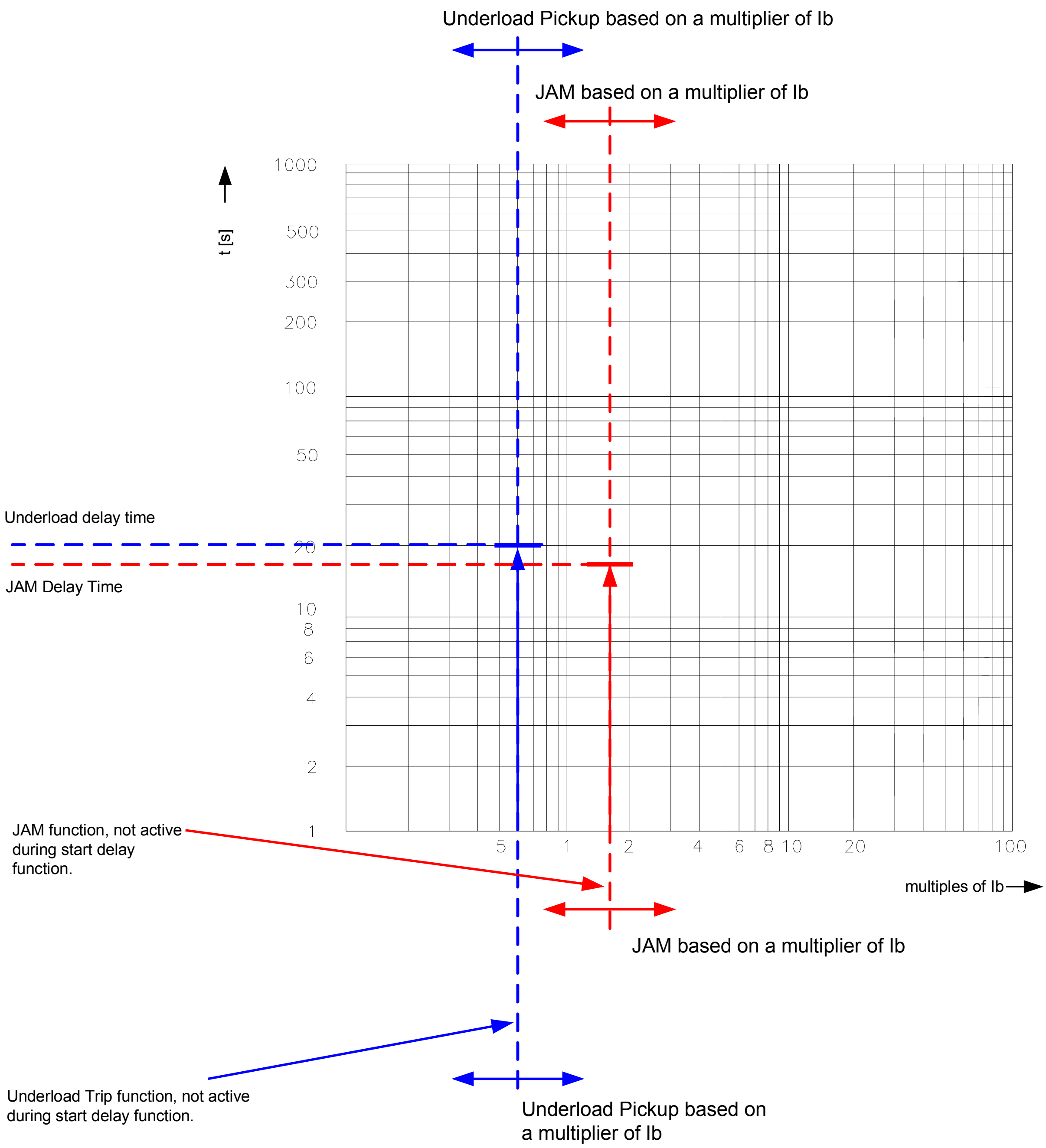
Available Elements:
I<[1] ,I<[2] ,I<[3]

Functional Description

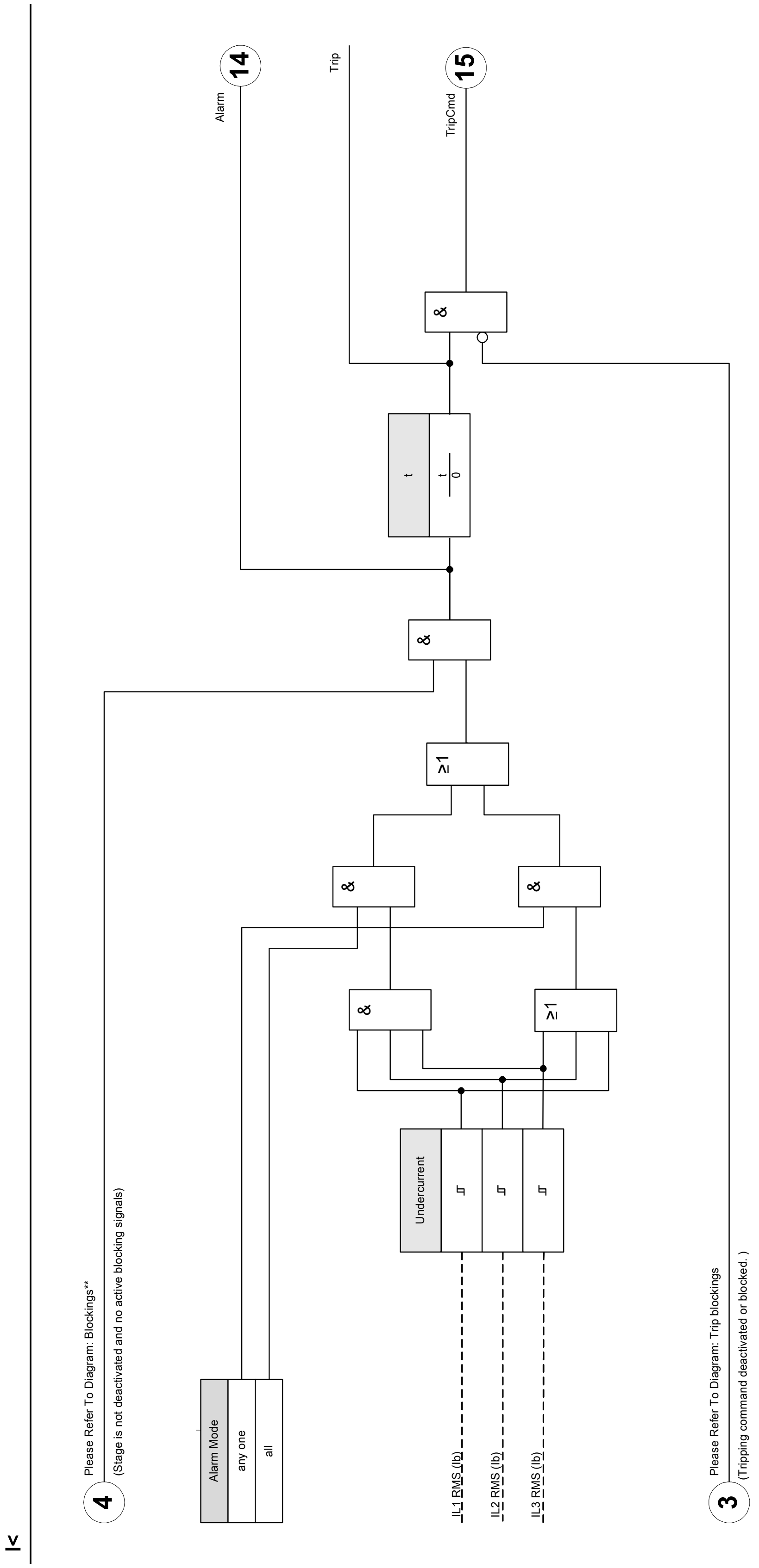
When the motor is running, a current reduction might indicate a malfunction in the load. *Underload* protection recognizes mechanical problems, such as a blocked flow or loss of back pressure in a pump, or a broken drive belt or drive shaft.

Refer to the underload protection limit - the left vertical line in the “Underload and Jam Trip Function example”. In the example, the underload trip is set at 60% of Ib (FLA). The protective device can be configured for underload alarm (if the trip command is blocked) and underload trip .

Underload and JAM Trip Function



These would be represented by two such vertical lines, both below the normal load current. Be sure to set the alarm level ***above*** the trip level. Each element has its own delay timer. Use the start delay to block tripping until the load stabilizes after a start. Use run delays to avoid nuisance alarms or trips for load transients.



Device Planning Parameters of the Underload Module

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, use	I<[1]: use I<[2]: do not use I<[3]: do not use	[Device planning]

Global Protection Parameters of the Underload Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I< /I<[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I< /I<[1]]
ExBlo3	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, Trip Cmds	MStart.Blo-I<Start	[Protection Para /Global Prot Para /I< /I<[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the stage, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I< /I<[1]]
Ex rev Interl	External blocking of the module by external reverse interlocking, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I< /I<[1]]

Setting Group Parameters of the Underload Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<n> /I< /I<[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /I< /I<[1]]
Ex rev Interl Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "Ex rev Interl Fc = active".	inactive, active	inactive	[Protection Para /<n> /I< /I<[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<n> /I< /I<[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo TripCmd Fc=active".	inactive, active	inactive	[Protection Para /<n> /I< /I<[1]]
Undercurrent	Underload Pickup based on a multiplier of Ib	0.05 - 0.90Ib	0.50Ib	[Protection Para /<n> /I< /I<[1]]
Alarm Mode	Indicates if one, two of three or all phases are required for operation	any one, all	any one	[Protection Para /<n> /I< /I<[1]]
t	Tripping delay	I<[1]: 0.4 - 1200.0s I<[2]: 0.4 - 1200.0s I<[3]: 0.0 - 1200.0s	I<[1]: 10.0s I<[2]: 10.0s I<[3]: 0.4s	[Protection Para /<n> /I< /I<[1]]
Meas Circuit Superv	Measuring Circuit Supervision	nactive, ctive	inactive	[Protection Para /<n> /I< /I<[1]]

Underload Module Input States

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

Underload Module Signals (Output States)

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

Underload Module Counter Values

Value	*Description*	*Default*	*Size*	*Menu path*
NumberOfAlarms	Number of alarms since last reset.	0	0 - 9999999999	[Operation /History /AlarmCr]
NumberOfTrips	Number of trips since last reset	0	0 - 9999999999	[Operation /History /TripCr]

Commissioning: Undercurrent [ANSI 37]

Object to be tested:

- Testing the pick-up value for Undercurrent protection
- Testing the trip delay
- Testing the fallback ratio

Necessary means:

- 3-phase current source
- Ammemeter
- Timer for measuring of the tripping time

Procedure:

Testing the threshold values(single-phase, three phase)
Feed in a testing current significantly greater than the pick-up value.
For testing the threshold values and fallback values, the test current has to be decreased until the relay is energized. When comparing the displayed values with those of the ammeter, 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. Feed in a testing current significantly greater than the pick-up value, the test current has to be decreased suddenly below the threshold value. The timer is started when the limiting value of the tripping current falls below the threshold and the operating time is elapsed and it is stopped when the relay trips.

Testing the fallback ratio:

Enlarge the measuring quantity to more than 103% of the trip value. The relay must only fall back at 103% of the trip value at the earliest.

Successful test result:

The measured tripping delays, threshold values and fallback ratio comply with those specified in the adjustment list. Permissible deviations/tolerances can be ftaken from Technical Data.

I - Overcurrent Protection [50, 51,51Q, 51V]

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

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

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

NOTICE **This module offers Adaptive Parameter Sets.**
Parameters can be modified within parameter sets dynamically by means of Adaptive Parameter Sets.
Please refer to chapter Parameter / Adaptive Parameter Sets.

The following table shows the application options of the Overcurrent Protection element

Applications of the I-Protection Module	Setting in	Option
ANSI 50 – Overcurrent protection, non-directional	Device Planning menu	Measuring Mode: Fundamental/TrueRMS/negative phase sequence current (I2)
ANSI 51 – Short circuit protection, non-directional	Device Planning menu	Measuring Mode: Fundamental/TrueRMS/negative phase sequence current (I2)
ANSI 51V – Voltage restraint overcurrent protection	Parameter Set: VRestraint = active	Measuring Mode: Fundamental/TrueRMS/negative phase sequence current (I2) Measuring Channel: Phase to Phase/Phase to Neutral
ANSI 51Q Negative Phase Sequence Overcurrent Protection	Parameter Set: Measuring Method =I2 (Negative Sequence Current)	
51R Voltage controlled overcurrent protection (**Please refer to the chapter Parameter/Adaptive Parameter**)	Adaptive Parameters	Measuring Mode: Fundamental/TrueRMS/negative phase sequence current (I2) Measuring Channel: (in voltage protection module) Phase to Phase/Phase to Neutral

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.
Alternatively the »*Measuring Mode«* can be set to *»I2«*. In this case the negative phase sequence current will be measured. This is to detect unbalanced faults.

Voltage restraint overcurrent protection 51V:

When the Parameter »*VRestraint«* is set to active the overcurrent protection element works voltage restraint. That means, the overcurrent pickup threshold will be lowered during voltage drops. This results in a more sensitive overcurrent protection. For the voltage threshold »*VRestraint max«* additionally the »*Measuring Channel«* can be determined.

Measuring Channel:

With the parameter *»Measuring Channel«* it can be determined, whether the »*Phase to Phase«* voltage or the »*Phase to Neutral«* voltage is measured.

For each element the following characteristics are available:

- DEFT (UMZ)
- NINV (IEC/AMZ)
- VINV (IEC/AMZ)
- LINV (IEC/AMZ)
- EINV (IEC/AMZ)
- MINV (ANSI/AMZ)
- VINV (ANSI/AMZ)
- EINV (ANSI/AMZ)
- Thermal Flat
- IT
- I2T
- I4T

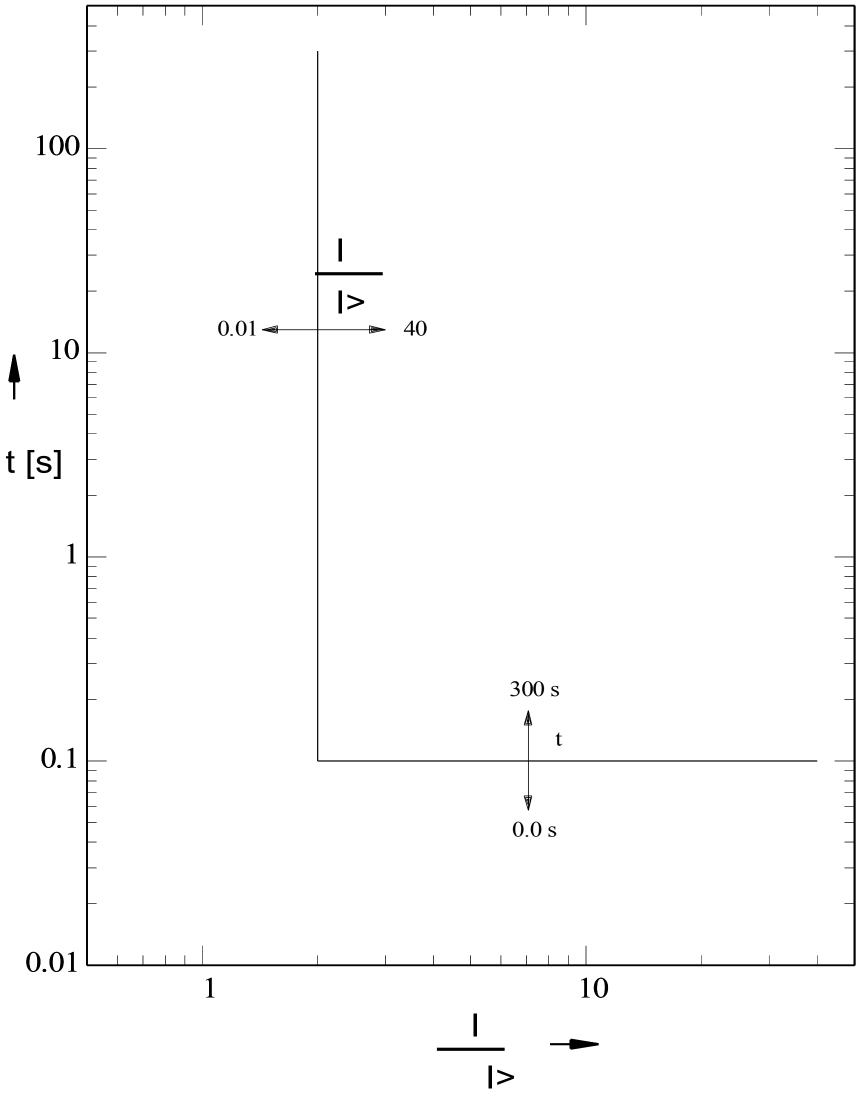
Explanation:

t = Tripping delay

t-char = Time multiplier/tripping characteristic factor. The setting range depends on the selected tripping curve.
I = Fault current

I> = If the pickup value is exceeded, the module/element starts to time out to trip.

DEFT



IEC NINV

Notice!

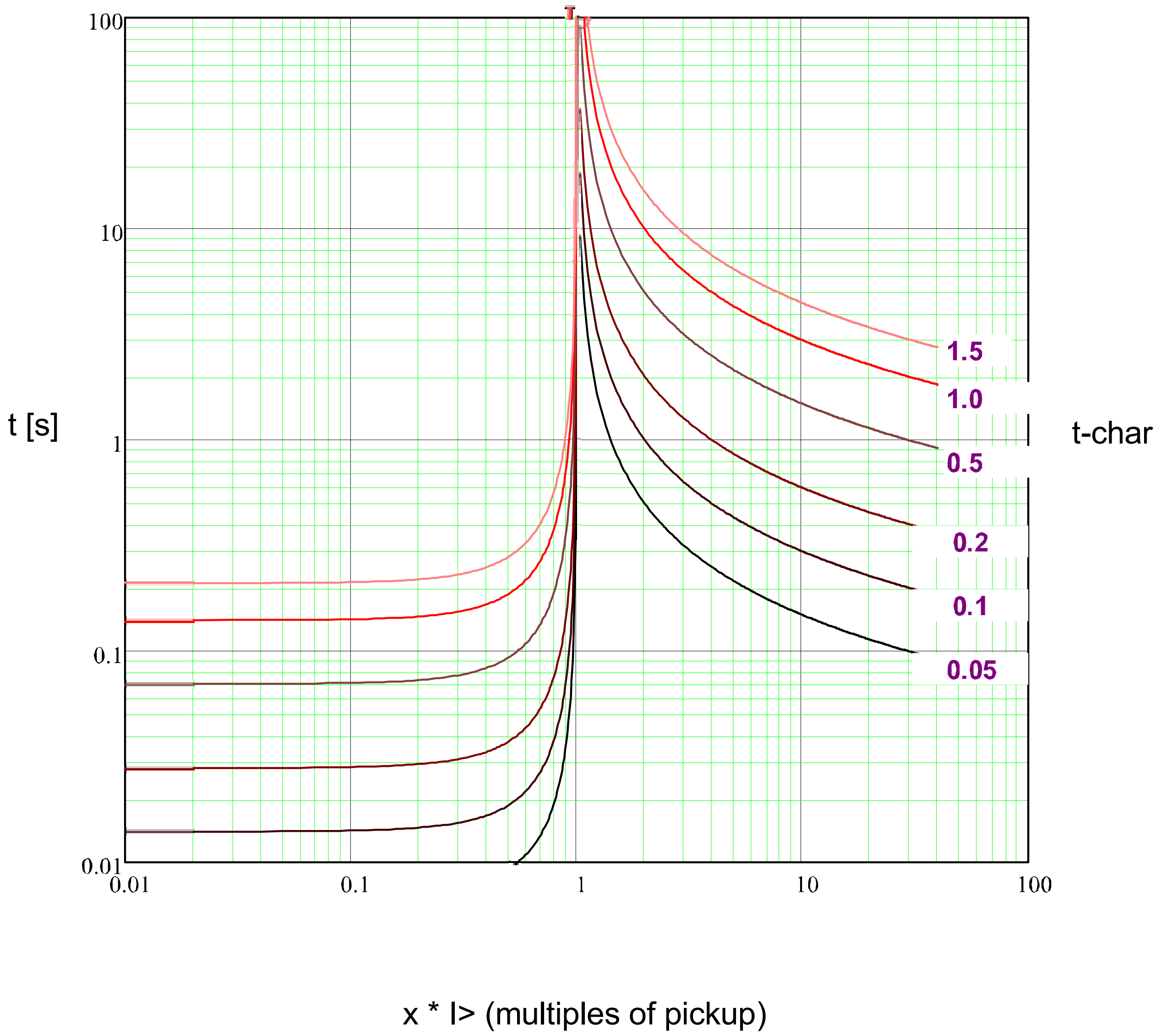
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

Reset

$$t = \left| \frac{0.14}{\left(\frac{I}{I>}\right)^{2} - 1} \right| \text{*t-char [s]}$$

Trip

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



IEC VINV

Notice!

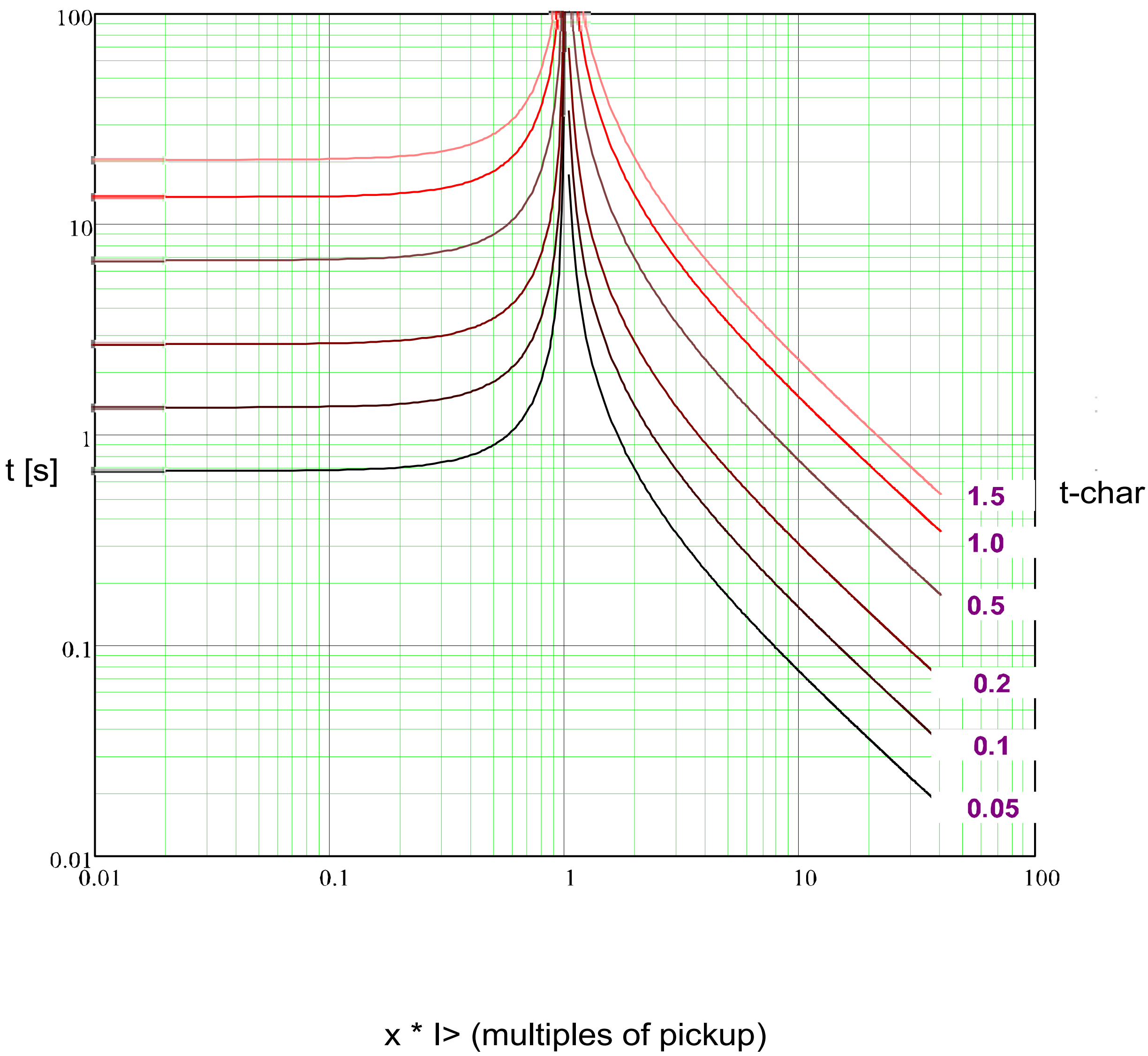
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

Reset

$$t = \left| \frac{13.5}{\left(\frac{I}{I>}\right)^{2} - 1} \right| \text{*t-char [s]}$$

Trip

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



IEC LINV

Notice!

Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

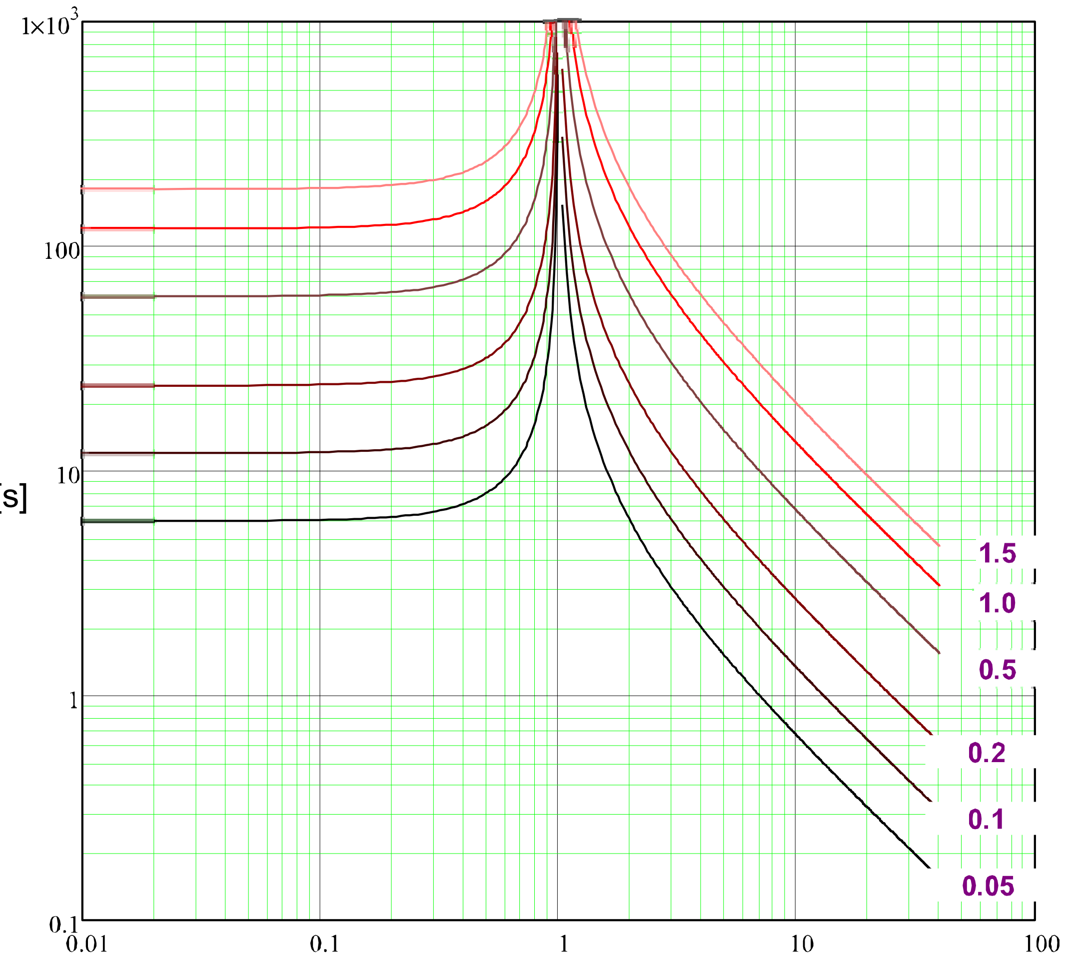
Reset

$$t = \left| \frac{120}{\left(\frac{I}{I>}\right)^2 - 1} \right| \text{*t-char [s]}$$

Trip

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

t [s]



t-char

x * I> (multiples of pickup)

IEC EINV

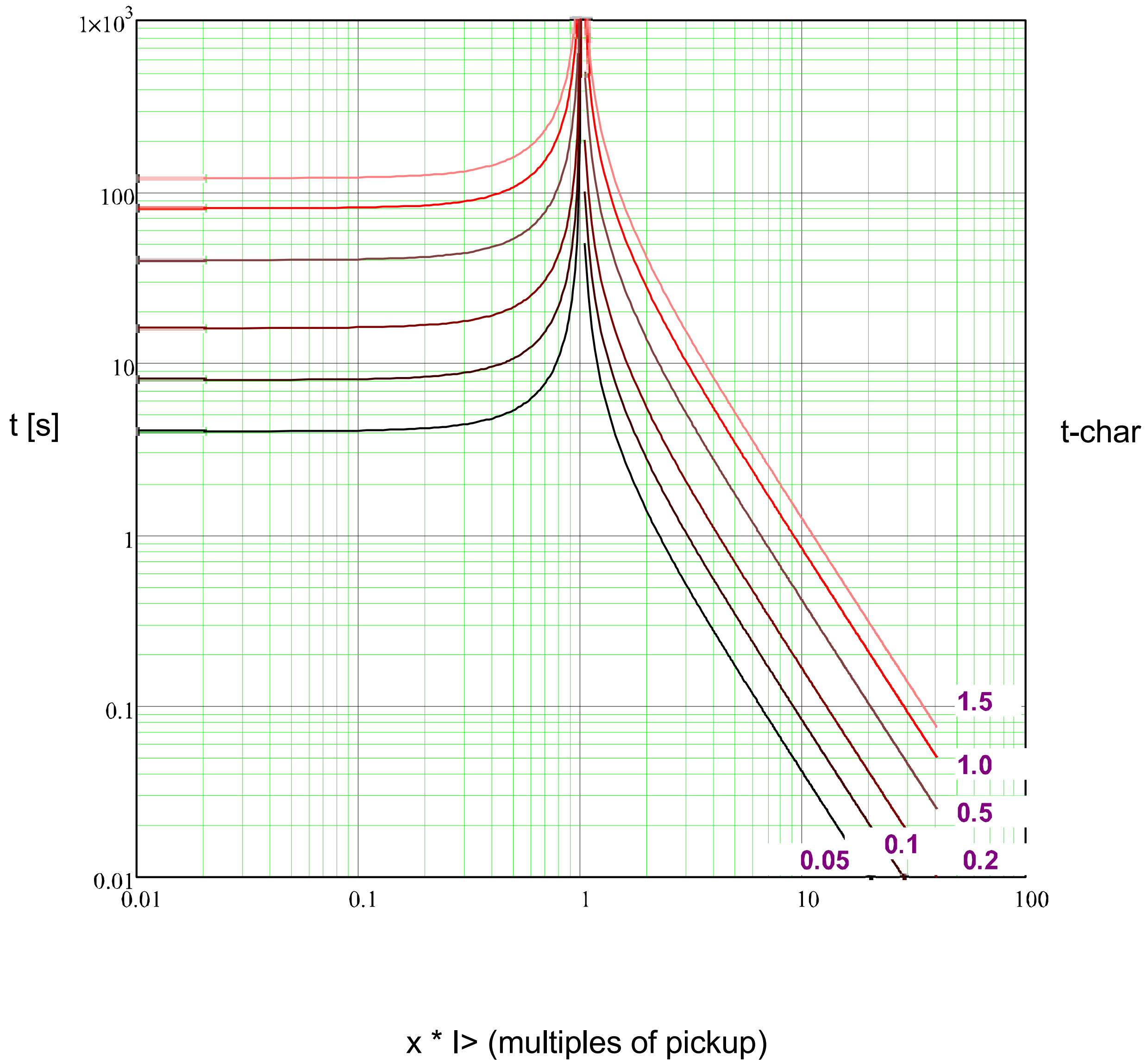
Notice!
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

Reset

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

Trip

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



ANSI MINV

Notice!

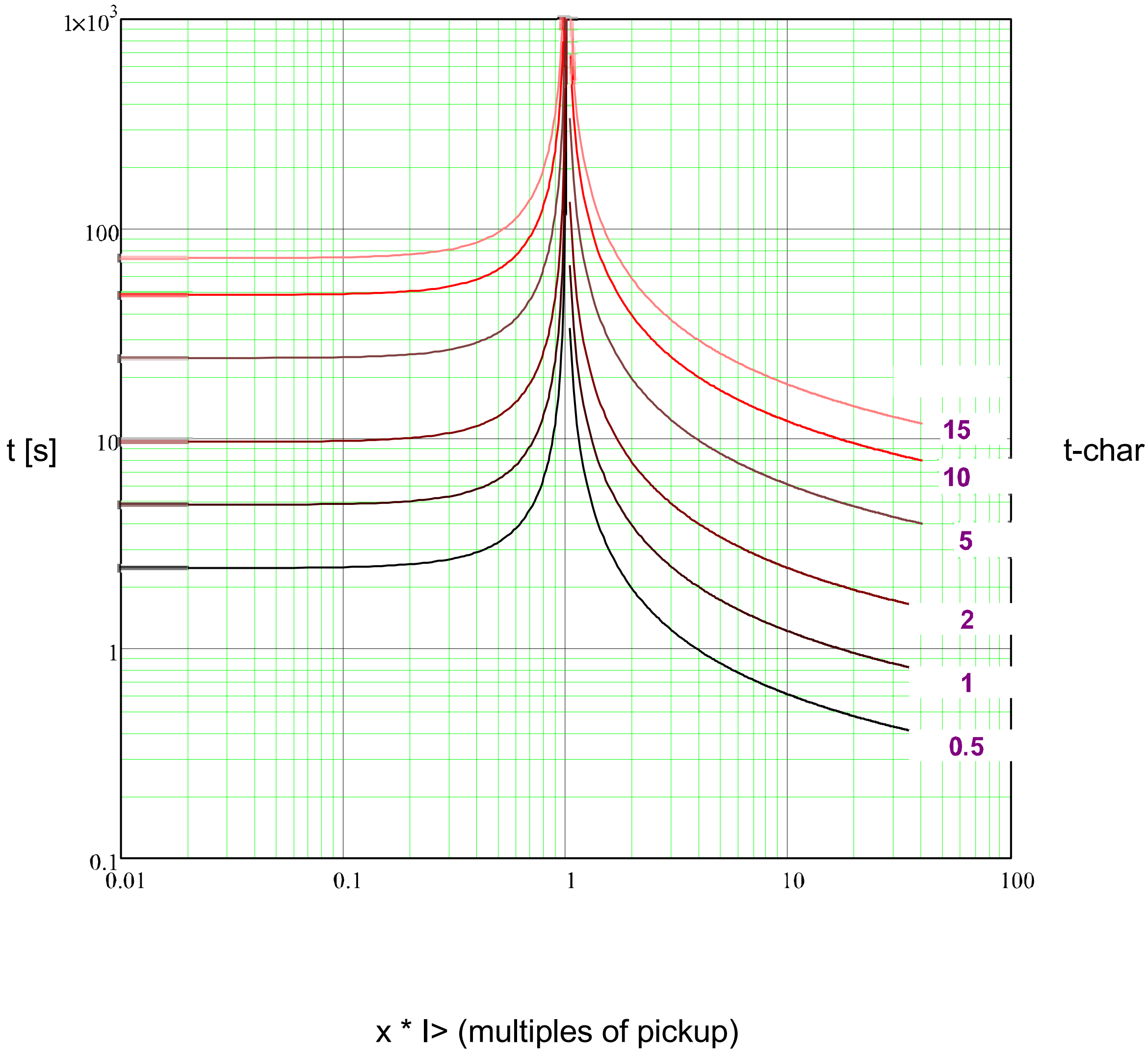
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

Reset

$$t = \left| \frac{4.85}{\left(\frac{I}{I>}\right)^{2} - 1} \right| \text{*t-char [s]}$$

Trip

$$t = \left(\frac{0.0515}{\left(\frac{I}{I>}\right)^{0.02} - 1} + 0.1140 \right) \text{*t-char [s]}$$



ANSI VINV

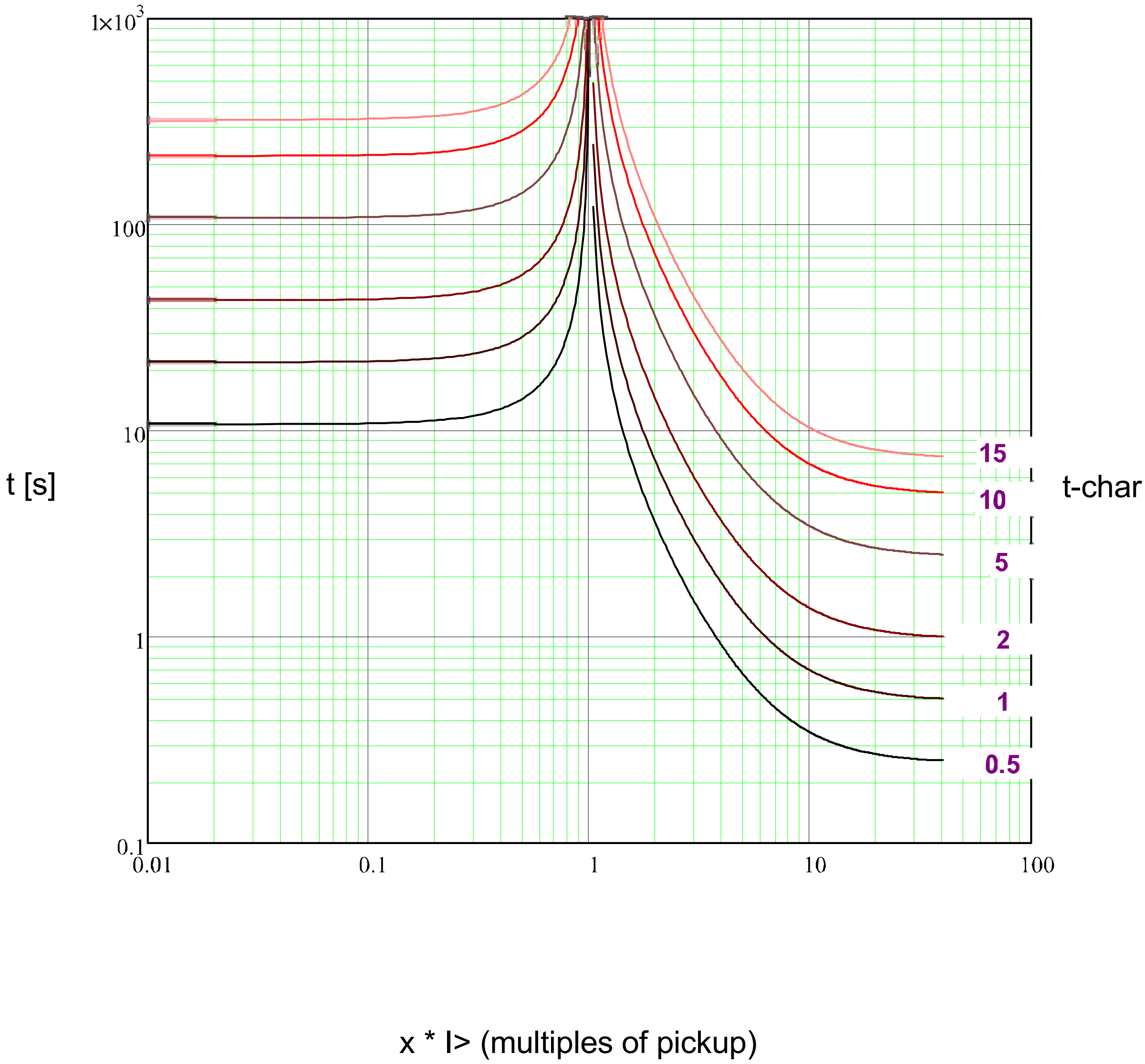
Notice!
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

Reset

$$t = \left| \frac{21.6}{\left(\frac{I}{I>}\right)^2 - 1} \right| \text{*t-char [s]}$$

Trip

$$t = \left(\frac{19.61}{\left(\frac{I}{I>}\right)^2 - 1} + 0.491 \right) \text{*t-char [s]}$$



ANSI EINV

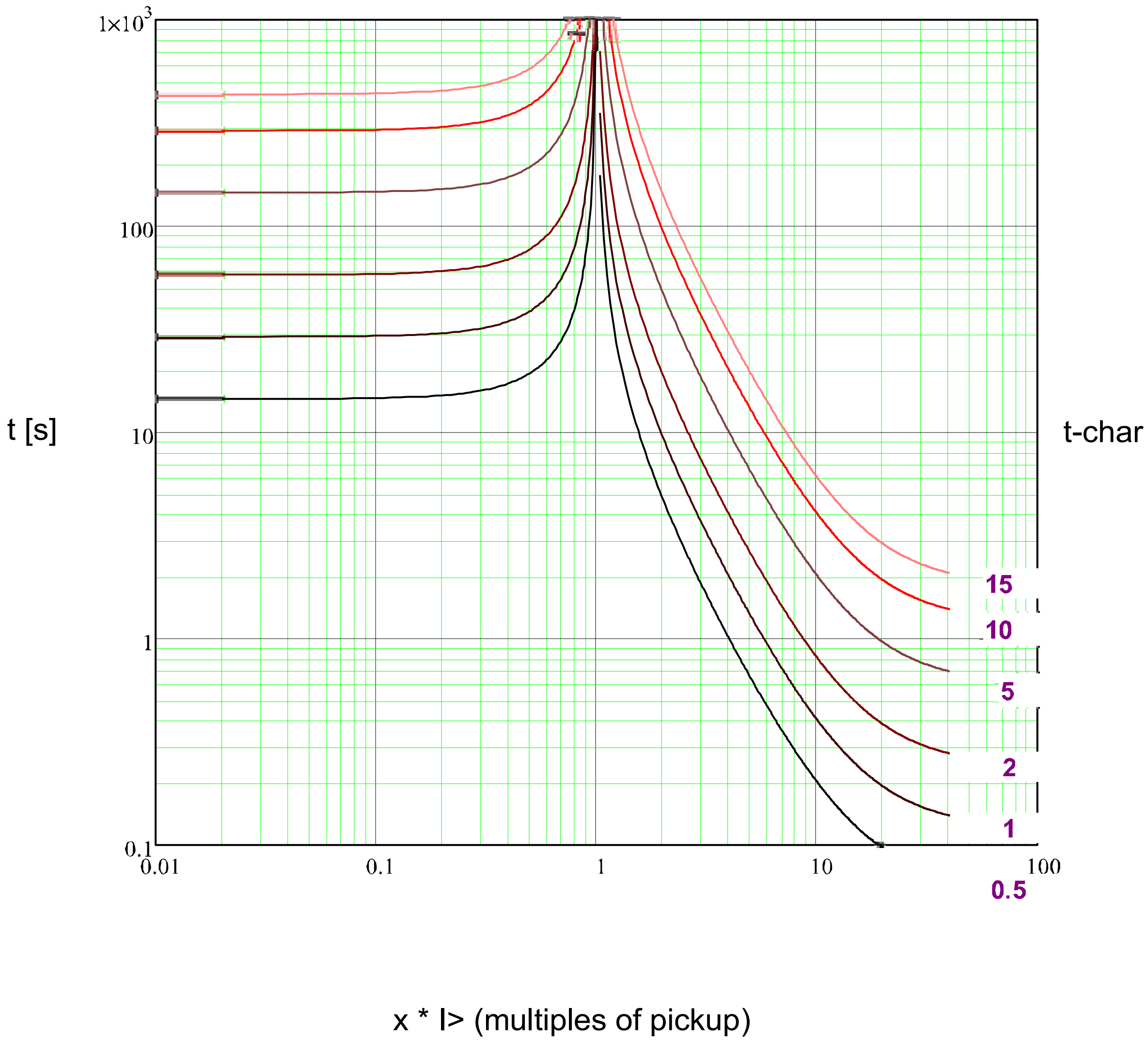
Notice!
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

Reset

$$t = \left| \frac{29.1}{\left(\frac{I}{I>}\right)^2 - 1} \right| \text{*t-char [s]}$$

Trip

$$t = \left(\frac{28.2}{\left(\frac{I}{I>}\right)^2 - 1} + 0.1217 \right) \text{*t-char [s]}$$



Therm Flat

Notice!

Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

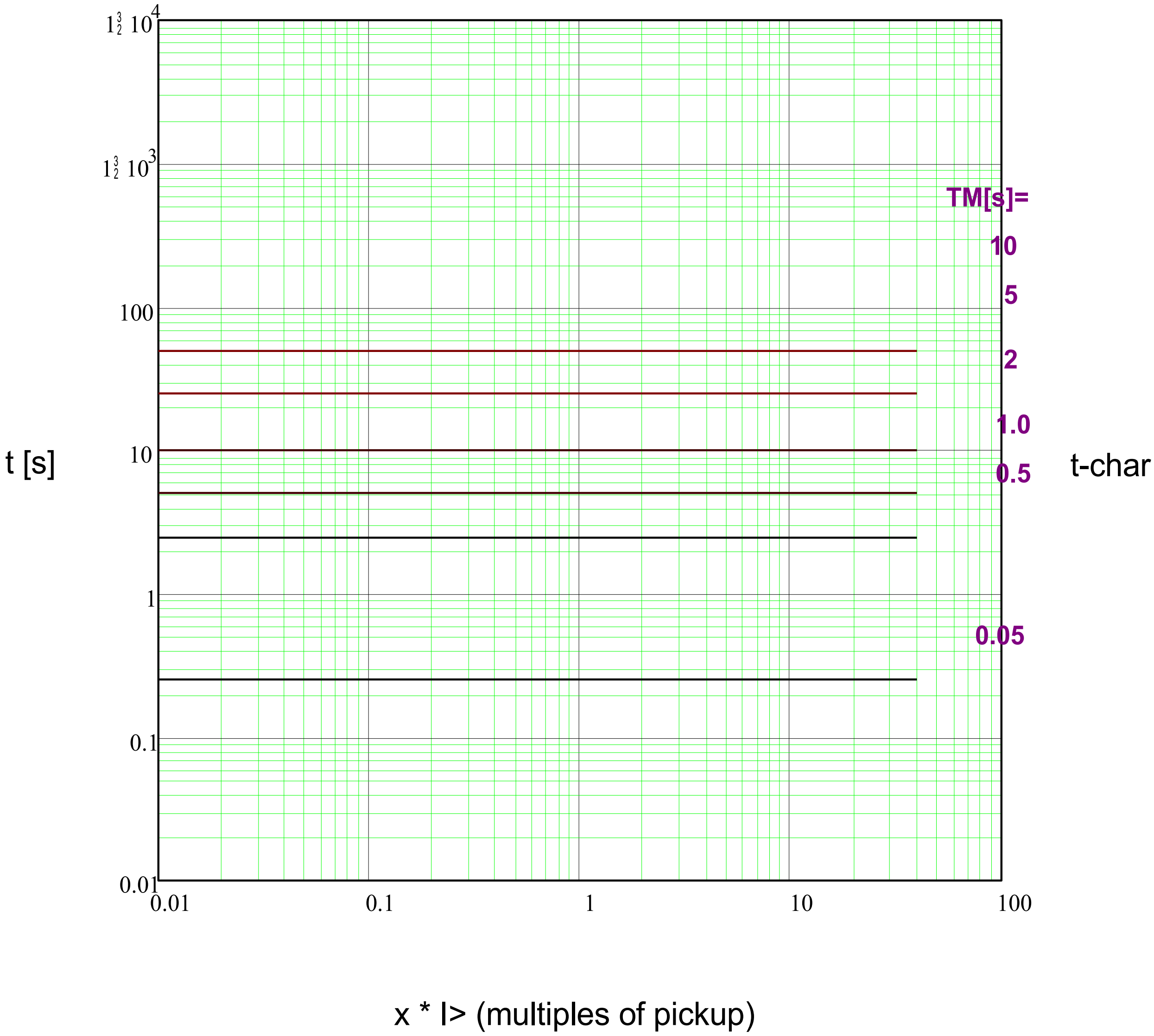
Reset

$$t = \left| \frac{5*3^2}{\left(\frac{I}{In}\right)^0} \right| *\text{t-char [s]}$$

Trip

$$t = \frac{5*1^2}{\left(\frac{I}{In}\right)^0} *\text{t-char [s]}$$

$$t = 45 *\text{t-char [s]}$$



IT

Notice!

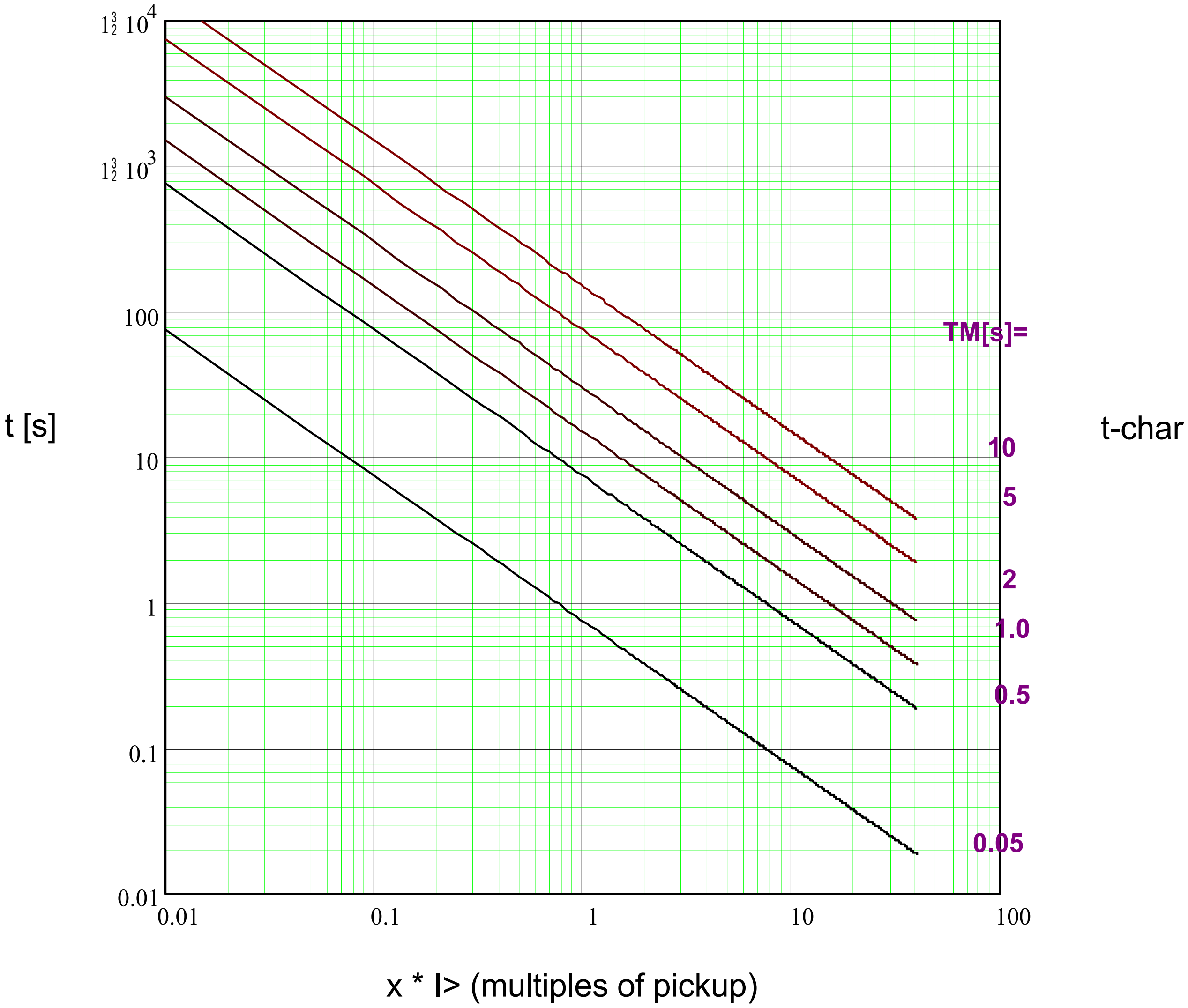
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

Reset

$$t = \left| \frac{5 \cdot 3^2}{\left(\frac{I}{In}\right)^0} \right| \cdot \text{t-char [s]}$$

Trip

$$t = \frac{5 \cdot 3^1}{\left(\frac{I}{In}\right)^1} \cdot \text{t-char [s]}$$



I2T

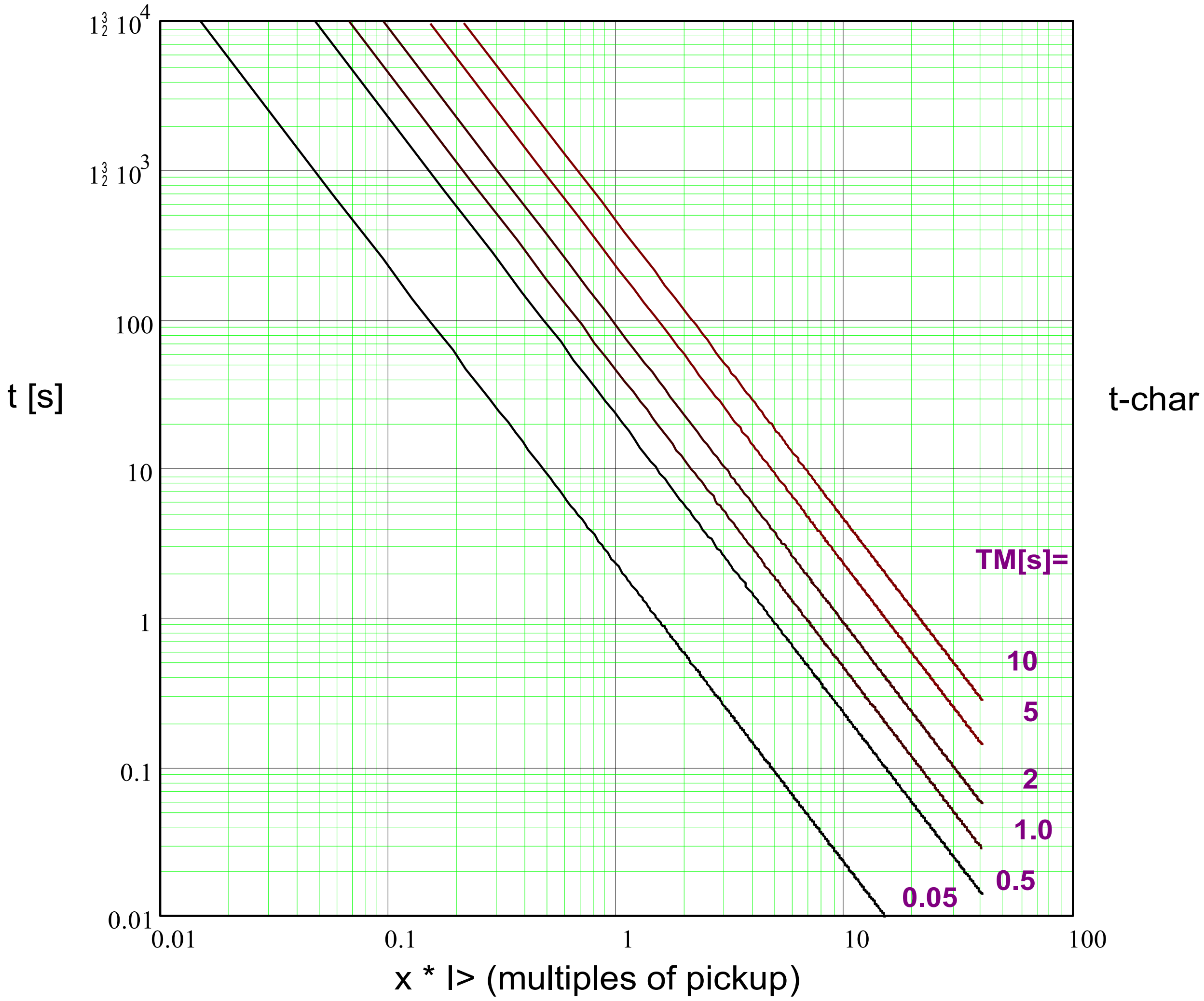
Notice!
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

Reset

$$t = \left| \frac{5*3^2}{\left(\frac{I}{In}\right)^0} \right| *\text{t-char [s]}$$

Trip

$$t = \frac{5*3^2}{\left(\frac{I}{In}\right)^2} *\text{t-char [s]}$$



I4T

Notice!

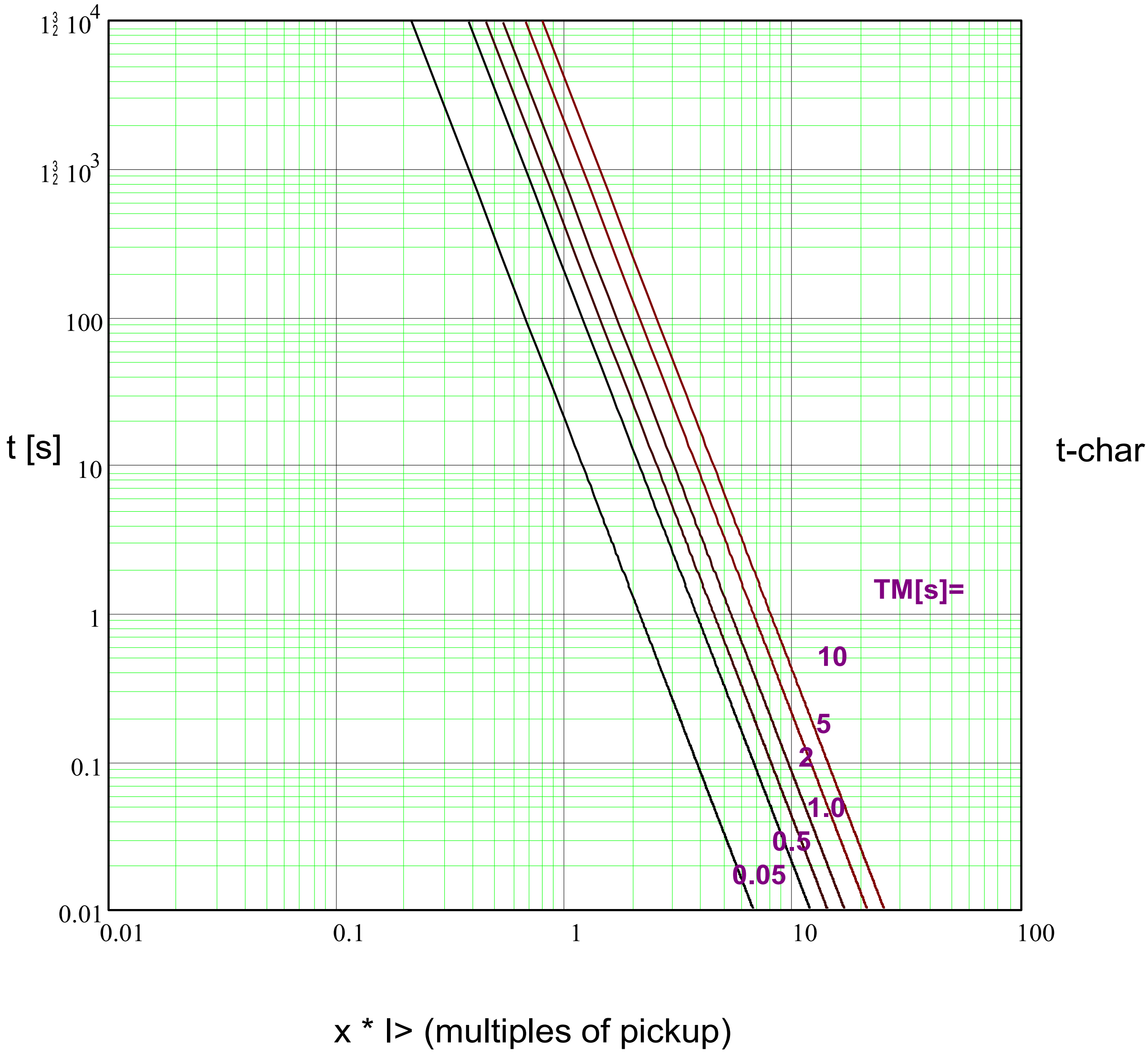
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

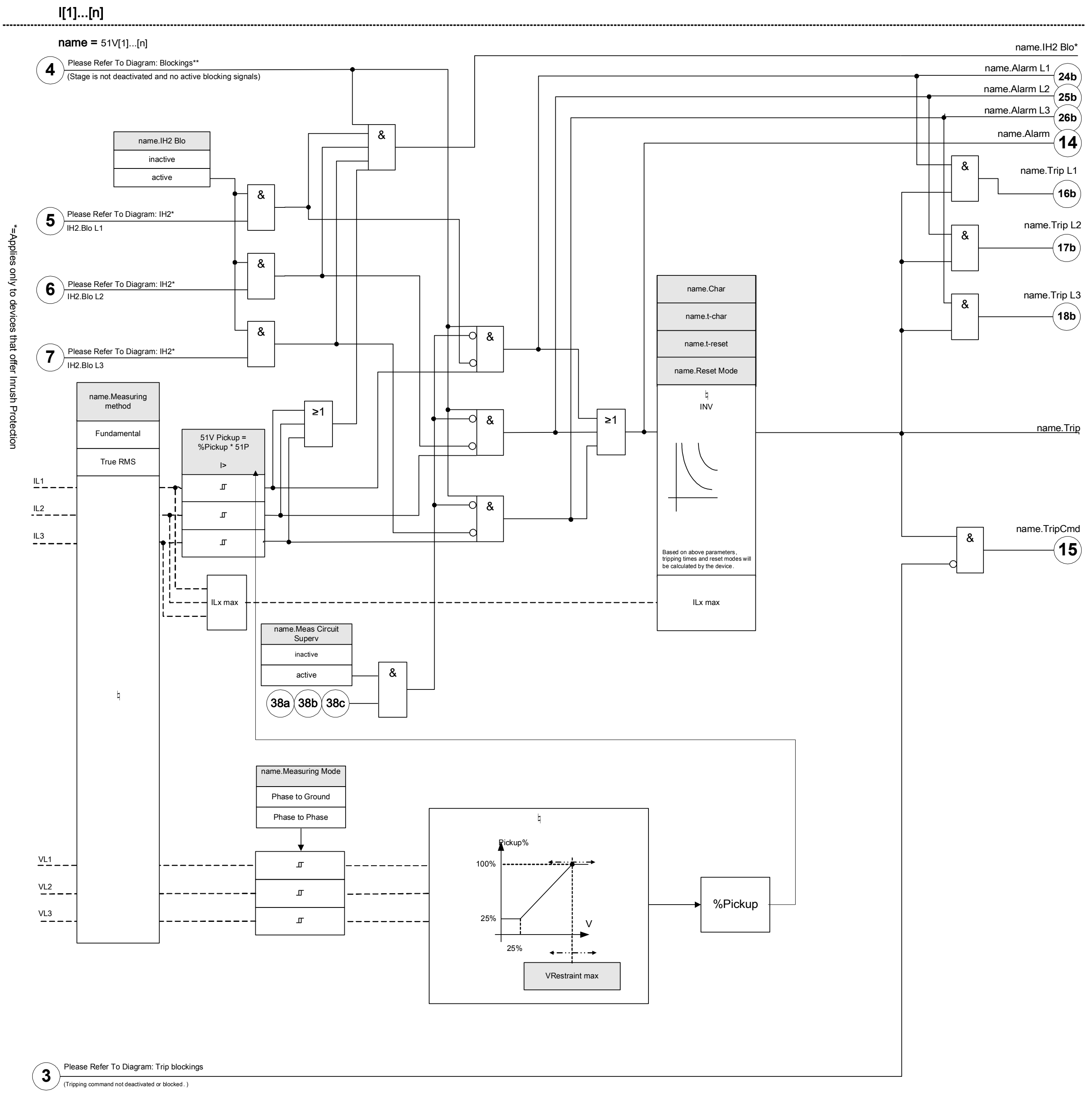
Reset

$$t = \left| \frac{5*3^{2}}{\left(\frac{I}{In}\right)^{0}} \right| \text{*t-char [s]}$$

Trip

$$t = \frac{5*3^{4}}{\left(\frac{I}{In}\right)^{4}} \text{*t-char [s]}$$




I[1]...[n]
name = 51V[1]...[n]
4
Please Refer To Diagram: Blockings**
(Stage is not deactivated and no active blocking signals)
name.IH2 Blo
inactive
active
5
Please Refer To Diagram: IH2*
IH2.Blo L1
6
Please Refer To Diagram: IH2*
IH2.Blo L2
7
Please Refer To Diagram: IH2*
IH2.Blo L3
*=Applies only to devices that offer Inrush Protection
name.Measuring method
Fundamental
True RMS
IL1
IL2
IL3
51V Pickup = %Pickup * 51P
I>
ILx max
name.Meas Circuit Superv
inactive
active
38a
38b
38c
name.Char
name.t-char
name.t-reset
name.Reset Mode
INV
Based on above parameters, tripping times and reset modes will be calculated by the device.
ILx max
name.IH2 Blo*
name.Alarm L1
24b
name.Alarm L2
25b
name.Alarm L3
26b
name.Alarm
14
name.Trip L1
16b
name.Trip L2
17b
name.Trip L3
18b
name.Trip
name.TripCmd
15
name.Measuring Mode
Phase to Ground
Phase to Phase
VL1
VL2
VL3
Pickup%
100%
25%
25%
V
VRestraint max
%Pickup
3
Please Refer To Diagram: Trip blockings
(Tripping command not deactivated or blocked .)

Device Planning Parameters of the I Module

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, non directional	I[1]: non directional I[2]: non directional I[3]: do not use I[4]: do not use I[5]: do not use I[6]: do not use	[Device planning]

Global Protection Parameters of the I Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /I[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /I[1]]
ExBlo3	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, Blo Starts	I[1]: MStart.Blo-IOCStart I[2]: MStart.Blo-IOCStart I[3]: MStart.Blo-IOCStart I[4]: MStart.Blo-IOCStart I[5]:MStart.Blo-IOCStart I[6]: MStart.Blo-IOCStart	[Protection Para /Global Prot Para /I-Prot /I[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the stage, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /I[1]]
Ex rev Interl	External blocking of the module by external reverse interlocking, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /I[1]]

Parameter	Description	Setting range	Default	Menu path
AdaptSet 1	Assignment Adaptive Parameter 1	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /I[1]]
AdaptSet 2	Assignment Adaptive Parameter 2	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /I[1]]
AdaptSet 3	Assignment Adaptive Parameter 3	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /I[1]]
AdaptSet 4	Assignment Adaptive Parameter 4	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /I[1]]

Setting Group Parameters of the I Module

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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo TripCmd Fc=active".	inactive, active	inactive	[Protection Para /<n> /I-Prot /I[1]]
Measuring method	Measuring method: fundamental or rms	Fundamental, True RMS, I2	True RMS	[Protection Para /<n> /I-Prot /I[1]]
I>	If the pickup value is exceeded, the module/element starts to time out to trip. Only available if: Characteristic = DEFT Or Characteristic = INV Minimum of the setting range If: VRestraint = active Minimum of the setting range If: VRestraint = inactive	0.02 - 40.00In	I[1]: 2In I[2]: 2.5In I[3]: 1.00In I[4]: 3.0In I[5]: 1.00In I[6]: 1.00In	[Protection Para /<n> /I-Prot /I[1]]
Char	Characteristic	DEFT, IEC NINV, IEC VINV, IEC EINV, IEC LINV, ANSI MINV, ANSI VINV, ANSI EINV, Therm Flat, IT, I2T, I4T	I[1]: DEFT I[2]: DEFT I[3]: ANSI MINV I[4]: DEFT I[5]: DEFT I[6]: DEFT	[Protection Para /<n> /I-Prot /I[1]]
t	Tripping delay Only available if: Characteristic = DEFT	0.00 - 300.00s	I[1]: 0s I[2]: 0.25s I[3]: 1.00s I[4]: 0.25s I[5]: 1.00s I[6]: 1.00s	[Protection Para /<n> /I-Prot /I[1]]
t-char	Time multiplier/tripping characteristic factor. The setting range depends on the selected tripping curve. Only available if: Characteristic = INV Or Characteristic = Therm Flat Or Characteristic = IT Or Characteristic = I2T Or Characteristic = I4T	0.02 - 20.00	1	[Protection Para /<n> /I-Prot /I[1]]

Parameter	Description	Setting range	Default	Menu path
Reset Mode	Reset Mode Only available if: Characteristic = INV Or Characteristic = Therm Flat Or Characteristic = IT Or Characteristic = I2T Or Characteristic = I4T	instantaneous, t-delay, calculated	I[1]: instantaneous I[2]: instantaneous I[3]: calculated I[4]: instantaneous I[5]: instantaneous I[6]: instantaneous	[Protection Para /<n> /I-Prot /I[1]]
t-reset	Reset time for intermittent phase failures (INV characteristics only) Available if:Reset Mode = t-delay	0.00 - 60.00s	0s	[Protection Para /<n> /I-Prot /I[1]]
nondir Trip at V=0	Only relevant for current protection modules/stages with directional feature! The device will trip non directional if this parameter is set to active and no direction could be determined because no reference voltage (V=0) could be measured any more (e.g. if there is a three-phase short circuit close to the device). If this parameter is set to inactive, the protection stage will be blocked in case of V=0. Only available if: Device planning: I.Mode = directional	inactive, active	inactive	[Protection Para /<n> /I-Prot /I[1]]
VRestraint	Voltage Restraint Protection	inactive, active	inactive	[Protection Para /<n> /I-Prot /I[1]]
Measuring Mode	Measuring Mode Only available if: VRestraint = active	Phase to Neutral, Phase to Phase	Phase to Neutral	[Protection Para /<n> /I-Prot /I[1]]
VRestraint max	Maximum voltage restraint level. Definition of Vn: Vn is dependent on the System Parameter setting of "VT con". When the System Parameters "VT con" is set to "phase-to-phase" , "Vn = VT sec ". When the System Parameters "VT con" is set to "phase-to-ground", "Vn = VT sec/SQRT(3)". Only available if: VRestraint = active	0.04 - 1.50Vn	1.00Vn	[Protection Para /<n> /I-Prot /I[1]]
Meas Circuit Superv	Measuring Circuit Supervision Only available if: VRestraint = active	inactive, active	inactive	[Protection Para /<n> /I-Prot /I[1]]

I Module Input States

Name	*Description*	*Assignment via*
ExBlo1-I	Module input state: External blocking1	[Protection Para /Global Prot Para /I-Prot /I[1]]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /I-Prot /I[1]]
ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command	[Protection Para /Global Prot Para /I-Prot /I[1]]
Ex rev Interl-I	Module input state: External reverse interlocking	[Protection Para /Global Prot Para /I-Prot /I[1]]
AdaptSet1-I	Module input state: Adaptive Parameter1	[Protection Para /Global Prot Para /I-Prot /I[1]]
AdaptSet2-I	Module input state: Adaptive Parameter2	[Protection Para /Global Prot Para /I-Prot /I[1]]
AdaptSet3-I	Module input state: Adaptive Parameter3	[Protection Para /Global Prot Para /I-Prot /I[1]]
AdaptSet4-I	Module input state: Adaptive Parameter4	[Protection Para /Global Prot Para /I-Prot /I[1]]

I Module Signals (Output States)

Name	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
Ex rev Interl	Signal: External reverse Interlocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Alarm L1	Signal: Alarm L1
Alarm L2	Signal: Alarm L2
Alarm L3	Signal: Alarm L3
Alarm	Signal: Alarm
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
Active AdaptSet	Active Adaptive Parameter
DefaultSet	Signal: Default Parameter Set
AdaptSet 1	Signal: Adaptive Parameter 1
AdaptSet 2	Signal: Adaptive Parameter 2
AdaptSet 3	Signal: Adaptive Parameter 3
AdaptSet 4	Signal: Adaptive Parameter 4

Counter Values of the I Module

Value	*Description*	*Default*	*Size*	*Menu path*
NumberOfAlarms	Number of alarms since last reset.	0	0 - 9999999999	[Operation /History /AlarmCr]
NumberOfTrips	Number of trips since last reset	0	0 - 9999999999	[Operation /History /TripCr]

Commissioning: Overcurrent Protection, Non-directional [50, 51]

Object to be tested

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

NOTICE

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

NOTICE

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

Total tripping time = tripping delay (please refer to the tolerances of the protection stages) + CB operating time (about 50 ms)

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

Necessary means :

- Current source
- May be: ampere meters
- Timer

Procedure:

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

Testing the total tripping delay (recommendation):

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

Testing the tripping delay (measuring at the relay output):

Measure the tripping times at the relay output.

Testing the fallback ratio:

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

Successful test result:

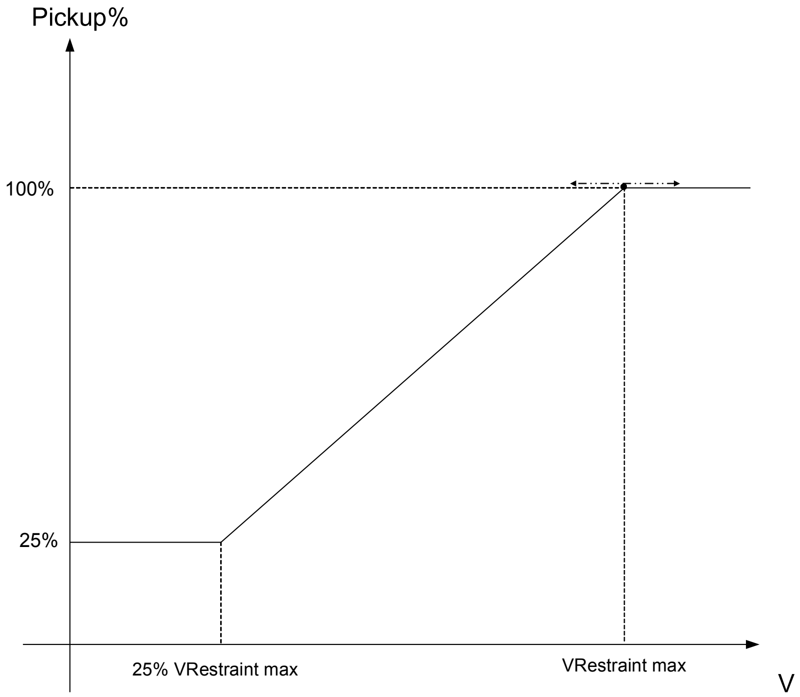
The measured total tripping delays or individual tripping delays, threshold values and fallback ratios correspond with those values, specified in the adjustment list. Permissible deviations/tolerances can be found under Technical Data.

51V - Voltage Restraint Overcurrent

For activating this function, the parameter »*VRestraint«* has to be set to *active* in the parameter set of the corresponding overcurrent element I[x].

The *51V* protection function restrains operation which reduces pickup levels. This allows the User to lower the pickup value of the *51V* protection function with the corresponding phase input voltage (phase-to-phase or phase-to-ground, depending on the setting of »*Measuring Channel«* within the current protection module). When the minimum fault phase current is close to the load current, it may make the phase time overcurrent protection coordination difficult. In this case, an undervoltage function may be used to alleviate this situation. When the voltage is low, the phase time overcurrent pickup threshold may be set low accordingly, so that the phase time overcurrent protection may achieve adequate sensitivity and better coordination. The device uses a simple linear model to determine the effective pickup by characterizing the relationship between the voltage and the phase time overcurrent pickup threshold.

Once the voltage restraint protection function is activated, the effective phase time overcurrent pickup threshold will be the calculated Pickup% times the phase time overcurrent pickup setting. The effective pickup threshold must be within the setting range allowed and, if it is less, the minimum pickup value will be used.



That means:

Vmin = 0.25*Vmax;

- Pickup%min = 25%;
- Pickup% = 25%, if V <= Vmin;
- Pickup% = 1/Vmax*(V - Vmin) + 25%, if Vmin < V < Vmax;
- Pickup% = 100%, if V >= Vmax;

The tripping curves (characteristic) will not be influenced by the voltage restraint function. If the voltage transformer supervision is activated, the voltage restraint overcurrent protection element is blocked in case of m.c.b. trip to avoid false trippings.

NOTICE

Definition of Vn:
Vn is dependent on the *»Measuring Channel«* setting in the current protection modules.

In case that this parameter is set to "Phase to Phase":

$$Vn = Main\,VT\,sec$$

In case that this parameter is set to "Phase to Neutral":

$$Vn = \frac{Main\,VT\,sec}{\sqrt{3}}$$

If the parameter *»VT con«* within the field parameters is set to *»Phase to Phase«* the setting *»Phase to Neutral«* in the current modules is effectless.

Commissioning: Overcurrent Protection, Non-directional [ANSI 51V]

Object to be tested:

Signals to be measured for Voltage Restraint protection function: the threshold values, total tripping time (recommended), or alternatively tripping delays and the dropout ratios; each time 3 x single-phase and 1 x three-phase.

NOTICE

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

Total tripping time: = tripping delay (please refer to the tolerances of the protection stages) + CB operating time (about 50 ms)

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

Necessary means:

- Current source;
- Voltage Source;
- Current and Voltage meters; and
- Timer.

Procedure:

Testing the threshold values (3 x single-phase and 1 x three-phase)
Feed %Pickup voltage. For each test performed, feed a current that is about 3-5% above the threshold value for activation/tripping. Then check if the pickup values are %Pickup of the value according to the standard overcurrent protection.

Testing the total tripping delay (recommendation):

Measure the total tripping times at the auxiliary contacts of the breakers (breaker tripping).

Testing the tripping delay (measuring at the relay output contact):

Measure the tripping times at the relay output contact.

Testing the dropout ratio:

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

Successful test result:

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

I2> - Negative-Sequence Overcurrent [51Q]

Elements

For activating this function, the parameter *»Measuring Mode«* has to be set to »*I2«* in the parameter set of the corresponding overcurrent element I[x].

The negative-sequence overcurrent protection function (*I2>*) is to be seen as an equivalent to the phase overcurrent protection with the exception that it uses negative-sequence current (I2>) as measured quantities instead of the three phase currents used by phase overcurrent protection function. The negative-sequence current used by *I2>* is derived from the following well-known symmetrical component transformation:

$$I_2 = \frac{1}{3}(I_{L1} + a^2 I_{L2} + a I_{L3})$$

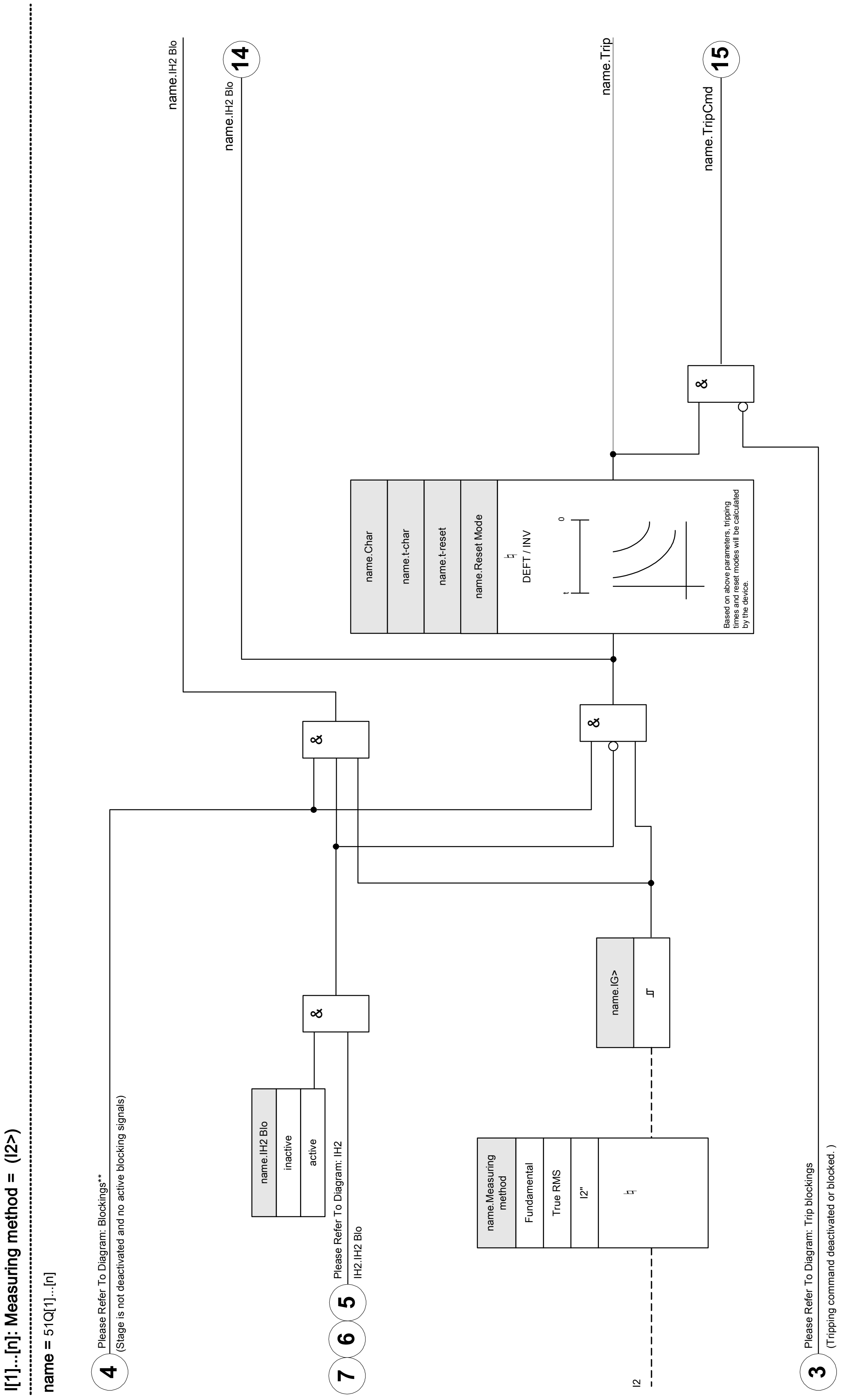
The pickup set value of a *I2>* protection function should be set in accordance of the negative-sequence current occurrence in the protected object.

Besides that, the negative-sequence overcurrent protection function (*I2>*) uses the same setting parameters as the phase overcurrent protection function, like trip and reset characteristics from both IEC/ANSI standards, time multiplier, etc.

The negative-sequence overcurrent protection function (*I2>*) can be used for line, generator, transformer and motor protection to protect the system from unbalanced faults. Because the *I2>* protection function operates on the negative-sequence current component which is normally absent during load conditions, the *I2>* can, therefore, be set more sensitive than the phase overcurrent protection functions. On the other hand, coordination of negative-sequence overcurrent protection function in a radial system does not mean automatically very long fault clearing time for the furthest upstream protection devices, because the tripping time of concerned negative-sequence overcurrent protection function needs only be coordinate with the next downstream device with the negative-sequence overcurrent protection function. This makes the *I2>* in many cases as an advantageous protection concept in addition to the phase overcurrent protection function.

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

NOTICE At the moment of breaker closure, negative-sequence current might be the result of transients.


I[1]...[n]: Measuring method = (I2>)
name = 51Q[1]...[n]
4 Please Refer To Diagram: Blockings**
(Stage is not deactivated and no active blocking signals)
7 6 5 Please Refer To Diagram: IH2
IH2.IH2 Blo
name.IH2 Blo
inactive
active
&
name.IH2 Blo
14
name.IH2 Blo
I2
name.Measuring method
Fundamental
True RMS
I2"
name.IG>
&
&
name.Char
name.t-char
name.t-reset
name.Reset Mode
DEFT / INV
Based on above parameters, tripping times and reset modes will be calculated by the device.
name.Trip
&
15
name.TripCmd
3 Please Refer To Diagram: Trip blockings
(Tripping command deactivated or blocked.)

Commissioning: Negative Sequence Overcurrent

Object to be tested:

Signals to be measured for each current protection function: the threshold values, total tripping time (recommended), or alternatively tripping delays and the dropout ratios.

NOTICE

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

Total tripping time: = tripping delay (please refer to the tolerances of the protection stages) + CB operating time (about 50 ms)

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

- Current source
- Current meters
- Timer

Procedure:

Testing the threshold values:

In order to get a negative-sequence current, please change the phase sequence at the terminals of the current source (in case of ABC sequence to ACB – in case of a ACB sequence to ABC).

For each test performed, feed a current that is about 3-5% above the threshold value for activation/tripping. Then check the threshold values.

Testing the total tripping delay (recommendation):

Measure the total tripping times at the auxiliary contacts of the breakers (breaker tripping).

Testing the tripping delay (measuring at the relay output contact):

Measure the tripping times at the relay output contact.

Testing the dropout ratio:

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

Successful test result:

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

Directional Features for Measured Ground Fault Elements 50N/51N

All ground fault elements can be selected as »n*on-directional/forward/reverse«* operated. This has to be done in the »*Device Planning«* menu.

Important Definitions

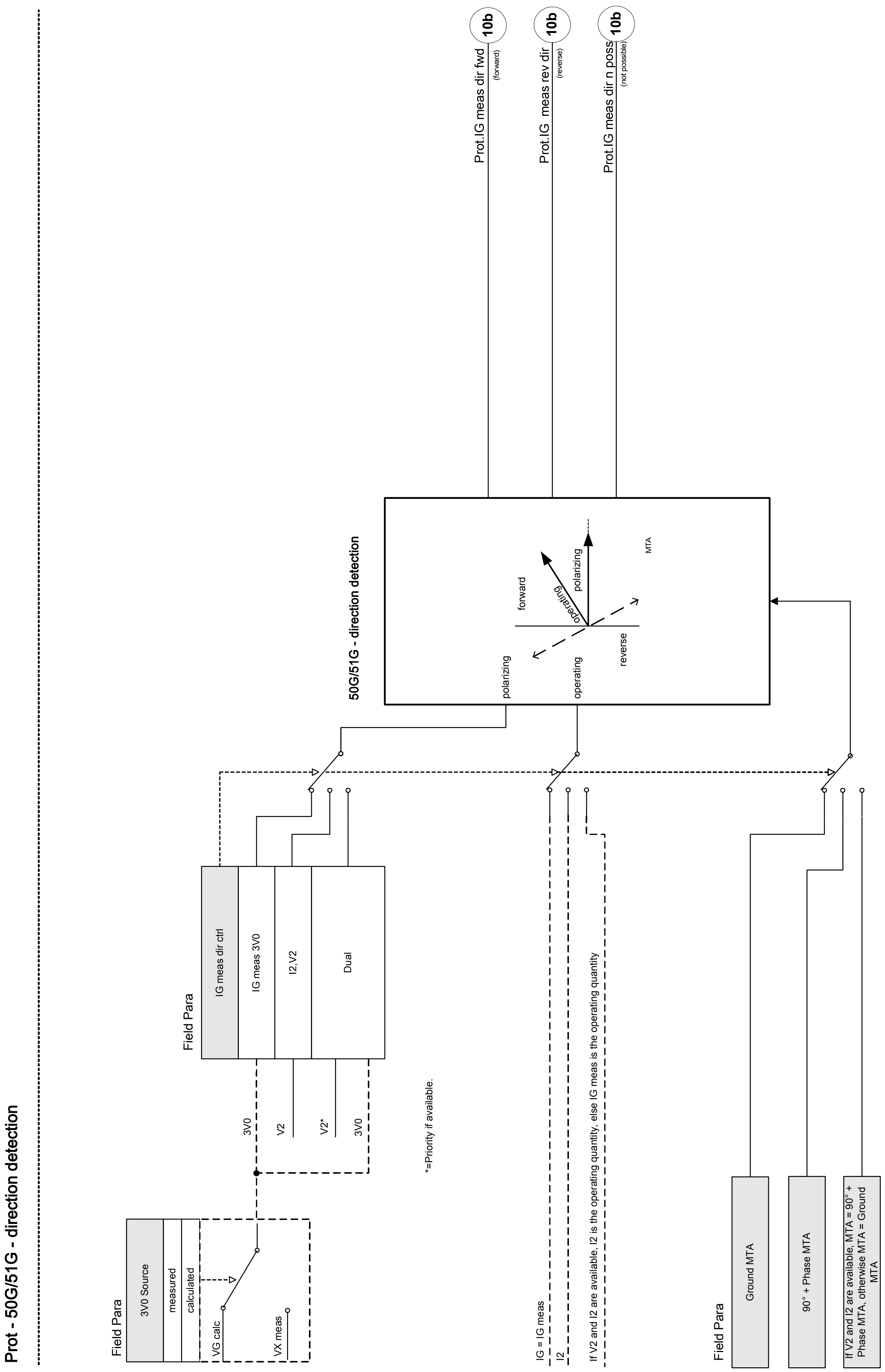
Polarizing Quantity: This is the quantity that is used as a reference value. The *polarizing quantity* can be selected by the parameter »*IG meas dir ctrl«* in the [Field Para/Direction] menu as follows:

- *»IG meas 3V0«*: The neutral voltage selected by the parameter »*3V0 Source«* will be used as the polarizing quantity. The traditional way to polarize a ground fault element is to use neutral voltage (3V0). The neutral voltage can, however, be either »*measured«* or »*calculated«*. This can be selected by the parameter »*3V0 Source«* in the [Field Para/Direction] menu.
- *»I2,V2«*: With this selection, the negative phase sequence voltage and current (Polarizing: V2/Operating: I2) will be used to detect direction. The monitored current is still the measured residual current IG meas.
- *»Dual«*: For this method, the negative phase sequence voltage »*V2«* will be used as polarizing quantity if »*V2«* and »I*2«* are available, otherwise 3V0 will be used. The operating quantity is either I2 if »*V2«* and »I*2«* are available, else IG meas.

The following table gives the User a quick overview of all possible directional settings.

50N/51N Direction Decision by Angle Between:	**[Field Para/ Direction]** **The Following Angle Has to Be Set:**	**[Field Para/Direction]:** **IG meas dir ctrl =**	**[Field Para/Direction]:** **3V0 Source =**
Measured ground current and neutral voltage: **IG meas, 3V0 (measured)**	Ground MTA	IG meas 3V0	measured
Measured ground current and neutral voltage: **IG meas, 3V0 (calculated)**	Ground MTA	IG meas 3V0	calculated
Negative sequence voltage and current **I2, V2**	90° + Phase MTA	I2,V2	not used
Negative phase sequence current and voltage (preferred), measured ground current and neutral voltage (alternatively): **I2, V2 (if available)** or else: **IG meas, 3V0 (measured)**	If V2 and I2 are available: 90° + Phase MTA else: Ground MTA	Dual	measured

Negative phase sequence current and voltage (preferred), measured ground current and neutral voltage (alternatively): **I2, V2 (if available)** or else: **IG meas, 3V0 (calculated)**	If V2 and I2 are available: 90° + Phase MTA else: Ground MTA	Dual	calculated


Prot - 50G/51G - direction detection
Field Para
3V0 Source
measured
calculated
VG calc
VX meas
Field Para
IG meas dir ctrl
IG meas 3V0
I2,V2
Dual
3V0
V2
V2*
3V0
*=Priority if available.
IG = IG meas
I2
If V2 and I2 are available, I2 is the operating quantity, else IG meas is the operating quantity
Field Para
Ground MTA
90° + Phase MTA
If V2 and I2 are available, MTA = 90° + Phase MTA, otherwise MTA = Ground MTA
50G/51G - direction detection
polarizing
operating
forward
reverse
operating
polarizing
MTA
Prot.IG meas dir fwd
(forward)
10b
Prot.IG meas rev dir
(reverse)
10b
Prot.IG meas dir n poss
(not possible)
10b

Directional Features for Calculated (IG calc) Ground Fault 50N/51N

All ground fault elements can be selected as »*non-directional/forward/reverse*« operated. This has to be done in the »*Device Planning*« menu.

Important Definitions

Polarizing Quantity: This is the quantity that is used as a reference value. The *polarizing quantity* can be selected by the parameter »*IG calc dir ctrl*« in the [Field Para/Direction] menu as follows:

- »*IG calc 3V0*«: The neutral voltage selected by the parameter »*3V0 Source*« will be used as the polarizing quantity. The traditional way to polarize a ground fault element is to use neutral voltage (3V0). The neutral voltage can, however, be either »*measured*« or »*calculated*«. This can be selected by the parameter »*3V0 Source*« in the [Field Para/Direction] menu.
- »*IG calc Ipol (IG meas)*«: The measured neutral current (usually = IG meas) will be used as polarizing quantity.
- »*Dual*«: For this method, the measured neutral current Ipol=IG meas will be used as polarizing quantity, if available, otherwise 3V0 will be used.
- »*I2,V2*«: With this selection, the negative phase sequence voltage and current will be used to detect the direction. The monitored current is still the calculated residual current IG calc.

Operating Quantity: For the directional IG calc elements, the *operating quantity* is in general the *calculated neutral current IG calc (*except from »*I2,V2*« mode, where »*I2*« is the operating quantity).

The ground maximum torque angles (MTA) can be adjusted from 0° to 360°, except, if »*IG calc Ipol (IG meas)*« is selected. In this case it is set to 0° (fixed).

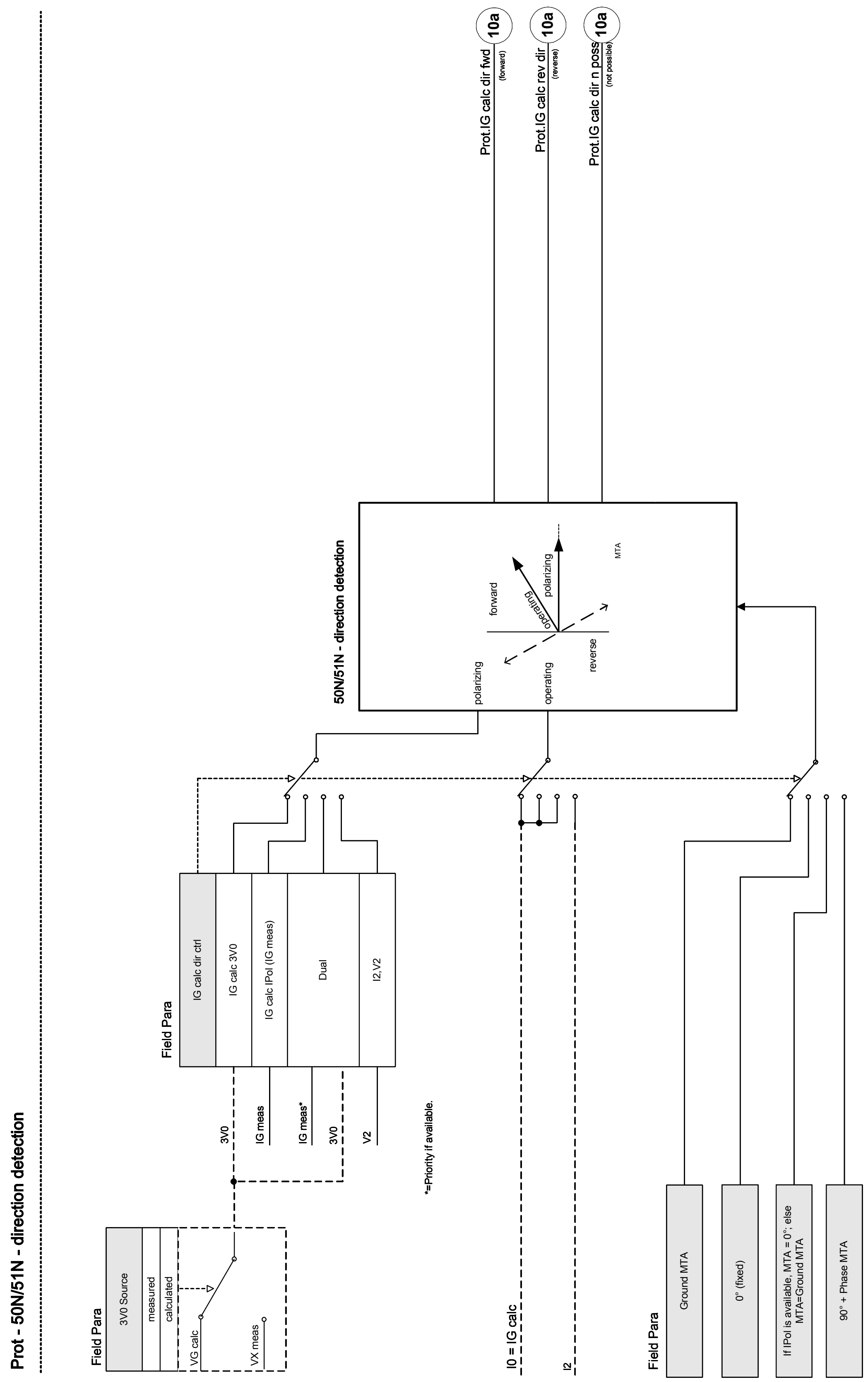
The MTA will also be set internally to 0° in case that Ipol=IG meas is available within the Dual-Mode

The following table gives the User a quick overview of all possible directional settings.

50N/51N Direction Decision by Angle Between:	**[Field Para/ Direction] The Following Angle Has to Be Set:**	**[Field Para/Direction]: IG calc dir ctrl =**	**[Field Para/Direction]: 3V0 Source =**
Residual current and neutral voltage: **IG calc, 3V0 (measured)**	Ground MTA	*IG calc 3V0*	measured
Residual current and neutral voltage: **IG calc, 3V0 (calculated)**	Ground MTA	*IG calc 3V0*	calculated
Residual current and neutral/ground current **IG calc, IG meas**	0° (fixed)	IG calc Ipol (IG meas)	not used

Residual current and neutral/ground current (preferred), residual current and neutral voltage (alternatively): **IG calc, IG meas (if available)** or else: **IG calc, 3V0 (measured)**	If Ipol (=IG meas) is available, MTA = 0° (fixed); else MTA=Ground MTA	Dual	measured

50N/51N Direction Decision by Angle Between:	**[Field Para/ Direction]** **The Following Angle Has to Be Set:**	**[Field Para/Direction]:** **IG calc dir ctrl =**	**[Field Para/Direction]:** **3V0 Source =**
Residual current and neutral/ground current (preferred), residual current and neutral voltage (alternatively): **IG calc, IG meas (if available)** or else: **IG calc, 3V0 (calculated)**	If Ipol (=IG meas) is available, MTA = 0° (fixed); else MTA=Ground MTA	Dual	calculated
Negative sequence voltage and current **I2, V2**	90° + Phase MTA	*I2,V2*	not used



Prot - 50N/51N - direction detection
Field Para
3V0 Source
measured
calculated
VG calc
VX meas
3V0
IG meas
IG meas*
3V0
V2
*=Priority if available.
Field Para
IG calc dir ctrl
IG calc 3V0
IG calc IPol (IG meas)
Dual
I2,V2
I0 = IG calc
I2
Field Para
Ground MTA
0° (fixed)
If IPol is available, MTA = 0°, else MTA=Ground MTA
90° + Phase MTA
50N/51N - direction detection
polarizing
operating
forward
reverse
MTA
Prot.IG calc dir fwd
(forward)
10a
Prot.IG calc rev dir
(reverse)
10a
Prot.IG calc dir n poss
(not possible)
10a

IG - Ground Fault [50N/G, 51N/G, 67N/G]

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

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

NOTICE **All earth current elements are identically structured.**

NOTICE **This module offers Adaptive Parameter Sets.**
Parameters can be modified within parameter sets dynamically by means of Adaptive Parameter Sets.
Please refer to chapter Parameter / Adaptive Parameter Sets.

The following table shows the application options of the earth overcurrent protection element

Applications of the IE-Protection Module	Setting in	Option
ANSI 50N/G – Earth overcurrent protection, non directional	Device Planning menu Setting: non directional	Measuring Mode: Fundamental/TrueRMS
ANSI 51N/G – Earth short circuit protection, non directional	Device Planning menu Setting: non directional	Measuring Mode: Fundamental/TrueRMS
ANSI 67N/G – Earth overcurrent/Earth short circuit protection, directional	Device Planning menu Setting: directional Field parameter menu 3V0 Source: measured/calculated 3I0 Source: measured/calculated	Measuring Mode: Fundamental/TrueRMS IG Source: measured/calculated VG Source: measured/calculated

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.

IG Source/VG Source:

Within the parameter menu, this parameter determines, whether the earth current and the residual voltage is »*measured*« or »*calculated*«.

Direction detection (3V0 Source und 3I0 Source)

In the field parameter menu it can be determined, if the earth current directional detection should be based on measured or calculated values of currents and voltages. This setting takes effect on all earth current elements.

NOTICE

- **Calculation of the residual voltage is only possible, when phase to neutral voltage is applied to the voltage inputs.**

  At setting »*measured*« the quantities to be measured, i. e. Residual voltage and the measured earth current have to be applied to the corresponding 4th measuring input.

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

- DEFT
- NINV (IEC)
- VINV (IEC)
- LINV (IEC)
- EINV (IEC)
- MINV (ANSI)
- VINV (ANSI)
- EINV (ANSI)
- Thermal Flat
- IT
- I2T
- I4T

Explanation:

t = Tripping delay

t-char = Time multiplier/tripping characteristic factor. The setting range depends on the selected tripping curve.

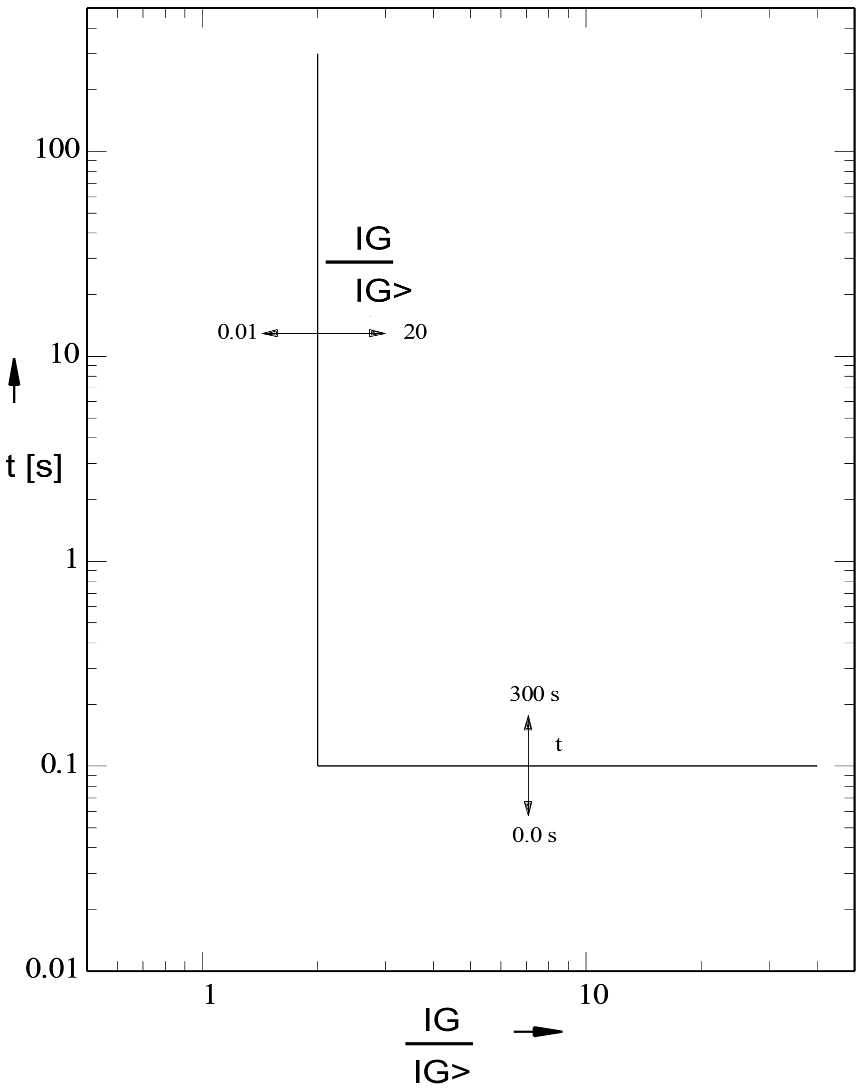
IG = Fault current

IG> = If the pickup value is exceeded, the module/element starts to time out to trip.

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

The device can optionally be procured with a sensitive earth current measuring input.

DEFT



IEC NINV

Notice!

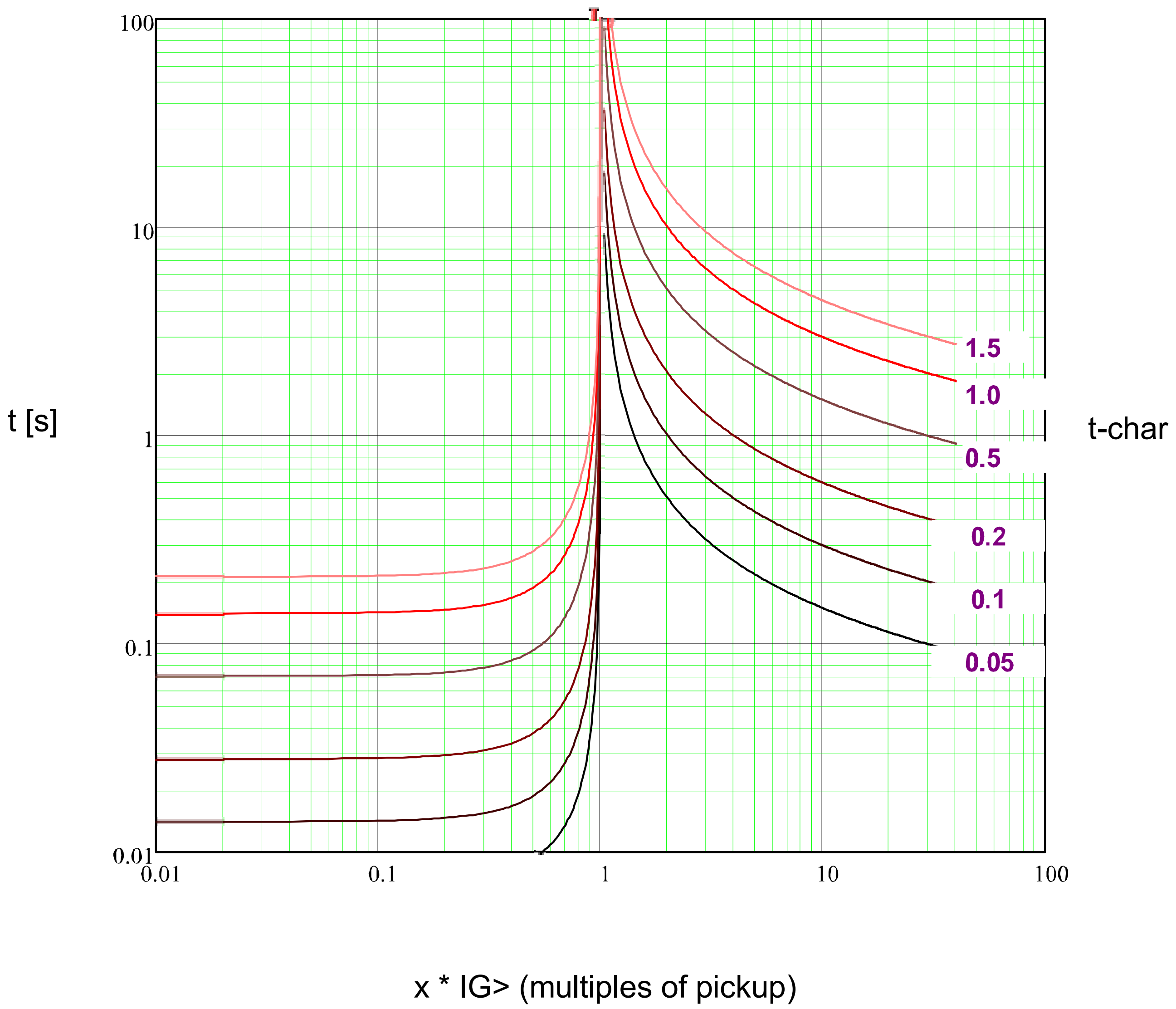
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

Reset

$$t = \left| \frac{0.14}{\left(\frac{IG}{IG>}\right)^{2} -1} \right| \text{*t-char [s]}$$

Trip

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



IEC VINV

Notice!

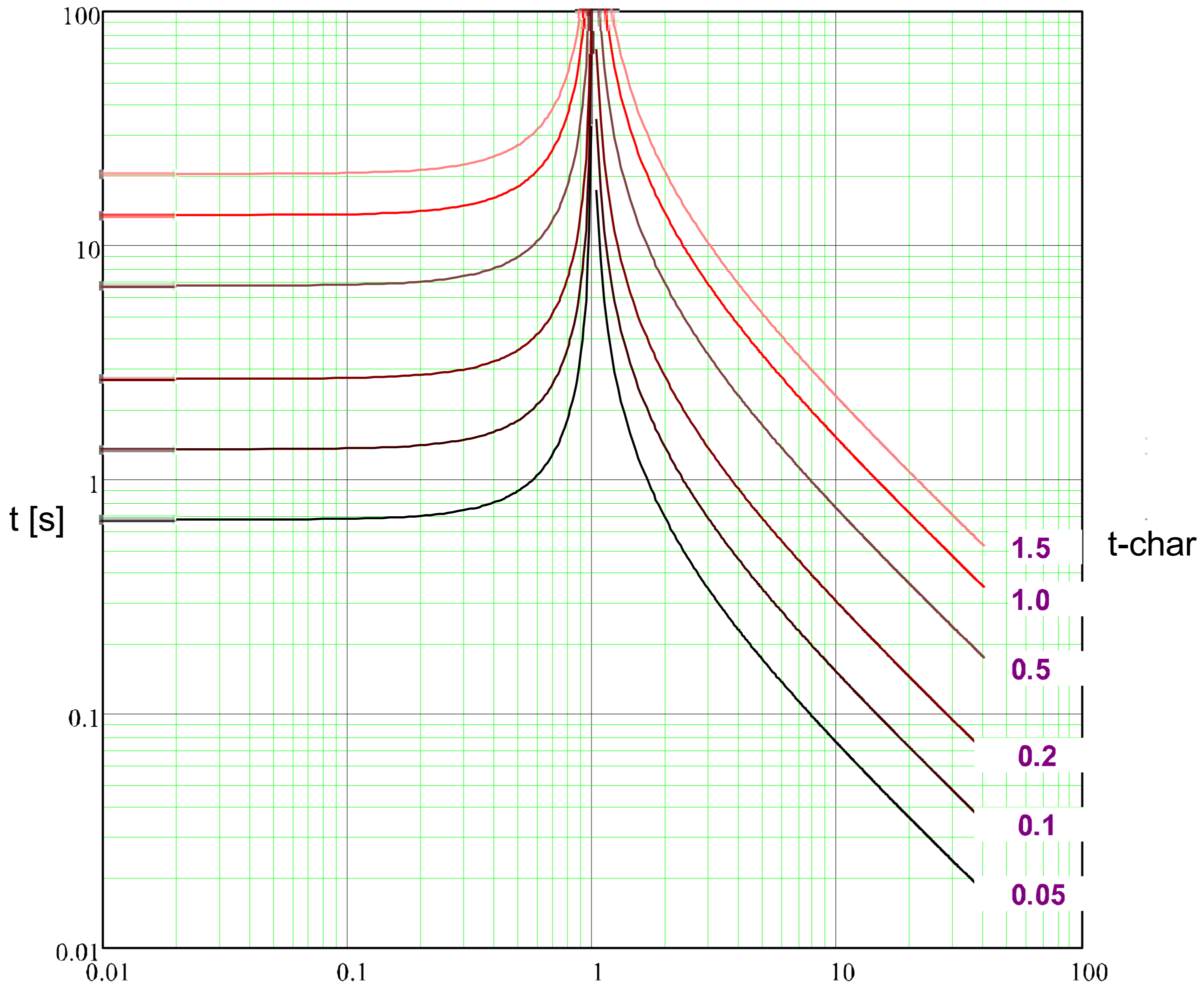
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

Reset

$$t = \left| \frac{13.5}{\left(\frac{IG}{IG>}\right)^2 - 1} \right| \text{*t-char [s]}$$

Trip

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



x * IG> (multiples of pickup)

IEC LINV

Notice!

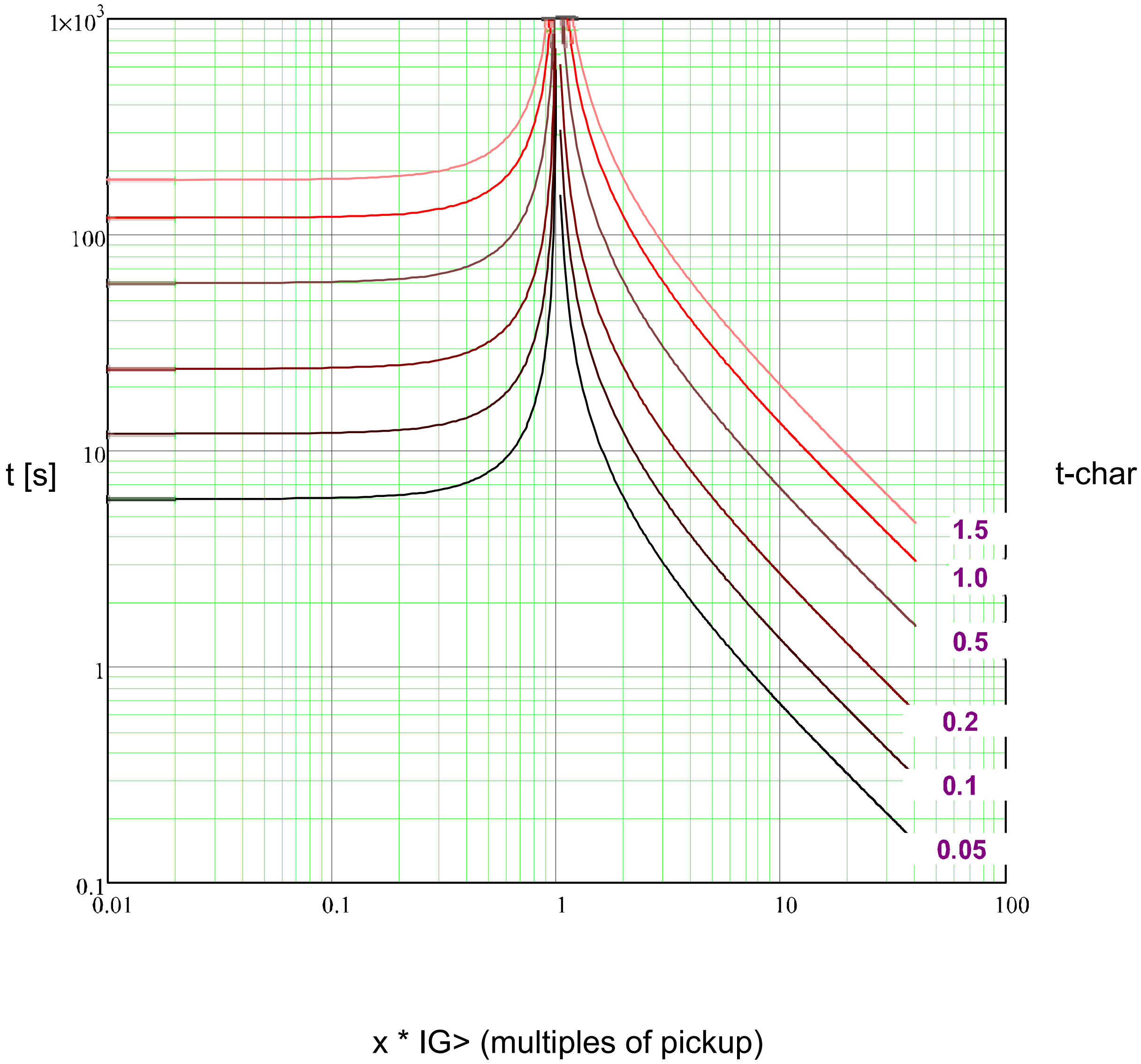
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

Reset

$$t = \left| \frac{120}{\left(\frac{IG}{IG>}\right)^2 - 1} \right| \text{*t-char [s]}$$

Trip

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



IEC EINV

Notice!

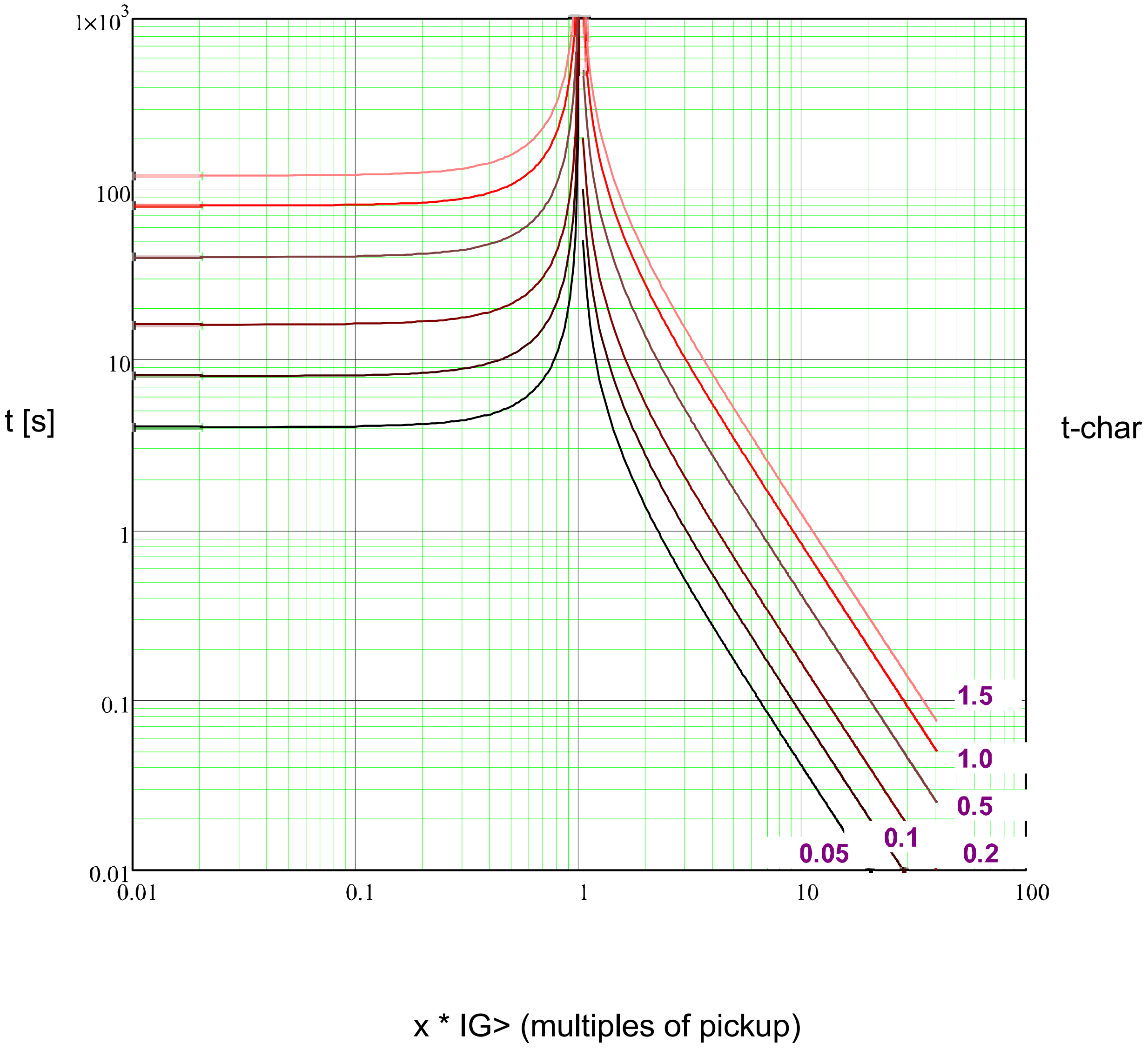
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

Reset

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

Trip

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



ANSI MINV

Notice!

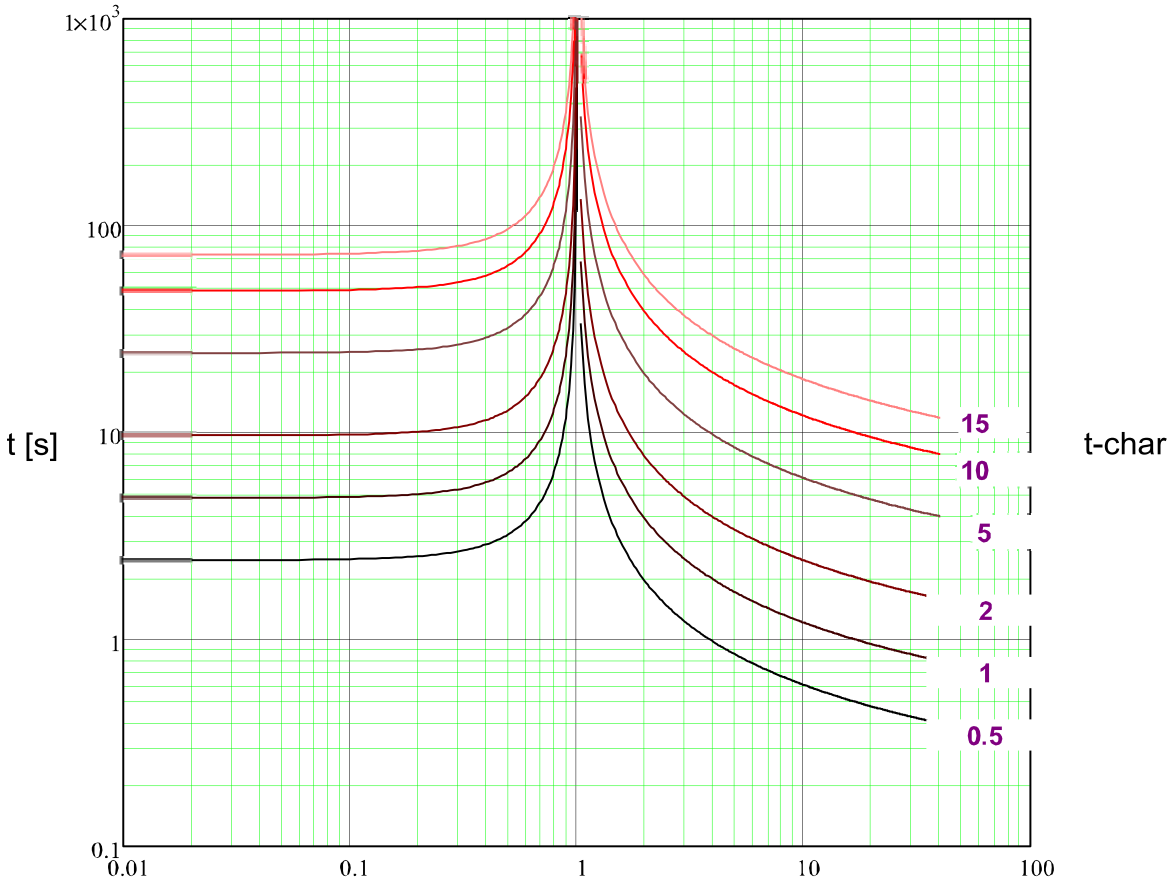
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

Reset

$$t = \left| \frac{4.85}{\left(\frac{IG}{I>}\right)^{2} - 1} \right| \text{*t-char [s]}$$

Trip

$$t = \left(\frac{0.0515}{\left(\frac{IG}{IG>}\right)^{0.02} - 1} + 0.1140 \right) \text{*t-char [s]}$$



x * IG> (multiples of pickup)

ANSI VINV

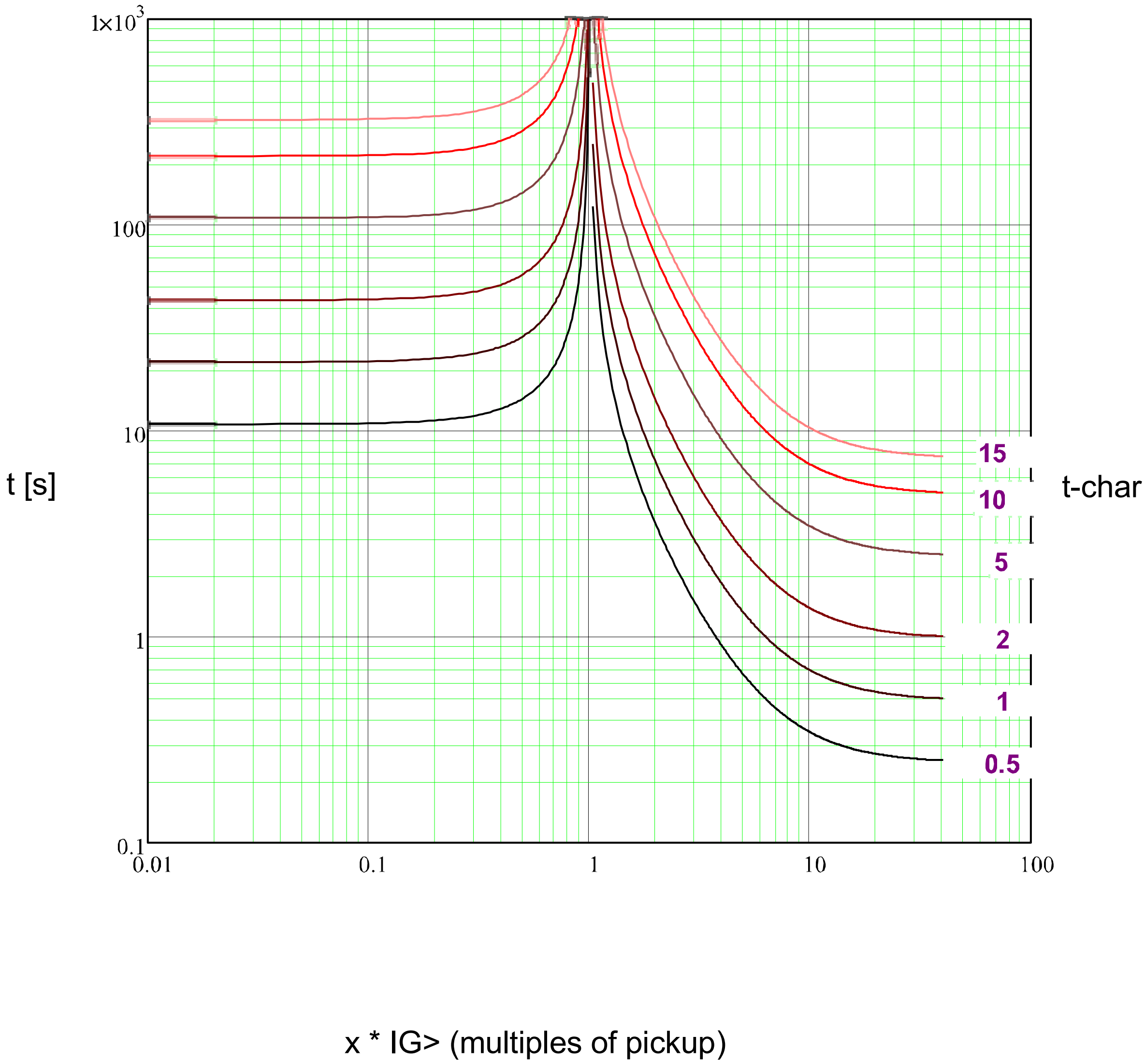
Notice!
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

Reset

$$t = \left| \frac{21.6}{\left(\frac{IG}{IG>}\right)^2 - 1} \right| \text{*t-char [s]}$$

Trip

$$t = \left(\frac{19.61}{\left(\frac{IG}{IG>}\right)^2 - 1} + 0.491 \right) \text{*t-char [s]}$$



ANSI EINV

Notice!

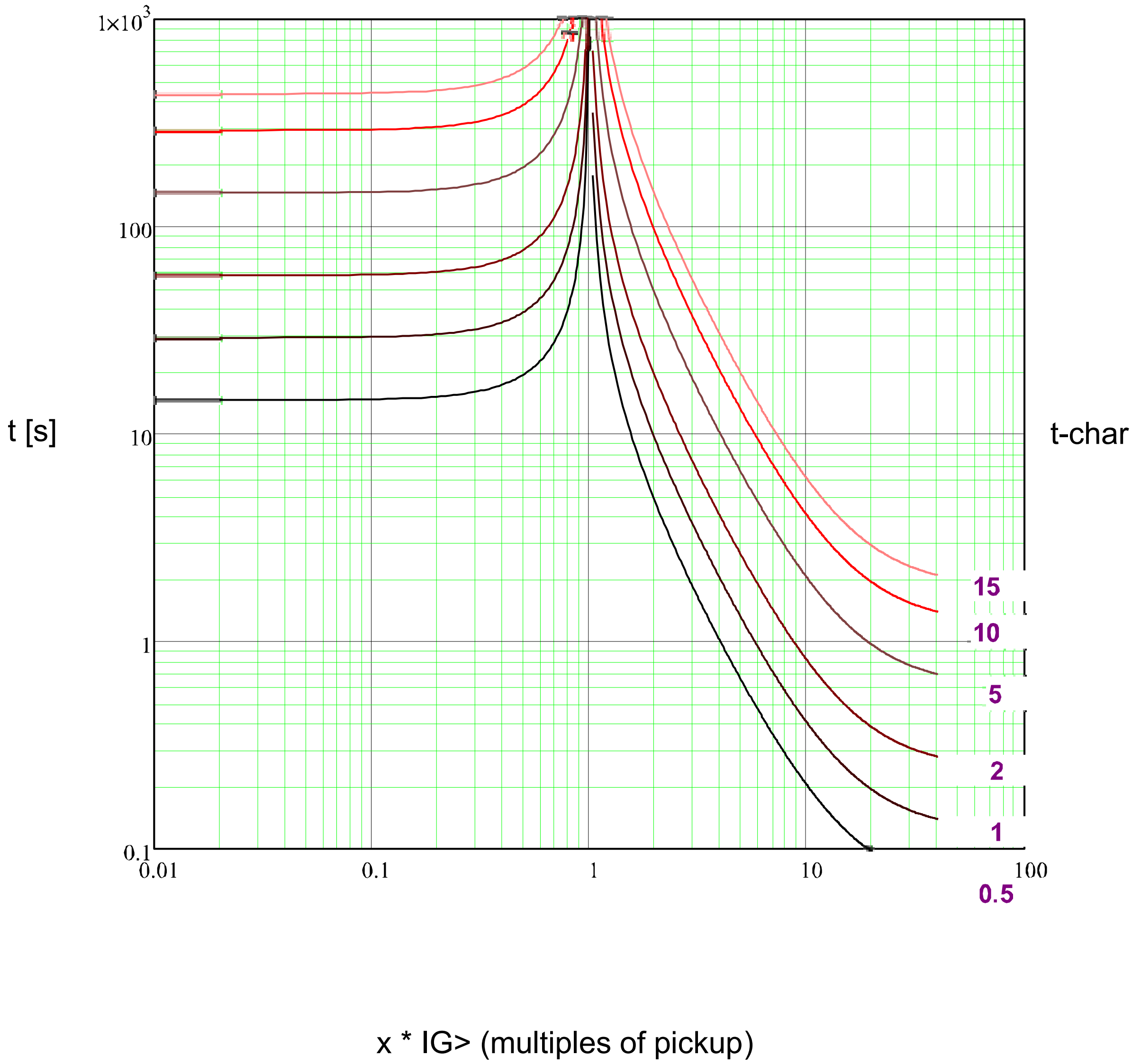
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

Reset

$$t = \left| \frac{29.1}{\left(\frac{IG}{IG>}\right)^2 - 1} \right| \text{*t-char [s]}$$

Trip

$$t = \left(\frac{28.2}{\left(\frac{IG}{IG>}\right)^2 - 1} + 0.1217 \right) \text{*t-char [s]}$$



Therm Flat

Notice!

Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

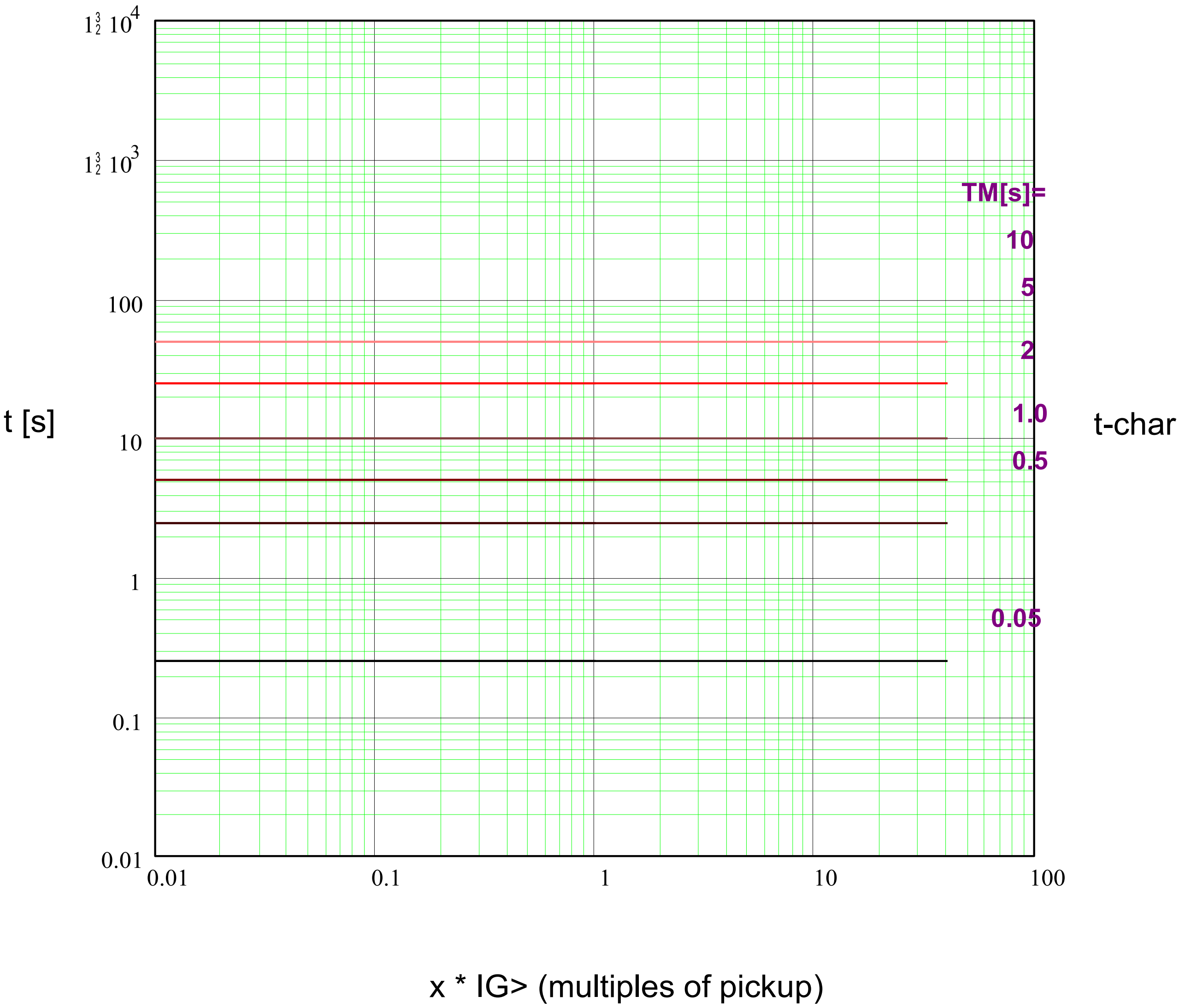
Reset

$$t = \left| \frac{5*1^2}{\left(\frac{IG}{IGnom}\right)^0} \right| *\text{t-char [s]}$$

Trip

$$t = \frac{5}{\left(\frac{IG}{IGnom}\right)^0} *\text{t-char [s]}$$

$$t = 5 \ *\text{t-char [s]}$$



IT

Notice!

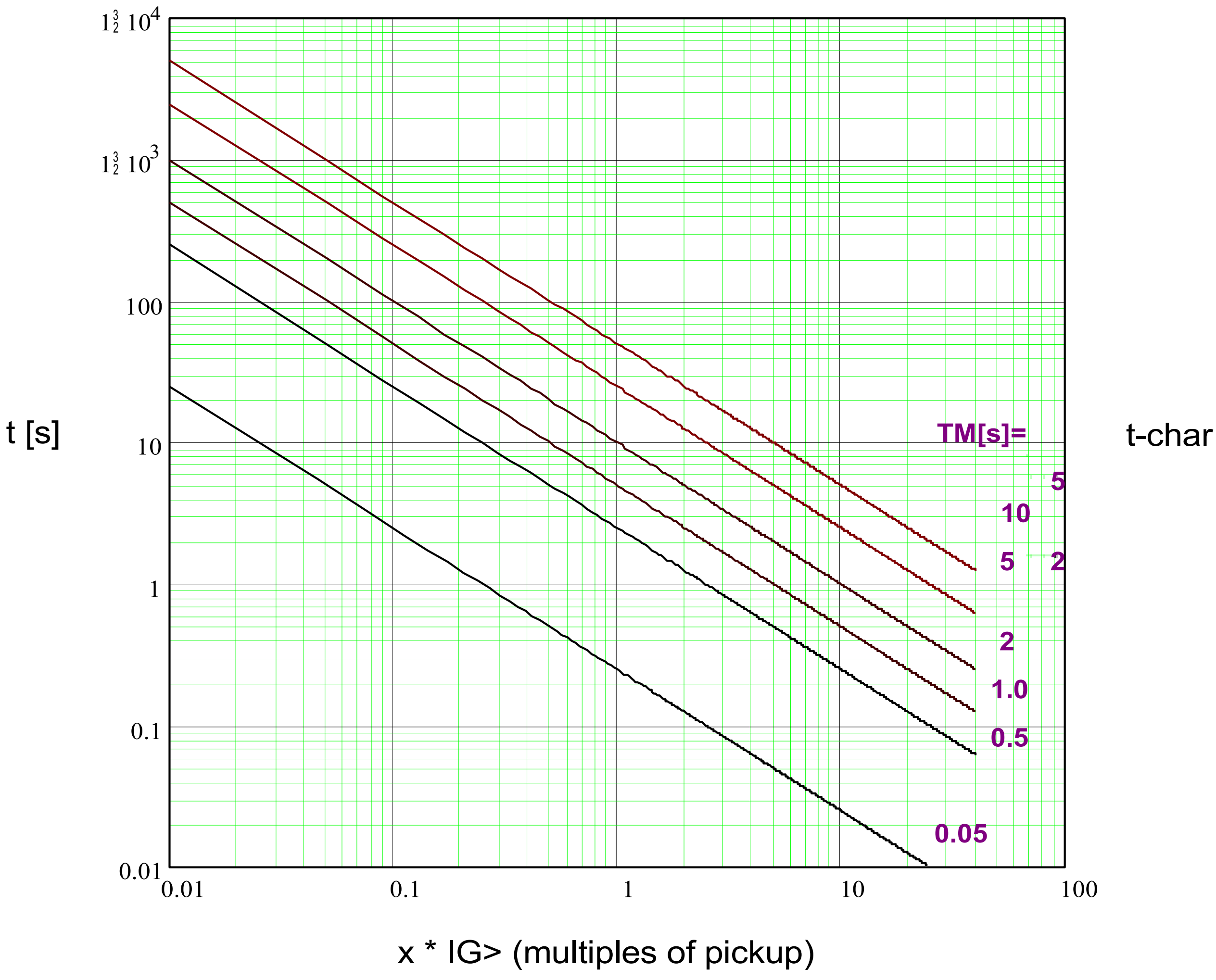
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

Reset

$$t = \left| \frac{5 \cdot 1^{2}}{\left(\frac{IG}{IGnom}\right)^{0}} \right| \text{*t-char [s]}$$

Trip

$$t = \frac{5 \cdot 1^{1}}{\left(\frac{IG}{IGnom}\right)^{1}} \text{*t-char [s]}$$



I2T

Notice!

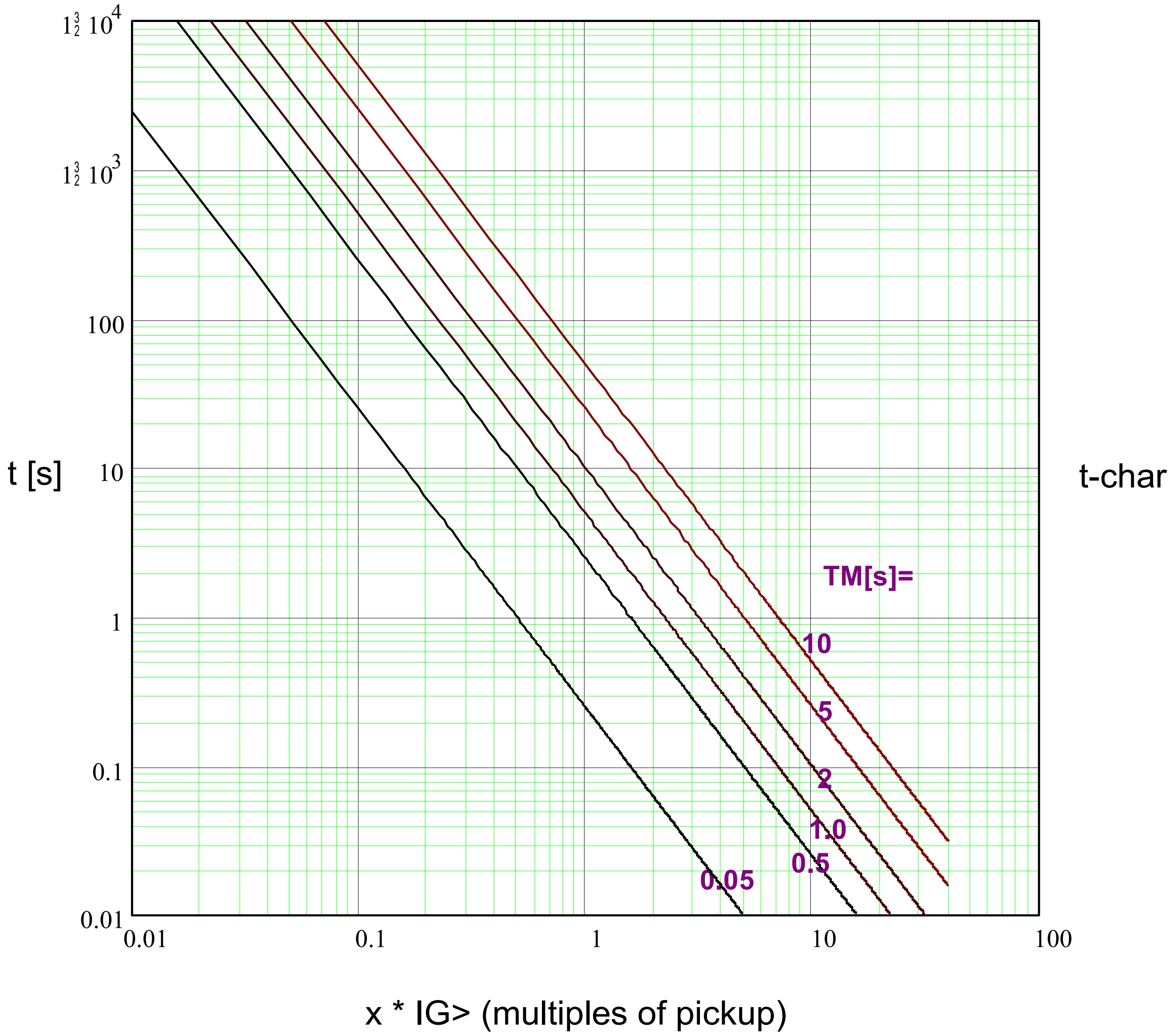
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

Reset

$$t = \left| \frac{5*1^2}{\left(\frac{IG}{IGnom}\right)^0} \right| \text{*t-char [s]}$$

Trip

$$t = \frac{5*1^2}{\left(\frac{IG}{IGnom}\right)^2} \text{*t-char [s]}$$



I4T

Notice!

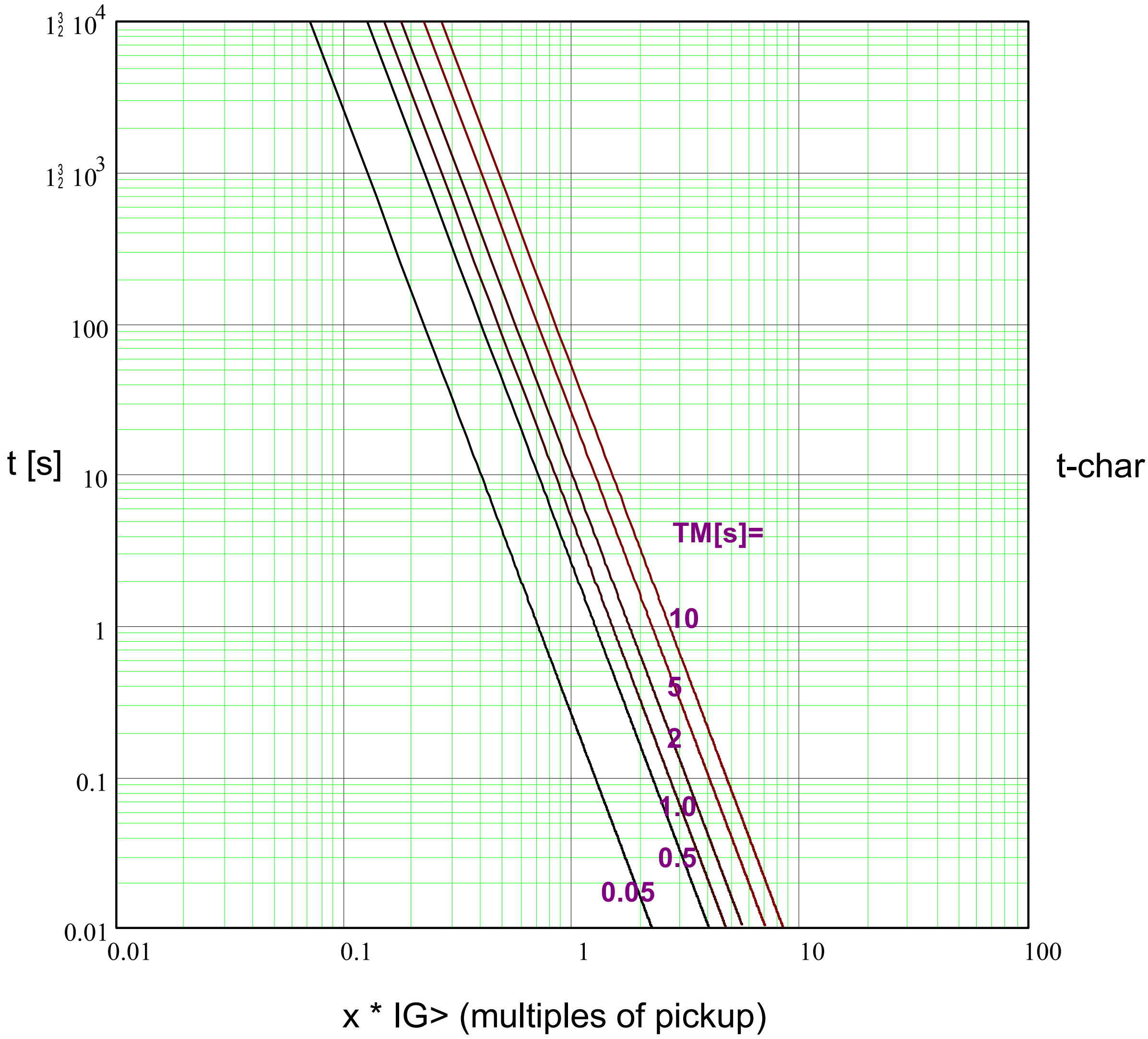
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

Reset

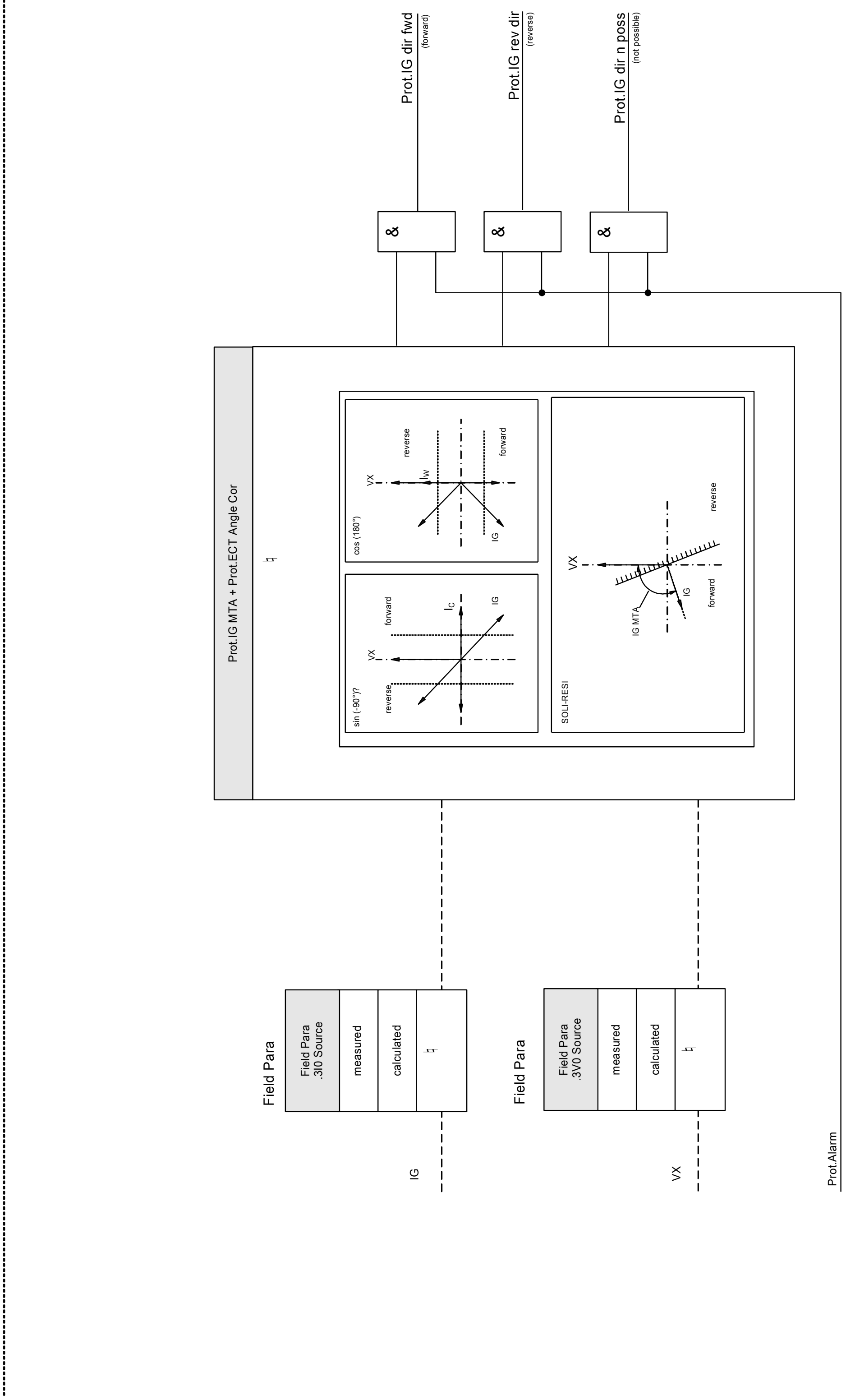
$$t = \left| \frac{5*1^{2}}{\left(\frac{IG}{IGnom}\right)^{0}} \right| *\text{t-char [s]}$$

Trip

$$t = \frac{5*1^{4}}{\left(\frac{IG}{IGnom}\right)^{4}} *\text{t-char [s]}$$

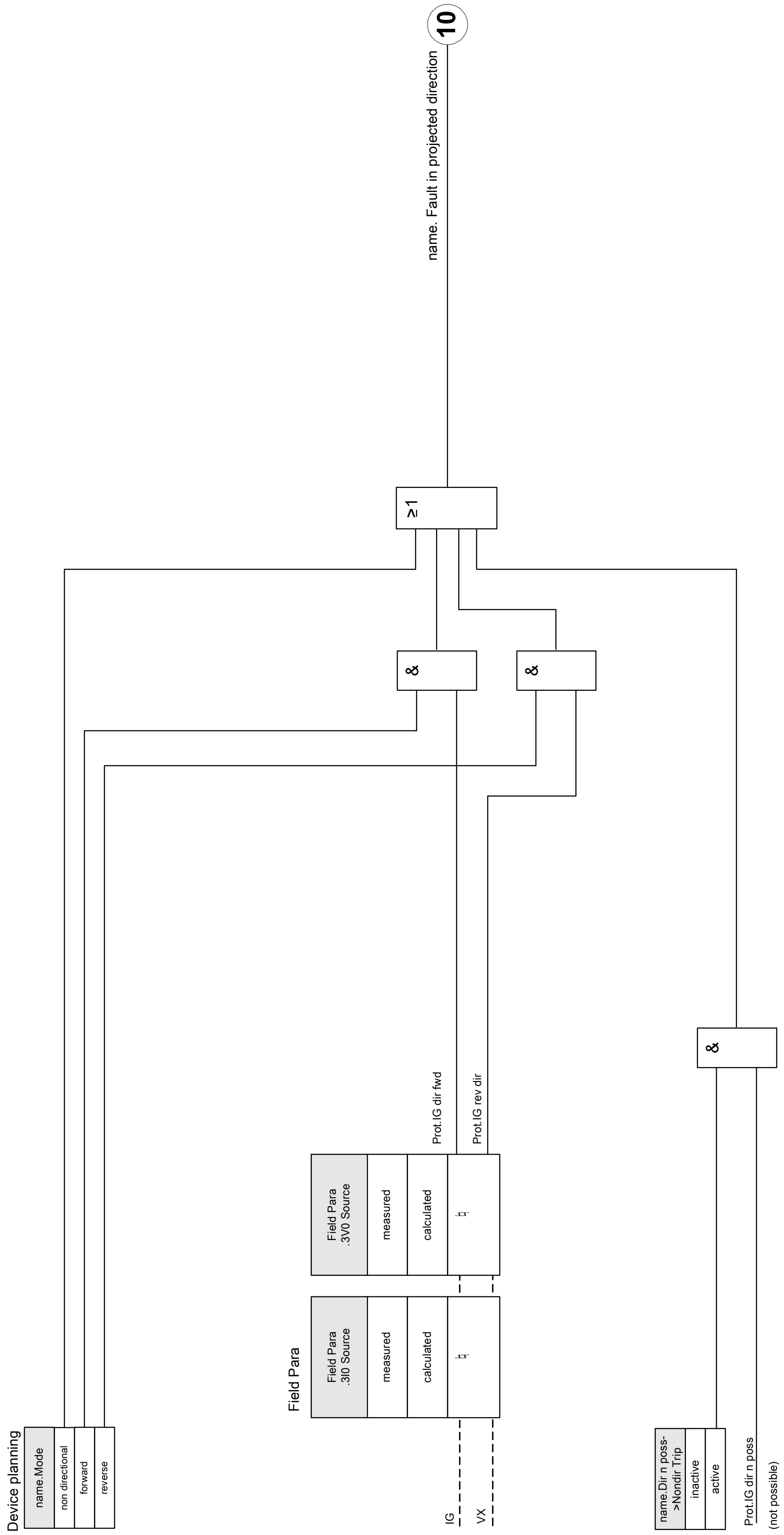


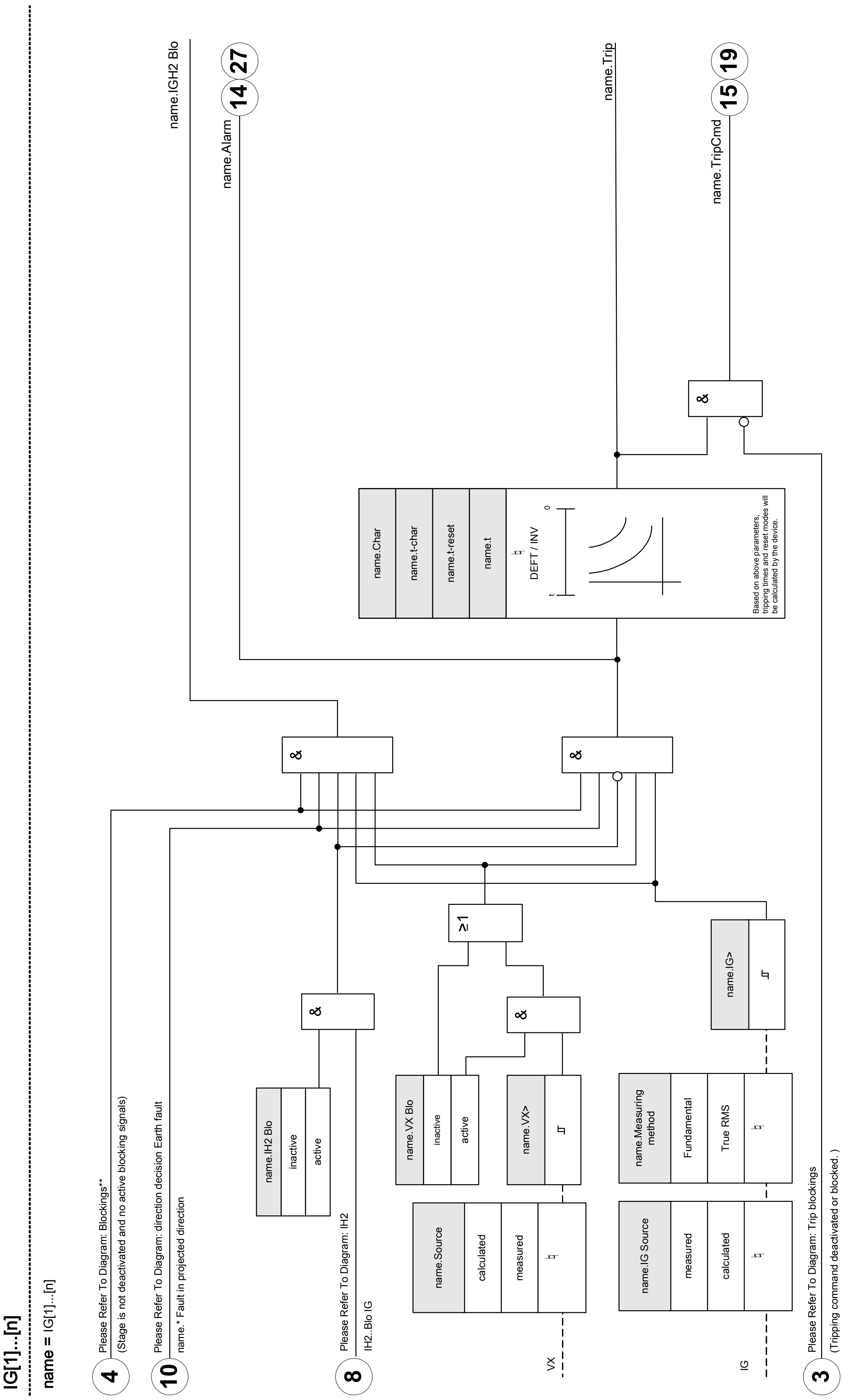
Prot - Earth fault - direction detection



direction decision Earth fault

name = IG[1]...[n]




IG[1]...[n]
name = IG[1]...[n]
4 Please Refer To Diagram: Blockings**
(Stage is not deactivated and no active blocking signals)
10 Please Refer To Diagram: direction decision Earth fault
name.* Fault in projected direction
8 Please Refer To Diagram: IH2
IH2..Blo IG
name.IH2 Blo
inactive
active
VX
name.Source
calculated
measured
name.VX Blo
inactive
active
name.VX>
IG
name.IG Source
measured
calculated
name.Measuring method
Fundamental
True RMS
name.IG>
3 Please Refer To Diagram: Trip blockings
(Tripping command deactivated or blocked.)
&
≥1
name.Char
name.t-char
name.t-reset
name.t
DEFT / INV
Based on above parameters, tripping times and reset modes will be calculated by the device.
name.IGH2 Blo
name.Alarm
14 27
name.Trip
name.TripCmd
15 19

Device Planning Parameters of the Ground Fault Protection

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

Global Protection Parameters of the Ground Fault Protection

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /IG[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /IG[1]]
ExBlo3	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, Trip Cmds	IG[1]: MStart.Blo-GOCStart IG[2]: MStart.Blo-GOCStart IG[3]: MStart.Blo-GOCStart IG[4]: MStart.Blo-GOCStart	[Protection Para /Global Prot Para /I-Prot /IG[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the stage, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /IG[1]]
Ex rev Interl	External blocking of the module by external reverse interlocking, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /IG[1]]
AdaptSet 1	Assignment Adaptive Parameter 1	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /IG[1]]
AdaptSet 2	Assignment Adaptive Parameter 2	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /IG[1]]

Parameter	Description	Setting range	Default	Menu path
AdaptSet 3	Assignment Adaptive Parameter 3	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /IG[1]]
AdaptSet 4	Assignment Adaptive Parameter 4	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /IG[1]]

Setting Group Parameters of the Ground Fault Protection

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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Measuring method	Measuring method: fundamental or rms	Fundamental, True RMS	True RMS	[Protection Para /<n> /I-Prot /IG[1]]
VX Source	Selection if VG is measured or calculated (neutral voltage or residual voltage)	measured, calculated	measured	[Protection Para /<n> /I-Prot /IG[1]]
Meas Circuit Superv	Measuring Circuit Supervision Only available if the device is equipped with a Measuring Circuit Supervision.	inactive, active	inactive	[Protection Para /<n> /I-Prot /IG[1]]
IG>	If the pickup value is exceeded, the module/stage will be started. Only available if:Default Current Measuring Card Only available if:Default Current Measuring Card	0.02 - 20.00In	IG[1]: 1In IG[2]: 2In IG[3]: 0.5In IG[4]: 0.5In	[Protection Para /<n> /I-Prot /IG[1]]
IGs>	If the pickup value is exceeded, the module/stage will be started.	0.002 - 2.000In	0.02In	[Protection Para /<n> /I-Prot /IG[1]]
Char	Characteristic	DEFT, IEC NINV, IEC VINV, IEC EINV, IEC LINV, ANSI MINV, ANSI VINV, ANSI EINV, Therm Flat, IT, I2T, I4T	DEFT	[Protection Para /<n> /I-Prot /IG[1]]
t	Tripping delay Only available if: Characteristic = DEFT	0.00 - 300.00s	IG[1]: 0.5s IG[2]: 0.5s IG[3]: 0.00s IG[4]: 0.00s	[Protection Para /<n> /I-Prot /IG[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
t-char	Time multiplier/tripping characteristic factor. The setting range depends on the selected tripping curve. Only available if: Characteristic = INV Or Characteristic = Therm Flat Or Characteristic = IT Or Characteristic = I2T Or Characteristic = I4T	0.02 - 20.00	1	[Protection Para /<n> /I-Prot /IG[1]]
Reset Mode	Reset Mode Only available if: Characteristic = INV Or Characteristic = Therm Flat Or Characteristic = IT Or Characteristic = I2T Or Characteristic = I4T	instantaneous, t-delay, calculated	instantaneous	[Protection Para /<n> /I-Prot /IG[1]]
t-reset	Reset time for intermittent phase failures (INV characteristics only) Only available if: Characteristic = INV Or Characteristic = Therm Flat Or Characteristic = IT Or Characteristic = I2T Or Characteristic = I4T Only available if:Reset Mode = t-delay	0.00 - 60.00s	0.00s	[Protection Para /<n> /I-Prot /IG[1]]
nondir Trip at VG=0	Only relevant for current protection modules/stages with directional feature! The device will trip non directional if this parameter is set to active and no direction could be determined because no reference voltage (V=0) could be measured any more (e.g. if there is a three-phase short circuit close to the device). If this parameter is set to inactive, the protection stage will be blocked in case of V=0. Only available if: Device planning: Earth current protection - Stage.Mode = directional	inactive, active	inactive	[Protection Para /<n> /I-Prot /IG[1]]
VX Blo	VX Blo = active means that the IG-stage will only excite if a residual voltage higher than the pickup value is measured at the same time. VX Blo = inactive means that the excitation of the IG stage does not depend on any residual voltage stage.	inactive, active	inactive	[Protection Para /<n> /I-Prot /IG[1]]
VX>	If the pickup value is exceeded, the module/stage will be started. Only available if: VX Blo = active	0.01 - 1.50Vn	1.00Vn	[Protection Para /<n> /I-Prot /IG[1]]

Ground Fault Protection Input States

Name	*Description*	*Assignment via*
ExBlo1-I	Module input state: External blocking1	[Protection Para /Global Prot Para /I-Prot /IG[1]]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /I-Prot /IG[1]]
ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command	[Protection Para /Global Prot Para /I-Prot /IG[1]]
Ex rev Interl-I	Module input state: External reverse interlocking	[Protection Para /Global Prot Para /I-Prot /IG[1]]
AdaptSet1-I	Module input state: Adaptive Parameter1	[Protection Para /Global Prot Para /I-Prot /IG[1]]
AdaptSet2-I	Module input state: Adaptive Parameter2	[Protection Para /Global Prot Para /I-Prot /IG[1]]
AdaptSet3-I	Module input state: Adaptive Parameter3	[Protection Para /Global Prot Para /I-Prot /IG[1]]
AdaptSet4-I	Module input state: Adaptive Parameter4	[Protection Para /Global Prot Para /I-Prot /IG[1]]

Ground Fault Protection Signals (Output States)

Name	Description
active	Signal: active
ExBlo	Signal: External Blocking
Ex rev Interl	Signal: External reverse Interlocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Alarm	Signal: Alarm IG
Trip	Signal: Trip
TripCmd	Signal: Trip Command
Active AdaptSet	Active Adaptive Parameter
DefaultSet	Signal: Default Parameter Set
AdaptSet 1	Signal: Adaptive Parameter 1
AdaptSet 2	Signal: Adaptive Parameter 2
AdaptSet 3	Signal: Adaptive Parameter 3
AdaptSet 4	Signal: Adaptive Parameter 4

Ground Fault Protection Counter Values

Value	Description	Default	Size	Menu path
NumberOfAlarms	Number of alarms since last reset.	0	0 - 9999999999	[Operation /History /AlarmCr]
NumberOfTrips	Number of trips since last reset	0	0 - 9999999999	[Operation /History /TripCr]

Commissioning: Ground Fault Protection – non-directional [50N/G, 51N/G]

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

Commissioning: Ground Fault Protection – Directional [50N/G, 51N/G, 67N/G]

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

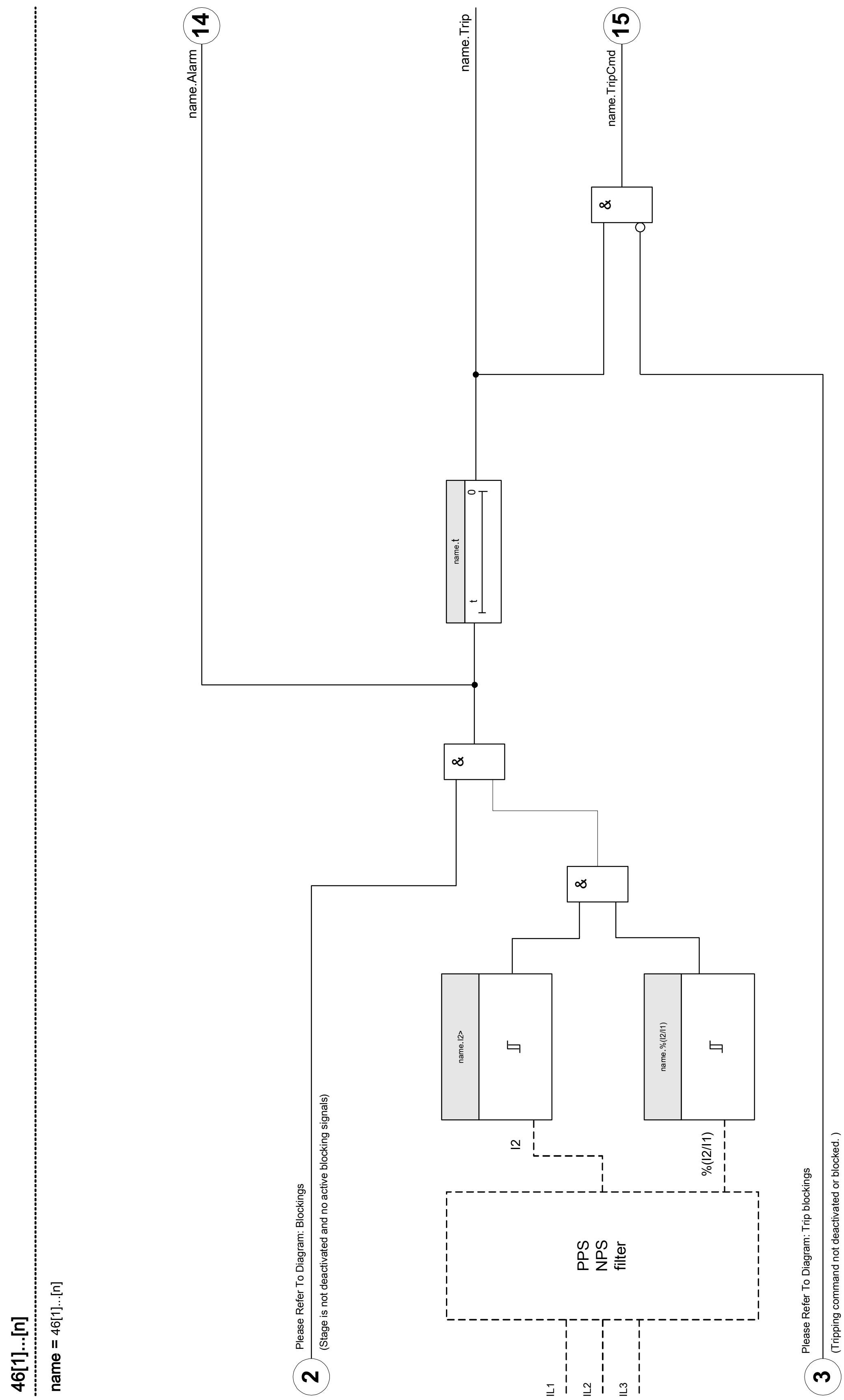
%I2/I1> - Unbalanced Load [46]

Elements:
I2>[1] ,I2>[2]

The *I2>* Current Unbalance element works similar to the *V 012* Voltage Unbalance element. The positive and negative sequence currents are calculated from the 3-phase currents. The Threshold setting defines a minimum operating current magnitude of I2 for the 46 function to operate, which insures that the relay has a solid basis for initiating a current unbalance trip. The »*%(I2/I1)*« setting is the unbalance trip pickup setting. It is defined by the ratio of negative sequence current to positive sequence current »*%(I2/I1)*«.

This function requires positive or negative sequence current magnitude above the threshold setting and the percentage current unbalance above the »*%(I2/I1)*« setting before allowing a current unbalance trip. Therefore, both the threshold and percent settings must be met for the specified Delay time setting before the relay initiates a trip for current unbalance.

NOTICE **All elements are identically structured.**


46[1]...[n]
name = 46[1]...[n]
2
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
IL1
IL2
IL3
PPS
NPS
filter
I2
%(I2/I1)
name.I2>
name.%(I2/I1)
&
&
name.t
t
0
name.Alarm
14
name.Trip
&
name.TripCmd
15
3
Please Refer To Diagram: Trip blockings
(Tripping command not deactivated or blocked.)

Device Planning Parameters of the Current Unbalance Module

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, use	I2>[1]: use I2>[2]: do not use	[Device planning]

Global Protection Parameters of the Current Unbalance Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /I2>[1]]
ExBlo2	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /I2>[1]]
ExBlo3	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, Trip Cmds	MStart.Blo-UnbalStart	[Protection Para /Global Prot Para /I-Prot /I2>[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the stage, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /I-Prot /I2>[1]]

Setting Group Parameters of the Current Unbalance Module

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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<n> /I-Prot /I2>[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo TripCmd Fc=active".	inactive, active	inactive	[Protection Para /<n> /I-Prot /I2>[1]]
I2>	The Threshold setting defines a minimum operating current magnitude of I2 for the 46 function to operate, which ensures that the relay has a solid basis for initiating a current unbalance trip. This is a supervisory function and not a trip level.	0.01 - 4.00In	0.01In	[Protection Para /<n> /I-Prot /I2>[1]]
%(I2/I1)	The %(I2/I1) setting is the unbalance trip pickup setting. It is defined by the ratio of negative sequence current to positive sequence current (% Unbalance=I2/I1). Phase sequence will be taken into account automatically.	inactive, active	inactive	[Protection Para /<n> /I-Prot /I2>[1]]
%(I2/I1)	The %(I2/I1) setting is the unbalance trip pickup setting. It is defined by the ratio of negative sequence current to positive sequence current (% Unbalance=I2/I1). Phase sequence will be taken into account automatically. Only available if: %(I2/I1) = use	2 - 40%	20%	[Protection Para /<n> /I-Prot /I2>[1]]
Char	Characteristic	DEFT, INV	DEFT	[Protection Para /<n> /I-Prot /I2>[1]]
t	Tripping delay Only available if: Characteristic = DEFT	0.00 - 300.00s	0.00s	[Protection Para /<n> /I-Prot /I2>[1]]
K	Indicates the thermal load capability of the engine while running with 100% unbalanced load current. Only available if: Characteristic = INV	1.0 - 200.0	10.0	[Protection Para /<n> /I-Prot /I2>[1]]
τ-cool	If the unbalanced load current falls below the pickup value, the cooling-off time is taken into account. If the unbalanced load exceeds the pickup value again, than the saved heat within the electrical equipment will lead to an accelerated trip. Only available if: Characteristic = INV	0.0 - 60000.0	0.0	[Protection Para /<n> /I-Prot /I2>[1]]

Current Unbalance Module Input States

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

Current Unbalance Module Signals (Output States)

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

Current Unbalance Module Counter Values

Value	*Description*	*Default*	*Size*	*Menu path*
NumberOfAlarms	Number of alarms since last reset.	0	0 - 9999999999	[Operation /History /AlarmCr]
NumberOfTrips	Number of trips since last reset	0	0 - 9999999999	[Operation /History /TripCr]

Commissioning: Current Unbalance Module

Object to be tested:

Test of the unbalanced load protection function.

Necessary means:

- Three-phase current source with adjustable current unbalance; and
- Timer.

Procedure:

Check the phase sequence:

- Ensure that the phase sequence is the same as that set in the field parameters.
- Feed-in a three-phase nominal current.
- Change to the »Measuring Values« menu.
- Check the measuring value for the unbalanced current *»I2«*. The measuring value displayed for »*I2«* should be zero (within the physical measuring accuracy).

NOTICE **If the displayed magnitude for I2 is the same as that for the symmetrical nominal currents fed to the relay, it implies that the phase sequence of the currents seen by the relay is reversed.**

- Now turn-off phase L1.
- Again check the measuring value of the unbalanced current »*I2«* in the »Measuring Values« menu. The measuring value of the asymmetrical current »*I2«* should now be 33%.
- Turn-on phase L1, but turn-off phase L2.

- Once again check the measuring value of the asymmetrical current I2 in the »Measuring Values« menu. The measuring value of the asymmetrical current »*I2*« should be again 33%.

- Turn-on phase L2, but turn-off phase L3.

- Again check the measuring value of asymmetrical current »*I2*« in the »Measuring Values« menu. The measuring value of the asymmetrical current »*I2*« should still be 33%.

Testing the trip delay:

- Apply a symmetrical three-phase current system (nominal currents).

- Switch off IL1 (the threshold value »*Threshold*« for »*I2*« must be below 33%).

- Measure the tripping time.

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

Testing the threshold values:

- Configure minimum »*%I2/I1*« setting (2%) and an arbitrary threshold value »*Threshold*« (I2).

- For testing the threshold value, a current has to be fed to phase A which is lower than three times the adjusted threshold value »*Threshold*« (I2).

- Feeding only phase A results in »*%I2/I1 = 100%*«, so the first condition »*%I2/I1 >= 2%*« is always fulfilled.

- Now increase the phase L1 current until the relay is activated.

Testing the dropout ratio of the threshold values:

Having tripped the relay in the previous test, now decrease the phase A current. The dropout ratio must not be higher than 0.97 times the threshold value.

Testing %I2/I1:

- Configure minimum threshold value »*Threshold*« (I2) (0.01 x In) and set »*%I2/I1*« greater or equal to 10%.

- Apply a symmetrical three-phase current system (nominal currents). The measuring value of »*%I2/I1*« should be 0%.

- Now increase the phase L1 current. With this configuration, the threshold value »*Threshold*« (I2) should be reached before the value »*%I2/I1*« reaches the set »*%I2/I1*« ratio threshold.

- Continue increasing the phase 1 current until the relay is activated.

Testing the dropout ratio of %I2/I1:

Having tripped the relay in the previous test, now decrease the phase L1 current. The dropout of »*%I2/I1*« has to be 1% below the »*%I2/I1*«setting.

Successful test result:

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

SOTF - Switch Onto Fault

SOTF

In case a faulty line is energized (e.g.: when an earthing switch is in the ON-Position), an instantaneous trip is required. The *SOTF* module is provided to generate a permissive signal for other protection functions such as overcurrents to accelerate their trips (via adaptive parameters). The *SOTF* condition is recognized according to the User's operation mode that can be based on:

- The breaker state (CB Pos);
- No current flowing (I<);
- Breaker state and no current flowing(CB Pos and I<);
- Breaker switched on manually (CB manually On); and/or
- An external trigger (Ex SOTF).

This protection module can initiate a high speed trip of the overcurrent protection modules.

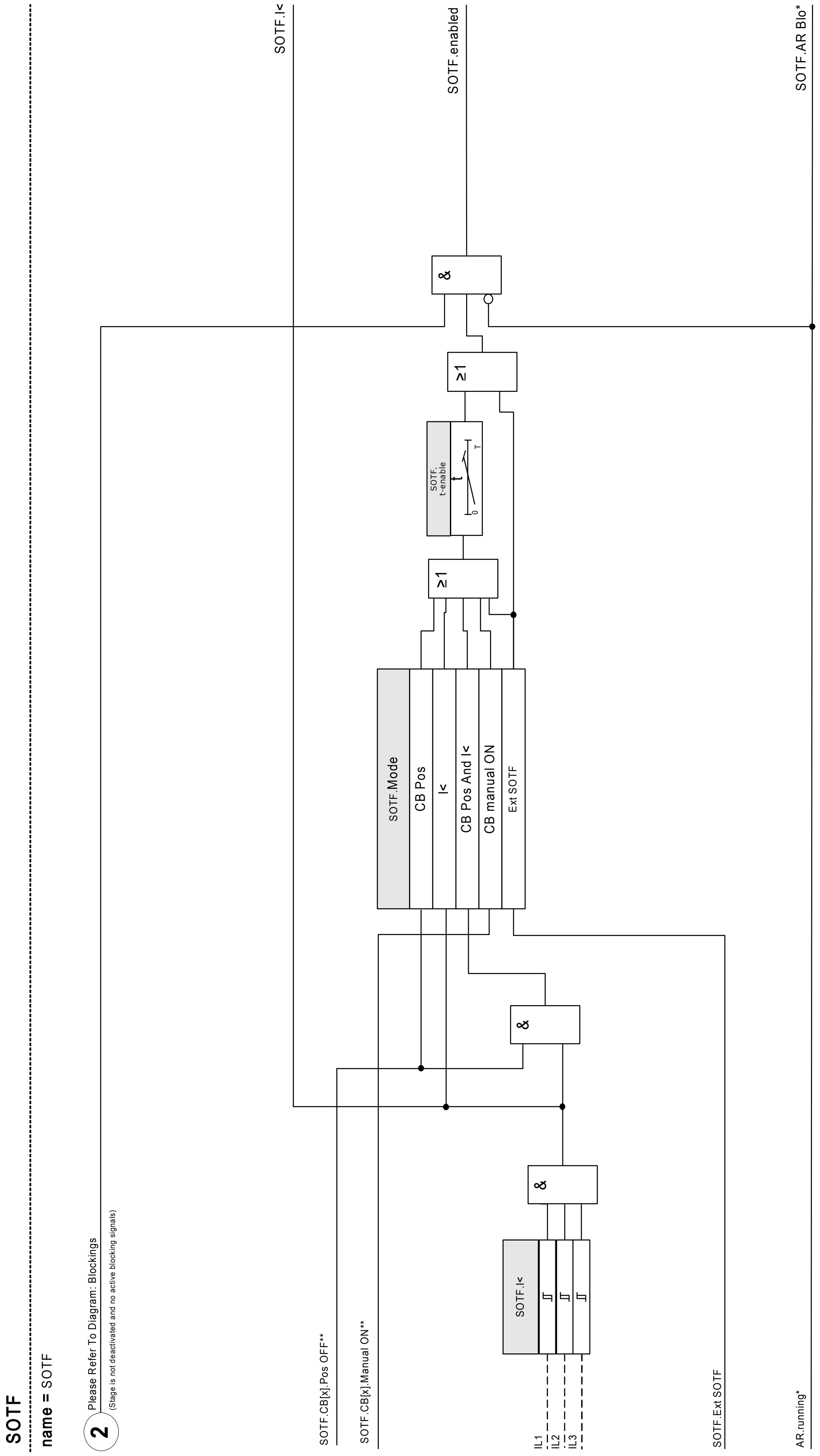
CAUTION

This module issues a signal only (the module is not armed and does not issue a trip command).

In order to influence the trip settings of the overcurrent protection in case of switching onto a fault, the User has to assign the signal "SOTF.ENABLED" onto an Adaptive Parameter Set. Please refer to Parameter / Adaptive Parameter Sets sections. Within the Adaptive Parameter Set, the User has to modify the trip characteristic of the overcurrent protection according to the User's needs.

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.



*Applies only for devices with Auto Reclosure

**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 Switch Onto Fault Module

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

Global Protection Parameters of the Switch Onto Fault Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Mode	Mode	CB Pos, I<, CB Pos And I<, CB manual ON, Ext SOTF	CB manual ON	[Protection Para /Global Prot Para /SOTF]
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 /SOTF]
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 /SOTF]
Ex rev Interl	External blocking of the module by external reverse interlocking, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /SOTF]
Assigned SG	Assigned Switchgear Only available if: Mode = CB Pos Or CB Pos And I<	-, SG	SG	[Protection Para /Global Prot Para /SOTF]
Ext SOTF	External Switch Onto Fault Only available if: Mode = Ext SOTF	1..n, DI-LogicList	-.-	[Protection Para /Global Prot Para /SOTF]

Setting Group Parameters of the Switch Onto Fault Module

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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Ex rev Interl Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "Ex rev Interl Fc = active".	inactive, active	inactive	[Protection Para /<n> /SOTF]
I<	The CB is in the OFF Position, if the measured current is less than this parameter.	0.01 - 1.00In	0.01In	[Protection Para /<n> /SOTF]
t-enable	While this timer is running, and while the module is not blocked, the Switch Onto Fault Module is effective (SOTF is armed).	0.10 - 10.00s	2s	[Protection Para /<n> /SOTF]

Switch Onto Fault Module Input States

Name	*Description*	*Assignment via*
ExBlo1-I	Module input state: External blocking	[Protection Para /Global Prot Para /SOTF]
ExBlo2-I	Module input state: External blocking	[Protection Para /Global Prot Para /SOTF]
Ex rev Interl-I	Module input state: External reverse interlocking	[Protection Para /Global Prot Para /SOTF]
Ext SOTF-I	Module input state: External Switch Onto Fault Alarm	[Protection Para /Global Prot Para /SOTF]

Signals of the Switch Onto Fault Module (Output States)

Name	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
Ex rev Interl	Signal: External reverse Interlocking
enabled	Signal: Switch Onto Fault enabled. This Signal can be used to modify Overcurrent Protection Settings.
I<	Signal: No Load Current.

Commissioning: Switch Onto Fault

Object to be tested:

Testing the module *Switch Onto Fault* according to the parameterized operating mode:

- The breaker state (CB Pos);
- No current flowing (I<);
- Breaker state and no current flowing(CB Pos and I<);
- Breaker switched on manually (CB manually On); and/or
- An external trigger (Ex SOTF).

Necessary means:

- Three-phase current source (If the Enable-Mode depends on current);
- Ampere meters (May be needed if the Enable-Mode depends on current); and
- Timer.

Test Example for Mode CB manual ON:

NOTICE

Mode I<: In order to test the effectiveness: Initially do not feed any current. Start the timer and feed with an abrupt change current that is distinctly greater than the I<-threshold to the measuring inputs of the relay.

Mode I< and Bkr state: Simultaneous switch on the breaker manually and feed with an abrupt change current that is distinctly greater than the I<-threshold.

Mode Bkr state: The breaker has to be in the OFF Position. The signal „SOTF.ENABLED"=0 is untrue. If the breaker is switched on, the signal „SOTF.ENABLED"=1 becomes true as long as the timer t-enabled is running.

- The Circuit Breaker has to be in the OFF Position. There must be no load current.
- The Status Display of the device shows the signal „SOTF.ENABLED"=1.

Testing:

- Switch the Circuit Breaker manually ON and start the timer at the same time.
- After the hold time t-enable is expired the state of the signal has to change to „SOTF.ENABLED"=0.
- Write down the measured time.

Successful test result:

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

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

Applications of the V-Protection Module	Setting in	Option
ANSI 59 Overvoltage protection	Device Planning menu Setting: V>	*Measuring Method*: Fundamental/TrueRMS Measuring Mode: Phase to ground
ANSI 27(t) Voltage dependent undervoltage protection	Device Planning menu Setting: V(t)<	*Measuring Method*: Fundamental/TrueRMS Measuring Mode: Phase to ground

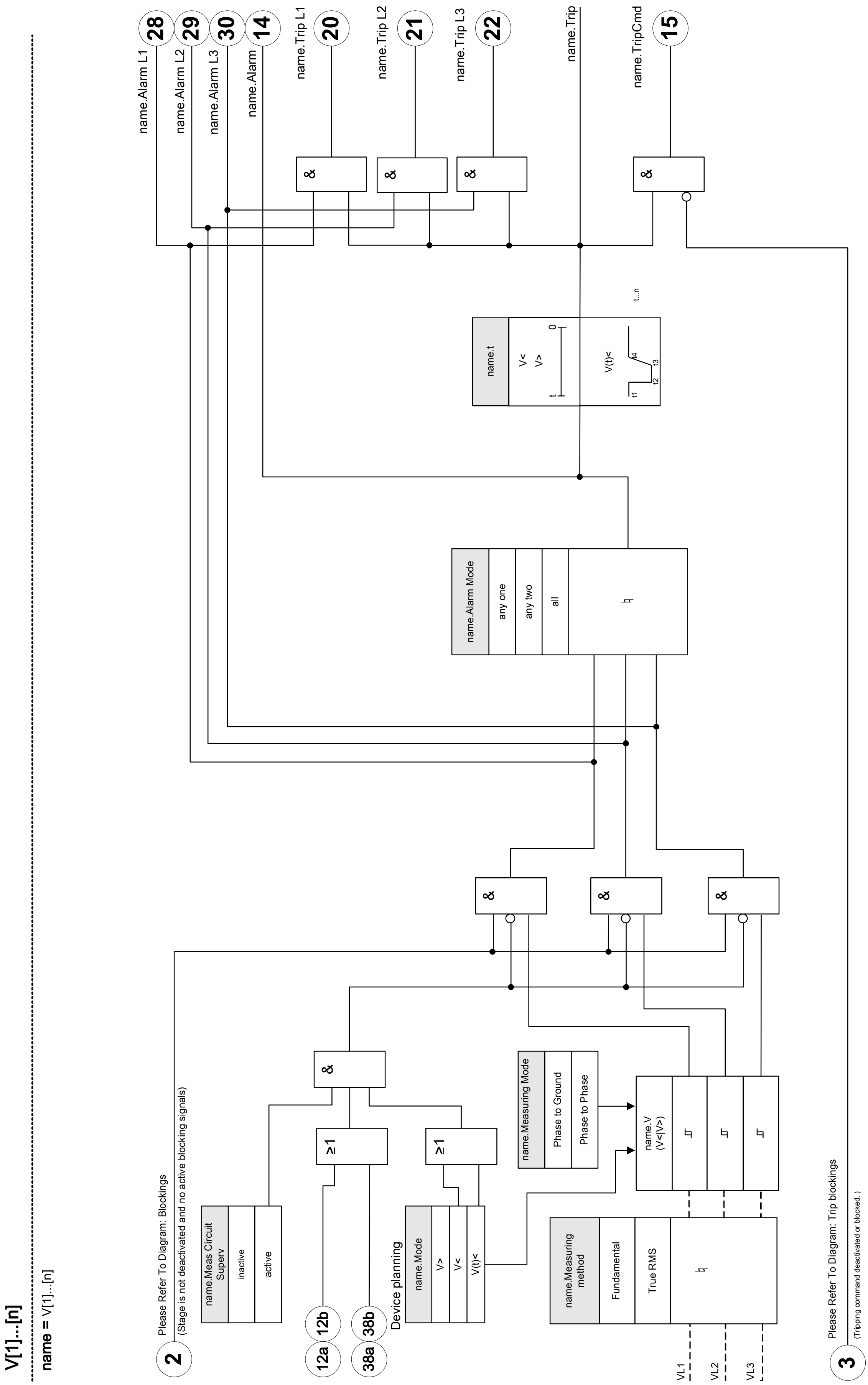
Measuring Method:

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

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.



V[1]...[n]
name = V[1]...[n]
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
Device planning
name.Mode
V>
V<
V(t)<
≥1
≥1
&
name.Measuring Mode
Phase to Ground
Phase to Phase
name.Measuring method
Fundamental
True RMS
name.V (V<|V>)
VL1
VL2
VL3
Please Refer To Diagram: Trip blockings
(Tripping command deactivated or blocked.)
3
name.Alarm Mode
any one
any two
all
name.t
V<
V>
t
0
V(t)<
t1
t2
t3
t4
t...n
name.Alarm L1
name.Alarm L2
name.Alarm L3
name.Alarm
name.Trip L1
name.Trip L2
name.Trip L3
name.Trip
name.TripCmd
28
29
30
14
20
21
22
15

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]]
ExBlo3	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, Trip Cmds	MStart.Blo-UnderV Start	[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 /<n> /V-Prot /V[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /V-Prot /V[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<n> /V-Prot /V[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo TripCmd Fc=active".	inactive, active	inactive	[Protection Para /<n> /V-Prot /V[1]]
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 /<n> /V-Prot /V[1]]
Measuring method	Measuring method: fundamental or rms	Fundamental, True RMS	V[1]: True RMS V[2]: True RMS V[3]: Fundamental V[4]: Fundamental V[5]: Fundamental V[6]: Fundamental	[Protection Para /<n> /V-Prot /V[1]]
Alarm Mode	Alarm criterion for the voltage protection stage.	any one, any two, all	any one	[Protection Para /<n> /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>	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 /<n> /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< Only available if: Device planning: V.Mode = V(t)<	0.01 - 1.50Vn	V[1]: 0.80Vn V[2]: 0.90Vn V[3]: 0.80Vn V[4]: 0.80Vn V[5]: 0.80Vn V[6]: 0.80Vn	[Protection Para /<n> /V-Prot /V[1]]
t	Tripping delay Only available if: Device planning: V.Mode = V> Or V<	0.00 - 300.00s	V[1]: 1s V[2]: 1.00s V[3]: 0.00s V[4]: 0.00s V[5]: 0.00s V[6]: 0.00s	[Protection Para /<n> /V-Prot /V[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Meas Circuit Superv	Measuring Circuit Supervision Only available if: Device planning: V.Mode = V(t)<	inactive, active	inactive	[Protection Para /<n> /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 = Vstart< Only available if: Device planning: V.Mode = Vstart<	0.01 - 1.50Vn	0.90Vn	[Protection Para /<n> /V-Prot /V[1]]
V(t)<1	Pickup value Only available if: Device planning: V.Mode = V(t)<	0.01 - 1.50Vn	0.01Vn	[Protection Para /<n> /V-Prot /V[1]]
t1	Tripping delay Only available if: Device planning: V.Mode = V(t)<	0.00 - 10.00s	0.00s	[Protection Para /<n> /V-Prot /V[1]]
V(t)<2	Pickup value Only available if: Device planning: V.Mode = V(t)<	0.01 - 1.50Vn	0.01Vn	[Protection Para /<n> /V-Prot /V[1]]
t2	Tripping delay Only available if: Device planning: V.Mode = V(t)<	0.00 - 10.00s	0.15s	[Protection Para /<n> /V-Prot /V[1]]
V(t)<3	Pickup value Only available if: Device planning: V.Mode = V(t)<	0.01 - 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 /<n> /V-Prot /V[1]]
t3	Tripping delay Only available if: Device planning: V.Mode = V(t)<	0.00 - 10.00s	0.15s	[Protection Para /<n> /V-Prot /V[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
V(t)<4	Pickup value Only available if: Device planning: V.Mode = V(t)<	0.01 - 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 /<n> /V-Prot /V[1]]
t4	Tripping delay Only available if: Device planning: V.Mode = V(t)<	0.00 - 10.00s	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 /<n> /V-Prot /V[1]]
V(t)<5	Pickup value Only available if: Device planning: V.Mode = V(t)<	0.01 - 1.50Vn	0.90Vn	[Protection Para /<n> /V-Prot /V[1]]
t5	Tripping delay Only available if: Device planning: V.Mode = V(t)<	0.00 - 10.00s	1.50s	[Protection Para /<n> /V-Prot /V[1]]
V(t)<6	Pickup value Only available if: Device planning: V.Mode = V(t)<	0.01 - 1.50Vn	0.90Vn	[Protection Para /<n> /V-Prot /V[1]]
t6	Tripping delay Only available if: Device planning: V.Mode = V(t)<	0.00 - 10.00s	3.00s	[Protection Para /<n> /V-Prot /V[1]]
V(t)<7	Pickup value Only available if: Device planning: V.Mode = V(t)<	0.01 - 1.50Vn	0.90Vn	[Protection Para /<n> /V-Prot /V[1]]
t7	Tripping delay Only available if: Device planning: V.Mode = V(t)<	0.00 - 10.00s	3.00s	[Protection Para /<n> /V-Prot /V[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
V(t)<8	Pickup value Only available if: Device planning: V.Mode = V(t)<	0.01 - 1.50Vn	0.90Vn	[Protection Para /<n> /V-Prot /V[1]]
t8	Tripping delay Only available if: Device planning: V.Mode = V(t)<	0.00 - 10.00s	3.00s	[Protection Para /<n> /V-Prot /V[1]]
V(t)<9	Pickup value Only available if: Device planning: V.Mode = V(t)<	0.01 - 1.50Vn	0.90Vn	[Protection Para /<n> /V-Prot /V[1]]
t9	Tripping delay Only available if: Device planning: V.Mode = V(t)<	0.00 - 10.00s	3.00s	[Protection Para /<n> /V-Prot /V[1]]
V(t)<10	Pickup value Only available if: Device planning: V.Mode = V(t)<	0.01 - 1.50Vn	0.90Vn	[Protection Para /<n> /V-Prot /V[1]]
t10	Tripping delay Only available if: Device planning: V.Mode = V(t)<	0.00 - 10.00s	3.00s	[Protection Para /<n> /V-Prot /V[1]]

Voltage Protection Module Input States

Name	*Description*	*Assignment via*
ExBlo1-I	Module input state: External blocking1	[Protection Para /Global Prot Para /V-Prot /V[1]]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /V-Prot /V[1]]

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

Voltage Protection Module Signals (Output States)

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

Counters of the Voltage Protection Module

Value	*Description*	*Default*	*Size*	*Menu path*
NumberOfAlarms	Number of alarms since last reset.	0	0 - 9999999999	[Operation /History /AlarmCr]
NumberOfTrips	Number of trips since last reset	0	0 - 9999999999	[Operation /History /TripCr]

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 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 103% of the trip value. At 103% of the trip value the relay is to fall back at the earliest.

VG, VX - Voltage Supervision [59N]

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.

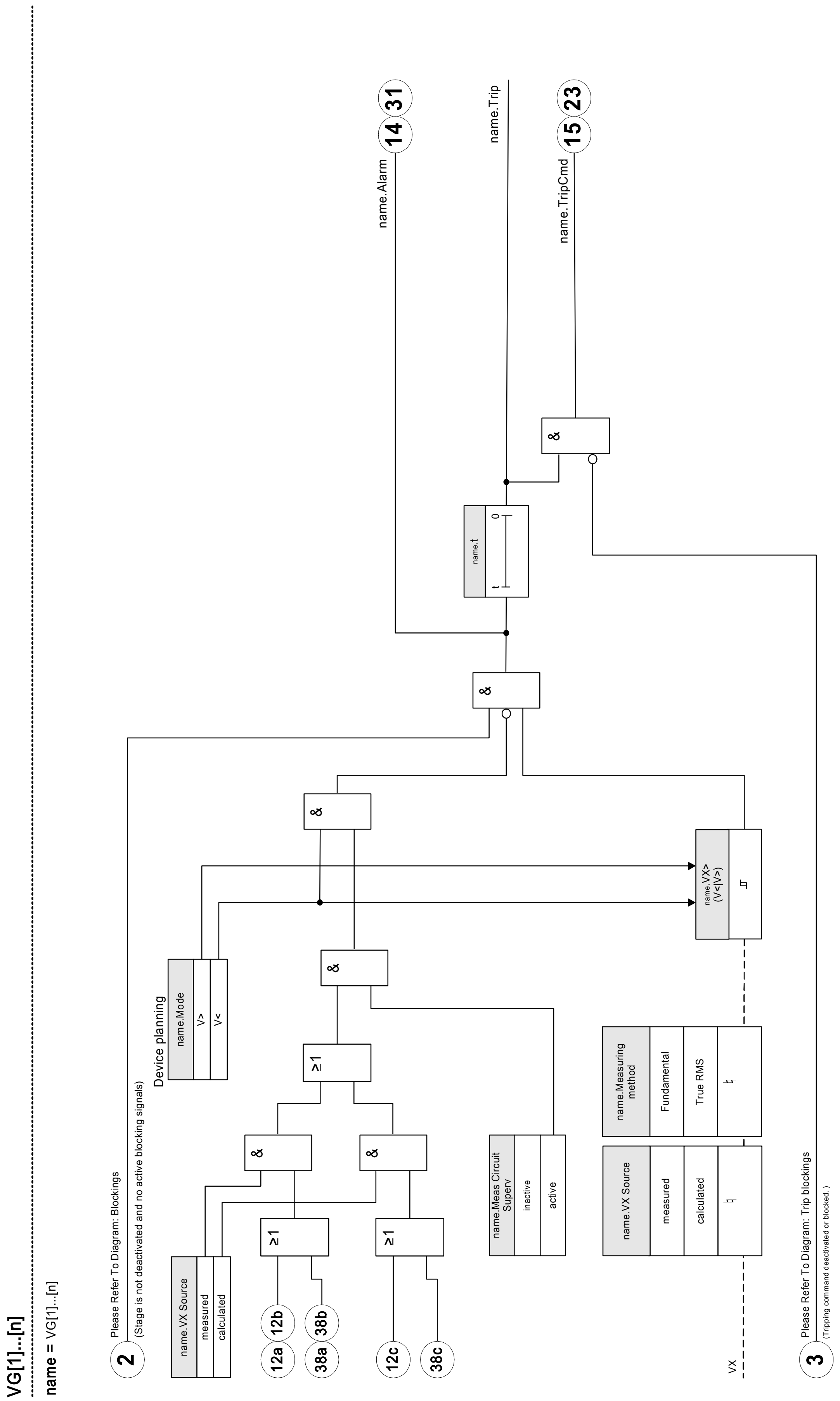
- Supervision of another (auxiliary) voltage against overvoltage or undervoltage.

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

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.


VG[1]...[n]
name = VG[1]...[n]
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
2
Device planning
name.Mode
V>
V<
name.VX Source
measured
calculated
12a
12b
38a
38b
12c
38c
≥1
≥1
&
&
≥1
&
&
&
&
name.Meas Circuit Superv
inactive
active
name.VX Source
measured
calculated
name.Measuring method
Fundamental
True RMS
name.VX>
(V<|V>)
VX
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.)
3

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]]
ExBlo3	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, Trip Cmds	MStart.Blo-UnderV Start	[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 /<n> /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 /<n> /V-Prot /VG[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<n> /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 /<n> /V-Prot /VG[1]]
VX Source	Selection if VG is measured or calculated (neutral voltage or residual voltage)	measured, calculated	measured	[Protection Para /<n> /V-Prot /VG[1]]
Measuring method	Measuring method: fundamental or rms	Fundamental, True RMS	True RMS	[Protection Para /<n> /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 /<n> /V-Prot /VG[1]]
VG<	Undervoltage Threshold Only available if: Device planning: VG.Mode = V<	0.01 - 1.50Vn	0.8Vn	[Protection Para /<n> /V-Prot /VG[1]]
t	Tripping delay	0.00 - 300.00s	VG[1]: 5s VG[2]: 0.00s	[Protection Para /<n> /V-Prot /VG[1]]
Meas Circuit Superv	Measuring Circuit Supervision	inactive, active	inactive	[Protection Para /<n> /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)

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

Counters of the Residual Voltage Supervision Module

Value	*Description*	*Default*	*Size*	*Menu path*
NumberOfAlarms	Number of alarms since last reset.	0	0 - 9999999999	[Operation /History /AlarmCr]
NumberOfTrips	Number of trips since last reset	0	0 - 9999999999	[Operation /History /TripCr]

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.

V 012 – Voltage Asymmetry [47]

Available elements:
V 012 [1] ,V 012 [2] ,V 012 [3] ,V 012 [4] ,V 012 [5] ,V 012 [6]

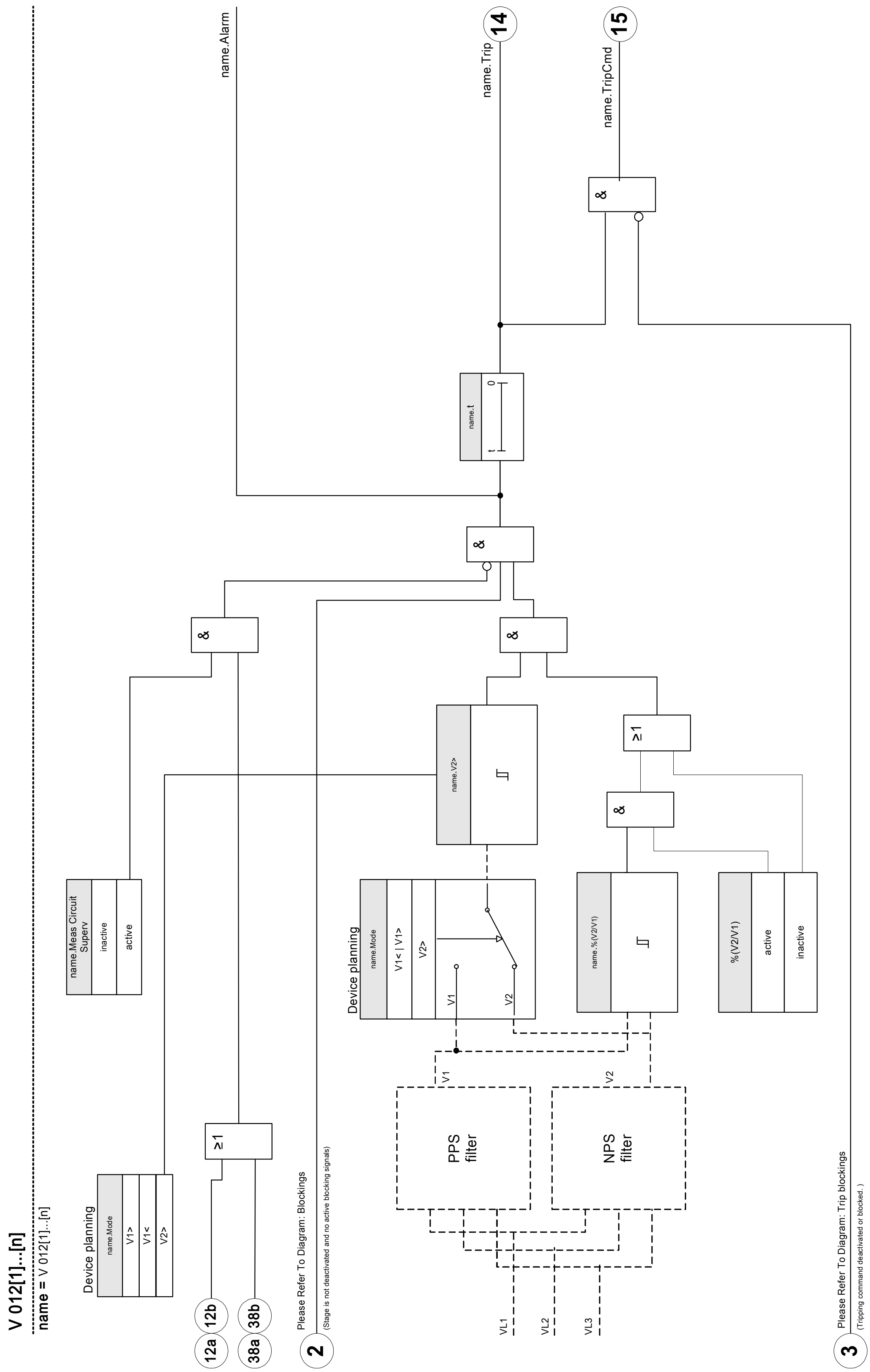
Within the Device planning menu this module can be projected in order to supervise the positive phase sequence voltage for over- or undervoltage or the negative phase sequence system for overvoltage. This module is based on the 3-phase voltages.

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	-


V 012[1]...[n]
name = V 012[1]...[n]
Device planning
name.Mode
V1>
V1<
V2>
12a
12b
38a
38b
≥1
name.Meas Circuit Superv
inactive
active
&
2
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
name.Alarm
PPS filter
NPS filter
V1
V2
VL1
VL2
VL3
Device planning
name.Mode
V1< | V1>
V2>
name.V2>
name.%(V2/V1)
%(V2/V1)
active
inactive
&
≥1
&
&
name.t
t
0
name.Trip
14
&
name.TripCmd
15
3
Please Refer To Diagram: Trip blockings
(Tripping command deactivated or blocked.)

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 /V 012 [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 /V 012 [1]]
ExBlo3	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.3	1..n, Trip Cmds	MStart.Blo-VUnbal Start	[Protection Para /Global Prot Para /V-Prot /V 012 [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 012 [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 /<n> /V-Prot /V 012 [1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /V-Prot /V 012 [1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<n> /V-Prot /V 012 [1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo TripCmd Fc=active".	inactive, active	inactive	[Protection Para /<n> /V-Prot /V 012 [1]]
V1>	Positive Phase Sequence Overvoltage Only available if: Device planning: V 012.Mode = V1>	0.01 - 1.50Vn	1.00Vn	[Protection Para /<n> /V-Prot /V 012 [1]]
V1<	Positive Phase Sequence Undervoltage Only available if: Device planning: V 012.Mode = V1<	0.01 - 1.50Vn	1.00Vn	[Protection Para /<n> /V-Prot /V 012 [1]]
V2>	Negative Phase Sequence Overvoltage Only available if: Device planning: V 012.Mode = V2>	0.01 - 1.50Vn	1.00Vn	[Protection Para /<n> /V-Prot /V 012 [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 /<n> /V-Prot /V 012 [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. Only available if: %(V2/V1) = use	2 - 40%	20%	[Protection Para /<n> /V-Prot /V 012 [1]]
t	Tripping delay	0.00 - 300.00s	0.00s	[Protection Para /<n> /V-Prot /V 012 [1]]
Meas Circuit Superv	Measuring Circuit Supervision	inactive, active	inactive	[Protection Para /<n> /V-Prot /V 012 [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 /V 012 [1]]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /V-Prot /V 012 [1]]
ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command	[Protection Para /Global Prot Para /V-Prot /V 012 [1]]

Signals of the Asymmetry Module (States of the Outputs)

Name	Description
active	Signal: active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Alarm	Signal: Alarm voltage asymmetry
Trip	Signal: Trip
TripCmd	Signal: Trip Command

Counters of the Asymmetry Module

Value	Description	Default	Size	Menu path
NumberOfAlarms	Number of alarms since last reset.	0	0 - 9999999999	[Operation /History /AlarmCr]
NumberOfTrips	Number of trips since last reset	0	0 - 9999999999	[Operation /History /TripCr]

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.

PQS - Power [32, 37]

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

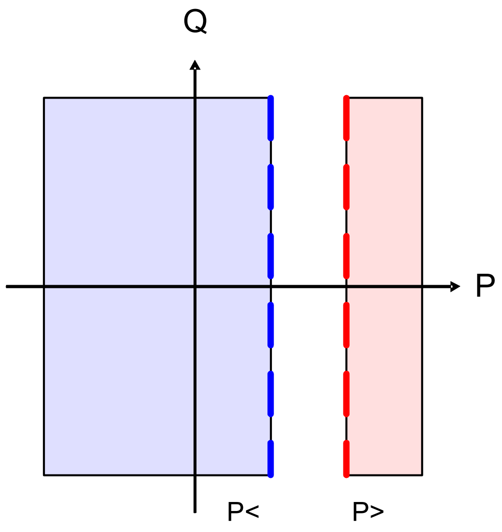
Each of the elements can be used as P<, P>, Pr>, Q<, Q>, Qr>, S< or S> within the device planning.

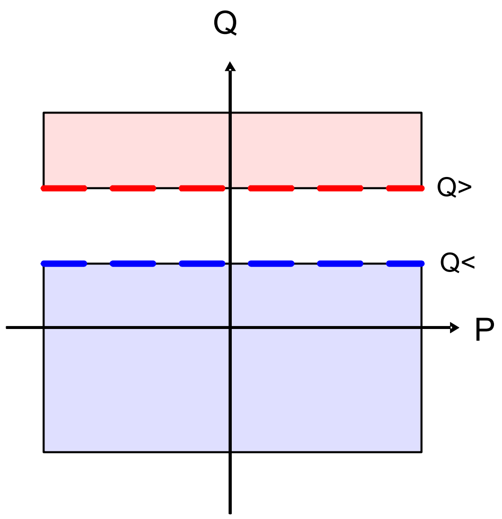
P< and P> are settable and effective in positive active power range, Q< and Q> in positive reactive power range. These modes are used for protecting against underload or overload in positive power direction.

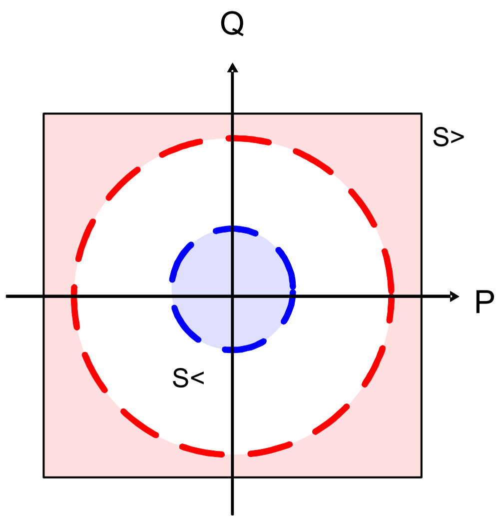
The apparent power makes S< or S> effective like a circle in all power quadrants. Protection is against underload and overload.

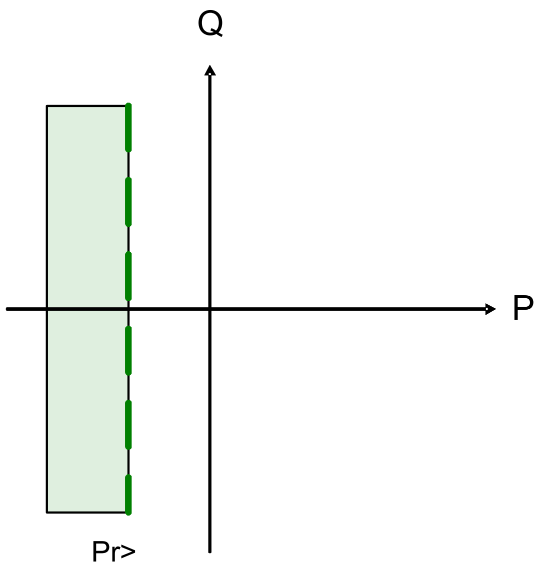
In reverse mode, Pr> is effective in negative active power range and Qr> in negative reactive power range. Both modes protect against power direction reversing from positive into negative direction.

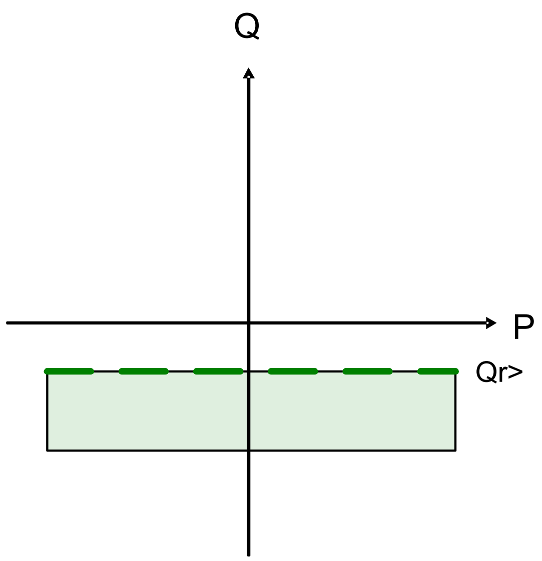
The following graphics show the areas that are protected by the corresponding modes.

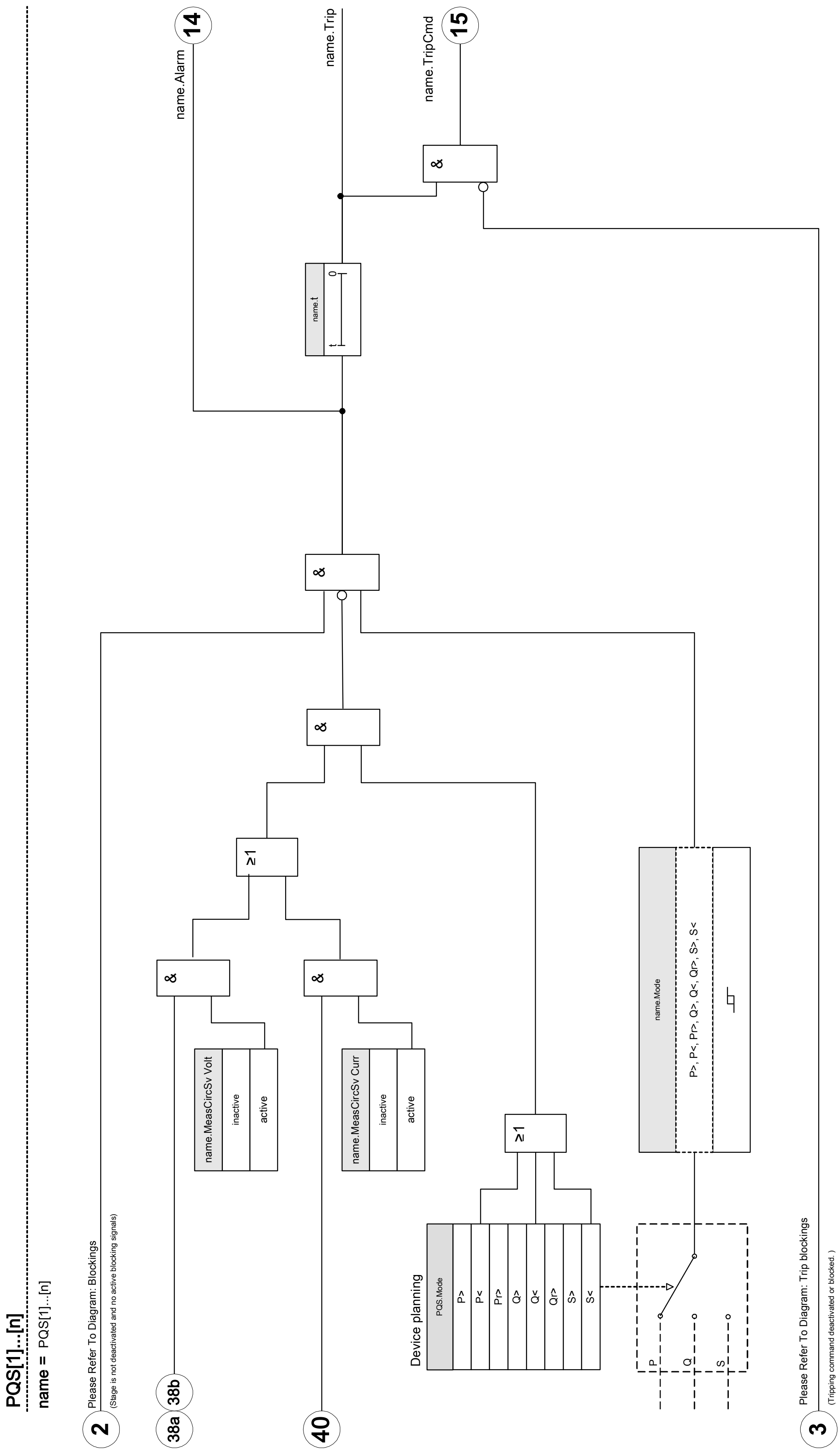

Q
P
P<
P>


Q
Q>
Q<
P


Q
S>
P
S<


Q
P
Pr>


Q
P
Qr>


PQS[1]...[n]
name = PQS[1]...[n]
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
2
38a
38b
40
name.MeasCircSv Volt
inactive
active
name.MeasCircSv Curr
inactive
active
&
≥1
Device planning
PQS.Mode
P>
P<
Pr>
Q>
Q<
Qr>
S>
S<
P
Q
S
name.Mode
P>, P<, Pr>, Q>, Q<, Qr>, S>, S<
name.t
t
0
name.Alarm
14
name.Trip
name.TripCmd
15
Please Refer To Diagram: Trip blockings
(Tripping command deactivated or blocked.)
3

Device Planning Parameters of the Power Protection Module

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, P>, P<, Pr>, Q>, Q<, Qr>, S>, S<	PQS [1]: P> PQS [2]: do not use PQS [3]: do not use PQS [4]: do not use PQS [5]: do not use PQS [6]: do not use	[Device planning]

Global Protection Parameters of the Power 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 /P-Prot /PQS [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 /P-Prot /PQS [1]]
ExBlo3	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, BloStart	Mstart.Blo-PowerStart	Protection Para /Global Prot Para /P-Prot /PQS [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 /P-Prot /PQS [1]]

Parameter Set Parameters of the Power Protection Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	PQS [1]: active PQS [2]: inactive PQS [3]: inactive PQS [4]: inactive PQS [5]: inactive PQS [6]: inactive	[Protection Para /<n> /P-Prot /PQS [1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /P-Prot /PQS [1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<n> /P-Prot /PQS [1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo TripCmd Fc=active".	inactive, active	inactive	[Protection Para /<n> /P-Prot /PQS [1]]
MeasCircSv Volt	Measuring Circuit Supervision Voltage Only available if: Device planning: PQS.Mode = P< Only available if: Device planning: PQS.Mode = Q< Only available if: Device planning: PQS.Mode = S<	inactive, active	inactive	[Protection Para /<n> /P-Prot /PQS [1]]
MeasCircSv Curr	Measuring Circuit Supervision Curent Only available if: Device planning: PQS.Mode = P< Only available if: Device planning: PQS.Mode = Q< Only available if: Device planning: PQS.Mode = S<	inactive, active	inactive	[Protection Para /<n> /P-Prot /PQS [1]]
P>	Over(load) Active Power Pickup Value. Can be used for monitoring the maximum allowed forward power limits of transformers or overhead lines. Definition for Sn is as follows: Sn = SQRT(3) * VT secondary rating * CT secondary rating (I=1/5A) for wye or Sn = 3 * VT secondary rating/SQRT(3) * CT secondary rating (I=1/5A) for delta connections. Only available if: Device planning: PQS.Mode = P>	0.02 - 10.00Sn	PQS [1]: 1.0Sn PQS [2]: 1.20Sn PQS [3]: 1.20Sn PQS [4]: 1.20Sn PQS [5]: 1.20Sn PQS [6]: 1.20Sn	[Protection Para /<n> /P-Prot /PQS [1]]

Parameter	Description	Setting range	Default	Menu path
P<	Under(load) Active Power Pickup Value (e.g. caused by idling motors). Definition for Sn is as follows: Sn = SQRT(3) * VT secondary rating * CT secondary rating (I=1/5A) for wye or Sn = 3 * VT secondary rating/SQRT(3) * CT secondary rating (I=1/5A) for delta connections. Only available if: Device planning: PQS.Mode = P<	0.02 - 10.00Sn	0.80Sn	[Protection Para /<n> /P-Prot /PQS [1]]
Pr>	Over Reverse Definition for Sn is as follows: Sn = SQRT(3) * VT secondary rating * CT secondary rating (I=1/5A) for wye or Sn = 3 * VT secondary rating/SQRT(3) * CT secondary rating (I=1/5A) for delta connections.	0.02 - 10.00Sn	1.20Sn	[Protection Para /<n> /P-Prot /PQS [1]]
Pr<	Under Reverse Definition for Sn is as follows: Sn = SQRT(3) * VT secondary rating * CT secondary rating (I=1/5A) for wye or Sn = 3 * VT secondary rating/SQRT(3) * CT secondary rating (I=1/5A) for delta connections.	0.02 - 10.00Sn	0.80Sn	[Protection Para /<n> /P-Prot /PQS [1]]
Pr>	Overload Reverse Active Power Pickup Value. Protection against reverse feeding into the power supply network. Definition for Sn is as follows: Sn = SQRT(3) * VT secondary rating * CT secondary rating (I=1/5A) for wye or Sn = 3 * VT secondary rating/SQRT(3) * CT secondary rating (I=1/5A) for delta connections. Only available if: Device planning: PQS.Mode = Pr>	0.003 - 1.000Sn	0.020Sn	[Protection Para /<n> /P-Prot /PQS [1]]
Q>	Over(load) Reactive Power Pickup Value. Monitoring the maximum allowed reactive power of the electrical equipment like transformers or overhead lines). If the maximum value is exceeded a condensator bank could be switched off. Definition for Sn is as follows: Sn = SQRT(3) * VT secondary rating * CT secondary rating (I=1/5A) for wye or Sn = 3 * VT secondary rating/SQRT(3) * CT secondary rating (I=1/5A) for delta connections. Only available if: Device planning: PQS.Mode = Q>	0.02 - 10.00Sn	1.20Sn	[Protection Para /<n> /P-Prot /PQS [1]]
Q<	Under(load) Reactive Power Pickup Value. Monitoring the minimum value of the reactive power. If it falls below the set value a condensator bank could be switched on. Definition for Sn is as follows: Sn = SQRT(3) * VT secondary rating * CT secondary rating (I=1/5A) for wye or Sn = 3 * VT secondary rating/SQRT(3) * CT secondary rating (I=1/5A) for delta connections. Only available if: Device planning: PQS.Mode = Q<	0.02 - 10.00Sn	0.80Sn	[Protection Para /<n> /P-Prot /PQS [1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Qr>	Over Reverse Definition for Sn is as follows: Sn = SQRT(3) * VT secondary rating * CT secondary rating (I=1/5A) for wye or Sn = 3 * VT secondary rating/SQRT(3) * CT secondary rating (I=1/5A) for delta connections.	0.02 - 10.00Sn	1.20Sn	[Protection Para /<n> /P-Prot /PQS [1]]
Qr<	Under Reverse Definition for Sn is as follows: Sn = SQRT(3) * VT secondary rating * CT secondary rating (I=1/5A) for wye or Sn = 3 * VT secondary rating/SQRT(3) * CT secondary rating (I=1/5A) for delta connections.	0.02 - 10.00Sn	0.80Sn	[Protection Para /<n> /P-Prot /PQS [1]]
Qr>	Overload Reverse Reactive Power Pickup Value Definition for Sn is as follows: Sn = SQRT(3) * VT secondary rating * CT secondary rating (I=1/5A) for wye or Sn = 3 * VT secondary rating/SQRT(3) * CT secondary rating (I=1/5A) for delta connections. Only available if: Device planning: PQS.Mode = Qr>	0.003 - 1.000Sn	0.020Sn	[Protection Para /<n> /P-Prot /PQS [1]]
S>	Over(load) Apparent Power Pickup Value Definition for Sn is as follows: Sn = SQRT(3) * VT secondary rating * CT secondary rating (I=1/5A) for wye or Sn = 3 * VT secondary rating/SQRT(3) * CT secondary rating (I=1/5A) for delta connections. Only available if: Device planning: PQS.Mode = S>	0.02 - 10.00Sn	1.20Sn	[Protection Para /<n> /P-Prot /PQS [1]]
S<	Under(load) Apparent Power Pickup Value Definition for Sn is as follows: Sn = SQRT(3) * VT secondary rating * CT secondary rating (I=1/5A) for wye or Sn = 3 * VT secondary rating/SQRT(3) * CT secondary rating (I=1/5A) for delta connections. Only available if: Device planning: PQS.Mode = S<	0.02 - 10.00Sn	0.80Sn	[Protection Para /<n> /P-Prot /PQS [1]]
t	Tripping delay	0.00 - 1100.00s	PQS [1]: 1.00s PQS [2]: 0.01s PQS [3]: 0.01s PQS [4]: 0.01s PQS [5]: 0.01s PQS [6]: 0.01s	[Protection Para /<n> /P-Prot /PQS [1]]
PowMeasMethod	Determines if the active power, reactive power and apparent power are calculated on the basis of RMS or DFT.	Fundamental TrueRMS	Fundamental	[Protection Para /<n> /P-Prot /PQS [1]]

States of the Inputs of the Power Protection Module

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

Signals of the Power Protection Module (States of the Outputs)

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

Counters of the Power Protection Module

Value	*Description*	*Default*	*Size*	*Menu path*
NumberOfAlarms	Number of alarms since last reset.	0	0 - 9999999999	[Operation /History /AlarmCr]
NumberOfTrips	Number of trips since last reset	0	0 - 9999999999	[Operation /History /TripCr]

Commissioning Examples for the Power Protection Module

Object to be tested:

Testing the projected Power Protection Modules.

- P>
- P<
- Pr
- Q>
- Q<
- Qr
- S>
- S<

Necessary means:

- 3-phase AC voltage source
- 3-phase AC current source
- Timer

Procedure – Testing the wiring:

- Feed rated voltage and rated current to the measuring inputs of the relay.
- Adjust the current pointers 30° lagging to the voltage pointers.
- The following measuring values have to be shown:
  P=0.86 Pn
  Q=0.5 Qn
  S=1 Sn

NOTICE **If the measured values are shown with a negative (algebraic) sign check the wiring.**

NOTICE

The examples shown within this chapter have to be carried out with the tripping values and tripping delays that apply to your switchboard.

If you are testing „greater than thresholds“ (e.g. P>) start by 80% of the tripping value and increase the object to be tested until the relay picks up.

In case that you are testing „less than thresholds“ (e.g. P<) start by 120% of the tripping value and reduce the object to be tested until the relay picks up.

If you are testing tripping delays of „greater than“ modules (e.g. P>) start a timer simultaneously with an abrupt change of the object to be tested from 80% of the tripping value to 120% of the tripping value.

If you are testing tripping delays of „less than“ modules (e.g. P<) start a timer simultaneously with an abrupt change of the object to be tested from 120% of the tripping value to 80% of the tripping value.

NOTICE

P>

Testing the threshold values (Example, Threshold 1.1 Pn)

- Feed rated voltage and 0.9 times rated current in phase to the measuring inputs of the relay (PF=1).
- The measured values for the active power „P“ must show a positive algebraic sign.
- Set the tripping threshold (e.g. 1.1 Pn).
- In order to test the tripping thresholds feed 0.9 times rated current to the measuring inputs of the relay. Increase the current slowly until the relay picks up. Ensure that the angle between current and voltage remains constant. Compare the tripping value to the parameterized.

Testing the tripping delay (Example, Threshold 1.1 Pn)

- Feed rated voltage and rated current in phase to the measuring inputs of the relay (PF=1).
- The measured values for the active power „P“ must show a positive algebraic sign.
- Set the tripping threshold (e.g. 1.1 Pn).
- In order to test the tripping delay feed 0.9 times rated current to the measuring inputs of the relay. Increase the current with an abrupt change to 1.2 In. Ensure that the angle between current and voltage remains constant. Measure the tripping delay at the output of the relay.

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

NOTICE

Q>
Testing the threshold values (Example, Threshold 1,1 Qn)

- Feed rated voltage and 0.9 times rated current (90° phase shift) to the measuring inputs of the relay (PF=0).
- The measured values for the active power „Q“ must show a positive algebraic sign.
- Set the tripping threshold (e.g. 1.1 Qn).
- In order to test the tripping thresholds feed 0.9 times rated current to the measuring inputs of the relay. Increase the current slowly until the relay picks up. Ensure that the angle between current and voltage remains constant. Compare the tripping value to the parameterized.

Testing the tripping delay (Example, Threshold 1.1 Qn)

- Feed rated voltage and rated current (90° phase shift) to the measuring inputs of the relay (PF=0).
- The measured values for the active power „Q“ must show a positive algebraic sign.
- Set the tripping threshold (e.g. 1.1 Qn).
- In order to test the tripping delay feed 0.9 times rated current to the measuring inputs of the relay. Increase the current with an abrupt change to 1.2 In. Ensure that the angle between current and voltage remains constant. Measure the tripping delay at the output of the relay.

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

NOTICE

P<

Testing the threshold values (Example, Threshold 0.3 Pn)

- Feed rated voltage and rated current in phase to the measuring inputs of the relay (PF=1).
- The measured values for the active power „P“ must show a positive algebraic sign.
- Set the tripping threshold (e.g. 0.3 Pn).
- In order to test the tripping thresholds feed 0.5 times rated current to the measuring inputs of the relay. Reduce the current slowly until the relay picks up. Ensure that the angle between current and voltage remains constant. Compare the tripping value to the parameterized.

Testing the tripping delay (Example, Threshold 0.3 Pn)

- Feed rated voltage and rated current in phase to the measuring inputs of the relay (PF=1).
- The measured values for the active power „P“ must show a positive algebraic sign.
- Set the tripping threshold (e.g. 0.3 Pn).
- In order to test the tripping delay feed 0.5 times rated current to the measuring inputs of the relay. Increase the current with an abrupt change to 0.2 In. Ensure that the angle between current and voltage remains constant. Measure the tripping delay at the output of the relay.

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

NOTICE

Q<
Testing the threshold values (Example, Threshold 0.3 Qn)

- Feed rated voltage and 0.9 times rated current (90° phase shift) to the measuring inputs of the relay (PF=0).
- The measured values for the active power „Q“ must show a positive algebraic sign.
- Set the tripping threshold (e.g. 0.3 Qn).
- In order to test the tripping thresholds feed 0.5 times rated current to the measuring inputs of the relay. Reduce the current slowly until the relay picks up. Ensure that the angle between current and voltage remains constant. Compare the tripping value to the parameterized.

Testing the tripping delay (Example, Threshold 0.3 Qn)

- Feed rated voltage and 0.9 times rated current (90° phase shift) to the measuring inputs of the relay (PF=0).
- The measured values for the active power „Q“ must show a positive algebraic sign.
- Set the tripping threshold (e.g. 0.3 Qn).
- In order to test the tripping delay feed 0.5 times rated current to the measuring inputs of the relay. Increase the current with an abrupt change to 0.2 In. Ensure that the angle between current and voltage remains constant. Measure the tripping delay at the output of the relay.

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

NOTICE

Pr

Testing the threshold values (Example, Threshold 0.2 Pn)

- Feed rated voltage and rated current with 180 degree phase shift between voltage and current pointers to the measuring inputs of the relay.
- The measured values for the active power „P“ must show a negative algebraic sign.
- Set the tripping threshold (e. g. 0.2 Pn).
- In order to test the tripping thresholds feed 0.1 times rated current to the measuring inputs of the relay. Increase the current slowly until the relay picks up. Ensure that the angle between current and voltage remains constant. Compare the tripping value to the parameterized.

Testing the tripping delay (Example, Threshold 0.2 Pn)

- Feed rated voltage and rated current with 180 degree phase shift between voltage and current pointers to the measuring inputs of the relay.
- The measured values for the active power „P“ must show a negative algebraic sign.
- Set the tripping threshold (e.g. 0.2 Pn).
- In order to test the tripping delay feed 0.1 times rated current to the measuring inputs of the relay. Increase the current with an abrupt change to 0.3 In. Ensure that the angle between current and voltage remains constant. Measure the tripping delay at the output of the relay.

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

NOTICE

Qr

Testing the threshold values (Example, Threshold 0.2 Qn)

- Feed rated voltage and rated current with -90 degree phase shift between voltage and current pointers to the measuring inputs of the relay.
- The measured values for the active power „Q“ must show a negative algebraic sign.
- Set the tripping threshold (e. g. 0.2 Qn).
- In order to test the tripping delay feed 0.1 times rated current to the measuring inputs of the relay. Increase the current slowly until the relay picks up. Ensure that the angle between current and voltage remains constant. Measure the tripping delay at the output of the relay.

Testing the tripping delay (Example, Threshold 0.2 Qn)

- Feed rated voltage and rated current with -90 degree phase shift between voltage and current pointers to the measuring inputs of the relay.
- The measured values for the active power „Q“ must show a negative algebraic sign.
- Set the tripping threshold (e. g. 0.2 Qn).
- In order to test the tripping thresholds feed 0.1 times rated current to the measuring inputs of the relay. Increase the current with an abrupt change to 0.3 In. Ensure that the angle between current and voltage remains constant. Compare the tripping value to the parameterized.

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

NOTICE

S>

Testing the threshold values

- Feed 80% of the S> threshold to the measuring inputs of the relay.
- Increase the fed power slowly until the relay picks up. Compare the measured value at the time of tripping to the parameterized setting.

Testing the tripping delay

- Feed 80% of the S> threshold to the measuring inputs of the relay.
- Increase the fed power with an abrupt change to 120% of the S> threshold. Measure the tripping delay at the output of the relay.

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

NOTICE

S<

Testing the threshold values

- Feed 120% of the S< threshold to the measuring inputs of the relay.
- Reduce the fed power slowly until the relay picks up. Compare the measured value at the time of tripping to the parameterized setting.

Testing the tripping delay

- Feed 120% of the S< threshold to the measuring inputs of the relay.
- Reduce the fed power with an abrupt change to 80% of the S< threshold. Measure the tripping delay at the output of the relay.

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

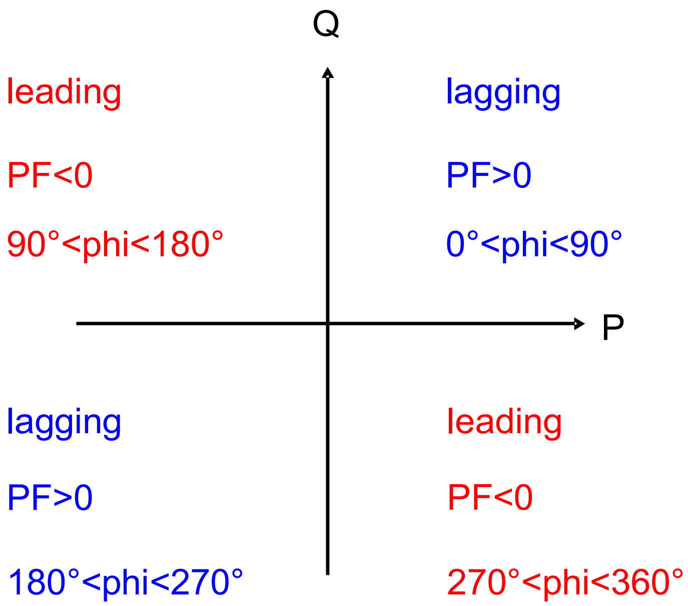
PF - Power Factor [55]

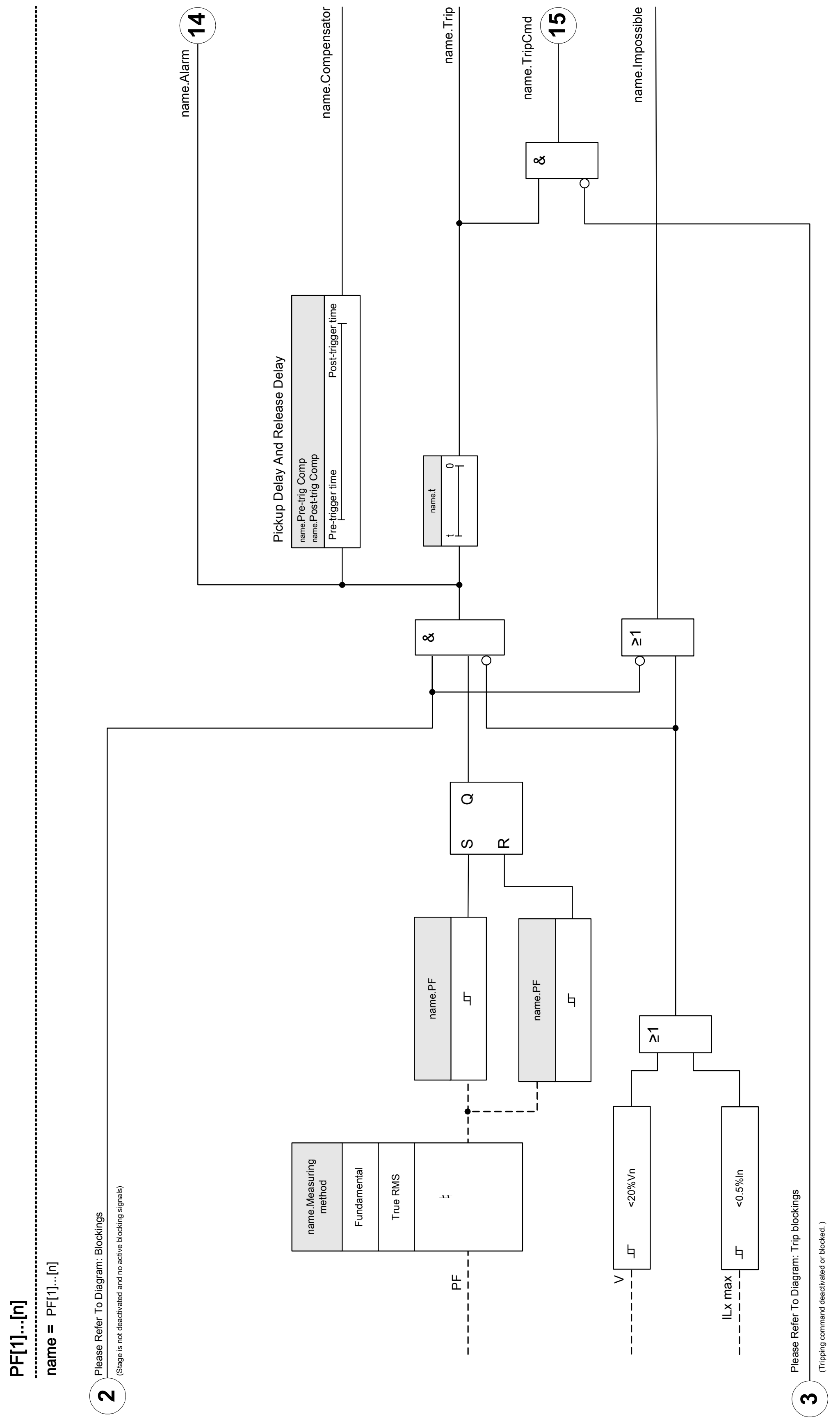
Available stages:
PF[1] ,PF[2]

These Element supervises the Power Factor within a defined area (limits).

The area is defined by four parameters.

- The Trigger quadrant (lead or lag).
- The Threshold (Power Factor value)
- The Reset quadrant (lead or lag).
- The Reset Value (Power Factor value)




PF[1]...[n]
name = PF[1]...[n]
2
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
PF
V
ILx max
name.Measuring method
Fundamental
True RMS
<20%Vn
<0.5%In
≥1
name.PF
name.PF
S
R
Q
&
≥1
name.t
t
0
Pickup Delay And Release Delay
name.Pre-trig Comp
name.Post-trig Comp
Pre-trigger time
Post-trigger time
&
name.Alarm
14
name.Compensator
name.Trip
name.TripCmd
15
name.Impossible
3
Please Refer To Diagram: Trip blockings
(Tripping command deactivated or blocked.)

Device Planning Parameters of the Power Factor Module

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

Global Protection Parameter of the Power Factor 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 /PF-Prot /PF[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 /PF-Prot /PF[1]]
ExBlo3	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, Start Blo	MStart.Blo-PFacStart	[Protection Para /Global Prot Para /I-Prot /PF[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 /PF-Prot /PF[1]]

Parameter Set Parameters of the Power Factor Module

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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<n> /PF-Prot /PF[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo TripCmd Fc=active".	inactive, active	inactive	[Protection Para /<n> /PF-Prot /PF[1]]
Measuring method	Measuring method: fundamental or rms	Fundamental, True RMS	Fundamental	[Protection Para /<n> /PF-Prot /PF[1]]
Trig Mode	Trigger Mode. Should the Module be triggered if the Current Phasor is leading to the Voltage Phasor = Lead? Or should the Module be triggered if the Current Phasor is lagging to the Voltage Phasor = Lag?	leading, lagging	lagging	[Protection Para /<n> /PF-Prot /PF[1]]
Trigger-PF	This is the power factor where the relay will pick-up.	0.5 - 0.99	0.8	[Protection Para /<n> /PF-Prot /PF[1]]
Res Mode	Trigger Mode. Should the Module be triggered if the Current Phasor is leading to the Voltage Phasor = Lead? Or should the Module be triggered if the Current Phasor is lagging to the Voltage Phasor = Lag?	leading, lagging	leading	[Protection Para /<n> /PF-Prot /PF[1]]
Reset-PF	This setting is the power factor, at which the relay will reset the power factor trip. It is like setting a hysteresis for the Trigger setting.	0.5 - 0.99	0.99	[Protection Para /<n> /PF-Prot /PF[1]]
t	Tripping delay	0.00 - 300.00s	0.00s	[Protection Para /<n> /PF-Prot /PF[1]]
Pre-trig Comp	Pickup (Pre-trigger) time for the Compensation Signal. When this timer is elapsed the compensation signal will be activated.	0.00 - 300.00s	5.00s	[Protection Para /<n> /PF-Prot /PF[1]]

Parameter	Description	Setting range	Default	Menu path
Post-trig Comp	Post-trigger time of the Compensation Signal. When this timer is elapsed the compensation signal will be deactivated.	0.00 - 300.00s	5.00s	[Protection Para /<n> /PF-Prot /PF[1]]

States of the Inputs of the Power Factor Module

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

Signals of the Power Factor Module (States of the Outputs)

Name	Description
active	Signal: active
ExBlo	Signal: External Blocking
Blo TripCmd	Signal: Trip Command blocked
ExBlo TripCmd	Signal: External Blocking of the Trip Command
Alarm	Signal: Alarm Power Factor
Trip	Signal: Trip Power Factor
TripCmd	Signal: Trip Command
Compensator	Signal: Compensation Signal
Impossible	Signal: Alarm Power Factor Impossible

Counters of the Power Factor Module

Value	*Description*	*Default*	*Size*	*Menu path*
NumberOfAlarms	Number of alarms since last reset.	0	0 - 9999999999	[Operation /History /AlarmCr]
NumberOfTrips	Number of trips since last reset	0	0 - 9999999999	[Operation /History /TripCr]

Commissioning: Power Factor [55]

Object to be tested:

- Testing the projected Power Factor Modules

Necessary means:

- 3-phase AC voltage source
- 3-phase AC current source
- Timer

Procedure – Testing the wiring:

- Feed rated voltage and rated current to the measuring inputs of the relay.
- Adjust the current pointers 30° lagging to the voltage pointers.
- The following measuring values have to be shown:
  P=0.86 Pn
  Q=0.5 Qn
  S=1 Sn

NOTICE **If the measured values are shown with a negative (algebraic) sign check the wiring.**

NOTICE **In this example PF-Trigger is set to 0.86 = 30° (lagging) and PF-Reset is set to 0.86 = 30° leading.**

Carry out the test with the settings (trigger and reset) that fit to your switchboard.

Testing the threshold values (Trigger) (PF Trigger: Example = 0.86 lagging):

- Feed rated voltage and rated current in phase to the measuring inputs of the relay (PF=1).
- Adjust the angle between voltage and current (current pointer lagging) until the relay picks up.
- Write down the pickup value.

Testing the Reset (PF Reset: Example = 0.86 leading):

- Reduce the angle between voltage and current beyond PF = 1 (current pointer leading) until the alarm drops off.
- Write down the reset value.

Testing the trip delay (PF Trigger: Example = 0.86 lagging):

- Feed rated voltage and rated current in phase to the measuring inputs of the relay (PF=1).
- Adjust the angle between voltage and current (current pointer lagging) with an abrupt change to PF = 0.707 (45°) lagging.
- Measure the tripping delay at the output of the relay. Compare the measured tripping time to the parameterized.

Successful test result:

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

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

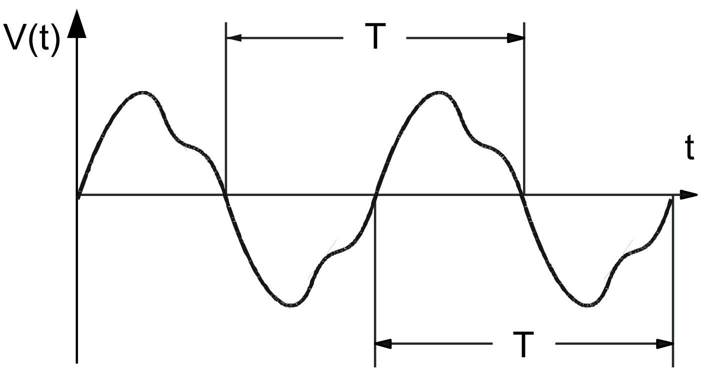
Available elements:
f[1] ,f[2] ,f[3] ,f[4] ,f[5] ,f[6]

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

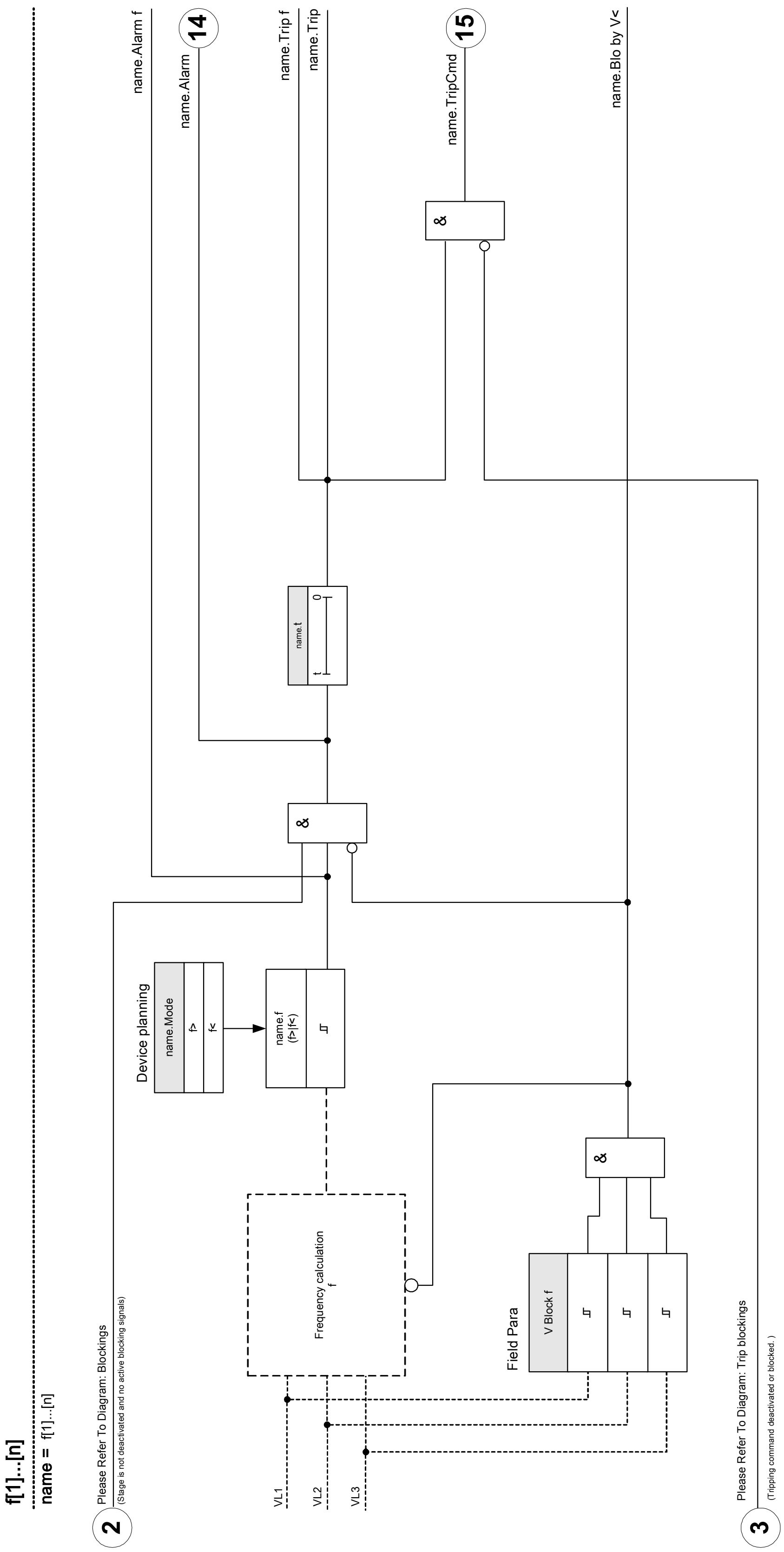
This protection element provides a pickup threshold and a tripping delay. If the frequency exceeds the set pickup threshold, an alarm will be issued instantaneously. If the frequency remains above the set tripping pickup until the tripping delay has elapsed, a tripping command will be issued.

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 phase voltages »*VL1*«, »*VL2*« and »*VL3*«. If all of the three phase voltages are below 15% Vn, the frequency calculation is blocked. 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:

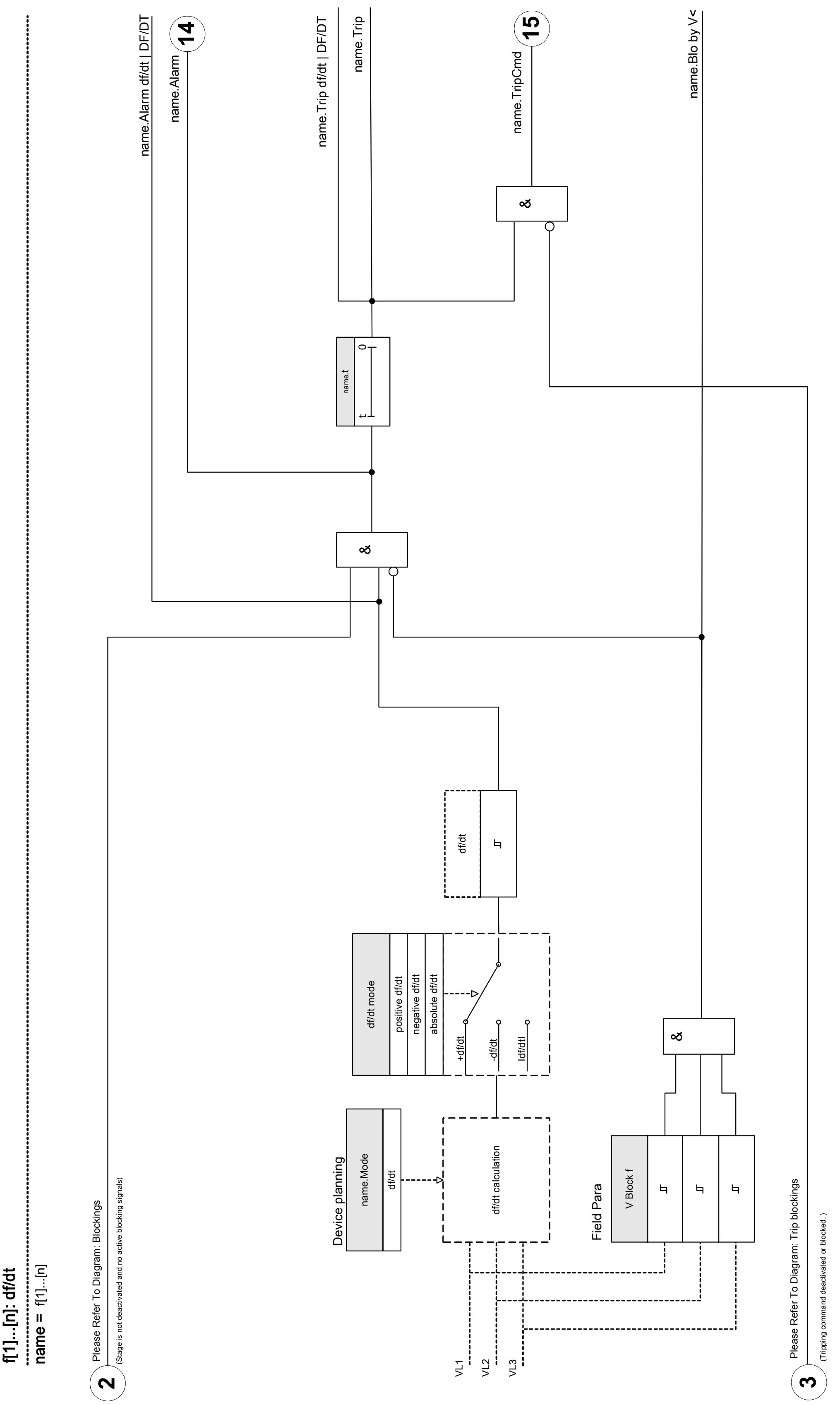
- Positive df/dt = the frequency element detects an increase in frequency
- Negative df/dt = the frequency element detects a decrease in frequency and
- Absolute df/dt (positive and negative) = the frequency element detects both, increase and decrease in frequency

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 phase voltages »*VL1*«, »*VL2*« and »*VL3*«. If any of the three phase voltages is below 15% Vn, the frequency calculation is blocked. 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]
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
2
Device planning
name.Mode
df/dt
df/dt calculation
VL1
VL2
VL3
df/dt mode
positive df/dt
negative df/dt
absolute df/dt
+df/dt
-df/dt
|df/dt|
df/dt
Field Para
V Block f
&
name.Alarm df/dt | DF/DT
name.Alarm
14
name.t
t
0
name.Trip df/dt | DF/DT
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 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.

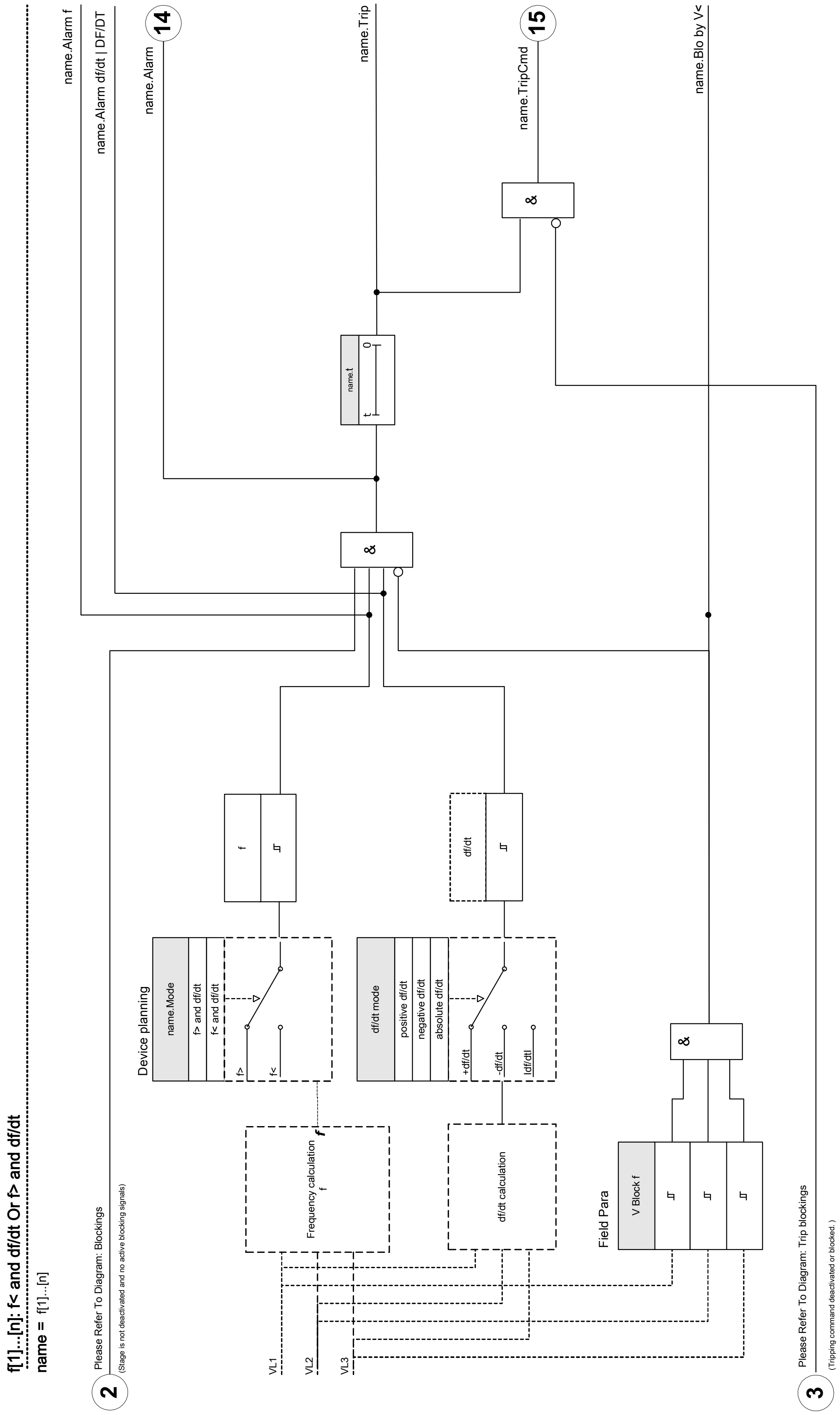
Whereby:

- 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 phase voltages »*VL1*«, »*VL2*« and »*VL3*«. If any of the three phase voltages is below 15% Vn, the frequency calculation is blocked. 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]
2
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
VL1
VL2
VL3
Frequency calculation
f
f
Device planning
name.Mode
f> and df/dt
f< and df/dt
f>
f<
f
df/dt calculation
df/dt mode
positive df/dt
negative df/dt
absolute df/dt
+df/dt
-df/dt
|df/dt|
df/dt
&
name.Alarm f
name.Alarm df/dt | DF/DT
name.Alarm
14
name.t
t
0
name.Trip
&
name.TripCmd
15
Field Para
V Block f
&
name.Blo by V<
3
Please Refer To Diagram: Trip blockings
(Tripping command deactivated or blocked.)

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 phase voltages »*VL1*«, »*VL2*« and »*VL3*«. If any of the three phase voltages is below 15% Vn, the frequency calculation is blocked. 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

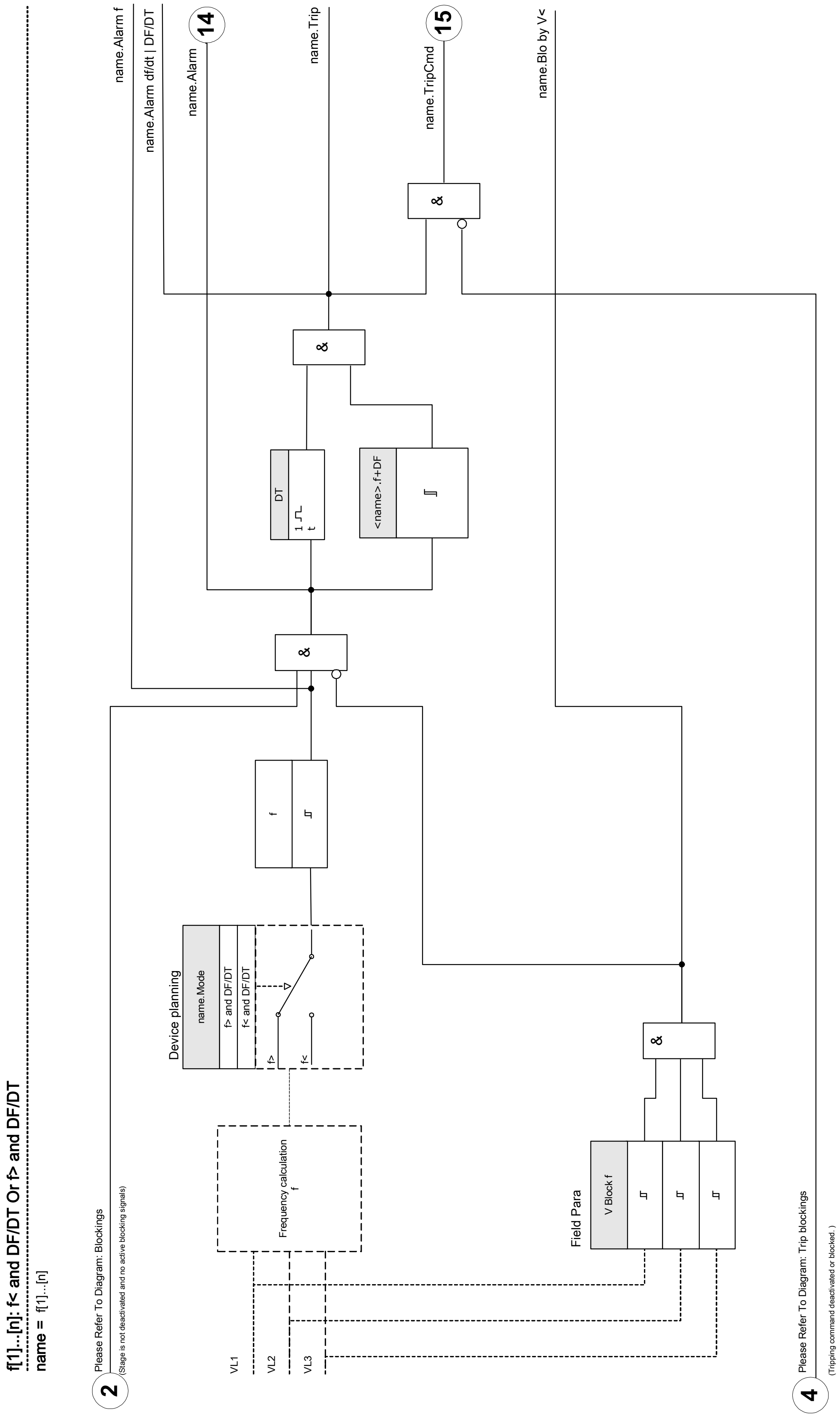
(Please refer to f(t) diagram after the block diagram)

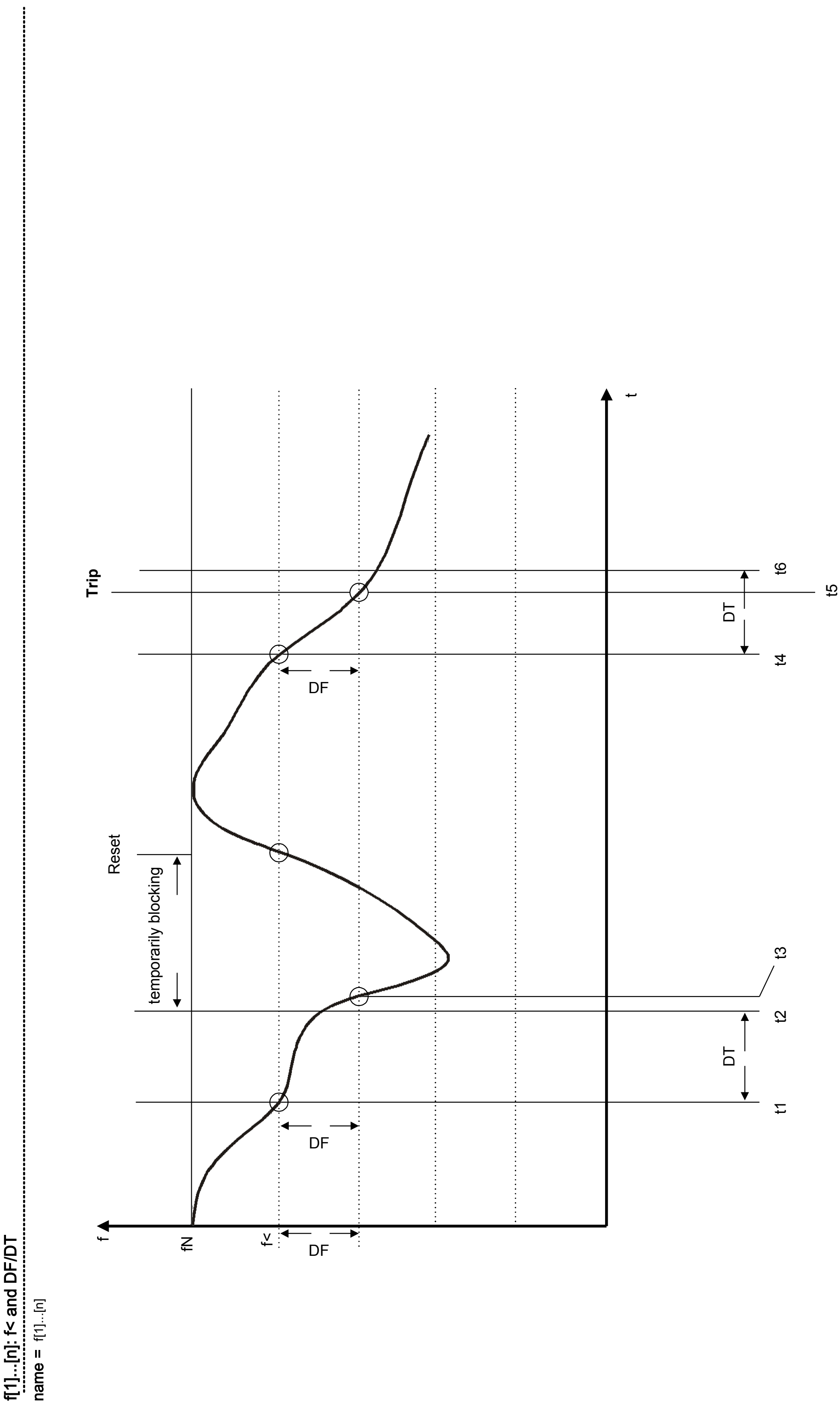
Case 1:

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)
4
Please Refer To Diagram: Trip blockings
(Tripping command deactivated or blocked.)
VL1
VL2
VL3
Frequency calculation
f
Device planning
name.Mode
f> and DF/DT
f< and DF/DT
f>
f<
f
Field Para
V Block 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<


f[1]...[n]: f< and DF/DT
name = f[1]...[n]
f
fN
f<
DF
t
Trip
Reset
temporarily blocking
DT
t1
t2
t3
t4
t5
t6

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.

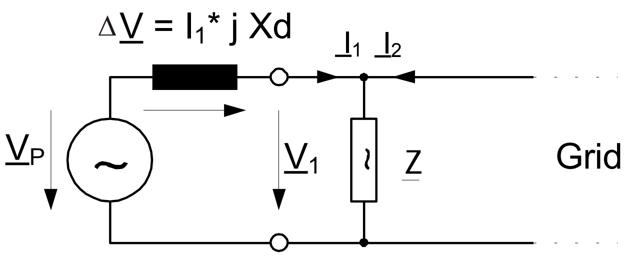
Trippings can also be caused by short-circuits within the grid, because a voltage vector surge higher than the preset value can occur. The magnitude of the voltage vector surge depends on the distance between the short-circuit and the generator. This function is also of advantage to the Power Utility 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 <15% Vn. The undervoltage lockout acts faster then the vector surge measurement.

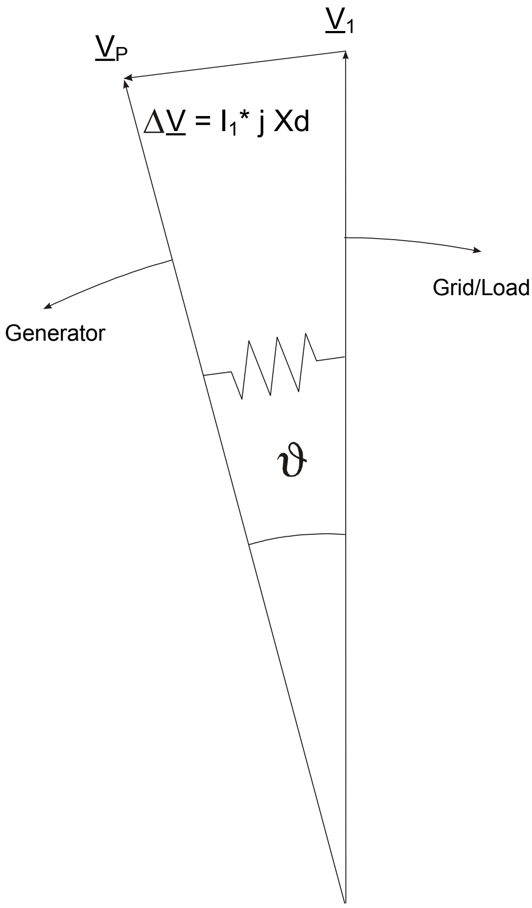
Vector surge tripping is blocked by a phase loss so that a VT fault (e. g.: faulty VTs fuse) does not cause false tripping.

Measuring Principle of Vector Surge Supervision:

Equivalent circuit at synchronous generator in parallel with the mains.

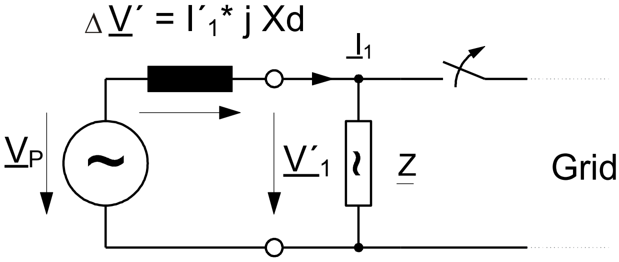


Voltage vectors at mains parallel operation.



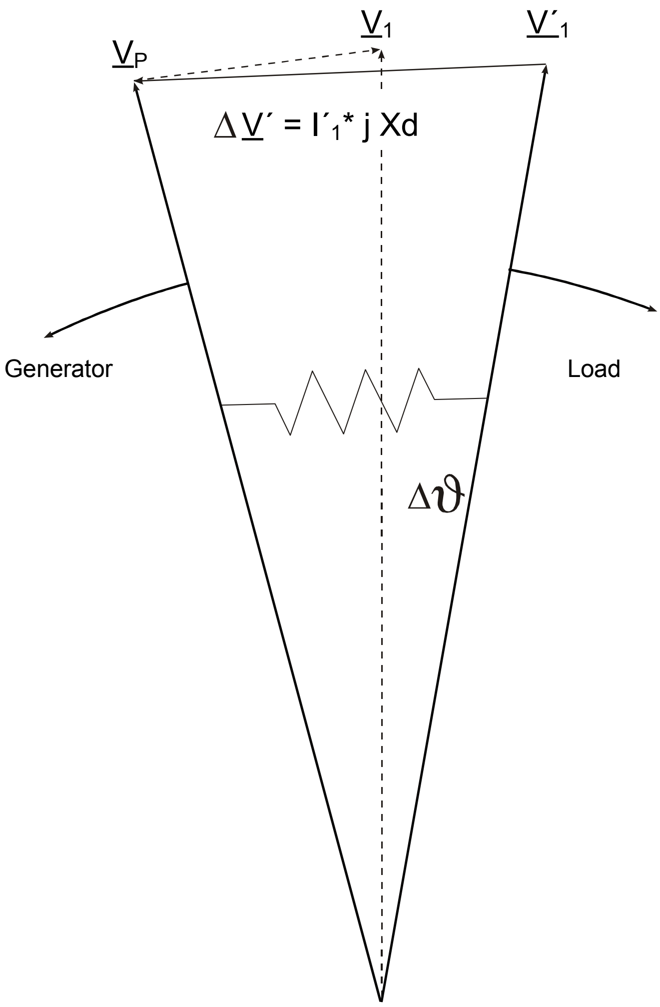
The rotor displacement angle between stator and rotor is dependent on the mechanical moving torque of the generator. The mechanical shaft power is balanced with the electrical fed mains power and, therefore the synchronous speed keeps constant.

Equivalent circuit at mains failure.

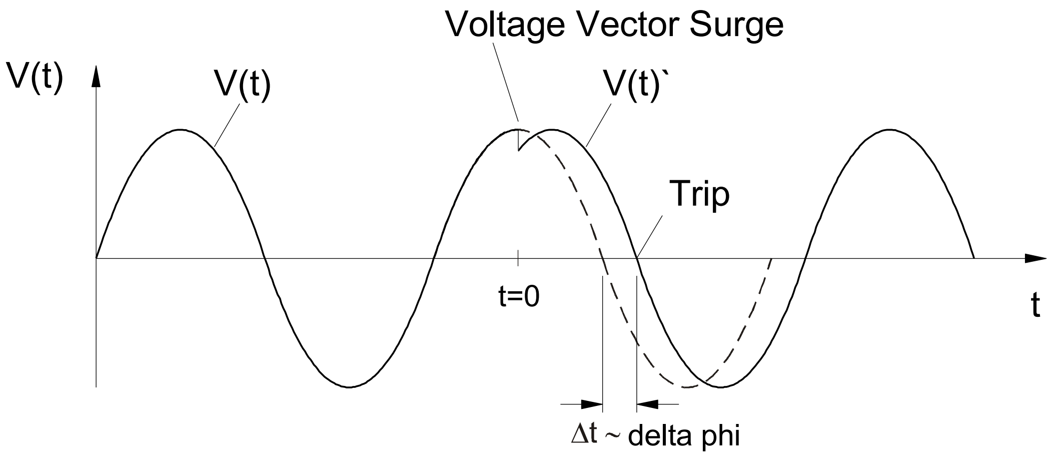


In case of mains failure or auto reclosing the generator suddenly feeds a very high consumer load. The rotor displacement angle is decreased repeatedly and the voltage vector V1 changes its direction (V1').

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.

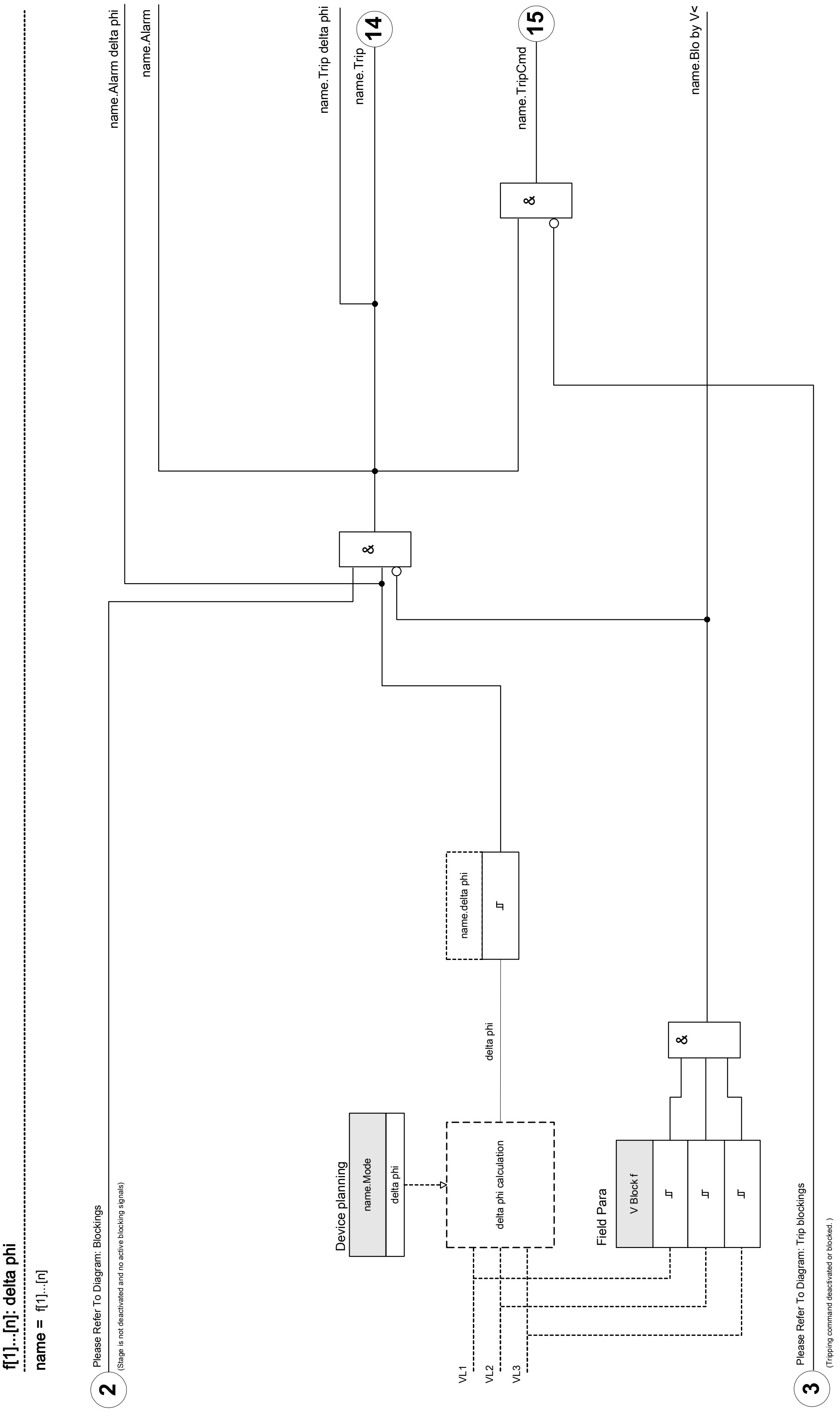
The relay measures the cycle duration. A new measuring is started at each zero passage. The measured cycle duration is internally compared with a reference time and from this the deviation of the cycle duration of the voltage signal is ascertained. In case of a vector surge as shown in the above graphic, 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 vector surge element supervises the three phase voltages »*VL1*«, »*VL2*« and »*VL3*«. If any of the three phase voltages is below 15% Vn, the vector surge calculation is blocked. 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]
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
Please Refer To Diagram: Trip blockings
(Tripping command deactivated or blocked.)
Device planning
name.Mode
delta phi
delta phi calculation
delta phi
name.delta phi
Field Para
V Block f
VL1
VL2
VL3
&
name.Alarm delta phi
name.Alarm
name.Trip delta phi
name.Trip
name.TripCmd
name.Blo by V<
2
3
14
15

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]]
ExBlo3	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, BloStart	Mstart.BloFrqStart	[Protection Para /Global Prot Para /f-Prot /f[1]]
ExBlo TripCmd	External blocking of the Trip Command of the module/the stage, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /f-Prot /f[1]]

Setting Group Parameters of the Frequency Protection Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	f[1]: active f[2]: active f[3]: inactive f[4]: inactive f[5]: inactive f[6]: inactive	[Protection Para /<n> /f-Prot /f[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /f-Prot /f[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<n> /f-Prot /f[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo TripCmd Fc=active".	inactive, active	inactive	[Protection Para /<n> /f-Prot /f[1]]
f>	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 /<n> /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 /<n> /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 /<n> /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	0.1 - 10.0Hz/s	1.0Hz/s	[Protection Para /<n> /f-Prot /f[1]]
t-df/dt	Trip delay df/dt	0.00 - 300.00s	1.00s	[Protection Para /<n> /f-Prot /f[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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 /<n> /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 /<n> /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 /<n> /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 /<n> /f-Prot /f[1]]

Frequency Protection Module Input States

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

Frequency Protection Module Signals (Output States)

Name	*Description*
active	Signal: active

Name	Description
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

Counters of the Frequency Protection Module

Value	Description	Default	Size	Menu path
NumberOfAlarms	Number of alarms since last reset.	0	0 - 9999999999	[Operation /History /AlarmCr]
NumberOfTrips	Number of trips since last reset	0	0 - 9999999999	[Operation /History /TripCr]

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:

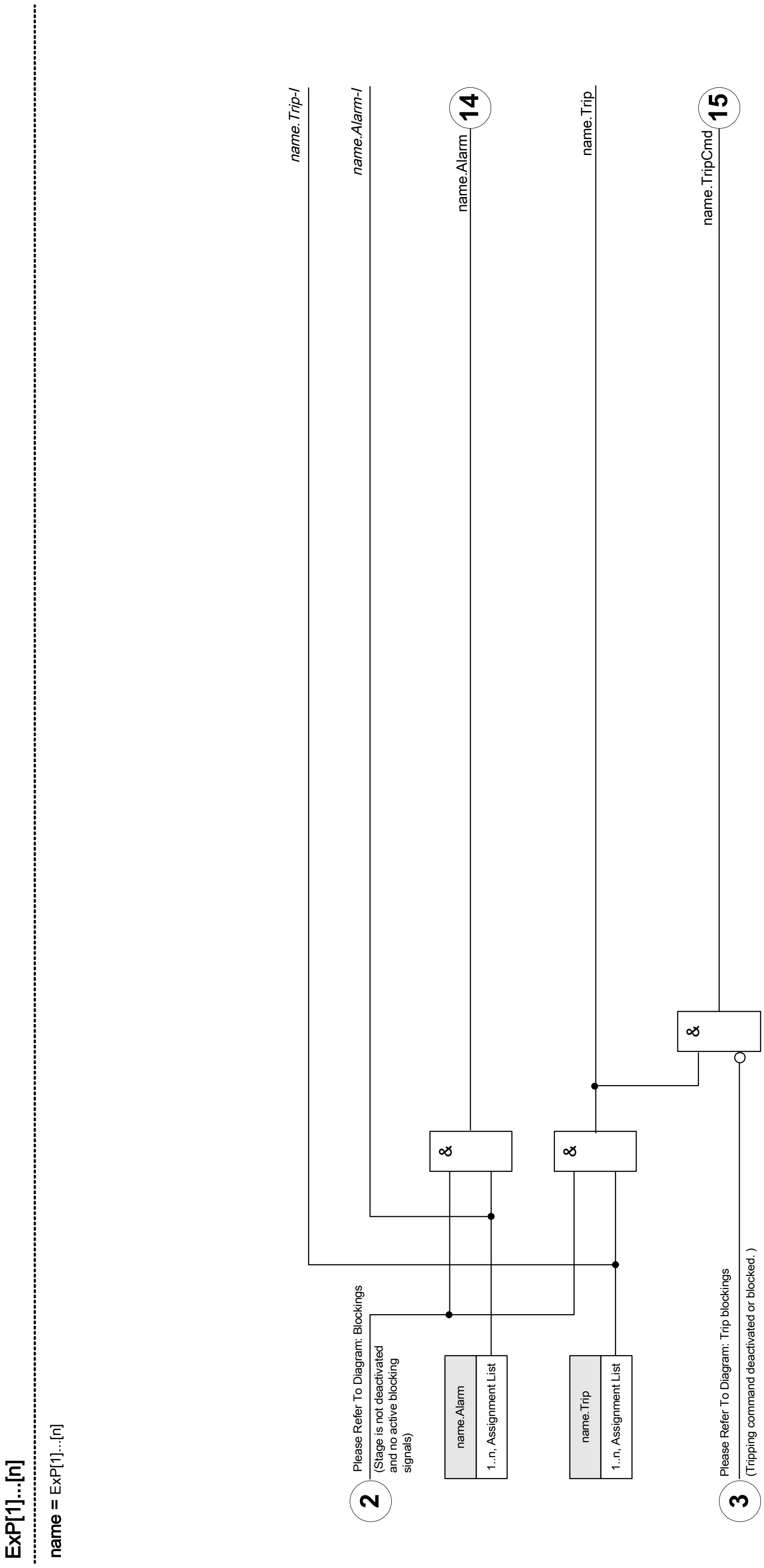
Permissible deviations/tolerances and dropout ratio can be taken from the Technical Data.

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)
2
name.Alarm
1..n, Assignment List
name.Trip
1..n, Assignment List
&
&
&
name.Trip-I
name.Alarm-I
name.Alarm
14
name.Trip
name.TripCmd
15
Please Refer To Diagram: Trip blockings
(Tripping command deactivated or blocked.)
3

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 /<n> /ExP /ExP[1]]

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

Module External Protection Input States

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

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

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. A breaker failure condition is recognized if current is still flowing through the breaker after tripping or opening breaker commands have been issued for a specified time. The User can select different trigger modes. In addition, up to three additional trigger events can be assigned from all the protection modules.

Trigger Modes

There are three trigger modes for the breaker failure available. In addition, there are three assignable trigger inputs available.

- *All Trips*: All trip signals that are assigned to this breaker (within the trip manager) will start the BF module.
- *Current Trips*: All current trips that are assigned to this breaker (within the trip manager) will start the BF module.
- *External Trips*: All external trips that are assigned to this breaker (within the trip manager) will start the BF module.
- In addition, the User can also select *none* (e.g.: if the User intends to use one of the three additional assignable trigger inputs).

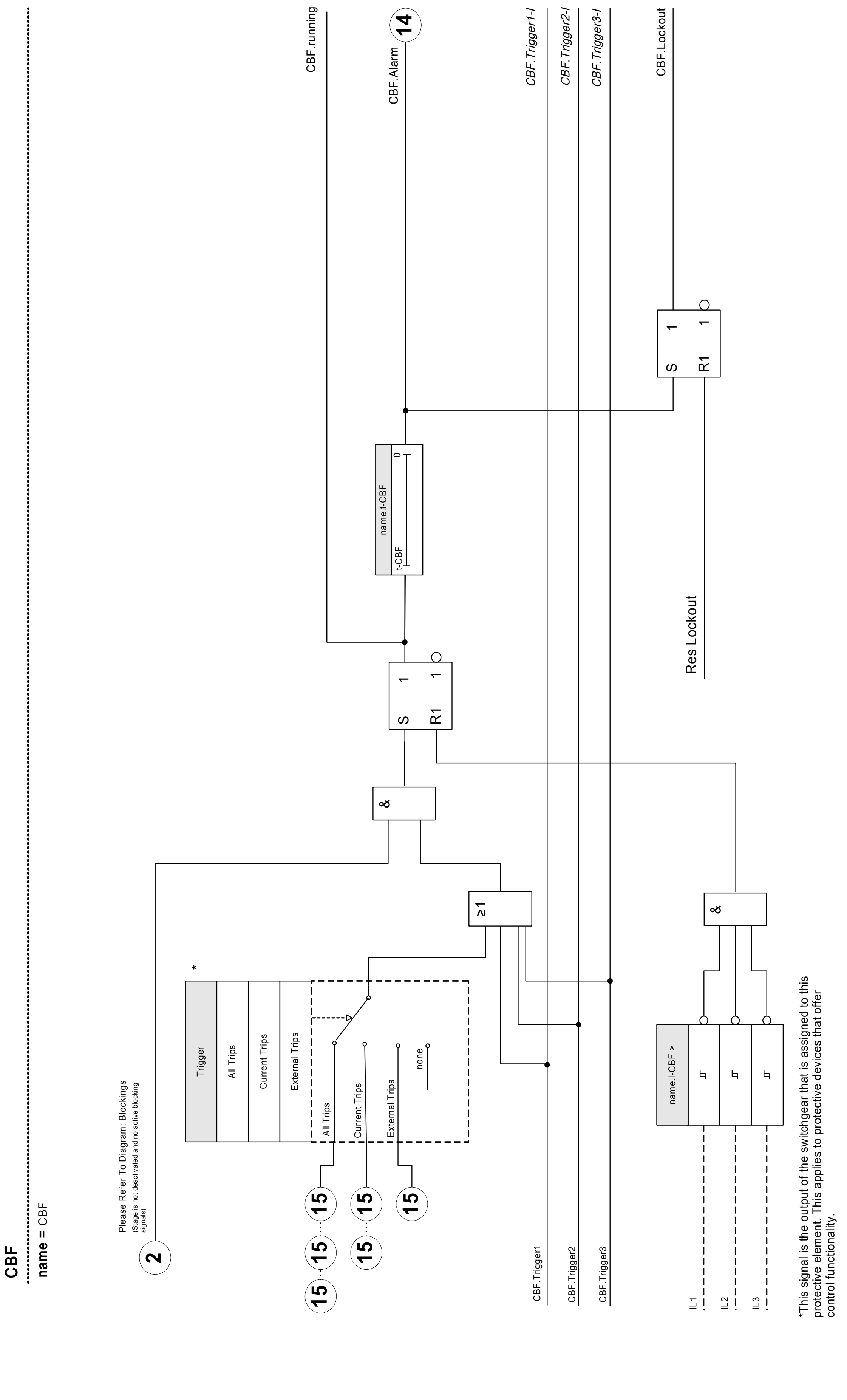
NOTICE **Those trips can exclusively start the breaker failures that are assigned within the trip manager to the breaker that is to be supervised.**

NOTICE **Select the winding side from which the measured currents should be taken in case this protective device is a transformer differential protection.**

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 within the interlockings of the circuit breaker.


CBF
name = CBF
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
2
15
15
15
15
15
15
15
Trigger
All Trips
Current Trips
External Trips
*
All Trips
Current Trips
External Trips
none
≥1
&
S 1
R1 1
CBF.running
name.t-CBF
t-CBF
0
CBF.Alarm
14
S 1
R1 1
CBF.Lockout
Res Lockout
CBF.Trigger1
CBF.Trigger2
CBF.Trigger3
CBF.Trigger1-I
CBF.Trigger2-I
CBF.Trigger3-I
IL1
IL2
IL3
name.I-CBF >
&
*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 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, Current 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/Acknowledge /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:**

- **The close-open time of the breaker (please refer to the technical data of the manufacturer of the breaker);**
- **+ The tripping delay of the device (please refer to the Technical Data section);**
- **+ The security margin; and**
- **+ The operating time.**

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<n> /Supervision /CBF]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /Supervision /CBF]
I-CBF >	Current level that needs to exist after Trip Command has been given.	0.00 - 0.10In	0.00In	[Protection Para /<n> /Supervision /CBF]
t-CBF	If the delay time is expired, an CBF alarm is given out.	0.00 - 10.00s	0.20s	[Protection Para /<n> /Supervision /CBF]

CBF Input States

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

Name	Description	Assignment via
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)

Name	Description
active	Signal: active
ExBlo	Signal: External Blocking
running	Signal: CBF-Module started
Alarm	Signal: Circuit Breaker Failure
Lockout	Signal: Lockout
Res Lockout	Signal: Reset Lockout

CBF Trigger (Current Trips) Functions

These trips will start the BF module if all trips have been selected as the trigger event.

Name	Description
-.-	No assignment
MStart.TripCmd	Signal: Trip Command
I[1].TripCmd	Signal: Trip Command
I[2].TripCmd	Signal: Trip Command
I[3].TripCmd	Signal: Trip Command
I[4].TripCmd	Signal: Trip Command
I[5].TripCmd	Signal: Trip Command

Name	*Description*
I[6].TripCmd	Signal: Trip Command
IG[1].TripCmd	Signal: Trip Command
IG[2].TripCmd	Signal: Trip Command
IG[3].TripCmd	Signal: Trip Command
IG[4].TripCmd	Signal: Trip Command
I2>[1].TripCmd	Signal: Trip Command
I2>[2].TripCmd	Signal: Trip Command
ThR.TripCmd	Signal: Trip Command
Jam[1].TripCmd	Signal: Trip Command
Jam[2].TripCmd	Signal: Trip Command
I<[1].TripCmd	Signal: Trip Command
I<[2].TripCmd	Signal: Trip Command
I<[3].TripCmd	Signal: Trip Command
RTD.TripCmd	Signal: Trip Command
V[1].TripCmd	Signal: Trip Command
V[2].TripCmd	Signal: Trip Command
V[3].TripCmd	Signal: Trip Command
V[4].TripCmd	Signal: Trip Command
V[5].TripCmd	Signal: Trip Command
V[6].TripCmd	Signal: Trip Command
VG[1].TripCmd	Signal: Trip Command
VG[2].TripCmd	Signal: Trip Command
V 012 [1].TripCmd	Signal: Trip Command
V 012 [2].TripCmd	Signal: Trip Command
V 012 [3].TripCmd	Signal: Trip Command
V 012 [4].TripCmd	Signal: Trip Command
V 012 [5].TripCmd	Signal: Trip Command
V 012 [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
PQS [1].TripCmd	Signal: Trip Command
PQS [2].TripCmd	Signal: Trip Command
PQS [3].TripCmd	Signal: Trip Command
PQS [4].TripCmd	Signal: Trip Command
PQS [5].TripCmd	Signal: Trip Command
PQS [6].TripCmd	Signal: Trip Command

Name	*Description*
PF[1].TripCmd	Signal: Trip Command
PF[2].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
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

Name	*Description*
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

Name	*Description*
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

Name	*Description*
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

Name	*Description*
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

Name	*Description*
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

Name	*Description*
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

Name	*Description*
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

Name	*Description*
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)

These trips will start the BF module if all current functions have been selected as the trigger event.

Name	*Description*
-.-	No assignment
I[1].TripCmd	Signal: Trip Command
I[2].TripCmd	Signal: Trip Command
I[3].TripCmd	Signal: Trip Command
I[4].TripCmd	Signal: Trip Command
I[5].TripCmd	Signal: Trip Command
I[6].TripCmd	Signal: Trip Command
IG[1].TripCmd	Signal: Trip Command
IG[2].TripCmd	Signal: Trip Command
IG[3].TripCmd	Signal: Trip Command
IG[4].TripCmd	Signal: Trip Command
I2>[1].TripCmd	Signal: Trip Command
I2>[2].TripCmd	Signal: Trip Command
ThR.TripCmd	Signal: Trip Command
Jam[1].TripCmd	Signal: Trip Command
Jam[2].TripCmd	Signal: Trip Command
I<[1].TripCmd	Signal: Trip Command
I<[2].TripCmd	Signal: Trip Command
I<[3].TripCmd	Signal: Trip Command

These trips will start the BF module if external trips have been selected as the trigger event.

Name	Description
-.-	No assignment
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: Circuit Breaker Failure Protection

NOTICE **The time that is configured for the BF MUST NOT be below the breaker control time, otherwise an unwanted operation of the BF is caused by any protective trip.**

Object to Be Tested:

Test of the breaker failure protection.

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.

WARNING **Re-connect the control cable to the breaker!**

Successful Test Result:

The actual times measured comply with the setpoint times. The breaker in the higher-level section switches off.

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.**

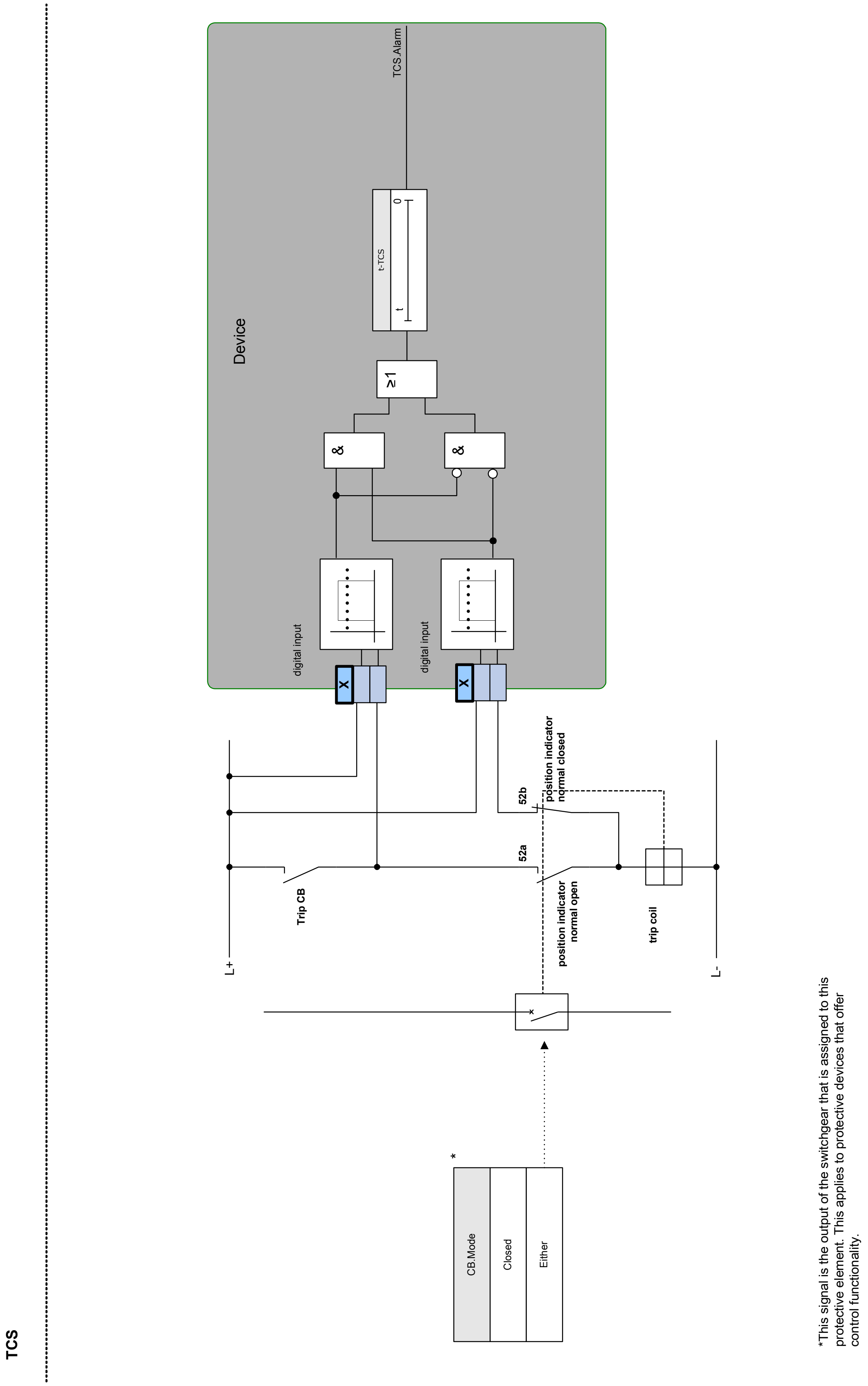
NOTICE **This Notice applies to protective devices that offer control functionality only! This protective element requires, that a switchgear (circuit breaker is assigned to it.**

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.

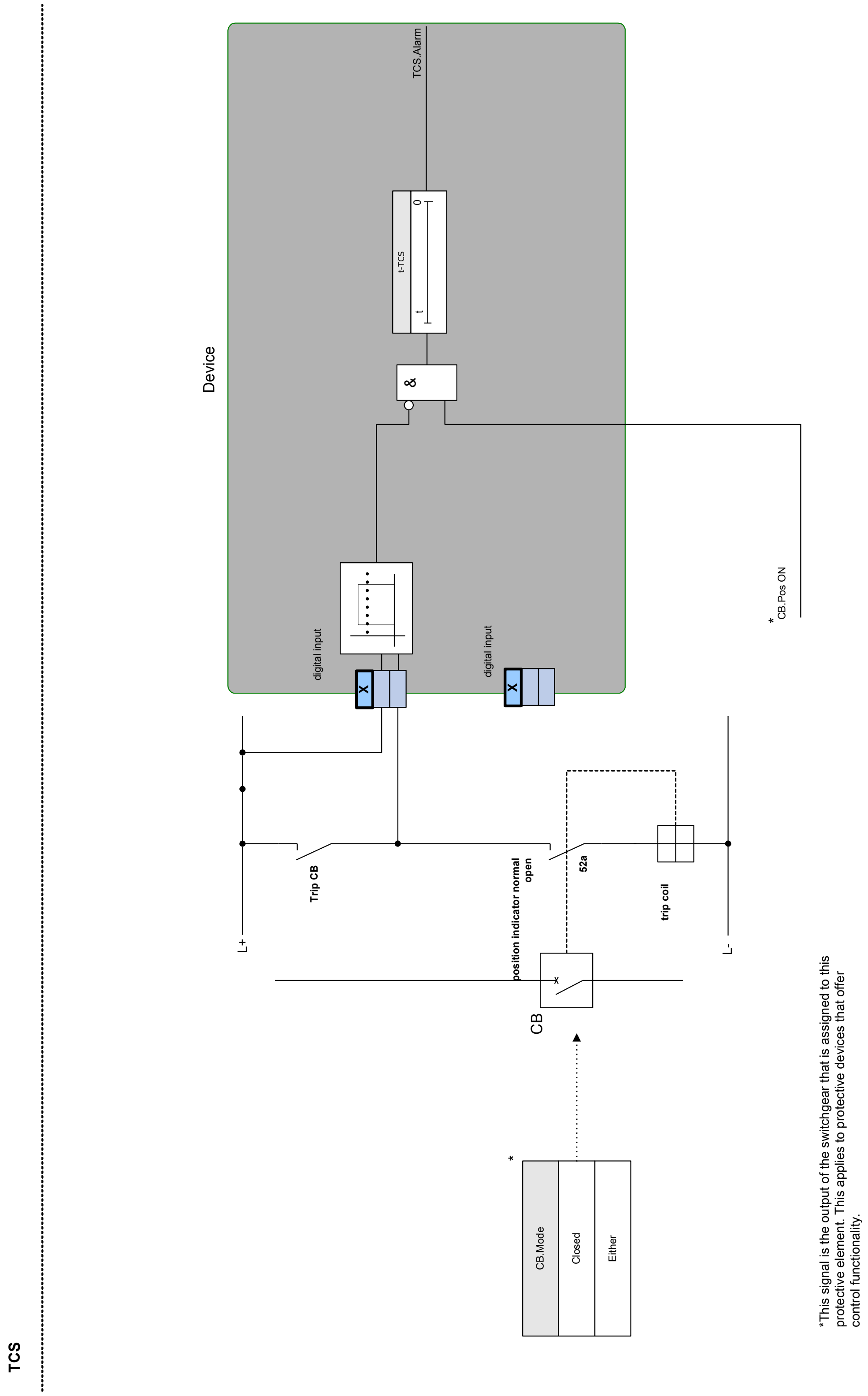
In order to identify a conductor failure in the trip circuit on the supply line or in the trip coil, the off-coil has to be looped-in to the supervision circuit.

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.



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.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.	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, DI Slot X1.DI 5, DI Slot X1.DI 6, DI Slot X1.DI 7, DI Slot X1.DI 8	-.-	[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	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, DI Slot X1.DI 5, DI Slot X1.DI 6, DI Slot X1.DI 7, DI Slot X1.DI 8	-.-	[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]

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

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 /<n> /Supervision /TCS]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /Supervision /TCS]
t-TCS	Tripping delay time of the Trip Circuit Supervision	0.10 - 10.00s	0.2s	[Protection Para /<n> /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]

Name	*Description*	*Assignment via*
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)

Name	*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.

CTS - Current Transformer Supervision [60L]

Available elements:
CTS

Wire breaks and failures within measuring circuits cause current transformer failures.
The module *»CTS«* can detect a failure of the CT if the calculated earth current does not match the measured one. If an adjustable threshold value (Difference of measured and calculated earth current) is exceeded, a CT failure can be assumed. This is signaled through a message/alarm.

The precondition is that the conductor currents are measured by the device and the earth current, for instance, by a ring core type current transformer.

The measuring principles of the circuit supervision are based on comparing the measured and the calculated residual currents:

In an ideal case these are:

$$(\vec{IL}1+\vec{IL}2+\vec{IL}3)+KI*\vec{IG}=3*I_0+KI*\vec{IG}=0$$

KI represents a correction factor which takes the different transformation ratio of the phase- and earth current transformers into account. The device automatically calculates this factor from the rated field parameters, i.e. the relation between the rated primary and secondary current values of the phase- and earth current transformers.

For compensating the current proportional ratio error of the measuring circuits, the dynamic correction factor Kd can be used. As a function of the measured max. current this factor is considering the linear rising measuring error.

The limiting value of the CT supervision is calculated as follows:

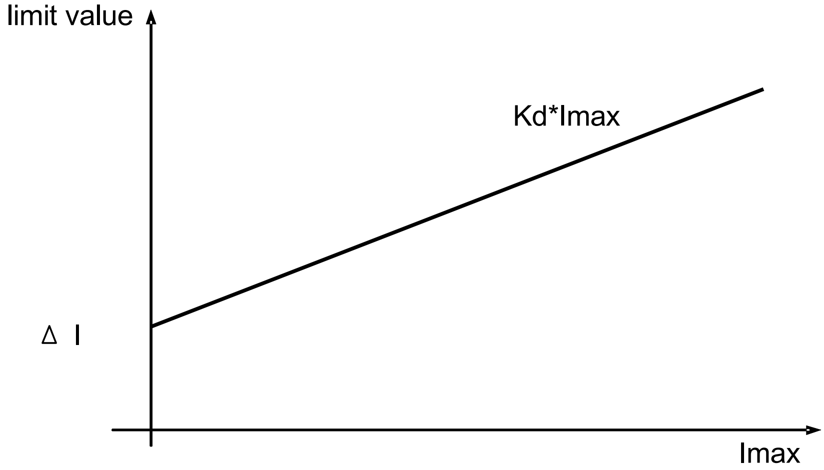
ΔI	=	deviation I (rated value)
Kd	=	correction factor
Imax	=	current maximum
Limiting value	=	ΔI + Kd x Imax

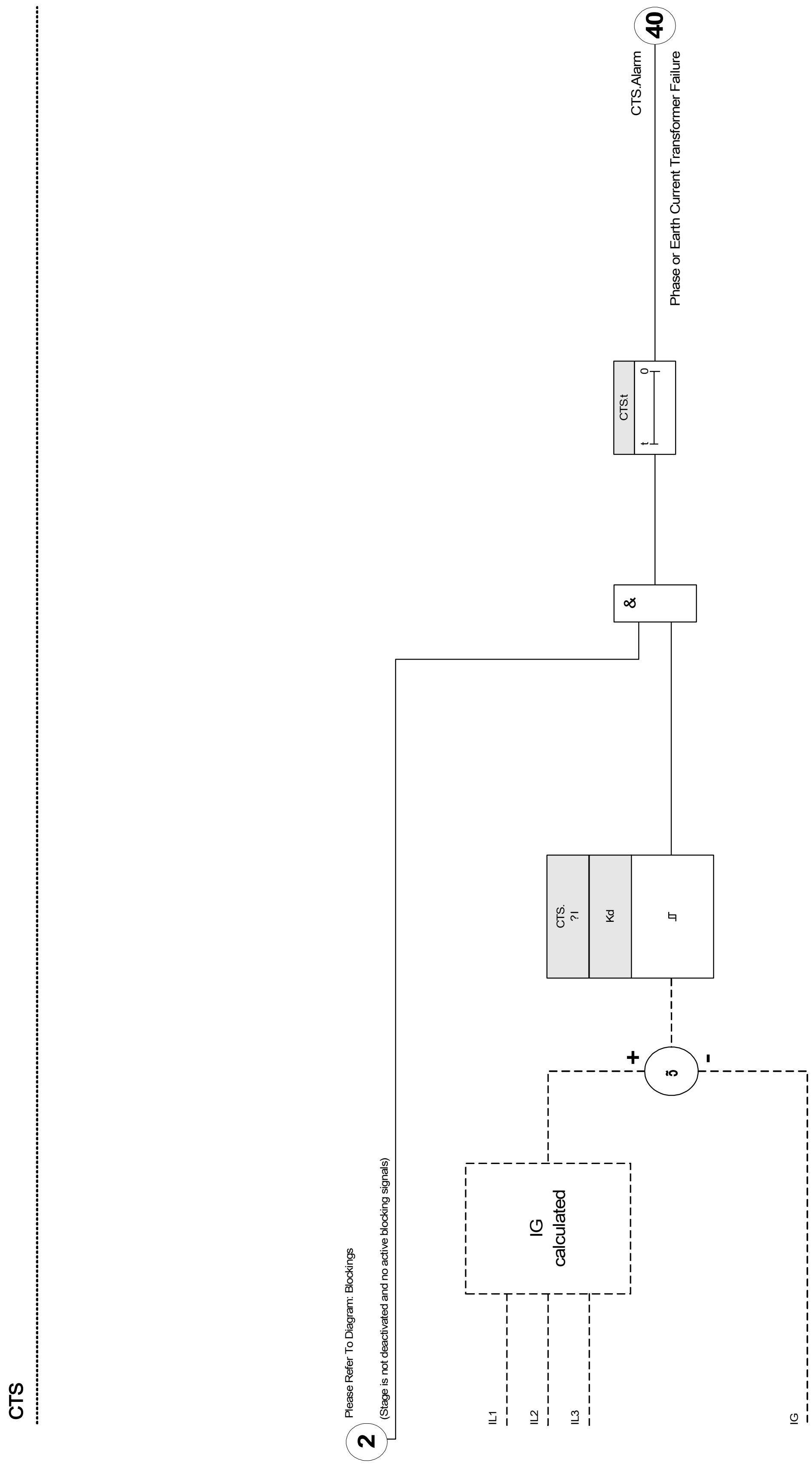
Precondition for identifying an error:

$$3*\vec{I}_0+KI*\vec{IG}\geqslant Delta\ I+Kd*Imax$$

The evaluation method of the circuit supervision by using factor Kd can be graphically represented as follows:

CAUTION **If the current is measured in two phases only (for instant only IL1/IL3) or if there is no separate earth current measuring (e.g. normally via a cable-type CT), the supervision function should be deactivated.**


limit value
Kd*Imax
Δ I
Imax


CTS
2
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
IL1
IL2
IL3
IG
IG calculated
+
-
CTS. ?I
Kd
&
CTS t
CTS.Alarm
Phase or Earth Current Transformer Failure
40

Device Planning Parameters of the Current Transformer Supervision

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

Global Protection Parameter of the Current Transformer Supervision

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

Setting Group Parameters of the Current Transformer Supervision

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<n> /Supervision /CTS]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /Supervision /CTS]
ΔI	In order to prevent faulty tripping of phase selective protection functions that use the current as tripping criterion. If the difference of the measured earth current and the calculated value I0 is higher than the pick up value ΔI, an alarm event is generated after expiring of the excitation time. In such a case, a fuse failure, a broken wire or a faulty measuring circuit can be assumed.	0.10 - 1.00In	0.50In	[Protection Para /<n> /Supervision /CTS]
Alarm delay	Alarm delay	0.1 - 9999.0s	1.0s	[Protection Para /<n> /Supervision /CTS]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Kd	Dynamic correction factor for the evaluation of the difference between calculated and measured earth current. This correction factor allows transformer faults, caused by higher currents, to be compensated.	0.00 - 0.99	0.00	[Protection Para /<n> /Supervision /CTS]

Current Transformer Supervision Input States

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

Current Transformer Supervision Signals (Outputs States)

Name	*Description*
active	Signal: active
ExBlo	Signal: External Blocking
Alarm	Signal: Alarm Current Transformer Measuring Circuit Supervision

Commissioning: Current Transformer Failure Supervision

NOTICE

Precondition:

1. **Measurement of all three phase currents (are applied to the measuring inputs of the device).**
2. **The earth current is detected via a cable-type transformer (not in Holmgreen connection).**

Object to be tested:

Check of the CT supervision (by comparing the calculated with the measured earth current).

Necessary means:

- Three-phase current source

Procedure, part 1:

- Set the limiting value of the CTS to *»delta I=0.1*In«*.
- Feed a three-phase, symmetrical current system (approx. nominal current) to the secondary side.
- Disconnect the current of one phase from one of the measuring inputs (the symmetrical feeding at secondary side has to be maintained).
- Make sure that the signal »CTS.ALARM« is generated now.

Successful test result, part 1:

- The signal »CTS.ALARM« is generated.

Procedure, part 2:

- Feed a three-phase, symmetrical current system (approx. nominal current) to the secondary side.
- Feed a current that is higher than the threshold value for the measuring circuit supervision to the earth current measuring input.
- Ascertain that the signal »CTS.ALARM« is generated now.

Successful test result, part 2:

The signal »CTS.ALARM« is generated.

LOP - Loss of Potential

Available elements:
LOP

Loss of Potential - Evaluating Measured Quantities

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« is* set in the field parameters.

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.

The LOP function detects the loss of voltage in any of the voltage input measuring circuits. Faulty tripping of protective elements that take undervoltage into account can be prevented by means of this supervision element. The following measured values and information to detect an Phase VT Failure condition:

- Three-phase voltages;
- Ratio of negative-to-positive sequence voltages;
- Zero sequence voltage;
- Three-phase currents;
- Residual current (I0);
- Pickup flags from all overcurrent elements; and
- Breaker status

After a set time delay time an Alarm »LOP.LOP Blo« will be issued.

How to set up the Loss of Potential (Evaluating Measured Quantities)

- Set the Alarm Time Delay »t-Alarm«.

- To prevent a malfunction of the VT supervision assign those Alarms of instantaneous overcurrent elements that should block the Loss of Potential element.

- It is necessary to set the parameter »*LOP.LOPB Enable«* to »*active«.* Otherwise the Measuring circuit supervision cannot block undervoltage depending elements in case of a loss of potential.

How to make the Loss of Potential (Evaluating Measured Quantities) effective

The Loss of Potential respectively measuring circuit supervision can be used to block protective elements like undervoltage protection in order to prevent faulty tripping.

- Set the parameter »*Measuring Circuit Supervision=active«* within those protective elements that should be blocked by the Loss of Potential supervision.

Loss of Potential - Fuse Failure

VT Supervision via digital inputs (Fuse Failure):

The module *»LOP«* 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 *»LOP«*.

Setting the Parameters for detecting a fuse failure (FF) of a phase voltage transformer

In order to detect a fuse failure of a phase voltage transformer via digital input, please proceed as follows:

- Assign a digital input onto the parameter »*LOP.Ex FF VT«* that represents the state of the automatic circuit breaker of the phase voltage transformer.

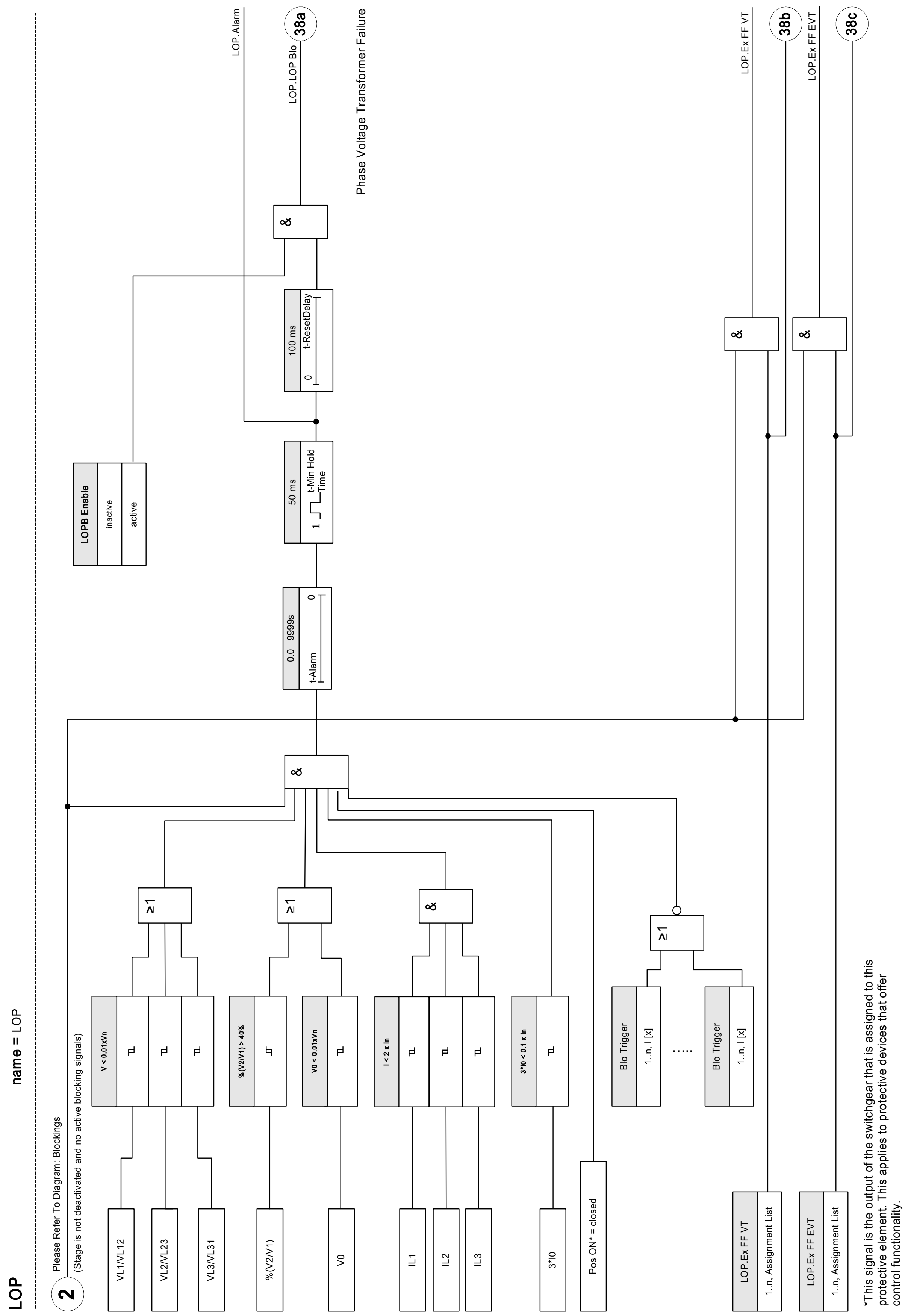
- Set the parameter »*Measuring Crcuit Supervison=active«* within all those protective elements, that should be blocked by a fuse failure.

Setting the Parameters for detecting a fuse failure (FF) of a earth phase voltage transformer:

In order to detect a fuse failure of a phase voltage transformer via digital input, please proceed as follows:

- Assign a digital input onto the parameter »*LOP.Ex FF EVT«* that represents the state of the automatic circuit breaker of the phase voltage transformer.

- Set the parameter »*Measuring Crcuit Supervison=active«* within all those protective elements, that should be blocked by a fuse failure.


LOP
name = LOP
2
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
VL1/VL12
VL2/VL23
VL3/VL31
V < 0.01xVn
%(V2/V1)
%(V2/V1) > 40%
V0
V0 < 0.01xVn
IL1
IL2
IL3
I < 2 x In
3*I0
3*I0 < 0.1 x In
Pos ON* = closed
Blo Trigger
1..n, I [x]
.....
Blo Trigger
1..n, I [x]
≥1
≥1
&
≥1
&
LOPB Enable
inactive
active
0.0 9999s
t-Alarm
0
50 ms
1
t-Min Hold Time
100 ms
0
t-ResetDelay
&
LOP.Alarm
LOP.LOP Blo
38a
Phase Voltage Transformer Failure
LOP.Ex FF VT
1..n, Assignment List
LOP.Ex FF EVT
1..n, Assignment List
&
&
LOP.Ex FF VT
38b
LOP.Ex FF EVT
38c
*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 LOP Module

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

Global Protection Parameters of the LOP Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
CB Pos Detect	Criterion by which the Circuit Breaker Switch Position is to be detected.	-.-, SG.Pos	SG.Pos	[Protection Para /Global Prot Para /Supervision /LOP]
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 /LOP]
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 /LOP]
Blo Trigger1	An Alarm of this protective element will block the Loss of Potential Detection.	Blo Trigger	-.-	[Protection Para /Global Prot Para /Supervision /LOP]
Blo Trigger2	An Alarm of this protective element will block the Loss of Potential Detection.	Blo Trigger	-.-	[Protection Para /Global Prot Para /Supervision /LOP]
Blo Trigger3	An Alarm of this protective element will block the Loss of Potential Detection.	Blo Trigger	-.-	[Protection Para /Global Prot Para /Supervision /LOP]
Blo Trigger4	An Alarm of this protective element will block the Loss of Potential Detection.	Blo Trigger	-.-	[Protection Para /Global Prot Para /Supervision /LOP]

Parameter	Description	Setting range	Default	Menu path
Blo Trigger5	An Alarm of this protective element will block the Loss of Potential Detection.	Blo Trigger	-.-	[Protection Para /Global Prot Para /Supervision /LOP]
Ex FF VT	Alarm Fuse Failure Voltage Transformers	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Supervision /LOP]
Ex FF EVT	Alarm Fuse Failure Earth Voltage Transformers	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /Supervision /LOP]

Setting Group Parameters of the LOP Module

Parameter	Description	Setting range	Default	Menu path
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<n> /Supervision /LOP]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parameterized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /Supervision /LOP]
LOPB Enable	Activate (allow) or inactivate (disallow) blocking by the module LOP.	inactive, active	inactive	[Protection Para /<n> /Supervision /LOP]
t-Alarm	Pickup Delay	0 - 9999.0s	0.1s	[Protection Para /<n> /Supervision /LOP]

LOP Module Input States

Name	*Description*	*Assignment via*
ExBlo1-I	Module input state: External blocking1	[Protection Para /Global Prot Para /Supervision /LOP]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /Supervision /LOP]
Pos	Module input state: Circuit Breaker Position (0 = Indeterminate, 1 = OFF, 2 = ON, 3 = Disturbed)	[Protection Para /Global Prot Para /Supervision /LOP]
Ex FF VT-I	State of the module input: Alarm Fuse Failure Voltage Transformers	[Protection Para /Global Prot Para /Supervision /LOP]
Ex FF EVT-I	State of the module input: Alarm Fuse Failure Earth Voltage Transformers	[Protection Para /Global Prot Para /Supervision /LOP]
Blo Trigger1-I	State of the module input: An Alarm of this protective element will block the Loss of Potential Detection.	[Protection Para /Global Prot Para /Supervision /LOP]
Blo Trigger2-I	State of the module input: An Alarm of this protective element will block the Loss of Potential Detection.	[Protection Para /Global Prot Para /Supervision /LOP]
Blo Trigger3-I	State of the module input: An Alarm of this protective element will block the Loss of Potential Detection.	[Protection Para /Global Prot Para /Supervision /LOP]
Blo Trigger4-I	State of the module input: An Alarm of this protective element will block the Loss of Potential Detection.	[Protection Para /Global Prot Para /Supervision /LOP]

Name	Description	Assignment via
Blo Trigger5-I	State of the module input: An Alarm of this protective element will block the Loss of Potential Detection.	[Protection Para /Global Prot Para /Supervision /LOP]

LOP Module Signals (Output States)

Name	Description
active	Signal: active
ExBlo	Signal: External Blocking
Alarm	Signal: Alarm Loss of Potential
LOP Blo	Signal: Loss of Potential blocks other elements.
Ex FF VT	Signal: Ex FF VT
Ex FF EVT	Signal: Alarm Fuse Failure Earth Voltage Transformers

Blocking Trigger

Name	Description
-.-	No assignment
I[1].Alarm	Signal: Alarm
I[2].Alarm	Signal: Alarm
I[3].Alarm	Signal: Alarm
I[4].Alarm	Signal: Alarm
I[5].Alarm	Signal: Alarm
I[6].Alarm	Signal: Alarm
IG[1].Alarm	Signal: Alarm IG
IG[2].Alarm	Signal: Alarm IG
IG[3].Alarm	Signal: Alarm IG
IG[4].Alarm	Signal: Alarm IG

Commissioning: Loss of Potential

Object to be tested:

Test of the module *LOP*.

Necessary means:

- Three-phase current source
-
- Three-phase voltage source.

Procedure:

Test part 1:

Examine if the output signal »LOP BLO « becomes true if:

- Any of the three-phase voltages becomes less 0.01*Vn Volt
- The residual voltage is less than 0.01*Vn Volt or the %V2/V1 ratio is greater 40%
- All three-phase currents are less than 2 * Ipu (rated current)
- The residual current is less than 0.1 Ipu (rated current)
- No pickup of an IOC elemen which should block VT Supervision
- The breaker is closed.

Successful test result part 1:

The output signals only become true if all the above mentioned conditions are fulfilled.

Test part 2:

Set the parameter »*Measuring Circuit Supervision=active«* within those protective elements that should be blocked by the Loss of Potential supervision (like undervoltage protection.,voltage controlled overcurrent protection...).

Check those protective elements if they are blocked if the Loss of Potential supervision has generated a block command.

Successful test result part 2:

All protective elements that should be blocked in case of Loss of Potential supervision are blocked if the conditions (Procedure part 1) are fulfilled.

Commissioning: Loss of Potential (FF via DI)

Object to be tested:

Check if the auto fuse failure is correctly identified by the device.

Procedure:

- Disconnect the automatic circuit breaker of the VTs (all poles to be dead)

Successful test result:

- The state of the respective digital input changes.
- All protective elements are blocked which should not have an unwanted operation caused by a fuse failure »*Measuring Circuit Supervision=active«.*

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

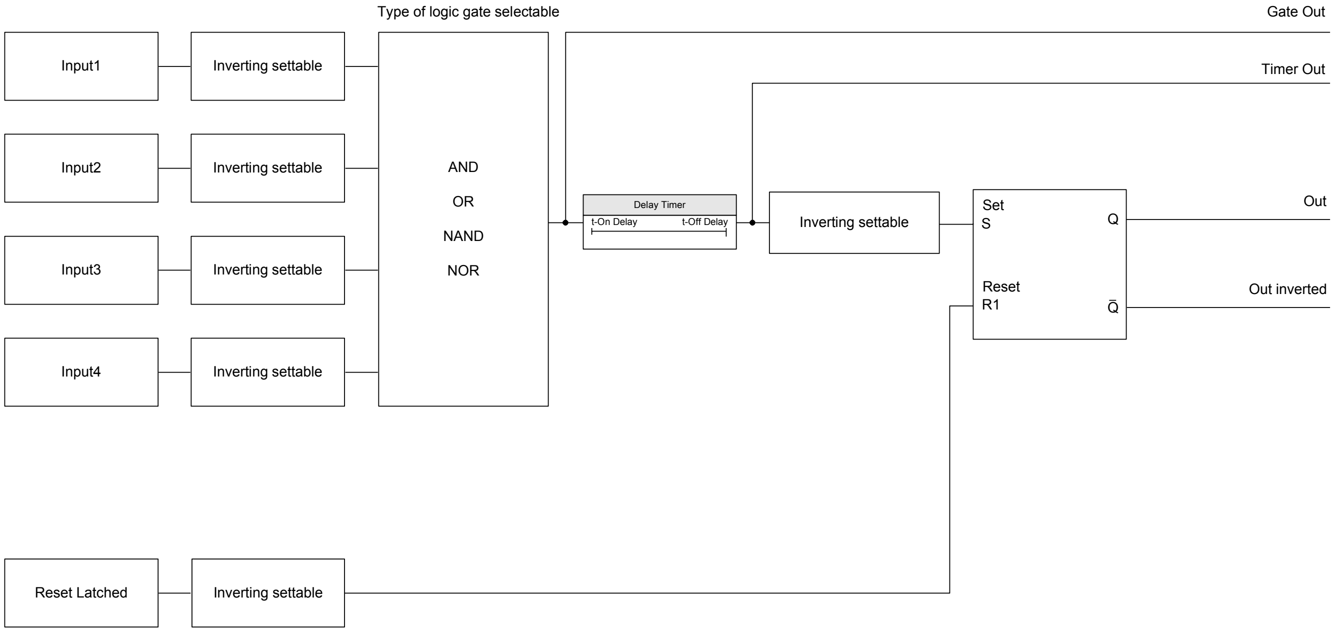
Available Elements (Equations):
Logics

General Description

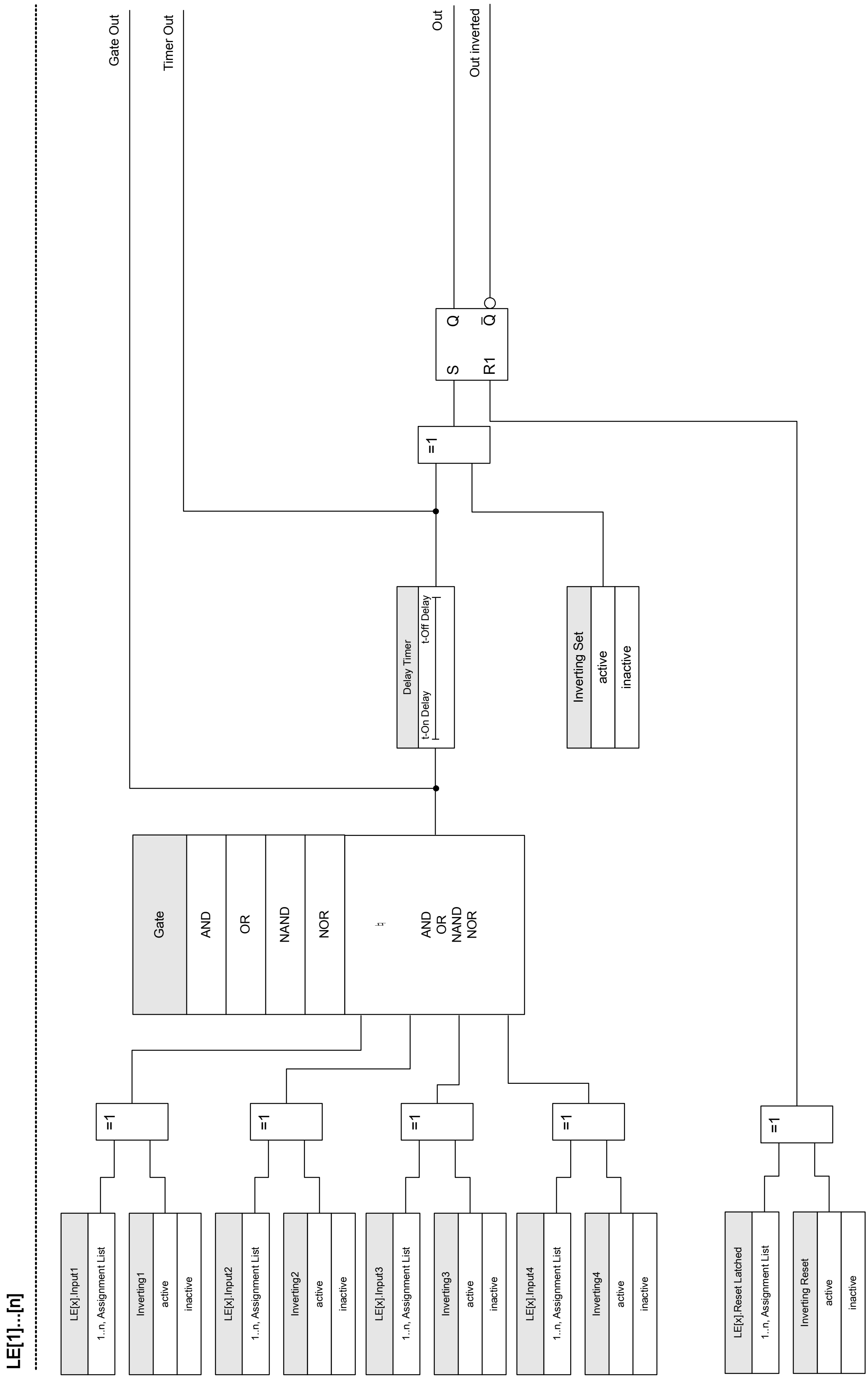
The Protective Relay includes programmable Logic Equations for programming output relays, blocking of protective functions and custom logic functions in the relay.

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

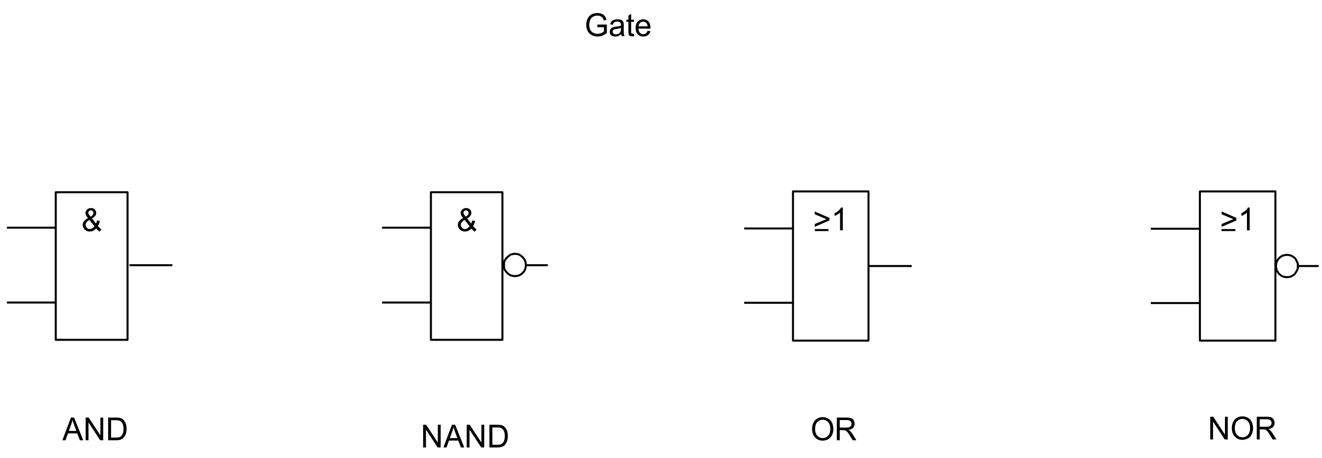


Detailed Overview – Overall Logic diagram



Available Gates (Operators)

Within the Logic Equation, the following Gates can be used:



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.

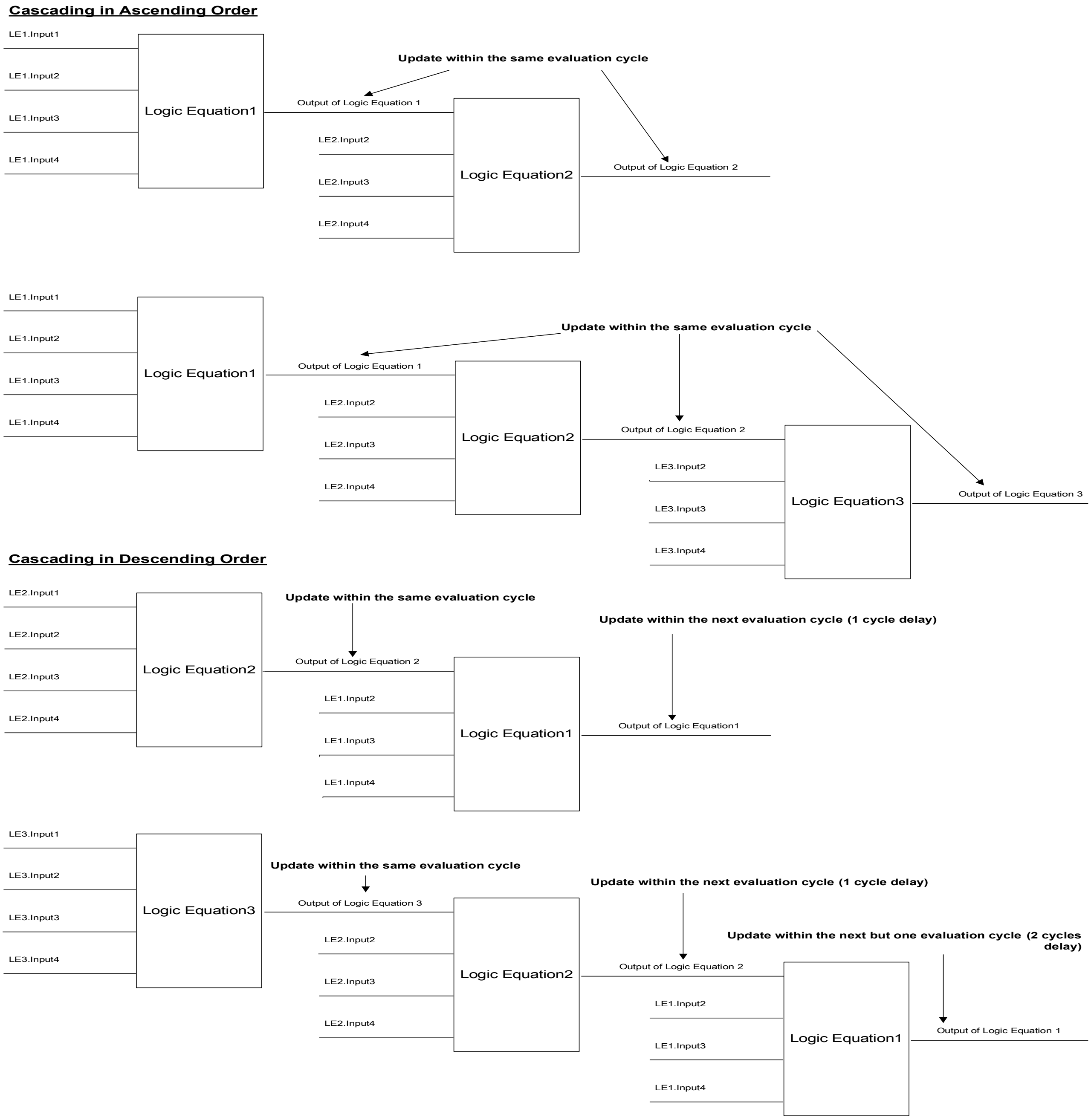
Cascading Logical Outputs

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.Inverting 1	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.Inverting 2	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.Inverting 3	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.Inverting 4	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]
LE1.t-Off Delay	Switch Off Delay	0.00 - 36000.00s	0.00s	[Logics /LE 1]

Parameter	Description	Setting range	Default	Menu path
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

Name	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 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 keep their “Force Position” only 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 <u>will NOT follow a force command</u> as long as it is disarmed at the same time.**

NOTICE **A relay output contact <u>will follow a force command:</u>**

- **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 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 keep their “Disarm Position” only 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 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 keep their "Forced Value" only 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 keep their “Forced Value” only 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

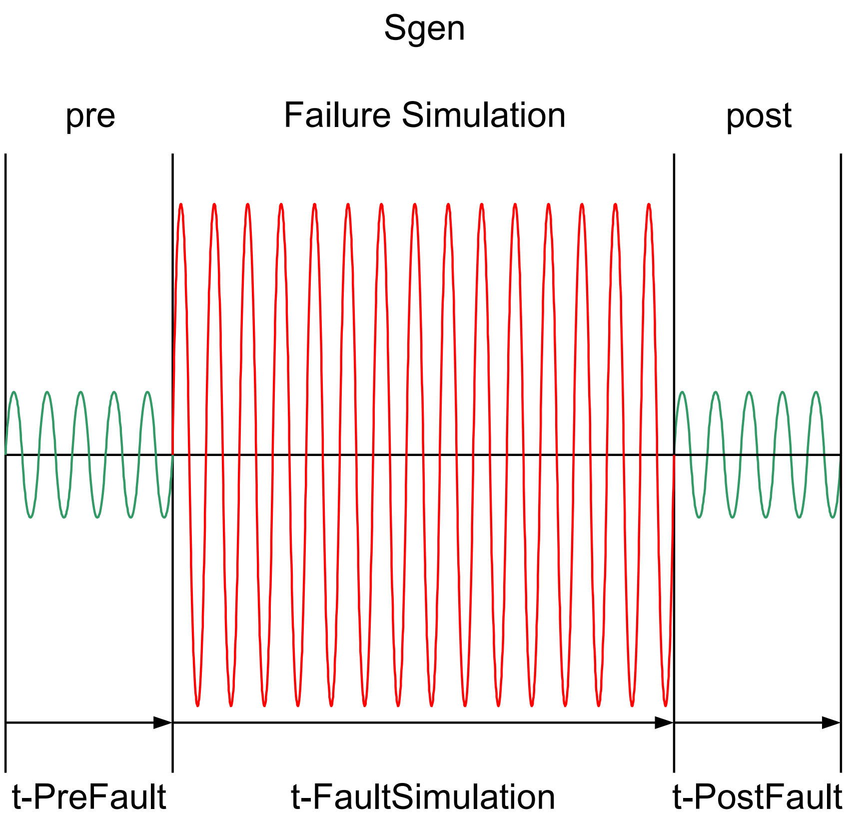
* = Availability depends on ordered device.

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).

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**:*

Stop Options	Cold Simulation (Option 1)	Hot Simulation (Option 2)
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.	**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	**Simulation is authorized to trip the breaker:** How To?: Call up [Service/Test Mode/Sgen /Process] TripCmd Mode = With TripCmd

Stop Options	Cold Simulation (Option 1)	Hot Simulation (Option 2)
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		
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.		

**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 Mode (Prot inhibit) /Sgen /Configuration /Times]
FaultSimulation	Duration of Fault Simulation	0.00 - 10800.00s	0.0s	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /Times]
PostFault	t-PostFault	0.00 - 300.00s	0.0s	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /Times]
TripCmd Mode	Trip Command Mode	No TripCmd, With TripCmd	No TripCmd	[Service /Test Mode (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.Pos ON	[Service /Test Mode (Prot inhibit) /Sgen /Process]

Parameter	Description	Setting range	Default	Menu path
Ex ForcePost	Force Post state. Abort simulation.	1..n, Assignment List	-.-	[Service /Test Mode (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 - 2.00Vn	1.0Vn	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PreFault /Voltage]
VL2	Voltage Fundamental Magnitude in Pre State: phase L2	0.00 - 2.00Vn	1.0Vn	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PreFault /Voltage]
VL3	Voltage Fundamental Magnitude in Pre State: phase L3	0.00 - 2.00Vn	1.0Vn	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PreFault /Voltage]
VX	Voltage Fundamental Magnitude in Pre State: VX	0.00 - 2.00Vn	0.0Vn	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PreFault /Voltage]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
phi VL1	Start Position respectively Start Angle of the Voltage Phasor during Pre-Phase:phase L1	-360 - 360°	0°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PreFault /Voltage]
phi VL2	Start Position respectively Start Angle of the Voltage Phasor during Pre-Phase:phase L2	-360 - 360°	240°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PreFault /Voltage]
phi VL3	Start Position respectively Start Angle of the Voltage Phasor during Pre-Phase:phase L3	-360 - 360°	120°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PreFault /Voltage]
phi VX meas	Start Position respectively Start Angle of the Voltage Phasor during Pre-Phase: VX	-360 - 360°	0°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PreFault /Voltage]
VL1	Voltage Fundamental Magnitude in Fault State: phase L1	0.00 - 2.00Vn	0.5Vn	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-FaultSimulation /Voltage]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
VL2	Voltage Fundamental Magnitude in Fault State: phase L2	0.00 - 2.00Vn	0.5Vn	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-FaultSimulation /Voltage]
VL3	Voltage Fundamental Magnitude in Fault State: phase L3	0.00 - 2.00Vn	0.5Vn	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-FaultSimulation /Voltage]
VX	Voltage Fundamental Magnitude in Fault State: phase VX	0.00 - 2.00Vn	0.5Vn	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-FaultSimulation /Voltage]
phi VL1	Start Position respectively Start Angle of the Voltage Phasor during Fault-Phase:phase L1	-360 - 360°	0°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-FaultSimulation /Voltage]
phi VL2	Start Position respectively Start Angle of the Voltage Phasor during Fault-Phase:phase L2	-360 - 360°	240°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-FaultSimulation /Voltage]

Parameter	Description	Setting range	Default	Menu path
phi VL3	Start Position respectively Start Angle of the Voltage Phasor during Fault-Phase:phase L3	-360 - 360°	120°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-FaultSimulation /Voltage]
phi VX meas	Start Position respectively Start Angle of the Voltage Phasor during Fault-Phase: VX	-360 - 360°	0°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-FaultSimulation /Voltage]
VL1	Voltage Fundamental Magnitude during Post phase: phase L1	0.00 - 2.00Vn	1.0Vn	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PostFault /Voltage]
VL2	Voltage Fundamental Magnitude during Post phase: phase L2	0.00 - 2.00Vn	1.0Vn	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PostFault /Voltage]
VL3	Voltage Fundamental Magnitude during Post phase: phase L3	0.00 - 2.00Vn	1.0Vn	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PostFault /Voltage]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
VX	Voltage Fundamental Magnitude during Post phase: phase VX	0.00 - 2.00Vn	0.0Vn	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PostFault /Voltage]
phi VL1	Start Position respectively Start Angle of the Voltage Phasor during Post phase: phase L1	-360 - 360°	0°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PostFault /Voltage]
phi VL2	Start Position respectively Start Angle of the Voltage Phasor during Post phase: phase L2	-360 - 360°	240°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PostFault /Voltage]
phi VL3	Start Position respectively Start Angle of the Voltage Phasor during Post phase: phase L3	-360 - 360°	120°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PostFault /Voltage]
phi VX meas	Start Position respectively Start Angle of the Voltage Phasor during Post phase: phase VX	-360 - 360°	0°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PostFault /Voltage]

Current Parameter of the Failure Simulator

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
IL1	Current Fundamental Magnitude in Pre State: phase L1	0.00 - 40.00In	0.0In	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PreFault /Current]
IL2	Current Fundamental Magnitude in Pre State: phase L2	0.00 - 40.00In	0.0In	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PreFault /Current]
IL3	Current Fundamental Magnitude in Pre State: phase L3	0.00 - 40.00In	0.0In	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PreFault /Current]
IG meas	Current Fundamental Magnitude in Pre State: IG	0.00 - 25.00In	0.0In	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PreFault /Current]
phi IL1	Start Position respectively Start Angle of the Current Phasor during Pre-Phase:phase L1	-360 - 360°	0°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PreFault /Current]

Parameter	Description	Setting range	Default	Menu path
phi IL2	Start Position respectively Start Angle of the Current Phasor during Pre-Phase:phase L2	-360 - 360°	240°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PreFault /Current]
phi IL3	Start Position respectively Start Angle of the Current Phasor during Pre-Phase:phase L3	-360 - 360°	120°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PreFault /Current]
phi IG meas	Start Position respectively Start Angle of the Current Phasor during Pre-Phase: IG	-360 - 360°	0°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PreFault /Current]
IL1	Current Fundamental Magnitude in Fault State: phase L1	0.00 - 40.00In	0.0In	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-FaultSimulation /Current]
IL2	Current Fundamental Magnitude in Fault State: phase L2	0.00 - 40.00In	0.0In	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-FaultSimulation /Current]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
IL3	Current Fundamental Magnitude in Fault State: phase L3	0.00 - 40.00In	0.0In	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-FaultSimulation /Current]
IG meas	Current Fundamental Magnitude in Fault State: IG	0.00 - 25.00In	0.0In	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-FaultSimulation /Current]
phi IL1	Start Position respectively Start Angle of the Current Phasor during Fault-Phase:phase L1	-360 - 360°	0°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-FaultSimulation /Current]
phi IL2	Start Position respectively Start Angle of the Current Phasor during Fault-Phase:phase L2	-360 - 360°	240°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-FaultSimulation /Current]
phi IL3	Start Position respectively Start Angle of the Current Phasor during Fault-Phase:phase L3	-360 - 360°	120°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-FaultSimulation /Current]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
phi IG meas	Start Position respectively Start Angle of the Current Phasor during Fault-Phase: IG	-360 - 360°	0°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-FaultSimulation /Current]
IL1	Current Fundamental Magnitude during Post phase: phase L1	0.00 - 40.00In	0.0In	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PostFault /Current]
IL2	Current Fundamental Magnitude during Post phase: phase L2	0.00 - 40.00In	0.0In	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PostFault /Current]
IL3	Current Fundamental Magnitude during Post phase: phase L3	0.00 - 40.00In	0.0In	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PostFault /Current]
IG meas	Current Fundamental Magnitude during Post phase: IG	0.00 - 25.00In	0.0In	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PostFault /Current]

Parameter	Description	Setting range	Default	Menu path
phi IL1	Start Position respectively Start Angle of the Current Phasor during Post phase: phase L1	-360 - 360°	0°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PostFault /Current]
phi IL2	Start Position respectively Start Angle of the Current Phasor during Post phase: phase L2	-360 - 360°	240°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PostFault /Current]
phi IL3	Start Position respectively Start Angle of the Current Phasor during Post phase: phase L3	-360 - 360°	120°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PostFault /Current]
phi IG meas	Start Position respectively Start Angle of the Current Phasor during Post phase: IG	-360 - 360°	0°	[Service /Test Mode (Prot inhibit) /Sgen /Configuration /t-PostFault /Current]

States of the Inputs of the Failure Simulator

Name	Description	Assignment via
ExBlo	Module input state: External blocking	[Service /Test Mode (Prot inhibit) /Sgen /Process]
Ex ForcePost-I	State of the module input:Force Post state. Abort simulation.	[Service /Test Mode (Prot inhibit) /Sgen /Process]

Signals of the Failure Simulator (States of the Outputs)

Name	*Description*
Running	Signal; Measuring value simulation is running
State	Signal: Wave generation states: 0=AdcNormal, 1=PreFault, 2=Fault, 3=Post, 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 Mode (Prot inhibit) /Sgen /Process]
Stop Simulation	Stopp Fault Simulation (Using the test parameters)	inactive, active	inactive	[Service /Test Mode (Prot inhibit) /Sgen /Process]

Failure Simulator Values

Value	*Description*	*Default*	*Size*	*Menu path*
State	Wave generation states: 0=AdcNormal, 1=PreFault, 2=Fault, 3=Post, 4=InitReset	L1 L2 L3 Normal	L1 L2 L3 Normal, t-PreFault, t-FaultSimulation, t-PostFault, Init Res	[Service /Test Mode (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 B2: height/-width (7 Pushbottons/Door Mounting)	173 mm (6.811")/ 212.7 mm (8.374")
Housing B2: height/-width (8 Pushbottons/Door Mounting)	183 mm (7.205")/ 212.7 mm (8.374")
Housing B2: height/-width (7 and 8 Pushbottons/19")	173 mm (6.811" / 4U)/ 212.7 mm (8.374" / 42 HP)
Housing depth (incl. terminals):	208 mm (8.189")
Material, housing:	Aluminum extruded section
Material, front panel:	Aluminum/Foil front
Mounting position:	Horizontal (±45° around the X-axis must be permitted)
Weight:	approx. 4.2 kg (9.259 lb)

Current and Earth Current Measurement

Plug-in Connectors with Integrated Short-Circuiter

(Conventional Current Inputs)

Nominal currents:	1 A / 5 A	
Max. measuring range:	up to 40 x In (phase currents) up to 25 x In (earth current standard) up to 2.5 x In (earth current sensitive)	
Continuous loading capacity:	Phase current/Earth current 4 x In/continuously	Earth current sensitive 2 x In/continuously
Overcurrent proof:	Phase current/Earth current 30 x In/10 s 100 x In/1 s 250 x In/10 ms (1 half-wave)	Earth current sensitive 10 x In/10 s 25 x In/1 s 100 x In/10 ms (1 half-wave)
Power consumption:	Phase current inputs: at In = 1 A S = 0.15 mVA at In = 5 A S = 0.15 mVA	
	Earth current input: at In = 1 A S = 0.35 mVA at In = 5 A S = 0.35 mVA	Sensitive earth current input: at In = 1 A S = 0.35 mVA at In = 5 A S = 0.35 mVA
Frequency range:	50 Hz / 60 Hz ±10%	
Terminals:	Screw-type terminals with integrated short-circuiters (contacts)	
Screws:	M4, captive type acc. to VDEW	
Connection Cross Sections:	1 x or 2 x 2.5 mm² (2 x AWG 14) with wire end ferrule 1 x or 2 x 4.0 mm² (2 x AWG 12) with ring cable sleeve or cable sleeve 1 x or 2 x 6 mm² (2 x AWG 10) with ring cable sleeve or cable sleeve The current measuring board´s terminal blocks may be used as with 2 (double) conductors AWG 10,12,14 otherwise with single conductors only.	

Voltage and Residual Voltage Measurement

Nominal voltages:	60 - 520 V (can be configured)
Max. measuring range:	2 x nominal voltage or 800 V
Continuous loading capacity:	800 V AC
Power consumption:	at Vn = 100 V S = 0.1 mVA at Vn = 110 V S = 0.1 mVA at Vn = 230 V S = 0.4 mVA at Vn = 400 V S = 1.0 mVA
Frequency range:	50 Hz or 60 Hz ±10%
Terminals:	Screw-type terminals

Frequency Measurement

Nominal frequencies:	50 Hz / 60 Hz

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 communication is permitted to be interrupted
Max. permissible making current:	18 A peak value for ŧ 0.25 ms 12 A peak value for ŧ 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	13 W
48-230 V AC (for frequencies of 50-60 Hz):	7 VA	13 VA

Display

Display type:	LCD with LED background illumination
Resolution graphics display:	128 x 128 pixel

LED-Type:	Two colored: red/green
Number of LEDs, Housing B2:	15

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:	<4 mA
Reaction time:	<20 ms
Fallback time:	<30 ms

(Safe state of the digital inputs)

4 Switching thresholds:	Un = 24 V DC, 48 V DC, 60 V DC, 110 V AC/DC, 230 V AC/DC
Un = 24 V DC:	
Switching threshold 1 ON:	min. 19.2 V DC
Switching threshold 1 OFF:	max. 9.6 V DC
Un = 48 V/60V DC:	
Switching threshold 2 ON:	Min. 42.6 V DC
Switching threshold 2 OFF:	max. 21.3 V DC
Un = 110 V AC/DC:	
Switching threshold 3 ON:	min. 88.0 V DC/88.0 V AC
Switching threshold 3 OFF:	max. 44.0 V DC/44.0 V AC
Un = 230 V AC/DC:	
Switching threshold 4 ON:	min. 184 V DC/184 V AC
Switching threshold 4 OFF	max. 92 V DC/92 V AC
Terminals:	Screw-type terminals

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
Terminals:	Screw-type terminals

Supervision Contact (SC)

Continuous current::	5 A AC/DC
Max. Switch-on current:	15 A AC/DC for 4 s
Max. breaking current:	5 A AC up to 250 V AC
	5 A DC up to 30 V (resistive)
	0.25 A DC at 250 V (resistive)
Max. switching voltage:	250 V AC/250 V DC
Switching capacity:	1250 VA
Contact type:	1 changeover contact
Terminals:	Screw-type terminals

Analog Outputs

The following technical data only apply to devices, which are equipped with analog outputs. Please refer to the order code of your device.

The mode of each output can be individually selected between current or voltage output. Shielded cable for the analog outputs is recommended. The terminals of the HF shield should be used, when connecting the shield to earth on both sides of the cable is not possible. On one side of the cable the shield has to be directly connected to earth. In case of the use of unshielded twisted pair cables, the length must not exceed 10 m. All analog outputs have a common potential. Each output has an own common terminal.

Current mode	
Range:	0-20 mA
Max. load resistance:	1 kΩ
Voltage mode	
Range:	0-10 V maximum output current 20 mA
Accuracy:	0.5% of the nominal value 20 mA resp. 10 V
Influence of temperature to accuracy:	<1%
Test voltage of outputs (one group) against other electrical groups:	2.5 kV
Test voltage of outputs (one group) against earth:	1.0 kV

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. The shielding has to be fixed at the screw that is marked with the ground symbol (rear side of the device).**

Fibre Optic*

Master/Slave:	Slave
Connection:	ST-Plug

URTD-Interface*

Connection:	Versatile Link

*availability depends on device

Boot phase

After switching on the power supply the protection will be available in approximately 16 seconds. After approximately 2 min 10 s 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.I, 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 ANSI C37.90.2	26 MHz – 80 MHz 80 MHz – 1 GHz 1 GHz – 3 GHz	10 V/m 35 V/m 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

Tolerances

It has to be observed, that the set pickup and release values (hysteresis) including tolerances, are always within the permissible measuring range.

Real Time Clock Tolerances

Resolution:	1 ms
Tolerance:	<1 minute / month (+20°C) <±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 synchronisation	<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
Modbus TCP	Dependent on the time drift of the time generator	Dependent on the network load

Measured Values Tolerances

Phase and Earth Current Measuring

Accuracy: Class 0,5

Amplitude error if I < 1 x IN:	±0.5% of the rated value *
Amplitude error if I > 1 x IN < 2 x IN:	±0.5% of the measured value *
Amplitude error if I > 2 x IN:	±1.0% of the measured value *
Resolution:	0.01 A (0.001 A for earth current sensitive)
	* For earth current sensitive the precision does not depend on the nominal value but is referenced to 100 mA (with In =1 A) respectively. 500 mA (with In = 5 A)
Harmonics	up to 20% 3rd harmonic ±1% up to 20% 5th harmonic ±1%
Frequency influence	<±2% / Hz in the range of ±5 Hz of the parameterized nominal frequency
Temperature influence	<±1% within the range of 0°C up to +60°C

Phase-to-Earth and Residual Voltage Measurement

Precision:	Class 0,5
Amplitude error for V<100 V (measured):	±0.5 V
Amplitude error for V<100 V (calculated):	±1.0 V
Amplitude error for V<Vn (measured):	±0.5% (of the rated value)
Amplitude error for V<Vn (calculated):	±1.0% (of the rated value)
Amplitude error for V>Vn (measured):	±0.5% (of the measured value)
Amplitude error for V>Vn (calculated):	±1.0% (of the calculated value)
Resolution:	0.1 V
Harmonics	up to 20% 3rd harmonic ±1% up to 20% 5th harmonic ±1%
Frequency influence	<±2% / Hz in the range of ±5 Hz of the parameterized nominal frequency
Temperature influence	<±1% within the range of 0°C up to +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 Stages Tolerances

Note:
The tripping delay relates to the time between alarm and trip. The tolerance of the operating time relates to the time between the measured value has exceeded the threshold until the protection stage is alarmed.

Overcurrent protection stages: I[x]	*Tolerance*
I>	±1.5% of the setting value resp. 1% In
Resetting ratio	97% or 0.5% x In
t	DEFT ±1% resp. ±10 ms
Operating time Starting from I higher than 1.1 x I>	<35 ms <65 ms (If IOC Motor start blocking is arranged)
Release time	<45 ms
t-char	±5% IEC NINV, IEC VINV, IEC LINV, IEC EINV, ANSI MINV, ANSI ANSI VINV, ANSI EINV, Therm Flat, IT, I2T, I4T
t-reset Only available if: Characteristic = INV	±1% resp. ±10 ms

Earth current stages: IG[x]	*Tolerance*
IG>	±1.5% of the setting value resp. 1% In
Resetting ratio	97% or 0.5% x In
t	DEFT ±1% resp. ±10 ms
Operating time Starting from IG higher than 1.1 x IG>	<35 ms <65 ms (If GOC Motor start blocking is arranged)
Release time	<45 ms
t-char	±5% IEC NINV, IEC VINV, IEC LINV, IEC EINV, ANSI MINV, ANSI ANSI VINV, ANSI EINV, Therm Flat, IT, I2T, I4T
t-reset Only available if: Characteristic = INV	±1% resp. ±10 ms

Negative phase sequence current: I2[x]	*Tolerance*
I2	±2% of the setting value resp. ±1% In
Resetting ratio	97% or 0.5% x In
t Tripping delay time (DEFT)	DEFT ±1% resp. ±10 ms
Operating time Starting from I2 higher than 1.1 x I>	<65 ms
Release time	<45 ms

Earth current: IG[x]	*Tolerance*
IG>	±1.5% of the setting value resp. ±1% In
resetting ratio	97% or 0.5% x In
VE>	±1.5% of the setting value resp. ±1% In
Resetting ratio	97% or 0.5% x In
t	DEFT ±1% resp. ±10 ms
Operating time Starting from IG higher than 1.1 x IG>	<35 ms <65 ms (If IOC Motor start blocking is arranged)
Release time	<45ms
t-char	±5% IEC NINV, IEC VINV, IEC LINV, IEC EINV, ANSI MINV, ANSI ANSI VINV, ANSI EINV, Therm Flat, IT, I2T, I4T
t-reset Only available if: Characteristic = INV	±1% resp. ±10 ms

Unbalanced load :I2>[x]	*Tolerance*
I2>	±2% of the setting value resp.1% In
Resetting ratio	97% or 0.5% x In
t	DEFT ±1% resp. ±10 ms
Operating time Starting from I2 higher than 1.3 x I2>	<65 ms
Release time	<45 ms
k	±5% INV
τ-cool	±5% INV

Voltage Protection V>[x]	*Tolerance*
V>	±1.5% of the setting value resp. ±1% Vn
Resetting ratio	97% or 0.5% x Vn
t	±1% resp. ±10 ms
Operating time Starting from U higher than 1.3 x U>	<40ms
Release time	<40ms

Voltage Protection V<[x]	*Tolerance*
V<	±1.5% of the setting value resp. ±1% Vn
Resetting ratio	103% or 0.5% x Vn
t	±1% resp. ±10 ms
Operating time Starting from V lower than 0.7 x V<	<40ms
Release time	<40ms

Voltage Protection V(t)<[x]	*Tolerance*
V(t)<	±1.5% of the setting value resp. ±1% Vn
Resetting ratio	103% or 0.5% x Vn
t	±1% resp. ±10 ms
Operating time Starting from V lower than 0.7 x V<	<40ms
Release time	<40ms

Residual Voltage Protection VG[x]	*Tolerance*
VG>	±1.5% of the setting value resp. ±1% Vn
Resetting ratio	97% or 0.5% x Vn
t	±1% resp. ±10 ms
Operating time Starting from VE higher than 1.3 x VG>	<40ms
Release time	<40ms

Frequency Protection f>[x]	*Tolerance*
f>	±10 mHz at fn
Resetting ratio	99.95% or 0.05% fn
t	±1% resp. ±10 ms
Operating time Starting from f higher than f>+0.02 Hz	40-50Hz <60ms 50-70Hz <50ms
Release time	40-50Hz <85ms 50-70Hz <75ms

Frequency Protection f<[x]	*Tolerance*
f<	±10 mHz at fn
t	±1% resp. ±10 ms
Resetting ratio	100.05% or 0.05% fn
Operating time Starting from f lower than f<-0.02 Hz	40-50Hz <60ms 50-70Hz <50ms
Release time	40-50Hz <85ms 50-70Hz <75ms
V Block f	±1.5% of the setting value resp. ±1% Un
Resetting ratio	103% or 0.5% x Un

Rate of Change of Frequency df/dt	*Tolerance*
df/dt	±100 mHz per Second
t	±1% resp. ±10 ms
Operating time	<40 ms
Release time	<40 ms

Vector surge delta phi	*Tolerance*
delta phi	±0.5° [1-30°] at Vn and fn
Operating time	<40 ms

Circuit Breaker Failure Protection CBF	*Tolerance*
I-CBF>	±1.5% of the setting value resp. ±1% In
Resetting ratio	0.5% x In
t-CBF	±1% resp. ±10 ms
Operating time Starting from I higher than 1.3 x I-CBF>	<40 ms
Release time	<40 ms

Trip Circuit Supervision TCS	*Tolerance*
t-TCS	±1% resp. ±10 ms

Current Transformer Supervision CTS	*Tolerance*
ΔI	±2% of the setting value resp. ±1.5% In
Resetting ratio	94%
t	±1% resp. ± 10 ms

Asymmetry V012[x]	*Tolerance*
V1>	±2% of the setting value resp. ±1.5% Vn
resetting ratio	97% or 0.5% x Vn
V1<	±2% of the setting value resp. ±1.5% Vn
resetting ratio	103% or 0.5% x Vn
V2>	±2% of the setting value resp. ±1.5% Vn
Resetting ratio	97% or 0.5% x Vn
t	±1% resp. ±10 ms
Threshold	±2% of the setting value resp. ±1.5% Vn
%V2/V1 ≥ 0.1 x Vn	±1%
Resetting ratio	97% or 0.5% x Vn
t	DEFT ±1% resp. ±10 ms
Operating time	<60ms

Asymmetry V012[x]	*Tolerance*
Release time	<40ms

SOTF – Switch onto fault	*Tolerance*
Operating time	<35 ms
I<	±1.5% of the setting value resp.1% x In
t-enable	±1% resp. ±10 ms

LOP - loss of potential	*Tolerance*
t-Alarm	±1% resp. ±10 ms

PQS	*Tolerance at 0.8 Vn (Vn =100 V) symmetrically feeded*
P>, Q> |PF|>0,5	±3% of the setting value resp. ±0.1% of Sn
Resetting ratio	97% of setting values or 0.2 W
t	±1% of the setting value resp. ±10 ms
Operating time	<75 ms
Resetting time	<75 ms

PQS	*Tolerance at 0.8 Vn (Vn =100 V) symmetrically feeded*
P<, Q< |PF|>0,5	±3% of the setting value resp. ±0.1% of Sn
Resetting ratio	103% of setting values or 0.2 W
t	±1% of the setting value resp. ±10 ms
Operating time	<75 ms
Resetting time	<75 ms

PQS	*Tolerance at 0.8 Vn (Vn =100 V) symmetrically feeded*
S>	±3% of the setting value resp. ±0.1% of Sn
Resetting ratio	97% of setting values or 0.2 W
t	±1% of the setting value resp. ±10 ms
Operating time	<75 ms
Resetting time	<75 ms

PQS	*Tolerance at 0.8 Vn (Vn =100 V) symmetrically feeded*
S<	±3% of the setting value resp. ±0.1% of Sn
Resetting ratio	103% of setting values or 0.2 W
t	±1% of the setting value resp. ±10 ms
Operating time	<75 ms
Resetting time	<75 ms

PQS	*Tolerance at 0.8 Vn (Vn =100 V) symmetrically feeded*
Pr |PF|>0,5	±3% of the setting value resp. 0.1% of Sn
Resetting ratio	97% of Setting values >0.07 Sn up to 58% of setting values <0.07 Sn
t	±1% of the setting value resp. ±10 ms
Operating time	<75 ms
Resetting time	<75 ms

PQS	*Tolerance at 0.8 Vn (Vn =100 V) symmetrically feeded*
Qr |PF|>0,5	±3% of the setting value resp. 0.1% of Sn
Resetting ratio	97% of Setting values >0.07 Sn up to 58% of setting values <0.07 Sn resp. |PF| >0,9 or reset at +1° at |PF| >0.99
t	±1% of the setting value resp. ±10 ms
Operating time	<75 ms
Resetting time	<75 ms

PF (Power Factor)	*Tolerance*
PF	± 0.01 (absolute)
Operating time	<120 ms

RTD Protection: RTD [x]	*Tolerance*
Pickup	±1°C
Resetting ratio	99% or 1%
t	DEFT ±1% resp. ±10 ms
Operating time	<40 ms
Release time	<45 ms

Thermal Model: ThR	*Tolerance*
I2	±2% of the setting value resp. ±1% In
Resetting ratio	98% or 0.5% x In
t	DEFT ±1% resp. ±10 ms
Alarm ThR	±1.5 % of the setting value
Trip ThR	±1.5 % of the setting value

JAM Protection: JAM [x]	*Tolerance*
Pickup	±1.5% of the setting value resp. 1% In
Resetting ratio	97% or 0.5% x In
t	DEFT ±1% resp. ±10 ms
Operating time	<65 ms
Release time	<45 ms

Undercurrent Protection: I< [x]	*Tolerance*
I<	±1.5% of the setting value resp. 1% In
Resetting ratio	97% or 0.5% x In
t	DEFT ±1% resp. ±10 ms
Operating time	<65 ms
Release time	<45 ms

Mechanical Load Shedding MLS	*Tolerance*
Pickup Threshold	±1.5% of the setting value resp. 1% In
Resetting ratio	97% or 0.5% x In
t-Pickup Delay	DEFT ±1% resp. ±10 ms
Dropout Threshold	±1.5% of the setting value resp. 1% In
Resetting ratio	97% or 0.5% x In
t-Drop Delay	DEFT ±1% resp. ±10 ms
Operating time	<65 ms
Release time	<45 ms

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.NonInterl-I	Non-Interlocking
SG.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.Pos not ON	Signal: Pos not ON
SG.Pos ON	Signal: Circuit Breaker is in ON-Position
SG.Pos OFF	Signal: Circuit Breaker is in OFF-Position
SG.Pos Indeterm	Signal: Circuit Breaker is in Indeterminate Position
SG.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.Ready	Signal: Circuit breaker is ready for operation.
SG.t-Dwell	Signal: Dwell time
SG.Interl ON	Signal: One or more IL_On inputs are active.

Name	*Description*
SG.Interl OFF	Signal: One or more IL_Off inputs are active.
SG.CES succesf	Command Execution Supervision: Switching command executed successfully.
SG.CES Disturbed	Command Execution Supervision: Switching Command unsuccessful. Switchgear in disturbed position.
SG.CES Fail TripCmd	Command Execution Supervision: Trip command not executed.
SG.CES SwitchgDir	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.CES ON d OFF	Command Execution Supervision: On Command during a pending OFF Command.
SG.CES SG not ready	Command Execution Supervision: Switchgear not ready
SG.CES Fiel Interl	Command Execution Supervision: Switching Command not executed because of field interlocking.
SG.CES SyncTimeout	Command Execution Supervision: Switching Command not excecuted. No Synchronization signal while t-sync was running.
SG.Prot ON	Signal: ON Command issued by the Prot module
SG.TripCmd	Signal: Trip Command
SG.Ack TripCmd	Signal: Acknowledge Trip Command
SG.ON incl Prot ON	Signal: The ON Command includes the ON Command issued by the Protection module.
SG.OFF incl TripCmd	Signal: The OFF Command includes the OFF Command issued by the Protection module.
SG.Position Ind manipul	Signal: Position Indicators faked
SG.SGwear Slow SG	Signal: Alarm, the circuit breaker (load-break switch) becomes slower
SG.Res SGwear Sl SG	Signal: Resetting the slow Switchgear Alarm
SG.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.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.ON Cmd manual	Signal: ON Cmd manual
SG.OFF Cmd manual	Signal: OFF Cmd manual
SG.Sync ON request	Signal: Synchronous ON request
SG.Aux ON-I	Module Input State: Position indicator/check-back signal of the CB (52a)
SG.Aux OFF-I	Module input state: Position indicator/check-back signal of the CB (52b)
SG.Ready-I	Module input state: CB ready
SG.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.Ack TripCmd-I	State of the module input: Acknowledgement Signal (only for automatic acknowledgement) Module input signal

Name	*Description*
SG.Interl ON1-I	State of the module input: Interlocking of the ON command
SG.Interl ON2-I	State of the module input: Interlocking of the ON command
SG.Interl ON3-I	State of the module input: Interlocking of the ON command
SG.Interl OFF1-I	State of the module input: Interlocking of the OFF command
SG.Interl OFF2-I	State of the module input: Interlocking of the OFF command
SG.Interl OFF3-I	State of the module input: Interlocking of the OFF command
SG.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.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.Operations Alarm	Signal: Service Alarm, too many Operations
SG.Isum Intr trip: IL1	Signal: Maximum permissible Summation of the interrupting (tripping) currents exceeded: IL1
SG.Isum Intr trip: IL2	Signal: Maximum permissible Summation of the interrupting (tripping) currents exceeded: IL2
SG.Isum Intr trip: IL3	Signal: Maximum permissible Summation of the interrupting (tripping) currents exceeded: IL3
SG.Isum Intr trip	Signal: Maximum permissible Summation of the interrupting (tripping) currents exceeded in at least one phase.
SG.Res TripCmd Cr	Signal: Resetting of the Counter: total number of trip commands
SG.Res Sum trip	Signal: Reset summation of the tripping currents
SG.WearLevel Alarm	Signal: Threshold for the Alarm
SG.WearLevel Lockout	Signal: Threshold for the Lockout Level
SG.Res SGwear Curve	Signal: Res SGwear Curve
SG.Isum Intr ph Alm	Signal: Isum Intr ph Alm
SG.Res Isum Intr ph Alm	Signal: Res Isum Intr ph Alm
MStart.active	Signal: active
MStart.Blo TripCmd	Signal: Trip Command blocked
MStart.Trip	Signal: Trip
MStart.TripCmd	Signal: Trip Command
MStart.Start	Signal: Motor is in start mode
MStart.Run	Signal: Motor is in run mode
MStart.Stop	Signal: Motor is in stop mode
MStart.Blo	Signal: Motor is blocked for starting or transition to Run mode
MStart.NOCSBlocked	Signal: Motor is prohibited to start due to number of cold start limits
MStart.SPHBlocked	Signal: Motor is prohibited to start due to starts per hour limits
MStart.SPHBlockAlarm	Signal: Motor is prohibited to start due to starts per hour limits, would come active in the next stop
MStart.TBSBlocked	Signal: Motor is prohibited to start due to time between starts limits
MStart.ThermalBlo	Signal: Thermal block
MStart.RemBlockStart	Signal: Motor is prohibited to start due to external blocking through digital input DI

Name	*Description*
MStart.TransitionTrip	Signal: Start transition fail trip
MStart.ZSSTrip	Signal: Zero speed trip (possible locked rotor)
MStart.INSQSP2STFaill	Signal: Fail to transit from stop to start based on reported back time
MStart.INSQSt2RunFail	Signal: Fail to transit from start to run based on reported back time
MStart.LATBlock	Signal: Long acceleration timer enforced
MStart.ColdStartSeq	Signal: Motor cold start sequence flag
MStart.ForcedStart	Signal: Motor being forced to start
MStart.TripPhaseReverse	Signal: Relay tripped because of phase reverse detection
MStart.EmergOverrideDI	Signal: Emergency override start blocking through digital input DI
MStart.EmergOverrideUI	Signal: Emergency override start blocking through front panel
MStart.ABSActive	Signal: Anti-backspin is active. For certain applications, such as pumping a fluid up a pipe, the motor may be driven backward for a period of time after it stops. The anti-backspin timer prevents starting the motor while it is spinning in the reverse direction.
MStart.Blo-GOCStart	Signal: Ground Instantaneous Overcurrent Start Delay. GOC (Instantaneous Overcurrent) elements are blocked for the time programmed under this parameter
MStart.Blo-IOCStart	Signal: Phase Instantaneous Overcurrent Start Delay. IOC (Instantaneous Overcurrent) elements are blocked for the time programmed under this parameter
MStart.Blo-I<Start	Signal: Underload Start Delay. Underload(Instantaneous Overcurrent) elements are blocked for the time programmed under this parameter
MStart.Blo-JamStart	Signal: JAM Start Delay. JAM(Instantaneous Overcurrent) elements are blocked for the time programmed under this parameter
MStart.Blo-UnbalStart	Signal: Motor start block current unbalance signal
MStart.Blo-Generic1	Generic Start Delay. This value can be used to block any protective element.1
MStart.Blo-Generic2	Generic Start Delay. This value can be used to block any protective element.2
MStart.Blo-Generic3	Generic Start Delay. This value can be used to block any protective element.3
MStart.Blo-Generic4	Generic Start Delay. This value can be used to block any protective element.4
MStart.Blo-Generic5	Generic Start Delay. This value can be used to block any protective element.5
MStart.I_Transit	Signal: Current transition signal
MStart.T_Transit	Signal: Time transition signal
MStart.StartMotorCmd	Signal: Start motor command
MStart.MotorStopBlo	Signal: Motor stop block other protection functions
MStart.Rotating forward	Signal: Rotation Direction forward
MStart.Rotating backward	Signal: Rotation Direction reverse
MStart.Blo-VUnbal Start	Signal: Motor start block voltage unbalance signal.
MStart.Blo-UnderV Start	Signal: Undervoltage Start Delay. Undervoltage elements are blocked for the time programmed under this parameter

Name	*Description*
MStart.Block-OverVStart	Signal: Overvoltage Start Delay. Overvoltage elements are blocked for the time programmed under this parameter
MStart.Blo-PowerStart	Signal: Power Start Delay. Power elements are blocked for the time programmed under this parameter
MStart.Blo-PFacStart	Signal: Power Factor Start Delay. Power Factor elements are blocked for the time programmed under this parameter
MStart.Blo-FrqStart	Signal: Frequency Start Delay. Frequency elements are blocked for the time programmed under this parameter
MStart.Start Signal-I	State of the module input: Motor Start Signal. User can tie a digital input to this Input. If "Start-I" becomes true, "StartMotorCommand" becomes true for at least 500ms.
MStart.Stop-I	State of the module input: Stop Motor Signal
MStart.StartBlock-I	State of the module input: Start Motor Signal
MStart.EmgOvr-I	State of the module input: Emergency Override. Signal has to be active in order to release the thermal capacity of the motor. Please notice that by doing this you run the risk of damaging the motor. “EMGOVR” has to be set to “DI” or “DI or UI” for this input to take effect
MStart.INSQ-I	State of the module input: INcomplete SeQuence
MStart.ThermSwitch-I	State of the module input: Therm Switch
MStart.ZSS-I	State of the module input: Zero Speed Switch
I[1].active	Signal: active
I[1].ExBlo	Signal: External Blocking
I[1].Ex rev Interl	Signal: External reverse Interlocking
I[1].Blo TripCmd	Signal: Trip Command blocked
I[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
I[1].Alarm L1	Signal: Alarm L1
I[1].Alarm L2	Signal: Alarm L2
I[1].Alarm L3	Signal: Alarm L3
I[1].Alarm	Signal: Alarm
I[1].Trip L1	Signal: General Trip Phase L1
I[1].Trip L2	Signal: General Trip Phase L2
I[1].Trip L3	Signal: General Trip Phase L3
I[1].Trip	Signal: Trip
I[1].TripCmd	Signal: Trip Command
I[1].DefaultSet	Signal: Default Parameter Set
I[1].AdaptSet 1	Signal: Adaptive Parameter 1
I[1].AdaptSet 2	Signal: Adaptive Parameter 2
I[1].AdaptSet 3	Signal: Adaptive Parameter 3
I[1].AdaptSet 4	Signal: Adaptive Parameter 4
I[1].ExBlo1-I	Module input state: External blocking1
I[1].ExBlo2-I	Module input state: External blocking2
I[1].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command

Name	*Description*
I[1].Ex rev Interl-I	Module input state: External reverse interlocking
I[1].AdaptSet1-I	Module input state: Adaptive Parameter1
I[1].AdaptSet2-I	Module input state: Adaptive Parameter2
I[1].AdaptSet3-I	Module input state: Adaptive Parameter3
I[1].AdaptSet4-I	Module input state: Adaptive Parameter4
I[2].active	Signal: active
I[2].ExBlo	Signal: External Blocking
I[2].Ex rev Interl	Signal: External reverse Interlocking
I[2].Blo TripCmd	Signal: Trip Command blocked
I[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
I[2].Alarm L1	Signal: Alarm L1
I[2].Alarm L2	Signal: Alarm L2
I[2].Alarm L3	Signal: Alarm L3
I[2].Alarm	Signal: Alarm
I[2].Trip L1	Signal: General Trip Phase L1
I[2].Trip L2	Signal: General Trip Phase L2
I[2].Trip L3	Signal: General Trip Phase L3
I[2].Trip	Signal: Trip
I[2].TripCmd	Signal: Trip Command
I[2].DefaultSet	Signal: Default Parameter Set
I[2].AdaptSet 1	Signal: Adaptive Parameter 1
I[2].AdaptSet 2	Signal: Adaptive Parameter 2
I[2].AdaptSet 3	Signal: Adaptive Parameter 3
I[2].AdaptSet 4	Signal: Adaptive Parameter 4
I[2].ExBlo1-I	Module input state: External blocking1
I[2].ExBlo2-I	Module input state: External blocking2
I[2].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
I[2].Ex rev Interl-I	Module input state: External reverse interlocking
I[2].AdaptSet1-I	Module input state: Adaptive Parameter1
I[2].AdaptSet2-I	Module input state: Adaptive Parameter2
I[2].AdaptSet3-I	Module input state: Adaptive Parameter3
I[2].AdaptSet4-I	Module input state: Adaptive Parameter4
I[3].active	Signal: active
I[3].ExBlo	Signal: External Blocking
I[3].Ex rev Interl	Signal: External reverse Interlocking
I[3].Blo TripCmd	Signal: Trip Command blocked
I[3].ExBlo TripCmd	Signal: External Blocking of the Trip Command
I[3].Alarm L1	Signal: Alarm L1
I[3].Alarm L2	Signal: Alarm L2
I[3].Alarm L3	Signal: Alarm L3

Name	*Description*
I[3].Alarm	Signal: Alarm
I[3].Trip L1	Signal: General Trip Phase L1
I[3].Trip L2	Signal: General Trip Phase L2
I[3].Trip L3	Signal: General Trip Phase L3
I[3].Trip	Signal: Trip
I[3].TripCmd	Signal: Trip Command
I[3].DefaultSet	Signal: Default Parameter Set
I[3].AdaptSet 1	Signal: Adaptive Parameter 1
I[3].AdaptSet 2	Signal: Adaptive Parameter 2
I[3].AdaptSet 3	Signal: Adaptive Parameter 3
I[3].AdaptSet 4	Signal: Adaptive Parameter 4
I[3].ExBlo1-I	Module input state: External blocking1
I[3].ExBlo2-I	Module input state: External blocking2
I[3].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
I[3].Ex rev Interl-I	Module input state: External reverse interlocking
I[3].AdaptSet1-I	Module input state: Adaptive Parameter1
I[3].AdaptSet2-I	Module input state: Adaptive Parameter2
I[3].AdaptSet3-I	Module input state: Adaptive Parameter3
I[3].AdaptSet4-I	Module input state: Adaptive Parameter4
I[4].active	Signal: active
I[4].ExBlo	Signal: External Blocking
I[4].Ex rev Interl	Signal: External reverse Interlocking
I[4].Blo TripCmd	Signal: Trip Command blocked
I[4].ExBlo TripCmd	Signal: External Blocking of the Trip Command
I[4].Alarm L1	Signal: Alarm L1
I[4].Alarm L2	Signal: Alarm L2
I[4].Alarm L3	Signal: Alarm L3
I[4].Alarm	Signal: Alarm
I[4].Trip L1	Signal: General Trip Phase L1
I[4].Trip L2	Signal: General Trip Phase L2
I[4].Trip L3	Signal: General Trip Phase L3
I[4].Trip	Signal: Trip
I[4].TripCmd	Signal: Trip Command
I[4].DefaultSet	Signal: Default Parameter Set
I[4].AdaptSet 1	Signal: Adaptive Parameter 1
I[4].AdaptSet 2	Signal: Adaptive Parameter 2
I[4].AdaptSet 3	Signal: Adaptive Parameter 3
I[4].AdaptSet 4	Signal: Adaptive Parameter 4
I[4].ExBlo1-I	Module input state: External blocking1
I[4].ExBlo2-I	Module input state: External blocking2

Name	*Description*
I[4].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
I[4].Ex rev Interl-I	Module input state: External reverse interlocking
I[4].AdaptSet1-I	Module input state: Adaptive Parameter1
I[4].AdaptSet2-I	Module input state: Adaptive Parameter2
I[4].AdaptSet3-I	Module input state: Adaptive Parameter3
I[4].AdaptSet4-I	Module input state: Adaptive Parameter4
I[5].active	Signal: active
I[5].ExBlo	Signal: External Blocking
I[5].Ex rev Interl	Signal: External reverse Interlocking
I[5].Blo TripCmd	Signal: Trip Command blocked
I[5].ExBlo TripCmd	Signal: External Blocking of the Trip Command
I[5].Alarm L1	Signal: Alarm L1
I[5].Alarm L2	Signal: Alarm L2
I[5].Alarm L3	Signal: Alarm L3
I[5].Alarm	Signal: Alarm
I[5].Trip L1	Signal: General Trip Phase L1
I[5].Trip L2	Signal: General Trip Phase L2
I[5].Trip L3	Signal: General Trip Phase L3
I[5].Trip	Signal: Trip
I[5].TripCmd	Signal: Trip Command
I[5].DefaultSet	Signal: Default Parameter Set
I[5].AdaptSet 1	Signal: Adaptive Parameter 1
I[5].AdaptSet 2	Signal: Adaptive Parameter 2
I[5].AdaptSet 3	Signal: Adaptive Parameter 3
I[5].AdaptSet 4	Signal: Adaptive Parameter 4
I[5].ExBlo1-I	Module input state: External blocking1
I[5].ExBlo2-I	Module input state: External blocking2
I[5].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
I[5].Ex rev Interl-I	Module input state: External reverse interlocking
I[5].AdaptSet1-I	Module input state: Adaptive Parameter1
I[5].AdaptSet2-I	Module input state: Adaptive Parameter2
I[5].AdaptSet3-I	Module input state: Adaptive Parameter3
I[5].AdaptSet4-I	Module input state: Adaptive Parameter4
I[6].active	Signal: active
I[6].ExBlo	Signal: External Blocking
I[6].Ex rev Interl	Signal: External reverse Interlocking
I[6].Blo TripCmd	Signal: Trip Command blocked
I[6].ExBlo TripCmd	Signal: External Blocking of the Trip Command
I[6].Alarm L1	Signal: Alarm L1
I[6].Alarm L2	Signal: Alarm L2

Name	*Description*
I[6].Alarm L3	Signal: Alarm L3
I[6].Alarm	Signal: Alarm
I[6].Trip L1	Signal: General Trip Phase L1
I[6].Trip L2	Signal: General Trip Phase L2
I[6].Trip L3	Signal: General Trip Phase L3
I[6].Trip	Signal: Trip
I[6].TripCmd	Signal: Trip Command
I[6].DefaultSet	Signal: Default Parameter Set
I[6].AdaptSet 1	Signal: Adaptive Parameter 1
I[6].AdaptSet 2	Signal: Adaptive Parameter 2
I[6].AdaptSet 3	Signal: Adaptive Parameter 3
I[6].AdaptSet 4	Signal: Adaptive Parameter 4
I[6].ExBlo1-I	Module input state: External blocking1
I[6].ExBlo2-I	Module input state: External blocking2
I[6].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
I[6].Ex rev Interl-I	Module input state: External reverse interlocking
I[6].AdaptSet1-I	Module input state: Adaptive Parameter1
I[6].AdaptSet2-I	Module input state: Adaptive Parameter2
I[6].AdaptSet3-I	Module input state: Adaptive Parameter3
I[6].AdaptSet4-I	Module input state: Adaptive Parameter4
IG[1].active	Signal: active
IG[1].ExBlo	Signal: External Blocking
IG[1].Ex rev Interl	Signal: External reverse Interlocking
IG[1].Blo TripCmd	Signal: Trip Command blocked
IG[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
IG[1].Alarm	Signal: Alarm IG
IG[1].Trip	Signal: Trip
IG[1].TripCmd	Signal: Trip Command
IG[1].DefaultSet	Signal: Default Parameter Set
IG[1].AdaptSet 1	Signal: Adaptive Parameter 1
IG[1].AdaptSet 2	Signal: Adaptive Parameter 2
IG[1].AdaptSet 3	Signal: Adaptive Parameter 3
IG[1].AdaptSet 4	Signal: Adaptive Parameter 4
IG[1].ExBlo1-I	Module input state: External blocking1
IG[1].ExBlo2-I	Module input state: External blocking2
IG[1].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
IG[1].Ex rev Interl-I	Module input state: External reverse interlocking
IG[1].AdaptSet1-I	Module input state: Adaptive Parameter1
IG[1].AdaptSet2-I	Module input state: Adaptive Parameter2
IG[1].AdaptSet3-I	Module input state: Adaptive Parameter3

Name	*Description*
IG[1].AdaptSet4-I	Module input state: Adaptive Parameter4
IG[2].active	Signal: active
IG[2].ExBlo	Signal: External Blocking
IG[2].Ex rev Interl	Signal: External reverse Interlocking
IG[2].Blo TripCmd	Signal: Trip Command blocked
IG[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
IG[2].Alarm	Signal: Alarm IG
IG[2].Trip	Signal: Trip
IG[2].TripCmd	Signal: Trip Command
IG[2].DefaultSet	Signal: Default Parameter Set
IG[2].AdaptSet 1	Signal: Adaptive Parameter 1
IG[2].AdaptSet 2	Signal: Adaptive Parameter 2
IG[2].AdaptSet 3	Signal: Adaptive Parameter 3
IG[2].AdaptSet 4	Signal: Adaptive Parameter 4
IG[2].ExBlo1-I	Module input state: External blocking1
IG[2].ExBlo2-I	Module input state: External blocking2
IG[2].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
IG[2].Ex rev Interl-I	Module input state: External reverse interlocking
IG[2].AdaptSet1-I	Module input state: Adaptive Parameter1
IG[2].AdaptSet2-I	Module input state: Adaptive Parameter2
IG[2].AdaptSet3-I	Module input state: Adaptive Parameter3
IG[2].AdaptSet4-I	Module input state: Adaptive Parameter4
IG[3].active	Signal: active
IG[3].ExBlo	Signal: External Blocking
IG[3].Ex rev Interl	Signal: External reverse Interlocking
IG[3].Blo TripCmd	Signal: Trip Command blocked
IG[3].ExBlo TripCmd	Signal: External Blocking of the Trip Command
IG[3].Alarm	Signal: Alarm IG
IG[3].Trip	Signal: Trip
IG[3].TripCmd	Signal: Trip Command
IG[3].DefaultSet	Signal: Default Parameter Set
IG[3].AdaptSet 1	Signal: Adaptive Parameter 1
IG[3].AdaptSet 2	Signal: Adaptive Parameter 2
IG[3].AdaptSet 3	Signal: Adaptive Parameter 3
IG[3].AdaptSet 4	Signal: Adaptive Parameter 4
IG[3].ExBlo1-I	Module input state: External blocking1
IG[3].ExBlo2-I	Module input state: External blocking2
IG[3].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
IG[3].Ex rev Interl-I	Module input state: External reverse interlocking
IG[3].AdaptSet1-I	Module input state: Adaptive Parameter1

Name	*Description*
IG[3].AdaptSet2-I	Module input state: Adaptive Parameter2
IG[3].AdaptSet3-I	Module input state: Adaptive Parameter3
IG[3].AdaptSet4-I	Module input state: Adaptive Parameter4
IG[4].active	Signal: active
IG[4].ExBlo	Signal: External Blocking
IG[4].Ex rev Interl	Signal: External reverse Interlocking
IG[4].Blo TripCmd	Signal: Trip Command blocked
IG[4].ExBlo TripCmd	Signal: External Blocking of the Trip Command
IG[4].Alarm	Signal: Alarm IG
IG[4].Trip	Signal: Trip
IG[4].TripCmd	Signal: Trip Command
IG[4].DefaultSet	Signal: Default Parameter Set
IG[4].AdaptSet 1	Signal: Adaptive Parameter 1
IG[4].AdaptSet 2	Signal: Adaptive Parameter 2
IG[4].AdaptSet 3	Signal: Adaptive Parameter 3
IG[4].AdaptSet 4	Signal: Adaptive Parameter 4
IG[4].ExBlo1-I	Module input state: External blocking1
IG[4].ExBlo2-I	Module input state: External blocking2
IG[4].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
IG[4].Ex rev Interl-I	Module input state: External reverse interlocking
IG[4].AdaptSet1-I	Module input state: Adaptive Parameter1
IG[4].AdaptSet2-I	Module input state: Adaptive Parameter2
IG[4].AdaptSet3-I	Module input state: Adaptive Parameter3
IG[4].AdaptSet4-I	Module input state: Adaptive Parameter4
I2>[1].active	Signal: active
I2>[1].ExBlo	Signal: External Blocking
I2>[1].Blo TripCmd	Signal: Trip Command blocked
I2>[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
I2>[1].Alarm	Signal: Alarm Negative Sequence
I2>[1].Trip	Signal: Trip
I2>[1].TripCmd	Signal: Trip Command
I2>[1].ExBlo1-I	Module input state: External blocking1
I2>[1].ExBlo2-I	Module input state: External blocking2
I2>[1].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
I2>[2].active	Signal: active
I2>[2].ExBlo	Signal: External Blocking
I2>[2].Blo TripCmd	Signal: Trip Command blocked
I2>[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
I2>[2].Alarm	Signal: Alarm Negative Sequence
I2>[2].Trip	Signal: Trip

Name	*Description*
I2>[2].TripCmd	Signal: Trip Command
I2>[2].ExBlo1-I	Module input state: External blocking1
I2>[2].ExBlo2-I	Module input state: External blocking2
I2>[2].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
ThR.Alarm Pickup	Signal: Alarm Pickup
ThR.Alarm Timeout	Signal: Alarm Timeout
ThR.RTD effective	RTD effective
ThR.Load above SF	Load above Service Factor
ThR.active	Signal: active
ThR.ExBlo	Signal: External Blocking
ThR.Blo TripCmd	Signal: Trip Command blocked
ThR.ExBlo TripCmd	Signal: External Blocking of the Trip Command
ThR.Alarm	Signal: Alarm
ThR.Trip	Signal: Trip
ThR.TripCmd	Signal: Trip Command
ThR.ExBlo1	Module input state: External blocking
ThR.ExBlo2	Module input state: External blocking
ThR.ExBlo TripCmd	Module input state: External Blocking of the Trip Command
Jam[1].active	Signal: active
Jam[1].ExBlo	Signal: External Blocking
Jam[1].Ex rev Interl	Signal: External reverse Interlocking
Jam[1].Blo TripCmd	Signal: Trip Command blocked
Jam[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
Jam[1].Alarm	Signal: Alarm
Jam[1].Trip	Signal: Trip
Jam[1].TripCmd	Signal: Trip Command
Jam[1].ExBlo1-I	Module input state: External blocking1
Jam[1].ExBlo2-I	Module input state: External blocking2
Jam[1].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
Jam[1].Ex rev Interl-I	Module input state: External reverse interlocking
Jam[2].active	Signal: active
Jam[2].ExBlo	Signal: External Blocking
Jam[2].Ex rev Interl	Signal: External reverse Interlocking
Jam[2].Blo TripCmd	Signal: Trip Command blocked
Jam[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
Jam[2].Alarm	Signal: Alarm
Jam[2].Trip	Signal: Trip
Jam[2].TripCmd	Signal: Trip Command
Jam[2].ExBlo1-I	Module input state: External blocking1
Jam[2].ExBlo2-I	Module input state: External blocking2

Name	Description
Jam[2].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
Jam[2].Ex rev Interl-I	Module input state: External reverse interlocking
I<[1].active	Signal: active
I<[1].ExBlo	Signal: External Blocking
I<[1].Ex rev Interl	Signal: External reverse Interlocking
I<[1].Blo TripCmd	Signal: Trip Command blocked
I<[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
I<[1].Alarm	Signal: Alarm
I<[1].Trip	Signal: Trip
I<[1].TripCmd	Signal: Trip Command
I<[1].ExBlo1-I	Module input state: External blocking1
I<[1].ExBlo2-I	Module input state: External blocking2
I<[1].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
I<[1].Ex rev Interl-I	Module input state: External reverse interlocking
I<[2].active	Signal: active
I<[2].ExBlo	Signal: External Blocking
I<[2].Ex rev Interl	Signal: External reverse Interlocking
I<[2].Blo TripCmd	Signal: Trip Command blocked
I<[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
I<[2].Alarm	Signal: Alarm
I<[2].Trip	Signal: Trip
I<[2].TripCmd	Signal: Trip Command
I<[2].ExBlo1-I	Module input state: External blocking1
I<[2].ExBlo2-I	Module input state: External blocking2
I<[2].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
I<[2].Ex rev Interl-I	Module input state: External reverse interlocking
I<[3].active	Signal: active
I<[3].ExBlo	Signal: External Blocking
I<[3].Ex rev Interl	Signal: External reverse Interlocking
I<[3].Blo TripCmd	Signal: Trip Command blocked
I<[3].ExBlo TripCmd	Signal: External Blocking of the Trip Command
I<[3].Alarm	Signal: Alarm
I<[3].Trip	Signal: Trip
I<[3].TripCmd	Signal: Trip Command
I<[3].ExBlo1-I	Module input state: External blocking1
I<[3].ExBlo2-I	Module input state: External blocking2
I<[3].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
I<[3].Ex rev Interl-I	Module input state: External reverse interlocking
MLS.active	Signal: active
MLS.ExBlo	Signal: External Blocking

Name	*Description*
MLS.Alarm	Signal: Alarm
MLS.Trip	Signal: Trip
MLS.ExBlo1-I	Module input state: External blocking1
MLS.ExBlo2-I	Module input state: External blocking2
RTD.active	Signal: active
RTD.ExBlo	Signal: External Blocking
RTD.Blo TripCmd	Signal: Trip Command blocked
RTD.ExBlo TripCmd	Signal: External Blocking of the Trip Command
RTD.Alarm	Alarm RTD Temperature Protection
RTD.Trip	Signal: Trip
RTD.TripCmd	Signal: Trip Command
RTD.Windg 1 Trip	Winding 1 Signal: Trip
RTD.Windg 1 Alarm	Winding 1 Alarm RTD Temperature Protection
RTD.Windg 1 Timeout Alarm	Winding 1 Timeout Alarm
RTD.Windg 1 Invalid	Winding 1 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
RTD.Windg 2 Trip	Winding 2 Signal: Trip
RTD.Windg 2 Alarm	Winding 2 Alarm RTD Temperature Protection
RTD.Windg 2 Timeout Alarm	Winding 2 Timeout Alarm
RTD.Windg 2 Invalid	Winding 2 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
RTD.Windg 3 Trip	Winding 3 Signal: Trip
RTD.Windg 3 Alarm	Winding 3 Alarm RTD Temperature Protection
RTD.Windg 3 Timeout Alarm	Winding 3 Timeout Alarm
RTD.Windg 3 Invalid	Winding 3 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
RTD.Windg 4 Trip	Winding 4 Signal: Trip
RTD.Windg 4 Alarm	Winding 4 Alarm RTD Temperature Protection
RTD.Windg 4 Timeout Alarm	Winding 4 Timeout Alarm
RTD.Windg 4 Invalid	Winding 4 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
RTD.Windg 5 Trip	Winding 5 Signal: Trip
RTD.Windg 5 Alarm	Winding 5 Alarm RTD Temperature Protection
RTD.Windg 5 Timeout Alarm	Winding 5 Timeout Alarm
RTD.Windg 5 Invalid	Winding 5 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
RTD.Windg 6 Trip	Winding 6 Signal: Trip
RTD.Windg 6 Alarm	Winding 6 Alarm RTD Temperature Protection
RTD.Windg 6 Timeout Alarm	Winding 6 Timeout Alarm
RTD.Windg 6 Invalid	Winding 6 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
RTD.MotBear 1 Trip	Motor Bearing 1 Signal: Trip

Name	*Description*
RTD.MotBear 1 Alarm	Motor Bearing 1 Alarm RTD Temperature Protection
RTD.MotBear 1 Timeout Alarm	Motor Bearing 1 Timeout Alarm
RTD.MotBear 1 Invalid	Motor Bearing 1 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
RTD.MotBear 2 Trip	Motor Bearing 2 Signal: Trip
RTD.MotBear 2 Alarm	Motor Bearing 2 Alarm RTD Temperature Protection
RTD.MotBear 2 Timeout Alarm	Motor Bearing 2 Timeout Alarm
RTD.MotBear 2 Invalid	Motor Bearing 2 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
RTD.LoadBear 1 Trip	Load Bearing 1 Signal: Trip
RTD.LoadBear 1 Alarm	Load Bearing 1 Alarm RTD Temperature Protection
RTD.LoadBear 1 Timeout Alarm	Load Bearing 1 Timeout Alarm
RTD.LoadBear 1 Invalid	Load Bearing 1 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
RTD.LoadBear 2 Trip	Load Bearing 2 Signal: Trip
RTD.LoadBear 2 Alarm	Load Bearing 2 Alarm RTD Temperature Protection
RTD.LoadBear 2 Timeout Alarm	Load Bearing 2 Timeout Alarm
RTD.LoadBear 2 Invalid	Load Bearing 2 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
RTD.Aux1 Trip	Auxiliary 1 Signal: Trip
RTD.Aux1 Alarm	Auxiliary 1 Alarm RTD Temperature Protection
RTD.Aux1 Timeout Alarm	Auxiliary 1 Timeout Alarm
RTD.Aux1 Invalid	Auxiliary 1 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
RTD.Aux2 Trip	Auxiliary 2 Signal: Trip
RTD.Aux2 Alarm	Auxiliary 2 Alarm RTD Temperature Protection
RTD.Aux2 Timeout Alarm	Auxiliary 2 Timeout Alarm
RTD.Aux2 Invalid	Auxiliary 2 Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
RTD.Trip WD Group	Trip all Windings
RTD.Alarm WD Group	Alarm all Windings
RTD.TimeoutAlmWDGrp	Timeout Alarm all Windings
RTD.Windg Group Invalid	Winding Group Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
RTD.Trip MB Group	Trip all Motor Bearings
RTD.Alarm MB Group	Alarm all Motor Bearings
RTD.TimeoutAlmMBGrp	Timeout Alarm all Motor Bearings
RTD.MotBear Group Invalid	Motor Bearing Group Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
RTD.Trip LB Group	Trip all Load Bearings
RTD.Alarm LB Group	Alarm all Load Bearings
RTD.TimeoutAlmLBGrp	Timeout Alarm all Load Bearings

Name	*Description*
RTD.LoadBear Group Invalid	Load Bearing Group Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
RTD.Trip Any Group	Trip Any Group
RTD.Alarm Any Group	Alarm Any Group
RTD.TimeoutAlmAnyGrp	Timeout Alarm Any Group
RTD.Trip Group 1	Trip Group 1
RTD.Trip Group 2	Trip Group 2
RTD.Timeout Alarm	Alarm timeout expired
RTD.Trip Aux Group	Trip Auxiliary Group
RTD.Alarm Aux Group	Alarm Auxiliary Group
RTD.TimeoutAlmAuxGrp	Timeout Alarm Auxiliary Group
RTD.AuxGrpInvalid	Invalid Auxiliary Group
RTD.ExBlo1-I	Module input state: External blocking1
RTD.ExBlo2-I	Module input state: External blocking2
RTD.ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
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

Name	*Description*
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
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

Name	*Description*
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
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
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
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

Name	*Description*
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
V 012 [1].active	Signal: active
V 012 [1].ExBlo	Signal: External Blocking
V 012 [1].Blo TripCmd	Signal: Trip Command blocked
V 012 [1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
V 012 [1].Alarm	Signal: Alarm voltage asymmetry
V 012 [1].Trip	Signal: Trip
V 012 [1].TripCmd	Signal: Trip Command
V 012 [1].ExBlo1-I	Module input state: External blocking1
V 012 [1].ExBlo2-I	Module input state: External blocking2
V 012 [1].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
V 012 [2].active	Signal: active
V 012 [2].ExBlo	Signal: External Blocking
V 012 [2].Blo TripCmd	Signal: Trip Command blocked
V 012 [2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
V 012 [2].Alarm	Signal: Alarm voltage asymmetry
V 012 [2].Trip	Signal: Trip
V 012 [2].TripCmd	Signal: Trip Command
V 012 [2].ExBlo1-I	Module input state: External blocking1
V 012 [2].ExBlo2-I	Module input state: External blocking2
V 012 [2].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
V 012 [3].active	Signal: active
V 012 [3].ExBlo	Signal: External Blocking
V 012 [3].Blo TripCmd	Signal: Trip Command blocked
V 012 [3].ExBlo TripCmd	Signal: External Blocking of the Trip Command
V 012 [3].Alarm	Signal: Alarm voltage asymmetry
V 012 [3].Trip	Signal: Trip
V 012 [3].TripCmd	Signal: Trip Command
V 012 [3].ExBlo1-I	Module input state: External blocking1
V 012 [3].ExBlo2-I	Module input state: External blocking2

Name	*Description*
V 012 [3].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
V 012 [4].active	Signal: active
V 012 [4].ExBlo	Signal: External Blocking
V 012 [4].Blo TripCmd	Signal: Trip Command blocked
V 012 [4].ExBlo TripCmd	Signal: External Blocking of the Trip Command
V 012 [4].Alarm	Signal: Alarm voltage asymmetry
V 012 [4].Trip	Signal: Trip
V 012 [4].TripCmd	Signal: Trip Command
V 012 [4].ExBlo1-I	Module input state: External blocking1
V 012 [4].ExBlo2-I	Module input state: External blocking2
V 012 [4].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
V 012 [5].active	Signal: active
V 012 [5].ExBlo	Signal: External Blocking
V 012 [5].Blo TripCmd	Signal: Trip Command blocked
V 012 [5].ExBlo TripCmd	Signal: External Blocking of the Trip Command
V 012 [5].Alarm	Signal: Alarm voltage asymmetry
V 012 [5].Trip	Signal: Trip
V 012 [5].TripCmd	Signal: Trip Command
V 012 [5].ExBlo1-I	Module input state: External blocking1
V 012 [5].ExBlo2-I	Module input state: External blocking2
V 012 [5].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
V 012 [6].active	Signal: active
V 012 [6].ExBlo	Signal: External Blocking
V 012 [6].Blo TripCmd	Signal: Trip Command blocked
V 012 [6].ExBlo TripCmd	Signal: External Blocking of the Trip Command
V 012 [6].Alarm	Signal: Alarm voltage asymmetry
V 012 [6].Trip	Signal: Trip
V 012 [6].TripCmd	Signal: Trip Command
V 012 [6].ExBlo1-I	Module input state: External blocking1
V 012 [6].ExBlo2-I	Module input state: External blocking2
V 012 [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
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

Name	*Description*
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.
f[3].Trip df/dt | DF/DT	Signal: Trip df/dt or DF/DT
f[3].Trip delta phi	Signal: Trip Vector Surge

Name	*Description*
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
PQS [1].active	Signal: active
PQS [1].ExBlo	Signal: External Blocking
PQS [1].Blo TripCmd	Signal: Trip Command blocked
PQS [1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
PQS [1].Alarm	Signal: Alarm Power Protection
PQS [1].Trip	Signal: Trip Power Protection
PQS [1].TripCmd	Signal: Trip Command
PQS [1].ExBlo1-I	Module input state: External blocking
PQS [1].ExBlo2-I	Module input state: External blocking
PQS [1].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
PQS [2].active	Signal: active
PQS [2].ExBlo	Signal: External Blocking
PQS [2].Blo TripCmd	Signal: Trip Command blocked
PQS [2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
PQS [2].Alarm	Signal: Alarm Power Protection
PQS [2].Trip	Signal: Trip Power Protection
PQS [2].TripCmd	Signal: Trip Command
PQS [2].ExBlo1-I	Module input state: External blocking
PQS [2].ExBlo2-I	Module input state: External blocking
PQS [2].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
PQS [3].active	Signal: active

Name	*Description*
PQS [3].ExBlo	Signal: External Blocking
PQS [3].Blo TripCmd	Signal: Trip Command blocked
PQS [3].ExBlo TripCmd	Signal: External Blocking of the Trip Command
PQS [3].Alarm	Signal: Alarm Power Protection
PQS [3].Trip	Signal: Trip Power Protection
PQS [3].TripCmd	Signal: Trip Command
PQS [3].ExBlo1-I	Module input state: External blocking
PQS [3].ExBlo2-I	Module input state: External blocking
PQS [3].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
PQS [4].active	Signal: active
PQS [4].ExBlo	Signal: External Blocking
PQS [4].Blo TripCmd	Signal: Trip Command blocked
PQS [4].ExBlo TripCmd	Signal: External Blocking of the Trip Command
PQS [4].Alarm	Signal: Alarm Power Protection
PQS [4].Trip	Signal: Trip Power Protection
PQS [4].TripCmd	Signal: Trip Command
PQS [4].ExBlo1-I	Module input state: External blocking
PQS [4].ExBlo2-I	Module input state: External blocking
PQS [4].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
PQS [5].active	Signal: active
PQS [5].ExBlo	Signal: External Blocking
PQS [5].Blo TripCmd	Signal: Trip Command blocked
PQS [5].ExBlo TripCmd	Signal: External Blocking of the Trip Command
PQS [5].Alarm	Signal: Alarm Power Protection
PQS [5].Trip	Signal: Trip Power Protection
PQS [5].TripCmd	Signal: Trip Command
PQS [5].ExBlo1-I	Module input state: External blocking
PQS [5].ExBlo2-I	Module input state: External blocking
PQS [5].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
PQS [6].active	Signal: active
PQS [6].ExBlo	Signal: External Blocking
PQS [6].Blo TripCmd	Signal: Trip Command blocked
PQS [6].ExBlo TripCmd	Signal: External Blocking of the Trip Command
PQS [6].Alarm	Signal: Alarm Power Protection
PQS [6].Trip	Signal: Trip Power Protection
PQS [6].TripCmd	Signal: Trip Command
PQS [6].ExBlo1-I	Module input state: External blocking
PQS [6].ExBlo2-I	Module input state: External blocking
PQS [6].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
PF[1].active	Signal: active

Name	*Description*
PF[1].ExBlo	Signal: External Blocking
PF[1].Blo TripCmd	Signal: Trip Command blocked
PF[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
PF[1].Alarm	Signal: Alarm Power Factor
PF[1].Trip	Signal: Trip Power Factor
PF[1].TripCmd	Signal: Trip Command
PF[1].Compensator	Signal: Compensation Signal
PF[1].Impossible	Signal: Alarm Power Factor Impossible
PF[1].ExBlo1-I	Module input state: External blocking
PF[1].ExBlo2-I	Module input state: External blocking
PF[1].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
PF[2].active	Signal: active
PF[2].ExBlo	Signal: External Blocking
PF[2].Blo TripCmd	Signal: Trip Command blocked
PF[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
PF[2].Alarm	Signal: Alarm Power Factor
PF[2].Trip	Signal: Trip Power Factor
PF[2].TripCmd	Signal: Trip Command
PF[2].Compensator	Signal: Compensation Signal
PF[2].Impossible	Signal: Alarm Power Factor Impossible
PF[2].ExBlo1-I	Module input state: External blocking
PF[2].ExBlo2-I	Module input state: External blocking
PF[2].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
ExP[1].active	Signal: active
ExP[1].ExBlo	Signal: External Blocking
ExP[1].Blo TripCmd	Signal: Trip Command blocked
ExP[1].ExBlo TripCmd	Signal: External Blocking of the Trip Command
ExP[1].Alarm	Signal: 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

Name	*Description*
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
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
URTD.Windg1 Superv	Signal: Supervision Channel Windg1
URTD.Windg2 Superv	Signal: Supervision Channel Windg2
URTD.Windg3 Superv	Signal: Supervision Channel Windg3
URTD.Windg4 Superv	Signal: Supervision Channel Windg4
URTD.Windg5 Superv	Signal: Supervision Channel Windg5
URTD.Windg6 Superv	Signal: Supervision Channel Windg6
URTD.MotBear1 Superv	Signal: Supervision Channel MotBear1
URTD.MotBear2 Superv	Signal: Supervision Channel MotBear2
URTD.LoadBear1 Superv	Signal: Supervision Channel LoadBear1

Name	*Description*
URTD.LoadBear2 Superv	Signal: Supervision Channel LoadBear2
URTD.Aux1 Superv	Signal: Supervision Channel Aux1
URTD.Aux2 Superv	Signal: Supervision Channel Aux2
URTD.Superv	Signal: URTD Supervision Channel
URTD.active	Signal: URTD active
URTD.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.
SOTF.active	Signal: active
SOTF.ExBlo	Signal: External Blocking
SOTF.Ex rev Interl	Signal: External reverse Interlocking
SOTF.enabled	Signal: Switch Onto Fault enabled. This Signal can be used to modify Overcurrent Protection Settings.
SOTF.I<	Signal: No Load Current.
SOTF.ExBlo1-I	Module input state: External blocking
SOTF.ExBlo2-I	Module input state: External blocking
SOTF.Ex rev Interl-I	Module input state: External reverse interlocking
SOTF.Ext SOTF-I	Module input state: External Switch Onto Fault Alarm
CBF.active	Signal: active
CBF.ExBlo	Signal: External Blocking
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
CTS.active	Signal: active
CTS.ExBlo	Signal: External Blocking

Name	*Description*
CTS.Alarm	Signal: Alarm Current Transformer Measuring Circuit Supervision
CTS.ExBlo1-I	Module input state: External blocking1
CTS.ExBlo2-I	Module input state: External blocking2
LOP.active	Signal: active
LOP.ExBlo	Signal: External Blocking
LOP.Alarm	Signal: Alarm Loss of Potential
LOP.LOP Blo	Signal: Loss of Potential blocks other elements.
LOP.Ex FF VT	Signal: Ex FF VT
LOP.Ex FF EVT	Signal: Alarm Fuse Failure Earth Voltage Transformers
LOP.ExBlo1-I	Module input state: External blocking1
LOP.ExBlo2-I	Module input state: External blocking2
LOP.Ex FF VT-I	State of the module input: Alarm Fuse Failure Voltage Transformers
LOP.Ex FF EVT-I	State of the module input: Alarm Fuse Failure Earth Voltage Transformers
LOP.Blo Trigger1-I	State of the module input: An Alarm of this protective element will block the Loss of Potential Detection.
LOP.Blo Trigger2-I	State of the module input: An Alarm of this protective element will block the Loss of Potential Detection.
LOP.Blo Trigger3-I	State of the module input: An Alarm of this protective element will block the Loss of Potential Detection.
LOP.Blo Trigger4-I	State of the module input: An Alarm of this protective element will block the Loss of Potential Detection.
LOP.Blo Trigger5-I	State of the module input: An Alarm of this protective element will block the Loss of Potential Detection.
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
BO Slot X2.BO 1	Signal: Binary Output Relay
BO Slot X2.BO 2	Signal: Binary Output Relay
BO Slot X2.BO 3	Signal: Binary Output Relay
BO Slot X2.BO 4	Signal: Binary Output Relay
BO Slot X2.BO 5	Signal: Binary Output Relay
BO Slot X2.BO 6	Signal: Binary Output Relay
BO Slot 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

Name	*Description*
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.
BO Slot X5.BO 1	Signal: Binary Output Relay
BO Slot X5.BO 2	Signal: Binary Output Relay
BO Slot X5.BO 3	Signal: Binary Output Relay
BO Slot X5.BO 4	Signal: Binary Output Relay
BO Slot X5.BO 5	Signal: Binary Output Relay
BO Slot X5.BO 6	Signal: Binary Output Relay
BO Slot X5.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 X5.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.
Analog Input[1].active	active
Analog Input[2].active	active
Analog Input[3].active	active
Analog Input[4].active	active
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:

Name	*Description*
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:
Start rec.Storing	Signal: Data are saved
Start rec.MotorStart	Module input state: Start of recorder
Start rec.MotorRun	Module input state: Motor is in run mode
Start rec.Motor Speed2	Module input state: Motor operates in speed 2
Start rec.ITransit	Module input state: Motor operations transition on current
Trend rec.Hand Reset	Hand Reset
PQSCr.Cr Oflw Ws Net	Signal: Counter Overflow Ws Net
PQSCr.Cr Oflw Wp Net	Signal: Counter Overflow Wp Net
PQSCr.Cr Oflw Wp+	Signal: Counter Overflow Wp+
PQSCr.Cr Oflw Wp-	Signal: Counter Overflow Wp-
PQSCr.Cr Oflw Wq Net	Signal: Counter Overflow Wq Net
PQSCr.Cr Oflw Wq+	Signal: Counter Overflow Wq+
PQSCr.Cr Oflw Wq-	Signal: Counter Overflow Wq-
PQSCr.Ws Net Res Cr	Signal: Ws Net Reset Counter
PQSCr.Wp Net Res Cr	Signal: Wp Net Reset Counter
PQSCr.Wp+ Res Cr	Signal: Wp+ Reset Counter
PQSCr.Wp- Res Cr	Signal: Wp- Reset Counter
PQSCr.Wq Net Res Cr	Signal: Wq Net Reset Counter
PQSCr.Wq+ Res Cr	Signal: Wq+ Reset Counter
PQSCr.Wq- Res Cr	Signal: Wq- Reset Counter
PQSCr.Res all Energy Cr	Signal: Reset of all Energy Counters
PQSCr.Cr OflwW Ws Net	Signal: Counter Ws Net will overflow soon
PQSCr.Cr OflwW Wp Net	Signal: Counter Wp Net will overflow soon
PQSCr.Cr OflwW Wp+	Signal: Counter Wp+ will overflow soon
PQSCr.Cr OflwW Wp-	Signal: Counter Wp- will overflow soon
PQSCr.Cr OflwW Wq Net	Signal: Counter Wq Net will overflow soon
PQSCr.Cr OflwW Wq+	Signal: Counter Wq+ will overflow soon
PQSCr.Cr OflwW Wq-	Signal: Counter Wq- will overflow soon
Modbus.Transmission	Signal: SCADA active
Modbus.Scada Cmd 1	Scada Command
Modbus.Scada Cmd 2	Scada Command
Modbus.Scada Cmd 3	Scada Command
Modbus.Scada Cmd 4	Scada Command
Modbus.Scada Cmd 5	Scada Command
Modbus.Scada Cmd 6	Scada Command
Modbus.Scada Cmd 7	Scada Command

Name	*Description*
Modbus.Scada Cmd 8	Scada Command
Modbus.Scada Cmd 9	Scada Command
Modbus.Scada Cmd 10	Scada Command
Modbus.Scada Cmd 11	Scada Command
Modbus.Scada Cmd 12	Scada Command
Modbus.Scada Cmd 13	Scada Command
Modbus.Scada Cmd 14	Scada Command
Modbus.Scada Cmd 15	Scada Command
Modbus.Scada Cmd 16	Scada Command
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)
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)

Name	*Description*
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
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

Name	*Description*
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 I Demand	Signal: Resetting of Statistics - Current Demand (avg, peak avg)
Statistics.ResFc P Demand	Signal: Resetting of Statistics - Power Demand (avg, peak avg)
Statistics.ResFc Max	Signal: Resetting of all Maximum values
Statistics.ResFc Min	Signal: Resetting of all Minimum values
Statistics.StartFc 1-I	State of the module input: Start of Statistics 1
Statistics.StartFc 2-I	State of the module input: Start of Statistics 2
SysA.active	Signal: active
SysA.ExBlo	Signal: External Blocking
SysA.Alarm Watt Power	Signal: Alarm permitted Active Power exceeded
SysA.Alarm VAr Power	Signal: Alarm permitted Reactive Power exceeded
SysA.Alarm VA Power	Signal: Alarm permitted Apparent Power exceeded
SysA.Alarm Watt Demand	Signal: Alarm averaged Active Power exceeded
SysA.Alarm VAr Demand	Signal: Alarm averaged Reactive Power exceeded
SysA.Alarm VA Demand	Signal: Alarm averaged Apparent Power exceeded
SysA.Alm Current Demd	Signal: Alarm averaged demand current
SysA.Alarm I THD	Signal: Alarm Total Harmonic Distortion Current
SysA.Alarm V THD	Signal: Alarm Total Harmonic Distortion Voltage
SysA.Trip Watt Power	Signal: Trip permitted Active Power exceeded
SysA.Trip VAr Power	Signal: Trip permitted Reactive Power exceeded
SysA.Trip VA Power	Signal: Trip permitted Apparent Power exceeded
SysA.Trip Watt Demand	Signal: Trip averaged Active Power exceeded
SysA.Trip VAr Demand	Signal: Trip averaged Reactive Power exceeded
SysA.Trip VA Demand	Signal: Trip averaged Apparent Power exceeded
SysA.Trip Current Demand	Signal: Trip averaged demand current

Name	*Description*
SysA.Trip I THD	Signal: Trip Total Harmonic Distortion Current
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
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

Name	*Description*
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
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

Name	*Description*
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
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

Name	*Description*
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
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)

Name	Description
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
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

Name	*Description*
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)
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)

Name	*Description*
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
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

Name	*Description*
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)
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

Name	Description
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
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

Name	*Description*
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
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

Name	*Description*
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
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

Name	*Description*
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
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

Name	*Description*
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
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)

Name	Description
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
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

Name	*Description*
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)
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)

Name	*Description*
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
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

Name	*Description*
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)
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

Name	*Description*
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
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

Name	*Description*
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.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
Sys.min 1 param changed	Signal: At least one parameter has been changed
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 TripCr	Signal:: Res TripCr
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.

Name	*Description*
Sys.PS4-I	State of the module input respectively of the signal, that should activate this Parameter Setting Group.

List of the Digital Inputs

The following list comprises all Digital Inputs. This list is used in various Protective Elements (e.g. TCS, Q->&V<...). The availability and the number of entries depends on the type of device.

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)

Name	*Description*
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)

Name	*Description*
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)

Name	*Description*
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)

Name	*Description*
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)

Name	*Description*
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)

Name	*Description*
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)

Name	*Description*
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)

Name	*Description*
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)

Notes:

We appreciate your comments about the content of our publications.

Please send comments to: kemp.doc@woodward.com

Please include the manual number from the front cover of this publication.

Woodward Kempen GmbH reserves the right to update any portion of this publication at any time. Information provided by Woodward Kempen GmbH is believed to be correct and reliable. However, Woodward Kempen GmbH assumes no responsibility unless otherwise expressly undertaken.

This is the original manual (source).

Woodward Kempen GmbH

Krefelder Weg 47 D – 47906 Kempen (Germany)
Postfach 10 07 55 (P.O.Box) D – 47884 Kempen (Germany)
Phone: +49 (0) 21 52 145 1

Internet

www.woodward.com

Sales

Phone: +49 (0) 21 52 145 331 or +49 (0) 711 789 54 510
Fax: +49 (0) 21 52 145 354 or +49 (0) 711 789 54 101
e-mail: SalesPGD_EUROPE@woodward.com

Service

Phone: +49 (0) 21 52 145 600 Telefax: +49 (0) 21 52 145 455
e-mail: SupportPGD_Europe@woodward.com