# NGRM700 (HRG) NGRM750 (LRG)

Neutral Grounding Resistor Monitor





#### **Neutral Grounding Resistor Monitor**

## NGRM700 (HRG) NGRM750 (LRG)



Certifications



UL File number: E493737, E173157

#### **Device features**

- Determination of *R*<sub>NGR</sub> with passive and active measurement methods
- Continuous monitoring of the R<sub>NGR</sub> even if the installation is de-energized;
- · Alarm or trip on ground fault
- Monitoring of the current INGR
- Monitoring of the voltage U<sub>NGR</sub>
- Faulted phase indication (optional; up to 690 V direct coupling, otherwise via potential transformers)
- Ethernet communication
- Web server
- Language selection (German, English GB and US, Spanish, French)
- Test button (internal, external) with/without tripping
- FFT analysis of neutral current and voltage
- Pulser control for manual ground fault location
- Relay outputs for detection of ground faults and resistor faults
- Relay output for shutdown of the installation after a configurable time
- Can be combined with RCMS... for automatic shutdown of feeders
- · Graphical user interface
- Integrated wide-range power supply unit for operating the NGR monitor (AC/DC 24...240 V)
- Range of use up to 5000 m AMSL
- Fault/History memory
- Analogue output of measured values (0...10 V, 4...20 mA, etc., selectable parameter)
- Detachable HMI for door mounting
- · Password protection
- Tripping on RMS, fundamental component signal or harmonics
- · Detection of AC and DC ground faults
- · Variants High Resistance Grounded (HRG), Low Resistance Grounded (LRG)

	HRG		LRG	
	NGRM500	NGRM700	NGRM550	NGRM750
U <sub>sys LL</sub>	40025000V			
I <sub>NGR nom</sub>	0100 A 102000 A		2000 A	
<b>R</b> NGR nom	155000 Ω		0,1200 Ω	

#### **Product description**

The NGRM700 is only intended for use in high-resistance grounded systems. The NGRM750 is only intended for use in low-resistance grounded systems. In these systems, the NGRM7... monitors

- the current through the neutral grounding resistor (NGR),
- the voltage between the star point of the transformer and ground (voltage drop across the NGR),
- the condition of the neutral grounding resistor (NGR),
- line-to-line and line-to-ground voltages.
- **1** Systems with a resistance-grounded star point can be used when an **interruption of the power supply would involve excessive costs due to production**

**stoppage** (e.g. automotive production, chemical industry). The ground fault that occurs between a phase and ground does not lead to a failure of the power supply in these systems. A ground fault must be detected and eliminated as quickly as possible, since the occurrence of another ground fault in a second phase would lead to a tripping of the overcurrent protective device.

In order to meet the requirements of applicable standards, customised parameter settings must be made on the equipment in order to adapt it to local equipment and operating conditions. Please heed the limits of the range of application indicated in the technical data.

#### Function

The NGRM7... monitors NGR resistance  $R_{NGR}$ , neutral voltage  $U_{NGR}$  and current  $I_{NGR}$ . NGR resistance is monitored using an active and a passive procedure:

- active The device generates an active test pulse and measures  $R_{NGR}$  even if the installation is de-energised.
- passive Only effective when installation is energized: The resistance  $R_{NGR}$  is determined when  $I_{NGR}$  or  $U_{NGR}$  exceeds an internal threshold. The device measures the existing current and voltage and calculates  $R_{NGR}$ .

In the case of the "auto" method, monitoring switches automatically between "active" and "passive" when the measured current or voltage value exceeds or falls below the internal threshold. The threshold is 15 % of the nominal value and can be adjusted by Bender if required.

A shorted or open NGR is reliably detected in an energized as well as a de-energized installation with the active measurement method.

When the "passive" method is selected, no switching of the monitoring takes place. No monitoring of the NGR occurs while the installation is de-energized.

The measurement method can be selected as a set point or via the configurable digital input I1 if the NGR method "external" has been selected (for software versions from July 2021). Should the use of frequency inverters lead to interferences with the  $R_{NGR}$  measured value during the active measurement, a filter for active resistance measurement can be added. To this end, 3 pre-defined filters (weak, medium, strong) have been implemented. In addition, the filter parameters can be adapted individually in the setting "Customer-specific".

The NGR-fault relay switches from the operating state (selectable as fail-safe or non-failsafe) to the alarm state when the measured resistance RNGR is outside of the configured thresholds.

A ground fault is signalled via the corresponding ground-fault relay when  $I_{NGR}$  or  $U_{NGR}$  exceeds the selectable thresholds. After the adjustable time delay has elapsed, the trip relay operates. A connection to installations ranging from 400 V...25 kV is possible via the appropriate CD-series coupling device.  $I_{NGR}$  is measured with (universal) **measuring current transformers** with a 5 A or 50 mA secondary rating. The ratio of the used measuring current transformer can be set internally for best measurement performance of  $I_{NGR}$ .

The **phase-voltage monitoring** function can be used to indicate which phase has the ground fault. Direct coupling is possible up to a system voltage of 690 V.

For higher voltages, use potential transformers (PT). The ratio is an NGRM7... setting.

## User interface FP200-NGRM



#### **Display elements**

1 -	ON	Operation LED, green;
		on when power supply is available
2 -		The LC display shows device and measurement information.
3 -	SERVICE	The LED is on when there is either a device fault or a connection fault, and when the device is in maintenance mode.
4 -	TRIPPED	The LED is on when the trip relay has been tripped due to an NGR fault, ground fault or a device error.
5 -	NGR FAULT	The LED flashes in case of a prewarning: NGR fault detected, NGR-fault relay has tripped, trip relay has not tripped yet ( <i>t</i> <sub>NGR trip</sub> elapses).
		The LED is on when an NGR fault has been de- tected. Trip relay and NGR-fault relay have tripped.
6 -	GROUND	The LED flashes in case of a prewarning: ground
	FAULT	fault detected, ground-fault relay has tripped, trip relay has not tripped yet ( <i>t</i> <sub>GF trip</sub> elapses).
		The LED is on: ground fault detected, trip relay has tripped, installation has not been shut down yet.

## **Device buttons**

7 -	٨	Navigates up in a list or increases a value.
8 -	MENU	Opens the device menu.
	ESC	Cancels the current process or navigates one step back in the device menu.
9 -	RESET	Resets alarms.
	<	Navigates backwards (e.g. to the previous setting step) or selects parameter.
10 -	TEST	Starts the device self test.
	>	Navigates forwards (e.g. to the next setting step) or selects parameter.
11 -	INFO	Shows information.
	V	Navigates down in a list or reduces a value.
12 -	DATA	Indicates data and values.
	OK	Confirms an action or a selection.
13 -	X1	Interface X1
14 -	ETH	Ethernet interface
15 -	R on/off	Terminating resistor for A/B (Modbus RTU)
Buz	zer	Active in case of alarm and/or test
Rea	r side	
	REMOTE	RJ45 port for connection of FP200-NGRM to enclosure
	Х3	Without function

## Connectors CD...



- Connection to star point
- **G1, RS** Connection to *R*<sub>S</sub> of the NGRM7...
- **G, E** Connection to E of the NGRM7... and to the protective earth conductor of the installation (PE)

## Connection star connection: $U_{sys} \le 690 \text{ V}$

For these voltages, the phase monitor of the NGRM7... can be connected directly to the phase conductors to be monitored.



1 The "N" connection of the CD-series coupling device should be as close to the transformer star point as possible.

Connection Star connection:  $U_{sys} \le 690 \text{ V}$  with pulser



1 The "N" connection of the CD-series coupling device should be as close to the transformer star point as possible. An intermediate relay may be required between the power contactor of the pulser and the digital output at X1 of the FP200-NGRM.

#### Connection star connection: $U_{sys} > 690 V$

For these voltages, the phase monitor of the NGRM7... can only be connected to the conductors to be monitored via potential transformers (PT).



Note:

\* PT ratio "primary: secondary" can be adjusted in the NGRM7....

1 The "N" connection of the CD-series coupling device should be as close to the transformer star point as possible

## Artificial neutral (delta connection): Connection with a zigzag transformer

If no star point is available, the following circuit can create an artificial neutral.



## Measuring current transformer connection

Depending on the system to be monitored, a suitable measuring current transformer has to be chosen. All common measuring current transformers (50 mA or 5 A on the secondary side) can be used. The following table helps you with the choice:

System type	AC + DC	AC	AC	AC
I <sub>NGR</sub>	0,525 A	525 A	51000 A	102000 A
f	03800 Hz	423800 Hz	50/60 Hz	50/60 Hz
Transformation ratio Bender measuring current transformer	Measuring range (see CTUB103 manual) 5 A 100:1 10 A 200:1 25 A 500:1	600:1		
Connecting cable	max. 30 m	max. 40 m	max. 25 m (4	mm²/AWG12)
Connecting table	provided cable or 0.751.5 mm <sup>2</sup> /AWG1816		max. 40 m (6	mm²/AWG10)
I∆n				
	CTUB103	CTAC / CTAS	CTB3151	Any standard current transformer can be used.
Туре	CTUB103		СТВ	
	<u>  S1(k)    S2(l)  </u> 			
CT: Terminal k	NGRM7: 50 mA	NGRM7: <b>50 mA</b>	NGRM7: <b>5 A</b>	NGRM7: <b>5 A</b>
CT: Terminal I	NGRM7: <b>C</b>	NGRM7: <b>C</b>	NGRM7: <b>C</b>	NGRM7: <b>C</b>

#### Connection of relays (ground-fault, NGR and trip relay)



The delay times of the various relays are not the same. See table "Trip times relays" in the manual.

## Connection to the X1 interface

#### Pin assignment X1 interface



#### X1: Input I1...3

The input is only detected as "activated" after the contact has been activated for at least 150 ms. This way, short interference pulses are ignored.



Input I1...3: Potential-free contact to common or 0 V and 24 V in conjunction with a PLC

## X1: Output Q1...2





External supply e.g.12...24 V



Connection to Q1, Q2: external relay or PLC.

## **1** Observe maximum current values!

The maximum **output current** on **X1**(+24 V) is **100 mA**. In case of higher currents, the relays require an external 24 V supply. The maximum current on **Q1 and Q2 is 300 mA each**.

#### X1: Analogue output

Analogue output	Mode	Permissible Ioad
Current output	020 mA	$\leq$ 600 $\Omega$
	420 mA	$\leq$ 600 $\Omega$
	0400 μΑ	$\leq$ 4 k $\Omega$
Voltage output	010V	$\geq 1  k\Omega$
M_	210V	$\geq 1  \mathrm{k}\Omega$

## **Technical Data**

Insulation coordination according to IEC 60664-1/IEC	60664-3/DIN EN 50178
Definitions	
Measuring circuit 1 (IC1)	(L1, L2, L3)
Supply circuit (IC2)	(A1, A2)
Measuring circuit/Control circuit (IC3)	(RS, E, CT), (X1, Ethernet)
Output circuit 1 (IC4)	(11, 12, 14)
Output circuit 2 (IC5)	(21, 22, 24)
Output circuit 3 (IC6)	(31, 32, 34)
Rated voltage	690 V
Overvoltage category	
Rated impulse voltage	
IC1 / (IC26)	8 kV
IC2 / (IC36)	4 kV
IC3 / (IC46)	4 kV
IC4 / (IC56)	4 kV
IC5 / (IC6)	4 kV
Rated insulation voltage	
IC1 / (IC26)	800 V
1(2/(1(36)))	250 V
1(3/(1(4-6)))	250 V
I(4 / (I(5 - 6)))	250 V 250 V
105 / (106)	250 V 250 V
Pollution degree exterior	2507
Safe isolation (reinforced insulation) between	
	overvoltage category III 800 V
1(2)/(1(2) - 6)	overvoltage category III, 300 V
1(2 / (1(4 - 6)))	overvoltage category III, 300 V
1(1)/(1(1))	overvoltage category III, 500 V
IC4 / (IC50)	overvoltage category III, 500 V
Voltage tests (routing test) acc. to IEC 61010.1	overvollage category III, 500 v
1C2 / (1C3 0)	
1C3 / (1C40)	
IC4 / (IC50)	
	AC 2.2 KV
Supply voltage	
Nominal supply voltage Us	
≤ 2000 m	AC/DC, 24240 V
$\leq$ 2000 m (for UL applications)	AC/DC, 48240 V
$\leq$ 2000 m (for AS/NZS 2081 applications)	AC/DC, 48230 V
$> 2000 \le 5000 \text{ m}$	AC/DC, 24120 V
$>$ 2000 $\leq$ 5000 m (for UL and AS/NZS 2081 application of the second states of the second	tions) AC/DC, 48120 V
Tolerance U <sub>s</sub>	±15 %
Tolerance U <sub>s</sub> (for UL applications)	-50+15 %
Tolerance U <sub>s</sub> (for AS/NZS 2081 applications)	-25+20 %
Frequency range U <sub>s</sub>	DC, 4070 Hz
Power consumption (typ. 50/60 Hz)	$\leq$ 6.5 W / 13 VA
Phase monitoring	
Nominal measuring voltage Un	3 AC 100690 V, CAT III
Measuring range	1.2 x U <sub>n</sub>
Measurement accuracy	±1% of U <sub>n</sub>
Power consumption per phase	≤ 0.5 W
Overload capacity	2 x U <sub>n</sub> continuous
Input resistance	1.76 MΩ
PT ratio primary	110.000
PT ratio secondary	110,000
Measuring range with PT	100 V25 kV

Measuring input $R_5$ < 33 V RMS    Measuring range NGR (with $R_5 = 20$ kC) active  010 kCl    Measurement uncertainty for $T = 0 + 40$ °C $\pm 20$ Cl    Measurement uncertainty for $T = -40 + 70$ °C $\pm 40$ Cl    Measurement uncertainty for $T = -40 + 70$ °C $\pm 300$ Cl    Measurement uncertainty for $T = -40 + 70$ °C $\pm 300$ Cl    Measurement uncertainty for $T = -40 + 70$ °C $\pm 300$ Cl    Measurement uncertainty for $T = -40 + 70$ °C $\pm 300$ Cl    Measuring range Rustmenn  15 Cl 5 kCl    Response value $R_{klastmenn}$ Response value $R_{klastmenn}$ 100200 % Rustmenn  200500 Cl    Response delay, NGR-fault relay $75$ (±2.55)    Response delay, NGR-fault relay $75$ (±2.55)    Measuring circuit 5 A  Nominal measuring current $I_n$ DC / 50/60 Hz / 103200 Hz 5 A    Measuring circuit 5 O mA  Nominal measuring current $I_n$ DC / 50/60 Hz / 103200 Hz 5 O mA    Measuring circuit 5 O mA  Nominal measuring current $I_n$ DC / 50/60 Hz / 103200 Hz 5 O mA    Measuring circuit 5 A and 50 mA  Response delay, trip relay (configurable)  100 ms48 h, $\infty$ Tolerance $f_{ing}$ whens et	Monitoring R <sub>NGR</sub>	
Measuring range MGR (with $R_5 = 20 \text{ kC}$ ) active  010 kC    Measurement uncertainty for $T = -40+70$ °C  ±200    Measurement uncertainty for $T = -40+70$ °C  ±300    Measurement uncertainty for $T = -40+70$ °C  ±300    Measurement uncertainty for $T = -40+70$ °C  ±800    Measurement uncertainty for $T = -40+70$ °C  ±800    MRG  Setting range Ruse num  15.05 kC    Response value > Ruse num  10200 % Ruse num  10200 % Ruse num    Response value > Ruse num  10200 % Ruse num  10200 % Ruse num    LRG  Setting range Ruse num  200500 C    Response delay, NGR-fault relay  7 s (±2.5 s)  Response delay, NGR-fault relay    Response delay, NGR-fault relay  7 s (±2.5 s)  Response delay, trip relay  048 h    Monitoring Juce  Maximum continuous current  2 x h  0 x h for 0.03 s    Measuring circuit 5 A  Nominal measuring current /_n  DC / 50/60 Hz / 103200 Hz 5 M  Nominal measuring current /_n  DC / 50/60 Hz / 103200 Hz 5 M    Maximum continuous current  2 x h  0 werload capacity  10 x ln for 2 s  Measuring circuit 5 A and 50 mA  Response delay, trun elay (configurable)  10 mcs	Measuring input $R_{\rm S}$	< 33 V RMS
Measurement uncertainty for T = 0+40 °C $\pm 20 \Omega$ Measurement uncertainty for T = -40+70 °C $\pm 40 \Omega$ Measurement uncertainty for T = 0+40 °C $\pm 30 \Omega$ Measurement uncertainty for T = -40+70 °C $\pm 80 \Omega$ Measurement uncertainty for T = -40+70 °C $\pm 80 \Omega$ Measurement uncertainty for T = -40+70 °C $\pm 80 \Omega$ Measurement uncertainty for T = -40+70 °C $\pm 80 \Omega$ Measurement uncertainty for T = -40+70 °C $\pm 80 \Omega$ Measurement uncertainty for T = -40+70 °C $\pm 80 \Omega$ Measurement uncertainty for T = -40+70 °C $\pm 80 \Omega$ Measurement uncertainty for T = -40+70 °C $\pm 80 \Omega$ Measurement uncertainty for T = -40+70 °C $\pm 80 \Omega$ Measurement uncertainty for T = -40+70 °C $\pm 80 \Omega$ Measurement accuracy $\pm 10 \ldots$	Measuring range NGR (with $R_{\rm S} = 20 \text{ k}\Omega$ ) active	010 kΩ
Measurement uncertainty for T =+70 °C  ±40 °C    Measuring range NGR (with $R_5 = 100 \text{ kO2}$ ) active  010 kCl    Measurement uncertainty for T =+40 °C  ±30 °C    MRG  Setting range $R_{NGR nom}$ 15 °C5 kCl    Response value < $R_{NGR nom}$ 1090 % $R_{NGR nom}$ 1090 % $R_{NGR nom}$ Response value < $R_{NGR nom}$ 0.1200 °C  200 °C    Response value < $R_{NGR nom}$ 0.1200 °C  200 °C    Response value < $R_{NGR nom}$ 0.1200 °C  200 °C    Response delay, Krip relay  048 h  048 h    Monitoring <i>I</i> <sub>MGA</sub> Measuring circuit 5 A  Nominal measuring current <i>I</i> <sub>n</sub> DC / 50/60 Hz / 103200 Hz 5 M    Maximum continuous current  2 × <i>I</i> <sub>N</sub> 048 h  Nominal measuring current <i>I</i> _n  DC / 50/60 Hz / 103200 Hz 5 M    Maximum continuous current  2 × <i>I</i> <sub>N</sub> 048 h  Nominal measuring current <i>I</i> _n  DC / 50/60 Hz / 103200 Hz 5 M    Maximum continuous current <i>I</i> _n  DC / 50/60 Hz / 103200 Hz 5 M  Maximum continuous current  2 × <i>I</i> _N    Overload capacity  100 × <i>I</i> _n for 0.33  Measuring circuit 5 M and 50 mA  Neminal measuring current <i>I</i> _n  DC / 50/60 Hz / 103200 Hz 5 M A	Measurement uncertainty for $T = 0+40$ °C	±20 Ω
Measurement uncertainty for T = 0+40 °C $\pm 30 \Omega$ Measurement uncertainty for T = -40+70 °C $\pm 80 \Omega$ HRG  15 $\Omega$ 5 kΩ    Response value < $R_{\rm KGR nom}$ 1090 % $R_{\rm KGR nom}$ Response value < $R_{\rm KGR nom}$ 10200 % $R_{\rm KGR nom}$ Response value < $R_{\rm KGR nom}$ 0.1200 % $R_{\rm KGR nom}$ Response value < $R_{\rm KGR nom}$ 0.1200 % $R_{\rm KGR nom}$ Response value < $R_{\rm KGR nom}$ 200500 $\Omega$ Response value < $R_{\rm KGR nom}$ 20048 h    Monitoring <i>I</i> <sub>MGR</sub> Measuring current <i>I</i> _n  DC / 50/60 Hz / 103200 Hz 5 A    Maximum continuous current  2 x <i>I</i> _n  0 x <i>I</i> _n for 0.03 s    Measuring circuit 5 A  Nominal measuring current <i>I</i> _n  DC / 50/60 Hz / 103200 Hz 5 O A    Measuring circuit 5 O mA  Nominal measuring current <i>I</i> _n  DC / 50/60 Hz / 103200 Hz 5 O A    Measuring circuit 5 A and 50 mA  Response value <i>I</i> <sub>I/GR</sub> 10 mΩ    Measuring circuit 5 A and 50 mA  Response value <i>I</i> <sub>I/GR</sub> 10 m90 % <i>I</i> <sub>I/GR nom</sub> Response value <i>I</i> <sub>I/GR</sub> 1090 % <i>I</i> <sub>I/GR nom</sub> 10 mO ms48 h, ∞    Tolerance $t_{I/M}$ when set to  RMS  -200 ms  10 momins  2 x <i>I</i> _I/MS n	Measurement uncertainty for $T = -40+70^{\circ}$	°C ±40 Ω
$\begin{array}{llllllllllllllllllllllllllllllllllll$	Measuring range NGR (with $R_{\rm S}$ = 100 k $\Omega$ ) active	0…10 kΩ
Measurement uncertainty for T = -40+70 °C  ±80 Ω    HRG  5    Setting range $R_{MCR,nom}$ 15 Ω5 MΩ    Response value > $R_{MCR,nom}$ 1090 % $R_{MCR,nom}$ RG  10200 % $R_{MCR,nom}$ Setting range $R_{MCR,nom}$ 200500 Ω    Response value > $R_{MCR,nom}$ 200500 Ω    Response delay, KIP, Fault relay  7 s (±2.5 s)    Response delay, KIP, relating current $I_n$ DC / 50/60 Hz / 103200 Hz 5 A    Maximum continuous current  2 X $I_n$ Overload capacity  10 x $I_n$ for 0.03 s    Measuring circuit 5 0 mA  DC / 50/60 Hz / 103200 Hz 5 0 mA    Nominal measuring current $I_n$ DC / 50/60 Hz / 103200 Hz 5 0 mA    Measuring circuit 5 0 mA  Nominal measuring current $I_n$ Nowinal measuring current $I_n$ DC / 50/60 Hz / 103200 Hz 5 0 mA    Measuring circuits 5 A and 50 mA  Response delay, tip relay (configurable)    Response delay, ground-fault relay  < 40 ms (±10 ms)	Measurement uncertainty for $T = 0+40$ °C	±30 Ω
HKG Setting range $R_{\rm HGR nom}$ 15 $\Omega$ 5 k $\Omega$ Response value $> R_{\rm HGR nom}$ 1090 % $R_{\rm HGR nom}$ Response value $> R_{\rm HGR nom}$ 110200 $\Omega$ Response value $> R_{\rm HGR nom}$ 0.1200 $\Omega$ Response delay, KGR-fault relay 7 s (±2.5 s) Response delay, trip relay 048 h Monitoring / <sub>NGR</sub> Measuring circuit 5 A Nominal measuring current / <sub>n</sub> DC / 50/60 Hz / 103200 Hz 5 A Maximum continuous current 2.2 k <sub>n</sub> Overload capacity 10 x k <sub>n</sub> for 0.33 Measurement accuracy ±2% of l <sub>n</sub> Load 10 m $\Omega$ Measuring circuit 5 0 mA Nominal measuring current / <sub>n</sub> DC / 50/60 Hz / 103200 Hz 5 0 mA Response value $> R_{\rm HGR}$ 10 k k <sub>n</sub> for 0.33 Measurement accuracy ±2% of l <sub>n</sub> Load 20 10 m $\Omega$ Measuring circuit 5 0 mA Nominal measuring current / <sub>n</sub> DC / 50/60 Hz / 103200 Hz 50 mA Response value $> R_{\rm HGR}$ 10 k k for 2.2 k <sub>n</sub> Overload capacity 10 x ln for 2.2 k <sub>n</sub> Load 68 $\Omega$ Measuring circuit 5 A and 50 mA Response delay, ground-fault relay $\leq 40$ ms (±10 ms) Response delay, trip relay (configurable) 100 ms48 h, $\infty$ Tolerance $t_{\rm Hp}$ when set to RMS -200 ms Fundamental 0+150 ms (filter time) Harmonics 0+150 ms (filter time) Harmonics 0+150 ms (filter time) Heasuring current transformer ratio scondary 110,000 Measuring current transformer ratio scondary 110,000 Measuring range 2.x l <sub>MGR nom</sub> Exponse delay, ground-fault relay $\leq 40$ ms (±10 ms) Response delay, Ground-fault Parten 2	Measurement uncertainty for $T = -40+70^{-1}$	°C ±80 Ω
Setting range Ryski nom  15 123 KJ    Response value $> Ryski nom  1090 % Rysk nom    IRG  110200 % Rysk nom    Setting range Rysk nom  2.00500 Q    Response value > Rysk nom  2.00500 Q    Response delay, KGR-fault relay  7 s (±2.5 s)    Response delay, KGR-fault relay  7 s (±2.5 s)    Response delay, KGR-fault relay  048 h    Monitoring Inc.  Nominal measuring current In  DC / 50/60 Hz / 103200 Hz 5 A    Nominal measuring current In  DC / 50/60 Hz / 103200 Hz 5 O mA    Measuring circuit 5 A  Nominal measuring current In  DC / 50/60 Hz / 103200 Hz 5 O mA    Measuring circuit 50 mA  Nominal measuring current In  DC / 50/60 Hz / 103200 Hz 5 O mA    Measuring circuit 50 mA  Nominal measuring current In  DC / 50/60 Hz / 103200 Hz 50 mA    Measuring circuit 5 A and 50 mA  Response value /NGR  1090 % /NGR nom    Response delay, trip relay (configurable)  100 ms48 h, ∞  -200 ms    Tolerance ting when set to  RMS  -200 ms    Rust mark  0+150 ms (filter time)  Measuring current transformer ratio secondary  110,000    Measuring current transforme$	HKG	15.0 51.0
nesponse value > <i>R</i> <sub>NGR nom</sub> 10200 % <i>R</i> <sub>NGR nom</sub> LRG    Setting range <i>R</i> <sub>NGR nom</sub> 0.1200 Ω    Response value > <i>R</i> <sub>NGR nom</sub> 200500 Ω    Response delay, NGR-fault relay  7 s (±2.5)    Response delay, KGF fault relay  7 s (±2.5)    Monitoring <i>I</i> <sub>NGR</sub> 048 h    Monitoring <i>I</i> <sub>NGR</sub> 048 h    Measuring current <i>I</i> <sub>n</sub> DC / 50/60 Hz / 103200 Hz 5 A    Nominal measuring current <i>I</i> <sub>n</sub> DC / 50/60 Hz / 103200 Hz 5 A    Maximum continuous current  2 x <i>I</i> <sub>n</sub> Overload capacity  10 x <i>I</i> <sub>n</sub> for 0.03 s    Measuring circuit 50 mA  Nominal measuring current <i>I</i> <sub>n</sub> Nowinal measuring current <i>I</i> <sub>n</sub> DC / 50/60 Hz / 103200 Hz 50 mA    Measuring circuit 50 mA  Nowinal measuring current <i>I</i> <sub>n</sub> Nowinal measuring current <i>I</i> <sub>n</sub> DC / 50/60 Hz / 103200 Hz 50 MA    Measuring circuit 55 A and 50 mA  88 Ω    Response delay, tip relay (configurable)  100 ms48 h, ∞    Tolerance <i>t</i> <sub>fip</sub> when set to  70    RMS  -200 ms    Fundamental  0+150 ms (filter time)    Harmonics  04150 ms (filter time)	Setung range R <sub>NGR nom</sub>	10 00 % Proce
Information  110100 070000000000000000000000000000	Response value $> R_{MGR nom}$	1090 % ANGR nom 110 200 % Buco
Link0.1200 $\Omega$ Response value > $R_{MGR,nom}$ 0.1200 $\Omega$ Response delay, KGR-fault relay7 s (±2.5 s)Response delay, trip relay048 hMonitoring / <sub>MGR</sub> Measuring circuit 5 ANominal measuring current $I_n$ DC / 50/60 Hz / 103200 Hz 5 AMaximum continuous current2 x /_nOverload capacity10 x /_n for 0.03 sMeasuring circuit 50 mA0 moninal measuring current $I_n$ Nominal measuring current $I_n$ DC / 50/60 Hz / 103200 Hz 5 O mAMeasuring circuit 50 mA0 moninal measuring current $I_n$ Noverload capacity10 x ln for 2 sMeasuring circuit 5 A and 50 mA86 ΩMeasuring circuit 5 A and 50 mA86 ΩMeasuring circuit 5 A and 50 mA86 ΩMeasuring circuit 5 A and 50 mA96 //n (LoadMeasuring circuit 5 A and 50 mA86 ΩResponse value / <sub>MGR</sub> 1090 % //n (kGR nomRuber Nominal0+150 ms (filter time)Harmonics0+150 ms (filter time)Harmonics0+150 ms (filter time)Measuring current transformer ratio primary10,000Measuring range2 x //n (CD1000, CD1000-2, CD5000 (20 kΩ))Ris for U <sub>295</sub> S 4.3 kVCD1000, CD1000-2, CD5000 (20 kΩ)Ris for U <sub>295</sub> S 4.3 kVCD1400, CD25000 (10 kΩ)Measuring range1.2 x //n (Load nod)Verload capacity2 x //n (Load nod)Measuring range1.2 x //n (Load nod)Verload capacity2 x //n (Load nod)Monitoring U <sub>MGR</sub> DC / 50/60 Hz / 103200 Hz		110200 % //NGR nom
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$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Maximum continuous current	2 x /n
Measurement accuracy $\pm 2 \% \text{ of } I_n$ Load68 $\Omega$ Measuring circuits 5 A and 50 mA8 $\Omega$ Response value $I_{NGR}$ 1090 % $I_{NGR norm}$ Response delay, ground-fault relay $\leq 40 \text{ ms} (\pm 10 \text{ ms})$ Response delay, trip relay (configurable)100 ms48 h, $\infty$ Tolerance $t_{trip}$ when set to $-200 \text{ ms}$ RMS $-200 \text{ ms}$ Fundamental $0+150 \text{ ms}$ (filter time)Harmonics $0+150 \text{ ms}$ (filter time)Measuring current transformer ratio primary $110,000$ Measuring current transformer ratio secondary $110,000$ Measuring range $2 \times I_{NGR norm}$ Coupling $R_S$ for $U_{Sys} \leq 4.3 \text{ kV}$ Chord transformer gratio secondary $110,000$ Measuring range $2 \times I_{NGR norm}$ Coupling $W_{NGR}$ with $R_S = 20 \text{ k}\Omega$ $U_{NGR}$ with $R_S = 100 \text{ k}\Omega$ DC / 50/60 Hz / 103200 Hz; (400/ $\sqrt{3}) \ldots$ (4300/ $\sqrt{3}) V$ $U_{NGR}$ with $R_S = 100 \text{ k}\Omega$ DC / 50/60 Hz / 103200 Hz; (400/ $\sqrt{3}) \ldots$ (25/ $\sqrt{3}) \text{ kV}$ Measuring range $1.2 \times U_{NGR} \text{ norm}$ Overload capacity $2 \times 0 \text{ ms}$ fundamentalNore delay, trip relay (configurable)100 ms48 h, $\infty$ Tolerance $t_{trip}$ when set to $-200 \text{ ms}$ Response delay, ground-fault relay $40 \text{ ms} (\pm 10 \text{ ms})$ Response delay, trip relay (configurable)100 ms48 h, $\infty$ Tolerance $t_{trip}$ when set to $-200 \text{ ms}$ RMS $-200 \text{ ms}$ Fundamental $0+150  m$	Overload capacity	10 x In for 2 s
Load68 ΩMeasuring circuits 5 A and 50 mAResponse value $I_{NGR}$ 1090 % $I_{NGR nom}$ Response delay, ground-fault relay $\leq 40 ms (\pm 10 ms)$ Response delay, trip relay (configurable)100 ms48 h, $\infty$ Tolerance $t_{trip}$ when set to $-200 ms$ RMS $-200 ms$ Fundamental $0+150 ms$ (filter time)Harmonics $0+150 ms$ (filter time)Measuring current transformer ratio primary $110,000$ Measuring range $2 \times I_{NGR nom}$ Coupling $R_S$ for $U_{Sys} \leq 4.3 kV$ Collouo, CD1000-2, CD5000 (20 kΩ) $R_S$ for $U_{Sys} \leq 4.3 kV$ CD1000, CD1000-2, CD5000 (20 kΩ) $R_S$ for $U_{Sys} \leq 4.3 kV$ CD14400, CD25000 (100 kΩ)Monitoring $U_{NGR}$ DC / 50/60 Hz / 103200 Hz; (400/ $\sqrt{3}$ ) $\leq (4300/\sqrt{3}) V$ $U_{NGR}$ with $R_S = 20 k\Omega$ DC / 50/60 Hz / 103200 Hz; > (4.3 $\sqrt{3}$ ) (25/ $\sqrt{3}$ ) kVMeasuring range $1.2 \times U_{NGR}$ for 10 sMeasuring range $1.2 \times U_{NGR}$ for 10 sMeasurement accuracy $2 \%$ of $U_{NGR nom}$ with $U_{NGR nom} = (U_{SS} (1)/\sqrt{3})$ Voltage response value $1090 \% U_{NGR nom}$ Response delay, ground-fault relay $< 40 ms (\pm 10 ms)$ Response delay, trip relay (configurable) $100 ms48 h, ∞$ Tolerance $t_{trip}$ when set toRMSRMS $-200 ms$ Fundamental $0+150 ms$ (f	Measurement accuracy	±2 % of / <sub>n</sub>
Measuring circuits 5 A and 50 mA1090 % $I_{MGR nom}$ Response value $I_{NGR}$ 1090 % $I_{MGR nom}$ Response delay, ground-fault relay $\leq 40 \text{ ms} (\pm 10 \text{ ms})$ Response delay, trip relay (configurable)100 ms48 h, $\infty$ Tolerance $t_{trip}$ when set to $RMS$ RMS $-200 \text{ ms}$ Fundamental $0+150 \text{ ms}$ (filter time)Harmonics $0+150 \text{ ms}$ (filter time)Measuring current transformer ratio primary $110,000$ Measuring range $2 \times I_{NGR nom}$ Coupling $R_S$ for $U_{Sys} \leq 4.3 \text{ kV}$ CD 1000, CD 1000-2, CD 5000 (20 kΩ) $R_S$ for $U_{Sys} \geq 4.3 \text{ kV}$ CD 1000, CD 1000-2, CD 5000 (20 kΩ) $R_S$ for $U_{Sys} \geq 4.3 \text{ kV}$ CD 1000, CD 25000 (100 kΩ)Monitoring $U_{NGR}$ DC / 50/60 Hz / 103200 Hz; (400/ $\sqrt{3}$ ) $\leq (4300/\sqrt{3}) \text{ V}$ $U_{NGR}$ with $R_S = 20 \text{ k}\Omega$ DC / 50/60 Hz / 103200 Hz; > (4.3 / $\sqrt{3}$ ) (25/ $\sqrt{3}$ ) kWMeasuring range $1.2 \times U_{NGR nom}$ Overload capacity $2 \times U_{NGR nom}$ Overload capacity $2 \times U_{NGR nom}$ Notage response value $1090 \% U_{NGR nom}$ Response delay, ground-fault relay $\leq 40 \text{ ms} (\pm 10 \text{ ms})$ Response delay, trip relay (configurable) $100 \text{ ms}48 \text{ h}, \infty$ Tolerance $t_{trip}$ when set toRMSRMS $-200 \text{ ms}$ Fundamental $0+150 \text{ ms}$ (filter time)Harmonics $0+150 \text{ ms}$ (filter time)DC immunity in case of active $R_{NGR}$ measurementwith $R_S = 100 \text{ k}$	Load	68 Ω
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Response delay, ground-fault relay $\leq 40 \text{ ms} (\pm 10 \text{ ms})$ Response delay, trip relay (configurable)100 ms48 h, ∞Tolerance $t_{trip}$ when set toRMSRMS-200 msFundamental0+150 ms (filter time)Harmonics0+150 ms (filter time)Measuring current transformer ratio primary110,000Measuring current transformer ratio secondary110,000Measuring range2 x $I_{NGR nom}$ Coupling $R_S$ for $U_{Sys} \leq 4.3 \text{ kV}$ CD1000, CD1000-2, CD5000 (20 kΩ) $R_S$ for $U_{Sys} \leq 4.3 \text{ kV}$ CD14400, CD25000 (100 kΩ)Monitoring $U_{NGR}$ $U_{NGR}$ with $R_S = 20 \text{ kΩ}$ DC / 50/60 Hz / 103200 Hz; (400/ $\sqrt{3}$ ) (25/ $\sqrt{3}$ ) kVMeasuring range1.2 x $U_{NGR}$ momWeasuring range0+150 ms (filter time)Measuring range1.2 x $U_{NGR}$ mom0verload capacity2 % of $U_{NGR nom}$ with $U_{NGR nom} = (U_{Sys} (\pm 1)/\sqrt{3})$ Voltage response value1090 % $U_{MGR nom}$ Response delay, trip relay (configurable)100 ms48 h, ∞Tolerance $t_{trip}$ when set toRMSRMS-200 msFundamental0+150 ms (filter time)Harmonics0+150 ms (filter time)DC immunity in case of active $R_{NGR}$ measurementwith $R_S = 20 \text{ k}\Omega$ DC t=12 Vwith $R_S = 100 \text{ k}\Omega$ DC immunity in case of active $R_{NGR}$ measurementwith $R_S = 100  $	Response value / <sub>NGR</sub>	1090 % / <sub>NGR nom</sub>
Response delay, trip relay (configurable)100 ms48 h, $\infty$ Tolerance $t_{trip}$ when set toRMS $-200$ msFundamental $0+150$ ms (filter time)Harmonics $0+150$ ms (filter time)Measuring current transformer ratio primary $110,000$ Measuring current transformer ratio secondary $110,000$ Measuring range $2 \times I_{NGR nom}$ Coupling $R_S$ for $U_{Sys} \le 4.3$ kVCoupling $U_{NGR}$ with $R_S = 20$ k $\Omega$ $U_{NGR}$ with $R_S = 100$ k $\Omega$ DC / 50/60 Hz / 103200 Hz; (400/ $\sqrt{3}$ ) $\le$ (4300/ $\sqrt{3}$ ) V $U_{NGR}$ with $R_S = 100$ k $\Omega$ DC / 50/60 Hz / 103200 Hz; > (4.3 / $\sqrt{3}$ ) (25/ $\sqrt{3}$ ) kVMeasuring range $2 \times U_{NGR}$ normOverload capacity $2 \%$ of $U_{NGR nom}$ with $U_{NGR nom} = (U_{Sys} (L-L)/\sqrt{3})Voltage response value1090 % U_{NGR nom}Response delay, ground-fault relay\le 40 ms (\pm 10 ms)Response delay, trip relay (configurable)100 ms48 h, \inftyTolerance t_{trip} when set toRMSRMS-200 msFundamental0+150 ms (filter time)Harmonics0+150 ms (filter time)DC immunity in case of active R_{NGR} measurementwith R_S = 20 k\OmegaDC \pm 12 VWith R_S = 100 k\OmegaDC \pm 12 VDC immunity in case of active R_{NGR} measurementwith R_S = 100 k\OmegaDC \pm 12 VDC immunity in case of active R_{NGR} measurementwith R_S = 100 k\OmegaDC \pm 12 V$	Response delay, ground-fault relay	$\leq$ 40 ms (±10 ms)
Note Table TripProblem Set toRMS-200 msFundamental0+150 ms (filter time)Harmonics0+150 ms (filter time)Measuring current transformer ratio primary110,000Measuring current transformer ratio secondary110,000Measuring range2 x $I_{NGR nom}$ CouplingRs for $U_{sys} \le 4.3$ kVCD 1000, CD 1000-2, CD 5000 (20 kΩ)Rs for $U_{sys} > 4.3$ kVCD 104400, CD 25000 (20 kΩ)Rs for $U_{sys} > 4.3$ kVCD 104400, CD 25000 (20 kΩ)Monitoring $U_{NGR}$ $U_{NGR}$ with $R_s = 20$ kΩDC / 50/60 Hz / 103200 Hz; (400/ $\sqrt{3}$ ) $\le$ (4300/ $\sqrt{3}$ ) V $U_{NGR}$ with $R_s = 100$ kΩDC / 50/60 Hz / 103200 Hz; (400/ $\sqrt{3}$ ) $\le$ (4300/ $\sqrt{3}$ ) V $U_{NGR}$ with $R_s = 100$ kΩDC / 50/60 Hz / 103200 Hz; (400/ $\sqrt{3}$ ) $\le$ (4300/ $\sqrt{3}$ ) V $U_{NGR}$ with $R_s = 100$ kΩDC / 50/60 Hz / 103200 Hz; (400/ $\sqrt{3}$ ) $\le$ (4300/ $\sqrt{3}$ ) VVoltage response value1090 % $U_{NGR nom}$ Response delay, ground-fault relay $\le 40$ ms (±10 ms)Response delay, trip relay (configurable)100 ms48 h, ∞Tolerance trip when set toRMS-200 msFundamental0+150 ms (filter time)Harmonics0+150 ms (filter time)Harmonics0+150 ms (filter time)DC im	Response delay, trip relay (configurable)	100 ms48 h, ∞
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Measuring range $2 \times I_{NGR nom}$ Coupling $R_5$ for $U_{sys} \le 4.3$ kVCD1000, CD1000-2, CD5000 (20 kΩ) $R_5$ for $U_{sys} > 4.3$ kVCD14400, CD25000 (100 kΩ)Monitoring $U_{NGR}$ $U_{NGR}$ with $R_5 = 20$ kΩDC / 50/60 Hz / 103200 Hz; (400/ $\sqrt{3}$ ) $\le$ (4300/ $\sqrt{3}$ ) V $U_{NGR}$ with $R_5 = 100$ kΩDC / 50/60 Hz / 103200 Hz; > (4.3 / $\sqrt{3}$ ) (25/ $\sqrt{3}$ ) kVMeasuring range1.2 x $U_{NGR nom}$ Overload capacity2 % of $U_{NGR nom}$ with $U_{NGR nom} = (U_{sys}$ (L-1)/ $\sqrt{3}$ )Voltage response value1090 % $U_{NGR nom}$ Response delay, ground-fault relay $\le$ 40 ms ( $\pm$ 10 ms)Response delay, trip relay (configurable)100 ms48 h, $\infty$ Tolerance $t_{trip}$ when set to $-200$ msRMS $-200$ msFundamental $0+150$ ms (filter time)Harmonics $0+150$ ms (filter time)DC immunity in case of active $R_{NGR}$ measurement $DC \pm 12$ V with $R_5 = 100$ kΩDC ±12 V with $R_5 = 100$ kΩDC ±12 V DC ±60 V	Measuring current transformer ratio secondary	110,000
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Comparing $R_S$ for $U_{SyS} \le 4.3 \text{ kV}$ CD1000, CD1000-2, CD5000 (20 kΩ) $R_S$ for $U_{SyS} > 4.3 \text{ kV}$ CD14400, CD25000 (100 kΩ) <b>Monitoring</b> $U_{NGR}$ UNGR with $R_S = 20 \text{ k}\Omega$ DC / 50/60 Hz / 103200 Hz; (400/ $\sqrt{3}$ ) $\le$ (4300/ $\sqrt{3}$ ) V $U_{NGR}$ with $R_S = 100 \text{ k}\Omega$ DC / 50/60 Hz / 103200 Hz; (400/ $\sqrt{3}$ ) $\le$ (4300/ $\sqrt{3}$ ) VWeasuring range1.2 x $U_{NGR}$ nomOverload capacity2 x $U_{NGR}$ for 10 sMeasurement accuracy2 % of $U_{NGR nom}$ with $U_{NGR nom} = (U_{SyS} (L-L)/\sqrt{3})$ Voltage response value1090 % $U_{NGR nom}$ Response delay, ground-fault relay $\le$ 40 ms ( $\pm$ 10 ms)Response delay, trip relay (configurable)100 ms48 h, $\infty$ Tolerance $t_{trip}$ when set to $-200 \text{ ms}$ RMS $-200 \text{ ms}$ Fundamental $0+150 \text{ ms}$ (filter time)Harmonics $0+150 \text{ ms}$ (filter time)DC immunity in case of active $R_{NGR}$ measurement $DC \pm 12 \text{ V}$ with $R_S = 20 \text{ k}\Omega$ DC $\pm 12 \text{ V}$ With $R_S = 100 \text{ k}\Omega$ DC $\pm 12 \text{ V}$	Coupling	
$K_5$ for $U_{sys} \le 4.3$ kVCD 1000, CD 1000-2, CD 5000 (20 K2) $R_5$ for $U_{sys} > 4.3$ kVCD 14400, CD 25000 (100 kΩ) <b>Monitoring</b> $U_{NGR}$ U $U_{NGR}$ with $R_5 = 20$ kΩDC / 50/60 Hz / 103200 Hz; (400/ $\sqrt{3}$ ) $\le$ (4300/ $\sqrt{3}$ ) W $U_{NGR}$ with $R_5 = 100$ kΩDC / 50/60 Hz / 103200 Hz; (400/ $\sqrt{3}$ ) $\le$ (4300/ $\sqrt{3}$ ) WWeasuring range1.2 x $U_{NGR}$ nomOverload capacity2 x $U_{NGR}$ for 10 sMeasurement accuracy2 % of $U_{NGR nom}$ with $U_{NGR nom} = (U_{sys} (L-L)/\sqrt{3})$ Voltage response value1090 % $U_{NGR nom}$ Response delay, ground-fault relay $\le$ 40 ms ( $\pm$ 10 ms)Response delay, trip relay (configurable)100 ms48 h, $\infty$ Tolerance $t_{trip}$ when set to $RMS$ Rudamental $0+150$ ms (filter time)Harmonics $0+150$ ms (filter time)DC immunity in case of active $R_{NGR}$ measurementDC $\pm$ 12 Vwith $R_5 = 20$ kΩDC $\pm$ 12 Vwith $R_5 = 100$ kΩDC $\pm$ 10 KΩ		
Monitoring $U_{NGR}$ CD 14400, CD 25000 (100 K2))Monitoring $U_{NGR}$ DC / 50/60 Hz / 103200 Hz; (400/ $\sqrt{3}$ ) $\leq$ (4300/ $\sqrt{3}$ ) W $U_{NGR}$ with $R_S = 20 \text{ k}\Omega$ DC / 50/60 Hz / 103200 Hz; (400/ $\sqrt{3}$ ) $\leq$ (4300/ $\sqrt{3}$ ) WMeasuring range1.2 x U_{NGR nom}Overload capacity2 x U_{NGR for 10 s}Measurement accuracy2 % of $U_{NGR nom}$ with $U_{NGR nom} = (U_{sys}(L-L)/\sqrt{3})$ Voltage response value1090 % $U_{NGR nom}$ Response delay, ground-fault relay $\leq$ 40 ms ( $\pm$ 10 ms)Response delay, trip relay (configurable)100 ms48 h, $\infty$ Tolerance $t_{trip}$ when set to $-200$ msFundamental $0+150$ ms (filter time)Harmonics $0+150$ ms (filter time)DC immunity in case of active $R_{NGR}$ measurementDC $\pm$ 12 Vwith $R_S = 20$ k $\Omega$ DC $\pm$ 12 Vwith $R_S = 100$ k $\Omega$ DC $\pm$ 10 K $\Omega$	$R_{\rm S}$ for $U_{\rm SyS} \le 4.3$ kV	CD1000, CD1000-2, CD5000 (20 kC2)
Monitoring $U_{NGR}$ $U_{NGR}$ with $R_S = 20 \text{ k}\Omega$ DC / 50/60 Hz / 103200 Hz; (400/ $\sqrt{3}$ ) $\leq$ (4300/ $\sqrt{3}$ ) W $U_{NGR}$ with $R_S = 100 \text{ k}\Omega$ DC / 50/60 Hz / 103200 Hz; > (4.3 / $\sqrt{3}$ ) (25/ $\sqrt{3}$ ) WMeasuring range1.2 x U_{NGR nom}Overload capacity2 x U_{NGR nom} = (U_{sys} (L-1)/ $\sqrt{3}$ )Voltage response value1090 % U_{NGR nom} = (U_{sys} (L-1)/ $\sqrt{3}$ )Voltage response value1090 % U_{NGR nom} = (U_{sys} (L-1)/ $\sqrt{3}$ )Voltage response value1090 % U_{NGR nom} = (U_{sys} (L-1)/ $\sqrt{3}$ )Response delay, ground-fault relay $\leq$ 40 ms ( $\pm$ 10 ms)Response delay, trip relay (configurable)100 ms48 h, $\infty$ Tolerance $t_{trip}$ when set to $-200$ msRMS $-200$ msFundamental $0+150$ ms (filter time)Harmonics $0+150$ ms (filter time)DC immunity in case of active $R_{NGR}$ measurementwith $R_S = 20$ k $\Omega$ DC $\pm$ 12 Vwith $R_S = 100$ k $\Omega$ DC $\pm$ 00	$R_{\rm S}$ for $U_{\rm sys} > 4.3$ KV	CD14400, CD25000 (100 KS2)
	Monitoring U <sub>NGR</sub>	
$U_{NGR}$ with $R_S = 100 \text{ k}\Omega$ DC / 50/60 Hz / 103200 Hz; > (4.3 / $\sqrt{3}$ )(25/ $\sqrt{3}$ ) kVMeasuring range1.2 x $U_{NGR nom}$ Overload capacity2 x $U_{NGR}$ for 10 sMeasurement accuracy2 % of $U_{NGR nom}$ with $U_{NGR nom} = (U_{sys} (L-1)/\sqrt{3})$ Voltage response value1090 % $U_{NGR nom}$ Response delay, ground-fault relay $\leq$ 40 ms ( $\pm$ 10 ms)Response delay, trip relay (configurable)100 ms48 h, $\infty$ Tolerance $t_{trip}$ when set to $-200$ msRMS $-200$ msFundamental $0+150$ ms (filter time)Harmonics $0+150$ ms (filter time)DC immunity in case of active $R_{NGR}$ measurement $DC \pm 12$ Vwith $R_S = 20$ k $\Omega$ $DC \pm 12$ Vwith $R_S = 100$ k $\Omega$ $DC \pm 60$ V	$U_{\rm NGR}$ with $R_{\rm S} = 20 \mathrm{k}\Omega$ DC / 50/60 Hz / 10	3200 Hz; $(400/\sqrt{3}) \dots \le (4300/\sqrt{3})$ V
Measuring range1.2 x $U_{NGR nom}$ Overload capacity2 x $U_{NGR for 10 s}$ Measurement accuracy2 % of $U_{NGR nom}$ with $U_{NGR nom} = (U_{sys} ()/\sqrt{3})$ Voltage response value1090 % $U_{NGR nom}$ Response delay, ground-fault relay $\leq 40 ms (\pm 10 ms)$ Response delay, trip relay (configurable)100 ms48 h, $\infty$ Tolerance $t_{trip}$ when set to $-200 ms$ RMS $-200 ms$ Fundamental $0+150 ms$ (filter time)Harmonics $0+150 ms$ (filter time)DC immunity in case of active $R_{NGR}$ measurement $DC \pm 12 V$ with $R_S = 20 k\Omega$ $DC \pm 10 k\Omega$ DC $\pm 100 k\Omega$ $DC \pm 60 V$	$U_{\rm NGR}$ with $R_{\rm S} = 100 \mathrm{k}\Omega$ DC / 50/60 Hz / 10.	3200 Hz; > $(4.3 / \sqrt{3}) \dots (25 / \sqrt{3}) kV$
$\begin{array}{c c} \hline \text{Overload capacity} & 2 \times U_{\text{NGR}} \text{ for 10 s} \\ \hline \text{Measurement accuracy} & 2 \% \text{ of } U_{\text{NGR nom}} \text{ with } U_{\text{NGR nom}} = (U_{\text{sys} (L-1)}/\sqrt{3}) \\ \hline \text{Voltage response value} & 10 \dots 90 \% U_{\text{NGR nom}} \\ \hline \text{Response delay, ground-fault relay} & \leq 40 \text{ ms} (\pm 10 \text{ ms}) \\ \hline \text{Response delay, trip relay (configurable)} & 100 \text{ ms} \dots 48 \text{ h}, \infty \\ \hline \text{Tolerance } t_{\text{trip}} \text{ when set to} \\ \hline \text{RMS} & -20 \dots 0 \text{ ms} \\ \hline \text{Fundamental} & 0 \dots +150 \text{ ms} (\text{filter time}) \\ \hline \text{Harmonics} & 0 \dots +150 \text{ ms} (\text{filter time}) \\ \hline \text{DC immunity in case of active } R_{\text{NGR}} \text{ measurement} \\ \hline \text{with } R_{\text{S}} = 20 \text{ k}\Omega & \text{DC} \pm 12 \text{ V} \\ \hline \text{with } R_{\text{S}} = 100 \text{ k}\Omega & \text{DC} \pm 60 \text{ V} \end{array}$	Measuring range	1.2 x <i>U</i> <sub>NGR nom</sub>
Measurement accuracy2 % of $U_{NGR nom}$ with $U_{NGR nom} = (U_{sys}(L-1)/\sqrt{3})$ Voltage response value1090 % $U_{NGR nom}$ Response delay, ground-fault relay $\leq$ 40 ms ( $\pm$ 10 ms)Response delay, trip relay (configurable)100 ms48 h, $\infty$ Tolerance $t_{trip}$ when set to $-200$ msRMS $-200$ msFundamental $0+150$ ms (filter time)Harmonics $0+150$ ms (filter time)DC immunity in case of active $R_{NGR}$ measurementwith $R_S = 20$ k $\Omega$ DC $\pm$ 12 Vwith $R_S = 100$ k $\Omega$ DC $\pm$ 60 V	Overload capacity	2 x U <sub>NGR</sub> for 10 s
Voltage response value $1090 \% U_{NGR nom}$ Response delay, ground-fault relay $\leq 40 \text{ ms} (\pm 10 \text{ ms})$ Response delay, trip relay (configurable) $100 \text{ ms}48 \text{ h}, \infty$ Tolerance $t_{trip}$ when set to $RMS$ RMS $-200 \text{ ms}$ Fundamental $0+150 \text{ ms}$ (filter time)Harmonics $0+150 \text{ ms}$ (filter time)DC immunity in case of active $R_{NGR}$ measurement $DC \pm 12 \text{ V}$ with $R_S = 20 \text{ k}\Omega$ $DC \pm 12 \text{ V}$ with $R_S = 100 \text{ k}\Omega$ $DC \pm 60 \text{ V}$	Measurement accuracy 2 % of	$U_{\rm NGR nom}$ with $U_{\rm NGR nom} = (U_{\rm sys (L-L)}/\sqrt{3})$
Response delay, ground-fault relay $\leq 40 \text{ ms} (\pm 10 \text{ ms})$ Response delay, trip relay (configurable)  100 ms48 h, $\infty$ Tolerance $t_{trip}$ when set to $RMS$ RMS $-200 \text{ ms}$ Fundamental $0+150 \text{ ms}$ (filter time)    Harmonics $0+150 \text{ ms}$ (filter time)    DC immunity in case of active $R_{NGR}$ measurement  with $R_S = 20 \text{ k}\Omega$ DC ±12 V    with $R_S = 100 \text{ k}\Omega$ DC ±60 V  DC ±60 V	Voltage response value	1090 % U <sub>NGR nom</sub>
Response delay, trip relay (configurable)  100 ms48 h, ∞    Tolerance $t_{trip}$ when set to  -200 ms    RMS  -200 ms    Fundamental  0+150 ms (filter time)    Harmonics  0+150 ms (filter time)    DC immunity in case of active $R_{NGR}$ measurement  with $R_S = 20 \text{ k}\Omega$ with $R_S = 100 \text{ k}\Omega$ DC ±12 V    DC +60 V  DC ±60 V	Response delay, ground-fault relay	$\leq$ 40 ms (±10 ms)
Tolerance $t_{trip}$ when set to RMSRMS $-200$ msFundamental $0+150$ ms (filter time)Harmonics $0+150$ ms (filter time)DC immunity in case of active $R_{NGR}$ measurement with $R_S = 20$ k $\Omega$ DC ±12 V DC ±12 V DC ±60 V	Response delay, trip relay (configurable)	100 ms48 h, ∞
RMS $-200$ msFundamental $0+150$ ms (filter time)Harmonics $0+150$ ms (filter time)DC immunity in case of active $R_{NGR}$ measurementwith $R_S = 20$ k $\Omega$ DC ±12 Vwith $R_S = 100$ k $\Omega$ DC ±60 V	Tolerance t <sub>trip</sub> when set to	22
Fundamental $0+150$ ms (filter time)Harmonics $0+150$ ms (filter time)DC immunity in case of active $R_{NGR}$ measurement $DC \pm 12$ Vwith $R_S = 20$ k $\Omega$ $DC \pm 12$ Vwith $R_S = 100$ k $\Omega$ $DC \pm 60$ V	KMS Fundamental	-200 ms
DC immunity in case of active $R_{NGR}$ measurement0+150 ms (niter time)with $R_5 = 20 \text{ k}\Omega$ DC ±12 Vwith $R_5 = 100 \text{ k}\Omega$ DC ±60 V	runuamentai Harmonics	$U \dots + 150 \text{ ms}$ (filter time)
with $R_{\rm S} = 20 \text{ k}\Omega$ DC ±12 V with $R_{\rm S} = 100 \text{ k}\Omega$ DC ±60 V	DC immunity in case of active Russ measurement	
with $R_{\rm S} = 100 \rm k\Omega$ DC ±12 V	with $R_c = 20 \text{ kO}$	DC +12 V
	with $R_{\rm s} = 100  \rm k\Omega$	DC +60 V

## Digital inputs

Galvanic separation	no
Length connecting cables	max. 10 m
U <sub>in</sub>	DC 0 V, 24 V
Overload capacity	–5…32 V

## **Digital outputs**

Galvanic separation	no
Length connecting cables	max. 10 m
Currents (sink) for each output	max. 300 mA
Voltage	24 V
Overload capacity	–5…32 V

## Analogue output (M+)

Operating princ	iple	linear
Functions		I <sub>NGR</sub> , R <sub>NGR</sub>
Current	020 mA (≤ 600 Ω), $420$ mA (≤ 600 Ω), $0.$	$\dots$ 400 $\mu$ A ( $\leq$ 4 k $\Omega$ )
Voltage	$010 \text{ V} (\geq 1 \text{ k}\Omega),$	$210 \text{ V} (\geq 1 \text{ k}\Omega)$
Tolerance relate	d to the current/voltage end value	±20 %

## Ground-fault, NGR, trip relay

Switching elements	changeover contacts
Operating mode	configurable fail-safe/non-fail-safe
Electrical endurance, number of cycles	10,000
Switching capacity	2000 VA / 150 W
Contact data acc. to IEC 60947-5-1	
Rated operational voltage AC	250 V/250 V
Utilisation category	AC-13/AC-14
Rated operational current AC	5 A/3 A
Rated operational current AC (for UL applications)	3 A/3 A
Rated operational voltage DC	220/110/24 V
Utilisation category	DC12
Rated operational current DC	0.1/0.2/1 A
Minimum current	1 mA at AC/DC > 10 V

## Environment/EMC

EMC immunity (IEC 61000-6-2 / IEC 60255-26 Ed. 3.0)	DIN EN 61000-6-2
EMC emission (IEC 61000-6-4 / IEC 60255-26 Ed. 3.0)	DIN EN 61000-6-4
Operating temperature	-40+70 °C
Operating temperature for UL applications	-40+60 °C
Transport	−40+85 °C
Long-term storage	−40…+70 °C
Humidity	≤ 98 %
Classification of climatic conditions acc. to IEC 60721	
(with respect to temperature and rel. humidity)	
Stationary use (IEC 60721-3-3)	3K22
Transport (IEC 60721-3-2)	2K11
Long-term storage (IEC 60721-3-1)	1K22
Classification of mechanical conditions acc. to	
IEC 60721 / IEC 60255-21 / DIN EN 60068-2-6	
Stationary use	3M12
Transport	2M4

Transport	2M4
Long-term storage	1M12

Connection	
Screw-type terminals	
Tightening torque	0.50.6 Nm (57 lb-in)
Conductor sizes	AWG 24-12
Stripping length	7 mm
rigid/flexible	0.22.5 mm <sup>2</sup>
flexible with ferrule with/without plastic sleeve	0.252.5 mm <sup>2</sup>
Multiple conductor, rigid	0.21 mm <sup>2</sup>
Multiple conductor flexible	0.21.5 mm <sup>2</sup>
Multiple conductor flexible with ferrule without plastic sleeve	0.251 mm <sup>2</sup>
Multiple conductor, flexible with TWIN ferrule with plastic sleep	ve 0.51.5 mm <sup>2</sup>
Push-wire terminals X1	
Conductor sizes	AWG 24-16
Stripping length	10 mm
rigid/flexible	0.21.5 mm <sup>2</sup>
flexible with ferrule without plastic sleeve	0.251.5 mm <sup>2</sup>
flexible with ferrule with plastic sleeve	0.250.75 mm <sup>2</sup>

#### **Other**

Operating mode	continuous operation
Mounting	display-oriented
Operating altitude	≤ 5000 m AMSL
Degree of protection, internal components (DIN EN 60529)	IP30
Flammability class	UL 94V-0
Protective coating measurement equipment	SL1307, UL file E80315
Documentation number	D00292
Weight	1050 g

## Ordering information

Туре	System type	Supply voltage <i>U</i> <sub>s</sub> / Frequency range Hz	Art. No.
NGRM700	HRG	AC 24240 V, 4070 Hz	B94013700
NGRM750	LRG	DC 24240 V	B94013750

## Suitable system components

Description	Voltage/Current	Туре	Art. No.
Measuring current transformer	AC up to 30 A	CTAC35	B98110007
		CTAC60	B98110017
		CTAS50	B98110009
		CTAS80	B98110010
		CTAS120	B98110011
	AC/DC up to 10 A	CTUB103-CTBC35	B78120030
	AC/DC up to 25 A	CTUB103-CTBC60	B78120031
	AC/DC up to 25 A	CTUB103-CTBC120 B781200	
	AC >301000 A	CTB31CTB51	B980860xx <sup>1)</sup>

<sup>1)</sup> All types and ordering informations of this series are available on our website

Description	Voltage <b>U</b> sys	Туре	Art. No.
CD-series coupling device	400690 V	CD1000	B98039010
	4001000 V	CD1000-2	B98039053
	10004200 V	CD5000	B98039011
	430014550 V	CD14400	B98039054
	1455125000 V	CD25000	B98039055

Description	Length (m)	Туре	Art. No.
Connecting cables CTUB103	1	CTXS-100	B98110090
	2,5	CTXS-250	B98110091
	5	CTXS-500	B98110092
	10	CTXS-1000	B98110093

Description	max. connected measuring current transformers	Туре	Art. No.
Voltage supply for CTUB103 measuring current transformers	2	STEP-PS/1 AC/24 DC/0.5	B94053110
	7	STEP-PS/1 AC/24 DC/1.75	B94053111
	17	STEP-PS/1 AC/24 DC/4.2	B94053112









Bender GmbH & Co. KG • Germany Londorfer Straße 65 • 35305 Grünberg Tel.: +49 6401 807-0 • info@bender.de www.bender.de

USA, Mexico, Central America • Exton PA, USA 800.356.4266 / 610.383.9200 · info@bender.org www.bender.org

Canada • Missisauga ON, Canada 800.243.2438 / 905.602.9990 info@bender-ca.com • www.bender-ca.com

South America · Santiago de Chile +59 2.2933.4211 • info@bender-latinamerica.com www.bender-latinamerica.com

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