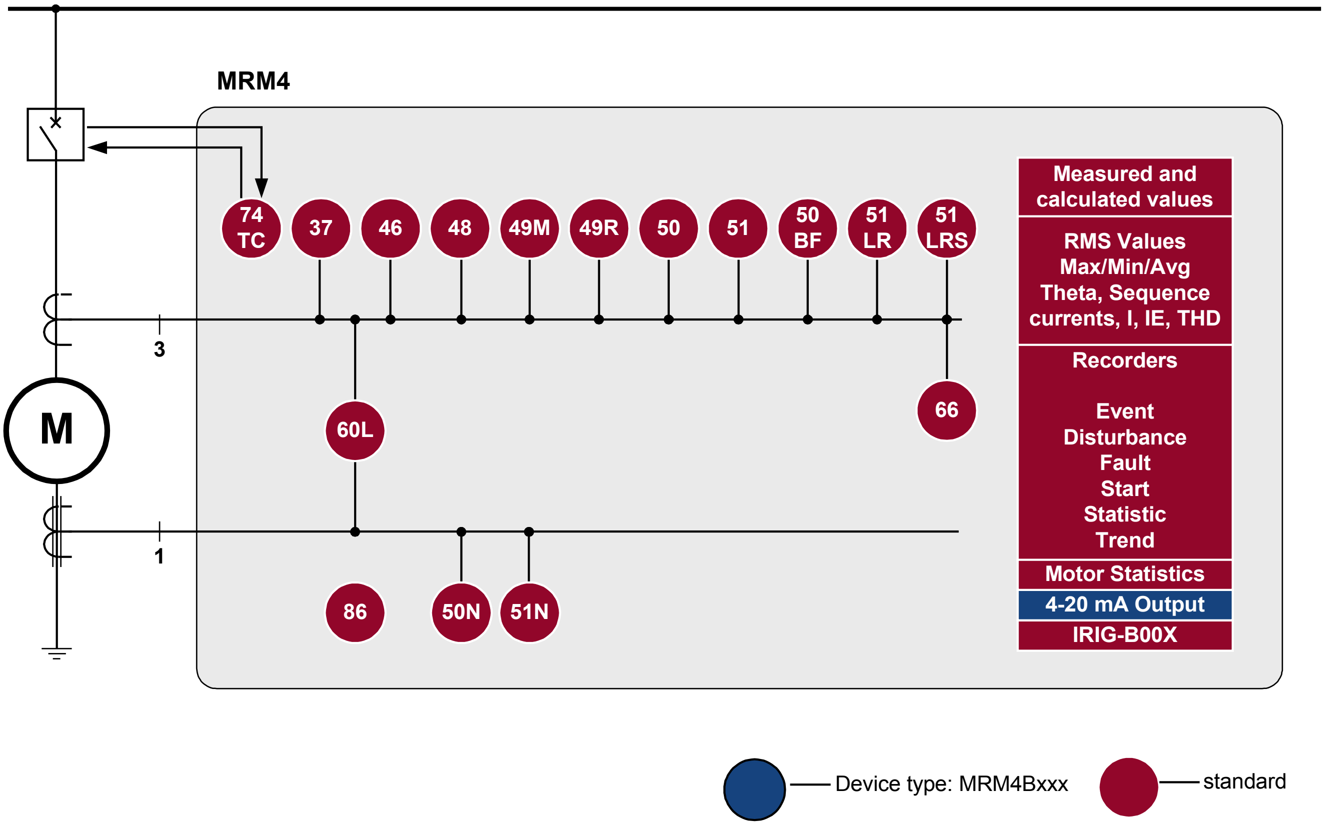
WOODWARD

MRM4
HighPROTEC

Motor Protection

Device Manual DOK-HB-MRM4E

MRM4 Application Overview



Order Code

Non-directional Motor Protection								MRM4-		0		
Analog Output	RTD	Remote Interface	Digital inputs	Binary output relays	Housing	Large display						
			8	6	B1	-			A			
1		X	4	4	B1	-			B			
Standard												
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

ANSI: 50, 51, 50N, 51N, 37, 46, 48, 49M, 49R, 60L, 66, 86, 50BF, 51LR, 51LRS, 74TC

This manual applies to devices (version):

Version 1.0.g

Build: 12674, 12871, 12940

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; and
- 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.

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. 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, be sure to check the Woodward documentation website:

http://eps.woodward.com/download

The latest version of most publications is available at:

http://eps.woodward.com/download

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).

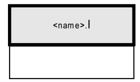
Important Information

WARNING

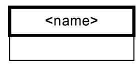
In line with the customer's requirement the devices are combined in a modular way (in compliance with the order code). The terminal assignment of the device can be found on the top of the device (wiring diagram).

Symbols

Setting value:

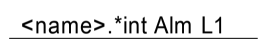


Device planning:

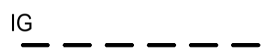


Signal:

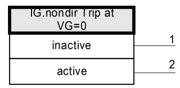
internal message



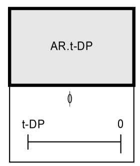
Measured values:



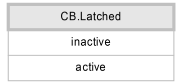
Functional description: If the setting value "IG.Block at VG=0" is set to "inactive" the output 1 is active and output 2 is inactive. If the setting value "IG.Block at VG=0" is set to "active" the output 2 is active and the output 1 is inactive.



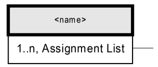
"⌀"=Elements with complex functions "gray-box".



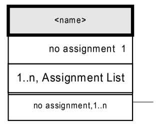
Option/features to be realised in the future



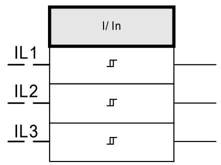
Parameter of a Module-Input with a SelectionList/DropDown. An (1..n) signal/output from the list or a pre-defined value can be selected.



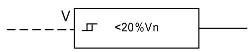
Parameter of a Module-Input (with special values): An (1..n) output from the list will be assigned to the input "<name>.identifier". If the parameter is set to "ItemNull", an "active"-signal will be given out.

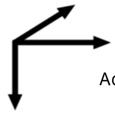


Limit value monitoring with three analogue input values. Compares 3 analogue values with the set limit; output values are three different binary values as a result of the comparision. If the analogue signal exceeds the limit I/In the corresponding output signal becomes "1".



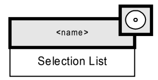
Limit value monitoring (Compared to a fixed value). Compares a value with the fixed set limit; output value is binary as a result of the comparision. If the signal exceeds the limit the corresponding output signal becomes "1".



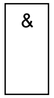


Adaptive Parameter

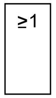
Direct Command



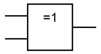
And



Or



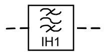
Exclusive-OR



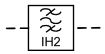
Negated input

Negated output

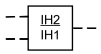
Band-pass (filter)
IH1



Band-pass (filter)
IH2



Quotient of analogue values

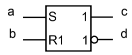


Analog values

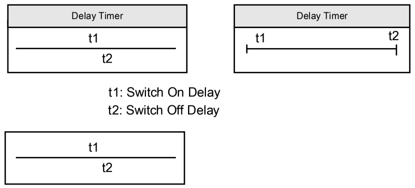
Analogue values comparator

RS flip-flop

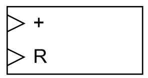
a	b	c	d
0	0	Unchanged	
0	1	0	1
1	0	1	0
1	1	0	1



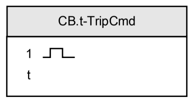
Time stage: A "1" at the input starts the stage. If the time <name>.t is expired the output becomes "1" too. The time stage will be reset by "0" at the input. Thus the output will be set to "0" at the same time.



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.

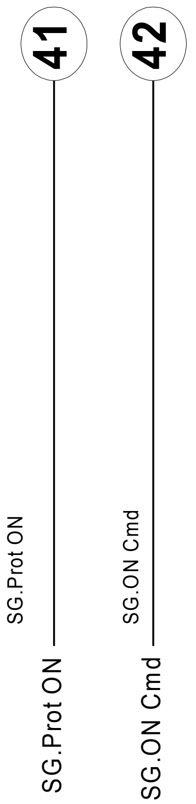


Output Signal —— 2

2 —— Input Signal

Signal	Description	No.
Prot.available	Please Refer To Diagram: **Prot**	1
name.active	Please Refer To Diagram: Blockings	2
name.Blo TripCmd	Please Refer To Diagram: Trip blockings	3
name.active	Please Refer To Diagram: Blockings**	4
IH2.Blo L1	Please Refer To Diagram: IH2	5
IH2.Blo L2	Please Refer To Diagram: IH2	6
IH2.Blo L3	Please Refer To Diagram: IH2	7
IH2.Blo IG	Please Refer To Diagram: IH2	8
name. Fault in projected direction	Please Refer To Diagram: direction decision phase overcurrent	9
name. Fault in projected direction	Please Refer To Diagram: direction decision Earth fault	10
CB.Trip CB	Please Refer To Diagram: CB	11
VTS.Alarm	Please Refer To Diagram: VTS	12
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, VG 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, VG 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, VG 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, VG 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, VG 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, VG 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, VG 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, VG 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, VG 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, VG 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, VG 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, VG 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, VG 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, VG 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, VG 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, VG 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, VG 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, VG 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	38
Q->&V<.Decoupling Energy Resource	Please Refer To Diagram: Q->&V<.Decoupling Energy Resource	39
CTS.Alarm	Please Refer To Diagram: CTS.Alarm	40


41
42
SG.Prot ON
SG.ON Cmd
SG.Prot ON
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.

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

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

1	2	3	Image References (Squares)

Load Reference Arrow System

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 defined 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

MRM4

Device Planning

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

WARNING

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

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

A planning service is also offered by *Woodward Kempen GmbH*.

WARNING

Beware of inadvertent deactivating protective functions/modules

If you are deactivating modules within the device planning all parameters of those modules will be set on default.

If you are activating one of these modules again all parameters of those reactivated modules will be set on default.

Device Planning Parameters of the Device

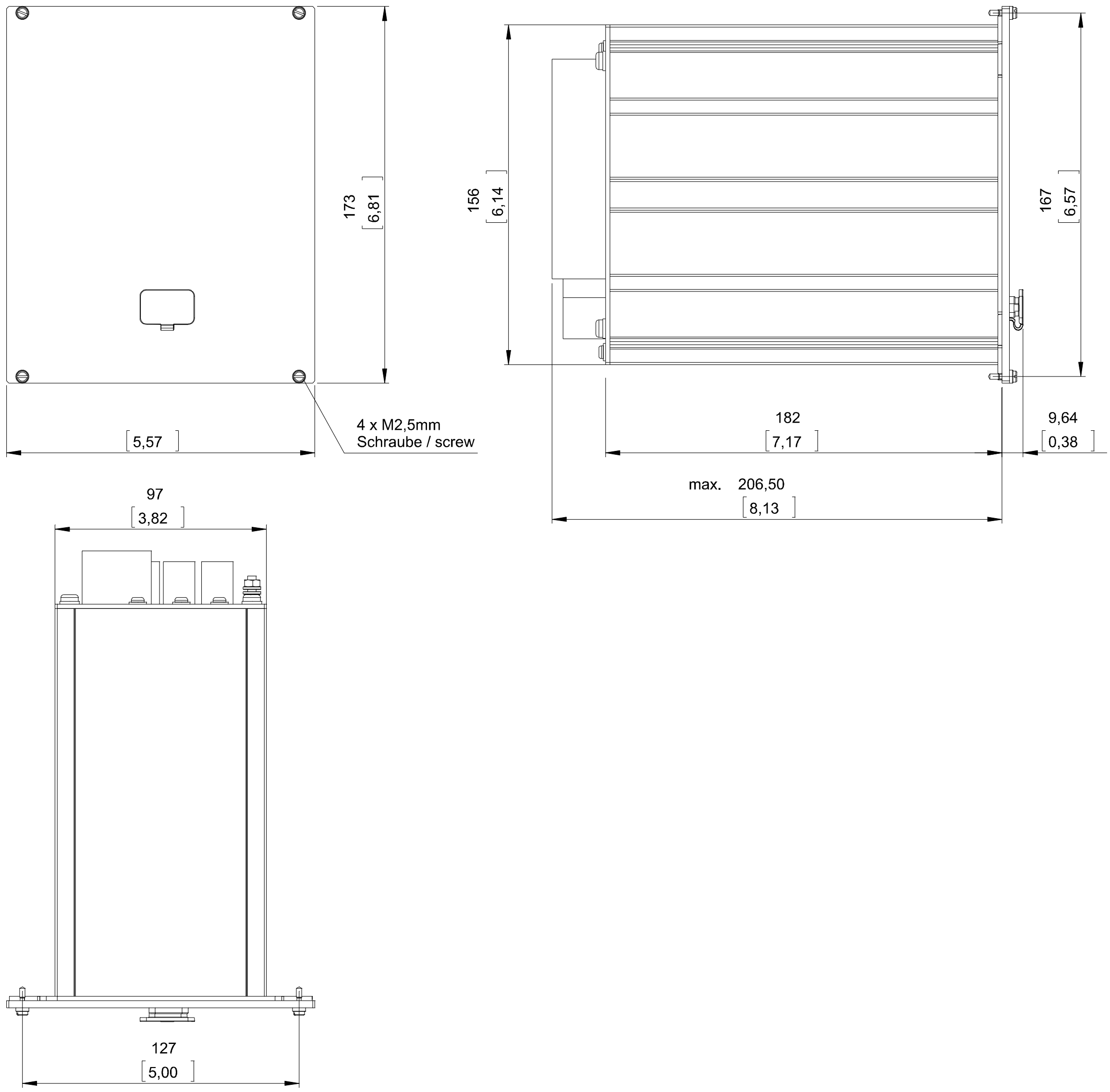
Parameter	*Description*	*Options*	*Default*	*Menu path*
Hardware Variant 1	Optional Hardware Extension	»A« 8 digital inputs | 6 binary output relays | IRIG-B, »B« 4 Digital Inputs | 4 Output Relays , Analog Output |IRIG-B	8 digital inputs | 6 binary output relays | IRIG-B	[MRM4]
Hardware Variant 2	Optional Hardware Extension	»0« Without	»0« Without	[MRM4]
Housing	Mounting form	»A« Flush mounting, »B« 19 inch mounting (semi-flush)	Flush mounting	[MRM4]
Communication	Communication	»A« Without protocol, »B« RS485/Terminals: Modbus RTU | IEC 60870-5-103, »C« Ethernet: RJ45: Modbus TCP »D« Fiber Optics: Profibus-DP, »E« RS485 / D-SUB: Profibus-DP, »F« Fiber Optics: Modbus RTU | IEC 60870-5-103, »G« RS485 D-SUB: Modbus RTU | IEC 60870-5-103	»A« Without	[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 B1 Housing (19” Devices)

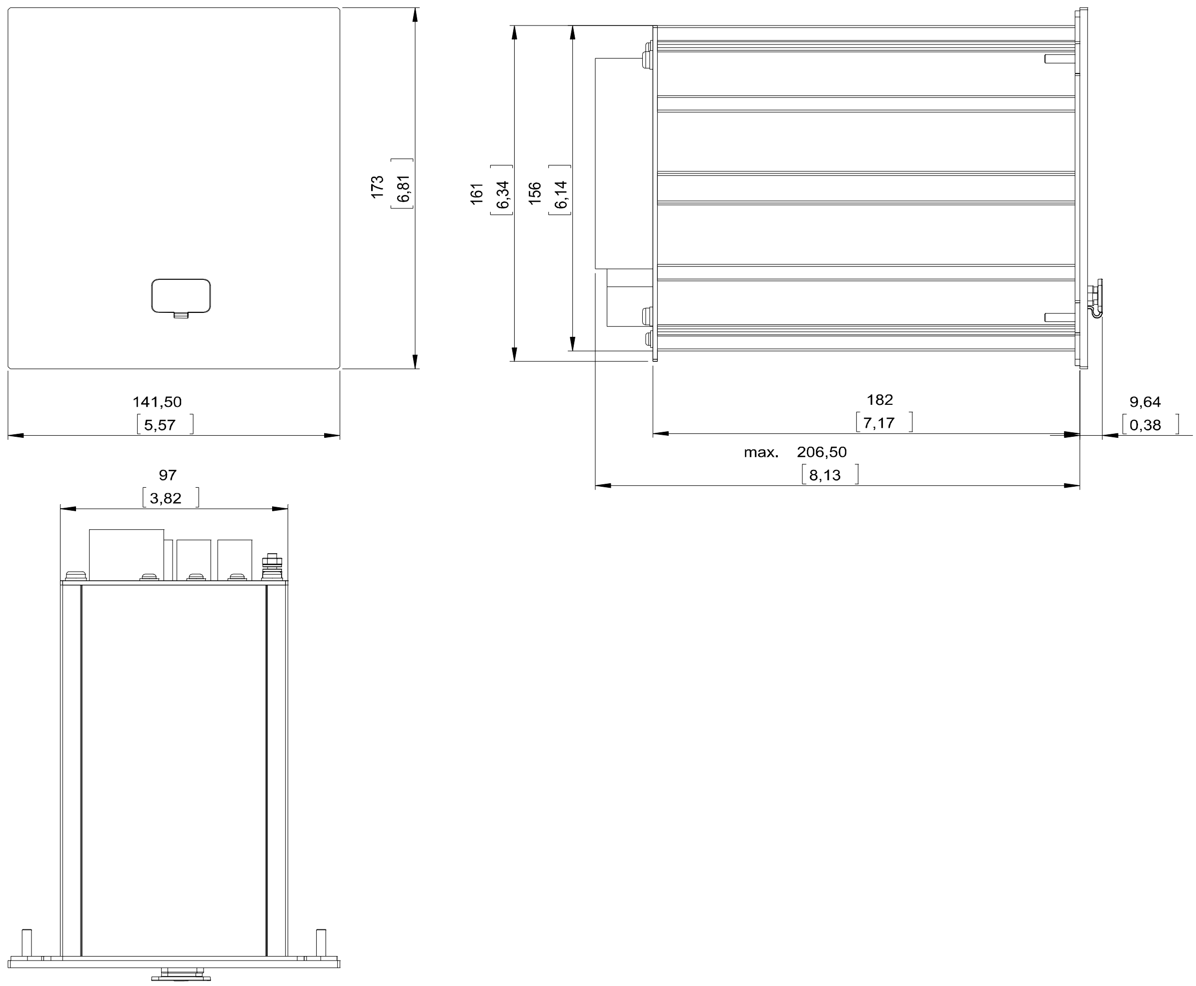
WARNING **The housing must be carefully grounded. Connect a ground cable (4 to 6 mm² / AWG 12-10) / 1,7 Nm [15 In-lb]) to the housing, using the screw, which is marked with the ground symbol (at the rear side of the device).**

The power supply card needs a separate ground connection (2.5 mm² (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 B1 Housing (Devices with 7 Softkeys)

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]).

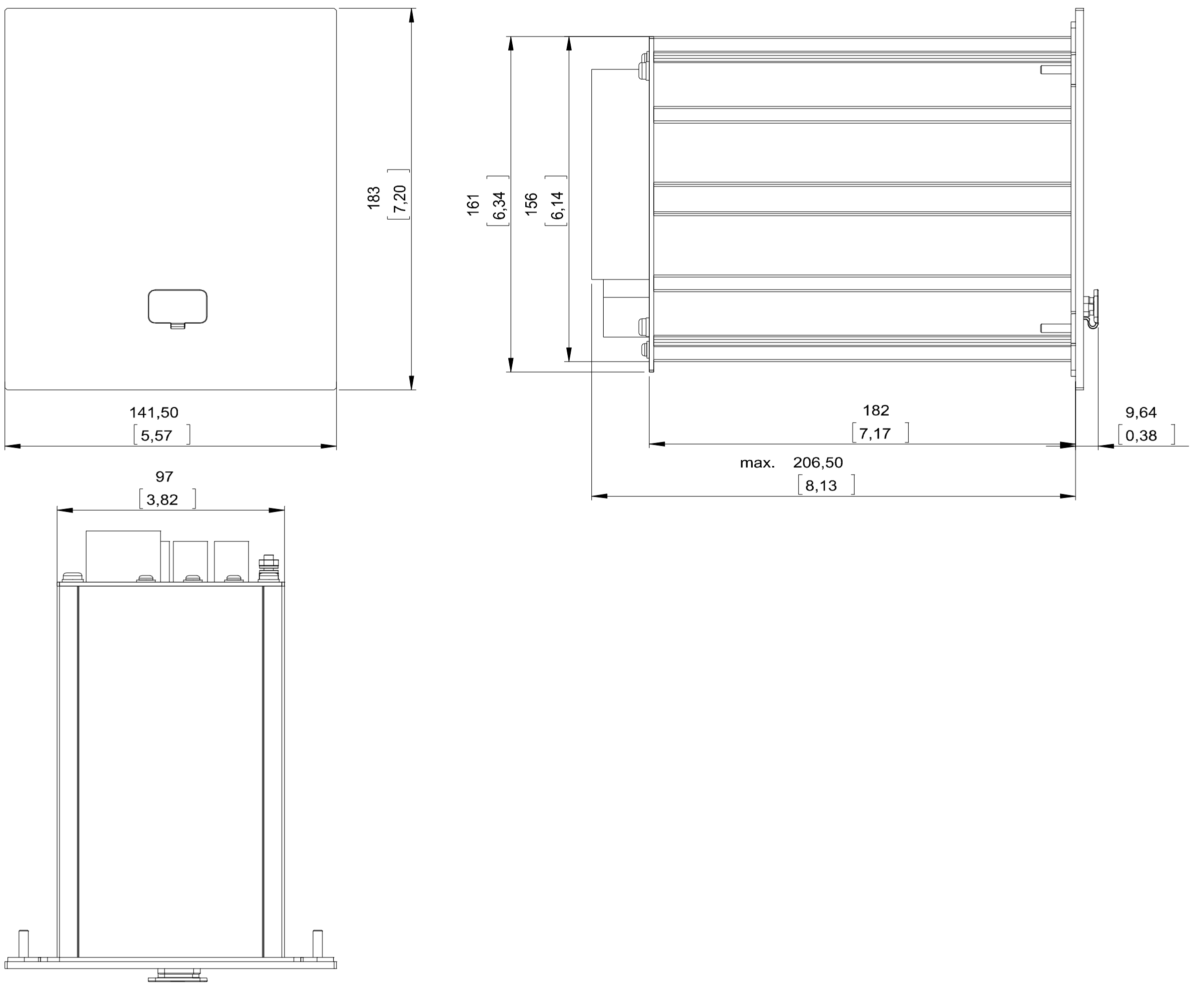
Three-Side-View - 8-Pushbutton Version

NOTICE

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

NOTICE

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



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

WARNING

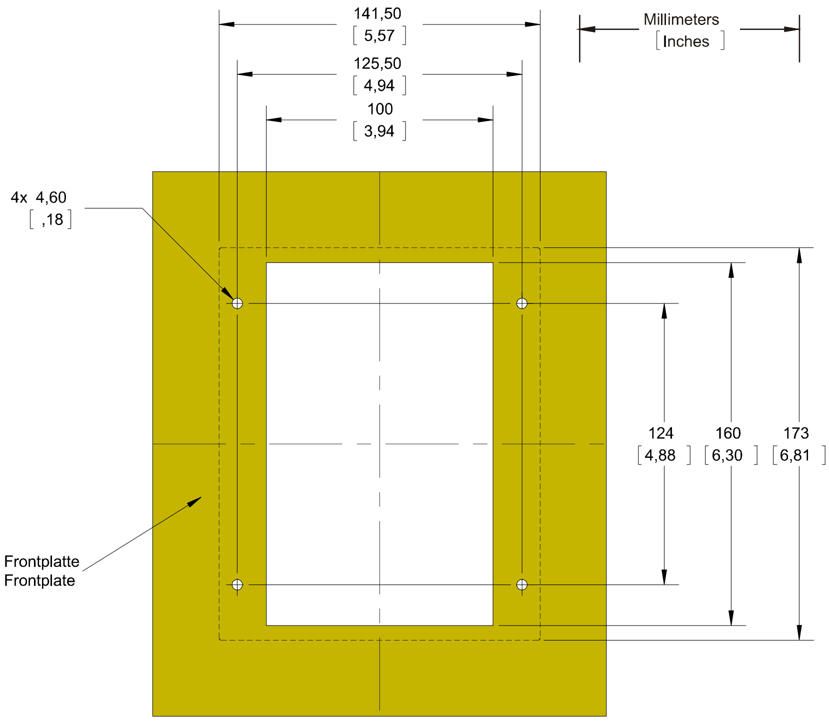
The housing must be carefully grounded. Connect a ground cable (4 to 6 mm² / AWG 12-10) / 1,7 Nm [15 In-lb]) to the housing, using the screw, which is marked with the ground symbol (at the rear side of the device).

The power supply card needs a separate ground connection (2.5 mm² (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)).**



B1 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).**

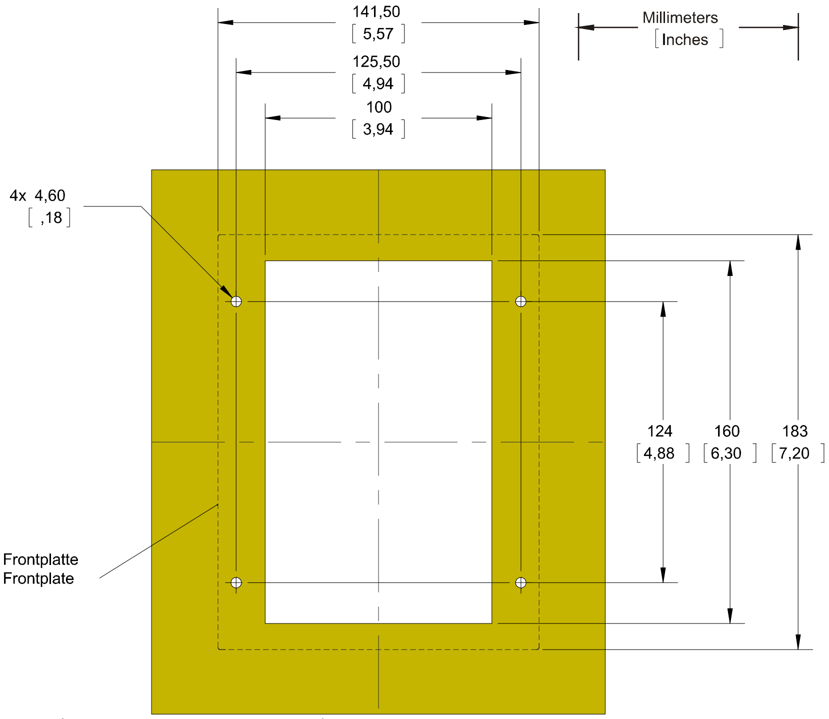
The power supply card needs a separate ground connection (2.5 mm^2 (AWG 14) at terminal X1 (0.56-0.79 Nm [5-7 In-lb]).

CAUTION **Be careful. Do not over-tighten 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]). Over-tightening 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)).**



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

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

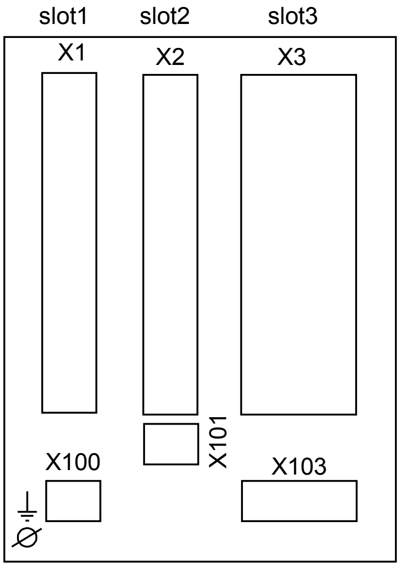
CAUTION **Be careful. Do not over-tighten the mountings nuts of the relay (M4 metric 4 mm). Check the torque by means of a torque wrench (1,7 Nm [15 In-lb]). Over-tightening the mounting nuts could due to personal injury or damage the relay.**

Assembly Groups

WARNING

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

Housing B1



B1 housing – schematic diagram

Grounding

WARNING

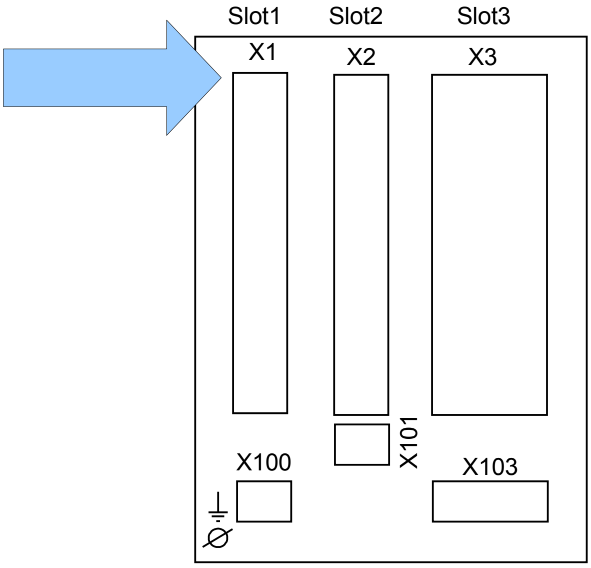
The housing must be carefully grounded. Connect a ground cable (4 to 6 mm^2 / AWG 12-10) / 1,7 Nm [15 In-lb]) to the housing, using the screw, which is marked with the ground symbol (at the rear side of the device).

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.

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).

- (**DI4-X1):** This assembly group comprises a wide-range power supply unit and four (4) 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; and
- 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 parametrized Wrong switching thresholds can result in malfunctions/wrong signal transfer times.**

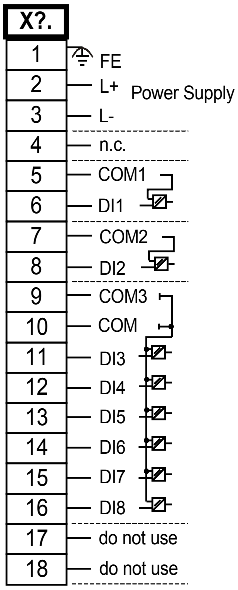
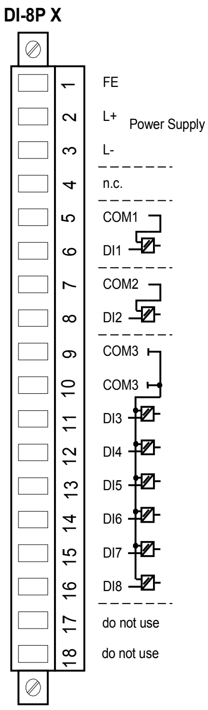
The digital inputs are provided with different switching thresholds (can be parametrized) (two AC and five DC input ranges). For the six grouped (connected to common potential) inputs and the two non-grouped inputs, the following switching levels can be defined:

- 24V DC;
- 48V DC / 60V DC;
- 110 V AC/DC; and
- 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-4 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;
- 4 digital inputs, grouped; and
- 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 parametrized Wrong switching thresholds can result in malfunctions/wrong signal transfer times.**

The digital inputs are provided with different switching thresholds (can be parametrized) (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:

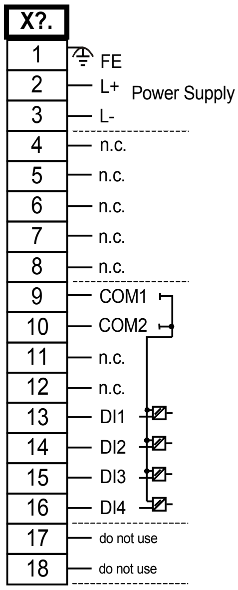
- 24V DC;
- 48V DC / 60V DC;
- 110 V AC/DC; and
- 230 V AC/DC.

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”.

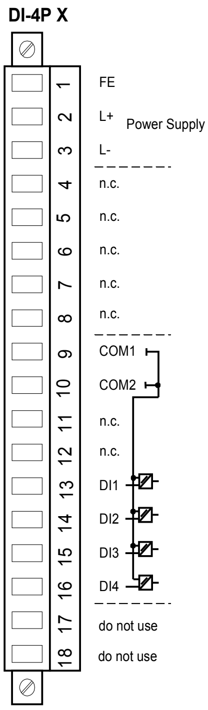
CAUTION **The ground terminal has to be connected to the »-pole« when using DC supply.**

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

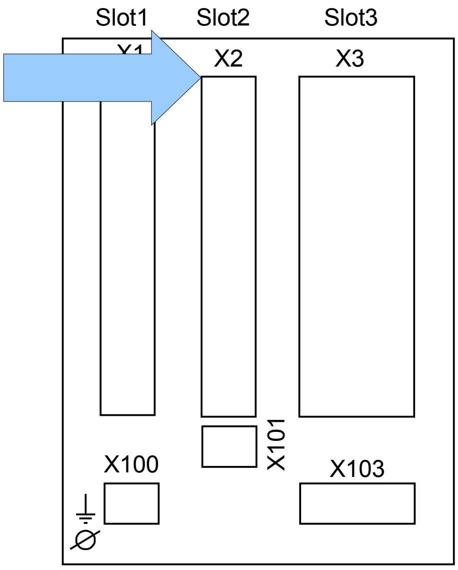
Terminals



Electro-mechanical assignment



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:

- **(OR-5 X2):** Assembly Group with 5 Changeover (CO), Supervision Contact (SC)
- **(OR-3AI X2):** Assembly Group with 2 Normally Open (Form A), 1 Changeover (Form C), SC, Analog Output IRIG-B

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

Binary Output Relays and System Contact

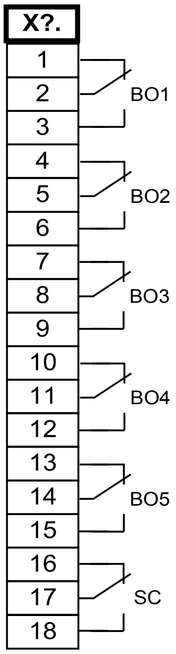
The number of the binary output relay contacts is related to the type of the device or type code. The binary output relays are potential-free change-over contacts. In chapter [Assignment/binary outputs] the assignment of the binary output relays is specified. The changeable signals are listed in the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

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

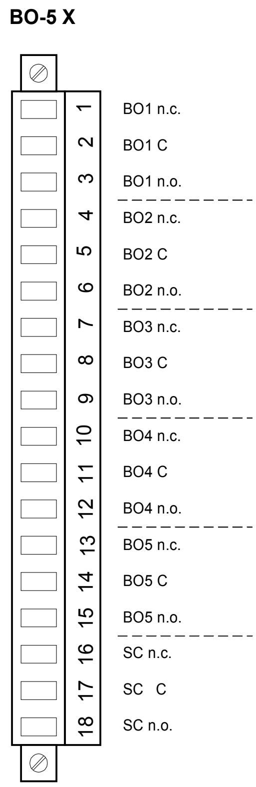
CAUTION **Please duly consider the current carrying capacity of the binary output relays. Please refer to the Technical Data.**

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

Terminals



Electro-mechanical assignment



OR - 3AI X - Output Relays and System Contact

The number of the binary output relay contacts is related to the type of the device or type code. The binary output relays are potential-free 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.

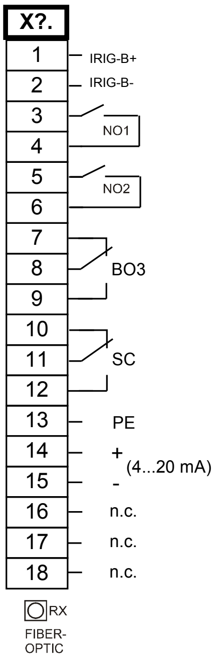
WARNING **Make sure that the tightening torque is 0.56-0.79 Nm [5-7 In-lb].**

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

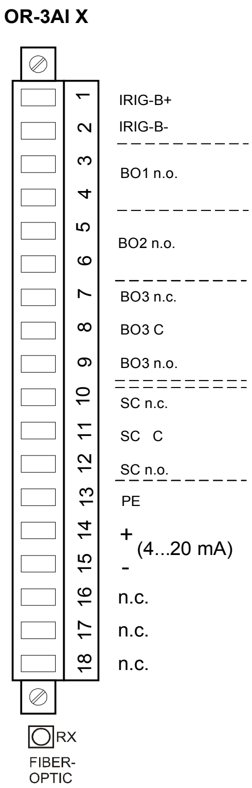
The *System-OK contact (SC relay)* cannot be configured. The system contact is a changeover contact that picks up when the device is free from internal faults. While the device is booting up, the *System OK relay (SC)* remains dropped-off (unenergized). As soon as the system is properly started (and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

For details on the Analogue Output please refer to the Technical Data.

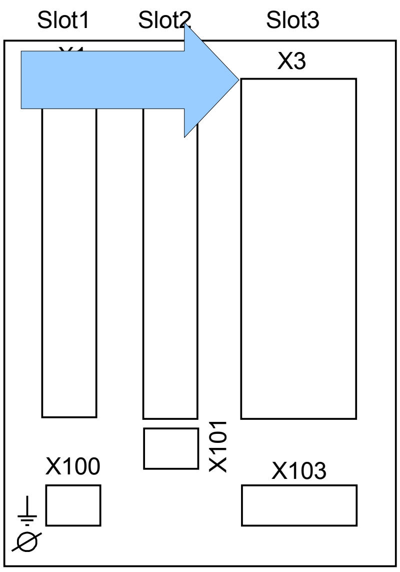
Terminals



Electro-mechanical assignment



Slot X3: Current Transformer Measuring Inputs



Rear side of the device (Slots)

This slot contains the current transformer measuring inputs.

Current Measuring Inputs and Ground Current Measuring Input

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

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

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

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

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

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

WARNING

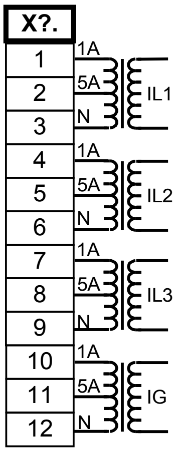
- **Do not interchange the inputs (1 A/5 A)**
- **Make sure the transformation ratios and the power of the CTs are correctly rated. If the rating of the CTs is not right (overrated), then the normal operational conditions may not be recognized. The pickup value of the measuring unit amounts approx. 3% 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.

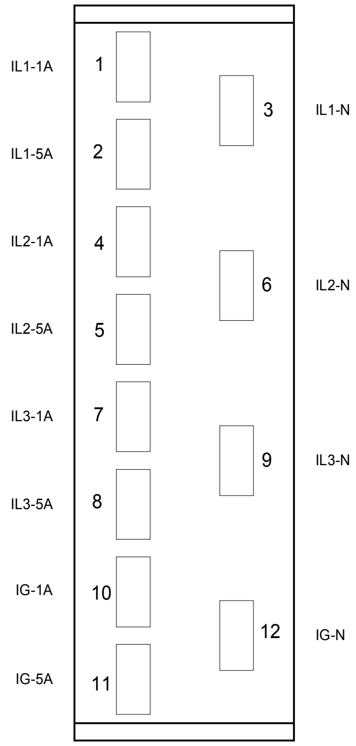
- **Overloading can result in destruction of the measuring inputs or faulty signals. Overloading means that in case of a short-circuit the current-carrying capacity of the measuring inputs could be exceeded.**

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.**

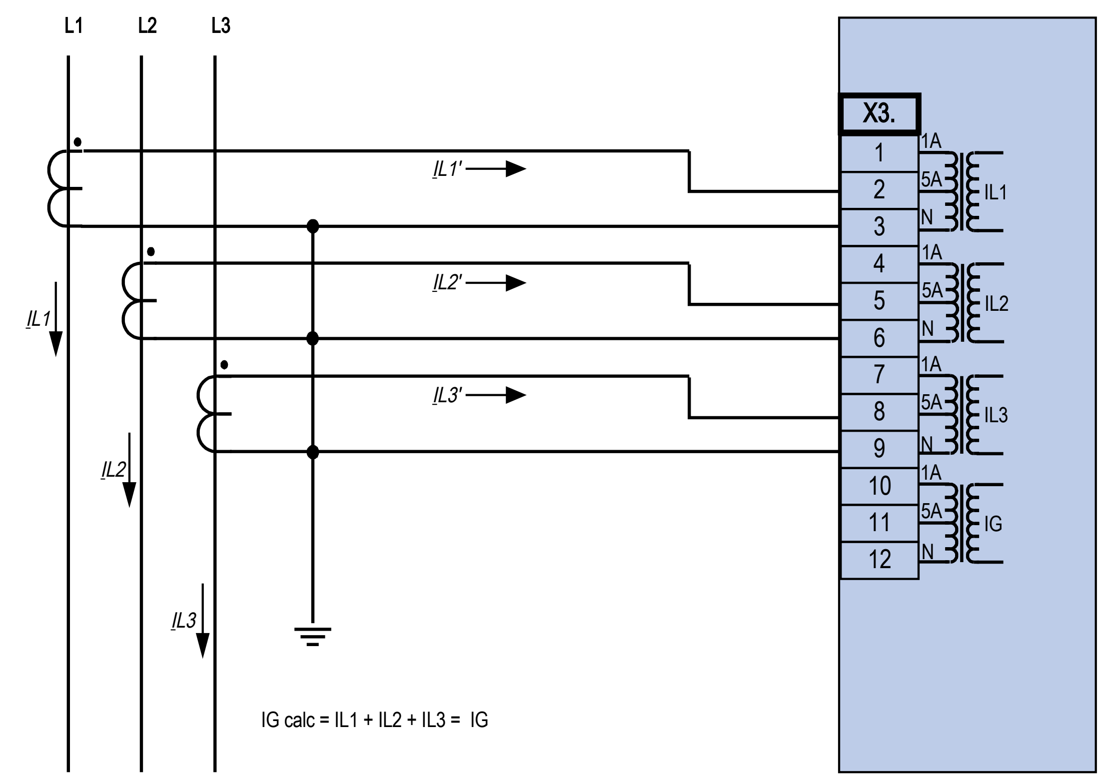
DANGER **The current measuring inputs may exclusively be connected to current measuring transformers (with galvanic separation).**

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

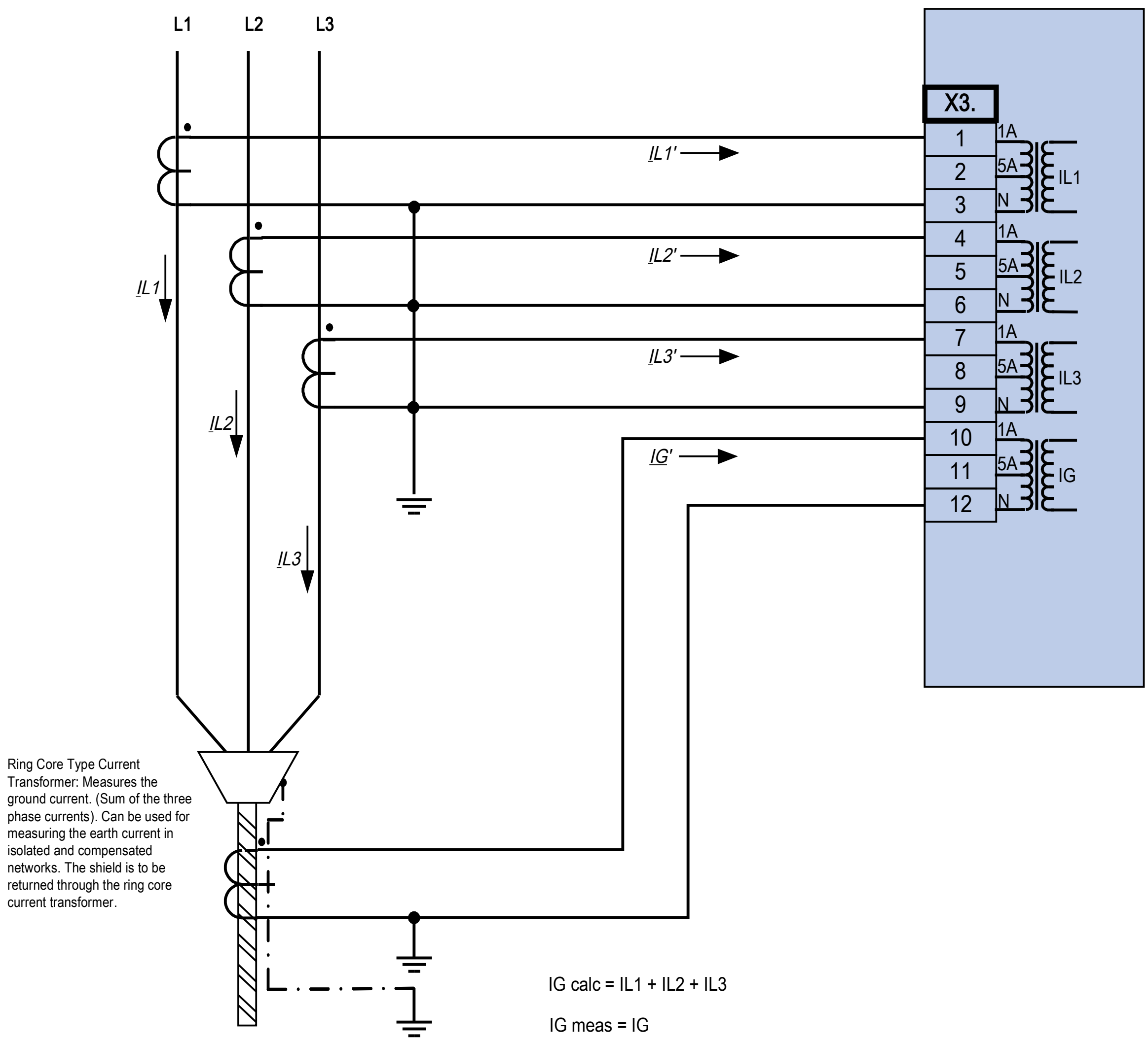
NOTICE **For current and voltage sensing function external wired and appropriate current and voltage transformer shall be used, based on the required input measurement ratings. Those devices provide the necessary insulation functionality.**

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

Current Transformer Connection Examples

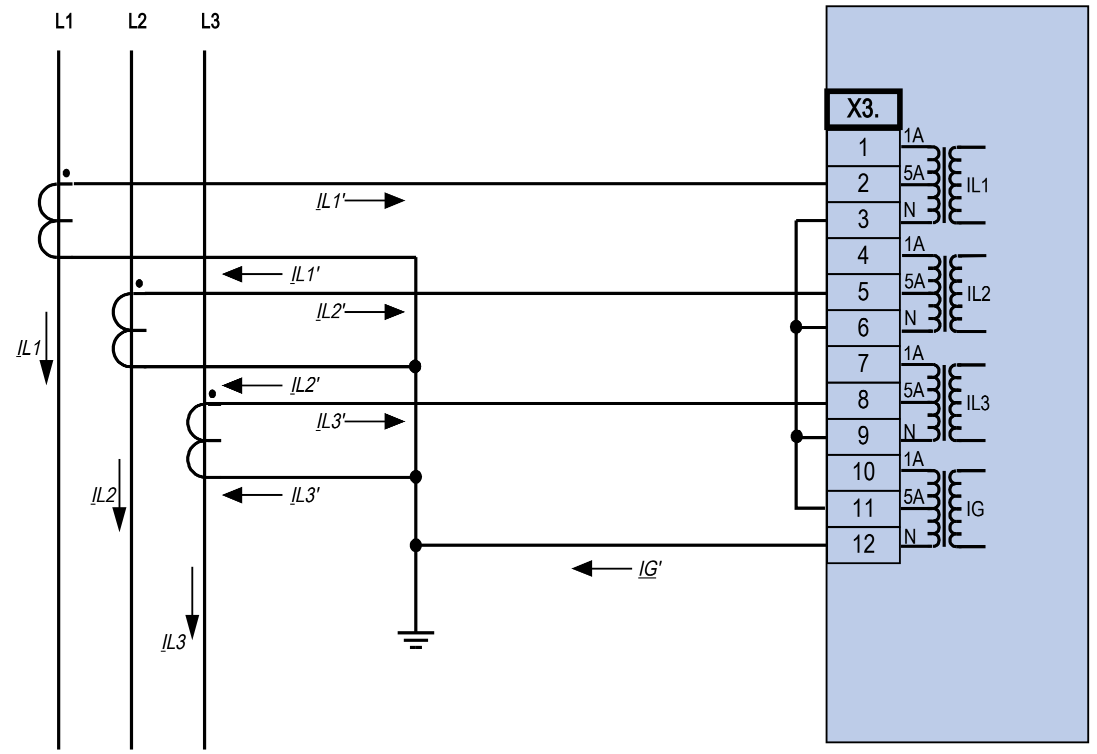


Three phase current measurement; In secondary = 5 A.

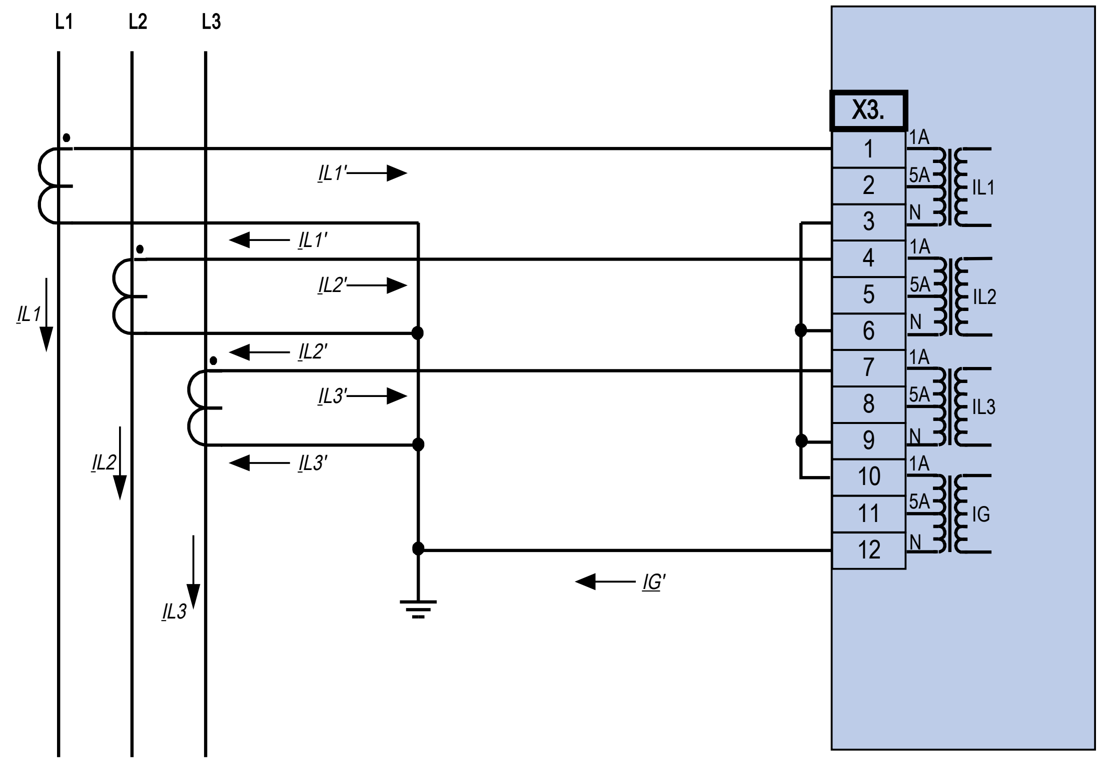


Three phase current measurement; In secondary = 1 A.
Earth-current measuring via cable-type current transformer ; IGnom secondary = 1 A.

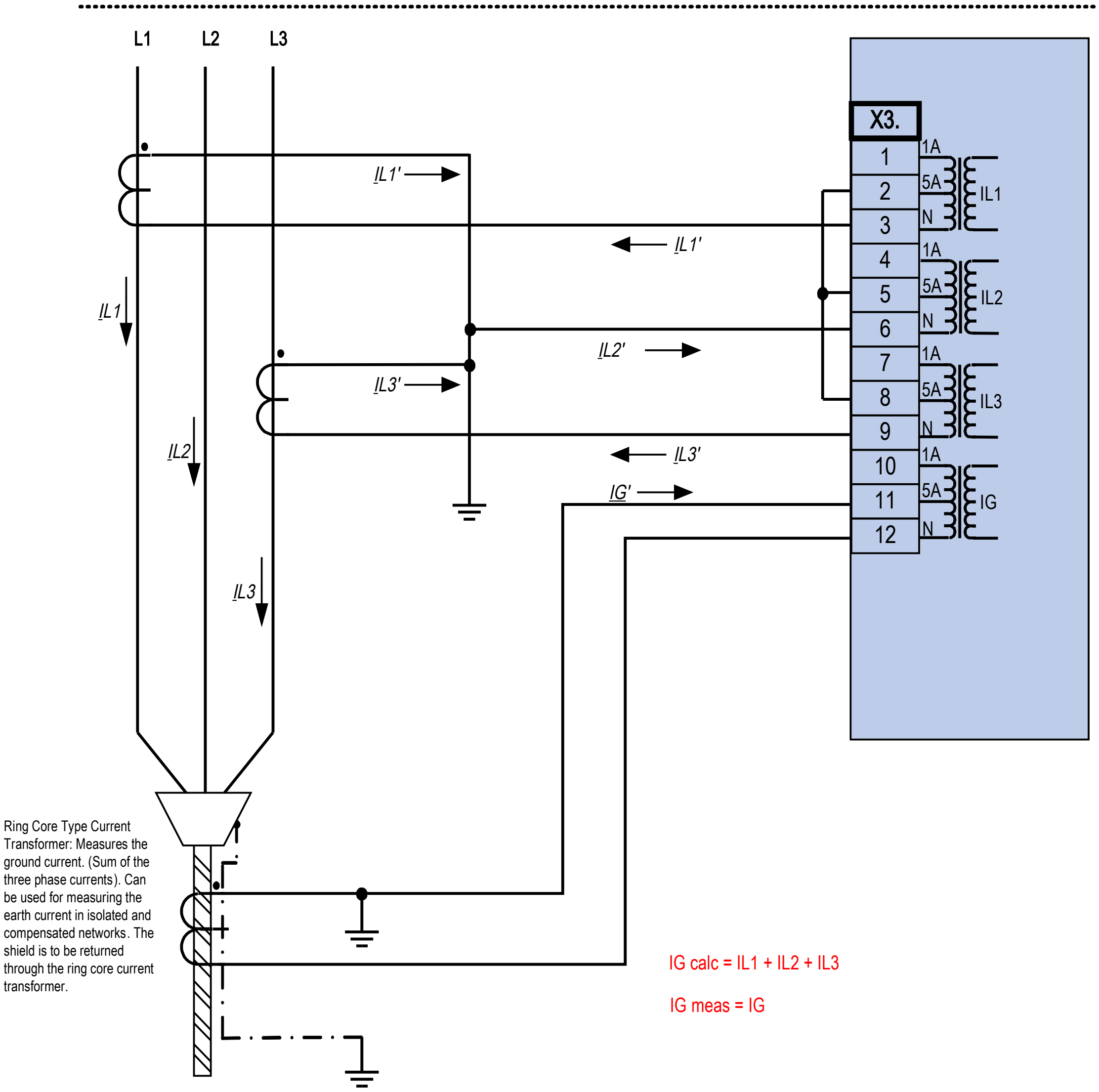
Warning!
The shielding at the dismantled end of the line has to be put through the cable-type current transformer and has to be grounded at the cable side.



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

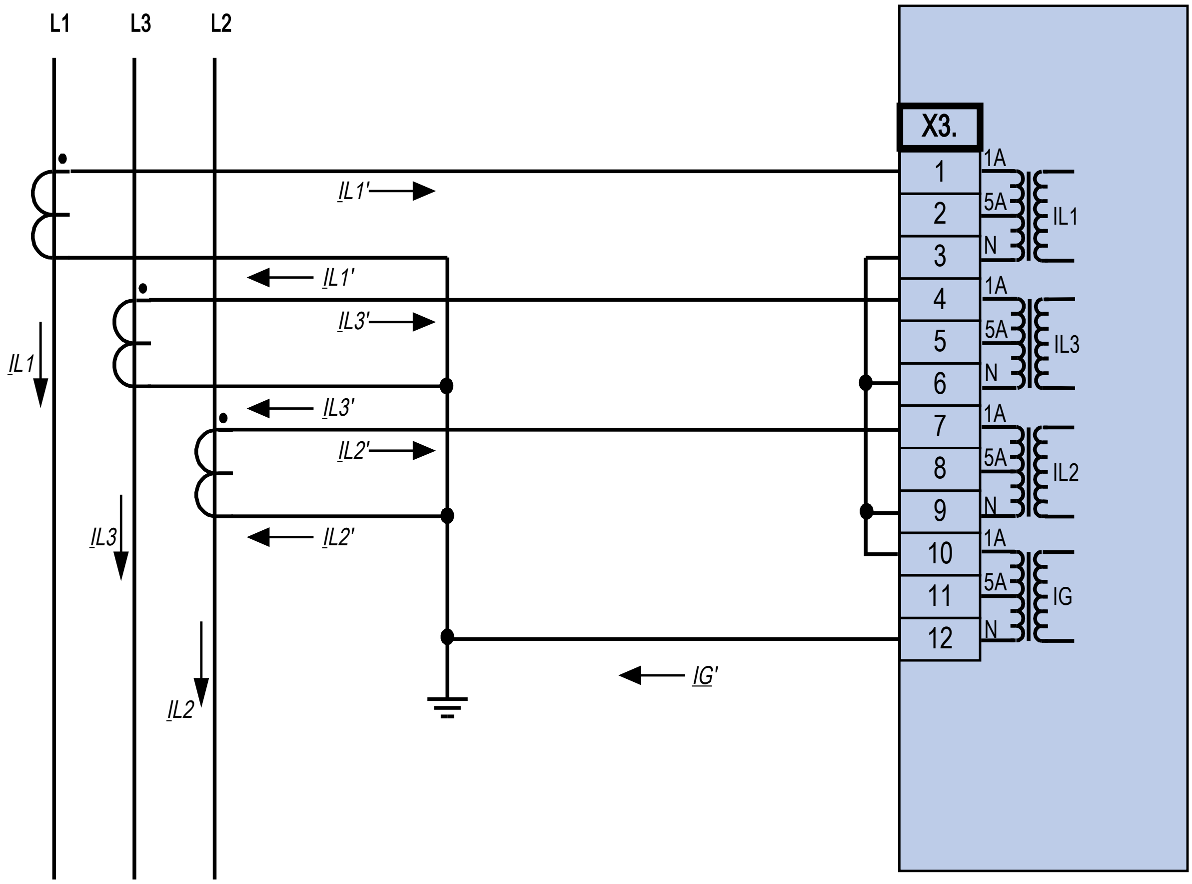


Three phase current measurement; In secondary = 1 A.
Earth-current measuring via Holmgreen-connection; IGnom secondary = 1 A.



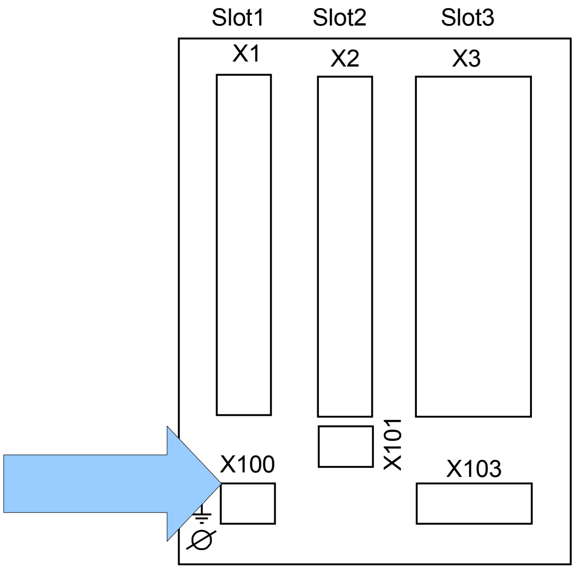
Two phase current measurement (Open Delta); In secondary = 5 A.
Earth-current measuring via cable-type current transformer ; IGnom secondary = 5 A.

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.

Slot X100: Ethernet Interface



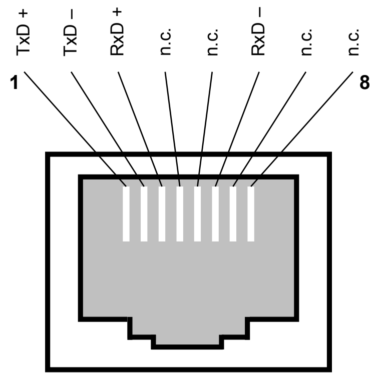
Rear side of the device (Slots)

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

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

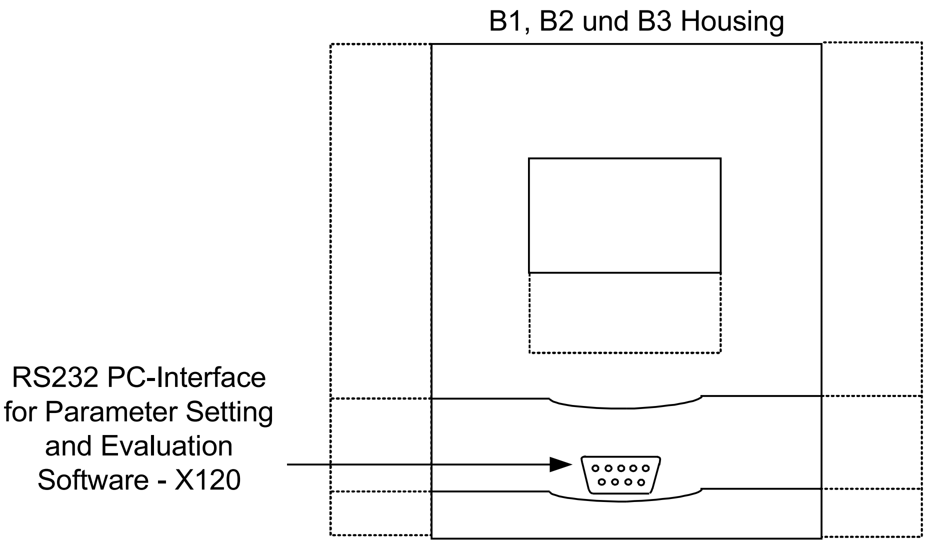
Ethernet - RJ45

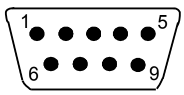
Terminals



PC Interface - X120

9-pole D-Sub at all device fronts



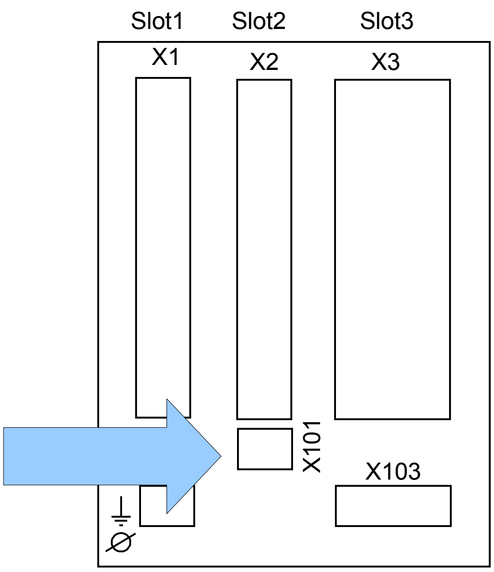
Electro-mechanical assignment for all device types
 1 DCD 2 RxD 3 TxD 4 DTR 5 GND 6 DSR 7 RTS 8 CTS 9 RI housing shielded

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
[illegible]	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

Slot X101: IRIG-B00X



Rear side of the device (Slots)

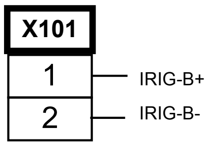
If the device is equipped with an IRIG-B00X interface is dependent on the ordered device type.

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

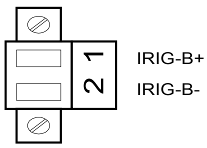
IRIG-B00X

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

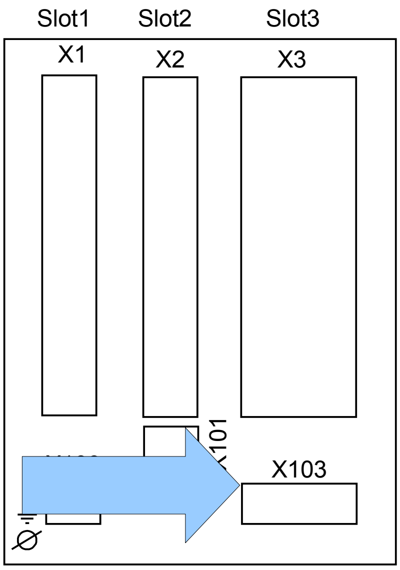
Terminal Markings



Electromechanical Assignment



Slot X103: Data Communication



Rear side of the device (Slots)

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

Available assembly groups in this slot:

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

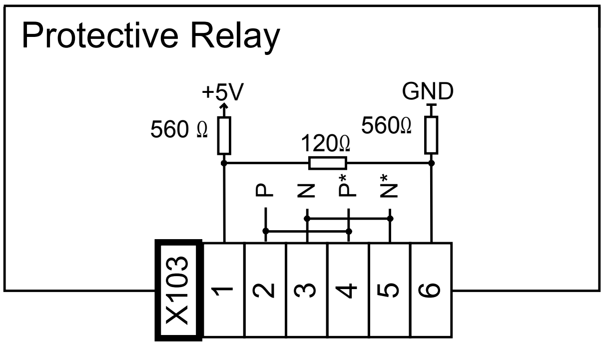
NOTICE **The available combinations can be gathered from the ordering code.**

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

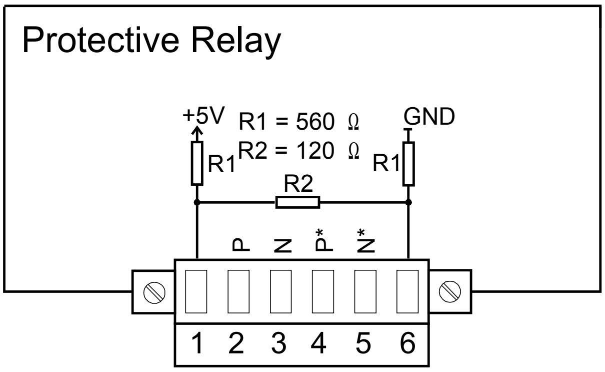
WARNING **There are two different versions of the RS485 interface. By means of the wiring diagram on the top of your device, you have to find out which version is built in your device (Type1 or Type2).**

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

RS485 – Type 1 (see wiring diagram)



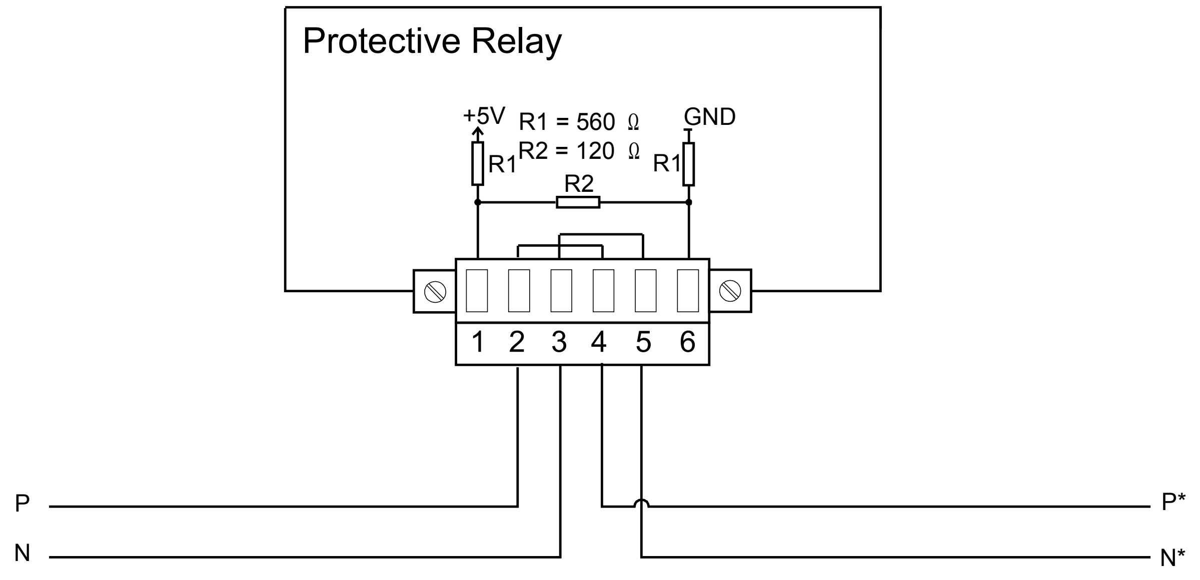
Electro-mechanical assignment Type 1 (see wiring diagram)



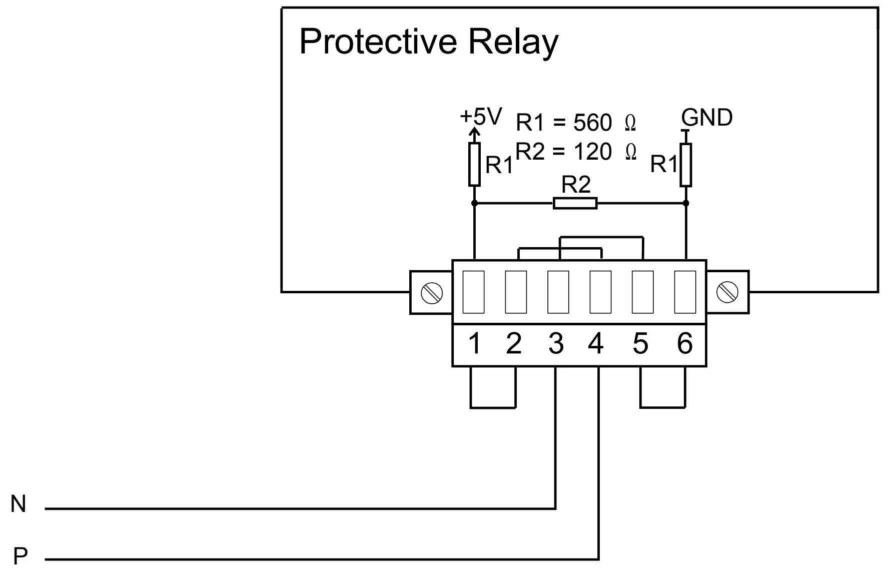
NOTICE **The Modbus® / IEC 60870-5-103 connection cable must be shielded. The shielding has to be fixed at the screw which is marked with the ground symbol at the rear side of the device.**

The communication is Half-duplex

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



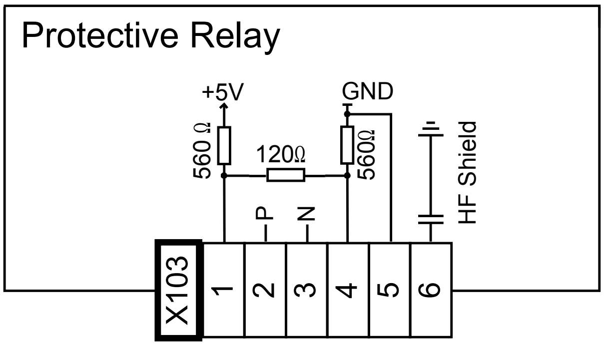
Type 1 Wiring example, Device at the End of the BUS (using the integrated Terminal Resistor)



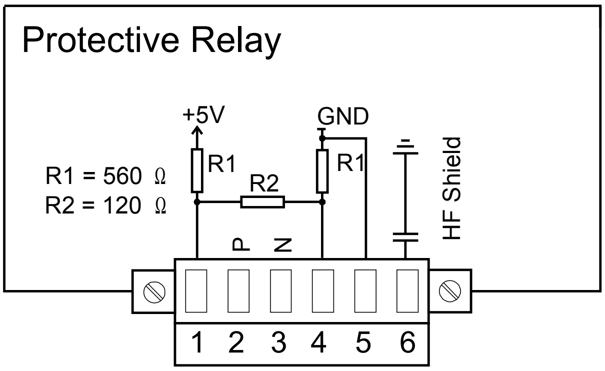
WARNING **There are two different versions of the RS485 interface. By means of the wiring diagram on the top of your device, you have to find out which version is built in your device (Type1 or Type2).**

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)

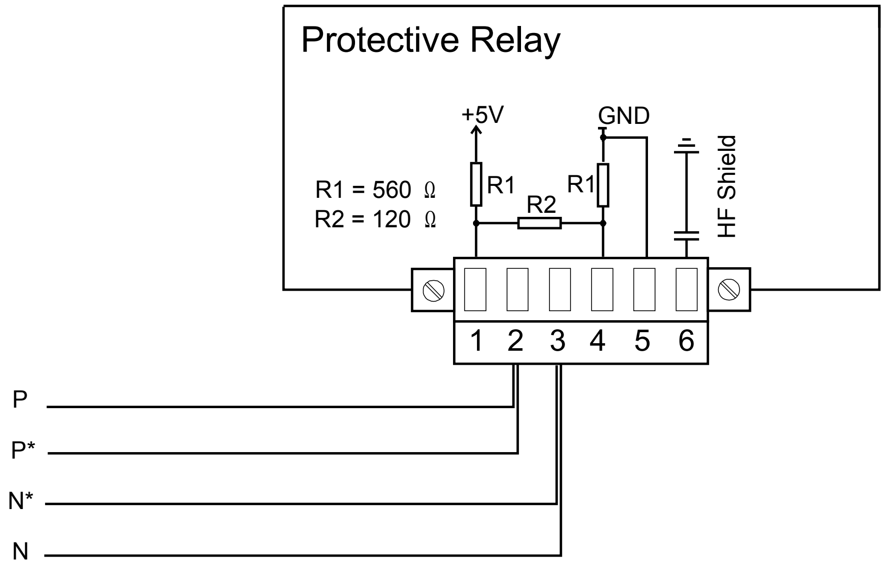


NOTICE

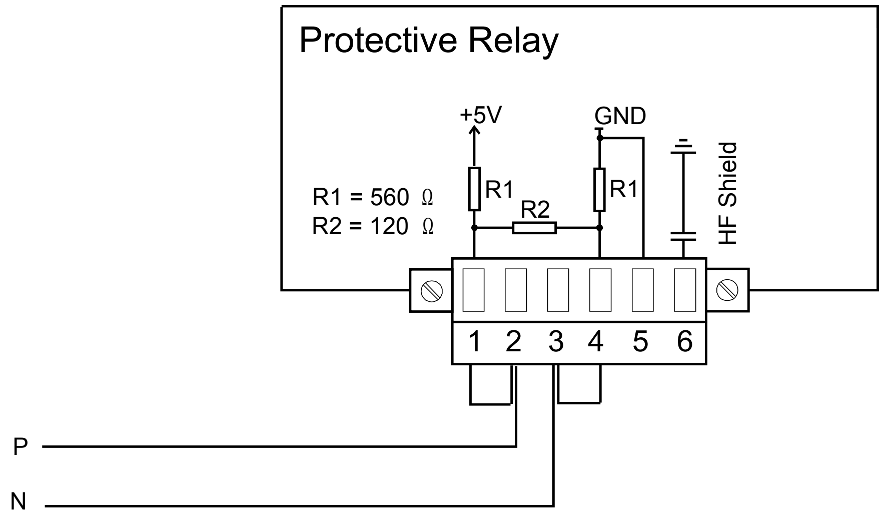
The Modbus® / IEC 60870-5-103 connection cable must be shielded. The shielding has to be fixed at the screw which is marked with the ground symbol at the rear side of the device.

The communication is Half-duplex

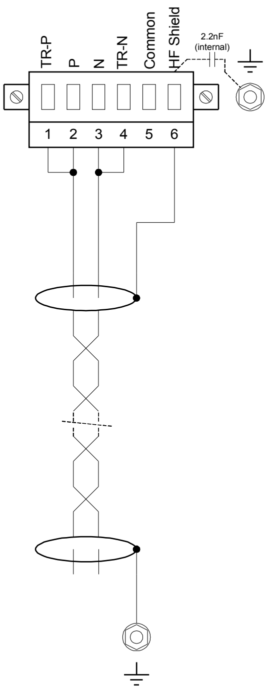
Type 2 Wiring example, Device in the Middle of the BUS



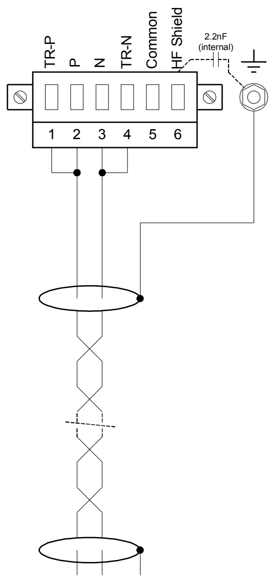
Type 2 Wiring example, Device at the End of the BUS (using the integrated Terminal Resistor)



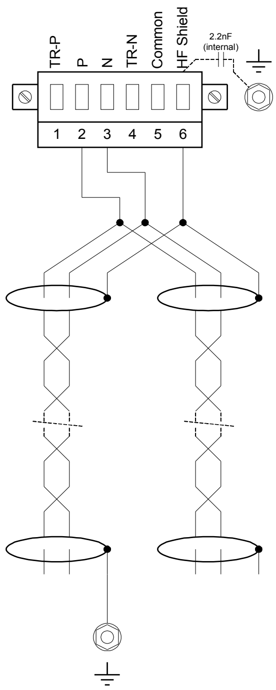
Type 2 Shielding Options (2-wire + Shield)



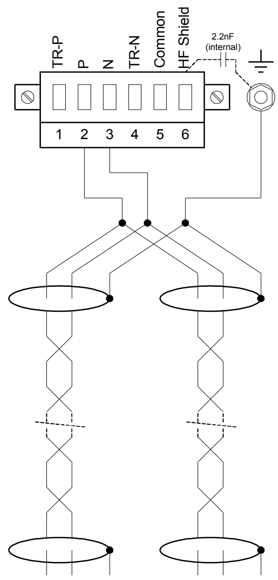
Shield at bus master side
connected to earth termination
resistors used



Shield at bus device side
connected to earth termination
resistors used

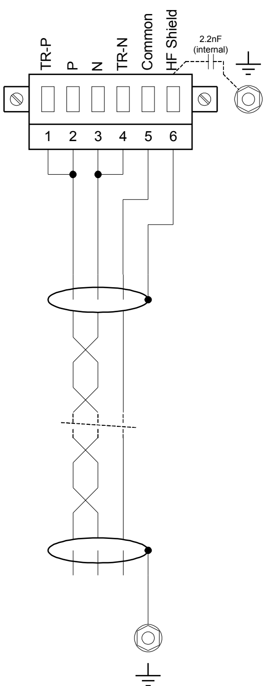


Shield at bus master side
connected to earth termination
resistors not used

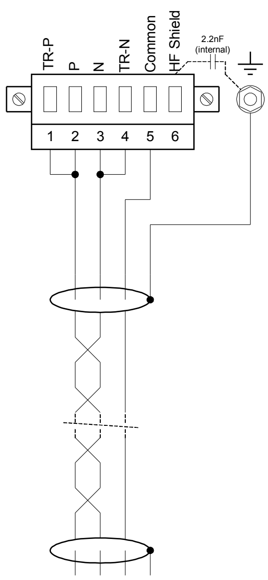


Shield at bus device side
connected to earth termination
resistors not used

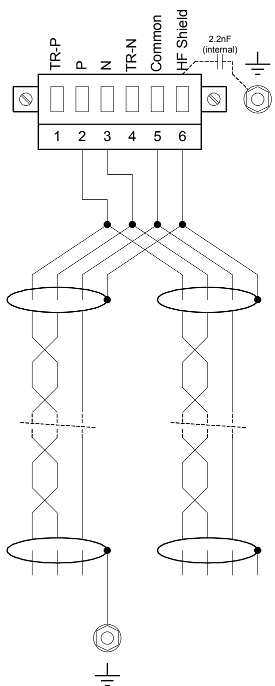
Type 2 Shielding Options (3-wire + Shield)



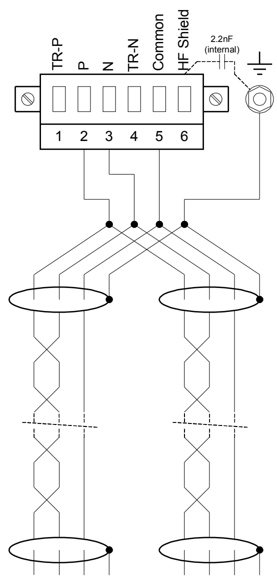
Shield at bus master side
connected to earth termination
resistors used



Shield at bus device side
connected to earth termination
resistors used



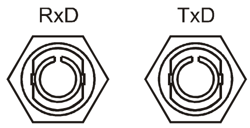
Shield at bus master side
connected to earth termination
resistors not used



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

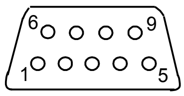
Profibus DP/ Modbus® RTU / IEC 60870-5-103 via Fibre Optic

Fibre Optic



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

D-SUB



Electro-mechanical assignment

D-SUB assignment - bushing

1 Earthing/shielding

3 RxD TxD - P: High-Level

4 RTS-signal

5 DGND: Ground, neg. Potential of aux voltage supply

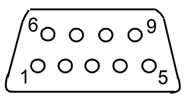
6 VP: pos. Potential of the aux voltage supply

8 RxD TxD - N: Low-Level

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

Profibus DP via D-SUB

D-SUB



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

NOTICE

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

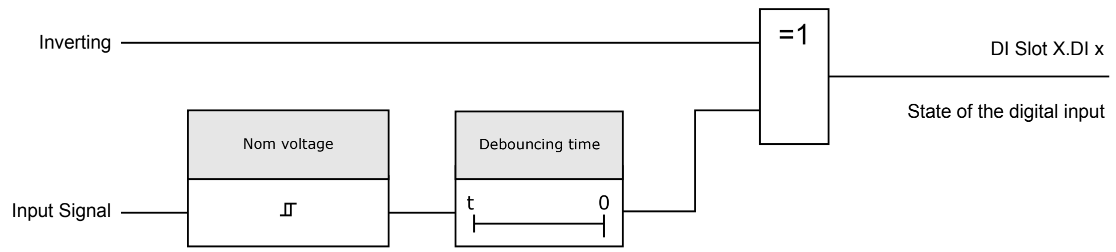
Input, Output and LED Settings

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; and
- *»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]

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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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]
Inverting 7	Inverting the input signals.	inactive, active	inactive	[Device Para /Digital Inputs /DI Slot X1 /Group 3]

Parameter	Description	Setting range	Default	Menu path
Debouncing time 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.	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

DI-4P X

DI Slot X1

Device Parameters of the Digital Inputs on DI-4P 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]
Inverting 1	Inverting the input signals.	inactive, active	inactive	[Device Para /Digital Inputs /DI Slot X1]
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]
Inverting 2	Inverting the input signals.	inactive, active	inactive	[Device Para /Digital Inputs /DI Slot X1]
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]
Inverting 3	Inverting the input signals.	inactive, active	inactive	[Device Para /Digital Inputs /DI Slot X1]
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]

Parameter	Description	Setting range	Default	Menu path
Inverting 4	Inverting the input signals.	inactive, active	inactive	[Device Para /Digital Inputs /DI Slot X1]
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]

Signals of the Digital Inputs on DI-4P X

Name	Description
DI 1	Signal: Digital Input
DI 2	Signal: Digital Input
DI 3	Signal: Digital Input
DI 4	Signal: Digital Input

Output Relays Settings

BO-5 X2

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

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

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

      The alarm relay can only be acknowledged after reset of those signals that had initiated setting of the relay and after expiry of the minimum retention time.

- *»Hold time«*: At signal changes, the minimal latching time ensures that the relay will be maintained picked-up or released for at least this period.

CAUTION

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

If binary output relays are parametrized »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

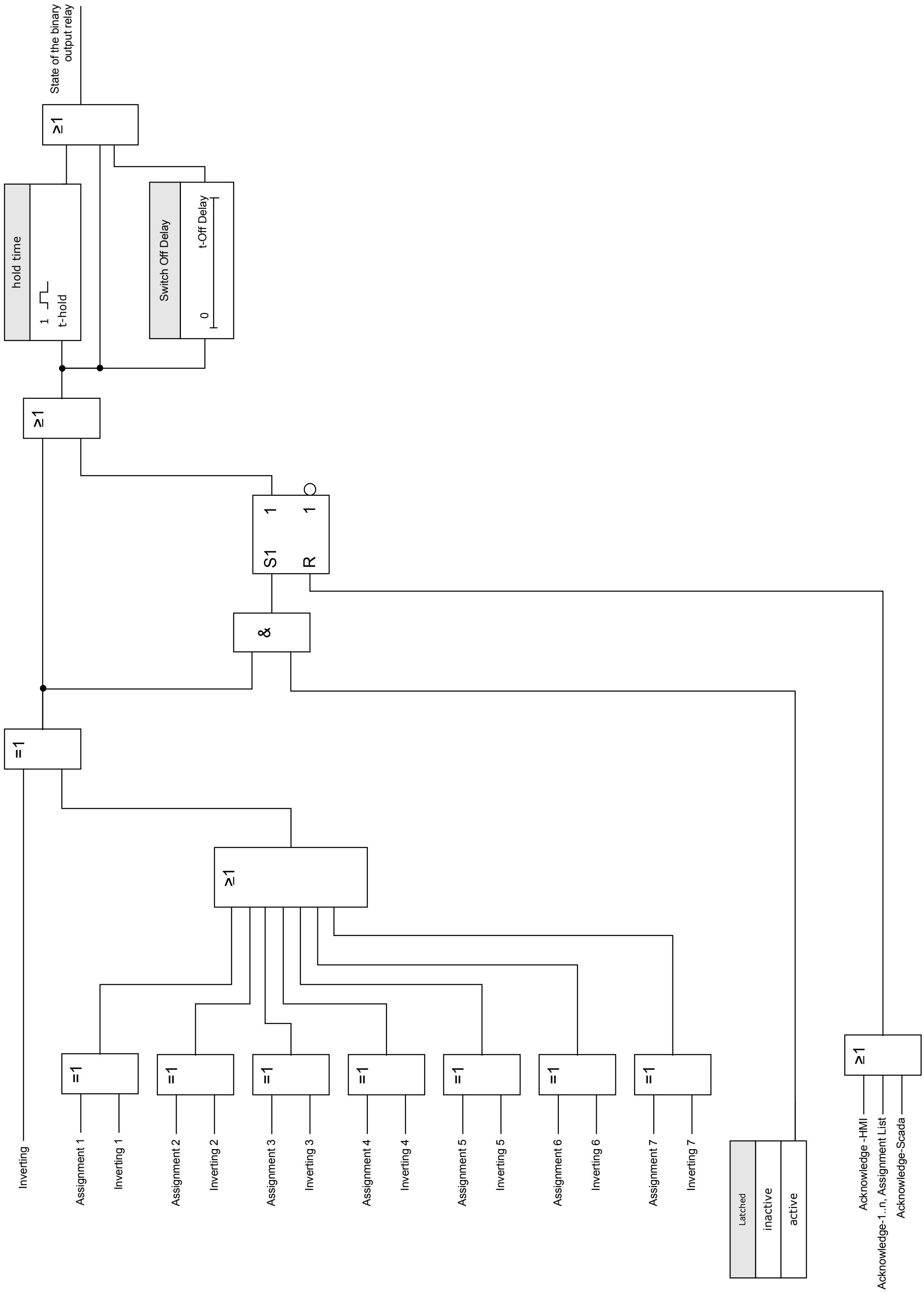
The *»System OK Relay«* (watchdog) cannot be configured.

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).**



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 parametrized The system contact is an operating current contact that picks-up, when the device is free from internal faults. While the device is booting up, the *System OK relay (SC)* remains dropped-off. As soon as the system was duly started up, the relay picks up and the assigned LED is activated accordingly (please refer to chapter Self Supervision).

OR-5 X

Direct Commands of OR-5 X

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
DISARMED	This is the second step, after the "DISARMED Ctrl" has been activated, that is required to DISARM the relay outputs. This will DISARM those output relays that are currently not latched and that are not on “hold” by a pending minimum hold time. CAUTION! RELAYS DISARMED in order to safely perform maintenance while eliminating the risk of taking an entire process off-line. (Note: Zone Interlocking and Supervision Contact cannot be disarmed). YOU MUST ENSURE that the relays are ARMED AGAIN after maintenance. Only available if: DISARMED Ctrl = active	inactive, active	inactive	[Service /Test /DISARMED /BO-5 X2]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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 /Force OR /BO-5 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 /Force OR /BO-5 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 /Force OR /BO-5 X2]
Force OR3	By means of this function the normal Output Relay State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Normal, De-Energized, Energized	Normal	[Service /Test /Force OR /BO-5 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 /Force OR /BO-5 X2]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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 /Force OR /BO-5 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 /Force OR /BO-5 X2]

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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
t-hold	To clearly identify the state transition of a binary output relay, the "new state" is being hold, at least for the duration of the hold time.	0.00 - 300.00s	0.00s	[Device Para /Binary Outputs /BO-5 X2 /BO 1]
t-Off Delay	Switch Off Delay	0.00 - 300.00s	0.00s	[Device Para /Binary Outputs /BO-5 X2 /BO 1]
Latched	Defines whether the Relay Output will be latched when it picks up.	inactive, active	active	[Device Para /Binary Outputs /BO-5 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-5 X2 /BO 1]
Inverting	Inverting of the Binary Output Relay.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 1]
Assignment 1	Assignment	1..n, Assignment List	CB.TripCmd	[Device Para /Binary Outputs /BO-5 X2 /BO 1]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 1]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO-5 X2 /BO 1]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 1]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO-5 X2 /BO 1]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 1]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO-5 X2 /BO 1]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 1]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO-5 X2 /BO 1]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 1]
Assignment 6	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO-5 X2 /BO 1]
Inverting 6	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 1]
Assignment 7	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO-5 X2 /BO 1]
Inverting 7	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 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-5 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-5 X2 /BO 2]
Latched	Defines whether the Relay Output will be latched when it picks up.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 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-5 X2 /BO 2]
Inverting	Inverting of the Binary Output Relay.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 2]
Assignment 1	Assignment	1..n, Assignment List	Prot.Alarm	[Device Para /Binary Outputs /BO-5 X2 /BO 2]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 2]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO-5 X2 /BO 2]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 2]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO-5 X2 /BO 2]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 2]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO-5 X2 /BO 2]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 2]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO-5 X2 /BO 2]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 2]
Assignment 6	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO-5 X2 /BO 2]
Inverting 6	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 2]
Assignment 7	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO-5 X2 /BO 2]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 7	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 2]
t-hold	To clearly identify the state transition of a binary output relay, the "new state" is being hold, at least for the duration of the hold time.	0.00 - 300.00s	0.00s	[Device Para /Binary Outputs /BO-5 X2 /BO 3]
t-Off Delay	Switch Off Delay	0.00 - 300.00s	0.00s	[Device Para /Binary Outputs /BO-5 X2 /BO 3]
Latched	Defines whether the Relay Output will be latched when it picks up.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 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-5 X2 /BO 3]
Inverting	Inverting of the Binary Output Relay.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 3]
Assignment 1	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO-5 X2 /BO 3]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 3]

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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 6	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 3]
Assignment 7	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO-5 X2 /BO 3]
Inverting 7	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 3]
t-hold	To clearly identify the state transition of a binary output relay, the "new state" is being hold, at least for the duration of the hold time.	0.00 - 300.00s	0.00s	[Device Para /Binary Outputs /BO-5 X2 /BO 4]
t-Off Delay	Switch Off Delay	0.00 - 300.00s	0.00s	[Device Para /Binary Outputs /BO-5 X2 /BO 4]
Latched	Defines whether the Relay Output will be latched when it picks up.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 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-5 X2 /BO 4]
Inverting	Inverting of the Binary Output Relay.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 4]

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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 4]
Assignment 6	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO-5 X2 /BO 4]
Inverting 6	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 4]
Assignment 7	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO-5 X2 /BO 4]
Inverting 7	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 4]
t-hold	To clearly identify the state transition of a binary output relay, the "new state" is being hold, at least for the duration of the hold time.	0.00 - 300.00s	0.00s	[Device Para /Binary Outputs /BO-5 X2 /BO 5]
t-Off Delay	Switch Off Delay	0.00 - 300.00s	0.00s	[Device Para /Binary Outputs /BO-5 X2 /BO 5]
Latched	Defines whether the Relay Output will be latched when it picks up.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 5]

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-5 X2 /BO 5]
Inverting	Inverting of the Binary Output Relay.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 5]
Assignment 1	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO-5 X2 /BO 5]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 5]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO-5 X2 /BO 5]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 5]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO-5 X2 /BO 5]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 5]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO-5 X2 /BO 5]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 5]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO-5 X2 /BO 5]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 5]
Assignment 6	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO-5 X2 /BO 5]
Inverting 6	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 5]
Assignment 7	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /BO-5 X2 /BO 5]
Inverting 7	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /BO-5 X2 /BO 5]
DISARMED Ctrl	Enables and disables the disarming of the relay outputs. This is the first step of a two step process, to inhibit the operation or the relay outputs. Please refer to "DISARMED" for the second step.	inactive, active	inactive	[Service /Test /DISARMED /BO-5 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 /DISARMED /BO-5 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 /DISARMED /BO-5 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 /Force OR /BO-5 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 /Force OR /BO-5 X2]

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

Name	Description	Assignment via
BO1.1	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 1]
BO1.2	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 1]
BO1.3	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 1]
BO1.4	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 1]
BO1.5	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 1]
BO1.6	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 1]
BO1.7	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 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-5 X2 /BO 1]
BO2.1	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 2]

Name	*Description*	*Assignment via*
BO2.2	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 2]
BO2.3	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 2]
BO2.4	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 2]
BO2.5	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 2]
BO2.6	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 2]
BO2.7	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 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-5 X2 /BO 2]
BO3.1	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 3]
BO3.2	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 3]

Name	*Description*	*Assignment via*
BO3.3	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 3]
BO3.4	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 3]
BO3.5	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 3]
BO3.6	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 3]
BO3.7	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 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-5 X2 /BO 3]
BO4.1	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 4]
BO4.2	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 4]
BO4.3	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 4]

Name	*Description*	*Assignment via*
BO4.4	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 4]
BO4.5	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 4]
BO4.6	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 4]
BO4.7	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 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-5 X2 /BO 4]
BO5.1	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 5]
BO5.2	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 5]
BO5.3	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 5]
BO5.4	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 5]

Name	*Description*	*Assignment via*
BO5.5	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 5]
BO5.6	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 X2 /BO 5]
BO5.7	Module input state: Assignment	[Device Para /Binary Outputs /BO-5 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-5 X2 /BO 5]

Signals of the Binary Output Relays on OR-5 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
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.

OR-3AI X

OR-3AI X2

Direct Commands of OR- 3AI 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 /DISARMED /OR-3AI 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 /Force OR /OR-3AI X2]

Parameter	Description	Setting range	Default	Menu path
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 /Force OR /OR-3AI 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 /Force OR /OR-3AI X2]
Force OR3	By means of this function the normal Output Relay State can be overwritten (forced). The relay can be set from normal operation (relay works according to the assigned signals) to "force energized" or "force de-energized" state.	Normal, De-Energized, Energized	Normal	[Service /Test /Force OR /OR-3AI X2]

Device Parameters of the Binary Output Relays on OR- 3AI X

Parameter	Description	Setting range	Default	Menu path
t-hold	To clearly identify the state transition of a binary output relay, the "new state" is being hold, at least for the duration of the hold time.	0.00 - 300.00s	0.1s	[Device Para /Binary Outputs /OR-3AI X2 /BO 1]
t-Off Delay	Switch Off Delay	0.00 - 300.00s	0.1s	[Device Para /Binary Outputs /OR-3AI X2 /BO 1]
Latched	Defines whether the Relay Output will be latched when it picks up.	inactive, active	inactive	[Device Para /Binary Outputs /OR-3AI 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 /OR-3AI X2 /BO 1]
Inverting	Inverting of the Binary Output Relay.	inactive, active	inactive	[Device Para /Binary Outputs /OR-3AI X2 /BO 1]
Assignment 1	Assignment	1..n, Assignment List	CB.TripCmd	[Device Para /Binary Outputs /OR-3AI X2 /BO 1]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /OR-3AI X2 /BO 1]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /OR-3AI X2 /BO 1]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /OR-3AI X2 /BO 1]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /OR-3AI X2 /BO 1]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /OR-3AI X2 /BO 1]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /OR-3AI X2 /BO 1]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /OR-3AI X2 /BO 1]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /OR-3AI X2 /BO 1]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /OR-3AI X2 /BO 1]
Assignment 6	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /OR-3AI X2 /BO 1]
Inverting 6	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /OR-3AI X2 /BO 1]
Assignment 7	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /OR-3AI X2 /BO 1]
Inverting 7	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /OR-3AI 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	0.1s	[Device Para /Binary Outputs /OR-3AI 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 /OR-3AI X2 /BO 2]
Latched	Defines whether the Relay Output will be latched when it picks up.	inactive, active	inactive	[Device Para /Binary Outputs /OR-3AI 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 /OR-3AI X2 /BO 2]
Inverting	Inverting of the Binary Output Relay.	inactive, active	inactive	[Device Para /Binary Outputs /OR-3AI X2 /BO 2]
Assignment 1	Assignment	1..n, Assignment List	Prot.Alarm	[Device Para /Binary Outputs /OR-3AI X2 /BO 2]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /OR-3AI X2 /BO 2]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /OR-3AI X2 /BO 2]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /OR-3AI X2 /BO 2]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /OR-3AI X2 /BO 2]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /OR-3AI X2 /BO 2]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /OR-3AI X2 /BO 2]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /OR-3AI X2 /BO 2]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /OR-3AI X2 /BO 2]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /OR-3AI X2 /BO 2]
Assignment 6	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /OR-3AI X2 /BO 2]
Inverting 6	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /OR-3AI X2 /BO 2]
Assignment 7	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /OR-3AI X2 /BO 2]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 7	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /OR-3AI X2 /BO 2]
t-hold	To clearly identify the state transition of a binary output relay, the "new state" is being hold, at least for the duration of the hold time.	0.00 - 300.00s	0.1s	[Device Para /Binary Outputs /OR-3AI X2 /BO 3]
t-Off Delay	Switch Off Delay	0.00 - 300.00s	0.00s	[Device Para /Binary Outputs /OR-3AI X2 /BO 3]
Latched	Defines whether the Relay Output will be latched when it picks up.	inactive, active	inactive	[Device Para /Binary Outputs /OR-3AI 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 /OR-3AI X2 /BO 3]
Inverting	Inverting of the Binary Output Relay.	inactive, active	inactive	[Device Para /Binary Outputs /OR-3AI X2 /BO 3]
Assignment 1	Assignment	1..n, Assignment List	CBF.Alarm	[Device Para /Binary Outputs /OR-3AI X2 /BO 3]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /OR-3AI X2 /BO 3]

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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 6	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /OR-3AI X2 /BO 3]
Assignment 7	Assignment	1..n, Assignment List	-.-	[Device Para /Binary Outputs /OR-3AI X2 /BO 3]
Inverting 7	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /Binary Outputs /OR-3AI X2 /BO 3]
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 /DISARMED /OR-3AI X2]
Disarm Mode	CAUTION!RELAYS DISARMED in order to safely perform maintenance while eliminating the risk of taking an entire process off-line. (Note: The Supervision Contact cannot be disarmed). YOU MUST ENSURE that the relays are ARMED AGAIN after maintenance.	permanent, Timeout	permanent	[Service /Test /DISARMED /OR-3AI 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 /DISARMED /OR-3AI X2]

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 /Force OR /OR-3AI 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 /Force OR /OR-3AI X2]

Input States of the Binary Output Relays on OR- 3AI X

Name	*Description*	*Assignment via*
BO1.1	Module input state: Assignment	[Device Para /Binary Outputs /OR-3AI X2 /BO 1]
BO1.2	Module input state: Assignment	[Device Para /Binary Outputs /OR-3AI X2 /BO 1]
BO1.3	Module input state: Assignment	[Device Para /Binary Outputs /OR-3AI X2 /BO 1]
BO1.4	Module input state: Assignment	[Device Para /Binary Outputs /OR-3AI X2 /BO 1]

Name	Description	Assignment via
BO1.5	Module input state: Assignment	[Device Para /Binary Outputs /OR-3AI X2 /BO 1]
BO1.6	Module input state: Assignment	[Device Para /Binary Outputs /OR-3AI X2 /BO 1]
BO1.7	Module input state: Assignment	[Device Para /Binary Outputs /OR-3AI 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 /OR-3AI X2 /BO 1]
BO2.1	Module input state: Assignment	[Device Para /Binary Outputs /OR-3AI X2 /BO 2]
BO2.2	Module input state: Assignment	[Device Para /Binary Outputs /OR-3AI X2 /BO 2]
BO2.3	Module input state: Assignment	[Device Para /Binary Outputs /OR-3AI X2 /BO 2]
BO2.4	Module input state: Assignment	[Device Para /Binary Outputs /OR-3AI X2 /BO 2]
BO2.5	Module input state: Assignment	[Device Para /Binary Outputs /OR-3AI X2 /BO 2]

Name	*Description*	*Assignment via*
BO2.6	Module input state: Assignment	[Device Para /Binary Outputs /OR-3AI X2 /BO 2]
BO2.7	Module input state: Assignment	[Device Para /Binary Outputs /OR-3AI 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 /OR-3AI X2 /BO 2]
BO3.1	Module input state: Assignment	[Device Para /Binary Outputs /OR-3AI X2 /BO 3]
BO3.2	Module input state: Assignment	[Device Para /Binary Outputs /OR-3AI X2 /BO 3]
BO3.3	Module input state: Assignment	[Device Para /Binary Outputs /OR-3AI X2 /BO 3]
BO3.4	Module input state: Assignment	[Device Para /Binary Outputs /OR-3AI X2 /BO 3]
BO3.5	Module input state: Assignment	[Device Para /Binary Outputs /OR-3AI X2 /BO 3]
BO3.6	Module input state: Assignment	[Device Para /Binary Outputs /OR-3AI X2 /BO 3]

Name	*Description*	*Assignment via*
BO3.7	Module input state: Assignment	[Device Para /Binary Outputs /OR-3AI 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 /OR-3AI X2 /BO 3]

Signals of the Binary Output Relays on OR- 3AI X

Name	*Description*
BO 1	Signal: Binary Output Relay
BO 2	Signal: Binary Output Relay
BO 3	Signal: Binary Output Relay
DISARMED!	Signal: CAUTION! RELAYS DISARMED in order to safely perform maintenance while eliminating the risk of taking an entire process off-line. (Note: The Self Supervision Contact cannot be disarmed). YOU MUST ENSURE that the relays are ARMED AGAIN after maintenance
Outs forced	Signal: The State of at least one Relay Output has been set by force. That means that the state of at least one Relay is forced and hence does not show the state of the assigned signals.

LED Configuration

The LEDs can be configured within menu:

[Device Para/LEDs/Group X]

CAUTION

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

CAUTION

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

If LEDs are parametrized »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 analogue 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.

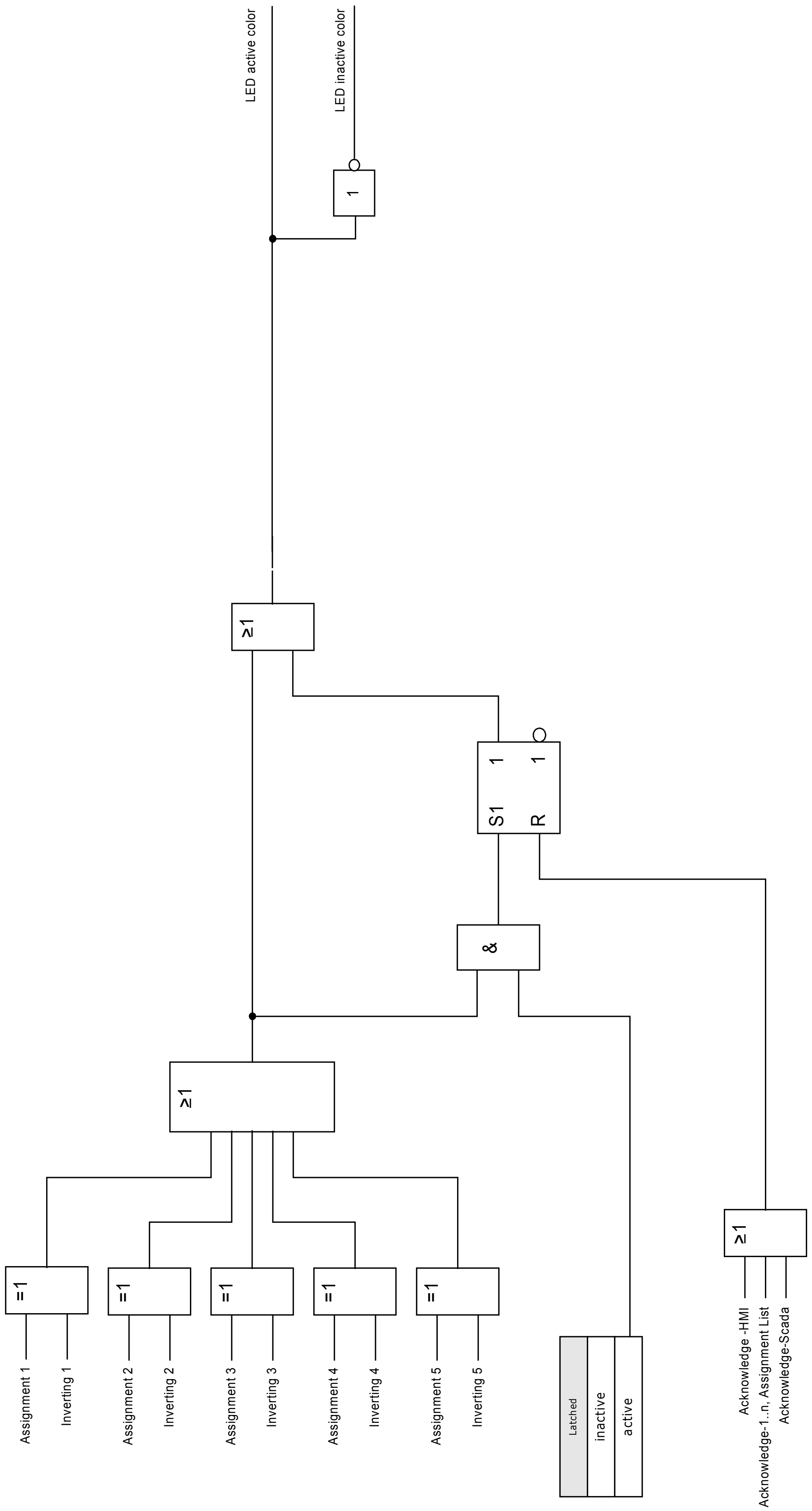
Acknowledgment options

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 parametrized

Global Protection Parameters of the LED Module

LED

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

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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
LED active color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	green, red, red flash, green flash, -	red	[Device Para /LEDs /LED 2]
LED inactive color	The LED lights up in this color if the state of the OR-assignment of the signals is untrue.	green, red, red flash, green flash, -	-	[Device Para /LEDs /LED 2]
Assignment 1	Assignment	1..n, Assignment List	I<[2].Trip	[Device Para /LEDs /LED 2]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 2]
Assignment 2	Assignment	1..n, Assignment List	I2>[2].Trip	[Device Para /LEDs /LED 2]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 2]
Assignment 3	Assignment	1..n, Assignment List	ThR.Alarm Timeout	[Device Para /LEDs /LED 2]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 2]
Assignment 4	Assignment	1..n, Assignment List	Jam[2].Trip	[Device Para /LEDs /LED 2]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 2]
Assignment 5	Assignment	1..n, Assignment List	MStart.SPHBlockAlarm	[Device Para /LEDs /LED 2]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 2]
Latched	Defines whether the LED will be latched when it picks up.	inactive, active	active	[Device Para /LEDs /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 /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 /LED 3]
LED inactive color	The LED lights up in this color if the state of the OR-assignment of the signals is untrue.	green, red, red flash, green flash, -	-	[Device Para /LEDs /LED 3]
Assignment 1	Assignment	1..n, Assignment List	ThR.TripCmd	[Device Para /LEDs /LED 3]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 3]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 3]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 3]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 3]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 3]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 3]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 3]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 3]
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 3]
Latched	Defines whether the LED will be latched when it picks up.	inactive, active	active	[Device Para /LEDs /LED 4]
Ack signal	Acknowledgement signal for the LED. If latching is set to active the LED can only be acknowledged if those signals that initiated the setting are no longer present. Only available if: Latched = active	1..n, Assignment List	-.-	[Device Para /LEDs /LED 4]
LED active color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	green, red, red flash, green flash, -	red	[Device Para /LEDs /LED 4]
LED inactive color	The LED lights up in this color if the state of the OR-assignment of the signals is untrue.	green, red, red flash, green flash, -	-	[Device Para /LEDs /LED 4]
Assignment 1	Assignment	1..n, Assignment List	I2>[1].TripCmd	[Device Para /LEDs /LED 4]

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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
LED active color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	green, red, red flash, green flash, -	red flash	[Device Para /LEDs /LED 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 /LED 5]
Assignment 1	Assignment	1..n, Assignment List	MStart.Start	[Device Para /LEDs /LED 5]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 5]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 5]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 5]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 5]
Inverting 3	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 5]
Assignment 4	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 5]
Inverting 4	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 5]
Assignment 5	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 5]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Inverting 5	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 5]
Latched	Defines whether the LED will be latched when it picks up.	inactive, active	inactive	[Device Para /LEDs /LED 6]
Ack signal	Acknowledgement signal for the LED. If latching is set to active the LED can only be acknowledged if those signals that initiated the setting are no longer present. Only available if: Latched = active	1..n, Assignment List	-.-	[Device Para /LEDs /LED 6]
LED active color	The LED lights up in this color if the state of the OR-assignment of the signals is true.	green, red, red flash, green flash, -	red	[Device Para /LEDs /LED 6]
LED inactive color	The LED lights up in this color if the state of the OR-assignment of the signals is untrue.	green, red, red flash, green flash, -	-	[Device Para /LEDs /LED 6]
Assignment 1	Assignment	1..n, Assignment List	MStart.Run	[Device Para /LEDs /LED 6]
Inverting 1	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 6]
Assignment 2	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 6]
Inverting 2	Inverting of the state of the assigned signal.	inactive, active	inactive	[Device Para /LEDs /LED 6]
Assignment 3	Assignment	1..n, Assignment List	-.-	[Device Para /LEDs /LED 6]

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

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

LED Module Input States

Name	*Description*	*Assignment via*
LED1.1	Module input state: LED	[Device Para /LEDs /LED 1]
LED1.2	Module input state: LED	[Device Para /LEDs /LED 1]

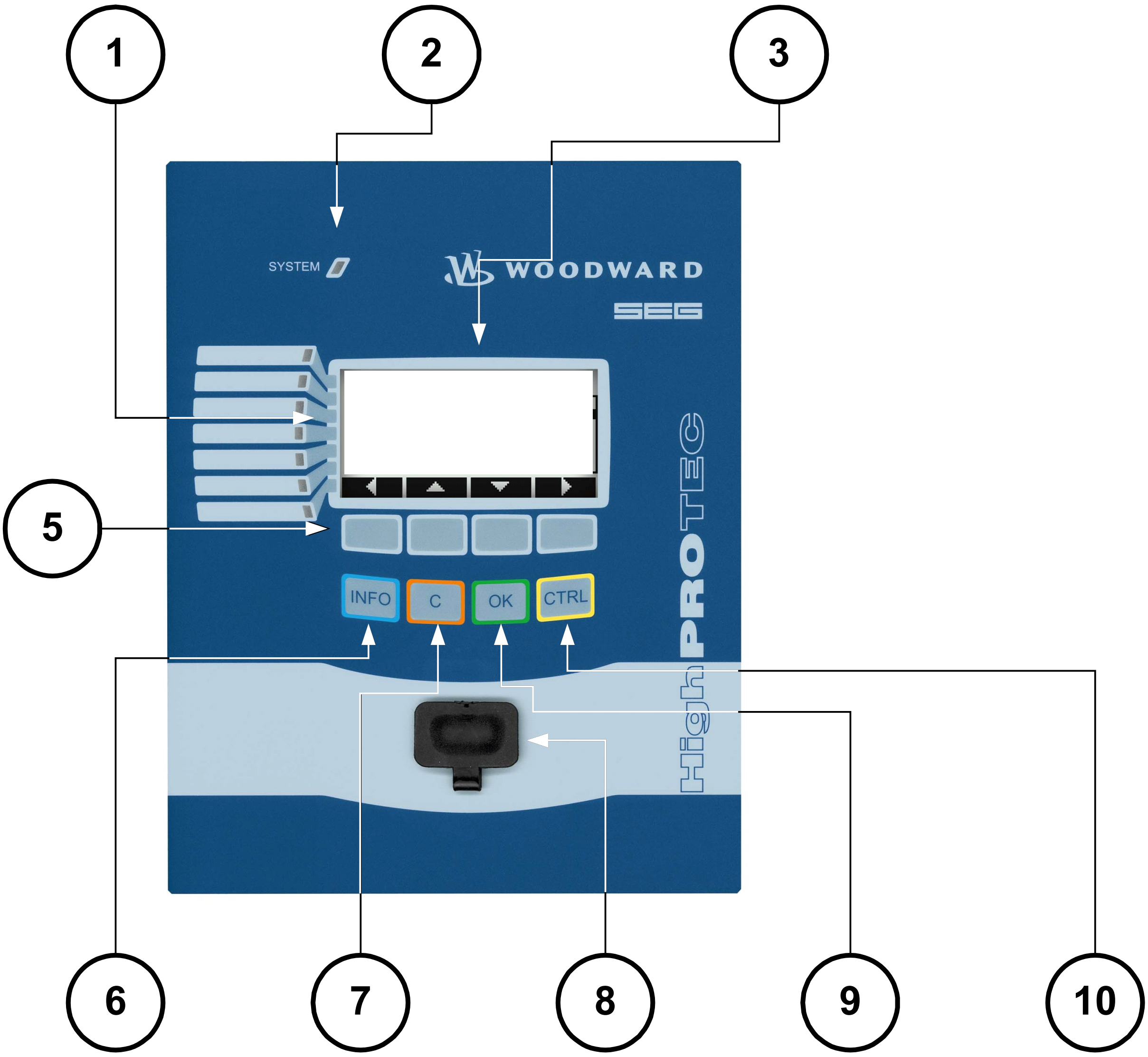
Name	*Description*	*Assignment via*
LED1.3	Module input state: LED	[Device Para /LEDs /LED 1]
LED1.4	Module input state: LED	[Device Para /LEDs /LED 1]
LED1.5	Module input state: LED	[Device Para /LEDs /LED 1]
Acknow Sig 1	Module input state: Acknowledgement Signal (only for automatic acknowledgement)	[Device Para /LEDs /LED 1]
LED2.1	Module input state: LED	[Device Para /LEDs /LED 2]
LED2.2	Module input state: LED	[Device Para /LEDs /LED 2]
LED2.3	Module input state: LED	[Device Para /LEDs /LED 2]
LED2.4	Module input state: LED	[Device Para /LEDs /LED 2]
LED2.5	Module input state: LED	[Device Para /LEDs /LED 2]
Acknow Sig 2	Module input state: Acknowledgement Signal (only for automatic acknowledgement)	[Device Para /LEDs /LED 2]
LED3.1	Module input state: LED	[Device Para /LEDs /LED 3]
LED3.2	Module input state: LED	[Device Para /LEDs /LED 3]
LED3.3	Module input state: LED	[Device Para /LEDs /LED 3]

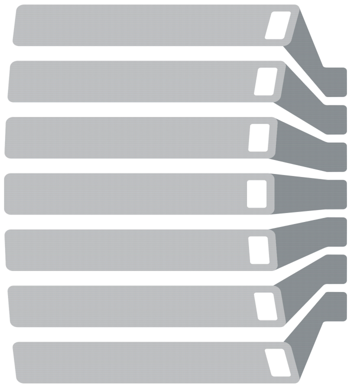
Name	*Description*	*Assignment via*
LED3.4	Module input state: LED	[Device Para /LEDs /LED 3]
LED3.5	Module input state: LED	[Device Para /LEDs /LED 3]
Acknow Sig 3	Module input state: Acknowledgement Signal (only for automatic acknowledgement)	[Device Para /LEDs /LED 3]
LED4.1	Module input state: LED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

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

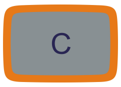
Name	*Description*	*Assignment via*
Acknow Sig 7	Module input state: Acknowledgement Signal (only for automatic acknowledgement)	[Device Para /LEDs /LED 7]

Navigation - Operation



1		LEDs	Messages inform you about operational conditions, system data or other device particulars. They additionally provide you with information regarding failures and functioning of the device as well as other states of the device and the equipment. Alarm signals can be freely allocated to LEDs out of the »ASSIGNMENT LIST«. An overview about all alarm signals available in the device can be obtained from the »ASSIGNMENT LIST« which can be found in the appendix.
		LED »System OK«	Should LED »System OK« flash red during operation, contact the Service Dept. immediately.
3		Display	Via the display you can read-out operational data and edit parameters.
5		Softkeys	The function of the »SOFTKEYS« are contextual. On the bottom line of the display the present function is displayed/symbolized. Possible functions are: • Navigation; • Parameter decrement/increment; • Scrolling up/down a menu page; • Moving to a digit; and • Change into the parameter setting mode »wrench symbol«.

6		INFO Key (Signals/Messages)	Looking through the present LED assignment. The direct select key can be actuated at any time. If the INFO key is actuated again you will leave the LED menu. Here only the first assignments of the LEDs will be shown. Every three seconds the »SOFTKEYs« will be shown (flashing). *Displaying the multiple Assignments* If the INFO-Button is pressed only the first assignments of any LED is shown. Every three seconds the »SOFTKEYs« will be shown (flashing). If there is more than one signal assigned to a LED (indicated by three dots), you can check the state of the multiple assignments if you proceed as follows. In order to show all (multiple) assignments select a LED by means of the »SOFTKEYs« »up« and »down« Via the »Softkey« »right« call up, a Sub-menu 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 ac-knowledge messages. In order to reset please press the Softkey »wrench« and enter the password. The reset menu can be left by pressing the Softkey »Arrow-left«.
8		RS232 Interface (*Smart View* Connection)	Connection to software *Smart View* is done via the RS232 interface.
9		»OK Key«	When using the »OK« key parameter changes are temporarily stored. If the »OK« key is pressed again, those changes are stored definitely.
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 sub-menus 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 sub-menu
	• Via »SOFTKEY« »Top of list« you will jump directly to the top of a list.
	• Via »SOFTKEY« »Bottom of list« you will jump directly to the end of a list.
	• Via »SOFTKEY« »+« the related digit will be incremented. (Continuous pressure -> fast).
	• Via »SOFTKEY« »-« the related digit will be decremented. (Continuous pressure -> fast).

Softkey	***Description***
←	• 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 sub-folder
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

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; and
- 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 dialogue).

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 dialogue with the »OK« button;
    - Close the Phone and Modem dialogue with the »OK« button; and
    - **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 user name 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 double check 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; and
- 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 pop-up 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; and
- 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 parametrize 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); or
- 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.**

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]

Value	*Description*	*Menu path*
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]
IL1 H2	Measured value: 2nd harmonic/1st harmonic of IL1	[Operation /Measured values /Current]
IL2 H2	Measured value: 2nd harmonic/1st harmonic of IL2	[Operation /Measured values /Current]
IL3 H2	Measured value: 2nd harmonic/1st harmonic of IL3	[Operation /Measured values /Current]
IG H2 meas	Measured value: 2nd harmonic/1st harmonic of IG (measured)	[Operation /Measured values /Current]
IG H2 calc	Measured value (calculated): 2nd harmonic/ 1st harmonic of IG (calculated)	[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]

Value	*Description*	*Menu path*
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 if ABC, I1/I2 if CBA	[Operation /Measured values /Current]

Output 4..20mA*

Available Elements:
20 mA Output

This output is 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/20 mA Output] menu option. Here the User can define to which parameter the 4-20 mA output will correlate.

Once the assignment has been made, the User can select the expected range of the parameter that will correlate to the 4-20 mA output. The User will be required to enter a »*Range min*«, and »*Range max*«. The »*Range min*« will determine the value at which 4 mA will be transmitted by the relay. Likewise, the »*Range max*« value will determine the value that will result in the transmission of a 20 mA output.

*availability depends on ordered device.

Global Protection Parameters of the 4..20mA Output

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Assignment	Assignment	-, I3 P (%Ib) avg, I3P Fla Demand, I2T Used, I2T Remained, Windg1, Windg2, Windg3, Windg4, Windg5, Windg6, MotBear1, MotBear2, LoadBear1, LoadBear2, Aux, RTD Max, Hot test Winding Temp	-	[Device Para /20 mA Output]
Range min	Adjustable range minimum _ _ _ _ _ _ _ _ _ _ _ _ _	0 - 200	0	[Device Para /20 mA Output]
Range max	Adjustable range maximum _ _ _ _ _ _ _ _ _ _ _ _ _	0 - 200	200	[Device Para /20 mA Output]

Statistics

Statistics

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

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

Read Out Statistics

- Call up the main menu.
- Call up the sub-menu *»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*
Reset	Reset of statistics	inactive, active	inactive	[Operation /Reset /Flags]

Global Protection Parameters of the Statistics Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Start via:	Start statistics by:	Duration, StartFct	Duration	[Device Para /Statistics]
StartFct	Update the displayed statistics and start new measuring interval if the assigned signal becomes true (rising edge): Only available if: Start via: = StartFct	1..n, Assignment List	-.-	[Device Para /Statistics]
ResetFct	Reset of statistics if the assigned signal becomes true (slope):	1..n, Assignment List	-.-	[Device Para /Statistics]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Duration	Recording time Only available if: Start via: = Duration	15 s, 30 s, 1 min, 10 min, 30 min, 1 h, 2 h, 6 h, 12 h, 1 d, 2 d, 5 d, 7 d, 10 d, 30 d	15 s	[Device Para /Statistics]

States of the Inputs of the Statistics Module

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

Signals of the Statistics Module

Name	*Description*
Reset	Signal: Reset of statistics

Counters of the Module Statistics

Value	*Description*	*Menu path*
MeasPointNo	Each measuring point that is taken over by the statistics increments this counter. By means of this counter, the User can check whether the statistics are alive and if data are being acquired.	[Operation /Count and RevData /Statistics]

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 <u>*Ex Acknowledge*</u>	All Binary Output Relays at once: <u>*Where? Within the menu Ex Acknowledge*</u>	All SCADA signals at once: <u>*Where? Within the menu Ex Acknowledge*</u>	All pending trip commands at once: <u>*Where? Within the menu Ex Acknowledge*</u>	

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 <u>*TripControl*</u>

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

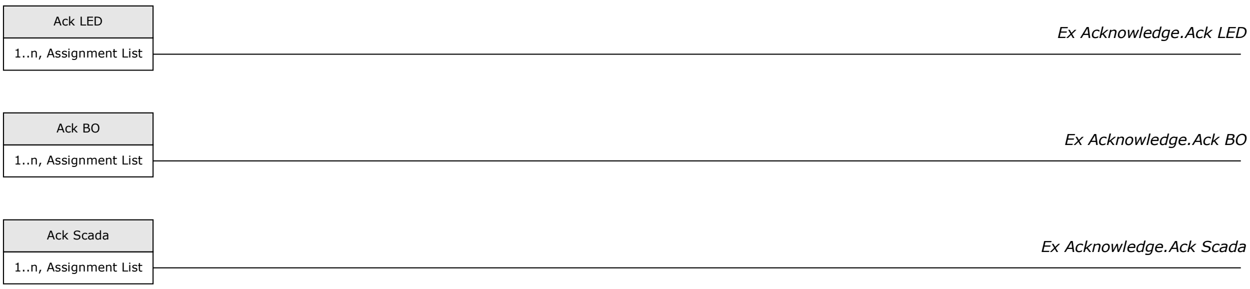
In case *Smart View* is not running – please start it.

- 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 pop-up 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; or
- 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.

External LED - Acknowledgment Signals

The following signals can be used for external acknowledgment of latched LEDs.

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 1	Signal: Digital Input
DI Slot X1.DI 2	Signal: Digital Input
DI Slot X1.DI 3	Signal: Digital Input
DI Slot X1.DI 4	Signal: Digital Input
DI Slot X1.DI 5	Signal: Digital Input
DI Slot X1.DI 6	Signal: Digital Input
DI Slot X1.DI 7	Signal: Digital Input

Name	*Description*
DI Slot X1.DI 8	Signal: Digital Input
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
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

Manual Resets

In menu *»Operation/Reset«* you can:

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

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

Manual Resets via Smart View

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

- If device data has not been loaded yet – click »Receive Data From The Device« in menu »Device«.
- Double click the »Operation« icon in the navigation tree.
- Double click the »Reset icon« within the operation menu.
- Double click the entry within the pop-up that is to be reset or deleted.

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

Reset

Current - Statistic Values

Value	*Description*	*Menu path*
IL1 max	IL1 maximum value (fundamental)	[Operation /Statistics /Current]
IL1 avg	IL1 average value (fundamental)	[Operation /Statistics /Current]
IL1 min	IL1 minimum value (fundamental)	[Operation /Statistics /Current]
IL2 max	IL2 maximum value (fundamental)	[Operation /Statistics /Current]
IL2 avg	IL2 average value (fundamental)	[Operation /Statistics /Current]
IL2 min	IL2 minimum value (fundamental)	[Operation /Statistics /Current]
IL3 max	IL3 maximum value (fundamental)	[Operation /Statistics /Current]
IL3 avg	IL3 average value (fundamental)	[Operation /Statistics /Current]
IL3 min	IL3 minimum value (fundamental)	[Operation /Statistics /Current]
I1 max	Maximum value positive phase sequence current (fundamental)	[Operation /Statistics /Current]
I1 avg	Average value positive phase sequence current (fundamental)	[Operation /Statistics /Current]

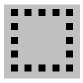
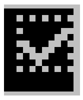
Value	*Description*	*Menu path*
I1 min	Minimum value positive phase sequence current (fundamental)	[Operation /Statistics /Current]
I2 max	Maximum value unbalanced load (fundamental)	[Operation /Statistics /Current]
I2 avg	Average value unbalanced load current (fundamental)	[Operation /Statistics /Current]
I2 min	Minimum value unbalanced load current (fundamental)	[Operation /Statistics /Current]
IL1 max RMS	IL1 maximum value (RMS)	[Operation /Statistics /Current RMS]
IL1 avg RMS	IL1 average value (RMS)	[Operation /Statistics /Current RMS]
IL1 min RMS	IL1 minimum value (RMS)	[Operation /Statistics /Current RMS]
IL2 max RMS	IL2 maximum value (RMS)	[Operation /Statistics /Current RMS]
IL2 avg RMS	IL2 average value (RMS)	[Operation /Statistics /Current RMS]
IL2 min RMS	IL2 minimum value (RMS)	[Operation /Statistics /Current RMS]
IL3 max RMS	IL3 maximum value (RMS)	[Operation /Statistics /Current RMS]
IL3 avg RMS	IL3 average value (RMS)	[Operation /Statistics /Current RMS]
IL3 min RMS	IL3 minimum value (RMS)	[Operation /Statistics /Current RMS]

Value	*Description*	*Menu path*
IG meas max RMS	Measured value: IG maximum value (RMS)	[Operation /Statistics /Current RMS]
IG meas avg RMS	Measured value: IG average value (RMS)	[Operation /Statistics /Current RMS]
IG meas min RMS	Measured value: IG minimum value (RMS)	[Operation /Statistics /Current RMS]
IG calc max RMS	Measured value (calculated):IG maximum value (RMS)	[Operation /Statistics /Current RMS]
IG calc avg RMS	Measured value (calculated):IG average value (RMS)	[Operation /Statistics /Current RMS]
IG calc min RMS	Measured value (calculated):IG minimum value (RMS)	[Operation /Statistics /Current RMS]
%IL1 THD max	IL1 Total Harmonic Distortion maximum value / Ground wave	[Operation /Statistics /Current RMS]
%IL2 THD max	IL2 Total Harmonic Distortion maximum value / Ground wave	[Operation /Statistics /Current RMS]
%IL3 THD max	IL3 Total Harmonic Distortion maximum value / Ground wave	[Operation /Statistics /Current RMS]
IL1 THD max	IL1 Total Harmonic Current maximum value	[Operation /Statistics /Current RMS]
IL2 THD max	IL2 Total Harmonic Current maximum value	[Operation /Statistics /Current RMS]
IL3 THD max	IL3 Total Harmonic Current maximum value	[Operation /Statistics /Current RMS]
%(I2/I1) max	Measured value (calculated): I2/I1 maximum value if ABC, I1/I2 if CBA	[Operation /Statistics /Current RMS]

Value	*Description*	*Menu path*
%(I2/I1) avg	Measured value (calculated): I2/I1 maximum value if ABC, I1/I2 if CBA	[Operation /Statistics /Current RMS]
%(I2/I1) min	%(I2/I1) min	[Operation /Statistics /Current RMS]

Status Display

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

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

Status Display via Smart View

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

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

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

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

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]

Recorder

Disturbance Recorder

Available elements:
Disturb rec

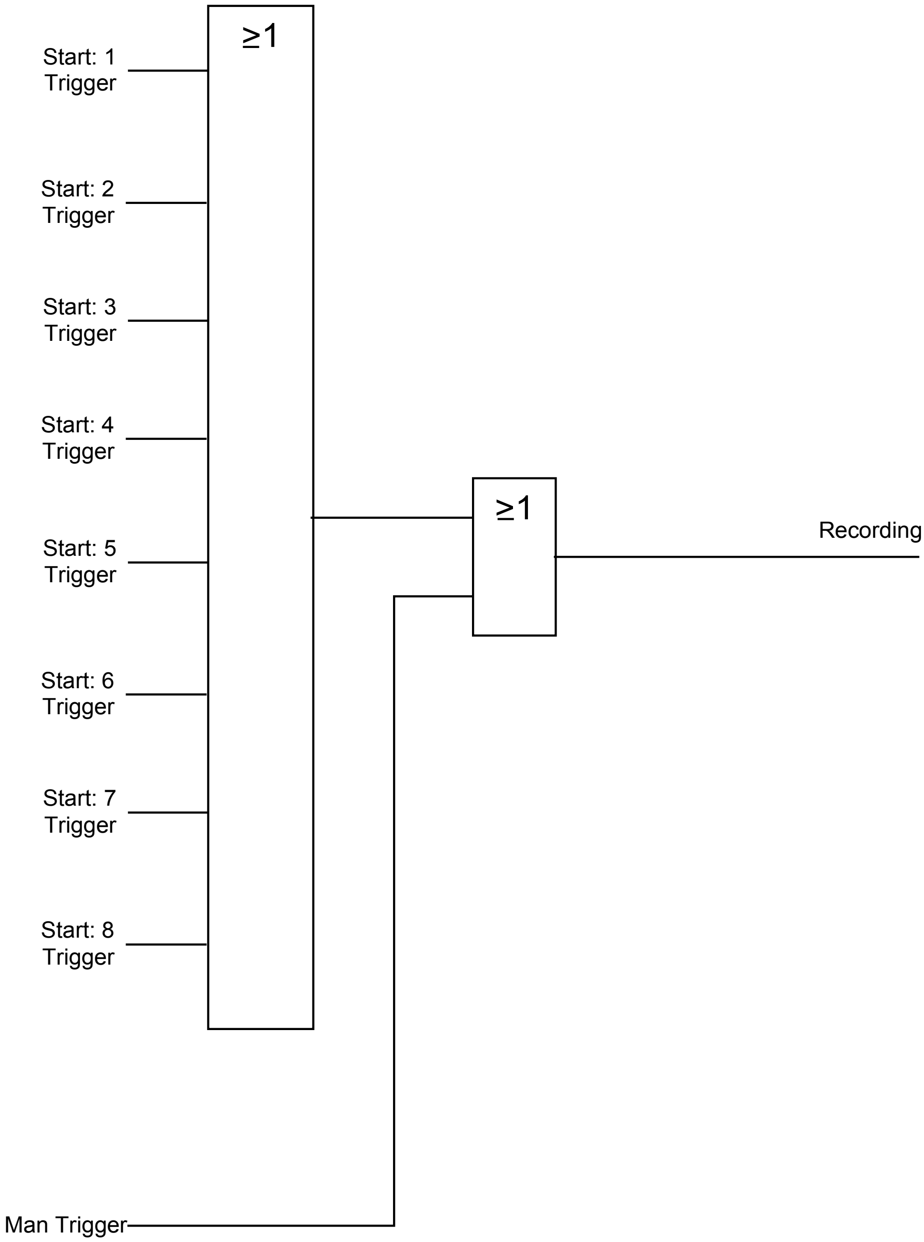
The disturbance recorder works with 32 samples per cycle. The disturbance recorder can be started by one of eight start events (selection from the »assignment list«/OR-Logic). The disturbance record contains the measuring values inclusively pre-trigger-time. By means of *Smart View/Datavisualizer* (option) 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 parametrized 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

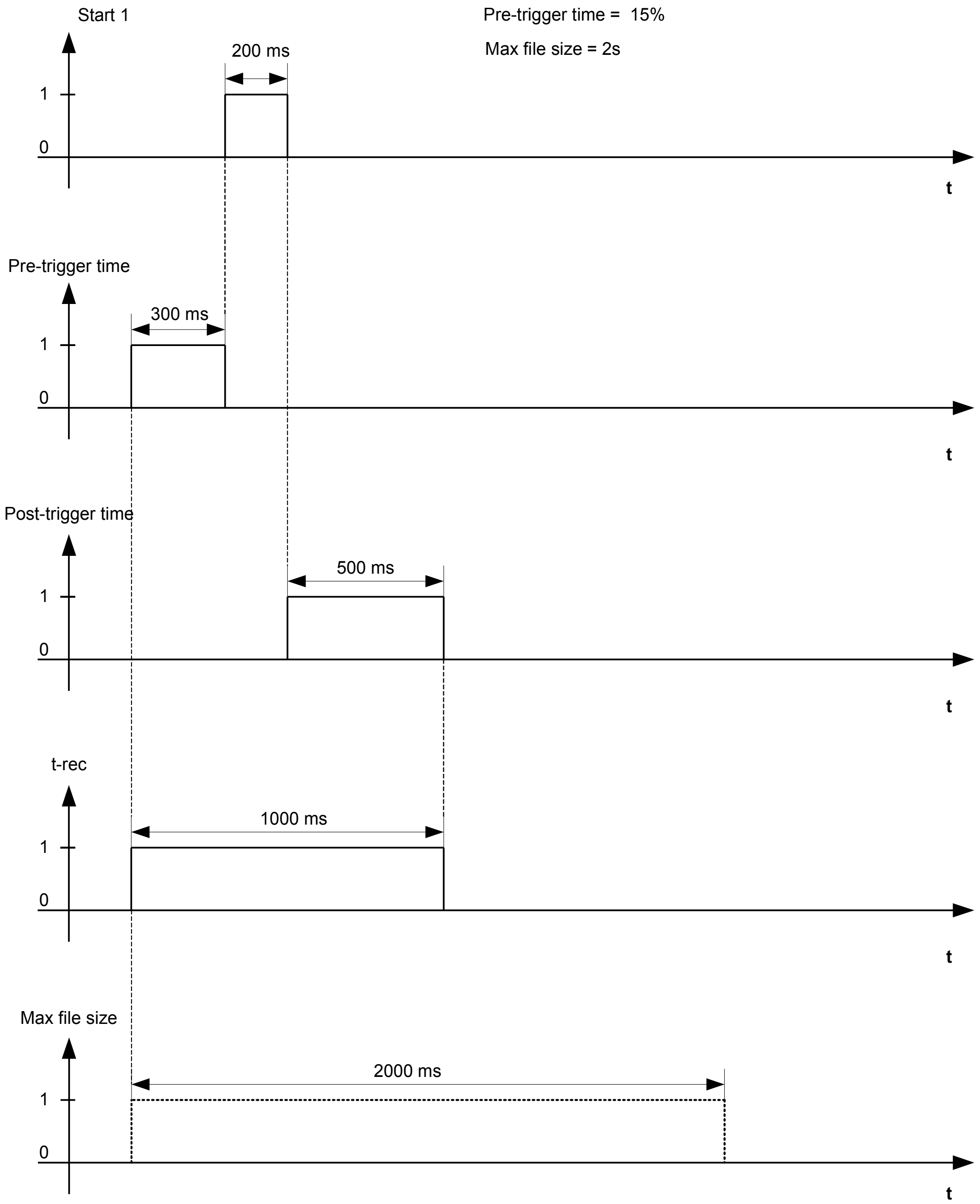
The disturbance recorder is started by the general activation facility. After the fault has been cancelled (+ follow-up time), the recording process is stopped (but after 10s at the latest).

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

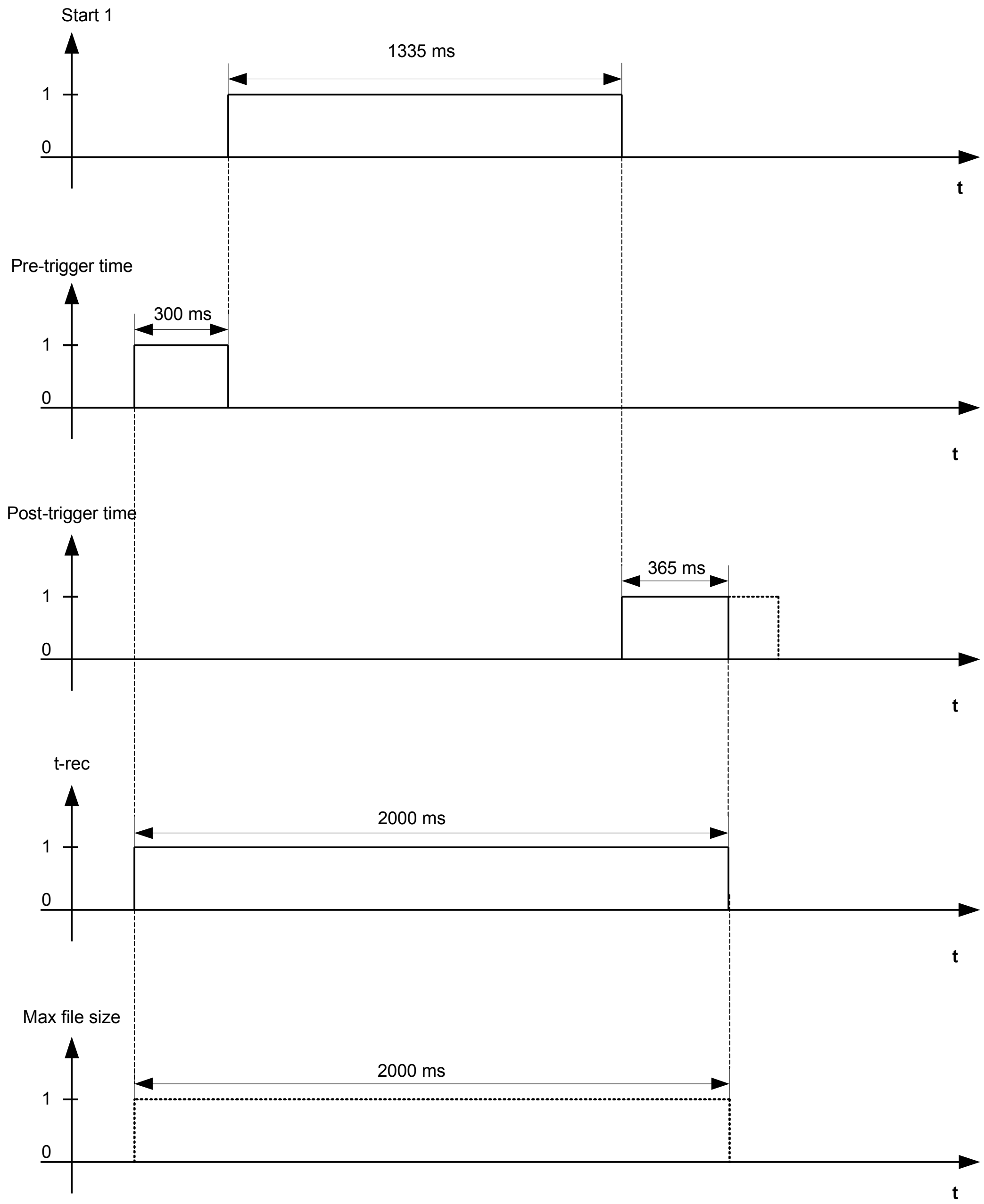
t-rec < Max file size



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 pop-up 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 analyse 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; and
- 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 /Flags]

Global Protection Parameters of the Disturbance Recorder

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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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]
Start2-I	State of the module input:: Trigger event / start recording if:	[Device Para /Recorders /Disturb rec]

Name	Description	Assignment via
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
Write err	Signal: Writing error in memory
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 /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 /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.

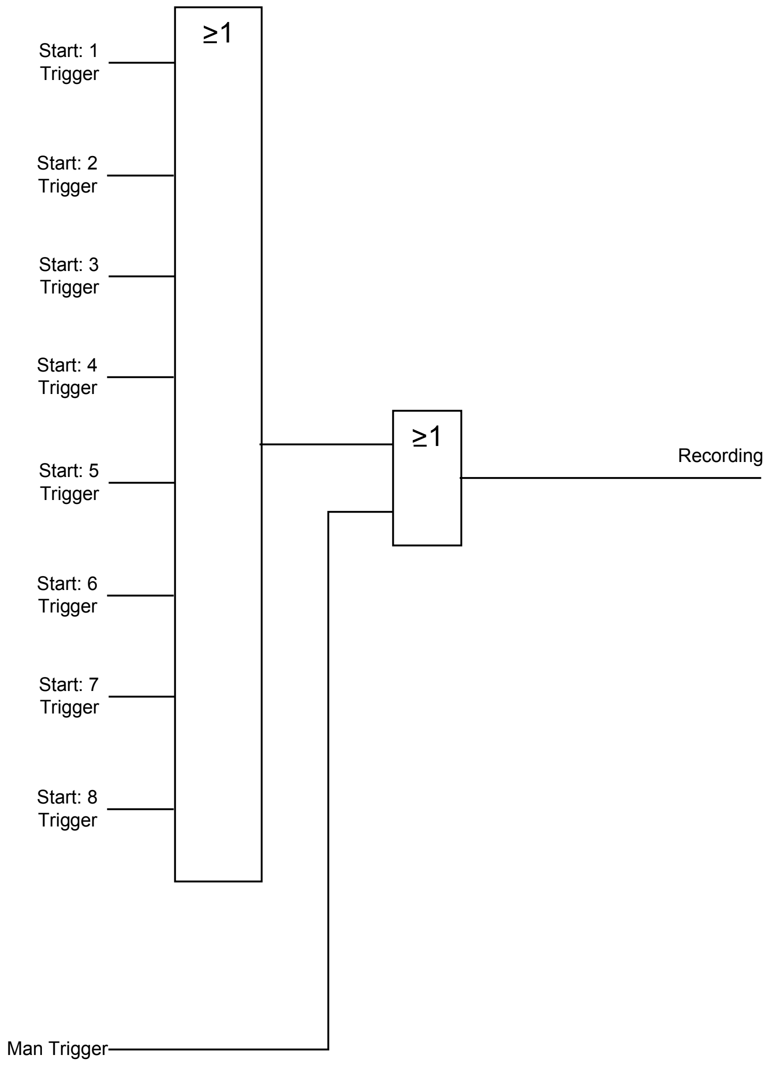
Name	Description
-.-	No assignment
Prot.Alarm L1	Signal: General-Alarm L1
Prot.Alarm L2	Signal: General-Alarm L2
Prot.Alarm L3	Signal: General-Alarm L3
Prot.Alarm G	Signal: General-Alarm - Earth fault
Prot.Alarm	Signal: General Alarm
Prot.Trip L1	Signal: General Trip L1
Prot.Trip L2	Signal: General Trip L2
Prot.Trip L3	Signal: General Trip L3
Prot.Trip	Signal: General Trip
CB.TripCmd	Signal: Trip Command
MStart.Alarm	Signal: Alarm
MStart.Trip	Signal: Trip
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

Name	*Description*
I[1].TripCmd	Signal: 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[3].Alarm L1	Signal: Alarm L1
I[3].Alarm L2	Signal: Alarm L2
I[3].Alarm L3	Signal: Alarm L3
I[3].Alarm	Signal: Alarm
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[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[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[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
IG[1].Alarm	Signal: Alarm IG
IG[1].Trip	Signal: Trip
IG[1].TripCmd	Signal: Trip Command
IG[2].Alarm	Signal: Alarm IG
IG[2].Trip	Signal: Trip
IG[2].TripCmd	Signal: Trip Command
IG[3].Alarm	Signal: Alarm IG
IG[3].Trip	Signal: Trip
IG[3].TripCmd	Signal: Trip Command
IG[4].Alarm	Signal: Alarm IG
IG[4].Trip	Signal: Trip
IG[4].TripCmd	Signal: Trip Command
I2>[1].Alarm	Signal: Alarm Negative Sequence
I2>[1].Trip	Signal: Trip
I2>[1].TripCmd	Signal: Trip Command
I2>[2].Alarm	Signal: Alarm Negative Sequence
I2>[2].Trip	Signal: Trip
I2>[2].TripCmd	Signal: Trip Command
ThR.Alarm	Signal: Alarm
ThR.Trip	Signal: Trip
ThR.TripCmd	Signal: Trip Command
Jam[1].Alarm	Signal: Alarm
Jam[1].Trip	Signal: Trip
Jam[1].TripCmd	Signal: Trip Command
Jam[2].Alarm	Signal: Alarm
Jam[2].Trip	Signal: Trip
Jam[2].TripCmd	Signal: Trip Command
I<[1].Alarm	Signal: Alarm
I<[1].Trip	Signal: Trip
I<[1].TripCmd	Signal: Trip Command
I<[2].Alarm	Signal: Alarm
I<[2].Trip	Signal: Trip

Name	*Description*
I<[2].TripCmd	Signal: Trip Command

Name	*Description*
I<[3].Alarm	Signal: Alarm
I<[3].Trip	Signal: Trip
I<[3].TripCmd	Signal: Trip Command
MLS.Alarm	Signal: Alarm
MLS.Trip	Signal: Trip
RTD.Alarm	Alarm RTD Temperature Protection
RTD.Trip	Signal: Trip
RTD.TripCmd	Signal: Trip Command
ExP[1].Trip	Signal: Trip
ExP[1].TripCmd	Signal: Trip Command
ExP[2].Trip	Signal: Trip
ExP[2].TripCmd	Signal: Trip Command
ExP[3].Trip	Signal: Trip
ExP[3].TripCmd	Signal: Trip Command
ExP[4].Trip	Signal: Trip
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
OR-3AI X2.BO 1	Signal: Binary Output Relay
OR-3AI X2.BO 2	Signal: Binary Output Relay
OR-3AI X2.BO 3	Signal: Binary Output Relay
OR-3AI 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
OR-3AI 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.



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 sub-menu Operation/Recorders/Fault rec.;
- Select a fault record; and
- analyze the corresponding measured values.

Read Out the Fault Recorder via Smart View

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

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

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

- **Call up the data as described above.**
- **Call up the menu [File/Print].**
- **Choose »Print Actual Working Window« within the pop-up**
- **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 /Flags]
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, Trip Cmds	Prot.Alarm	[Device Para /Recorders /Fault rec]
Start: 2	Start recording if the assigned signal is true.	1..n, Trip Cmds	-.-	[Device Para /Recorders /Fault rec]
Start: 3	Start recording if the assigned signal is true.	1..n, Trip Cmds	-.-	[Device Para /Recorders /Fault rec]
Start: 4	Start recording if the assigned signal is true.	1..n, Trip Cmds	-.-	[Device Para /Recorders /Fault rec]
Start: 5	Start recording if the assigned signal is true.	1..n, Trip Cmds	-.-	[Device Para /Recorders /Fault rec]
Start: 6	Start recording if the assigned signal is true.	1..n, Trip Cmds	-.-	[Device Para /Recorders /Fault rec]
Start: 7	Start recording if the assigned signal is true.	1..n, Trip Cmds	-.-	[Device Para /Recorders /Fault rec]
Start: 8	Start recording if the assigned signal is true.	1..n, Trip Cmds	-.-	[Device Para /Recorders /Fault rec]
Auto overwriting	If there is no more free memory capacity left, the oldest file will be overwritten.	inactive, active	active	[Device Para /Recorders /Fault rec]

Fault Recorder Input States

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

Name	*Description*	*Assignment via*
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

Fault Recorder Trigger Functions

These events (Pickups, Trips, Digital Inputs, Output Relay states) will start the fault recorder.

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 sub-menu *»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 pop-up**
- **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 /Flags]

Event Recorder Signals

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

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.

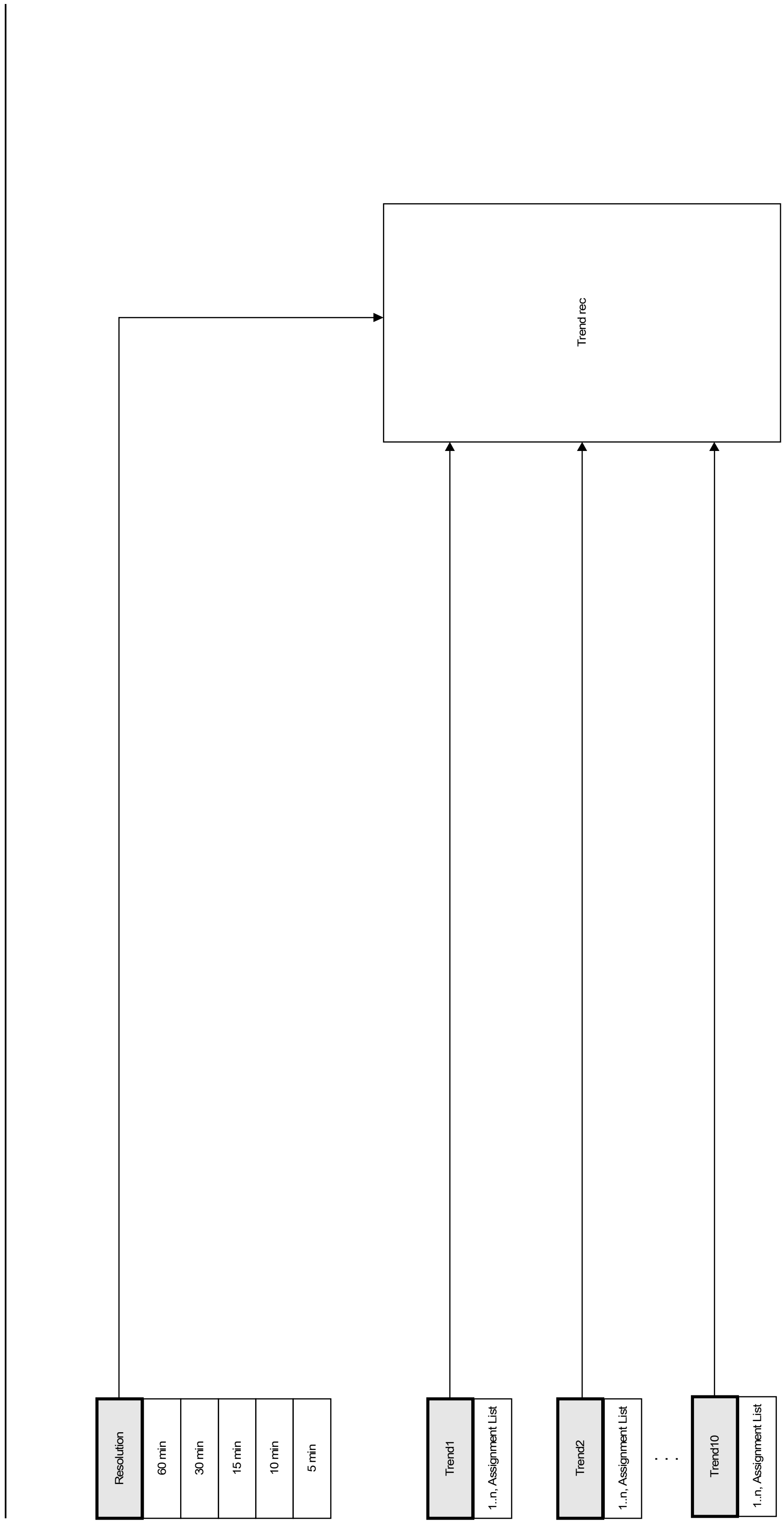
Configuring the Trend Recorder

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


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

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]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Trend1	Observed Value1	-, IL1 RMS, IL1 max RMS, IL1 avg RMS, IL1 min RMS, IL2 RMS, IL2 max RMS, IL2 avg RMS, IL2 min RMS, IL3 RMS, IL3 max RMS, IL3 avg RMS, IL3 min RMS, I0 , I1 , I2 , %(I2/I1), %(I2/I1) max, IL1 Ib, I2T Used, Hot test Winding Temp, Hottest MotBearTemp, Hottest LoadBearTemp, Windg1, Windg1 max, Windg2, Windg2 max, Windg3, Windg3 max, Windg4, Windg4 max, Windg5, Windg5 max, Windg6, Windg6 max, MotBear1, MotBear1 max, MotBear2, MotBear2 max, LoadBear1, LoadBear1 max, LoadBear2, LoadBear2 max, Aux, Aux max, RTD Max	IL1 RMS	[Device Para /Recorders /Trend rec]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Trend2	Observed Value2	-, IL1 RMS, IL1 max RMS, IL1 avg RMS, IL1 min RMS, IL2 RMS, IL2 max RMS, IL2 avg RMS, IL2 min RMS, IL3 RMS, IL3 max RMS, IL3 avg RMS, IL3 min RMS, I0 , I1 , I2 , %(I2/I1), %(I2/I1) max, IL1 Ib, I2T Used, Hottest Winding Temp, Hottest MotBearTemp, Hottest LoadBearTemp, Windg1, Windg1 max, Windg2, Windg2 max, Windg3, Windg3 max, Windg4, Windg4 max, Windg5, Windg5 max, Windg6, Windg6 max, MotBear1, MotBear1 max, MotBear2, MotBear2 max, LoadBear1, LoadBear1 max, LoadBear2, LoadBear2 max, Aux, Aux max, RTD Max	IL2 RMS	[Device Para /Recorders /Trend rec]

Parameter	Description	Setting range	Default	Menu path
Trend3	Observed Value3	-, IL1 RMS, IL1 max RMS, IL1 avg RMS, IL1 min RMS, IL2 RMS, IL2 max RMS, IL2 avg RMS, IL2 min RMS, IL3 RMS, IL3 max RMS, IL3 avg RMS, IL3 min RMS, I0 , I1 , I2 , %(I2/I1), %(I2/I1) max, IL1 Ib, I2T Used, Hottest Winding Temp, Hottest MotBearTemp, Hottest LoadBearTemp, Windg1, Windg1 max, Windg2, Windg2 max, Windg3, Windg3 max, Windg4, Windg4 max, Windg5, Windg5 max, Windg6, Windg6 max, MotBear1, MotBear1 max, MotBear2, MotBear2 max, LoadBear1, LoadBear1 max, LoadBear2, LoadBear2 max, Aux, Aux max, RTD Max	IL3 RMS	[Device Para /Recorders /Trend rec]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Trend4	Observed Value4	-, IL1 RMS, IL1 max RMS, IL1 avg RMS, IL1 min RMS, IL2 RMS, IL2 max RMS, IL2 avg RMS, IL2 min RMS, IL3 RMS, IL3 max RMS, IL3 avg RMS, IL3 min RMS, I0 , I1 , I2 , %(I2/I1), %(I2/I1) max, IL1 Ib, I2T Used, Hottest Winding Temp, Hottest MotBearTemp, Hottest LoadBearTemp, Windg1, Windg1 max, Windg2, Windg2 max, Windg3, Windg3 max, Windg4, Windg4 max, Windg5, Windg5 max, Windg6, Windg6 max, MotBear1, MotBear1 max, MotBear2, MotBear2 max, LoadBear1, LoadBear1 max, LoadBear2, LoadBear2 max, Aux, Aux max, RTD Max	%(I2/I1)	[Device Para /Recorders /Trend rec]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Trend5	Observed Value5	-, IL1 RMS, IL1 max RMS, IL1 avg RMS, IL1 min RMS, IL2 RMS, IL2 max RMS, IL2 avg RMS, IL2 min RMS, IL3 RMS, IL3 max RMS, IL3 avg RMS, IL3 min RMS, I0 , I1 , I2 , %(I2/I1), %(I2/I1) max, IL1 Ib, I2T Used, Hottest Winding Temp, Hottest MotBearTemp, Hottest LoadBearTemp, Windg1, Windg1 max, Windg2, Windg2 max, Windg3, Windg3 max, Windg4, Windg4 max, Windg5, Windg5 max, Windg6, Windg6 max, MotBear1, MotBear1 max, MotBear2, MotBear2 max, LoadBear1, LoadBear1 max, LoadBear2, LoadBear2 max, Aux, Aux max, RTD Max	-	[Device Para /Recorders /Trend rec]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Trend6	Observed Value6	-, IL1 RMS, IL1 max RMS, IL1 avg RMS, IL1 min RMS, IL2 RMS, IL2 max RMS, IL2 avg RMS, IL2 min RMS, IL3 RMS, IL3 max RMS, IL3 avg RMS, IL3 min RMS, I0 , I1 , I2 , %(I2/I1), %(I2/I1) max, IL1 Ib, I2T Used, HottestWindingTemp, Hottest MotBearTemp, Hottest LoadBearTemp, Windg1, Windg1 max, Windg2, Windg2 max, Windg3, Windg3 max, Windg4, Windg4 max, Windg5, Windg5 max, Windg6, Windg6 max, MotBear1, MotBear1 max, MotBear2, MotBear2 max, LoadBear1, LoadBear1 max, LoadBear2, LoadBear2 max, Aux, Aux max, RTD Max	-	[Device Para /Recorders /Trend rec]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Trend7	Observed Value7	-, IL1 RMS, IL1 max RMS, IL1 avg RMS, IL1 min RMS, IL2 RMS, IL2 max RMS, IL2 avg RMS, IL2 min RMS, IL3 RMS, IL3 max RMS, IL3 avg RMS, IL3 min RMS, I0 , I1 , I2 , %(I2/I1), %(I2/I1) max, IL1 Ib, I2T Used, HottestWindingTemp, Hottest MotBearTemp, Hottest LoadBearTemp, Windg1, Windg1 max, Windg2, Windg2 max, Windg3, Windg3 max, Windg4, Windg4 max, Windg5, Windg5 max, Windg6, Windg6 max, MotBear1, MotBear1 max, MotBear2, MotBear2 max, LoadBear1, LoadBear1 max, LoadBear2, LoadBear2 max, Aux, Aux max, RTD Max	-	[Device Para /Recorders /Trend rec]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Trend8	Observed Value8	-, IL1 RMS, IL1 max RMS, IL1 avg RMS, IL1 min RMS, IL2 RMS, IL2 max RMS, IL2 avg RMS, IL2 min RMS, IL3 RMS, IL3 max RMS, IL3 avg RMS, IL3 min RMS, I0 , I1 , I2 , %(I2/I1), %(I2/I1) max, IL1 Ib, I2T Used, HottestWindingTemp, Hottest MotBearTemp, Hottest LoadBearTemp, Windg1, Windg1 max, Windg2, Windg2 max, Windg3, Windg3 max, Windg4, Windg4 max, Windg5, Windg5 max, Windg6, Windg6 max, MotBear1, MotBear1 max, MotBear2, MotBear2 max, LoadBear1, LoadBear1 max, LoadBear2, LoadBear2 max, Aux, Aux max, RTD Max	-	[Device Para /Recorders /Trend rec]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Trend9	Observed Value9	-, IL1 RMS, IL1 max RMS, IL1 avg RMS, IL1 min RMS, IL2 RMS, IL2 max RMS, IL2 avg RMS, IL2 min RMS, IL3 RMS, IL3 max RMS, IL3 avg RMS, IL3 min RMS, I0 , I1 , I2 , %(I2/I1), %(I2/I1) max, IL1 Ib, I2T Used, HottestWindingTemp, Hottest MotBearTemp, Hottest LoadBearTemp, Windg1, Windg1 max, Windg2, Windg2 max, Windg3, Windg3 max, Windg4, Windg4 max, Windg5, Windg5 max, Windg6, Windg6 max, MotBear1, MotBear1 max, MotBear2, MotBear2 max, LoadBear1, LoadBear1 max, LoadBear2, LoadBear2 max, Aux, Aux max, RTD Max	-	[Device Para /Recorders /Trend rec]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Trend10	Observed Value10	-, IL1 RMS, IL1 max RMS, IL1 avg RMS, IL1 min RMS, IL2 RMS, IL2 max RMS, IL2 avg RMS, IL2 min RMS, IL3 RMS, IL3 max RMS, IL3 avg RMS, IL3 min RMS, I0 , I1 , I2 , %(I2/I1), %(I2/I1) max, IL1 Ib, I2T Used, HottestWindingTemp, Hottest MotBearTemp, Hottest LoadBearTemp, Windg1, Windg1 max, Windg2, Windg2 max, Windg3, Windg3 max, Windg4, Windg4 max, Windg5, Windg5 max, Windg6, Windg6 max, MotBear1, MotBear1 max, MotBear2, MotBear2 max, LoadBear1, LoadBear1 max, LoadBear2, LoadBear2 max, Aux, Aux max, RTD Max	-	[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 /Flags]

Motor Start Recorder

Available Elements:
Start rec

The Motor Start Recorder is accessed using *Smart View* or via the front panel interface of the relay. This feature provides information (the available list depends on the ordered device) recorded at the time of each start of the motor such as:

- Date of the motor start event;
- 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
- If start is successful starts.

Similarly, data at the time of start can be viewed in the *Data Visualizer* software. Here, the User can view the RMS value of the phase currents, thermal capacity used, and temperatures measured by the URTD module if a URTD is installed and attached to the relay.

Downloading Start Records

The start recorder data is downloaded from the device when the User has selected the »Start Rec« feature. To navigate to this feature, the User must go to the [Operations/Recorders] menu. Here the User will find the »Start Rec« menu item. To access data that has been stored in the device using *Smart View*, the User must select the »Receive Start Recorder« button in the upper left hand corner of the »Start Rec« window. When selected, the *Smart View* software will retrieve the stored records from the device.

A summary of the *Start Recorder* data can be retrieved by selecting the »Receive Summary Data« button in the upper left hand corner of the *Start Rec* window. A list of all currently available Start Records is viewable by selecting the »Refresh Start Recorder« button on the start recorder.

Deleting Start Records

It is possible to delete individual records. First, select »Receive Start Recorder«, and then select the recorder to be deleted by clicking on the record number, or record date followed by the selection of the »*Delete Start Record«* button in the upper left hand corner of the »*Start Rec«* window.

To permanently remove all start records within a device's start recorder, select the »*Delete All Start Records*« button also located in the upper left hand corner of the »*Start Rec*« window. This will remove all previously stored start records within the device to which the User is presently connected.

When using *Smart View* to view the *Start Recorder* data, the Start Recorder features can also be found by right clicking anywhere within the »*Start Rec*« window.

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 /Flags]
ClearStatisticRec	Delete all statistic recorder records (start trending)	inactive, active	inactive	[Operation /Reset /Flags]

Motor Start Recorder Counter Values

Value	*Description*	*Default*	*Size*	*Menu path*
NumberOfRecordsCr	Number of saved records	0	0 - 65535	[Operation /Count and RevData /Start rec]
Current entry	Current entry	0	0 - 65535	[Operation /Count and RevData /Start rec]

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.

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; and
- 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; and
- 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; and
- 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«; and*
- Response time (defining the period within which an inquiry 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:

- Bau Rrate Error and
- 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; and
- 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; and
  - Set the port-number.
- Set the maximum accepted time of “no communication”. If this time has expired – without any communication, the device concludes a failure within the master system.
- Allow or disallow the blocking of SCADA commands.

Part 3: Hardware Connection

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

Direct Commands of the Modbus®

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

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.	01.01.55	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]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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	active	[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
Scada Cmd 8	Scada Command
Scada Cmd 9	Scada Command
Scada Cmd 10	Scada Command
Scada Cmd 11	Scada Command
Scada Cmd 12	Scada Command
Scada Cmd 13	Scada Command
Scada Cmd 14	Scada Command
Scada Cmd 15	Scada Command
Scada Cmd 16	Scada Command

Modbus® Values

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

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

- Baud Rate 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 a status LED.

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

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]
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]

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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Latched 17	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 17-32]
Assignment 18	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 17-32]
Latched 18	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 17-32]
Assignment 19	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 17-32]
Latched 19	Defines whether the Input is latched. Only available if: Latched = active	inactive, active	inactive	[Device Para /Profibus /Assignment 17-32]
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]
Assignment 28	Assignment	1..n, Assignment List	-.-	[Device Para /Profibus /Assignment 17-32]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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]
Slave ID	Device address (Slave ID) within the bus system. Each device address has to be unique within a bus system.	2 - 125	2	[Device Para /Profibus /Bus parameters]

Inputs of the Profibus

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

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

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

Profibus Signals (Output States)

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
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

Name	Description
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
Master ID	Device address (Master ID) within the bus system. Each device address has to be unique within a bus system.	1	1 - 125	[Operation /Status display /Profibus /State]
HO Id PSub	Handoff Id of PbSub	0	0 - 9999999999	[Operation /Status display /Profibus /State]
t-WatchDog	The Profibus Chip detects a communication issue if this timer is expired without any communication (Parametrizing telegram).	0	0 - 9999999999	[Operation /Status display /Profibus /State]
Slave State	Communication State between Slave and Master.	Baud Search	Baud Search, Baud Found, PRM OK, PRM REQ, PRM Fault, CFG Fault, Clear Data, Data exchange	[Operation /Status display /Profibus /State]

Value	*Description*	*Default*	*Size*	*Menu path*
Baud rate	The baud rate that has been detected lastly, will still be shown after a connection issue.	-.-	12 Mb/s, 6 Mb/s, 3 Mb/s, 1.5 Mb/s, 0.5 Mb/s, 187500 baud, 93750 baud, 45450 baud, 19200 baud, 9600 baud, -.-	[Operation /Status display /Profibus /State]
PNO Id	PNO Identification Number. GSD Identification Number.	0C50h	0C50h	[Operation /Status display /Profibus /State]

IEC60870-5-103

IEC 103

IEC60870-5-103 Protocol Configuration

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

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

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

The time-controlled IEC60870-5-103 protocol is based on the Master-Slave working principle. This means that the substation control and protection system sends an enquiry or instruction to a certain device (slave address) which will then be answered or carried out accordingly.

The device meets the compatibility mode 2. Compatibility mode 3 is not supported.

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

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

- 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; and
- 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.	01.01.47	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
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]

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

IRIG-B00X

IRIG-B

NOTICE

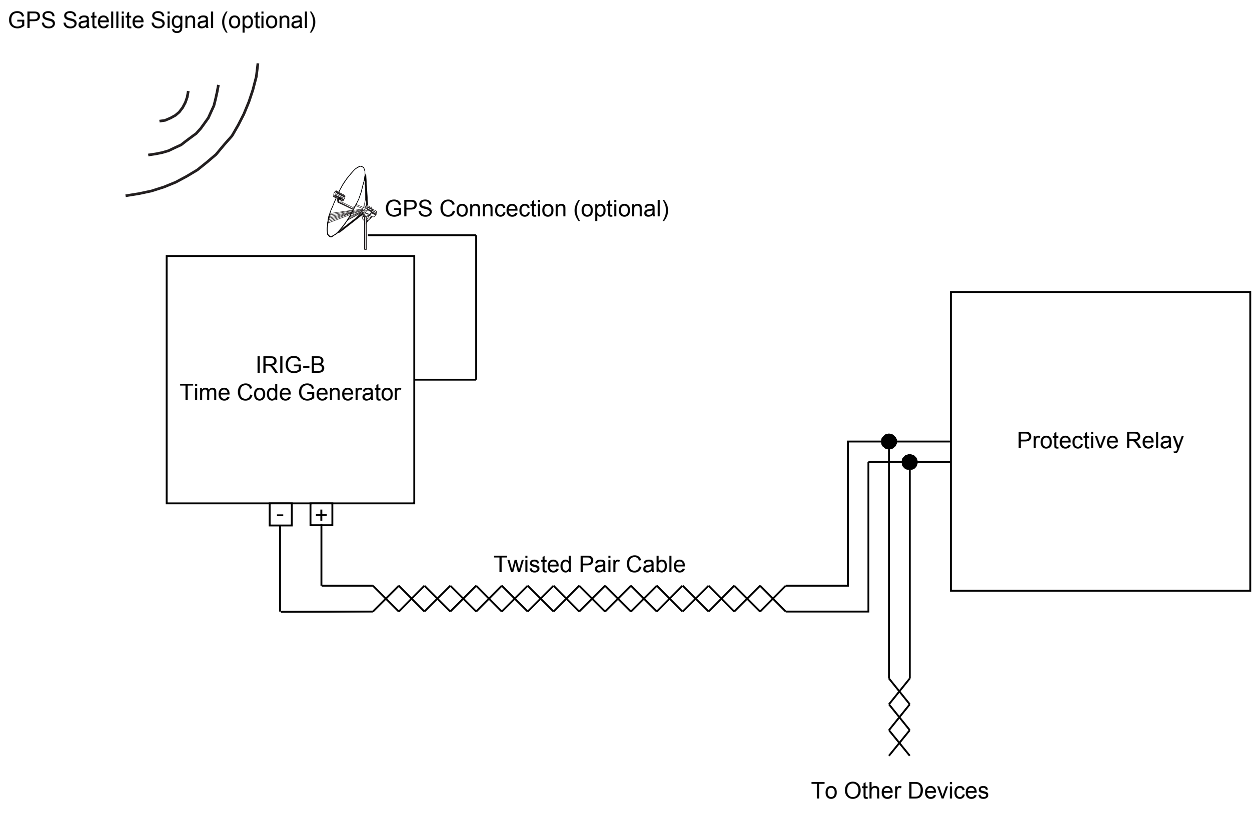
Requirement: A IRIG-B00X time code receiver is needed. IRIG-B004 and higher will support/transmit the "year" information.

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.

Please note, that the signal IRIG-B.active only becomes true, if the Function is set to active and the device receives valid IRIG-B data.

Principle - General Use

This standard is the most used standard to synchronize the time of protection devices in medium voltage applications.



Based on the IRIG STANDARD 200-04, the device interface and software provides all time synchronization formats IRIG-B00X (IRIG-B000 / B001 / B002 / B003 / B004 / B005 / B006 / B007) as described in the standard. IRIG-B004 and higher will support/transmit the “year” information.

Time code B has a time frame of 1 second with an index count of 10 milliseconds and contains time-of-year and year information in a binary code decimal (BCD) format, and seconds-of-day in straight binary seconds (SBS) format.

Time accuracy of ±1ms is a requirement to synchronize the different protection devices. This can be achieved by means of IRIG-B.

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

Function

The following IRIG-B parameters can be set within the Device Parameters menu.

- Set the IRIG-B type (choose B000 through B007).
- Set the time synchronization via IRIG-B to Active or Inactive.
- Set the time zone parameter (choose one of the 36 UTC Time Zones).
- Activate or deactivate the “Daylight Savings Time” function.

NOTICE **Parameter for Daylight Savings Time (summer-winter time) has to be set manually.**

Check the wiring (wiring error) if no IRIG signal can be detected.

A signal will be issued if no IRIG-B time code is received for longer than 60 s.

IRIG-B Control Commands

In addition to the date and time information, the IRIB-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 Time Code Generator.

The protective devices offer up to 18 IRIG-B assignment options for those control commands in order to carry out the assigned action. That means if the IRIG-B time code is fed with the corresponding state of those control commands, than they can be used for further processing within the devices (e.g.: in order to start statistics, switch on or off street lighting).

Device Planning Parameters of the IRIG-B00X

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, use	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 /Counter]

Global Protection Parameters of the IRIG-B00X

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Device Para /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).	IRIB-000, IRIB-001, IRIB-002, IRIB-003, IRIB-004, IRIB-005, IRIB-006, IRIB-007	IRIB-000	[Device Para /IRIG-B]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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-11 Midway Islands	UTC+0 London	[Device Para /IRIG-B]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Summer Time	Summer Time	inactive, active	inactive	[Device Para /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 /IRIG-B]
NoOfFrameErrors	Total Number of Frame Errors. Physically corrupted Frame.	0	0 - 65535	[Operation /Count and RevData /IRIG-B]
Edges	Edges	0	0 - 65535	[Operation /Count and RevData /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; and
- 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

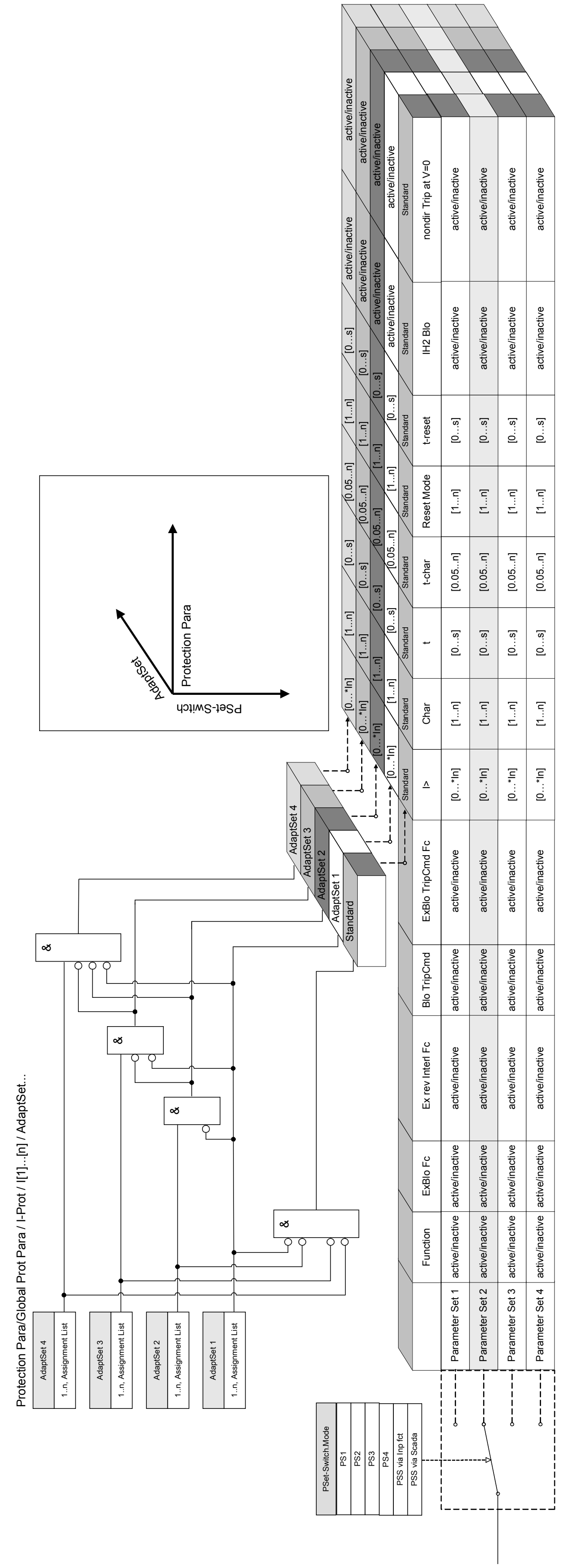
Signals are part of the Device Parameter Tree. The state of the signal is context-dependent.

- ***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.

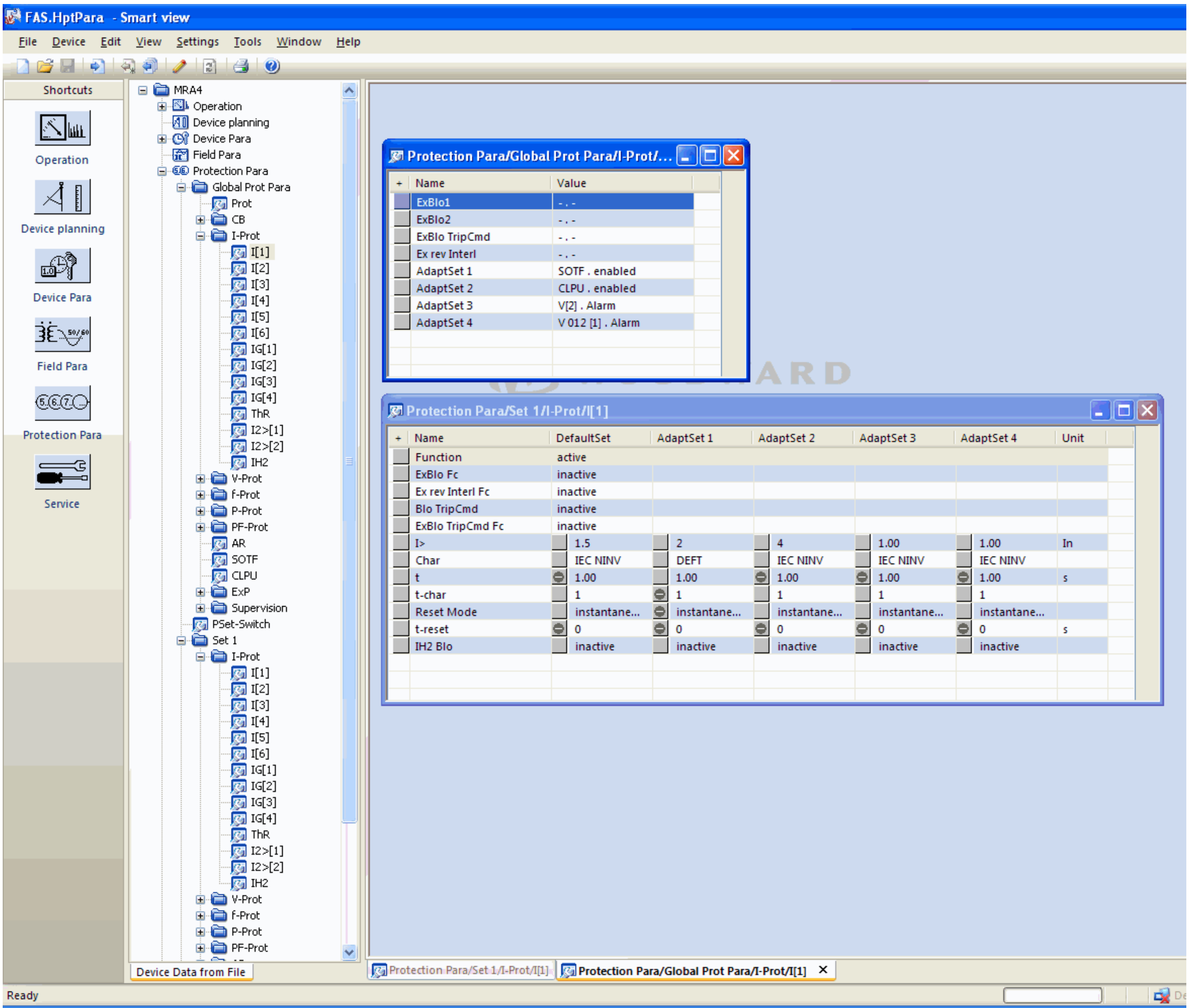
For some protection elements such as time overcurrent and instantaneous overcurrent (50P, 51P, 50G, 51G…), besides the “default” setting there exist another 4 “alternative” settings for pickup value, curve type, time dial, reset mode set values which can dynamically be switched-over by means of the configurable 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 <u>*SOTF*</u> condition, it should trip instantaneously. If the <u>*SOTF*</u> 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 screen shot 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: <u>*SOTF*</u> application (Switch-Onto-Fault);
3. Adaptive Set 2: <u>*CLPU*</u> application (Cold Load Pickup);
4. Adaptive Set 3: Voltage-Controlled time overcurrent protection (ANSI 51V); and
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
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 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

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
- parametrize 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.

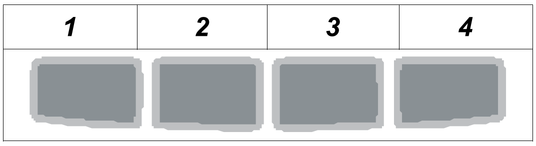
NOTICE **As long as you are within the parameter setting mode a wrench icon will be shown in the upper right corner of the display.**

6. For saving the altered parameter:
   - press the »OK« key and
   - 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; and
- Softkey 4.

Password Changes

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

NOTICE

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

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

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

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

Password Forgotten

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

Changing of Parameters - Example

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

- Edit/change the parameter.

Now you can:

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

To save parameter changes immediately,

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

To change additional parameters and save afterwards,

- move to other parameters and change them.

NOTICE

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

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

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

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

NOTICE

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

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

In addition to the question mark trace to the temporarily saved implausible parameter changes a general implausibility symbol/question mark is faded-in at the left corner of the display, and so it is possible to see from each point of the menu tree that 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 (pop-up) 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 pop-up 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; or
- Scada switches the setting groups.

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

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

Setting Group Switch via Smart View

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

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

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

Copying Setting Groups (Parameter Sets) via Smart View

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

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

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

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

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

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

Comparing Setting Groups via Smart View

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

- Click on menu item »Edit« and select »Compare Parameter Sets«.
- Select the two parameter sets from the (two) drop down menus you would like to have compared with each other.
- Press the pushbutton »compare«.
- The values that are different from the set parameters will be listed in tabular form.

Comparing Parameter Files via Smart View

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

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

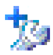
Converting Parameter Files via Smart View

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

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

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

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

Added parameter:	
Deleted parameter:	

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; and
- Gateway.

Direct Commands of the System Module

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Ack BO LED Scd TCmd	Reset the binary output relays, LEDs, SCADA and the Trip Command.	inactive, active	inactive	[Operation /Reset /Flags]
Ack LED	All acknowledgeable LEDs will be acknowledged.	inactive, active	inactive	[Operation /Reset /Flags]
Ack BO	All acknowledgeable binary output relays will be acknowledged.	inactive, active	inactive	[Operation /Reset /Flags]
Ack Scada	SCADA will be acknowledged.	inactive, active	inactive	[Operation /Reset /Flags]
Res OperationsCr	Reset all counters in history group operations	inactive, active	inactive	[Operation /Reset /History]
Res AlarmCr	Reset all counters in history group alarms	inactive, active	inactive	[Operation /Reset /History]
Res TripCr	Reset all counters in history group trips	inactive, active	inactive	[Operation /Reset /History]
Res TotalCr	Reset all counters in history group total	inactive, active	inactive	[Operation /Reset /History]
Res All	Reset of all Counters	inactive, active	inactive	[Operation /Reset /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	PSS via Inp fct	[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.	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, 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 /PSet-Switch]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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.	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, 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 /PSet-Switch]
PS3: activated by	This Setting Group will be the active one if: The Parameter Setting Group Switch is set to "Switch via Input" and the other three input functions are inactive at the same time. In case that there is more than one input function active, no Parameter Setting Group Switch will be executed. In case all input functions are inactive, the device will keep working with the Setting Group that was activated lastly. Only available if: PSet-Switch = PSS via Inp fct.	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, 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 /PSet-Switch]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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.	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, 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 /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	Primary 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]

Name	Description	Assignment via
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

Name	*Description*
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]
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]

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.

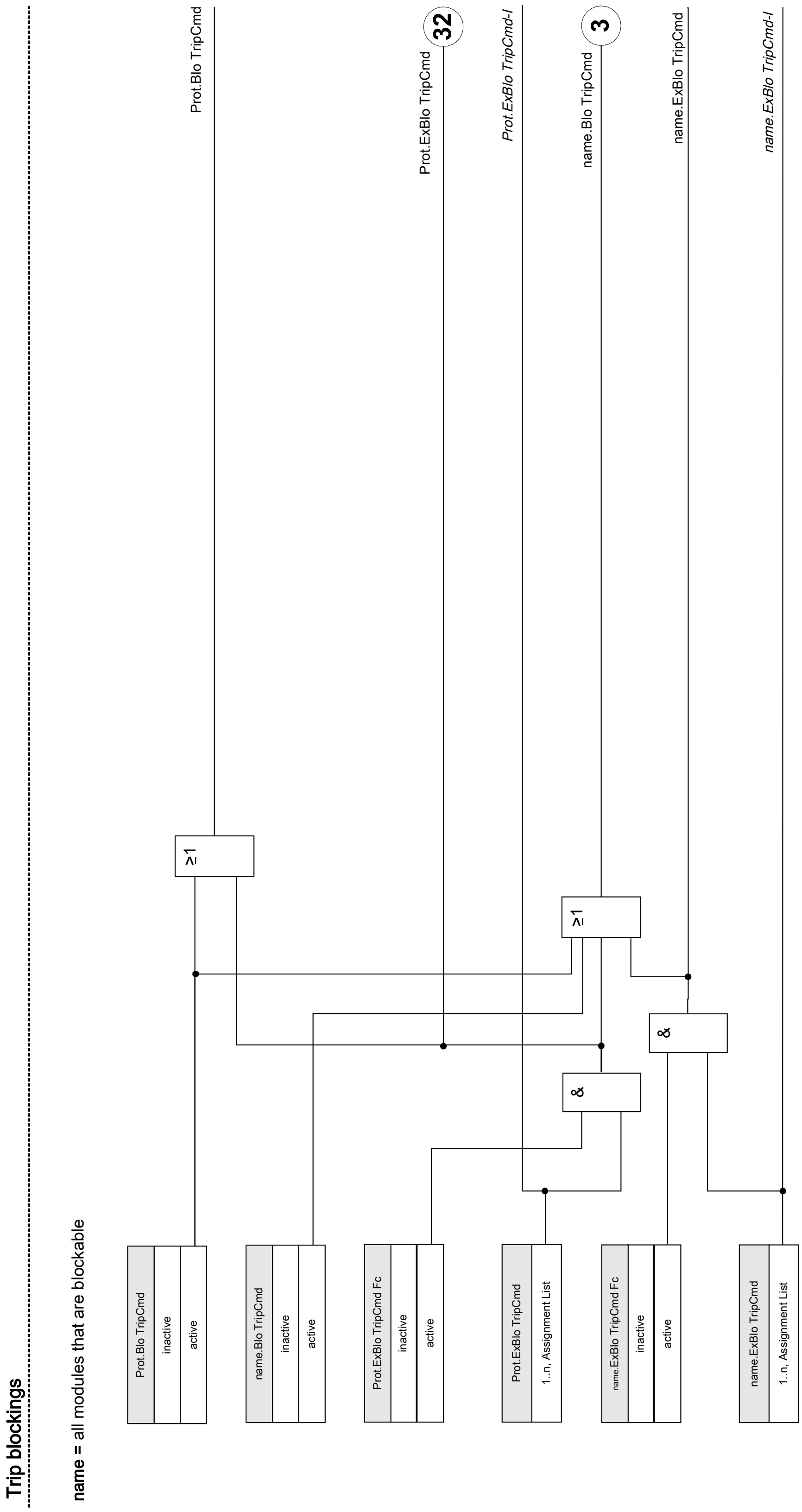
To block the tripping command of a protection stage temporarily by an active assignment.
The tripping command of any of the protection modules can be blocked from external. In this case, external

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«.

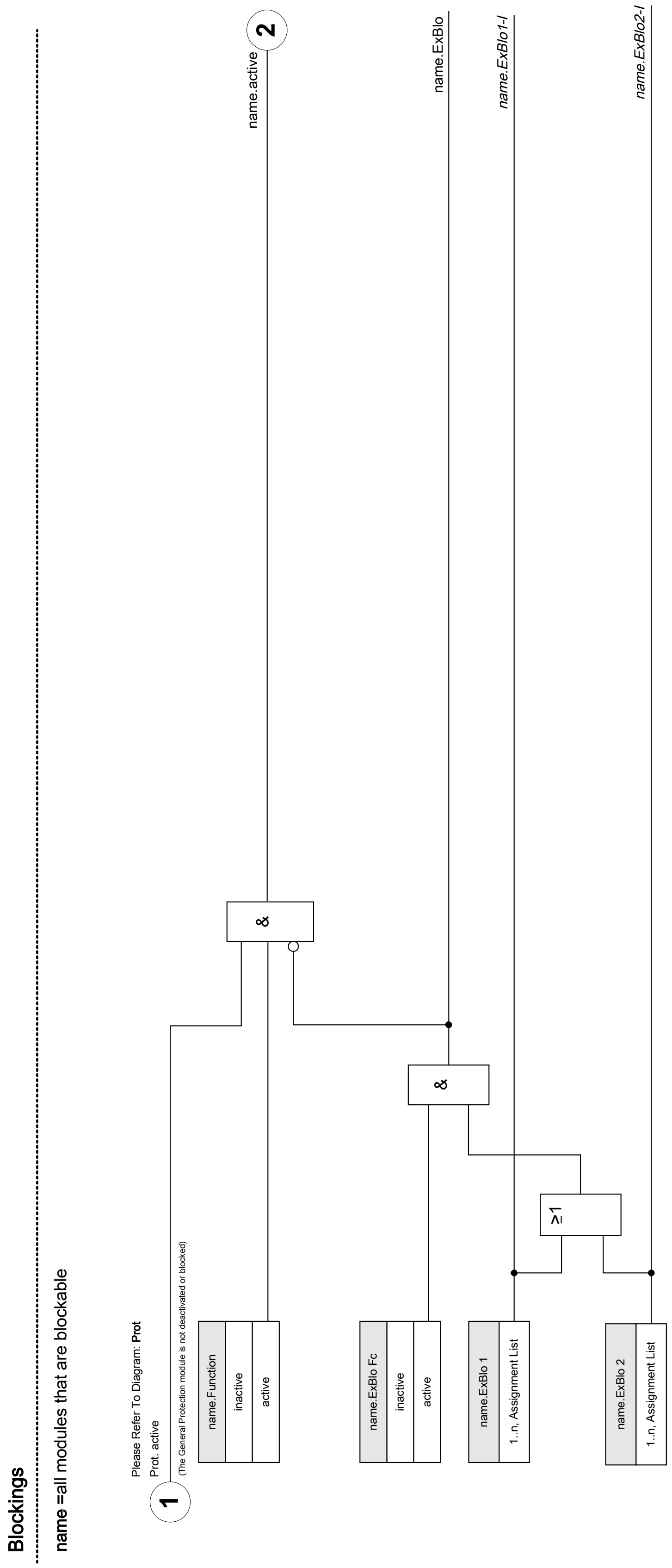
- In order to establish a temporary blockage of a protection stage, the parameter *»ExBlo TripCmd Fc«* of the module has to be set to *»active«*. This gives the permission: »The tripping command of this stage can be blocked«.

- 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

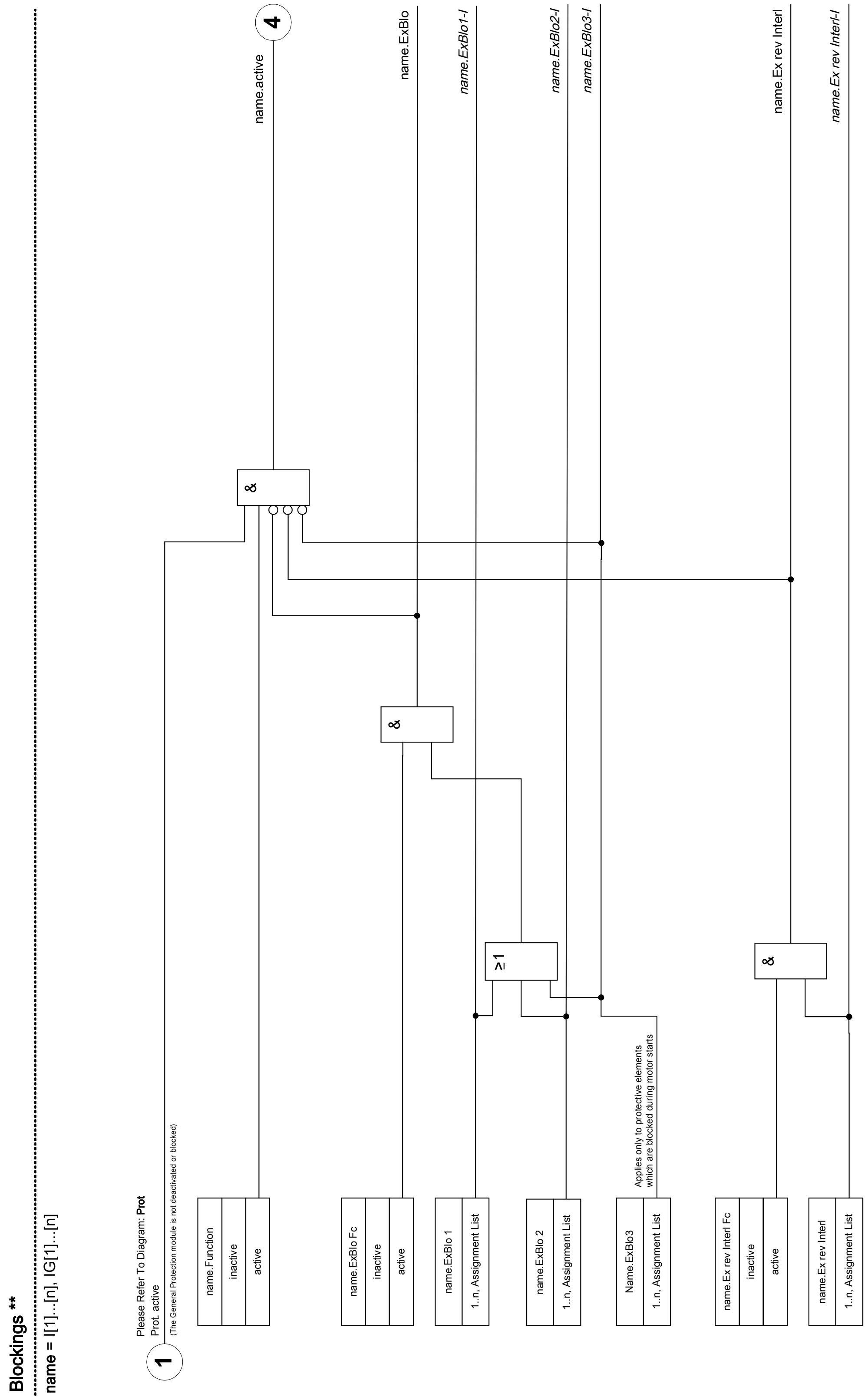


Activate, Deactivate respectively Block Temporarily Protection Functions



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

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



Module: Protection (Prot)

Prot

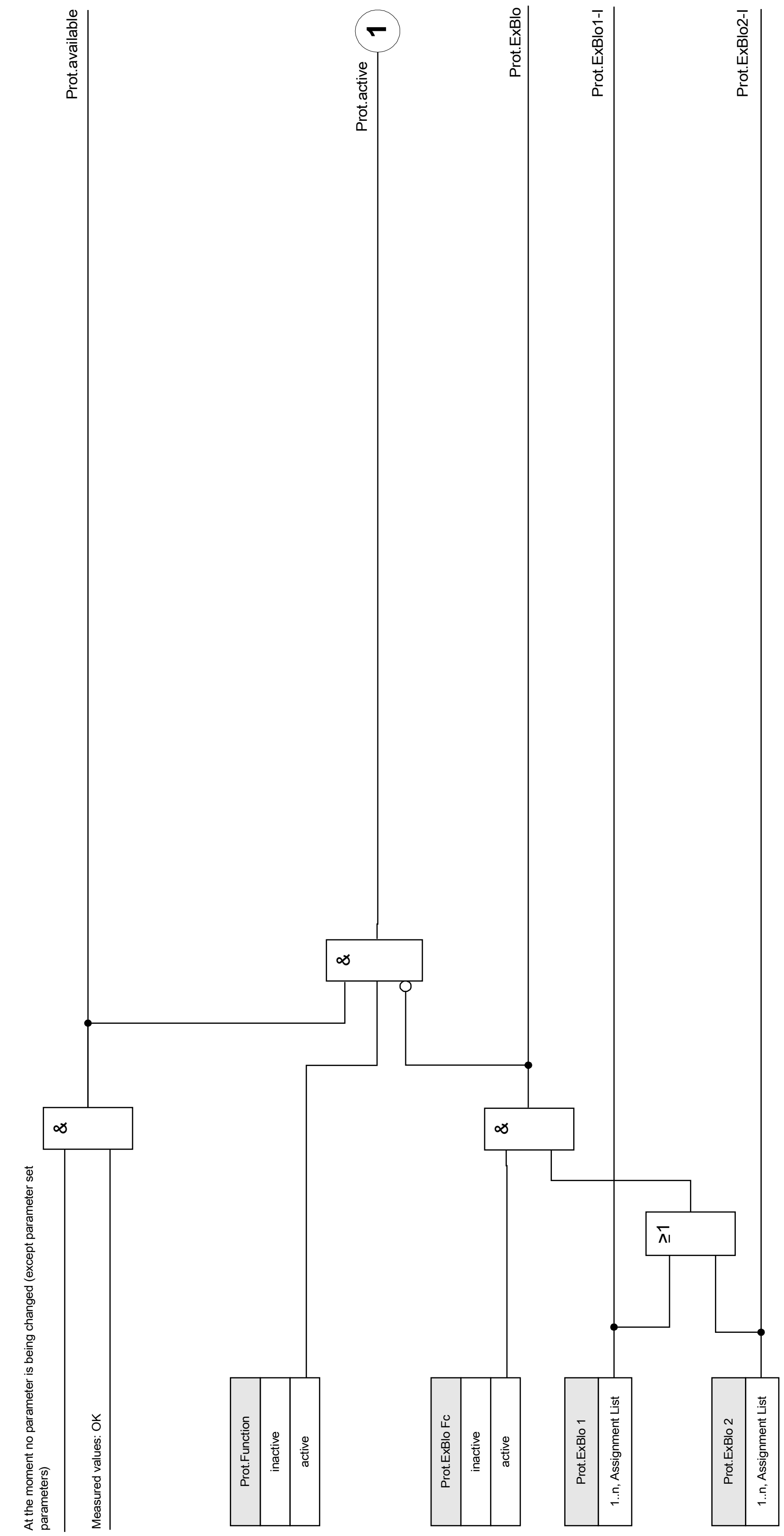
The module *»Protection«* serves as outer frame for all other protection modules, i.e. they are all enclosed by the module *»Protection«*. All alarms and tripping commands are combined in module *»Protection«* by an OR-logic.

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

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.active
1
Prot.Function
inactive
active
Prot.ExBlo Fc
inactive
active
&
Prot.ExBlo
≥1
Prot.ExBlo 1
1..n, Assignment List
Prot.ExBlo1-I
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«.

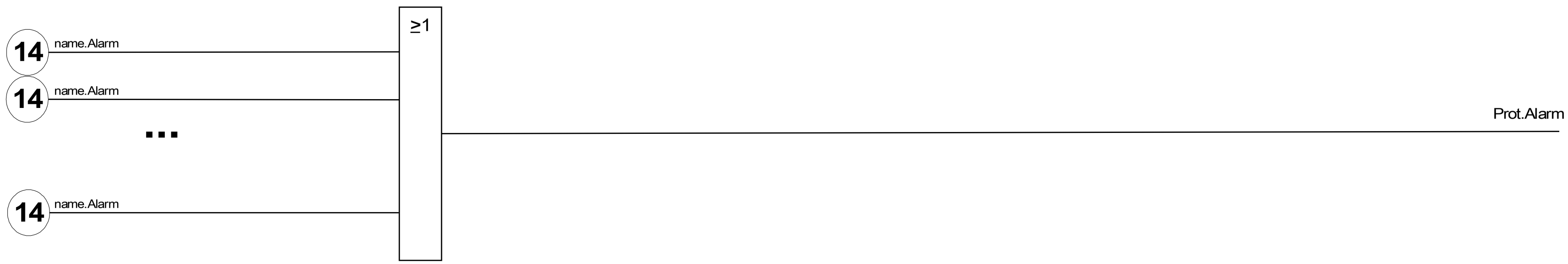
2. The master module *»Prot«* collects/summarizes the signals and issues an alarm or a trip signal »Prot.Alarm« »Prot.Trip«.

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, VG 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, VG 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 /Counter]

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]

Protection Module Signals (Output States)

Name	*Description*
available	Signal: Protection is available
active	Signal: active
ExBlo	Signal: External Blocking
Alarm L1	Signal: General-Alarm L1
Alarm L2	Signal: General-Alarm L2
Alarm L3	Signal: General-Alarm L3
Alarm G	Signal: General-Alarm - Earth fault
Alarm	Signal: General Alarm
Trip L1	Signal: 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*	*Assignment via*
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.	[]

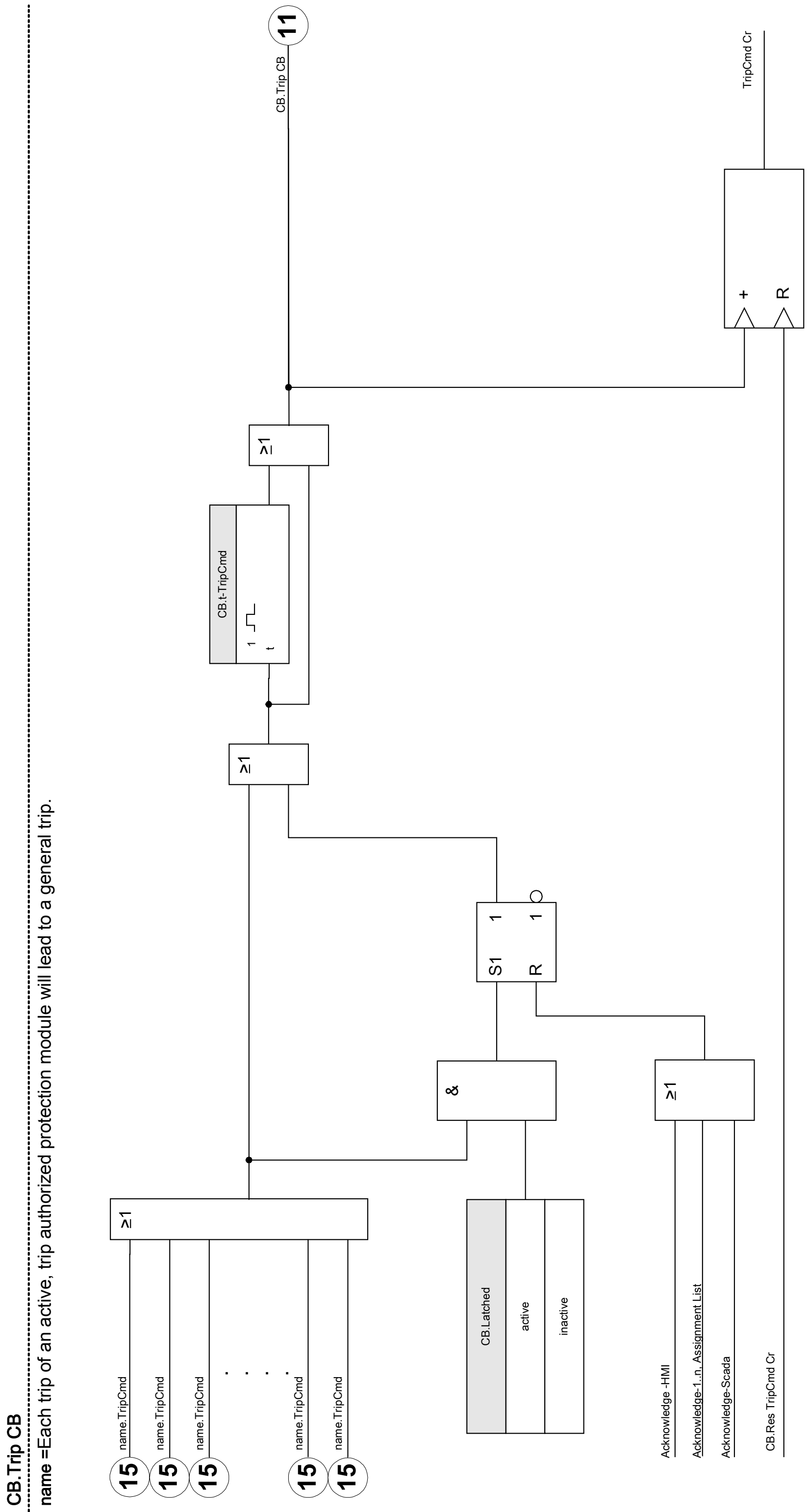
Trip and Breaker Management

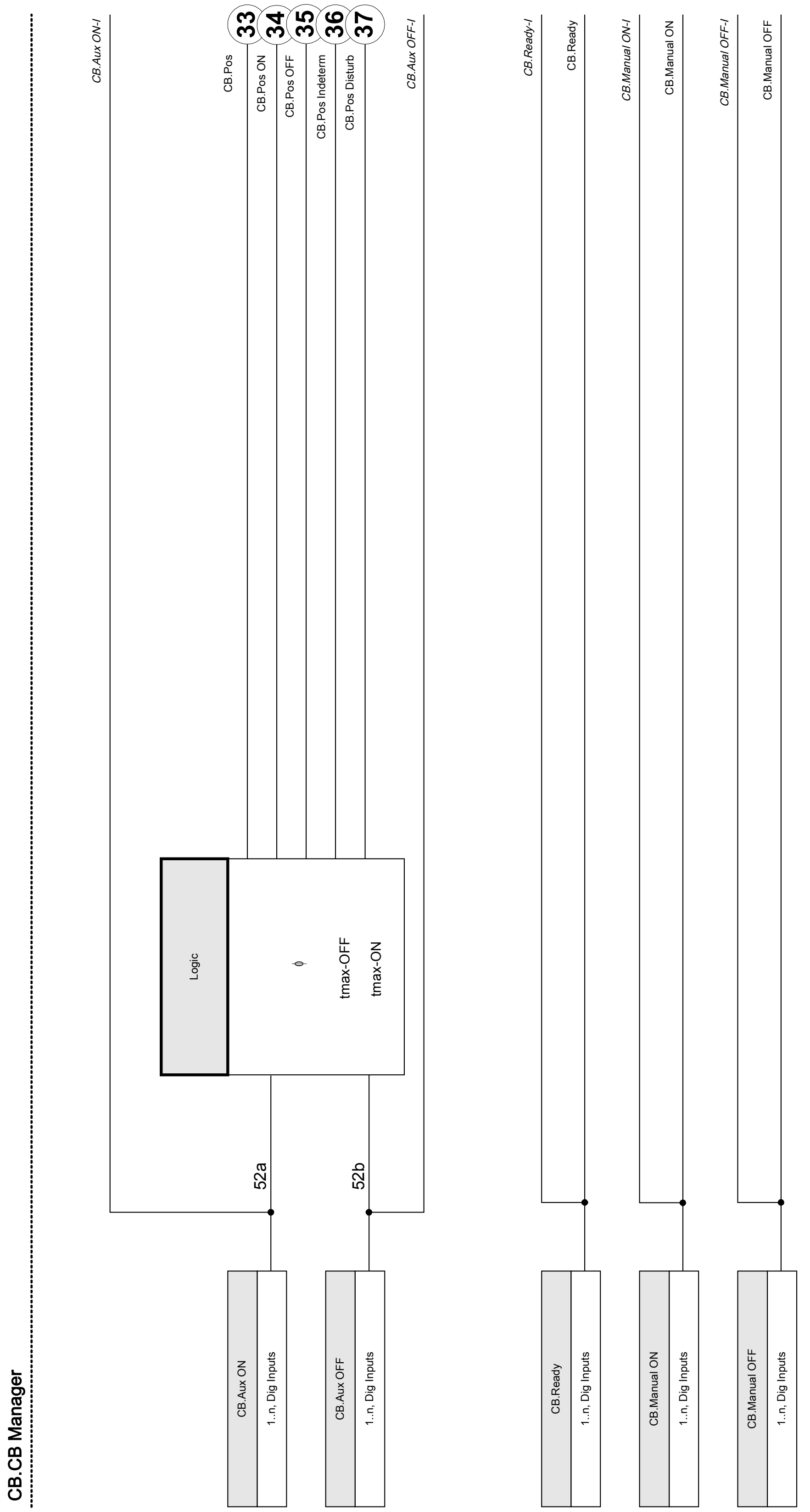
CB Manager (TripControl)

CB

The tripping commands of all protection modules are combined in module *»TripLogic«* by an OR logic. The command for tripping can come from each of the protection modules, but the actual tripping command to the CB is only given by the module *»TripLogic«*.

In addition to that you can set within this module the minimum hold time of the tripping command and define whether the tripping command is latched or not.


CB.Trip CB
name =Each trip of an active, trip authorized protection module will lead to a general trip.
15
name.TripCmd
15
name.TripCmd
15
name.TripCmd
15
name.TripCmd
15
name.TripCmd
≥1
&
CB.Latched
active
inactive
S1
1
R
1
≥1
Acknowledge -HMI
Acknowledge-1..n, Assignment List
Acknowledge-Scada
≥1
CB.t-TripCmd
1
t
≥1
CB.Trip CB
11
+
R
TripCmd Cr
CB.Res TripCmd Cr


CB.CB Manager
CB.Aux ON
1..n, Dig Inputs
CB.Aux OFF
1..n, Dig Inputs
CB.Ready
1..n, Dig Inputs
CB.Manual ON
1..n, Dig Inputs
CB.Manual OFF
1..n, Dig Inputs
52a
52b
Logic
tmax-OFF
tmax-ON
CB.Aux ON-I
CB.Pos
CB.Pos ON
CB.Pos OFF
CB.Pos Indeterm
CB.Pos Disturb
CB.Aux OFF-I
CB.Ready-I
CB.Ready
CB.Manual ON-I
CB.Manual ON
CB.Manual OFF-I
CB.Manual OFF
33
34
35
36
37

Direct Commands of the CB Manager

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Ack TripCmd	Acknowledge Trip Command	inactive, active	inactive	[Operation /Reset /Flags]

Global Protection Parameters of the CB Manager

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
t-TripCmd	Minimum hold time of the OFF-command (circuit breaker, load break switch).	0.0 - 300.0s	0.2s	[Protection Para /Global Prot Para /CB Manager /CB]
Latched	Defines whether the Binary Output Relay will be Latched when it picks up.	inactive, active	inactive	[Protection Para /Global Prot Para /CB Manager /CB]
Ack TripCmd	Acknowledge Trip Command	1..n, Assignment List	-.-	[Protection Para /Global Prot Para /CB Manager /CB]
tmax-OFF	Within this time the OFF command has to be carried out by the CB. Within this time the position indicators (check back signals) have to change from ON to OFF.	0.00 - 10.00s	0.10s	[Protection Para /Global Prot Para /CB Manager /CB]
tmax-ON	Within this time the ON command has to be carried out by the Breaker. Within this time the position indicators (check back signals) have to change from OFF to ON.	0.00 - 10.00s	0.10s	[Protection Para /Global Prot Para /CB Manager /CB]

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 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 /CB Manager /CB]
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 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 /CB Manager /CB]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Manual ON	The circuit breaker was switched on manually 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 Switch Onto Fault (SOTF), 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 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 /CB Manager /CB]
Manual OFF	The circuit breaker was switched off manually 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 Cold Load Pickup (CLPU), 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 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 /CB Manager /CB]

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 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 /CB Manager /CB]

CB Manager Input States

Name	Description	Assignment via
Acknow Sig-I	Module input state: Acknowledgement Signal (only for automatic acknowledgement) Module input signal	[Protection Para /Global Prot Para /CB Manager /CB]
Aux ON-I	Position indicator/check-back signal of the CB (52a)	[Protection Para /Global Prot Para /CB Manager /CB]
Aux OFF-I	Module input state: Position indicator/check-back signal of the CB (52b)	[Protection Para /Global Prot Para /CB Manager /CB]
Manual ON-I	Module input state: Circuit breaker was switched on manually	[Protection Para /Global Prot Para /CB Manager /CB]
Manual OFF-I	Module input state: Circuit breaker was switched off manually	[Protection Para /Global Prot Para /CB Manager /CB]

Name	Description	Assignment via
Ready-I	Module input state: CB ready	[Protection Para /Global Prot Para /CB Manager /CB]

CB Manager Signals (Outputs States)

Name	Description
TripCmd	Signal: Trip Command
Ack TripCmd	Signal: Acknowledge Trip Command
Pos	Signal: Circuit Breaker Position (0 = Indeterminate, 1 = OFF, 2 = ON, 3 = Disturbed)
Ready	Signal: Circuit breaker is ready for operation.
Manual OFF	Signal: Circuit breaker was switched off manually.
Manual ON	Signal: Circuit breaker was switched on manually
Pos OFF	Signal: Circuit Breaker is in OFF-Position
Pos ON	Signal: Circuit Breaker is in ON-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.

Breaker Wear

Available elements:
BW

Principle – General Use

The sum of the accumulated interrupted currents are monitored by the Breaker Wear Module.

Device Planning Parameters of the Breaker Wear Module

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

Global Protection Parameters of the Breaker Wear 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 /CB Manager /BW]
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 /CB Manager /BW]
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /Global Prot Para /CB Manager /BW]
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 parametrized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /Global Prot Para /CB Manager /BW]
Operations Alarm	Service Alarm, too many Operations	1 - 65535	100	[Protection Para /Global Prot Para /CB Manager /BW]
Isum Intr Alarm	Alarm, the Sum (Limit) of interrupting currents has been exceeded.	0 - 2500000A	10000A	[Protection Para /Global Prot Para /CB Manager /BW]

Breaker Wear Input States

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

Breaker Wear Signals (Output States)

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

Breaker Wear Counter Values

Value	*Description*	*Menu path*
TripCmd Cr	Counter: Total number of trips of the switchgear (circuit breaker, load break switch…).	[Operation /History /TotalCr]

Breaker Wear Values

Value	*Description*	*Default*	*Size*	*Menu path*
Sum trip IL1	Summation of the tripping currents phase1.	0A	0 - 65535A	[Operation /History /TotalCr]

Value	*Description*	*Default*	*Size*	*Menu path*
Sum trip IL2	Summation of the tripping currents phase2.	0A	0 - 65535A	[Operation /History /TotalCr]
Sum trip IL3	Summation of the tripping currents phase3.	0A	0 - 65535A	[Operation /History /TotalCr]

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 /Counter]

Protective Elements

MStart - Motor Starting and Control [48,66]

Available elements:
MStart

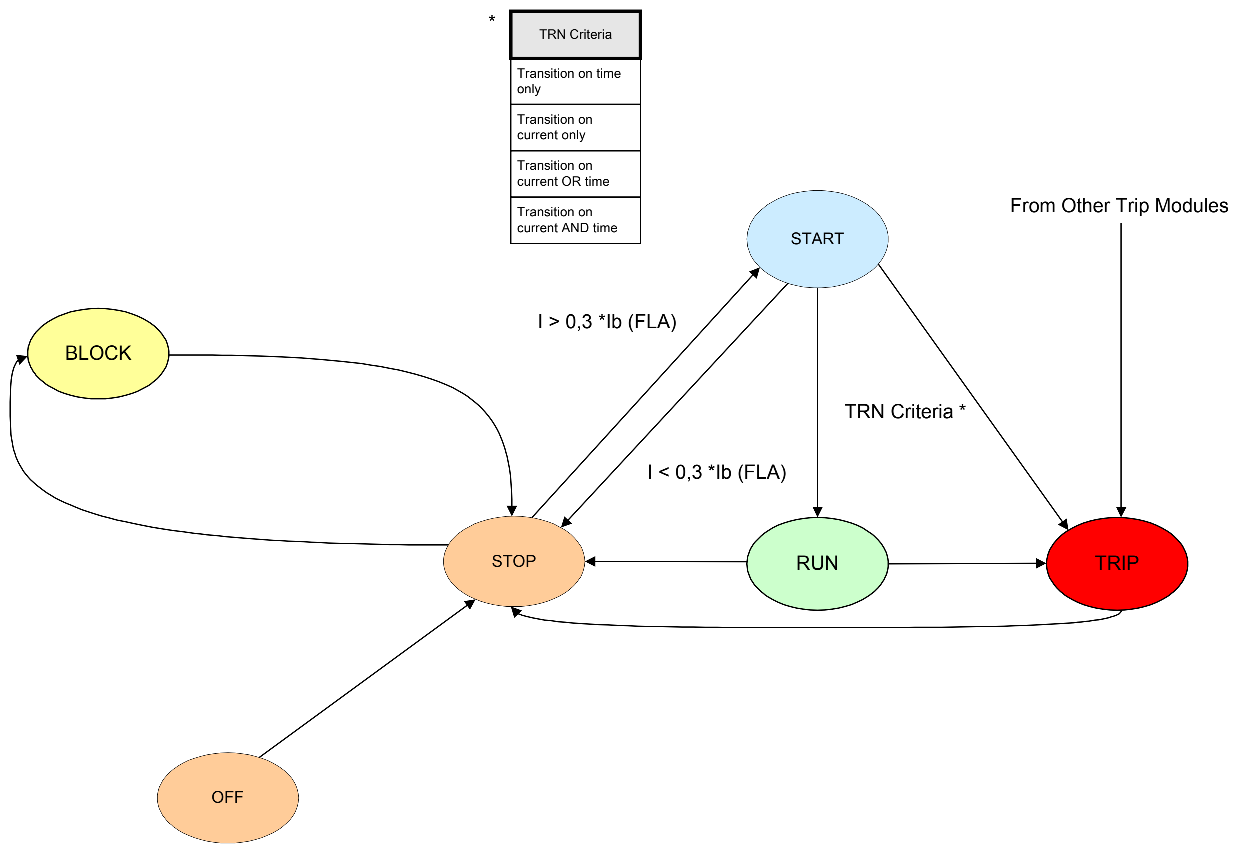
General – Principle Use

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; and
- 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;

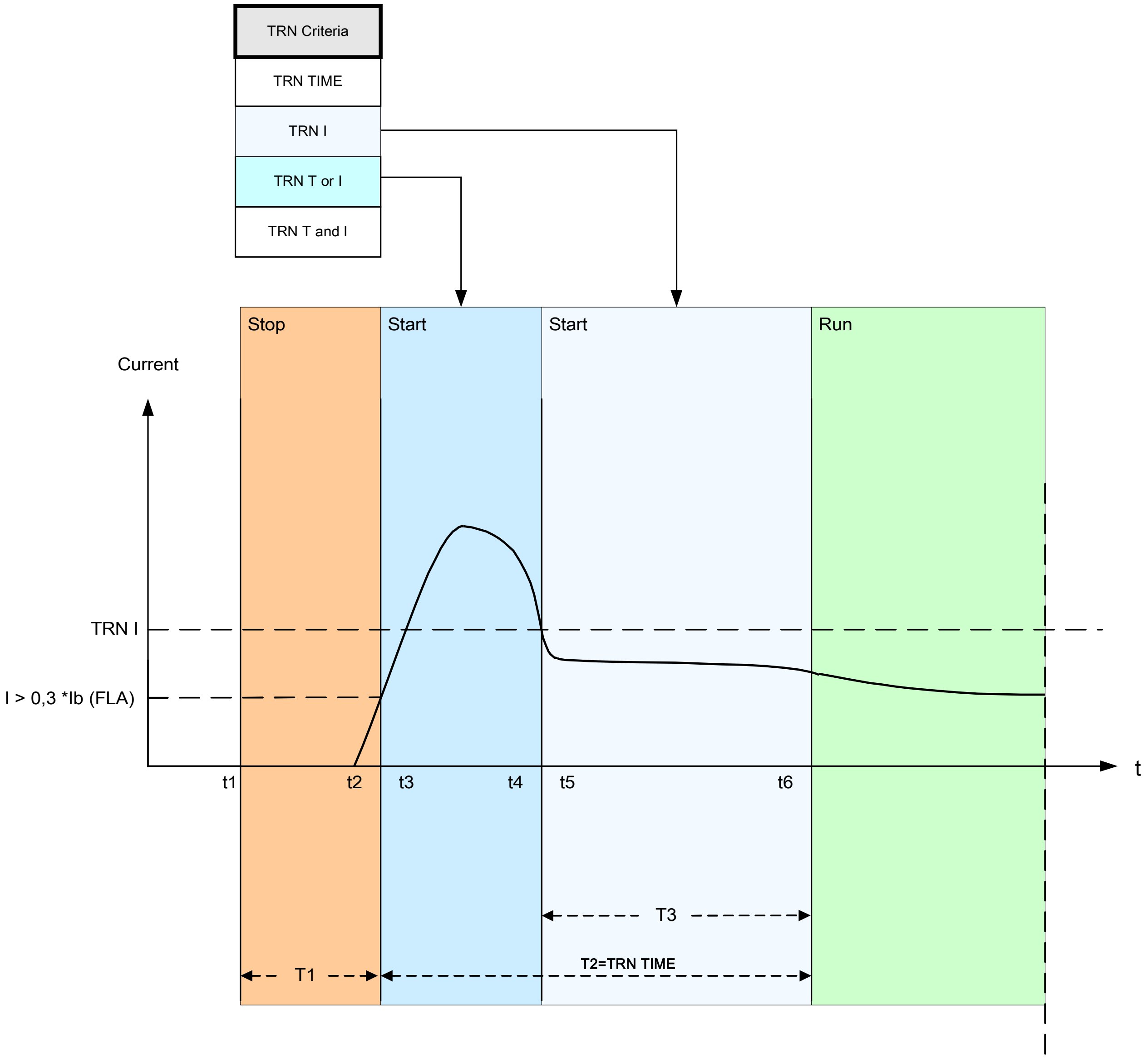
3. Stop cycle; and
4. Trip state.

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]

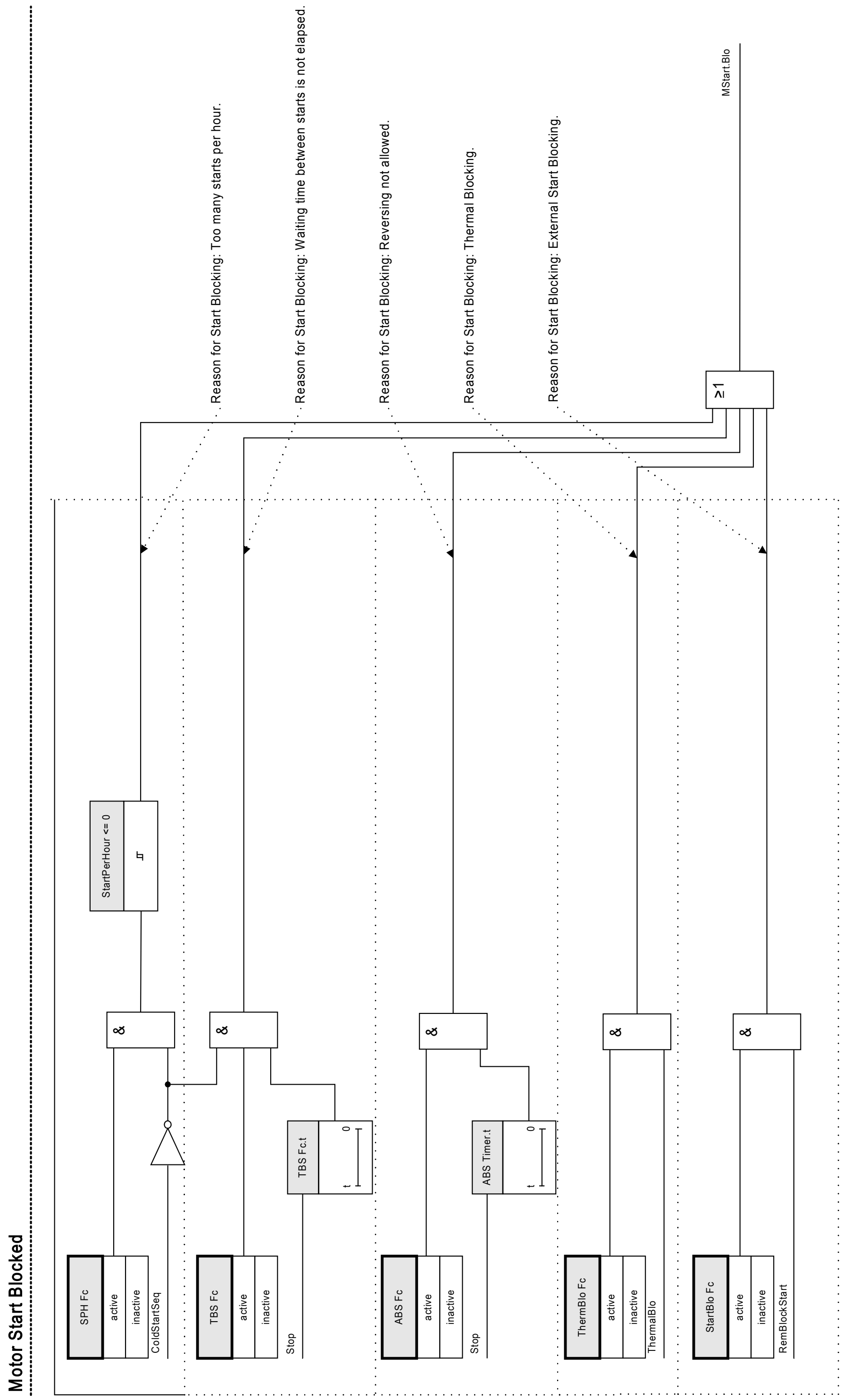
When the protective device declares a »START«, all start timers of the enabled functions begin to time. Each of these timers blocks the respective function until the set delay expires. These start timers are affected by transitions - they run for the set time, which may be less than or greater than the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


Motor Start Blocked
SPH Fc
active
inactive
ColdStartSeq
StartPerHour <= 0
&
TBS Fc
active
inactive
Stop
TBS Fc.t
t
0
&
ABS Fc
active
inactive
Stop
ABS Timer.t
t
0
&
ThermBlo Fc
active
inactive
ThermalBlo
&
StartBlo Fc
active
inactive
RemBlockStart
&
Reason for Start Blocking: Too many starts per hour.
Reason for Start Blocking: Waiting time between starts is not elapsed.
Reason for Start Blocking: Reversing not allowed.
Reason for Start Blocking: Thermal Blocking.
Reason for Start Blocking: External Start Blocking.
≥1
MStart.Blo

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.

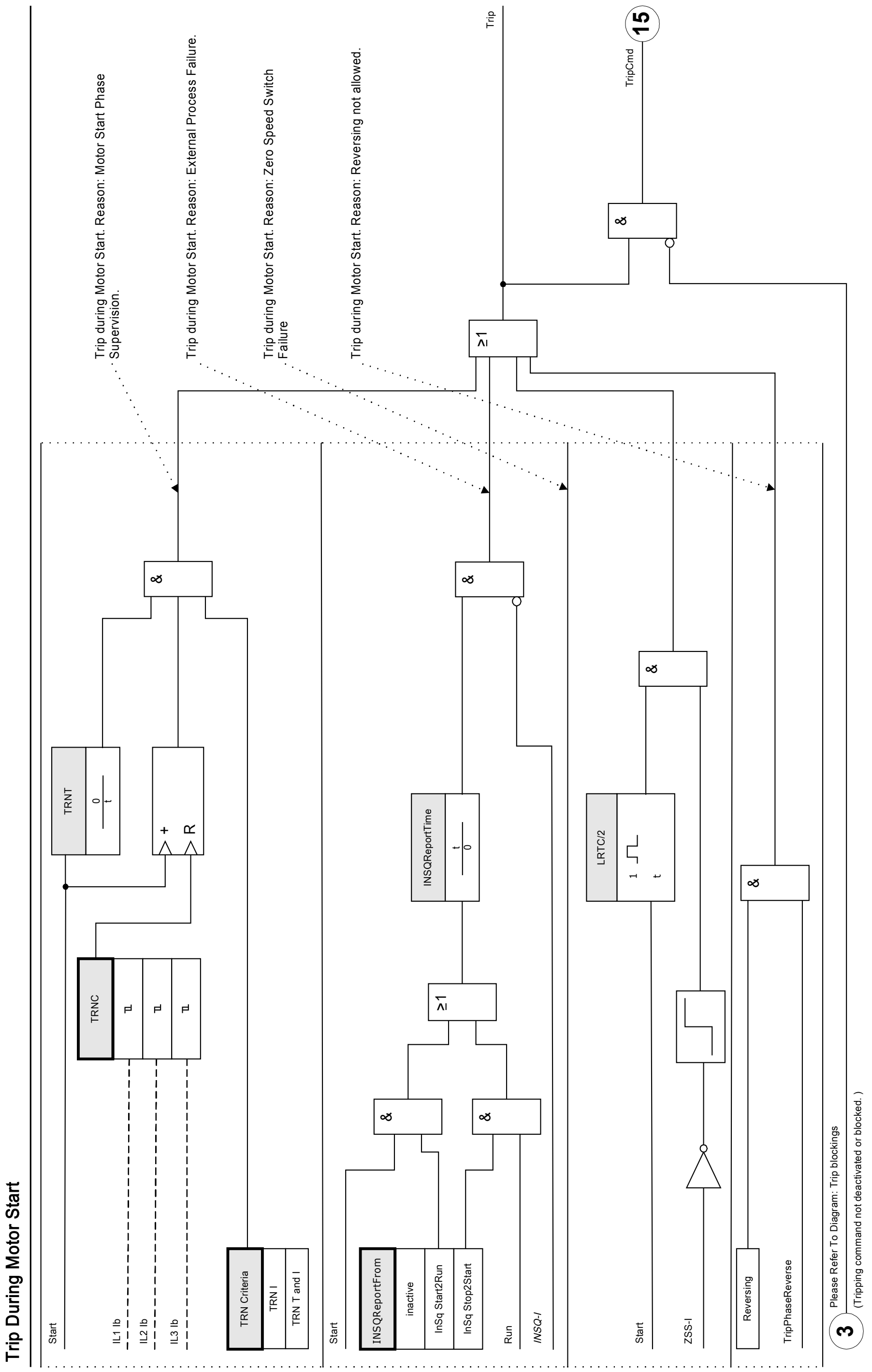
Forced Starting

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.



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.

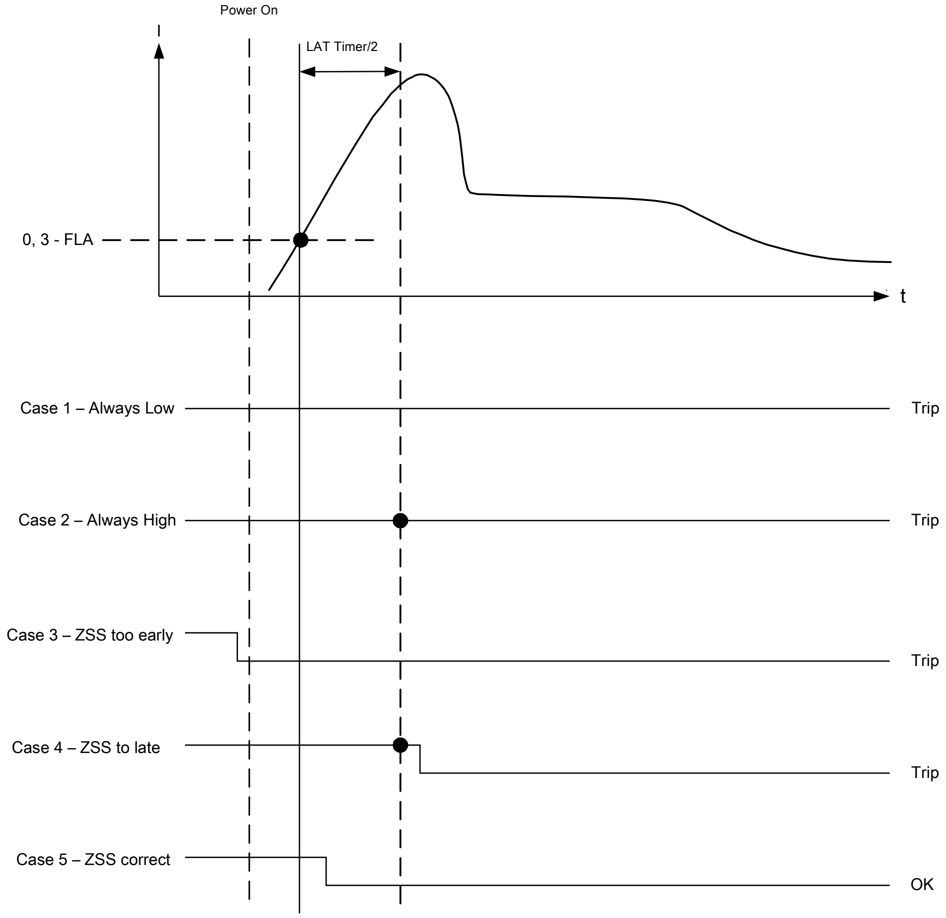
Note that the input must be energized continuously after the time delay has expired to hold off this trip.

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.



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)

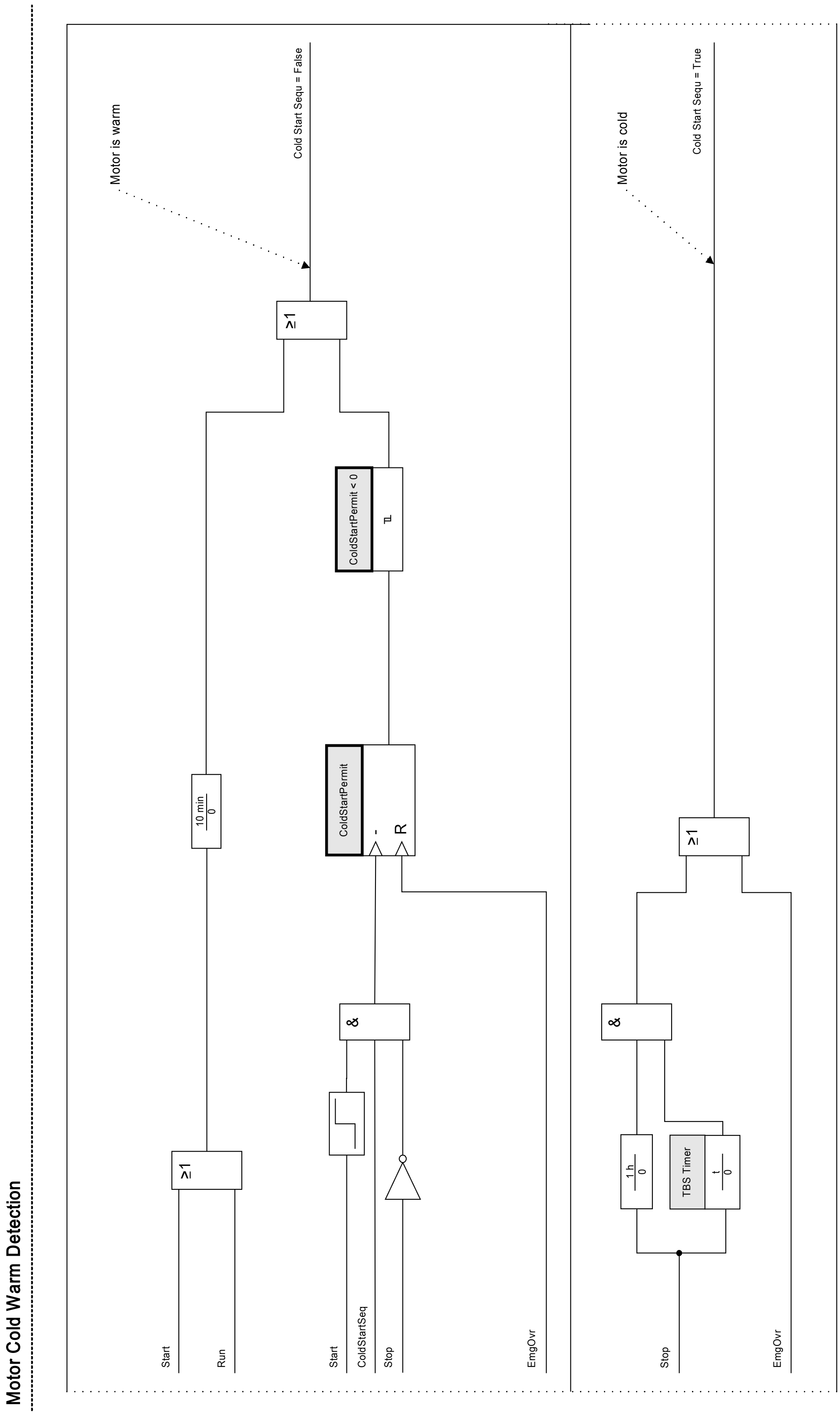
»ABS« sets the time in seconds before a motor restart is permitted after a trip or stop condition. This function can be set to »*inactive*«.

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.



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]
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]
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]

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

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

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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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]
Start Signal	Motor Start Signal. User can tie a digital input to this Input. If "Start-I" becomes true, "StartMotorCommand" becomes true for at least 500ms.	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, 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]
Stop	Stop Motor 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 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*
StartBlock	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 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 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 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]
ThermSwitch	Therm Switch	-.-, DI Slot X1.DI 1, DI Slot X1.DI 2, DI Slot X1.DI 3, DI Slot X1.DI 4, 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*
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 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]
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 - 1200s	10s	[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 - 1200s	60s	[Protection Para /Global Prot Para /MStart /Start Delay Timer]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
t-Blo-Generic1	t-Blo-Generic1	0 - 1200s	0s	[Protection Para /Global Prot Para /MStart /Start Delay Timer]
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*
ThermalBlo-I	State of the module input: ThermalBlo	[]
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.	[Protection Para /Global Prot Para /MStart /Motor Inputs]
Stop-I	State of the module input: Stop Motor Signal	[Protection Para /Global Prot Para /MStart /Motor Inputs]
StartBlock-I	State of the module input: Start Motor Signal	[Protection Para /Global Prot Para /MStart /Motor Inputs]

Name	*Description*	*Assignment via*
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]
ThermSwitch-I	State of the module input: Therm Switch	[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]

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)

Name	*Description*
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.
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

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 /EMGOVR]
RstForcedStart	Reset Forced Start flag	inactive, active	inactive	[Operation /Reset /Flags]

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]

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

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

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

I>> - IOC Function

The instantaneous overcurrent function (IOC) or 50P is intended to protect in the event of a high-current fault. The example IOC setting used in the Motor Protection Curve (see the Motor Protection Curve Examples in the Ultimate Trip Current Section) is 12 times (1,200%) of FLA. In general, the instantaneous IOC should be at least 1.5 times LRC (Locked Rotor Current), well above the locked rotor current normally seen at the moment of a start.

IOC should trip fast and therefore no run or pickup delay is provided. A start delay is set at a minimum of 0.03 sec. or more if needed to block IOC tripping on magnetizing inrush when the motor is first energized. An additional IOC tripping delay setting is set at a default of zero seconds.

IOC Trip Level

The IOC sets the instantaneous overcurrent trip limit in percentage of »*Ib*« (FLA) above at which the relay trips. This trip type can be set to Inactive to deactivate this protective device element. For currents clearly above the setting, the IOC function picks up in 1.5 power cycles or less (at 50 Hz).

IOC Start Delay (IOCSD)

This setting sets the number of power cycles after a start is recognized until the IOC trip and alarm functions are enabled. Use this delay to inhibit IOC tripping on a current peak caused by magnetic inrush when the motor is first energized (usually two to three cycles).

I - Overcurrent [50, 51]

Available elements:
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)

Applications of the I-Protection Module	**Setting in**	**Option**
ANSI 51 – Short circuit protection, non-directional	Device Planning menu	Measuring Mode: Fundamental/TrueRMS/negative phase sequence current (I2)
ANSI 51Q Negative Phase Sequence Overcurrent Protection (**Please refer to the 51Q chapter**)	Parameter Set: Measuring Method =I2 (Negative Sequence Current)	

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.

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; and
- I4T.

Explanation:

t = Tripping delay

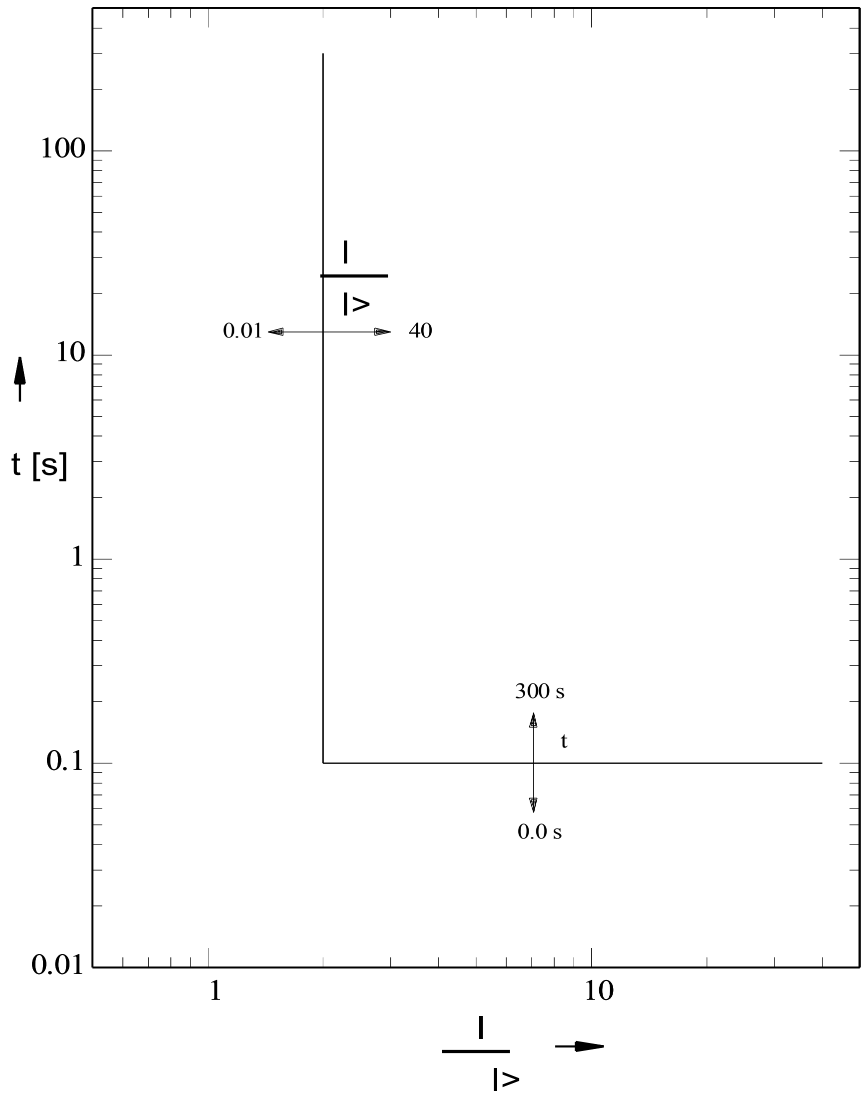
t-char = Time multiplier/tripping characteristic factor

I = Fault current

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

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

DEFT



IEC NINV

Notice!

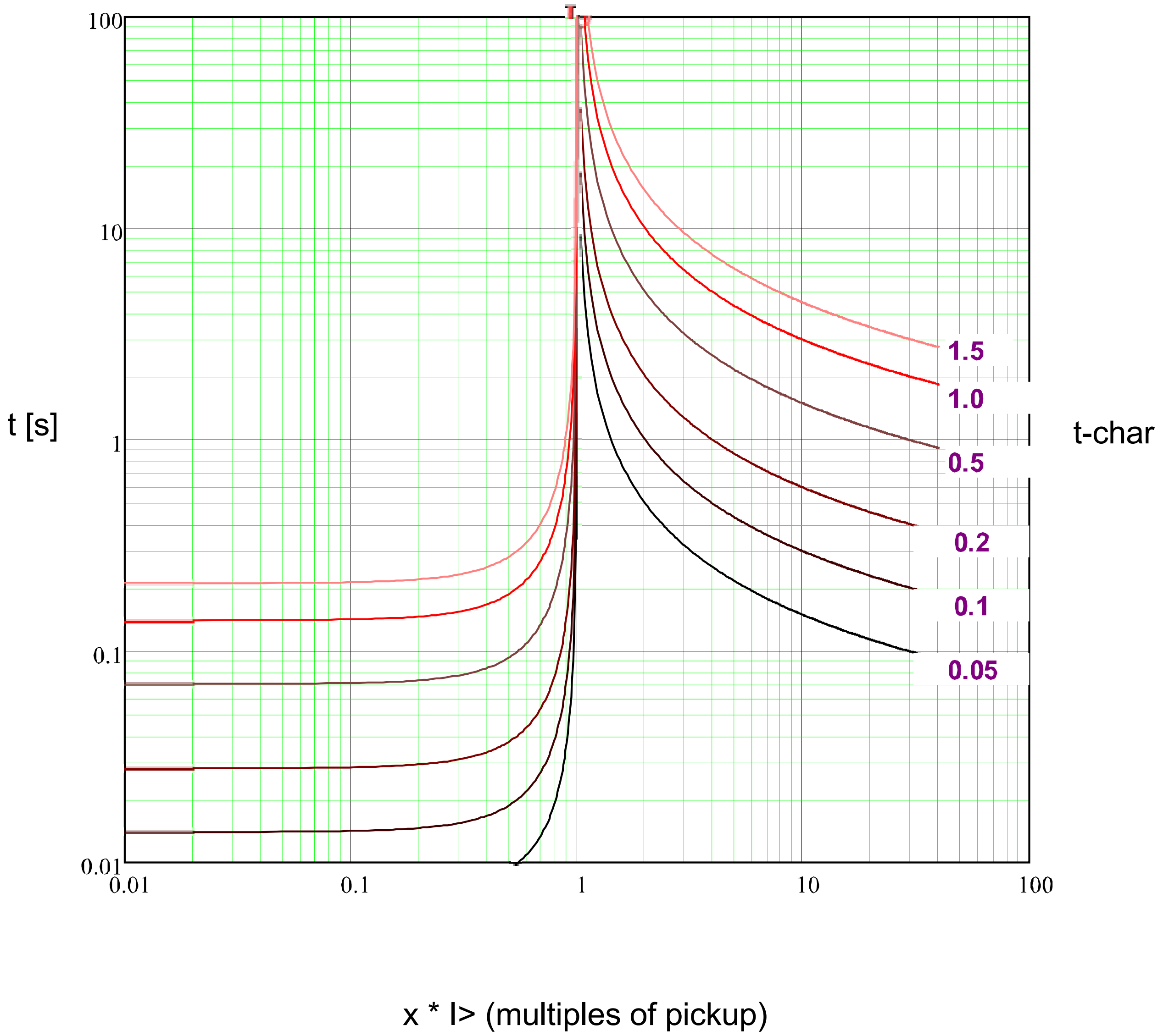
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

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!

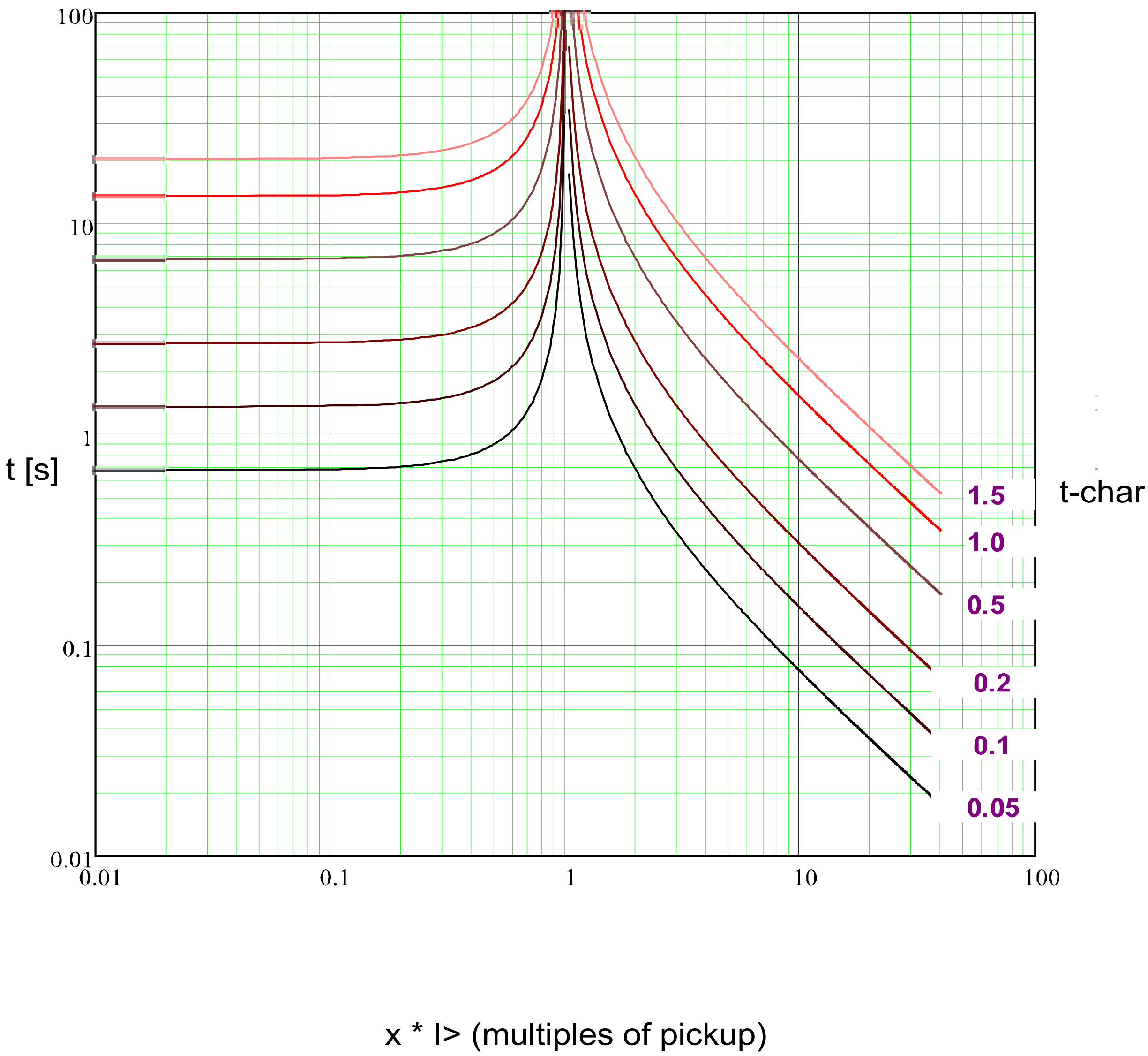
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

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!

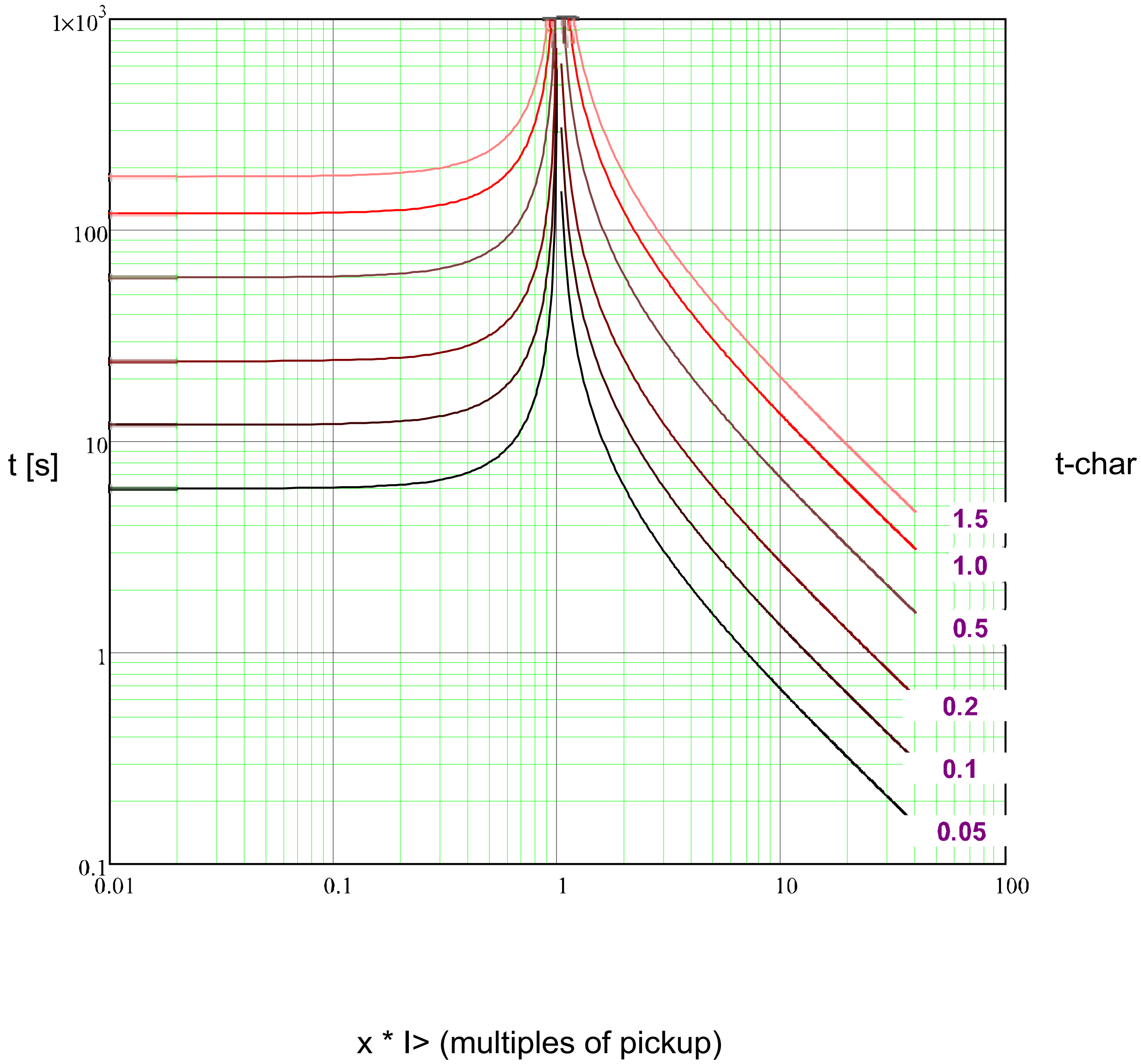
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

Reset

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

Trip

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



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

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

x * I> (multiples of pickup)

ANSI MINV

Notice!

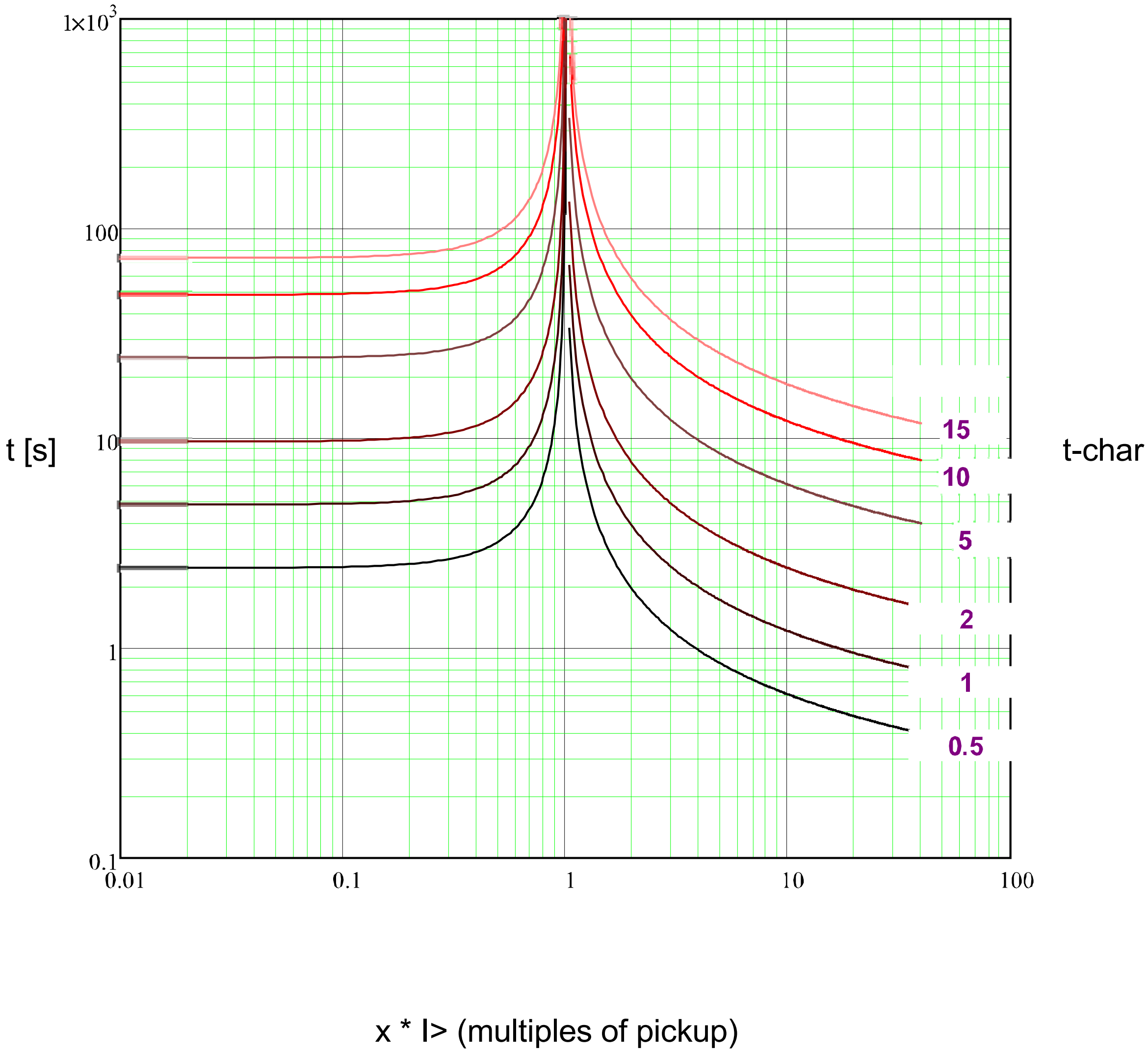
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

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

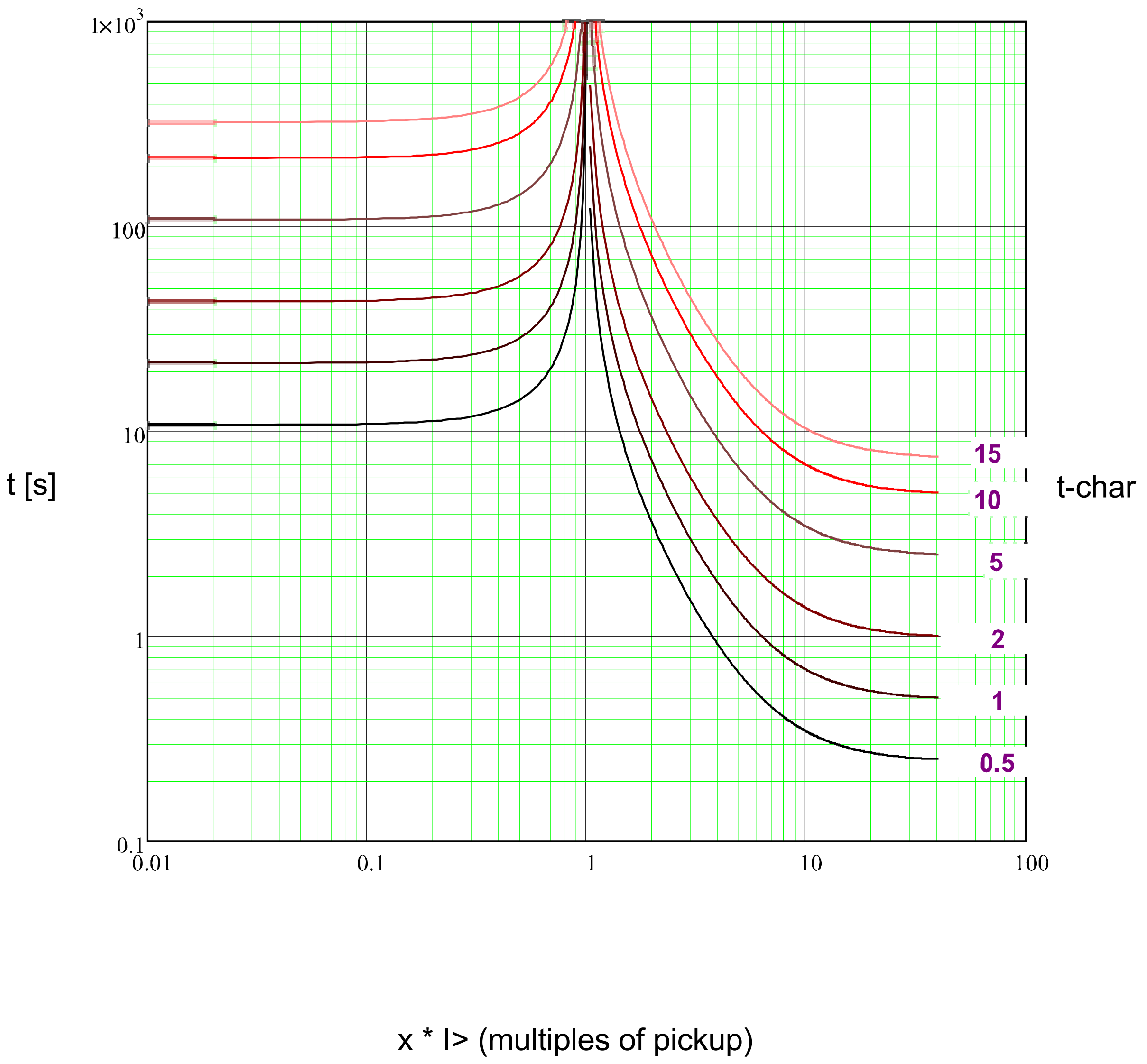
Notice!
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

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!

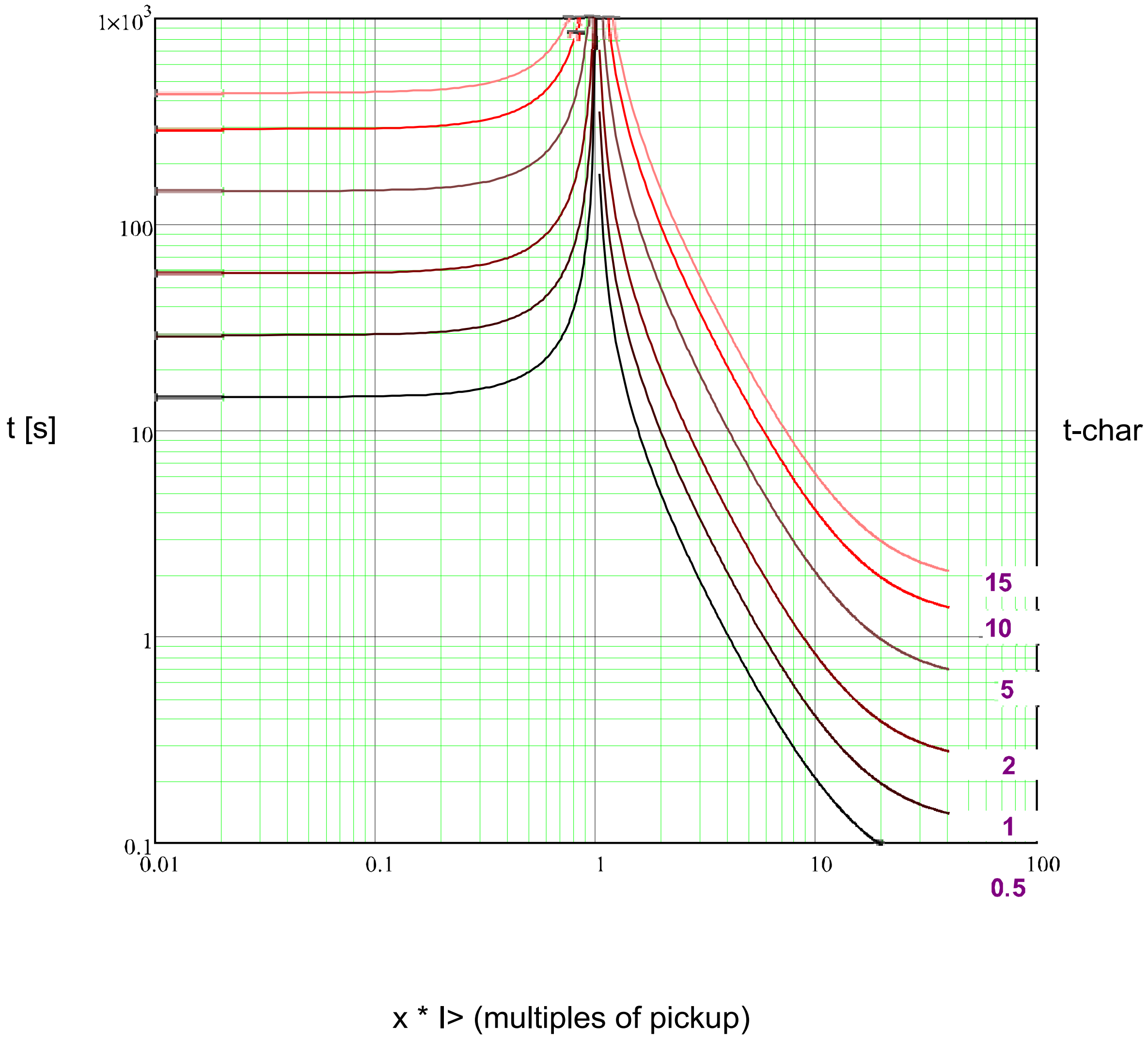
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

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.

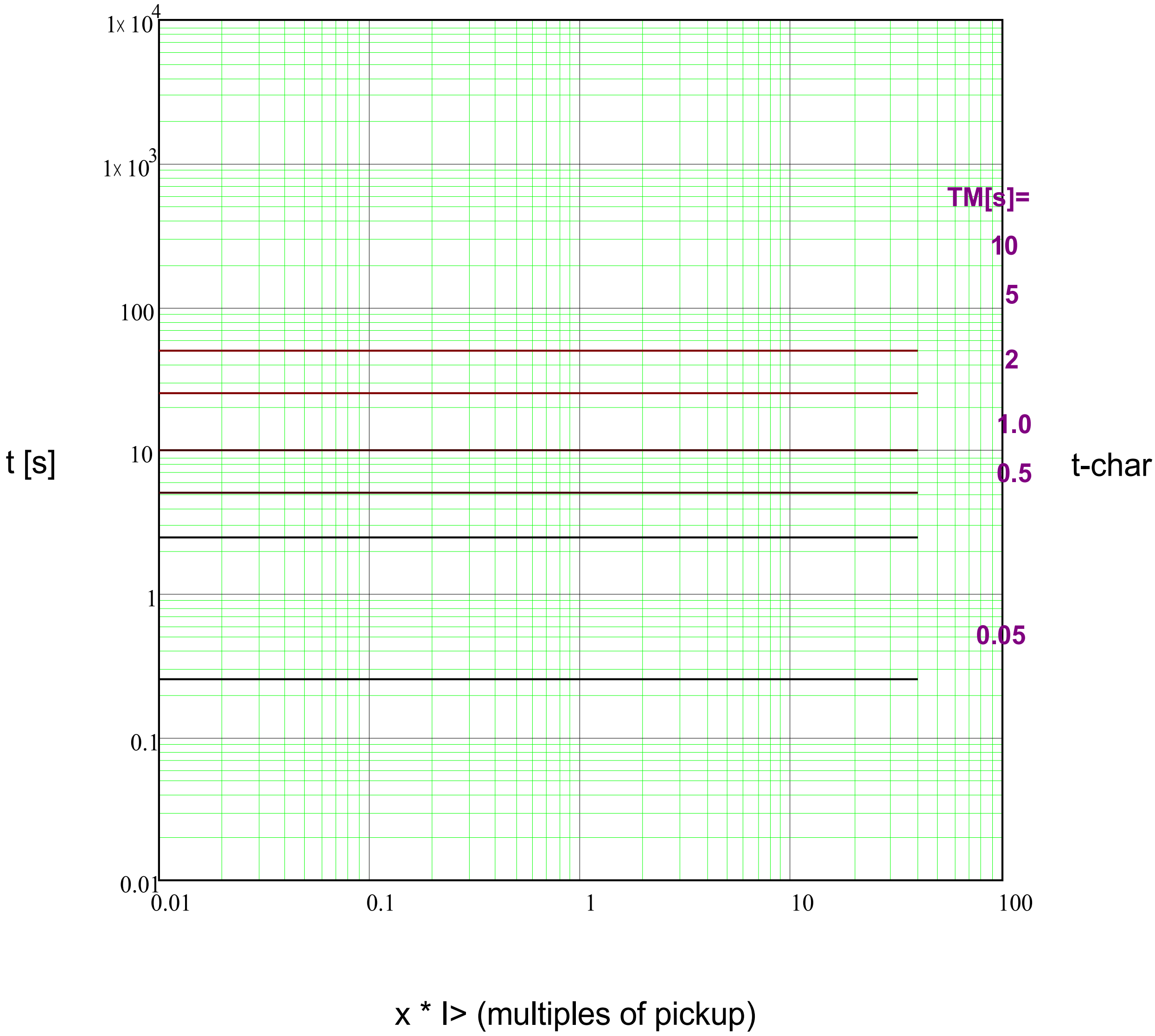
Reset

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

Trip

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

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

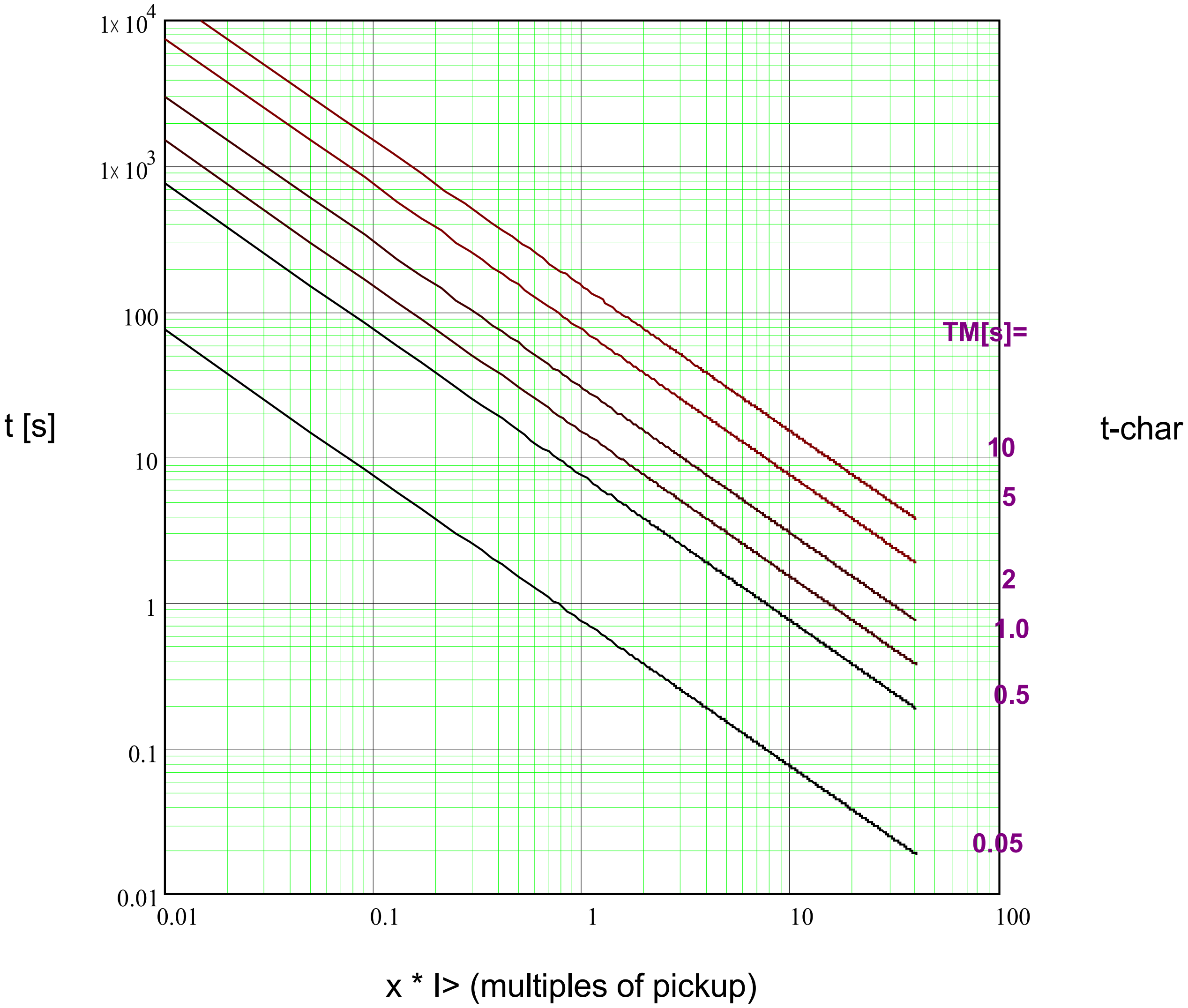


IT

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

Reset **Trip**

$$t = \left| \frac{5*3^2}{\left(\frac{I}{In}\right)^0} \right| \text{*t-char [s]} \qquad t = \frac{5*3^1}{\left(\frac{I}{In}\right)^1} \text{*t-char [s]}$$



I2T

Notice!

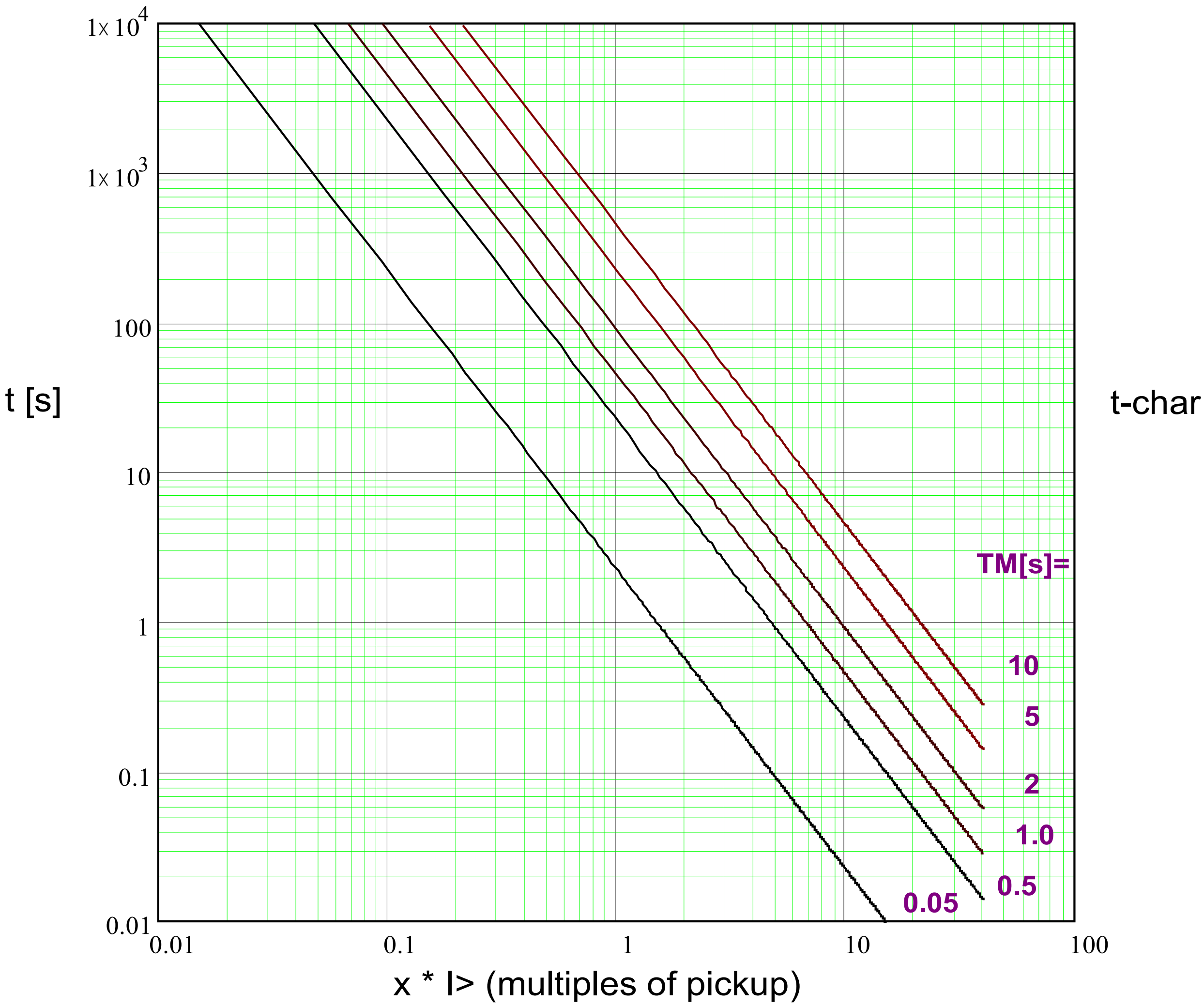
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

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!

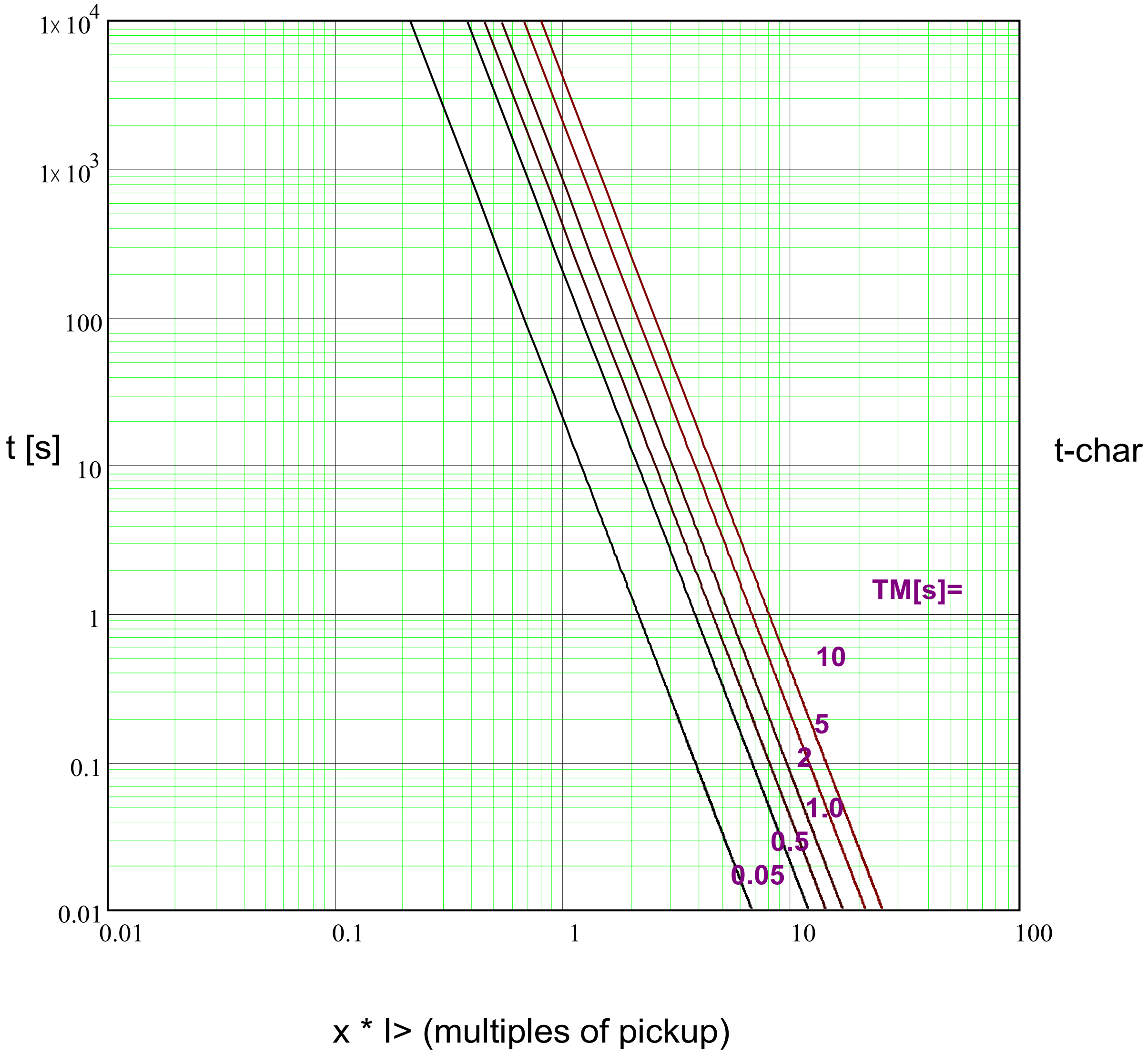
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

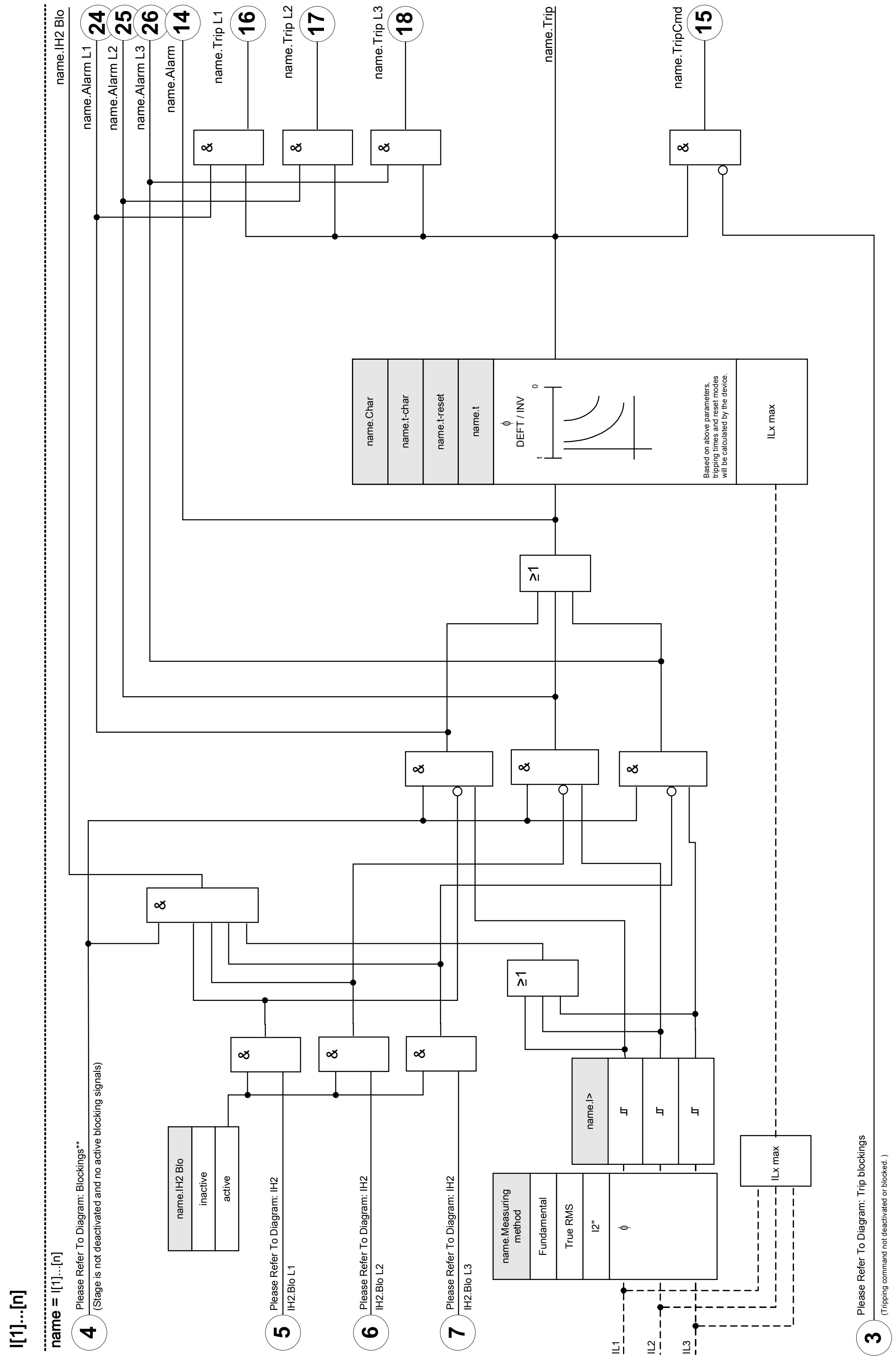
Reset

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

Trip

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





I[1]..[n]
name = I[1]..[n]
Please Refer To Diagram: Blockings**
(Stage is not deactivated and no active blocking signals)
4
Please Refer To Diagram: IH2
IH2.Blo L1
5
Please Refer To Diagram: IH2
IH2.Blo L2
6
Please Refer To Diagram: IH2
IH2.Blo L3
7
Please Refer To Diagram: Trip blockings
(Tripping command not deactivated or blocked.)
3
name.IH2 Blo
inactive
active
name.Measuring method
Fundamental
True RMS
I2"
name.I>
ILx max
IL1
IL2
IL3
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.IH2 Blo
name.Alarm L1
24
name.Alarm L2
25
name.Alarm L3
26
name.Alarm
14
name.Trip L1
16
name.Trip L2
17
name.Trip L3
18
name.Trip
name.TripCmd
15

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]: non directional 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, Trip Cmds	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]: inactive I[4]: inactive I[5]: inactive I[6]: inactive	[Protection Para /<n> /I-Prot /I[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parametrized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /I-Prot /I[1]]

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 parametrized "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]]
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 parametrized "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	Fundamental	[Protection Para /<n> /I-Prot /I[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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]: 2.00In 1.00In 1.00In 1.00In 1.00In I[2]: 5.00In 1.00In 1.00In 1.00In 1.00In I[3]: 1.00In I[4]: 1.00In 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	DEFT	[Protection Para /<n> /I-Prot /I[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
t	Tripping delay Only available if: Characteristic = DEFT	0.00 - 300.00s	I[1]: 0.50s 1.00s 1.00s 1.00s 1.00s I[2]: 0.0s 1.00s 1.00s 1.00s 1.00s I[3]: 1.00s I[4]: 1.00s 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]]
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 /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]]

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

Name	*Description*
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.

- Current source;
- May be: ampere meters; and
- 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.

I2> - Negative-Sequence Overcurrent [51Q]

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]. Please refer to chapter „I-Protection Module – Overcurrent Protection“.

The negative-sequence overcurrent element (*51Q*) 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 elements. The negative-sequence current used by *51Q* 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 *51Q* element should be set in accordance of the negative-sequence current occurrence in the protected object.

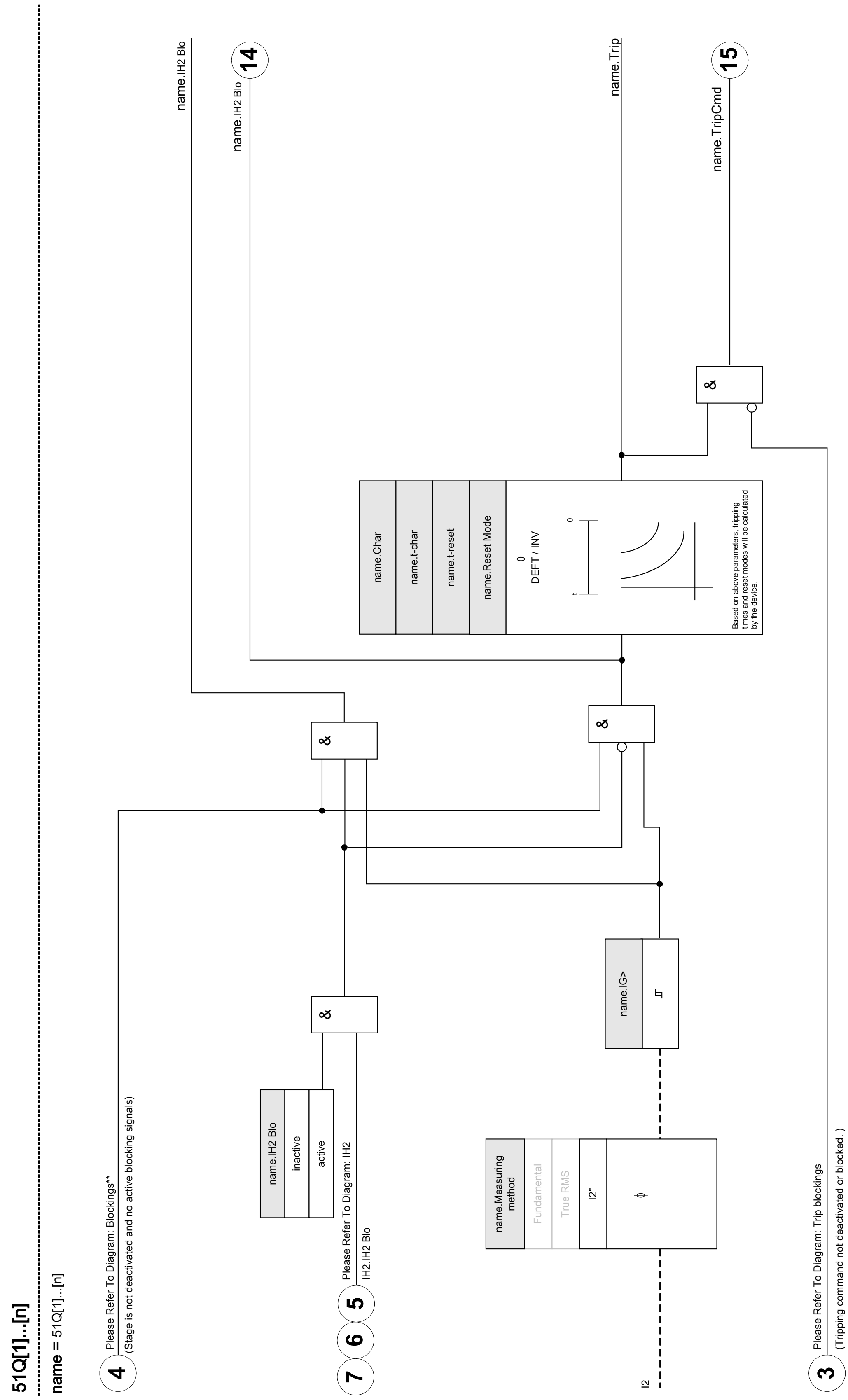
Besides that, the negative-sequence overcurrent element (*51Q*) uses the same setting parameters as the phase overcurrent elements, like trip and reset characteristics from both IEC/ANSI standards, time multiplier, etc.

The negative-sequence overcurrent element (*51Q*) can be used by line, generator, transformer and motor protection to protect the system from unbalanced faults. Because the *51Q* element operates on the negative-sequence current component which is normally absent during load conditions, the *51Q* can, therefore, be set more sensitive than the phase overcurrent elements. On the other hand, coordination of negative-sequence overcurrent elements 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 element needs only be coordinate with the next downstream device with the negative-sequence overcurrent element. This makes the *51Q* in many cases as an advantageous protection concept in addition to the phase overcurrent elements.

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 **All elements are identically structured.**

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



51Q[1]...[n]
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
name.IH2 Blo
14
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
name.TripCmd
15
3
Please Refer To Diagram: Trip blockings
(Tripping command not deactivated or blocked.)

Commissioning: Negative Sequence Overcurrent]

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 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.

Necessary means:

- Current source;
- Current meters; and
- 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.

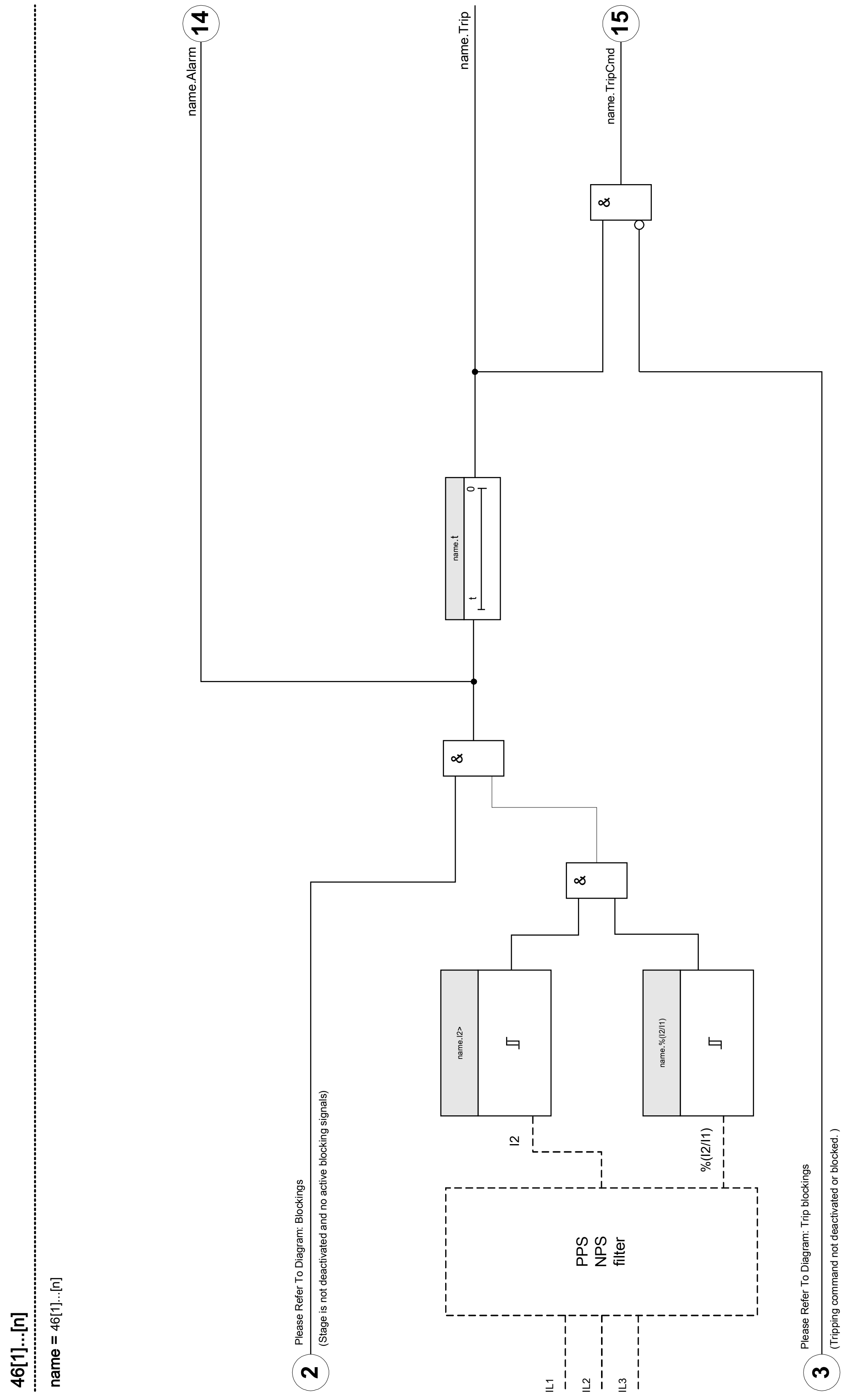
%I2/I1> - Unbalanced Load [46]

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]
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
2
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
Please Refer To Diagram: Trip blockings
(Tripping command not deactivated or blocked.)
3

Device Planning Parameters of the Current Unbalance Module

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

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 parametrized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /I-Prot /I2>[1]]
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<n> /I-Prot /I2>[1]]
ExBlo TripCmd Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parametrized "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), or %(I2/I1) for ABC rotation and %(I1/I2) for ACB rotation.	inactive, active	inactive	[Protection Para /<n> /I-Prot /I2>[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
%(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), or %(I2/I1) for ABC rotation and %(I1/I2) for ACB rotation. 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.

Special Notes on Earth Fault Current Transformers

Elements:

Earth Fault Protection

Functional Description

Earth current measurement is usually been done with a summation current transformer (core-balance transformer). This CT has a large primary window through which all three-phase conductors can pass.

Note that the earth fault current settings are based on the earth CT rated **primary current (In),** not on FLA or the phase CT ratio. For example, a pick-up setting of 0.10 gives a trip or alarm for an actual earth leakage current of 5 A on the primary side of the sensor with a 50:5 CT.

This function is only useful for a earthed power system. The earth return is normally made from the neutral of the secondary wire winding of the supply power transformer. Resistance earthing is acceptable as long as the resulting fault current is at a level the protective device can be set to detect.

The earth CT, which provides sensitive protection for high-resistance earth faults, may saturate for a robust heavy-current earth fault in a solidly-earthed system. Minimize the saturation problem by minimizing the burden. Use the shortest and heaviest leads possible between the earth CT and the relay. The relay itself has very low burden, usually much lower than the connecting wiring.

A residual connection – the wired summation of the phase CT circuits through the earth CT input – requires a much higher earth fault time setting to avoid false tripping. Thus, sensitivity is not nearly as good as with a separate flux-canceling CT.

If the relay is installed where a residual connection is used, XCT should be set to the same value as CT Pri. The User must then set the earth fault trip level at a high value to avoid nuisance tripping from CT ratio errors, third harmonic and certain higher harmonics, or other measurement errors producing false residual currents. Monitor the metered earth current during various loading conditions to ensure a good margin between these error currents and the earth fault trip current setting 50R [x]. Also, watch out for phase CTs that saturate during motor starting. The saturation produces a large residual current and a earth fault trip.

IG> - Earth Fault [50N/G, 51N/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 30 ms 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

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.

For each element the following characteristics are available:

- DEFT (UMZ);
- NINV (AMZ);
- VINV (AMZ);

- LINV (AMZ);
- EINV (AMZ);
- MINV (AMZ);
- VINV (AMZ);
- EINV (AMZ);
- Thermal Flat;
- IT;
- I2T; and
- I4T.

Explanation:

t = Tripping delay

t-char = Time multiplier/tripping characteristic factor

IG = Fault current

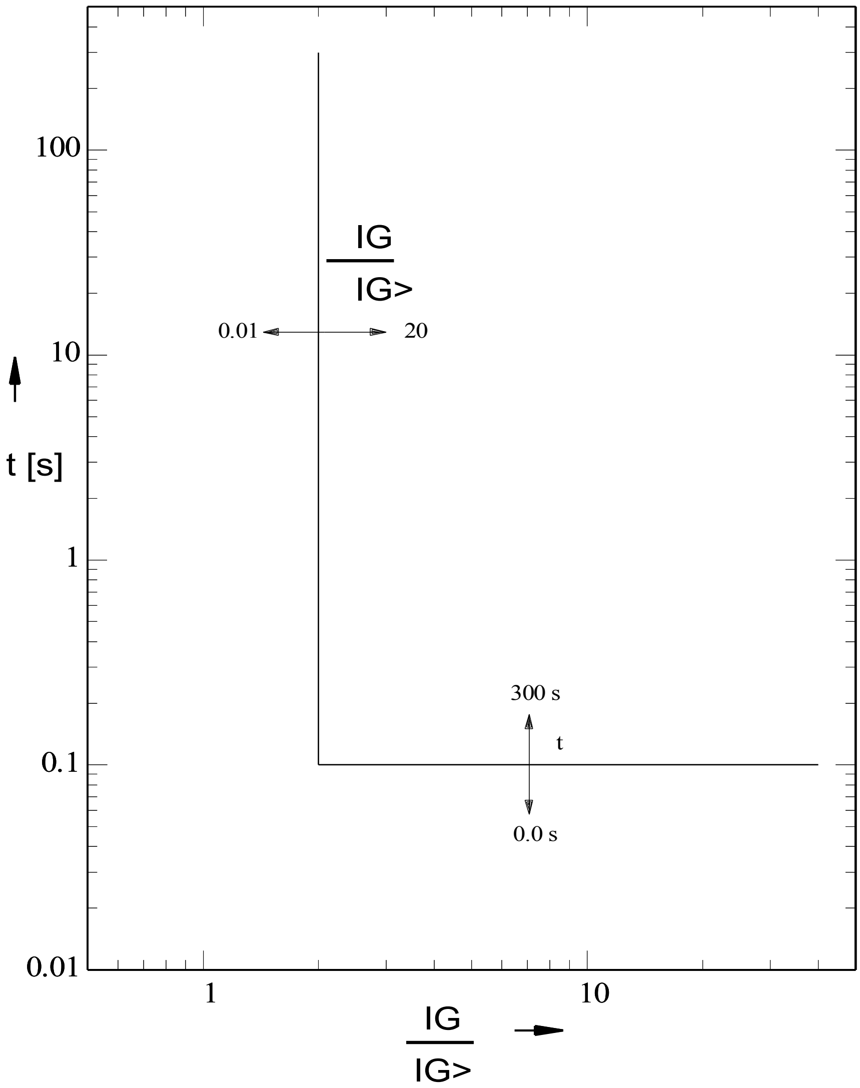
IG> = If the pickup value is exceeded, the module/element starts to time out to trip.

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

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

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

DEFT



IEC NINV

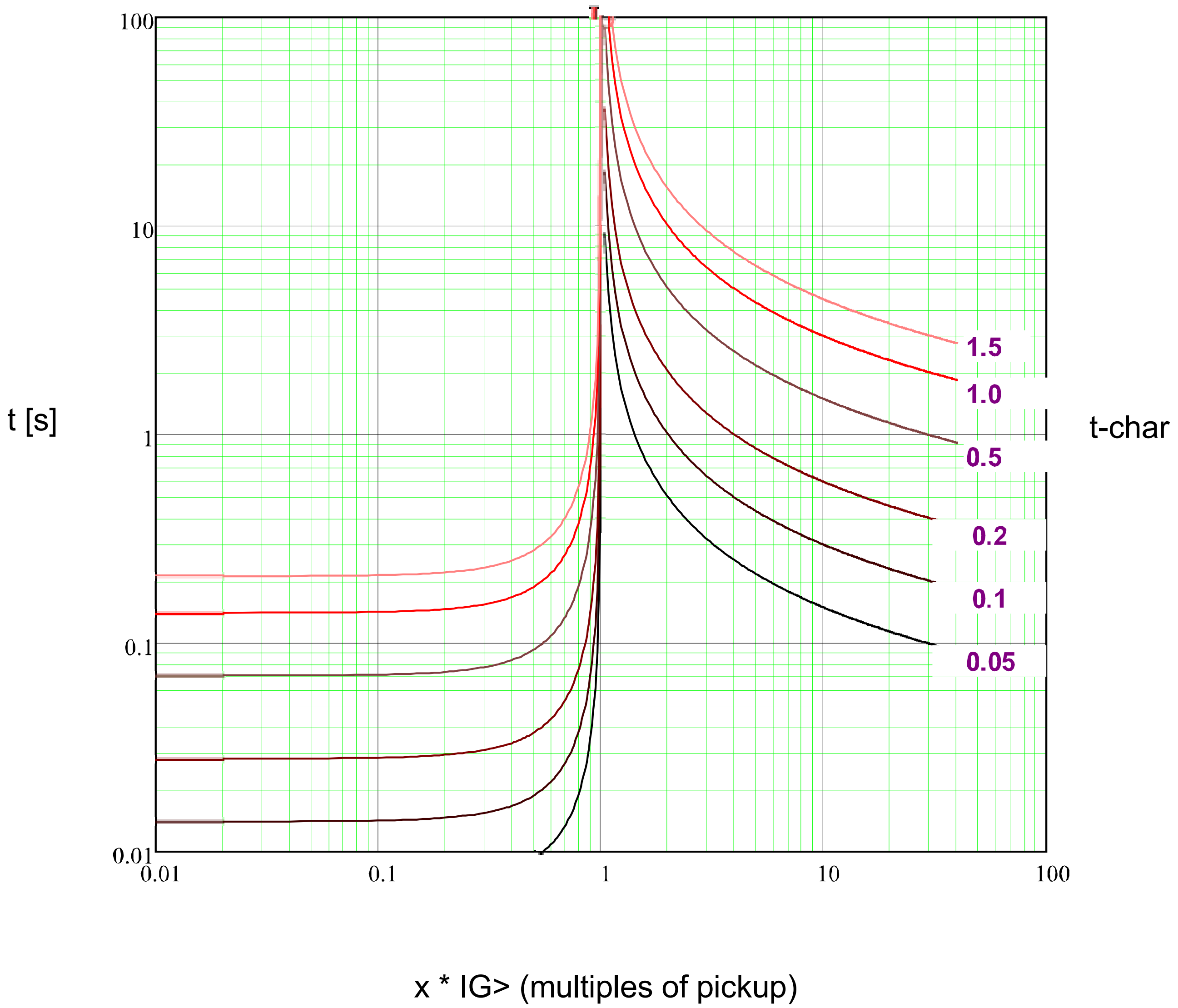
Notice!
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

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!

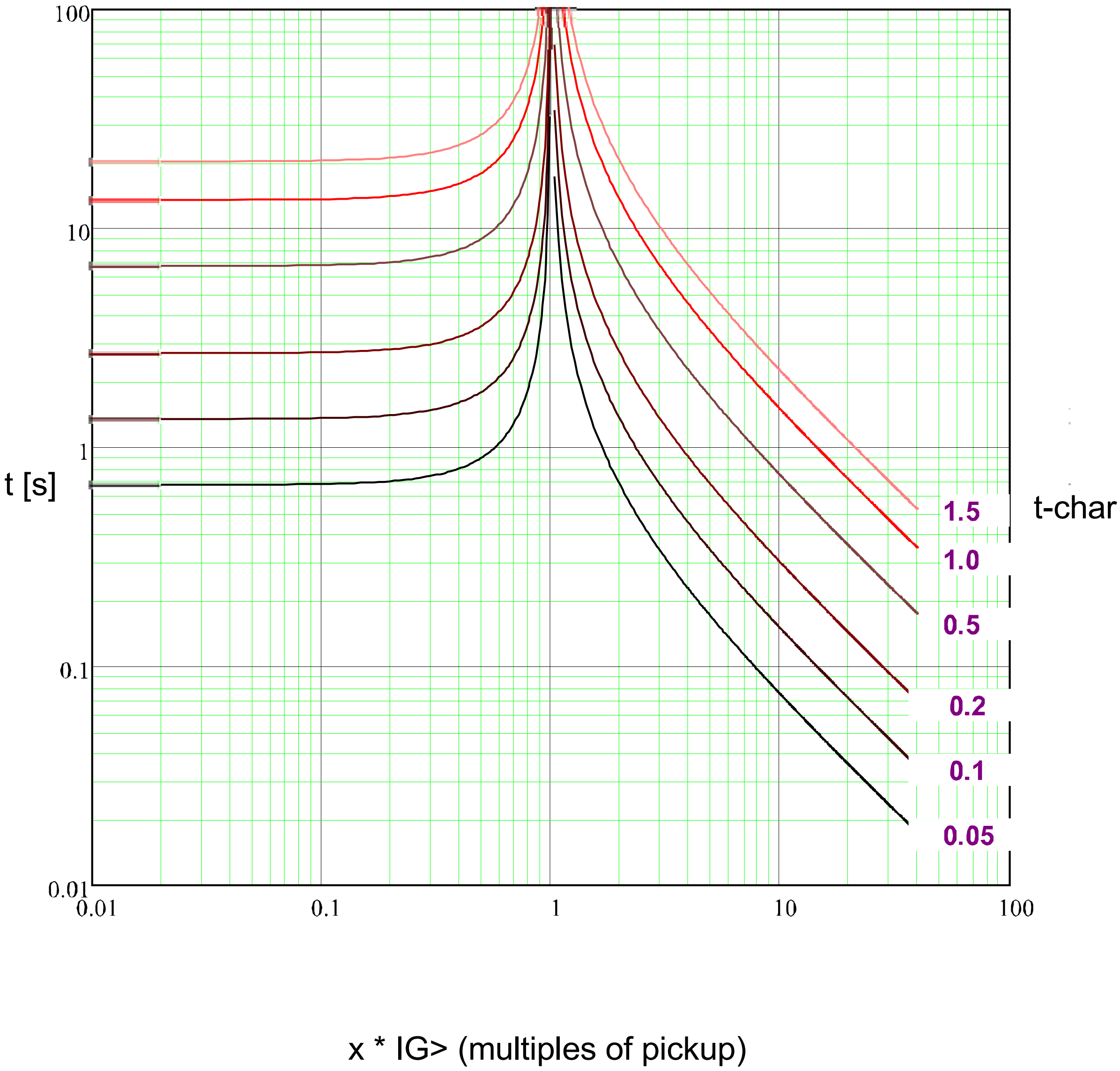
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

Reset

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

Trip

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



IEC LINV

Notice!

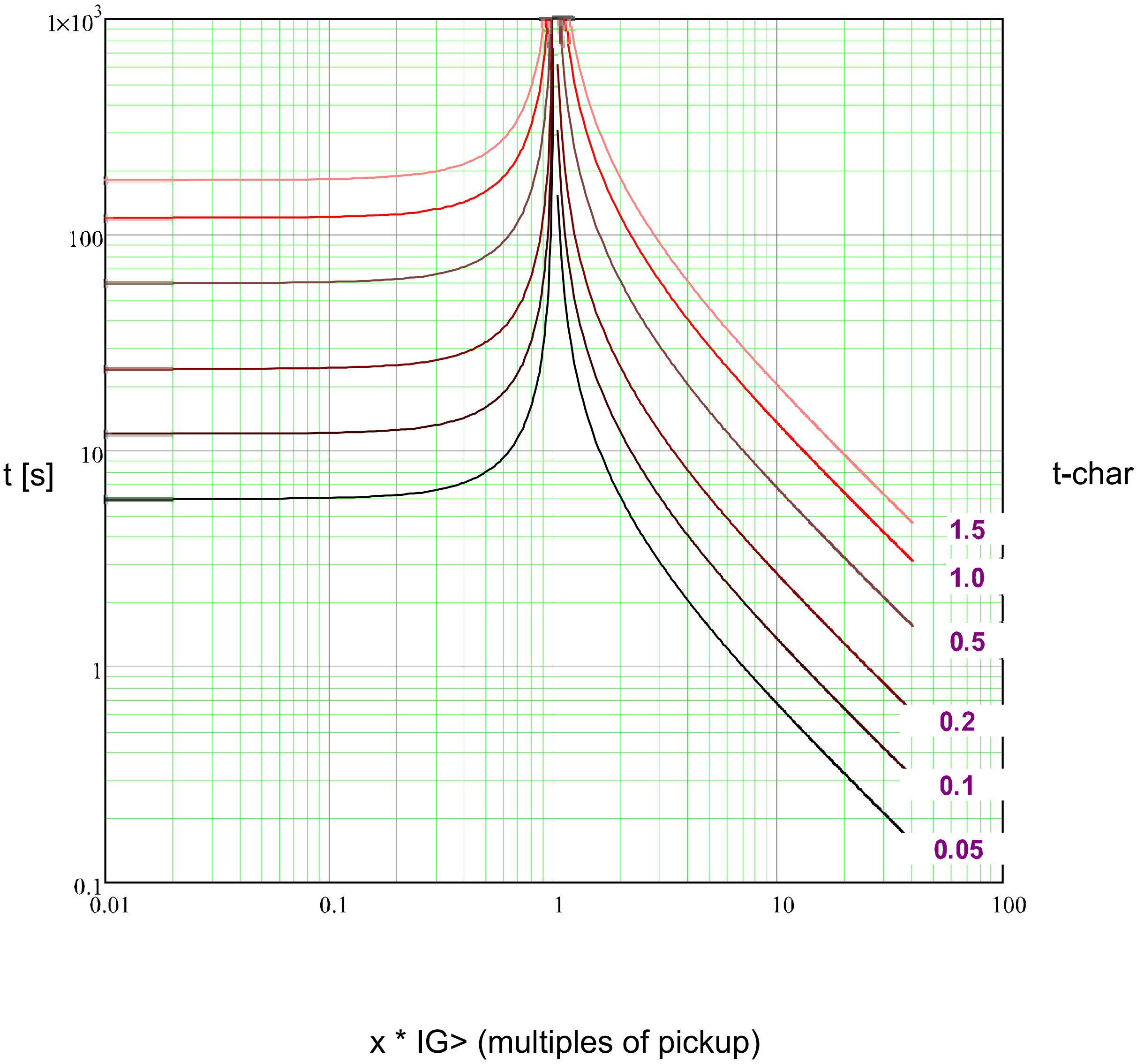
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

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!

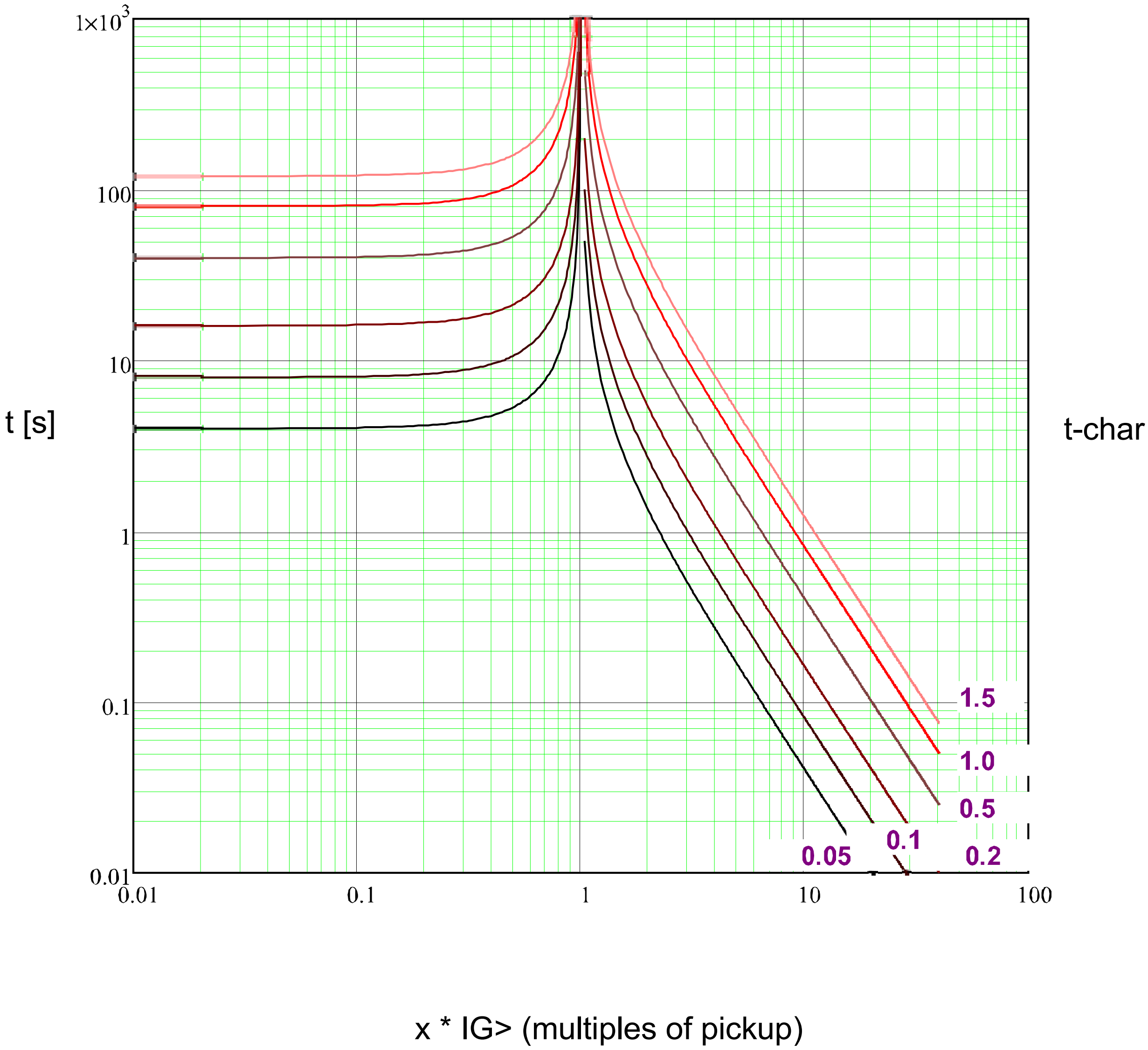
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

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!

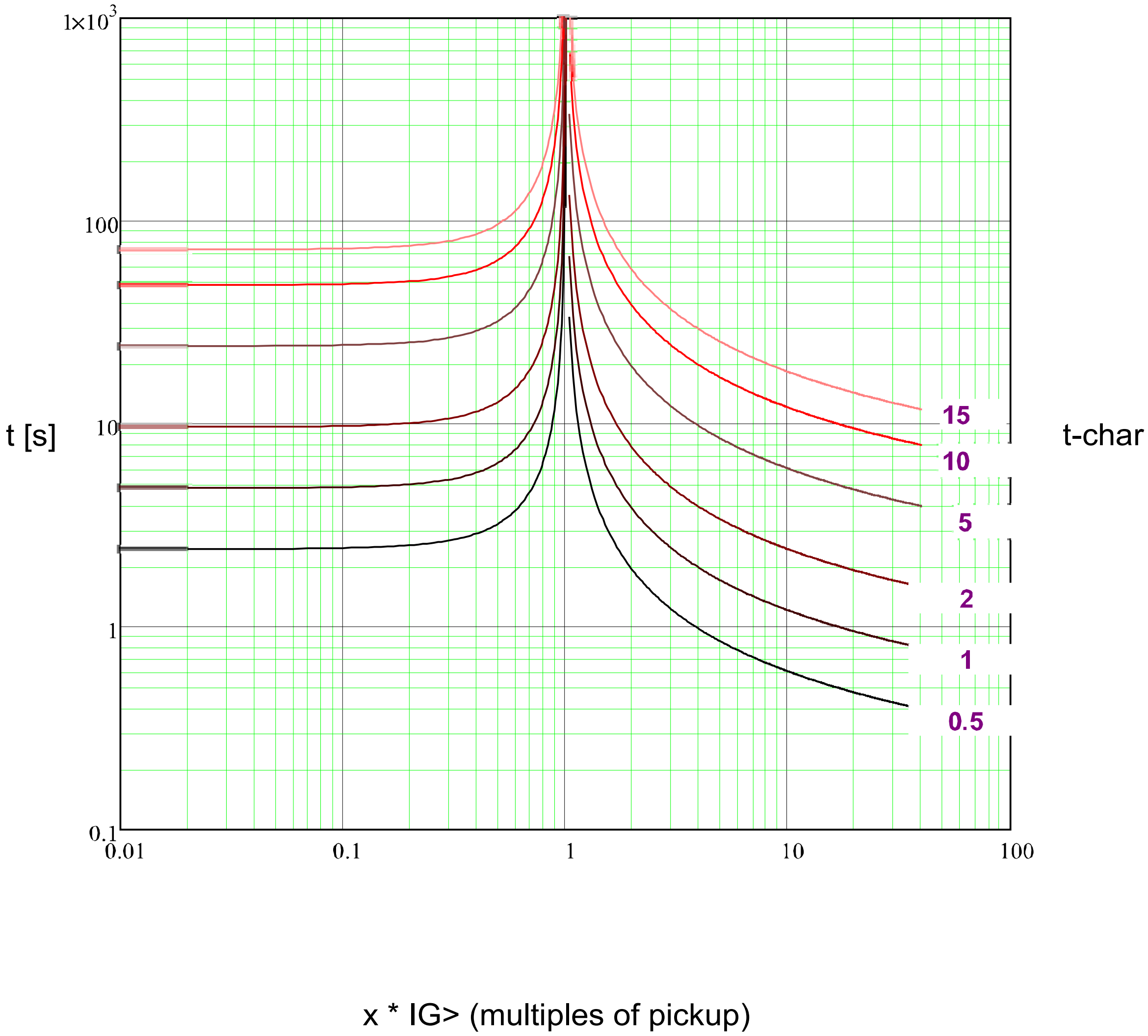
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

Reset

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

Trip

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



ANSI VINV

Notice!

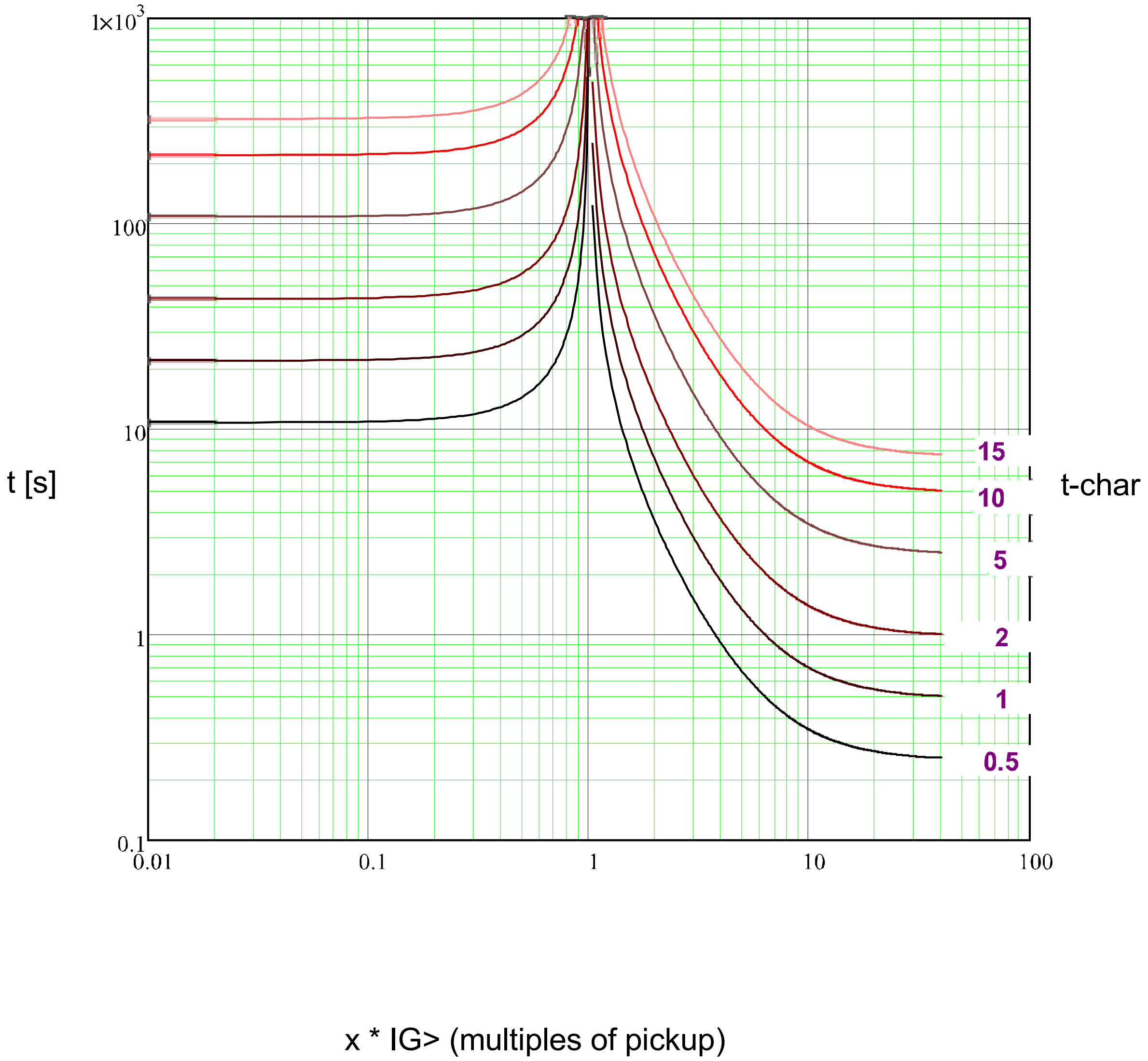
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

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!

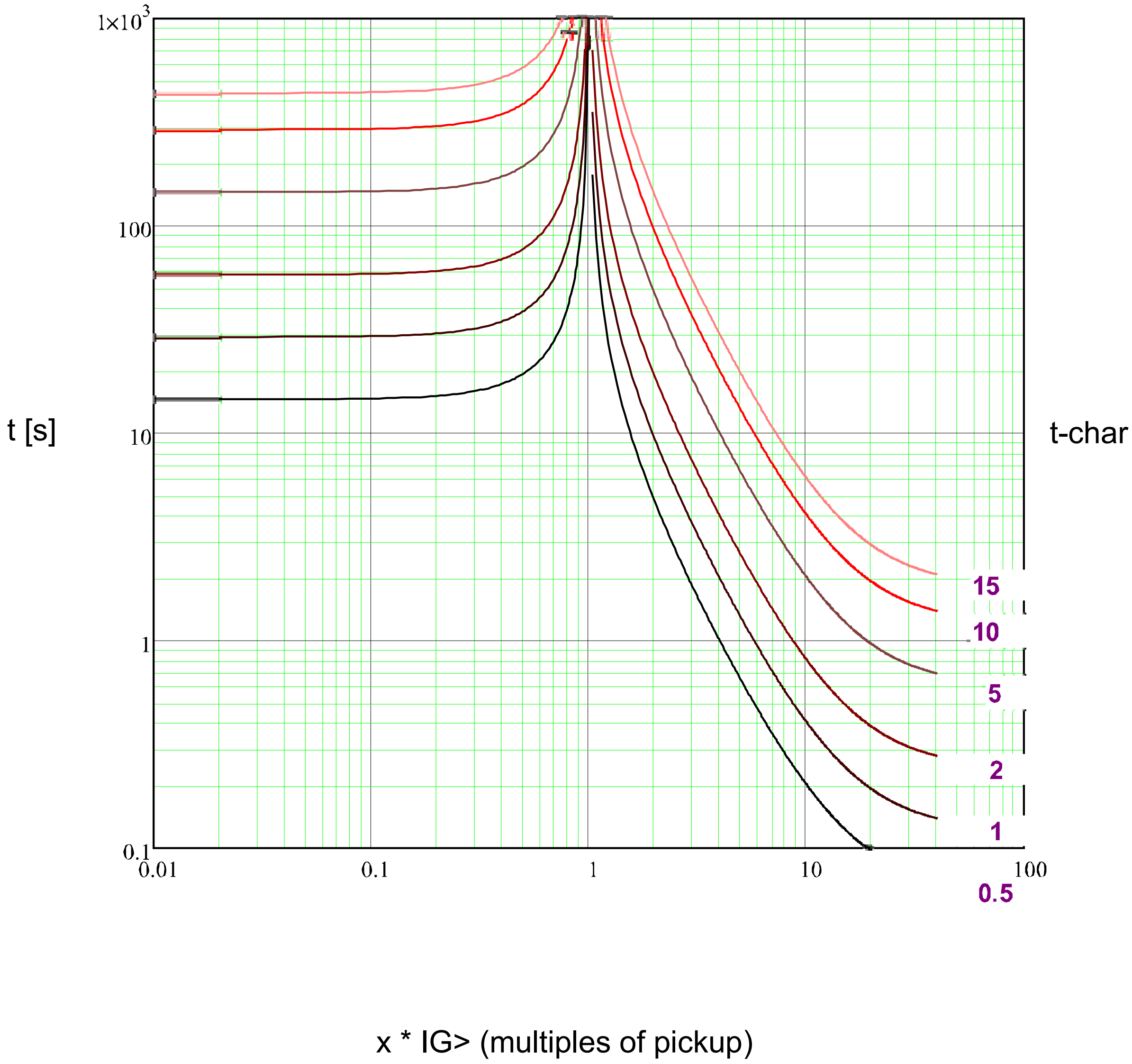
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

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.

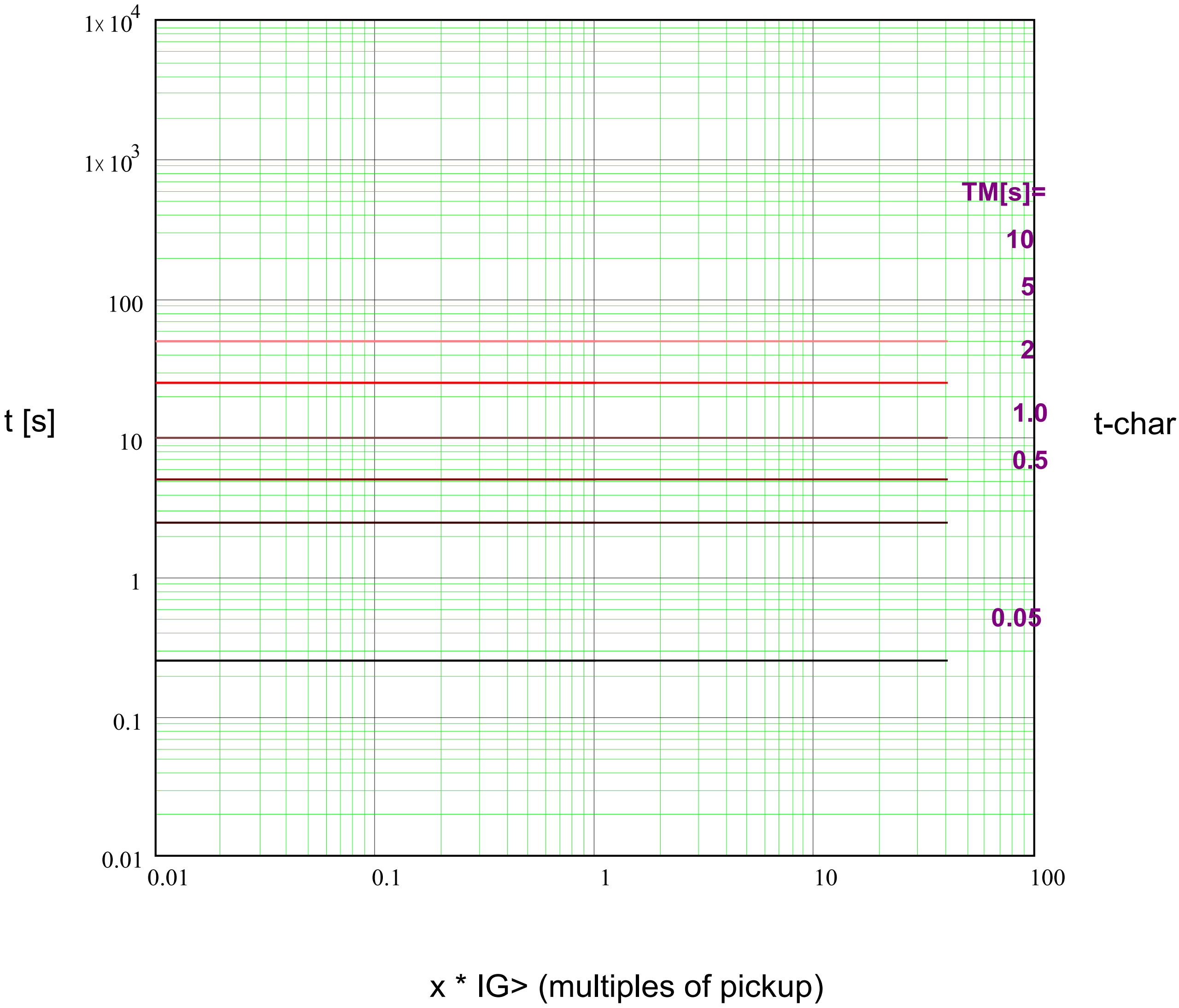
Reset

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

Trip

$$t = \frac{5}{\left(\frac{IG}{IGnom}\right)^0} * \text{t-char [s]}$$

$$t = 5 \ * \text{t-char [s]}$$



IT

Notice!

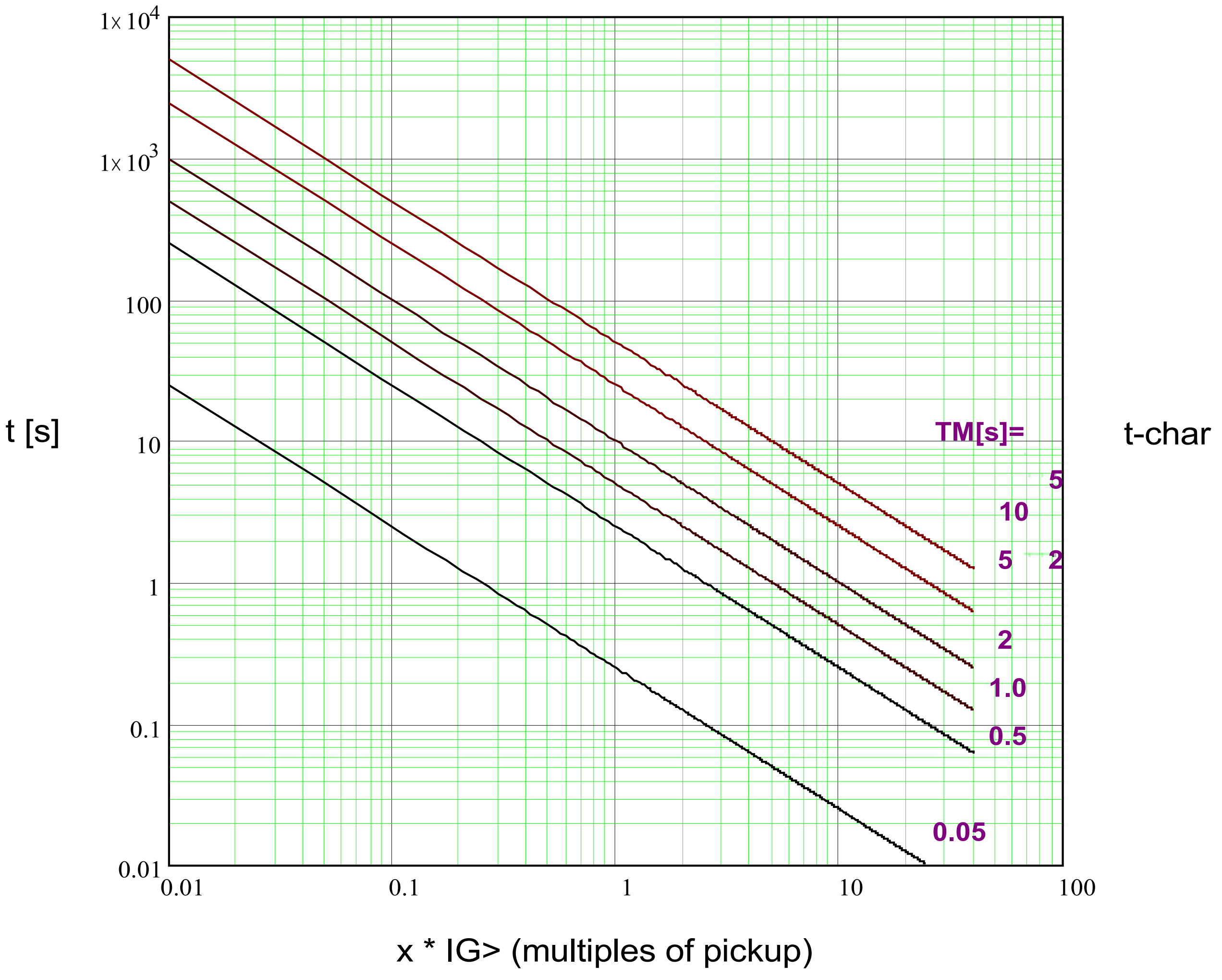
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

Reset

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

Trip

$$t = \frac{5*1^1}{\left(\frac{IG}{IGnom}\right)^1} \text{*t-char [s]}$$



I2T

Notice!

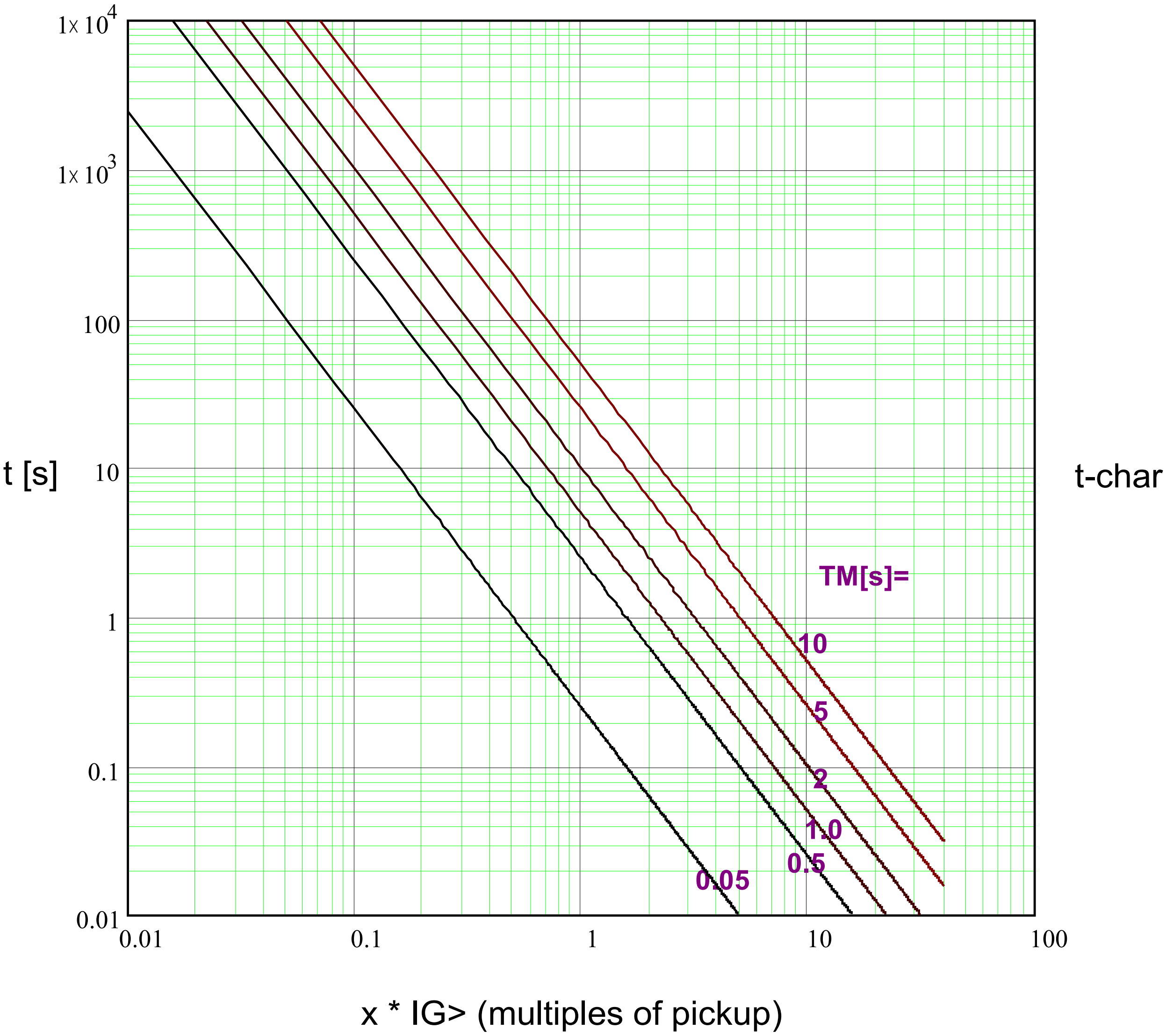
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

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!

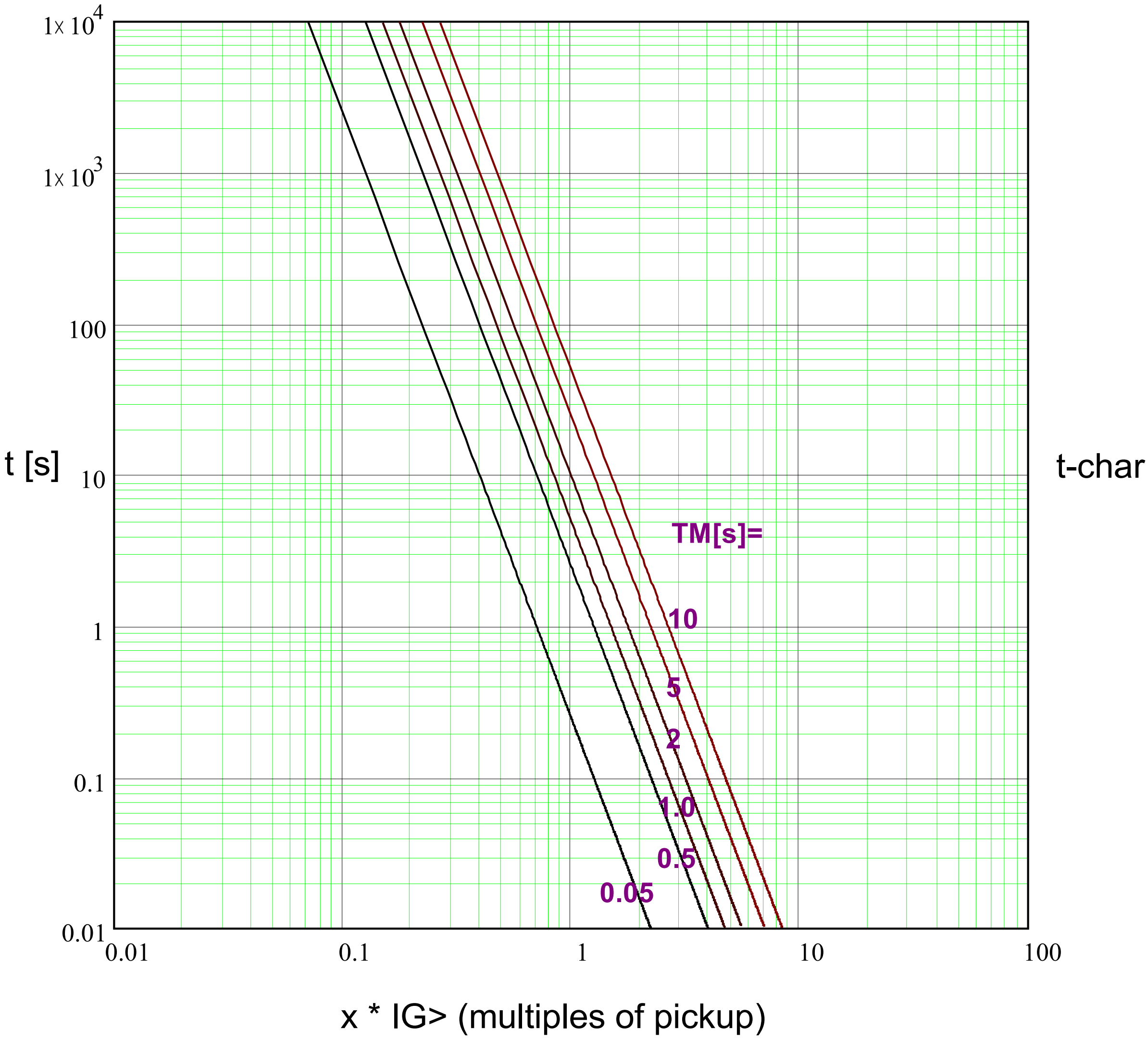
Various reset modes are available. Resetting via characteristic, delayed and instantaneous.

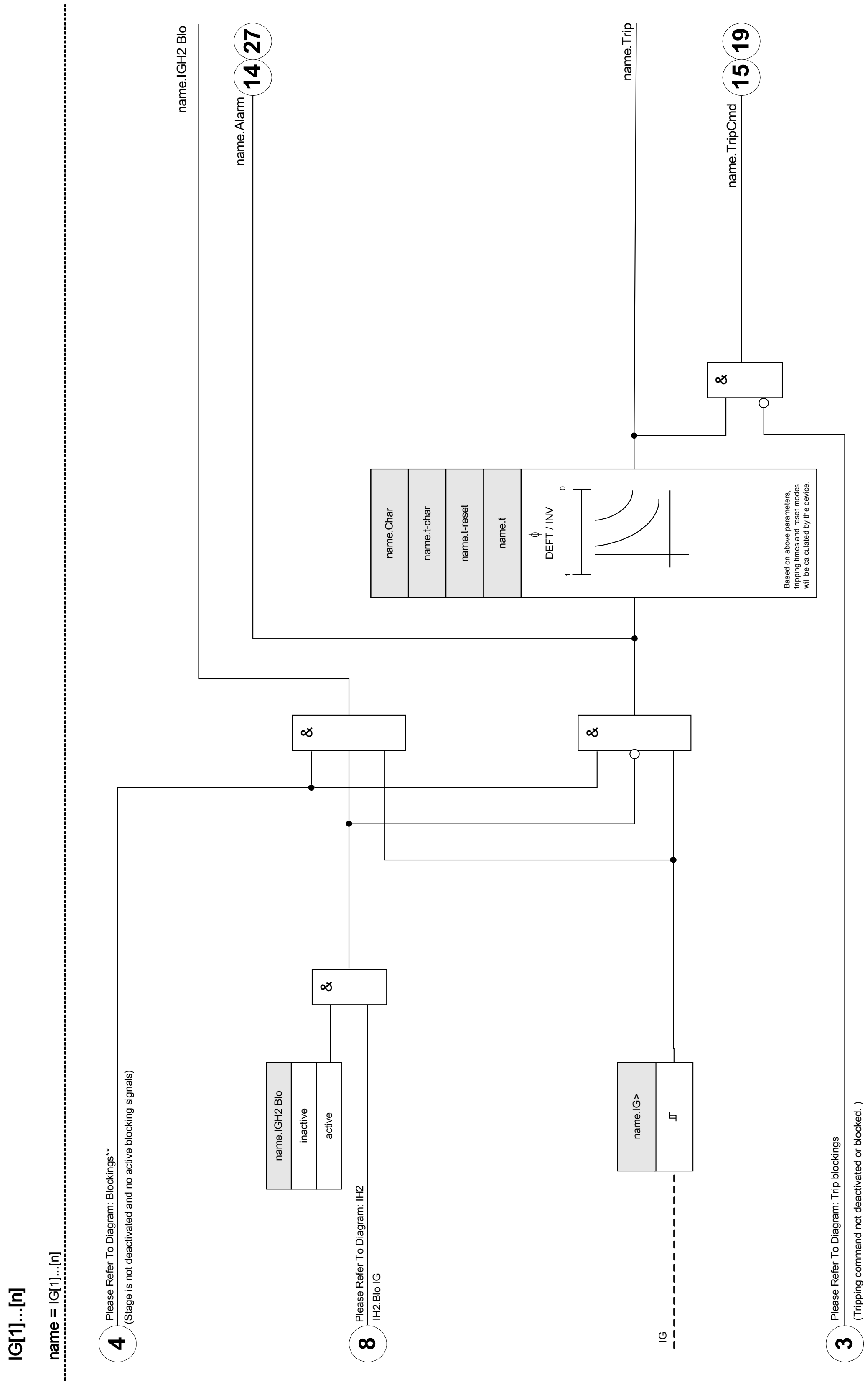
Reset

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

Trip

$$t = \frac{5 * 1^4}{\left(\frac{IG}{IGnom}\right)^4} * \text{t-char [s]}$$




IG[1]...[n]
name = IG[1]...[n]
4
Please Refer To Diagram: Blockings**
(Stage is not deactivated and no active blocking signals)
8
Please Refer To Diagram: IH2
IH2.Blo IG
name.IGH2 Blo
inactive
active
&
&
&
&
IG
name.IG>
name.IGH2 Blo
name.Alarm
14
27
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.Trip
name.TripCmd
15
19
3
Please Refer To Diagram: Trip blockings
(Tripping command not deactivated or blocked.)

Device Planning Parameters of the Ground Fault Protection

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

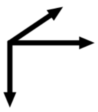
Global Protection Parameters of the Ground Fault Protection

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	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]]

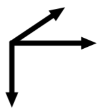
Parameter	*Description*	*Setting range*	*Default*	*Menu path*
AdaptSet 2	Assignment Adaptive Parameter 2	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /IG[1]]
AdaptSet 3	Assignment Adaptive Parameter 3	AdaptSet	-.-	[Protection Para /Global Prot Para /I-Prot /IG[1]]
AdaptSet 4	Assignment Adaptive 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]: inactive IG[4]: inactive	[Protection Para /<n> /I-Prot /IG[1]]
ExBlo Fc	Activate (allow) or inactivate (disallow) blocking of the module/stage. This parameter is only effective if a signal is assigned to the corresponding global protection parameter. If the signal becomes true, those modules/stages are blocked that are parametrized "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 parametrized "Ex rev Interl Fc = active".	inactive, active	inactive	[Protection Para /<n> /I-Prot /IG[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 /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 parametrized "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	measured	[Protection Para /<n> /I-Prot /IG[1]]
Measuring method	Measuring method: fundamental or rms	Fundamental, True RMS	Fundamental	[Protection Para /<n> /I-Prot /IG[1]]
IG> 	If the pickup value is exceeded, the module/stage will be started. Only available if: Characteristic = DEFT Or Characteristic = INV.	0.02 - 20.00In	IG[1]: 1.00In IG[2]: 0.02In IG[3]: 0.02In IG[4]: 0.02In	[Protection Para /<n> /I-Prot /IG[1]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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]: 0.50s 1.00s 1.00s 1.00s 1.00s IG[2]: 0.00s IG[3]: 0.00s IG[4]: 0.00s	[Protection Para /<n> /I-Prot /IG[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 /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]]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
t-reset 	Reset time for intermittent phase failures (INV characteristics only). Only available if:Reset Mode = t-delay.	0.00 - 60.00s	0.00s	[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]]

Name	Description	Assignment via
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

Commissioning: Ground Fault Protection – Non-directional [50N/G, 51N/G]

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

I< - Undercurrent [37]

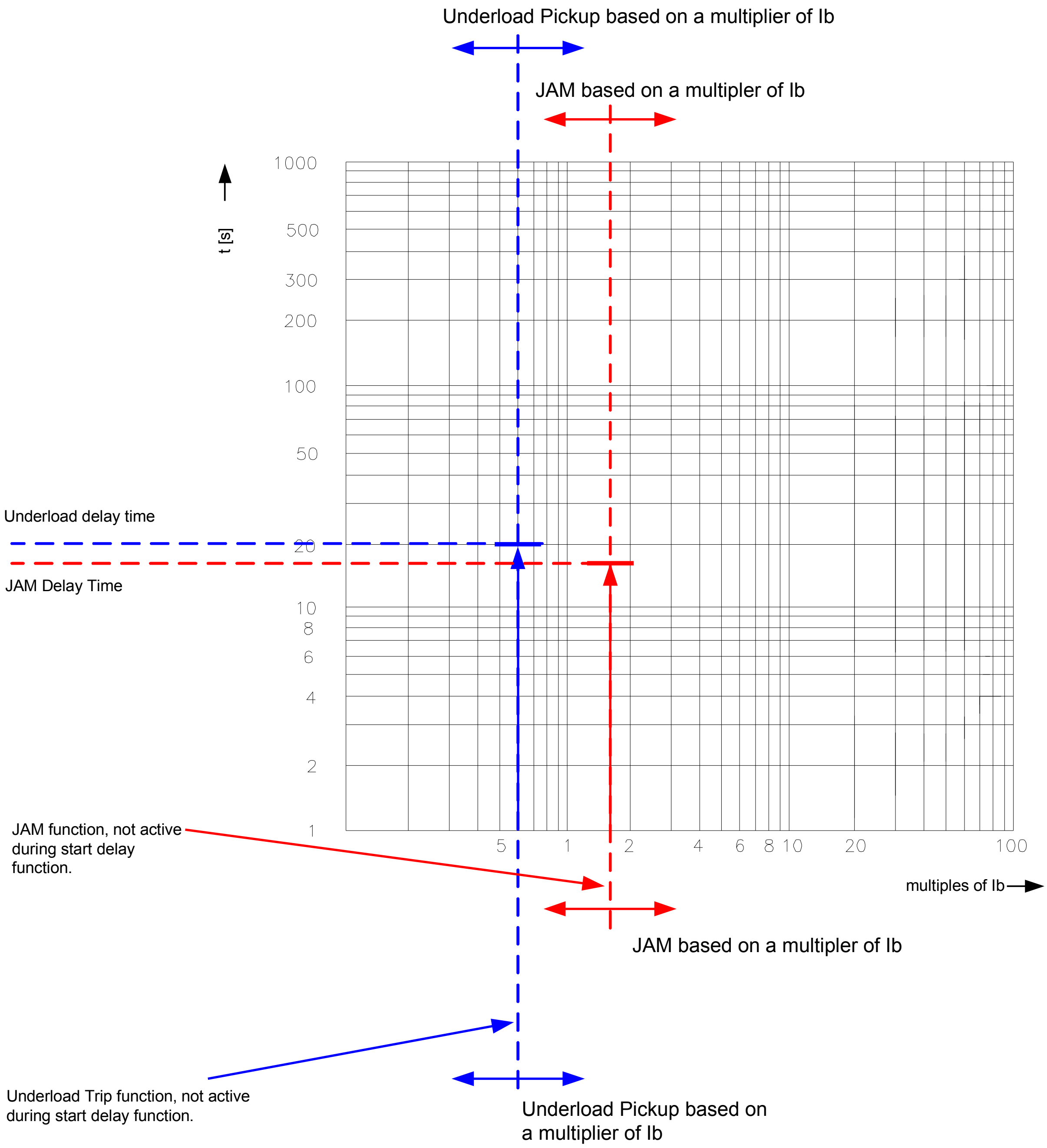
Available Elements:
I<[1] ,I<[2] ,I<[3]

Functional Description

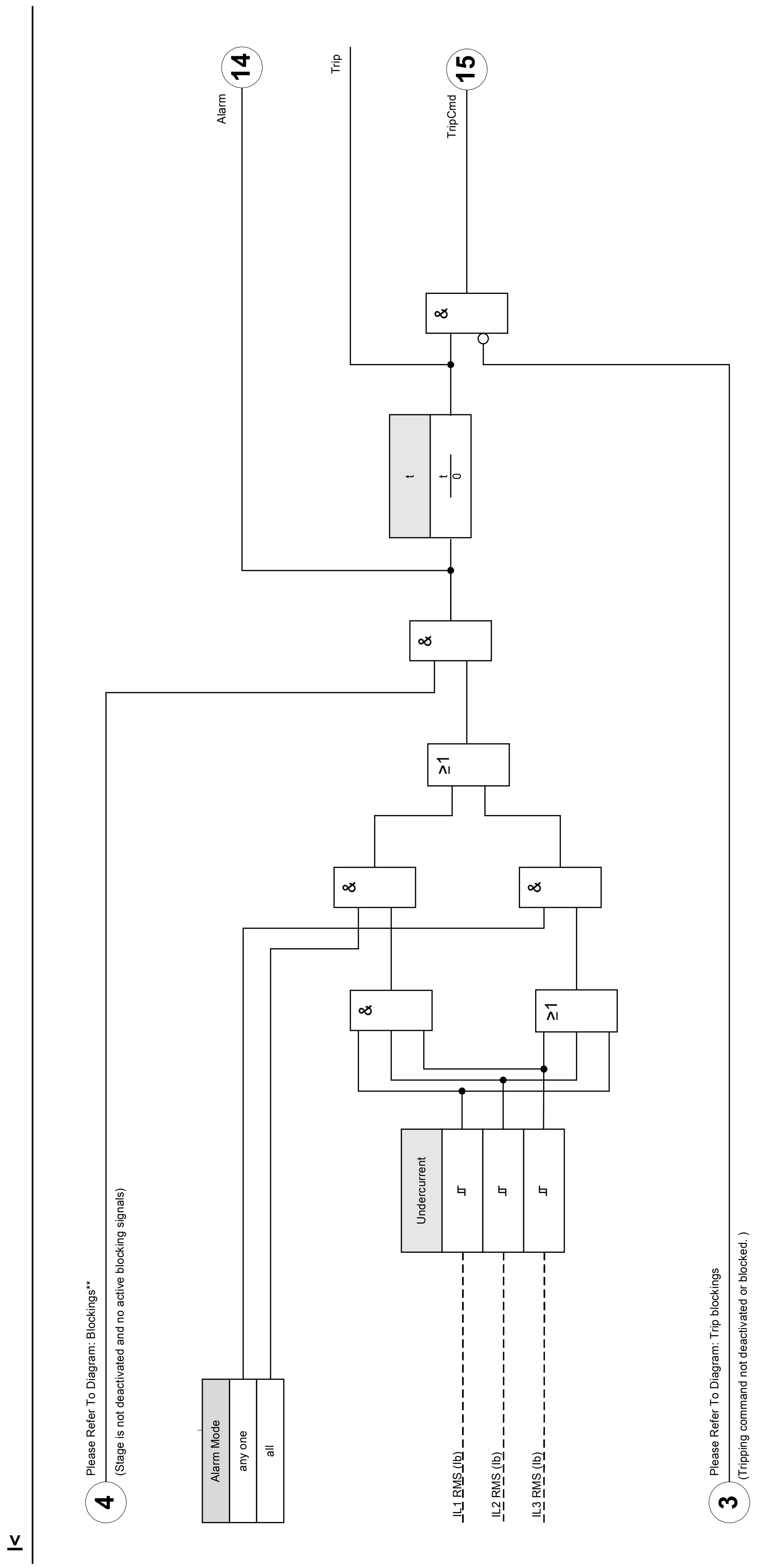
When the motor is running, a current reduction might indicate a malfunction in the load. *Underload* protection recognizes mechanical problems, such as a blocked flow or loss of back pressure in a pump, or a broken drive belt or drive shaft.

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.


I<
4
Please Refer To Diagram: Blockings**
(Stage is not deactivated and no active blocking signals)
Alarm Mode
any one
all
IL1 RMS (Ib)
IL2 RMS (Ib)
IL3 RMS (Ib)
Undercurrent
3
Please Refer To Diagram: Trip blockings
(Tripping command not deactivated or blocked.)
&
≥1
t
Alarm
14
Trip
TripCmd
15

Device Planning Parameters of the Underload Module

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

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]]

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 parametrized "ExBlo 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 parametrized "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	0.4 - 1200.0s	I<[1]: 2.0s I<[2]: 10.0s I<[3]: 0.4s	[Protection Para /<n> /I< /I<[1]]

Underload Module Input States

Name	*Description*	*Assignment via*
ExBlo1-I	Module input state: External blocking 1	[Protection Para /Global Prot Para /I< /I<[1]]
ExBlo2-I	Module input state: External blocking 2	[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	[]

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; and
- Testing the fallback ratio.

Necessary means:
- 3-phase current source;
- Ammeter; and
- 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 taken from Technical Data.

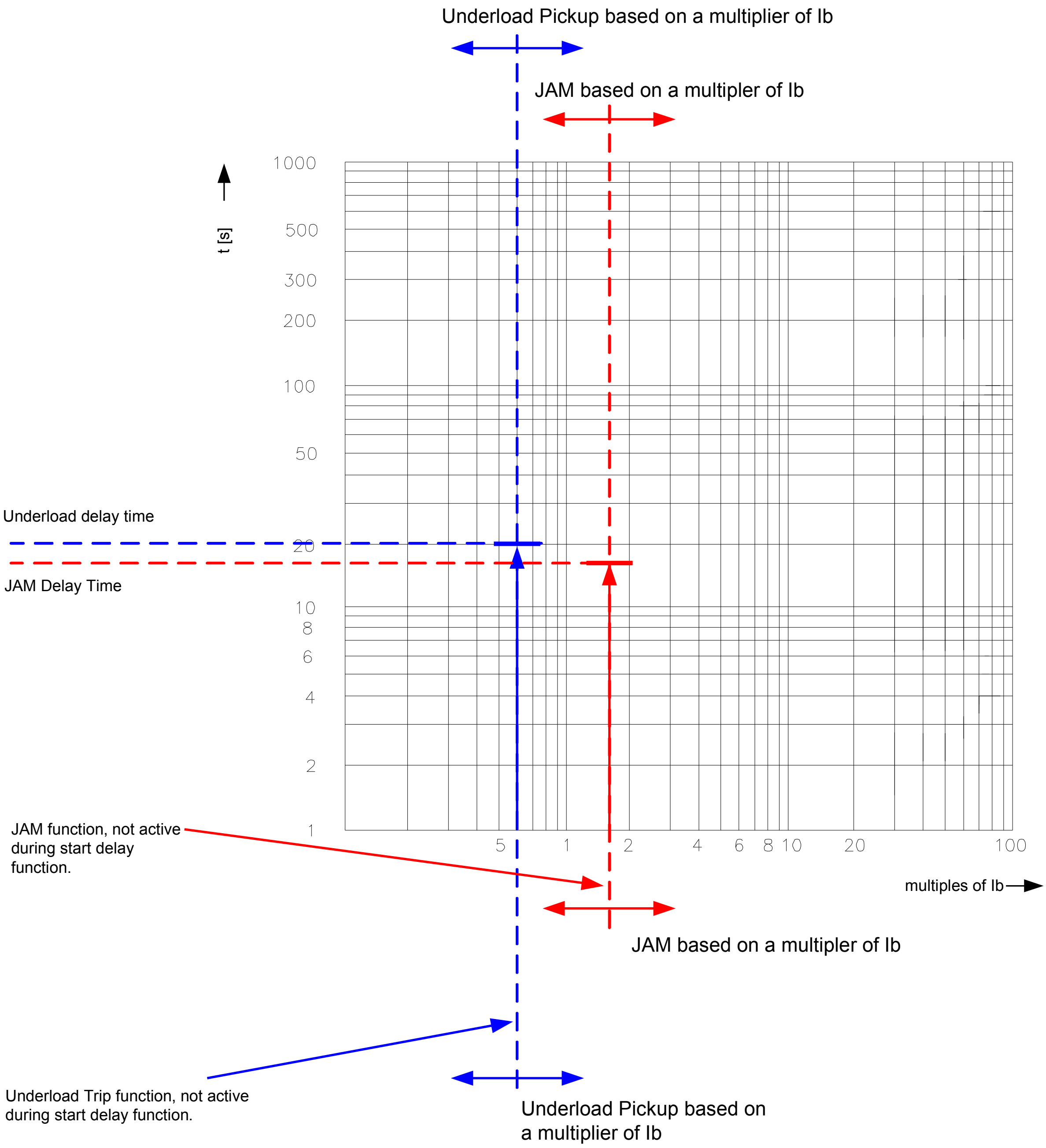
JAM [51LR]

Elements
Jam[1] ,Jam[2]

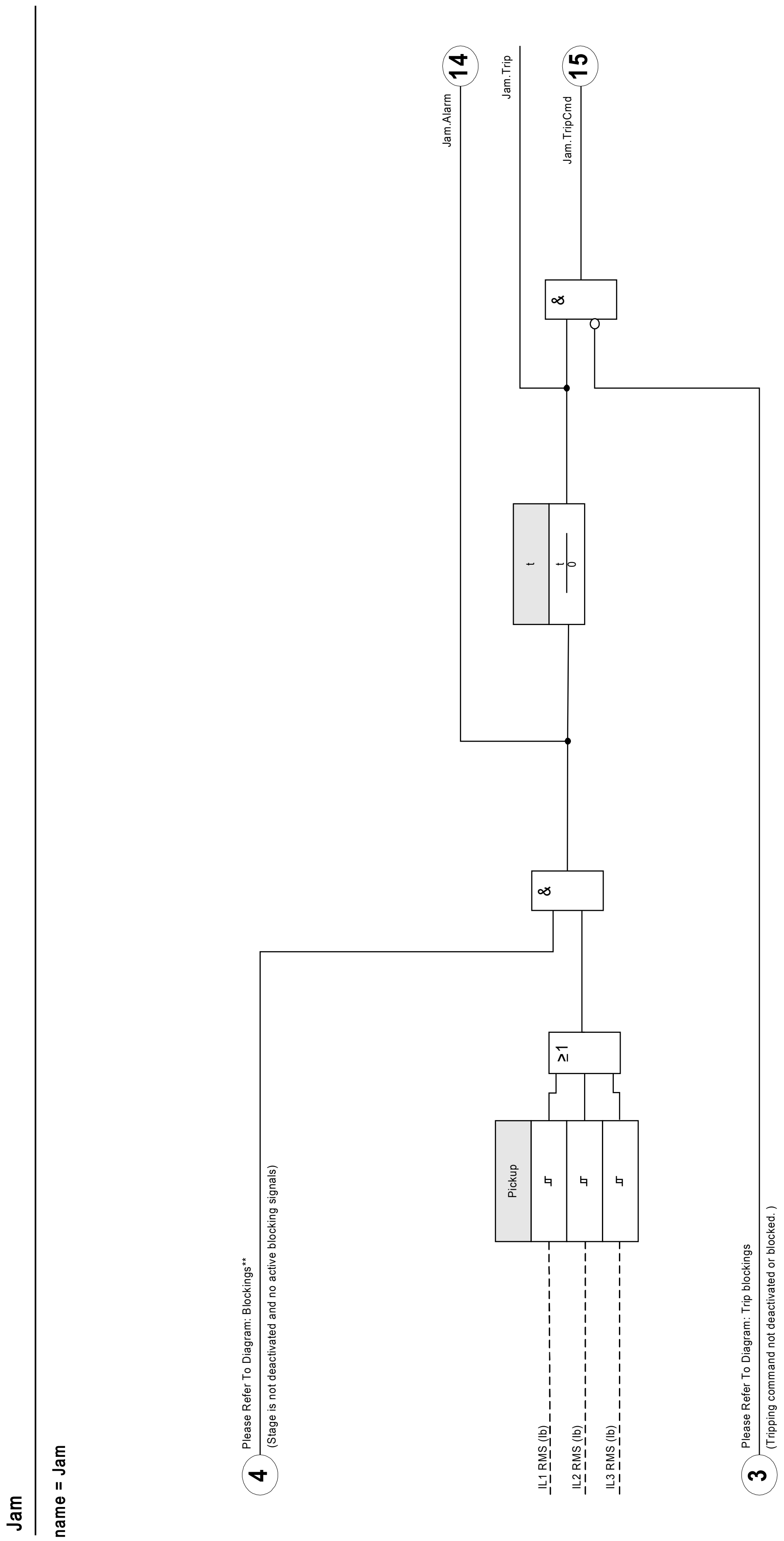
Functional Description

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
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
Jam.Alarm
Jam.Trip
&
Jam.TripCmd
14
15
4
3
Please Refer To Diagram: Trip blockings
(Tripping command not deactivated or blocked.)

Device Planning Parameters for JAM Protection

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

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 parametrized "ExBlo 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	Jam[1]: inactive Jam[2]: 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 parametrized "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]: 10Ib Jam[2]: 5Ib	[Protection Para /<n> /JAM-Prot /Jam[1]]
t	Tripping delay	0.0 - 1200.0s	Jam[1]: 2.0s Jam[2]: 10.0s	[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]]

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

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; and
- Testing the fallback ratio.

Necessary means:

- 3-phase current source;
- Ammeter; and
- 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 relay 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.

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).

MLS - Mechanical Load Shedding

Available elements:
MLS

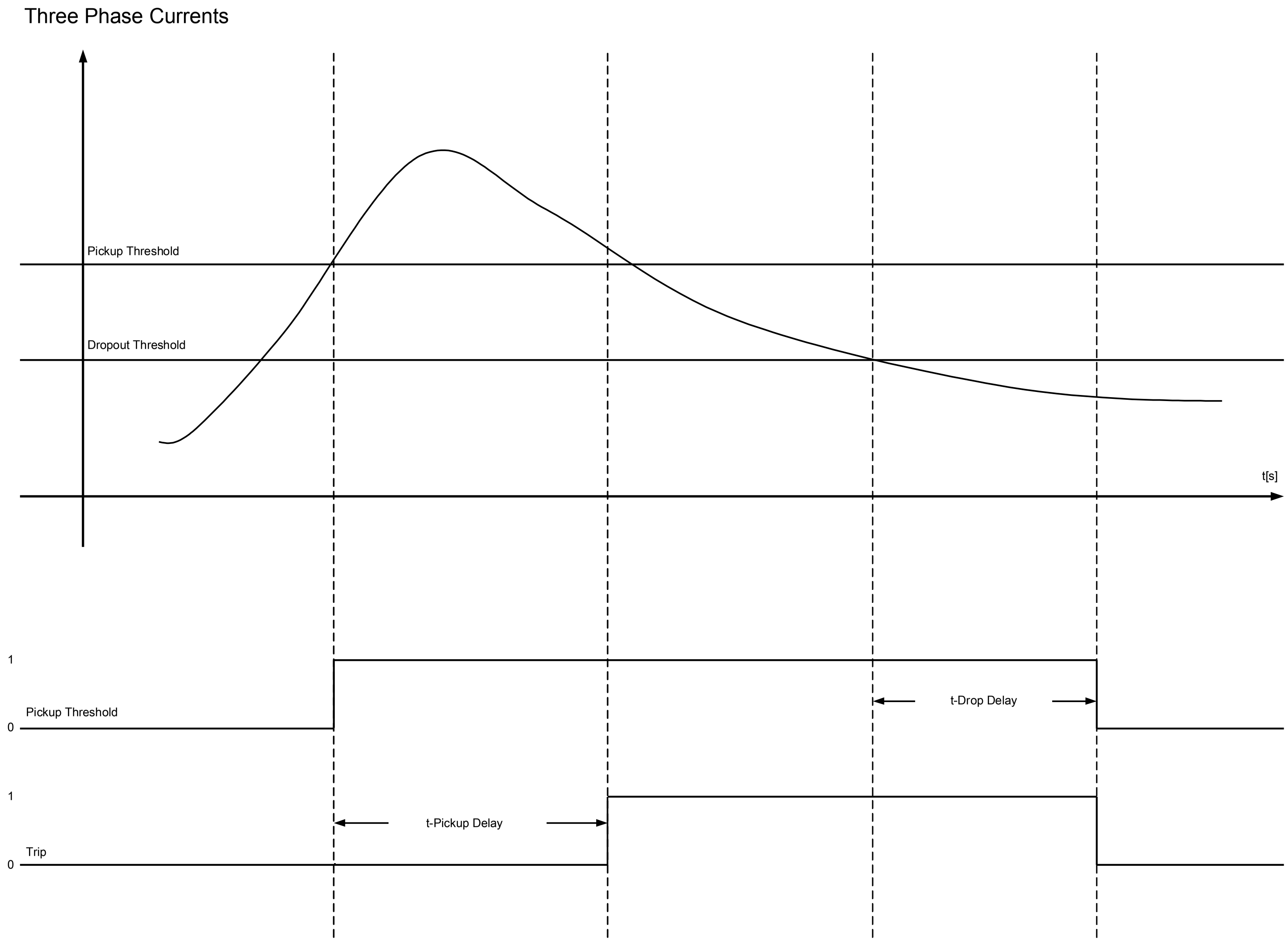
Functional Description

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.



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 parametrized "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]

Parameter	Description	Setting range	Default	Menu path
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 thresholds and
- Testing the delay times.

Necessary means:

- 3-phase current source;
- Ammeter; and
- 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.

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.

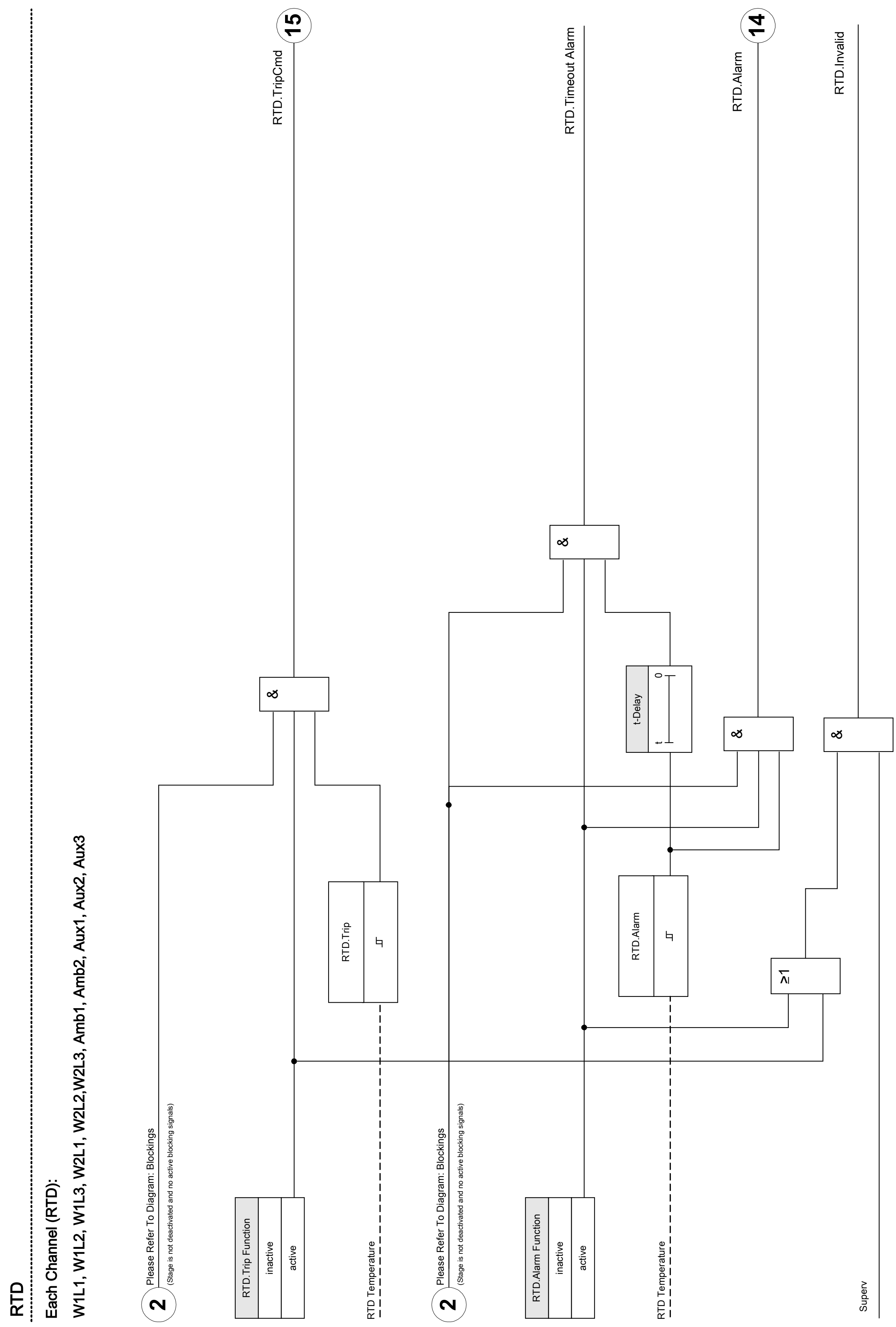
Each individual »Alarm Function« has a threshold setting range and can be individually enabled or disabled. It also has a timeout delay. The timeout flag will be set when the thermal capacity used has been above the alarm threshold for the timeout delay. The alarm threshold can be set much lower than 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
2
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
RTD.Trip Function
inactive
active
RTD Temperature
RTD.Trip
&
RTD.TripCmd
15
2
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
RTD.Alarm Function
inactive
active
RTD Temperature
RTD.Alarm
t-Delay
t
0
&
RTD.Timeout Alarm
&
RTD.Alarm
14
≥1
&
RTD.Invalid
Superv

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]
Developer only: wd	all channels from 0 to "Group1MaxChannel" are members of group 1	0 - 12	6	[Protection Para /Global Prot Para /Temp-Prot /RTD]
Developer only: mb	All channels from "Group1MaxChannel" to "Group2MaxChannel" are members of group 2.	0 - 12	8	[Protection Para /Global Prot Para /Temp-Prot /RTD]
Developer 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 parametrized "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 parametrized "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]

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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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]
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	1 min	[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]

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

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

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

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

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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
Aux Alarm Function	Auxiliary Alarm Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /Aux]
Aux Trip Function	Auxiliary Trip Function	inactive, active	active	[Protection Para /<n> /Temp-Prot /RTD /Aux]
Aux Alarm	Auxiliary Threshold for Temperature Alarm Only available if: Device planning: Alarm Function = use.	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. Only available if: Device planning: Alarm Function = use.	0 - 360min	1min	[Protection Para /<n> /Temp-Prot /RTD /Aux]
Aux Trip	Auxiliary Threshold for Temperature Trip Only available if: Device planning: Trip Function = use.	0 - 200°C	100°C	[Protection Para /<n> /Temp-Prot /RTD /Aux]
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]

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

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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.	0 - 200°C	80°C	[Protection Para /<n> /Temp-Prot /RTD /LoadBear]
Load Bearing t-Delay	Load 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 /LoadBear]
LoadBear Trip	Load Bearing Threshold for Temperature Trip Only available if: Device planning: Trip Function = use.	0 - 200°C	80°C	[Protection Para /<n> /Temp-Prot /RTD /LoadBear]
Function	Permanent activation or deactivation of module/stage.	inactive, active	inactive	[Protection Para /<n> /Temp-Prot /RTD /Voting1]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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]
Windg 6	Winding 6	no, yes	yes	[Protection Para /<n> /Temp-Prot /RTD /Voting1]

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
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]
Aux	Auxiliary	no, yes	no	[Protection Para /<n> /Temp-Prot /RTD /Voting1]
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]

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

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

Name	*Description*
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	MotBear 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	LoadBear 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	LoadBear 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)
Aux Trip	Auxiliary Signal: Trip
Aux Alarm	Auxiliary Alarm RTD Temperature Protection
Aux Timeout Alarm	Auxiliary Timeout Alarm
Aux Invalid	Auxiliary Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
Trip all Windg	Trip all Windings
Alarm all Windg	Alarm all Windings
Timeout Alarm all Windg	Timeout Alarm all Windg
Windg Invalid	Winding Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
Trip all Motor Bear	Trip all Motor Bearings
Alarm all Motor Bear	Alarm all Motor Bearings
Timeout Alarm all Motor Bear	Timeout Alarm all Motor Bearings
MotBear Invalid	Motor Bearing Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
Trip all Load Bear	Trip all Load Bearings
Alarm all Load Bear	Alarm all Load Bearings
Timeout Alarm all Load Bear	Timeout Alarm all Load Bearings
LoadBear Invalid	Load Bearing 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

Name	*Description*
Trip Group 2	Trip Group 2
Timeout Alarm	Alarm timeout expired

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]
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 auxiliary 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 auxiliary temperature trips since last reset.	0	0 - 65535	[Operation /History /TripCr]

Value	*Description*	*Default*	*Size*	*Menu path*
nChannelFails	Number of RTD channel failures.	0	0 - 65535	[Operation /History /AlarmCr]

URTD - Temperature Protection Interface

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
Aux Superv	Signal: Supervision Channel Aux
Superv	Signal: URTD Supervision Channel
active	Signal: URTD active

URTD Module Statistics

Value	*Description*	*Menu path*
Windg1 max	Winding 1 Maximum Value	[Operation /Statistics /URTD]
Windg1 avg	Winding 1 Average Value	[Operation /Statistics /URTD]
Windg1 min	Winding 1 Minimum Value	[Operation /Statistics /URTD]
Windg2 max	Winding 2 Maximum Value	[Operation /Statistics /URTD]

Value	*Description*	*Menu path*
Windg2 avg	Winding 2 Average Value	[Operation /Statistics /URTD]
Windg2 min	Winding 2 Minimum Value	[Operation /Statistics /URTD]
Windg3 max	Winding 3 (blank_k) Maximum Value	[Operation /Statistics /URTD]
Windg3 avg	Winding 3 Average Value	[Operation /Statistics /URTD]
Windg3 min	Winding 3 Minimum Value	[Operation /Statistics /URTD]
Windg4 max	Winding 4 Maximum Value	[Operation /Statistics /URTD]
Windg4 avg	Winding 4 Average Value	[Operation /Statistics /URTD]
Windg4 min	Winding 4 Minimum Value	[Operation /Statistics /URTD]
Windg5 max	Winding 5 Maximum Value	[Operation /Statistics /URTD]
Windg5 avg	Winding 5 Average Value	[Operation /Statistics /URTD]
Windg5 min	Winding 5 Minimum Value	[Operation /Statistics /URTD]
Windg6 max	Winding 6 Maximum Value	[Operation /Statistics /URTD]
Windg6 avg	Winding 6 Average Value	[Operation /Statistics /URTD]

Value	*Description*	*Menu path*
Windg6 min	Winding 6 Minimum Value	[Operation /Statistics /URTD]
MotBear1 max	Motor Bearing 1 Maximum Value	[Operation /Statistics /URTD]
MotBear1 avg	Motor Bearing 1 Average Value	[Operation /Statistics /URTD]
MotBear1 min	Motor Bearing 1 Minimum Value	[Operation /Statistics /URTD]
MotBear2 max	Motor Bearing 2 Maximum Value	[Operation /Statistics /URTD]
MotBear2 avg	Motor Bearing 2 Average Value	[Operation /Statistics /URTD]
MotBear2 min	Motor Bearing 2 Minimum Value	[Operation /Statistics /URTD]
LoadBear1 max	Load Bearing 1 Maximum Value	[Operation /Statistics /URTD]
LoadBear1 avg	Load Bearing 1 Average Value	[Operation /Statistics /URTD]
LoadBear1 min	Load Bearing 1 Minimum Value	[Operation /Statistics /URTD]
LoadBear2 max	Load Bearing 2 Maximum Value	[Operation /Statistics /URTD]
LoadBear2 avg	Load Bearing 2 Average Value	[Operation /Statistics /URTD]
LoadBear2 min	Load Bearing 2 Minimum Value	[Operation /Statistics /URTD]

Value	*Description*	*Menu path*
Aux max	Auxiliary Maximum Value	[Operation /Statistics /URTD]
Aux avg	Auxiliary Average Value	[Operation /Statistics /URTD]
Aux min	Auxiliary Minimum Value	[Operation /Statistics /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]
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]

Value	Description	Menu path
LoadBear1	Load Bearing 1	[Operation /Measured values /URTD]
LoadBear2	LoadBear 2	[Operation /Measured values /URTD]
Aux	Auxiliary	[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.

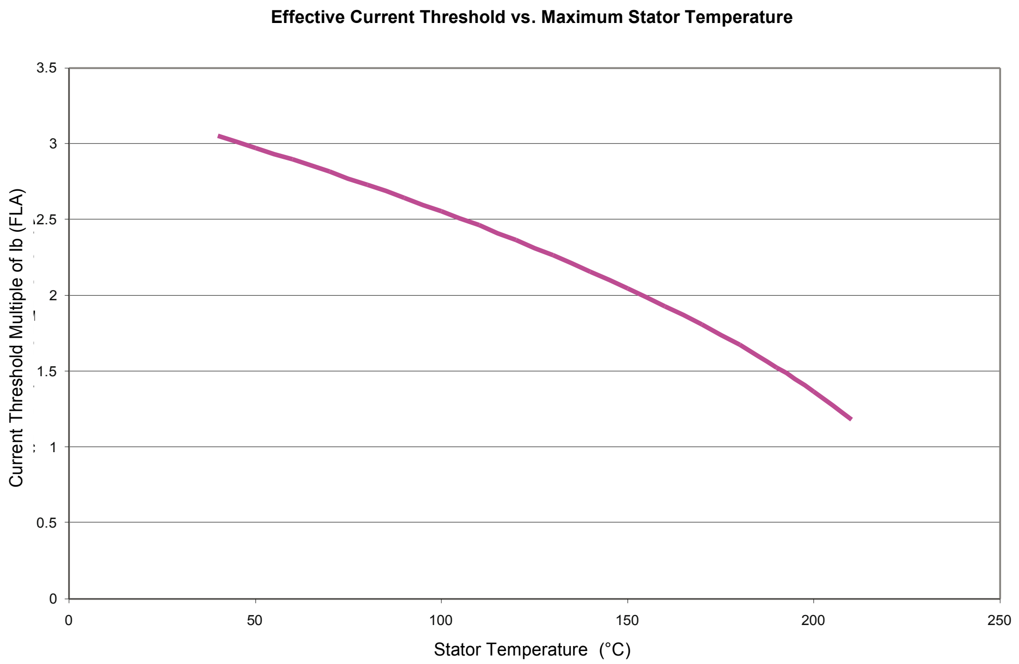
Knowing the maximum steady stator temperature qS (°C), the thermal capacity used can be estimated by the following formula.

$$TC_{Used}\% = \left(\frac{0_S}{240} + \frac{I_{ef}^2 * 50}{I_{LR}^2 * T_{LR}}\right) \quad \text{when} \quad I_{ef} > ITH * FLA$$

Take for example, ILR = 6FLA, 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.

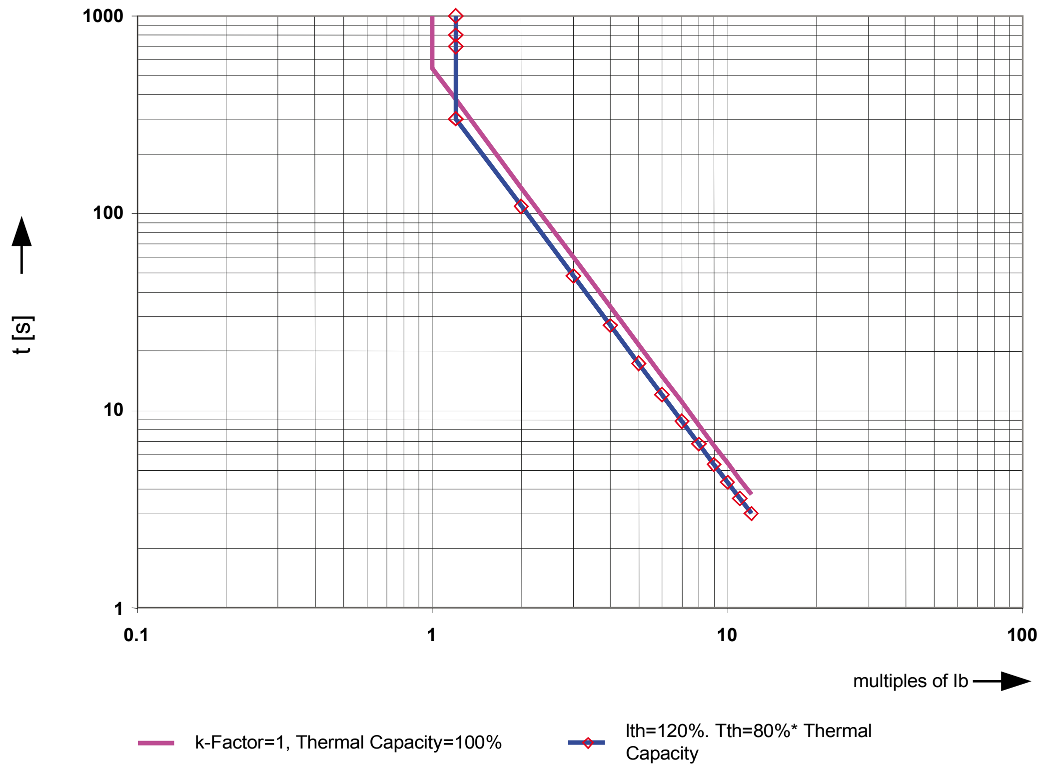
Stator Temperature Effect on Current Threshold Curve

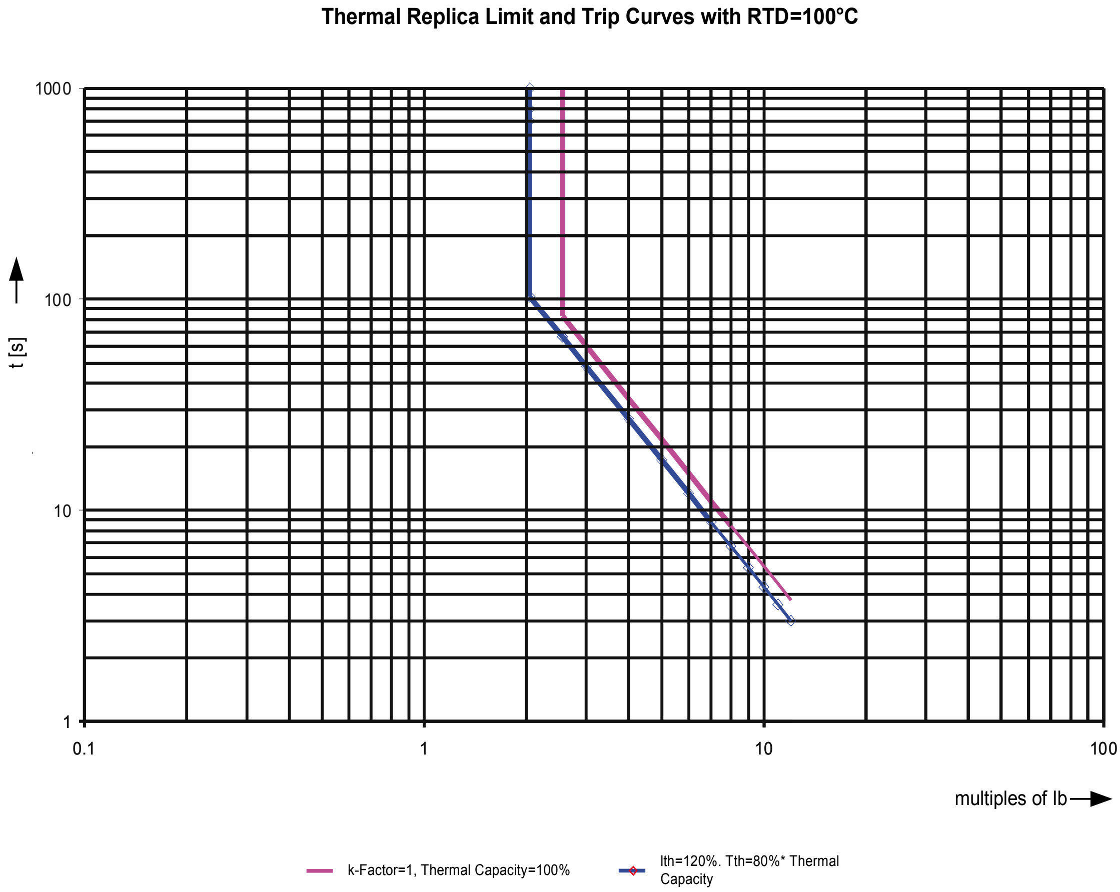
From the graph, it is seen that the lower the stator temperature, the higher the effective current threshold. Without stator temperature, given the current threshold of 1.0 * Ib (FLA) and 2.0 * Ib (FLA) of the stator phase current, the thermal model will use the full thermal capacity in 139.54 seconds. 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





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]

Parameter	Description	Setting range	Default	Menu path
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 parametrized "ExBlo Fc=active".	inactive, active	inactive	[Protection Para /<n> /I-Prot /ThR]
Blo TripCmd	Permanent blocking of the Trip Command of the module/stage.	inactive, active	inactive	[Protection Para /<n> /I-Prot /ThR]

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 parametrized "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 /Counter]

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.

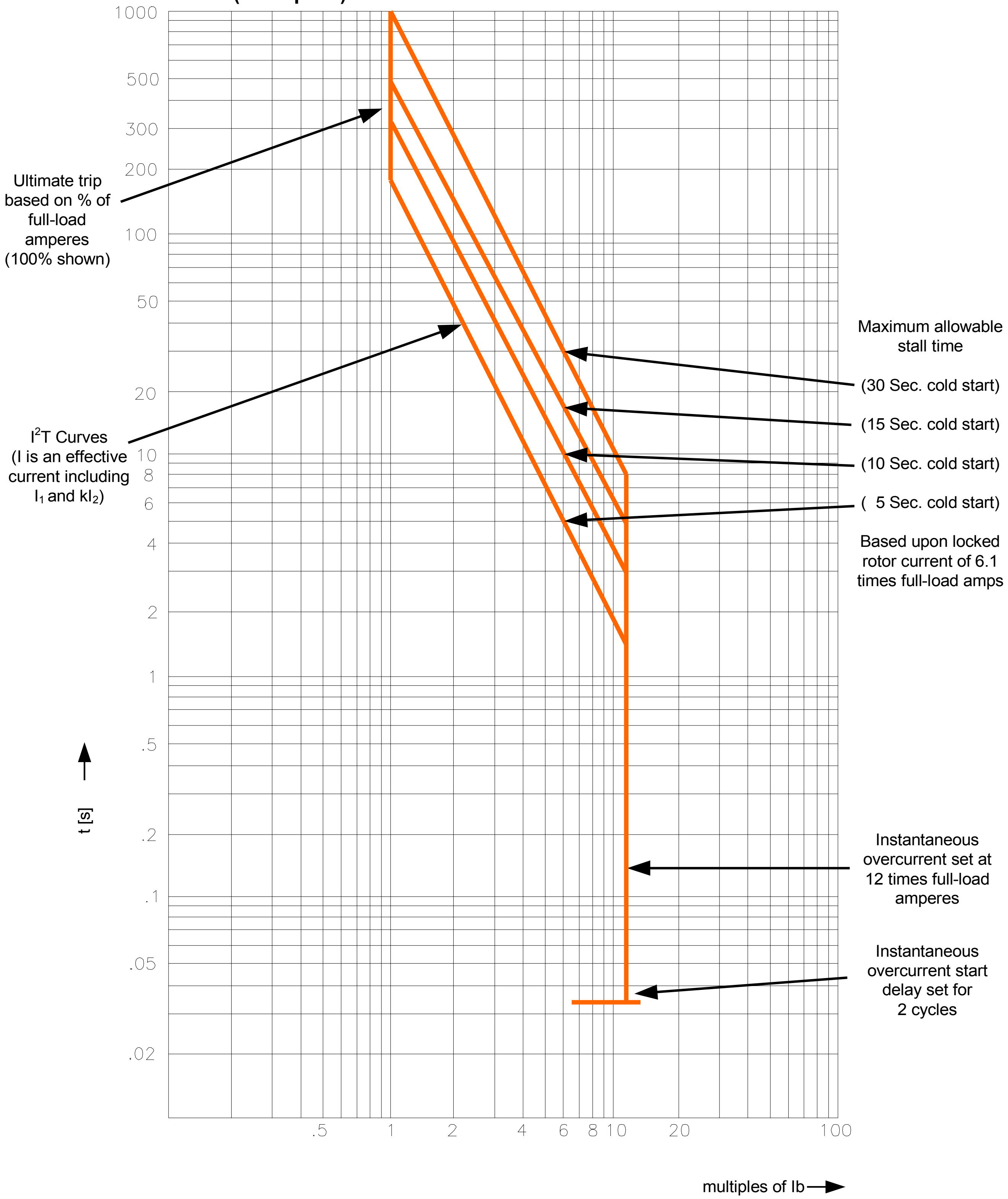
CAUTION **If UTC is set above 100% times the service factor, motor damage could result.**

In systems where an RTD is used the »*UTC*« pick-up point is biased by the measured temperature. This is shown in the example trip curve labeled “Motor Protection Curve Example 3” (with RTD) were you will see a shift in the »*UTC*« value to 2 times of »*Ib«* (FLA)

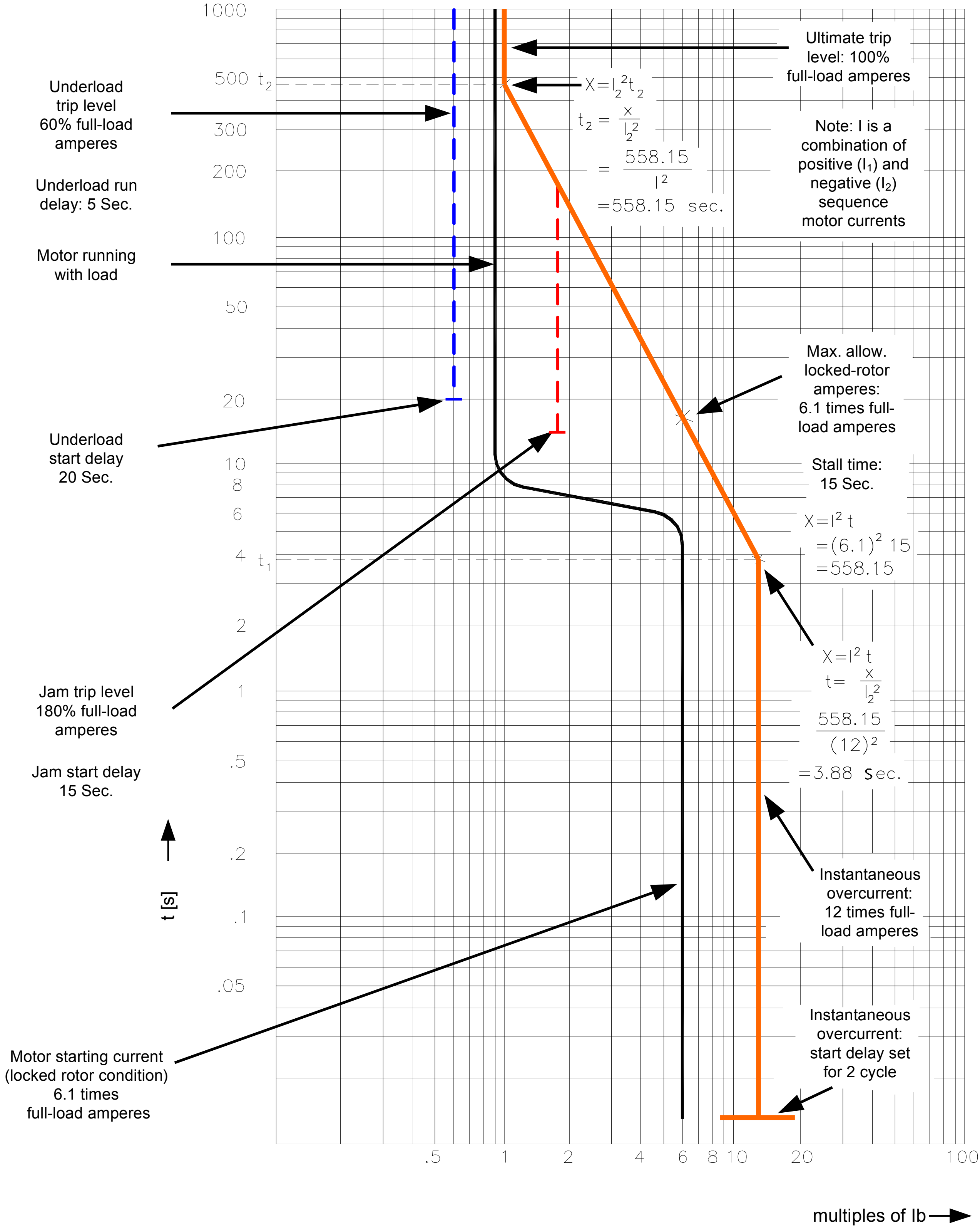
If stator temperature measurements are available, the algorithm may keep from tripping, even if the effective current is above the ultimate trip current setting, depending on stator temperature reports. It is still important to set a correct ultimate trip current so that the motor is well protected. If the RTDs, the module, or its communications to the relay fail, the algorithm falls back to use of »UTC«. Also, note that if all RTD channels are set to »*OFF*«, the algorithm reverts to the non-RTD calculation, which is based strictly on »*UTC*« .

Motor Protection Curves

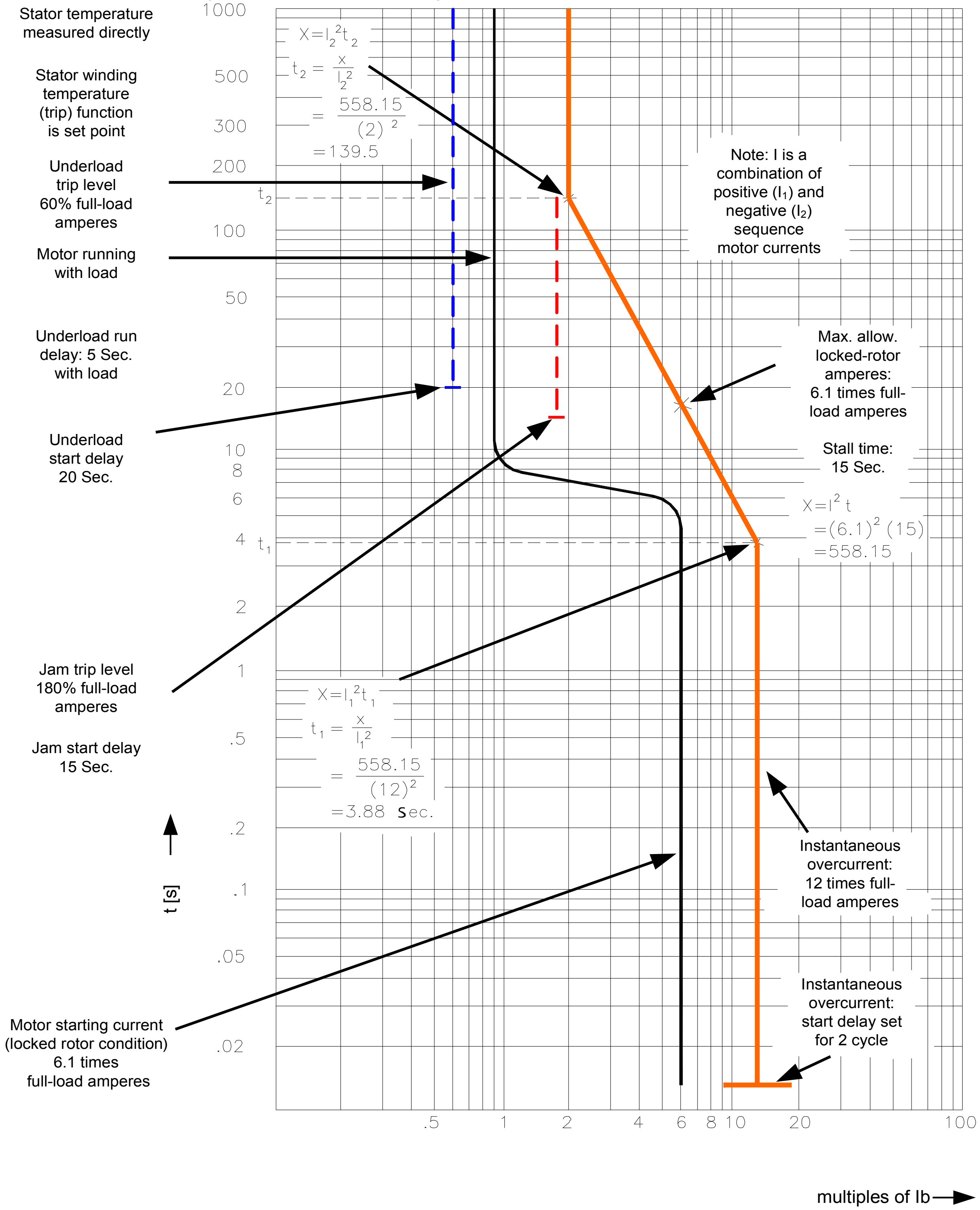
Motor Protection Curve (Example 1)



Motor Protection Curve (Example 2 - without RTDs)



Motor Protection Curve (Example 3 - with RTDs)

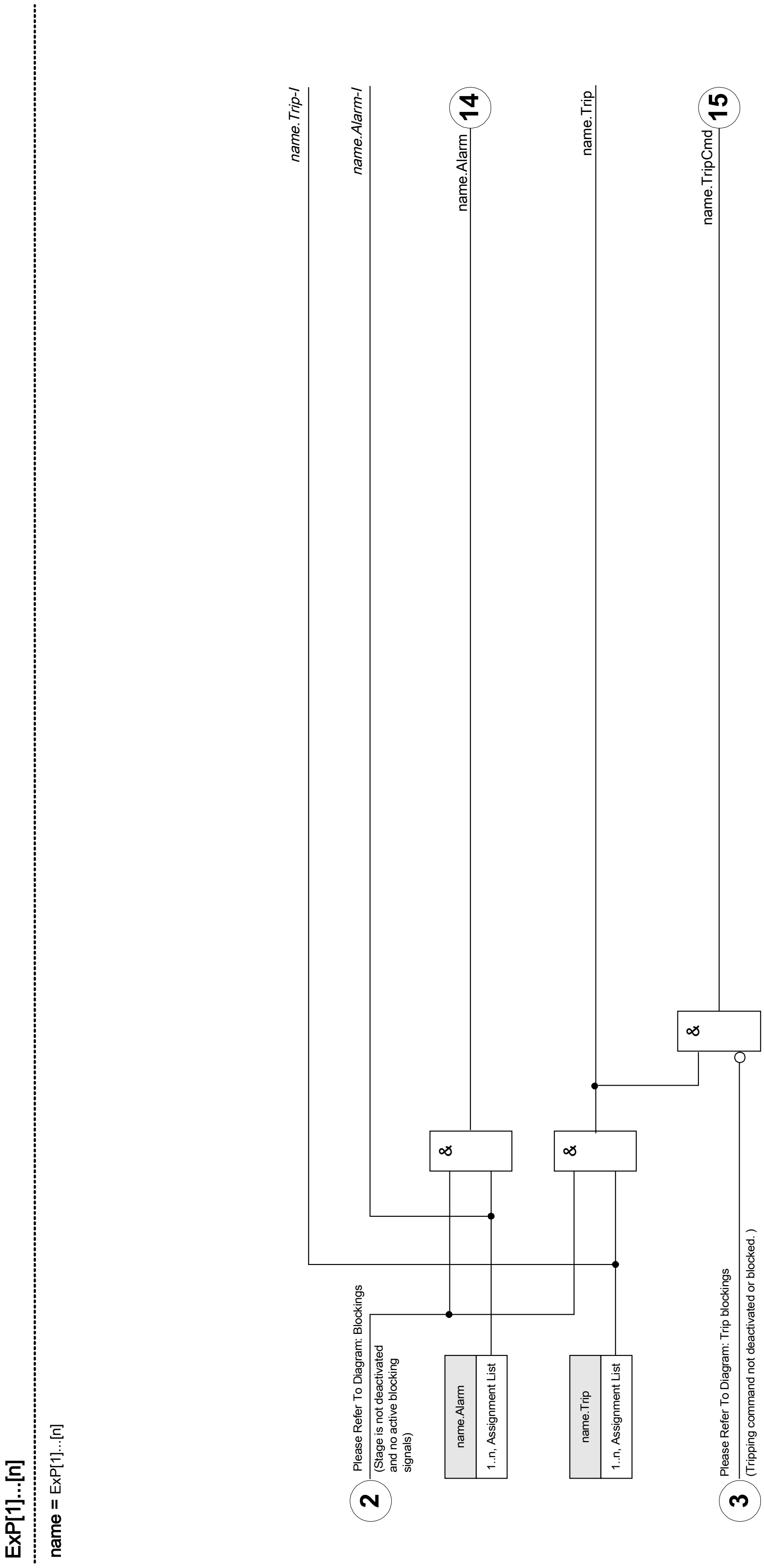


ExP - External Protection

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]
2
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
name.Alarm
1..n, Assignment List
name.Trip
1..n, Assignment List
3
Please Refer To Diagram: Trip blockings
(Tripping command not deactivated or blocked.)
name.Trip-I
name.Alarm-I
&
&
&
name.Alarm
14
name.Trip
name.TripCmd
15

Device Planning Parameters of the Module External Protection

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

Global Protection Parameters of the Module External Protection

Parameter	*Description*	*Setting range*	*Default*	*Menu path*
ExBlo1	External blocking of the module, if blocking is activated (allowed) within a parameter set and if the state of the assigned signal is true.	1..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 parametrized "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 parametrized "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]]

Name	Description	Assignment via
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 (trip commands) can be assigned from all the protection modules.

Trigger Modes

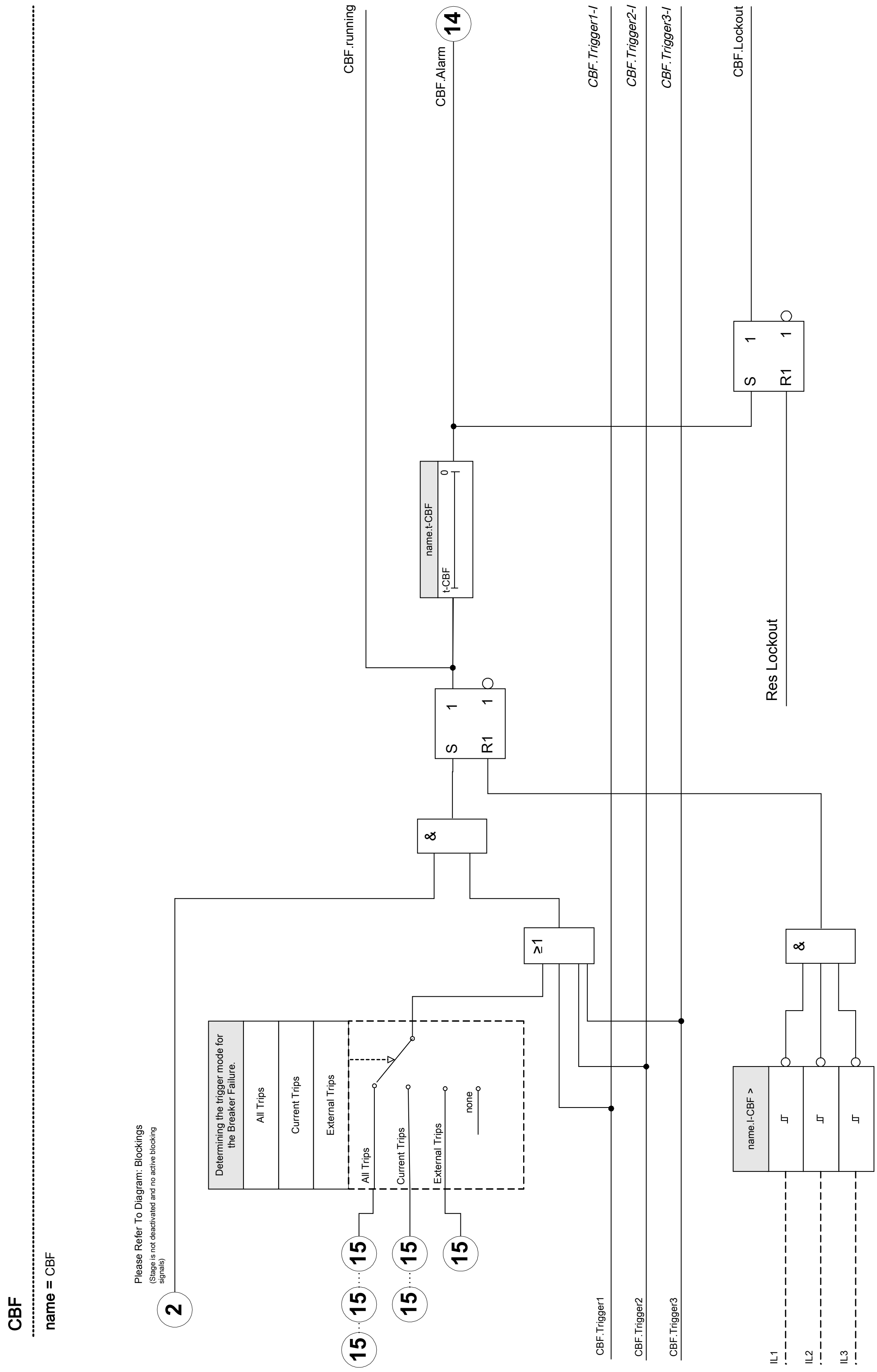
There are three trigger modes for the breaker failure available. In addition, there are three assignable trigger inputs available.

- *All Trips*: All trip signals that are assigned to this breaker (within the breaker manager) will start the BF module.
- *Current Trips*: All current trips that are assigned to this breaker (within the breaker manager) will start the BF module.
- *External Trips*: All external trips that are assigned to this breaker (within the breaker 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 breaker 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.**


CBF
name = CBF
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
2
15
15
15
15
15
15
Determining the trigger mode for the Breaker Failure.
All Trips
Current Trips
External Trips
All Trips
Current Trips
External Trips
none
≥1
&
S
1
R1
1
name.t-CBF
t-CBF
0
CBF.running
CBF.Alarm
14
CBF.Trigger1
CBF.Trigger2
CBF.Trigger3
CBF.Trigger1-I
CBF.Trigger2-I
CBF.Trigger3-I
S
1
R1
1
CBF.Lockout
Res Lockout
&
name.I-CBF >
IL1
IL2
IL3

Device Planning Parameters of the CBF

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, use	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, I Fc, ExP Fc	- . -	[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]

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 parametrized "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]
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

CBF Trigger 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

Name	*Description*
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
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

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

Name	Description
I2>[2].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 set point times. The breaker in the higher-level section switches off.

TCS - Trip Circuit Supervision [74TC]

Available elements:
TCS

The trip circuit is monitored by evaluating the auxiliary contacts of the circuit breaker. The CB trip circuits inclusive cable can be monitored by two non-grouped digital inputs. If a circuit is broken an alarm is issued. With this protection module it is assumed that the CB is provided with auxiliary contacts (CB-open and CB-closed), allocated to the digital inputs.

NOTICE **In Slot 1 has 2 digital inputs, each of which has a separate root (contact separation) for the trip circuit supervision.**

In this case the trip circuit supply voltage serves also as supply voltage for the digital inputs and so the supply voltage failure of a trip circuit can be detected directly.

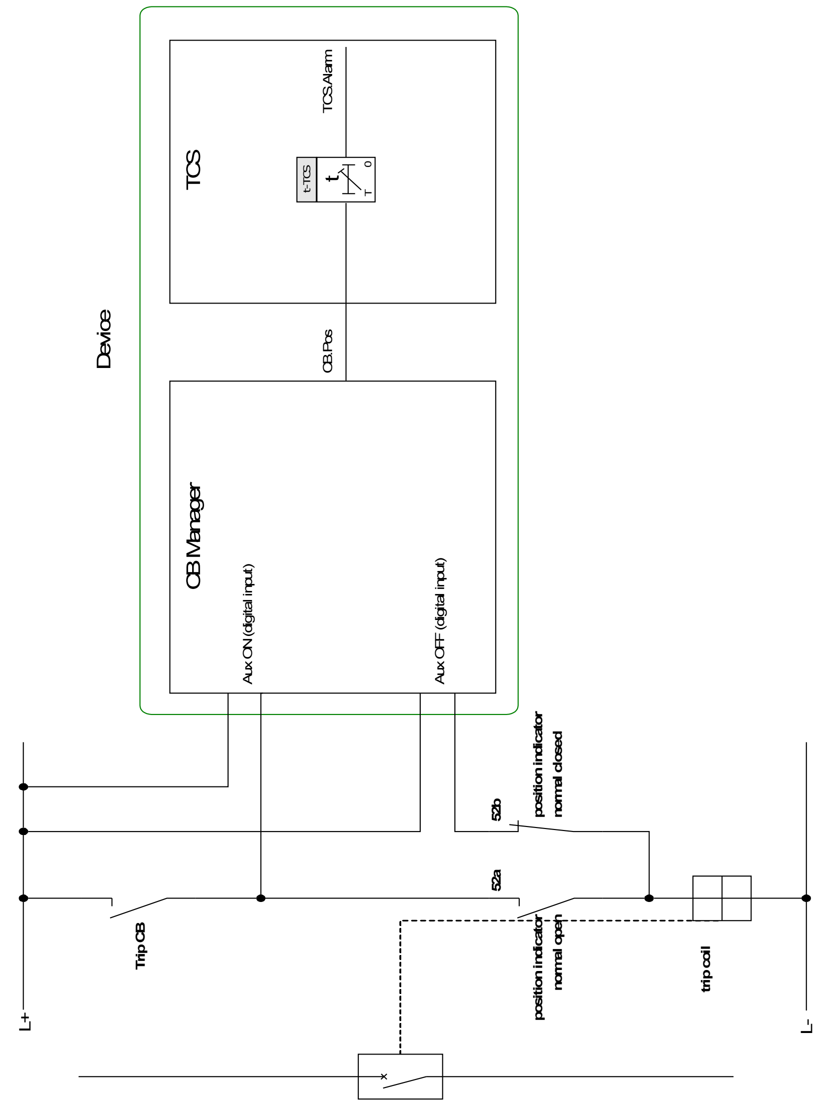
In order to identify a conductor-failure in the trip circuit on the supply line or in the trip coil, the off-coil has to be looped-in to the supervision circuit.

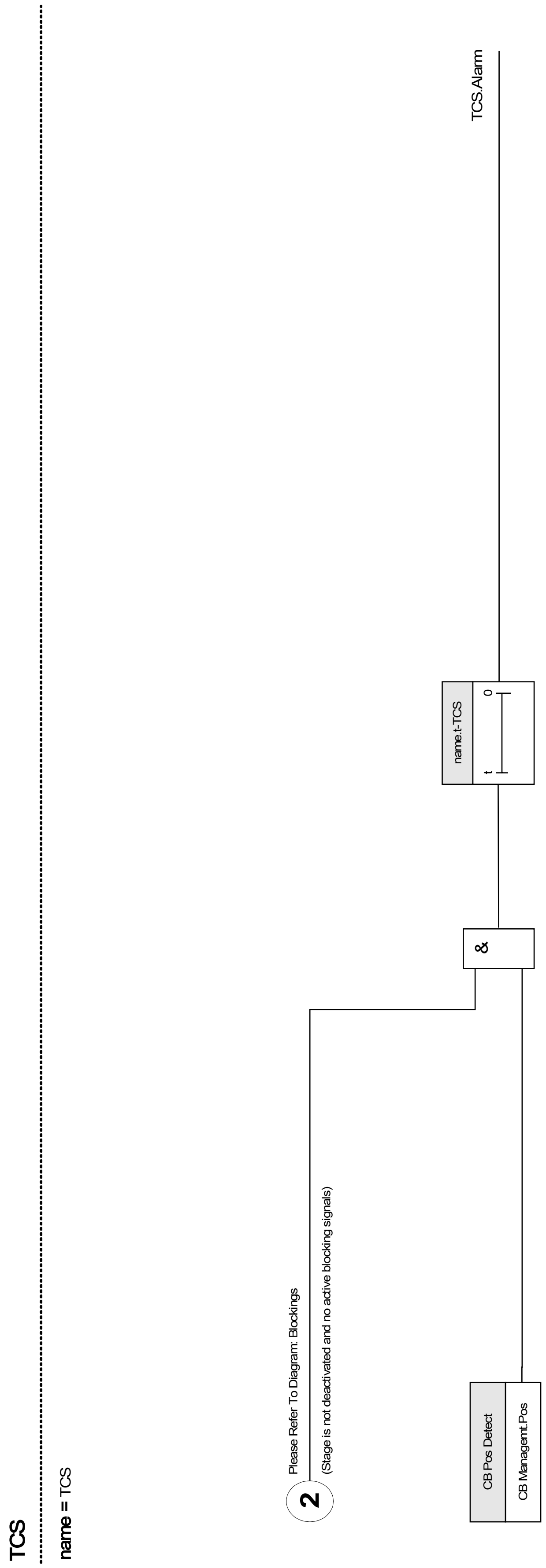
Via the two digital inputs the auxiliary contacts are checked continuously (»INPUT 1« and »Input 2«) for »identity« (both open or both closed). If »identity« is identified, the trip circuit is checked for a possible defect after a set time delay and if necessary the »TCS.ALARM« is issued.

The time delay is to be set in a way that switching actions cannot cause false trips in this module.

Connection example: Trip circuit supervision with two CB auxiliary contacts.

TCS




TCS
name = TCS
2
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
CB Pos Detect
CB Managemt.Pos
&
name.t-TCS
t
0
TCS.Alarm

Device Planning Parameters of the Trip Circuit Supervision

Parameter	*Description*	*Options*	*Default*	*Menu path*
Mode	Mode	do not use, use	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.	-.-, CB.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 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]
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 parametrized "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	Position indicator/check-back signal of the CB (52a)	[Protection Para /Global Prot Para /Supervision /TCS]
Aux OFF	Module input state: Position indicator/check-back signal of the CB (52b)	[]
ExBlo1-I	Module input state: External blocking1	[Protection Para /Global Prot Para /Supervision /TCS]
ExBlo2-I	Module input state: External blocking2	[Protection Para /Global Prot Para /Supervision /TCS]

Name	*Description*	*Assignment via*
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 signalled through a message/alarm.

The precondition is that the conductor currents are measured by the device and the earth current, for instance, by a ring core type current transformer.

The measuring principles of the circuit supervision are based on comparing the measured and the calculated residual currents. In an ideal case these are:

$$(\vec{IL1}+\vec{IL2}+\vec{IL3})+KI*\vec{IG}=3*I_0+KI*\vec{IG}=0$$

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.

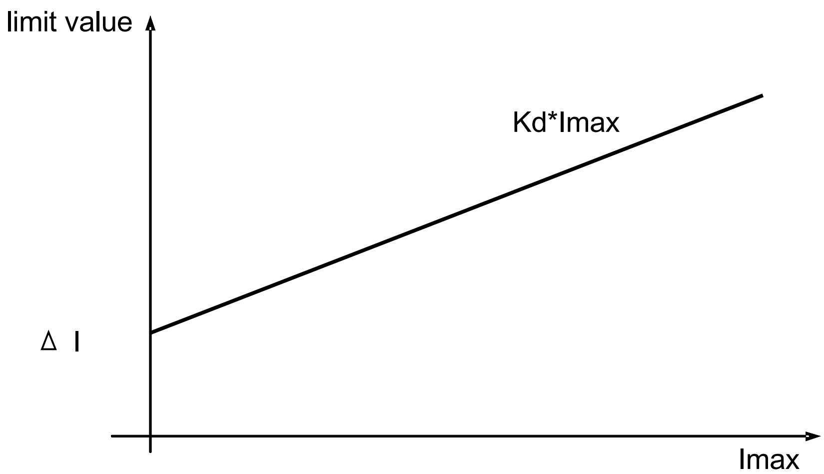
The limiting value of the CT supervision is calculated as follows:

ΔI = deviation I (rated value)
Kd = correction factor
Imax = current maximum
Limiting value = ΔI + Kd x Imax

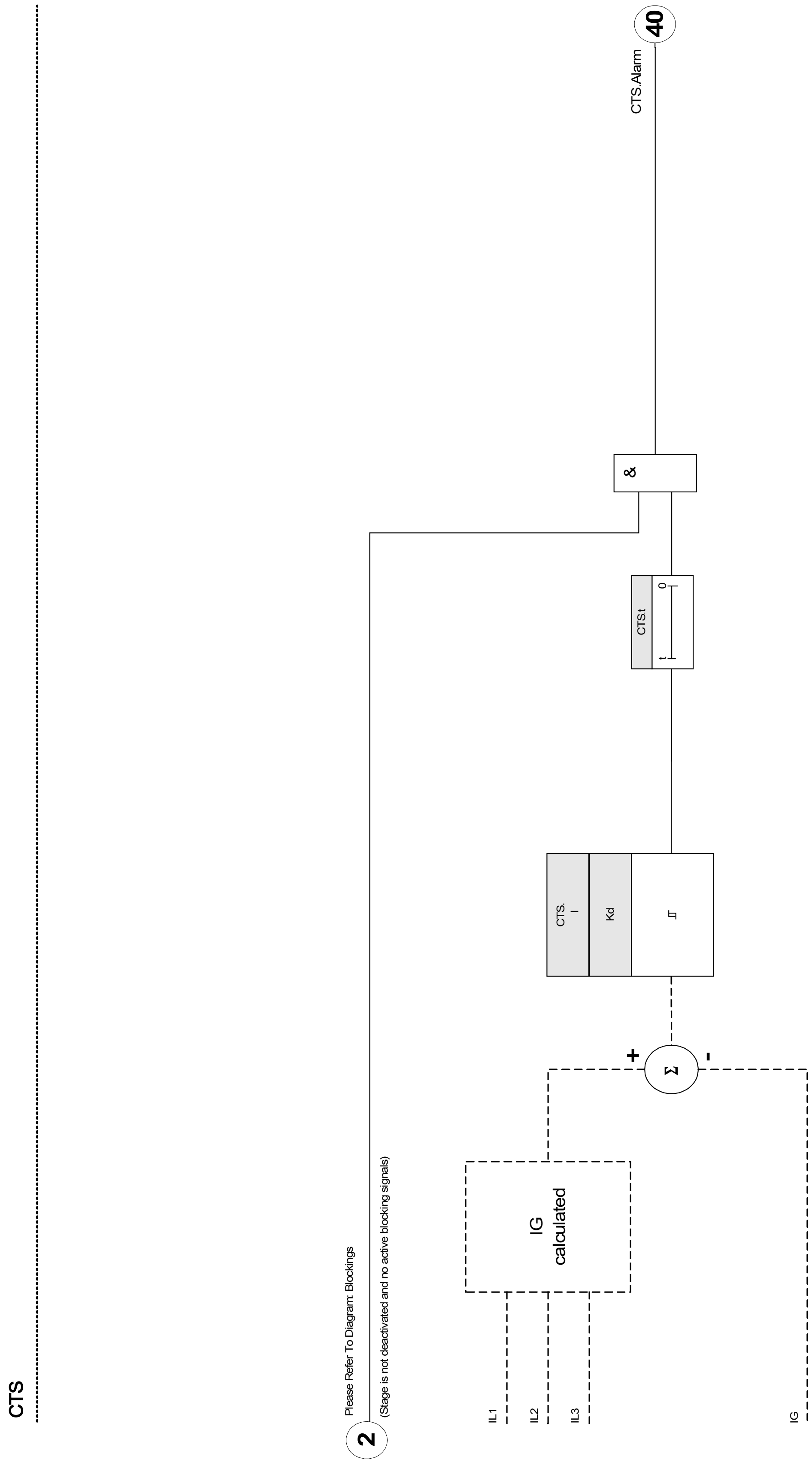
Precondition for identifying an error:

$$3*\vec{I}_0+KI*\vec{IG}\geq Delta\ I+Kd*Imax$$

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.**


CTS
2
Please Refer To Diagram: Blockings
(Stage is not deactivated and no active blocking signals)
IL1
IL2
IL3
IG
IG calculated
+
-
Σ
CTS. I
Kd
CTS.t
&
CTS.Alarm
40

Device Planning Parameters of the Current Transformer Supervision

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

Global Protection Parameter of the Current Transformer Supervision

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

Setting Group Parameters of the Current Transformer Supervision

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

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

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 non-cyclic 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 check sums

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. I f 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.

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; and**
- **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 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; and**
- **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 parametrized blocking functions work properly?**
- **Do all temporary parametrized (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 do 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 (Prot inhibit)/WARNING! Cont?/Force RO], 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 Rox*« 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 (Prot inhibit)/WARNING! Cont?/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 (Prot inhibit)/WARNING! Cont?/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).**
- **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.**

Technical Data

NOTICE **Use Copper conductors only, 75°C. Conductor size AWG 14 [2.5 mm^2].**

Climatic Environmental Conditions

Type of device	Storage Temperature:	Operating Temperature:
MRA4	-30°C up to +70°C (-22°F to 158°F)	-20°C up to +60°C (-4°F to 140°F)
MRI4	-25°C up to +70°C (-13°F to 158°F)	-0°C up to +55°C (-32°F to 131°F)
MRU4	-25°C up to +70°C (-13°F to 158°F)	-0°C up to +55°C (-32°F to 131°F)
MRDT4	-25°C up to +70°C (-13°F to 158°F)	-20°C up to +55°C (-4°F to 131°F)
MRM4	-25°C up to +70°C (-13°F to 158°F)	-0°C up to +55°C (-32°F to 131°F)

Permissible Humidity at Ann. Average:	<75% rel. (on 56d up to 95% rel.)
Permissible Installation Altitude:	<2000 m (6561.67 ft) above sea level If 4000 m (13123.35 ft) altitude apply a changed classification of the operating and test voltages may be necessary.

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	173 mm (6.811" / 4 U)/ 212.7 mm (8.374" / 42 HP)
Housing depth (incl. terminals):	208 mm (8.189")
Material, housing:	Aluminium extruded section
Material, front panel:	Aluminium/Foil front
Mounting position:	Horizontal (±45° around the X-axis must be permitted)
Weight:	approx. 2.4 kg (5.291 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)
Nominal currents: (Earth Current Sensitive)	0.1 A / 0.5 A
Max. measuring range: (Earth Current Sensitive)	up to 2.5 x In
Continuous loading capacity:	4 x In/continuously
Overcurrent proof:	30 x In/10 s 100 x In/1 s 250 x In/10 ms (1 half-wave)
Power consumption:	Phase current inputs: at In = 1A S = 0.15 mVA at In = 5A S = 0.15 mVA Earth current input: at In = 1A S = 0.35 mVA at In = 5A S = 0.35 mVA
Frequency range:	50 Hz / 60 Hz ±10%
Terminals:	Screw-type terminals with integrated short-circuiters (contacts)
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 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 <0.25 ms 12 A peak value for <1 ms

The voltage supply must be protected by a fuse of:

- 2,5 A time-lag miniature fuse 5x20 mm (approx. 1/5” x 0.8”) according to IEC 60127
- 3,5 A time-lag miniature fuse 6,3x32 mm (approx. 1/4” x 1 1/4”) according to UL 248-14

Power Consumption

Power supply range:	Power consumption in idle mode	Max. power consumption
24-270 V DC:	6 W	8.5 W
48-230 V AC (for frequencies of 50-60 Hz):	6 VA	8.5 VA

Display

Display type:	LCD with LED background illumination
Resolution graphics display:	128 x 64 pixel
LED-Type:	Two coloured: red/green
Number of LEDs, Housing B2:	8

Front Interface RS232

Baud rates:	115200 Baud
Handshake:	RTS and CTS
Connection:	9-pole D-Sub plug

Real Time Clock

Running reserve of the real time clock: 1 year min.

Digital Inputs

Max. input voltage:	300 V DC/259 V AC
Input current:	<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

Time Synchronization IRIG

Nominal input voltage:	5 V
Connection:	Screw-type terminals (twisted pair)

Analogue Output

Output Current	4...20 mA
Maximum Load Resistance	1 kΩ

In case of the use of unshielded twisted pair cables, the length must not exceed 10 m.

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 9 seconds. After approximately 1 min 5 seconds the boot phase is completed (HMI and Communication initialized).

Standards

Approvals

- GOST-R
- UL-listed file: e217753

Design Standards

Generic standard	EN 61000-6-2 EN 61000-6-3
Product standard	IEC 60255-6 EN 50178 UL 508 (Industrial Control Equipment) CSA C22.2 No. 14-95 (Industrial Control Equipment) ANSI C37.90

High Voltage Tests (IEC 60255-6)

High frequency interference test		
IEC 60255-22-1 class 3	Within one circuit	1 kV/2 s
	Circuit to earth	2.5 kV/2 s
	Circuit to circuit	2.5 kV/2 s
Insulation voltage test		
IEC 60255-5 EN 50178	All circuits to other circuits and exposed conductive parts	2.5 kV (eff.)/50Hz, 1 min.
	Except interfaces	1,5 kV DC, 1 min.
	and Voltage measuring input	3 kV (eff.)/50 Hz, 1 min.
Impulse voltage test		
IEC 60255-5		5 kV/0.5J, 1.2/50 µs

EMC Immunity Tests

Fast transient disturbance immunity test (Burst)		
IEC 60255-22-4 IEC 61000-4-4 class 4	Power supply, mains inputs	±4 kV, 2.5 kHz
	Other in- and outputs	±2 kV, 5 kHz
Surge immunity test		
IEC 61000-4-5 class 4	Within one circuit	2 kV
	Circuit to earth	4 kV
Class 3	Communication cables to earth	2 kV

Electrical discharge immunity test

IEC 60255-22-2 IEC 61000-4-2 class 3	Air discharge	8 kV
	Contact discharge	6 kV

Radiated radio-frequency electromagnetic field immunity test

IEC 61000-4-3	26 MHz – 80 MHz	10 V/m
Class X	80 MHz – 1 GHz	35 V/m
ANSI C37.90.2	1 GHz – 3 GHz	10 V/m

Immunity to conducted disturbances induced by radio frequency fields

IEC 61000-4-6 class 3		10 V

Power frequency magnetic field immunity test

IEC 61000-4-8 class 4	continues	30 A/m
	3 sec	300 A/m

EMC Emission Tests

Radio interference suppression test

IEC/CISPR11		Limit value class B

Radio interference radiation test

IEC/CISPR11		Limit value class B

Environmental Tests

Classification:

IEC 60068-1	Climatic classification	20/060/56
IEC 60721-3-1	Classification of ambient conditions (Storage)	1K5/1B1/1C1L/1S1/1M2 but min. -30°C
IEC 60721-3-2	Classification of ambient conditions (Transportation)	2K4/2B1/2C1/2S1/2M2 but min. -30°C
IEC 60721-3-3	Classification of ambient conditions (Stationary use at weather protected locations)	3K6/3B1/3C1/3S1/3M2 but min. -20°C/max +60°C

Test Ad: Cold

IEC 60068-2-1	Temperature	-20°C
	test duration	16 h

Test Bd: Dry Heat

IEC 60068-2-2	Temperature	60°C
	Relative humidity	<50%
	test duration	72 h

Test Cab: Damp Heat (steady state)

IEC 60068-2-78	Temperature	40°C
	Relative humidity	93%

	test duration	56 d
Test Db: Damp Heat (cyclic) IEC 60068-2-30	Temperature Relative humidity Cycles (12 + 12-hour)	60°C 95% 2

Mechanical Tests

Test Fc: Vibration response test IEC 60068-2-6 IEC 60255-21-1 class 1	(10 Hz – 59 Hz) Displacement	0.035 mm
	(59Hz – 150Hz) Acceleration	0.5 gn
	Number of cycles in each axis	1
Test Fc: Vibration endurance test IEC 60068-2-6 IEC 60255-21-1 class 1	(10 Hz – 150 Hz) Acceleration	1.0 gn
	Number of cycles in each axis	20
Test Ea: Shock tests IEC 60068-2-27 IEC 60255-21-2 class 1	Shock response test	5 gn, 11 ms, 3 impulses in each direction
	Shock resistance test	15 gn, 11 ms, 3 impulses in each direction
Test Eb: Shockendurance test IEC 60068-2-29 IEC 60255-21-2 class 1	Shock endurance test	10 gn, 16 ms, 1000 impulses in each direction
Test Fe: Earthquake test IEC 60068-3-3 KTA 3503 IEC 60255-21-3	Single axis earthquake vibration test	3 – 7 Hz: Horizontal 10 mm, 1 cycle each axis
class 2		7 – 35 Hz Horizontal: 2 gn, 1 cycle each axis

Tolerances

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

Measured Value Acquisition Tolerances

Phase and Earth Current Measuring

Frequency range:	50 Hz / 60 Hz ±10%
Accuracy:	Class 0.5
Amplitude error if I < 1 x IN:	±0.5% of the rated value
Amplitude error if I > 1 x IN < 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
Harmonics	up to 20% 3rd harmonic ±2% up to 20% 5th harmonic ±2%
Frequency influence	<±2%/Hz in the range of ±5 Hz of the parametrized nominal frequency
Temperature influence	<±1% within the range of -20°C up to +60°C

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
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
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

Thermal Replica: ThR	*Tolerance*
Ib	±2% of the setting value resp. 1% In
Alarm ThR	±1.5 % of the setting value

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

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

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

Assignment List

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

Name	*Description*
-.-	No assignment
Prot.available	Signal: Protection is available
Prot.active	Signal: active
Prot.ExBlo	Signal: External Blocking
Prot.Alarm L1	Signal: General-Alarm L1
Prot.Alarm L2	Signal: General-Alarm L2
Prot.Alarm L3	Signal: General-Alarm L3
Prot.Alarm G	Signal: General-Alarm - Earth fault
Prot.Alarm	Signal: General Alarm
Prot.Trip L1	Signal: 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
CB.TripCmd	Signal: Trip Command
CB.Ack TripCmd	Signal: Acknowledge Trip Command
CB.Ready	Signal: Circuit breaker is ready for operation.
CB.Manual OFF	Signal: Circuit breaker was switched off manually.
CB.Manual ON	Signal: Circuit breaker was switched on manually
CB.Pos OFF	Signal: Circuit Breaker is in OFF-Position
CB.Pos ON	Signal: Circuit Breaker is in ON-Position
CB.Pos Indeterm	Signal: Circuit Breaker is in Indeterminate Position
CB.Pos Disturb	Signal: Circuit Breaker Disturbed - Undefined Breaker Position. The Position Indicators contradict themselves. After expiring of a supervision timer this signal becomes true.
CB.Acknow Sig-I	Module input state: Acknowledgement Signal (only for automatic acknowledgement) Module input signal
CB.Aux ON-I	Position indicator/check-back signal of the CB (52a)
CB.Aux OFF-I	Module input state: Position indicator/check-back signal of the CB (52b)
CB.Manual ON-I	Module input state: Circuit breaker was switched on manually
CB.Manual OFF-I	Module input state: Circuit breaker was switched off manually
CB.Ready-I	Module input state: CB ready
BW.active	Signal: active

Name	*Description*
BW.ExBlo	Signal: External Blocking
BW.Operations Alarm	Signal: Service Alarm, too many Operations
BW.Isum Intr trip: IL1	Signal: Maximum permissible Summation of the interrupting (tripping) currents exceeded: IL1
BW.Isum Intr trip: IL2	Signal: Maximum permissible Summation of the interrupting (tripping) currents exceeded: IL2
BW.Isum Intr trip: IL3	Signal: Maximum permissible Summation of the interrupting (tripping) currents exceeded: IL3
BW.Isum Intr trip	Signal: Maximum permissible Summation of the interrupting (tripping) currents exceeded in at least one phase.
BW.Res TripCmd Cr	Signal: Resetting of the Counter: total number of trip commands
BW.Res Sum trip	Signal: Reset summation of the tripping currents
BW.ExBlo1-I	Module input state: External blocking1
BW.ExBlo2-I	Module input state: External blocking2
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
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

Name	*Description*
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.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

Name	*Description*
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
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

Name	Description
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
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

Name	*Description*
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
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

Name	*Description*
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 blocking 1
I[5].ExBlo2-I	Module input state: External blocking 2
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 Parameter 1
I[5].AdaptSet2-I	Module input state: Adaptive Parameter 2
I[5].AdaptSet3-I	Module input state: Adaptive Parameter 3
I[5].AdaptSet4-I	Module input state: Adaptive Parameter 4
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
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 blocking 1
I[6].ExBlo2-I	Module input state: External blocking 2
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

Name	*Description*
I[6].AdaptSet1-I	Module input state: Adaptive Parameter 1
I[6].AdaptSet2-I	Module input state: Adaptive Parameter 2
I[6].AdaptSet3-I	Module input state: Adaptive Parameter 3
I[6].AdaptSet4-I	Module input state: Adaptive Parameter 4
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 blocking 1
IG[1].ExBlo2-I	Module input state: External blocking 2
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 Parameter 1
IG[1].AdaptSet2-I	Module input state: Adaptive Parameter 2
IG[1].AdaptSet3-I	Module input state: Adaptive Parameter 3
IG[1].AdaptSet4-I	Module input state: Adaptive Parameter 4
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 blocking 1

Name	*Description*
IG[2].ExBlo2-I	Module input state: External blocking 2
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 Parameter 1
IG[2].AdaptSet2-I	Module input state: Adaptive Parameter 2
IG[2].AdaptSet3-I	Module input state: Adaptive Parameter 3
IG[2].AdaptSet4-I	Module input state: Adaptive Parameter 4
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 blocking 1
IG[3].ExBlo2-I	Module input state: External blocking 2
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 Parameter 1
IG[3].AdaptSet2-I	Module input state: Adaptive Parameter 2
IG[3].AdaptSet3-I	Module input state: Adaptive Parameter 3
IG[3].AdaptSet4-I	Module input state: Adaptive Parameter 4
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

Name	*Description*
IG[4].AdaptSet 3	Signal: Adaptive Parameter 3
IG[4].AdaptSet 4	Signal: Adaptive Parameter 4
IG[4].ExBlo1-I	Module input state: External blocking 1
IG[4].ExBlo2-I	Module input state: External blocking 2
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 Parameter 1
IG[4].AdaptSet2-I	Module input state: Adaptive Parameter 2
IG[4].AdaptSet3-I	Module input state: Adaptive Parameter 3
IG[4].AdaptSet4-I	Module input state: Adaptive Parameter 4
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 blocking 1
I2>[1].ExBlo2-I	Module input state: External blocking 2
I2>[1].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
I2>[2].active	Signal: active
I2>[2].ExBlo	Signal: External Blocking
I2>[2].Blo TripCmd	Signal: Trip Command blocked
I2>[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
I2>[2].Alarm	Signal: Alarm Negative Sequence
I2>[2].Trip	Signal: Trip
I2>[2].TripCmd	Signal: Trip Command
I2>[2].ExBlo1-I	Module input state: External blocking 1
I2>[2].ExBlo2-I	Module input state: External blocking 2
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

Name	*Description*
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 blocking 1
Jam[1].ExBlo2-I	Module input state: External blocking 2
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 blocking 1
Jam[2].ExBlo2-I	Module input state: External blocking 2
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 blocking 1
I<[1].ExBlo2-I	Module input state: External blocking 2

Name	Description
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 blocking 1
I<[2].ExBlo2-I	Module input state: External blocking 2
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 blocking 1
I<[3].ExBlo2-I	Module input state: External blocking 2
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
MLS.Alarm	Signal: Alarm
MLS.Trip	Signal: Trip
MLS.ExBlo1-I	Module input state: External blocking 1
MLS.ExBlo2-I	Module input state: External blocking 2
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

Name	*Description*
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
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	MotBear 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	LoadBear 1 Alarm RTD Temperature Protection

Name	Description
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	LoadBear 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.Aux Trip	Auxiliary Signal: Trip
RTD.Aux Alarm	Auxiliary Alarm RTD Temperature Protection
RTD.Aux Timeout Alarm	Auxiliary Timeout Alarm
RTD.Aux Invalid	Auxiliary Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
RTD.Trip all Windg	Trip all Windings
RTD.Alarm all Windg	Alarm all Windings
RTD.Timeout Alarm all Windg	Timeout Alarm all Windg
RTD.Windg Invalid	Winding Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
RTD.Trip all Motor Bear	Trip all Motor Bearings
RTD.Alarm all Motor Bear	Alarm all Motor Bearings
RTD.Timeout Alarm all Motor Bear	Timeout Alarm all Motor Bearings
RTD.MotBear Invalid	Motor Bearing Signal: Invalid Temperature Measurement Value (e.g caused by an defective or interrupted RTD Measurement)
RTD.Trip all Load Bear	Trip all Load Bearings
RTD.Alarm all Load Bear	Alarm all Load Bearings
RTD.Timeout Alarm all Load Bear	Timeout Alarm all Load Bearings
RTD.LoadBear Invalid	Load Bearing 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.ExBlo1-I	Module input state: External blocking 1
RTD.ExBlo2-I	Module input state: External blocking 2
RTD.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

Name	*Description*
ExP[1].Alarm	Signal: Alarm
ExP[1].Trip	Signal: Trip
ExP[1].TripCmd	Signal: Trip Command
ExP[1].ExBlo1-I	Module input state: External blocking 1
ExP[1].ExBlo2-I	Module input state: External blocking 2
ExP[1].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
ExP[1].Alarm-I	Module input state: Alarm
ExP[1].Trip-I	Module input state: Trip
ExP[2].active	Signal: active
ExP[2].ExBlo	Signal: External Blocking
ExP[2].Blo TripCmd	Signal: Trip Command blocked
ExP[2].ExBlo TripCmd	Signal: External Blocking of the Trip Command
ExP[2].Alarm	Signal: Alarm
ExP[2].Trip	Signal: Trip
ExP[2].TripCmd	Signal: Trip Command
ExP[2].ExBlo1-I	Module input state: External blocking 1
ExP[2].ExBlo2-I	Module input state: External blocking 2
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 blocking 1
ExP[3].ExBlo2-I	Module input state: External blocking 2
ExP[3].ExBlo TripCmd-I	Module input state: External Blocking of the Trip Command
ExP[3].Alarm-I	Module input state: Alarm
ExP[3].Trip-I	Module input state: Trip
ExP[4].active	Signal: active
ExP[4].ExBlo	Signal: External Blocking
ExP[4].Blo TripCmd	Signal: Trip Command blocked
ExP[4].ExBlo TripCmd	Signal: External Blocking of the Trip Command
ExP[4].Alarm	Signal: Alarm
ExP[4].Trip	Signal: Trip
ExP[4].TripCmd	Signal: Trip Command

Name	*Description*
ExP[4].ExBlo1-I	Module input state: External blocking 1
ExP[4].ExBlo2-I	Module input state: External blocking 2
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 Windg 1
URTD.Windg2 Superv	Signal: Supervision Channel Windg 2
URTD.Windg3 Superv	Signal: Supervision Channel Windg 3
URTD.Windg4 Superv	Signal: Supervision Channel Windg 4
URTD.Windg5 Superv	Signal: Supervision Channel Windg 5
URTD.Windg6 Superv	Signal: Supervision Channel Windg 6
URTD.MotBear1 Superv	Signal: Supervision Channel MotBear 1
URTD.MotBear2 Superv	Signal: Supervision Channel MotBear 2
URTD.LoadBear1 Superv	Signal: Supervision Channel LoadBear 1
URTD.LoadBear2 Superv	Signal: Supervision Channel LoadBear 2
URTD.Aux Superv	Signal: Supervision Channel Aux
URTD.Superv	Signal: URTD Supervision Channel
URTD.active	Signal: URTD active
CBF.active	Signal: active
CBF.ExBlo	Signal: External Blocking
CBF.running	Signal: CBF-Module started
CBF.Alarm	Signal: Circuit Breaker Failure
CBF.ExBlo1-I	Module input state: External blocking 1
CBF.ExBlo2-I	Module input state: External blocking 2
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	Position indicator/check-back signal of the CB (52a)
TCS.Aux OFF	Module input state: Position indicator/check-back signal of the CB (52b)
TCS.ExBlo1-I	Module input state: External blocking 1
TCS.ExBlo2-I	Module input state: External blocking 2
CTS.active	Signal: active
CTS.ExBlo	Signal: External Blocking
CTS.Alarm	Signal: Alarm Current Transformer Measuring Circuit Supervision
CTS.ExBlo1-I	Module input state: External blocking 1

Name	*Description*
CTS.ExBlo2-I	Module input state: External blocking 2
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 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
OR-3AI X2.BO 1	Signal: Binary Output Relay
OR-3AI X2.BO 2	Signal: Binary Output Relay
OR-3AI X2.BO 3	Signal: Binary Output Relay
OR-3AI 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
OR-3AI 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-5 X2.BO 1	Signal: Binary Output Relay
BO-5 X2.BO 2	Signal: Binary Output Relay
BO-5 X2.BO 3	Signal: Binary Output Relay
BO-5 X2.BO 4	Signal: Binary Output Relay
BO-5 X2.BO 5	Signal: Binary Output Relay
BO-5 X2.DISARMED!	Signal: CAUTION! RELAYS DISARMED in order to safely perform maintenance while eliminating the risk of taking an entire process off-line. (Note: The Self Supervision Contact cannot be disarmed). YOU MUST ENSURE that the relays are ARMED AGAIN after maintenance
BO-5 X2.Outs forced	Signal: The State of at least one Relay Output has been set by force. That means that the state of at least one Relay is forced and hence does not show the state of the assigned signals.
Event rec.Res all records	Signal: All records deleted
Disturb rec.recording	Signal: Recording
Disturb rec.Write err	Signal: Writing error in memory
Disturb rec.memory full	Signal: Memory full
Disturb rec.Clear fail	Signal: Clear failure in memory
Disturb rec.Res all records	Signal: All records deleted

Name	Description
Disturb rec.Res rec	Signal: Delete record
Disturb rec.Man Trigger	Signal: Manual Trigger
Disturb rec.Start1-I	State of the module input:: Trigger event / start recording if:
Disturb rec.Start2-I	State of the module input:: Trigger event / start recording if:
Disturb rec.Start3-I	State of the module input:: Trigger event / start recording if:
Disturb rec.Start4-I	State of the module input:: Trigger event / start recording if:
Disturb rec.Start5-I	State of the module input:: Trigger event / start recording if:
Disturb rec.Start6-I	State of the module input:: Trigger event / start recording if:
Disturb rec.Start7-I	State of the module input:: Trigger event / start recording if:
Disturb rec.Start8-I	State of the module input:: Trigger event / start recording if:
Fault rec.Res rec	Signal: Delete record
Fault rec.Man Trigger	Signal: Manual Trigger
Fault rec.Start1-I	State of the module input:: Trigger event / start recording if:
Fault rec.Start2-I	State of the module input:: Trigger event / start recording if:
Fault rec.Start3-I	State of the module input:: Trigger event / start recording if:
Fault rec.Start4-I	State of the module input:: Trigger event / start recording if:
Fault rec.Start5-I	State of the module input:: Trigger event / start recording if:
Fault rec.Start6-I	State of the module input:: Trigger event / start recording if:
Fault rec.Start7-I	State of the module input:: Trigger event / start recording if:
Fault rec.Start8-I	State of the module input:: Trigger event / start recording if:
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
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
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

Name	*Description*
Modbus.Scada Cmd 13	Scada Command
Modbus.Scada Cmd 14	Scada Command
Modbus.Scada Cmd 15	Scada Command
Modbus.Scada Cmd 16	Scada Command
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

Name	*Description*
IRIG-B.Control Signal2	Signal: IRIG-B Control Signal
IRIG-B.Control Signal4	Signal: IRIG-B Control Signal
IRIG-B.Control Signal5	Signal: IRIG-B Control Signal
IRIG-B.Control Signal6	Signal: IRIG-B Control Signal
IRIG-B.Control Signal7	Signal: IRIG-B Control Signal
IRIG-B.Control Signal8	Signal: IRIG-B Control Signal
IRIG-B.Control Signal9	Signal: IRIG-B Control Signal
IRIG-B.Control Signal10	Signal: IRIG-B Control Signal
IRIG-B.Control Signal11	Signal: IRIG-B Control Signal
IRIG-B.Control Signal12	Signal: IRIG-B Control Signal
IRIG-B.Control Signal13	Signal: IRIG-B Control Signal
IRIG-B.Control Signal14	Signal: IRIG-B Control Signal
IRIG-B.Control Signal15	Signal: IRIG-B Control Signal
IRIG-B.Control Signal16	Signal: IRIG-B Control Signal
IRIG-B.Control Signal17	Signal: IRIG-B Control Signal
IRIG-B.Control Signal18	Signal: IRIG-B Control Signal
Statistics.Reset	Signal: Reset of statistics
Statistics.StartFct-I	Module input state: Start statistics Module input signal
Statistics.ResetFct-I	Module input state: Reset statistics Module input signal
Sys.PS 1	Signal: Parameter Set 1
Sys.PS 2	Signal: Parameter Set 2
Sys.PS 3	Signal: Parameter Set 3
Sys.PS 4	Signal: Parameter Set 4
Sys.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

Name	Description
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.
Sys.PS4-I	State of the module input respectively of the signal, that should activate this Parameter Setting Group.

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.

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