Unbalance protection relay

ESTAsym CPR

Operating instructions

Revision history

Date	Name	Revision	Change
25.08.11	drt	00	initial document release
24.11.11	brm	01	update of content

Content

1 General

The ESTAsym CPR is designed to monitor medium and high voltage capacitors. The ESTAsym CPR can be set to monitor current or voltage, selectable from the menu. The device can monitor two threshold levels for Alarm / Trip. All thresholds / readings can be either a current or voltage value or a % setting of the maximum value. Once the Alarm or Trip level is reached the appropriate relay will operate, after the programmed delay time has elapsed. Both relays can be programmed to be held in the Alarm/Trip position until reset by the user if required, alternatively they can be set to automatically reset if the fault is cleared. A further relay can be used to operate when the Alarm/Trip or both Alarm+Trip have operated. The ESTAsym CPR can record details of the last 5 Alarm and Trip operations. An natural unbalance (out of balance or asymmetrical value) can be programmed into the device if required. This natural unbalance is subtracted from the measured value and allows a more exactly setting of the thresholds.

The ESTAsym CPR is working with unsigned absolute values. Due to this always a positive value is shown. Independent of the direction of the changing (meas. value increase / decrease) always a exceeding of the threshold is given.

Simplified diagram
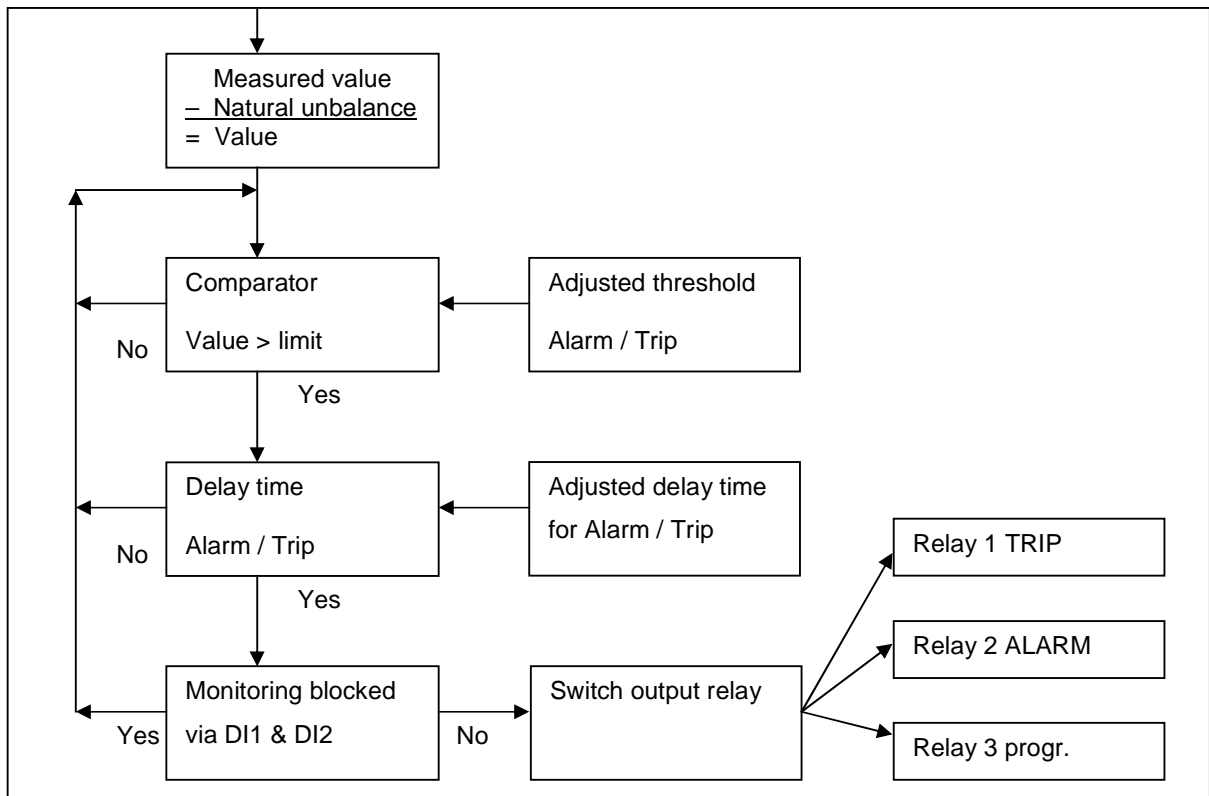
Important Information!

If the above sign appears besides a text passage in the manual the reader is strongly advised to read the corresponding information, as it is very important for the device usage! It can contain safety advice or other information for the correct handling of the device.

If the information is disregarded, the device may be inoperable or even damaged!

2   Application

High- and medium voltage capacitors taken into operation must be monitored all the time. Most of these capacitors are manufactured by using insulating oil for the dielectricum, which could catch fire in any case of fail. To avoid this, the capacitors must be monitored to detect failures. This monitoring can be done either by monitoring the unbalance current or unbalance voltage of capacitor groups.

However, this voltage / current may change in case of any failure of one capacitor, for instance caused by any flash over the inside winded foils.

2.1   Unbalance monitoring voltage
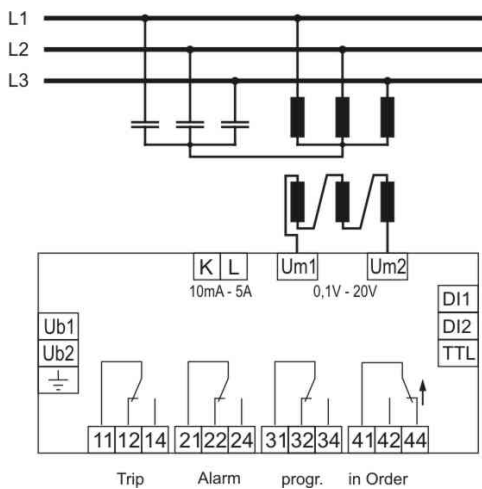
2.2   Unbalance monitoring current
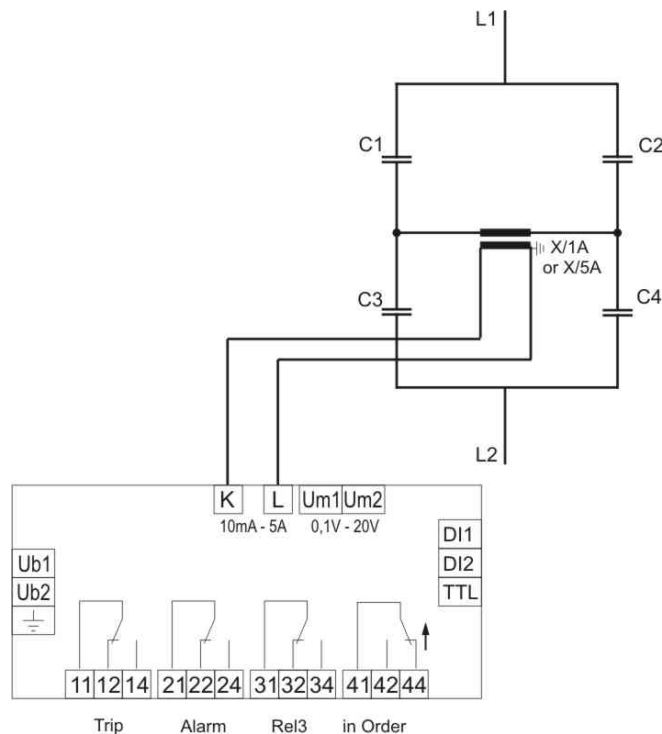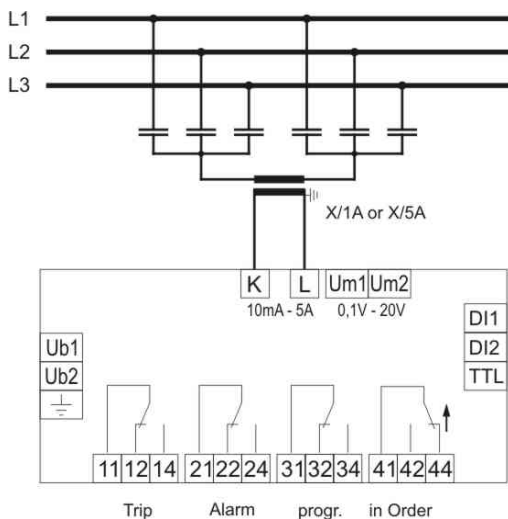
3   Operation

3.1   Power supply

The ESTAsym CPR is equipped with an power supply capable

for 40-250VAC 45-65Hz and 40-300VDC.
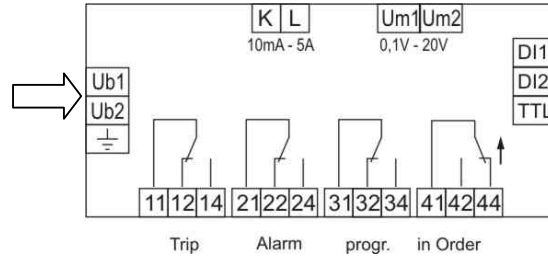
3.2   Inputs

3.2.1   Measurement input

The ESTAsym CPR has one voltage and one current input. Possible range for voltage input is 0,1-20V. The

measurement range for the current input 10mA-5A. The ESTAsym CPR supervises current or voltage. It's

not possible to use both inputs parallel!
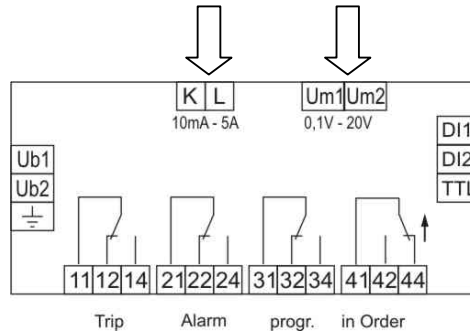
3.2.2   Blocking input

All monitoring functions can be blocked via inputs DI1 and DI2. Please check the referring manual item for

further information's.
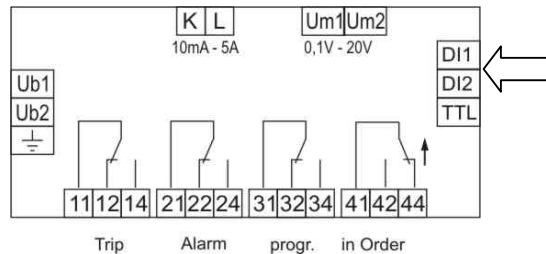
3.3   Outputs

The ESTAsym CPR has 4 relay outputs.

3.3.1   Trip relay

The trip relay operates change over contacts 11-12/14. Contacts 11-12 are normally closed and 11-14 normally open (no trip condition). However, if the trigger value (voltage or current) for trip is exceeded for a longer period than trt, contacts 11-14 will close and 11-12 will open.

3.3.2   Alarm relay

The alarm relay operates change over contacts 21-22/24. Contacts 21-22 are normally closed and 21-24 normally open (no alarm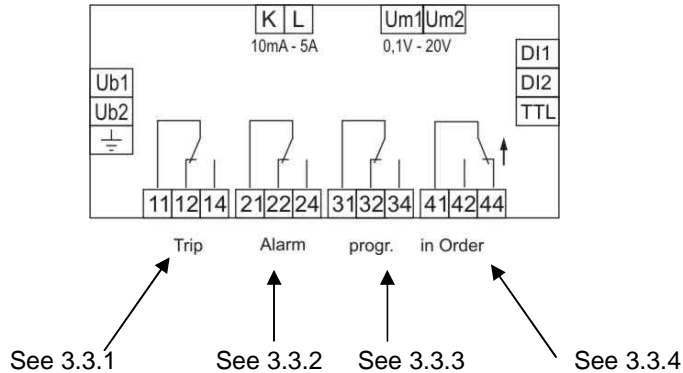 condition). However, if the trigger value (voltage or current) for alarm is exceeded for a longer period than ALt, contacts 21-24 will close and 21-22 will open.

3.3.3   Relay 3

The programmable relay can be set to work with alarm, trip or both. Under normal conditions (no trip, no alarm) the contacts 31-32 are closed and 31-34 open. In an alarm / trip situation, contacts 31-34 will close and 31-32 will open.

3.3.4   "In order" relay

The ESTAsym CPR has an self-supervision that monitors internal modules and software. If an internal fault is detected, the relay will open contact 41-44 and closes 41-42. Additional to the relay contact the fault is shown in the display "SyS" or "Prog". The "in order" relay is also a sign of life contact, in case of missing power supply the contacts 41-42 closes and contact 41-44 opens.

3.4 User Interface

3.4.1 Keys

Increase values, select menu items

Escape menu,
move cursor left,
push 3 sec to clear
trips/alarm

Enter menu,
move cursor right,
confirmation of settings

Decrease values, select menu items

3.4.2 Display

The right side of the display shows the actually chosen main menu items.

The top line of the display shows the codes for submenus and abbreviation for measurement values.
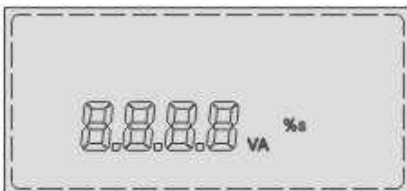
The second line of the display indicates the values for settings and measurement values.

The bottom line of the display indicates which output relays are in active state.

3.4.3 Input of numerical values

Whenever the ESTAsym CPR prompts for the input of a value, the routine will be the same:

A preset-value will be displayed with the first (highest) digit blinking. This digit can now be changed by use of the ▲ and ▼ keys. Use the ▶ button to change to the next smaller digit. After changing, the next digit will be also blinking and can now be altered just like the first one. When arriving the last digit, press the ▶ key once more. This position allows to set multipliers M (Mega) or k (kilo). To store the value, press the ▶ key once more, and the new value will be saved and used.

For the case that a adjusted value cannot be stored respectively another value is shown after confirmation with ▶ button, it's possible that the adjusted value is outside of the allowed range. For further information's about possible ranges, please check the table on the last page.

At any time, one can go back to the menu he came from without changing the value by pressing the ◀ key. In this case the modified value will **not** be used!

4 Menus

4.1 Info

The main menu "INFO" contains all information's about the adjusted thresholds, delay times for trip/alarm and the stored natural unbalance. In the Info menu it's not possible to change any values. To enter this menu use the ▼ button to select "Info" and enter the menu with ▶. Submenus can be selected by ▼.

nU Display's the stored value for "Natural Unbalance" for current respectively voltage.

trd Display's the adjusted threshold for trip.

trt Display's the adjusted time delay for trip

ALd Display's the adjusted threshold for alarm.

ALt Display's the adjusted time delay for alarm.

Fr Display's the software version of the device.

$d1$ Display's the state of digital input. Possible readings are:

   ▭ ▭ ▭ ▭   The function to block the monitoring system via DI1 and DI2 is switched off.

   $OPEn$ Terminals DI1 and DI2 are open.

   $CLSd$ Terminals DI1 and DI2 are closed.

The monitoring system can be blocked via the DI. Possible settings are explained in "Setup" menu item $d1$ and $d1L$.

4.2 Setup

The main menu "Setup" is split into two menu levels.

Level 1 is the "start menu", this contains settings to commissioning the ESTAsym CPR.

Level 2 is the expert menu this menu contains all possible settings. Because of the possible settings this menu is protected by an separate password.

4.2.1 *100* Start menu   **Password 242**

To enter this menu, use the ▼ button to select "Setup" and confirm by pushing ▶.
To enter the menu use password (242). The menus can be selected by ▲ and ▼ entered by ▶.

NU

This menu item allows store the natural unbalance for current or voltage of the monitored capacitors. To store the natural unbalance push the ▶ button. The second line of the display starts blinking and shows the actual measured value. To store the shown value push the ▶ button again. To set a new value for natural unbalance, just push the ▶ button again. The stored value for natural unbalance is shown in the "Info" menu. The evaluation of the natural unbalance happens according to amount. If the measured value drops below the stored value for natural unbalance, this causes a increased reading for display and supervision.

trd

Set the threshold for trip. The threshold can be set as real value (0,2 – 20 V for voltage / 20mA – 5A for current[*]). Also it's possible to set the threshold as percent value related to the nominal range for current or voltage. In factory setting the real value has to be adjusted.

! **Attention:** This value will be adapted by a later change of the transformer ratio automatically.

The input can changed to percent at menu item *PEr* in submenu *200*.

---

[*] When using a VT / CT the given thresholds are multiplied by the adjusted transformer ratio.

trt

Set the delay time for trip. If the trigger value (voltage or current) for trip is exceeded for a longer period than trt, contacts 11-14 will close and 11-12 will open.

ALd

Set the threshold for alarm. The threshold can be set as real value (0,2 – 20 V for voltage / 20mA – 5A for current*). Also it's possible to set the threshold as percent value related to the nominal range for current or voltage. In factory setting the real value has to be adjusted.

> **!** **Attention:** This value will be adapted by a later change of the transformer ratio automatically.

The input can changed to percent at menu item PEr in submenu 200.

ALt

Sets the delay time for alarm. If the trigger value (voltage or current) for alarm is exceeded for a longer period than ALt, contacts 21-24 will close and 21-22 will open.

trL

The trip relay output can be configured as either latch able or non latch able output.

no   The trip relay goes back to inactive state as soon as the trip value falls below the adjusted threshold.

YES   The trip relay remains in active state even when the trip value falls below the adjusted threshold. To reset push the "◄" Button for 3 sec. After a power interruption the relay goes back to origin state before the interruption.

ALL

The alarm relay output can be configured as either latch able or non latch able output.

no   The alarm relay goes back to inactive state as soon as the alarm value falls below the adjusted threshold.

ЧЕ5   The alarm relay remains in active state even when the alarm value falls below the adjusted threshold. To reset push the "◀" Button for 3 sec. After a power interruption the relay goes back to origin state before the interruption.

r3

The relay 3 is free to program to become active state with trip, alarm or both. Following settings are possible:

OFF   relay 3 is always switched off

A   relay 3 becomes active only with alarm relay

t   relay 3 becomes active only with trip relay

tnA   relay 3 becomes active with trip **and** alarm relay

tuA   relay 3 becomes active with trip **or** alarm relay

r3L

The relay 3 output can be configured as either latch able or non latch able output.

no   The trip relay 3 goes back to inactive state as soon as the trip / alarm value fall below the adjusted threshold.

ЧЕ5   The trip relay 3 remains in active state even when the trip / alarm value falls below the adjusted threshold. To reset push the "◀" Button for 3 sec. After a power interruption the relay goes back to origin state before the interruption.

4.2.2 Expert menu   Password 511

To enter this menu select "Setup" and enter the expert password (511). Select submenus 100 – 400 by using ▲ and ▼. Enter the submenus by pushing ▶.

4.2.2.1 *100* **Start menu**

Contains the same settings as start menu above.

4.2.2.2 *200* **Measurement menu**

CUr Current measuring

YES The ESTAsym CPR is measuring the current at input K&L. Trip and alarm thresholds are given in A respectively in % of nominal input range.

NO The ESTAsym CPR is measuring the voltage at input UM1 & UM2. Trip and alarm thresholds are given in V respectively in % of nominal input range.

PEr Values in percent

YES All values are shown in %. The thresholds for voltage or current are set in % related to nominal value of the input.

NO All values are shown as real value. The thresholds for voltage or current are set as real value.

!	**Attention:** A previous adjusted Transformerratio become set to 1 when altering this item.

trF Transformer factor

Voltage: adjustable VT ratio from 1-350.

Current: adjustable CT ratio from 1-4000.

Frq Frequency

Here it's possible to adjust the grid frequency. Possible settings are 50Hz and 60Hz. The setting for the frequency should be correct otherwise the measurement does not work proper.

4.2.2.3 $\exists\Box\Box$ Alarm menu

$\vdash\Gamma$ Trip active

$\exists E \mathsf{S}$ When exceeding the adjusted threshold for trip, the trip relays operates, the display is blinking and shows $\vdash\Gamma$ $\mathsf{!P}$ ALARM

$\mathsf{\Pi\Box}$ No event following the exceeding the trip threshold.

$\vdash\Gamma\mathsf{S}$ Store trip in "Alarm buffer"

$\exists E \mathsf{S}$ Trips are stored with the trigger value in the "Alarm buffer".

$\mathsf{\Pi\Box}$ Trips are not stored.

$\mathsf{\Pi L}$ Alarm active

$\exists E \mathsf{S}$ When exceeding the adjusted threshold for alarm, the alarm relays operates, the display is blinking and shows $\mathsf{\Pi L}$ ALARM

$\mathsf{\Pi\Box}$No event following the exceeding the trip threshold.

$\mathsf{\Pi L S}$ Store alarm in "Alarm buffer"

$\exists E \mathsf{S}$ Alarms are stored with the trigger value in the "Alarm buffer".

$\mathsf{\Pi\Box}$ Alarms are not stored.

$\mathsf{d\Box\Gamma}$ Drop off ratio (hysteresis)

Possible setting from 50% - 100% of adjusted thresholds for current and voltage. The "drop off ratio" defines the threshold when resetting a trip or an alarm when the monitored value falls below the adjusted threshold.

i.e.

Case 1: Threshold for trip is 0.5A and "drop of ratio" is 100% = trip is reset when the current falls below 0.5A.

Case 2: Threshold for trip is 0.5A and "drop of ratio" is 50% = trip is reset when the current falls below 0.25A.

!	The ESTAsym CPR is working with unsigned absolute values. Due to this always a positive value is shown. Independent of the direction of the changing (meas. value increase / decrease) always a exceeding of the threshold is given.

d 1 Digital input active

YES the monitoring system can be blocked via the digital input.

NO the monitoring system cannot be blocked via the digital input.

d 1L Digital input open or closed

YES monitoring system is blocked when terminals DI1 & DI2 are closed.

NO monitoring system is blocked when terminals DI1 & DI2 are open.

!	**Attention:** The digital input is activated respectively deactivated by opening respectively closing the contact DI1 and DI2. Connecting a voltage signal can destroy the ESTAsym CPR.

4.2.2.4 400 **Reset menu**

rtr   reset trip

rAL   reset alarm

rSE   reset stored alarms and trips

rNU   reset natural unbalance

rFS   reset the device to factory settings.

PS   change password "setup". Possible adjustment 000-999. Master password 242.

PE   change password "expert". Possible adjustment 000-999. Master password 511.

To switch off the password protection, set PE to 000.

4.3   Alarm

The submenu "Alarm" contains the last 5 trips and the last 5 alarms. The alarms and trips are stored with the value which has triggered the event. The alarm storage is an ring buffer, with upcoming a new trip/alarm, the oldest event will be deleted. Also it's possible to clear the "Alarm" menu in menu 400 "Reset menu".

To enter this menu, use the ▼ button to select "Alarm". Enter the menu by pushing ▶. Select the events by pushing the ▲ and ▼ buttons.
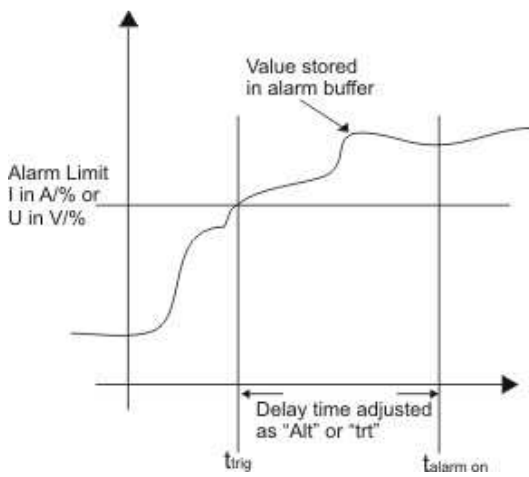
5   Technical Data ESTAsym CPR

Auxiliary voltage	40 – 250V AC, 45-65HZ / 40 – 300VDC, 5VA; max. fuse 6A
Voltage measuring	0,1 – 20V; burden 284kOhm; vt-ratio from 1 – 350, with low pass filter Continuous overload: 120V Short term overload: 500V for ten seconds Accuracy: 0.5% from upper range value
Current measuring	10mA – 5A; burden 20mOhm; ct-ratio from 1-4000, with low pass filter Continuous overload: 25A Short term overload: 100A for one second Accuracy: 0.5% from upper range value
Relay outputs	4 output relays, change over contact, voltfree, max fuse 6A Function: Relay 1: Trip, Relay 2: Alarm, Relay 3: adjustable Alarm, trip or both Relay 4: in order Max. output rating AC: 1250VA, max switching voltage: 440VAC Max. output rating DC (ohmic): 30V / 5A; 60V / 1A; 110V / 0,5A; 220V / 0,3A
Digital input	Blocking Alarm / Trip via digital input.
Interface	TTL, rear (optional accessories TTL-USB converter)
Ambient temperature	Operation: -20℃ – 70℃, storag e: -40℃ – 85℃
Humidity	0% - 95%, without moisture condensation
Overvoltage class	II, pollution degree 3 (DIN VDE 0110, Teil 1 / IEC 60664-1)
Standards	DIN VDE 0110 part 1 (IEC 60664-1:1992) VDE 0411 part 1 (DIN EN 61010-1 / IEC 61010-1:2001) VDE 0843 part 20 (DIN EN 61326 / IEC 61326: 1997 + A1:1998 +A2: 2000)
Conformity and listing	CE
Terminals	screw-type, max. 2,5mm^2
Casing	front: instrument casing plastic (UL94-VO), rear: metal
Protection class	Front: IP50, (IP54 by using a gasket), Rear: IP20
Weight	ca. 0,65 kg
Dimensions	144 x 144 x 58mm (h x w x d), cutout 138$^{+0,5}$ x 138$^{+0,5}$ mm

6 Menu overview

MEAS U / I in % ▼	INFO ▼		SETUP			▼ ALARM	
V / A	►		► 242	100 ►			
	Natural unbalance U / I („NU")	►	511	100 ►	Natural unbalance U / I („NU")		
	Trip value "trd"				Trip value "trd"	►	
	Trip time "trt"				Trip time "trt"	"tr1"	
	Alarm value "Ald"			▼	Alarm value "Ald"	"tr2"	
	Alarm time "Alt"				Alarm time "Alt"	"tr3"	
	Software version "Fr"				Trip latchable "trL"	"tr4"	
	Di state "dl"				Alarm latchable "ALL"	"tr5"	
					Relay 3 "r3"	"AL1"	
					Relay 3 latchable "r3L"	"AL2"	
						"AL3"	
				200 ►	Current / voltage metering "Cur"	"AL4"	
					Display real value or % "Per"	"AL5"	
				▼	Transformer factor "trF"		
					Line frequency "Frq"		
				300 ►	Trip active "tr"		
					Store trip in buffer "trs"		
				▼	Alarm active "AL"		
					Store alarm in buffer "ALS"		
					Drop off ratio "dor"		
					Activate DI "dl"		
					DI open or closed "dIL"		
				400 ►	Reset trip "rtr"		
					Reset alarm "rAL"		
					Reset stored alarms "rSE"		
					Reset natural unbalance "rNU"		
					Reset to factory settings "rFS"		
					Password setup "PS"		
					Password expertmenu "PE"		

7 Settings

Parameter	Range	Factory settings			Customer settings		
Natural unbalanced I "NU"							
Trip value "trd"	20mA-5A / 200mV-20V[*]	2A					
Trip time"trt"	0,1-100 s	0,1 s					
Alarm value"Ald"	20mA-5A / 200mV-20V*	1A					
Alarm time"Alt"	0,1-100 s	5,0 s					
Trip latchable"trL"		X	YES	NO	YES		NO
Alarm latchable"ALL"		X	YES	NO	YES		NO
Relays 3 „r3"		X	OFF		OFF		
			A		A		
			t		t		
			EnA		EnA		
			EwA		EwA		
Relay 3 latchable "r3L"		X	YES	NO	YES		NO
Current / voltage metering „Cur"		X	YES	NO	YES		NO
Display real value"PEr"			YES	X NO	YES		NO
Transformer factor "trF"	CT 1-4000 / PT 1-350	6					
Line frequency „Frq"	50 / 60	50					
Trip active"tr"		X	YES	NO	YES		NO
Store trip in buffer "trs"		X	YES	NO	YES		NO
Alarm active "AL"		X	YES	NO	YES		NO
Store alarm in buffer "ALS"		X	YES	NO	YES		NO
Drop off ratio "dor"	50% - 100%	90%					
Activate DI "dl"			YES	X NO	YES		NO
DI open or closed "dIL"			YES	X NO	YES		NO
Password „Setup"		242					
Password „Expert"		511					

---

[*] When using a VT / CT the given thresholds are multiplied by the adjusted transformer ratio.