



NGRM500

Neutral grounding resistor monitor



Intended use

The NGRM500 is only intended for use in high-resistance grounded systems. In these systems, the NGRM500 monitors

- the current through the neutral-grounding resistor (NGR),
- the voltage between the star point of the transformer and earth (voltage drop across the NGR),
- the condition of the NGR.

This quick-start guide does not replace the operating manual of the device.

Download: www.bender.de/manuals

Safety instructions



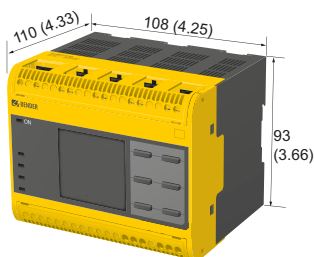
DANGER of electrocution due to electric shock!

Touching live parts of the system carries the risk of:

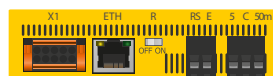
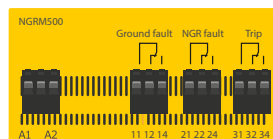
- An electric shock
- Damage to the electrical installation
- Destruction of the device

Before installing and connecting the device, make sure that the **installation has been de-energised**. Observe the rules for working on electrical installations.

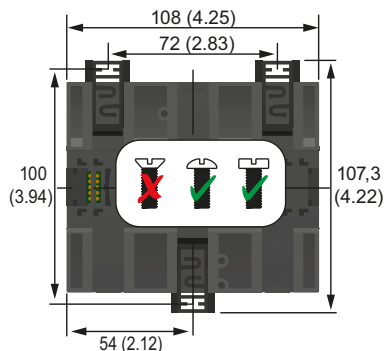
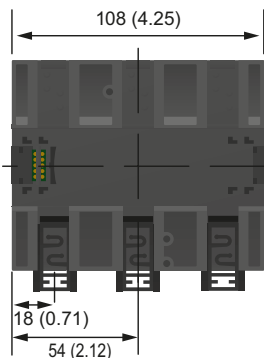
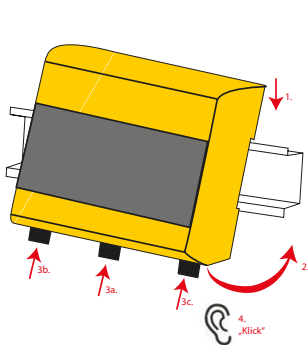
Dimension diagram (all dimensions in mm (in))



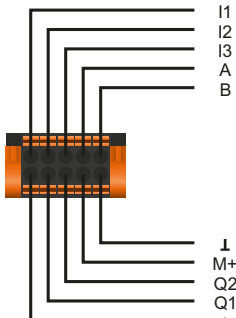
Enclosure view (front, top, bottom)



Mounting (DIN rail, screw mounting)

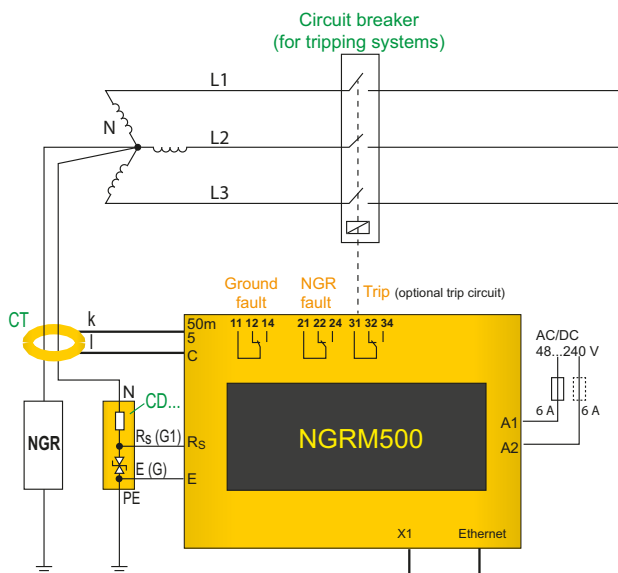


Connection X1

	I1	Pulser IN
	I2	Reset IN
	I3	Test IN
	A	Modbus RTU (A)
	B	Modbus RTU (B)
	⊥	Ground
	M+	Analogue output
	Q2	Open Collector: Pulser OUT
	Q1	Open Collector: Device health
	+	Output for supply of external relays (+24 V, max. 100 mA)

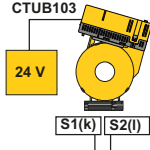
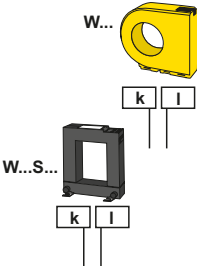
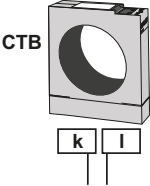
Star configuration

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



Measuring current transformer selection

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

System type	AC + DC	AC	AC
I_{NGR}	1...25 A	5...25 A	5...100 A
f	0...3800 Hz	42...3800 Hz	50/60 Hz
Bender CT Ratio	600:1	600:1	60:5
Connecting cable	max. 30 m	max. 40 m	max. 25 m (4 mm ² /AWG 12) max. 40 m (6 mm ² /AWG 10)
	provided cable or cable of 0.75...1.5 mm ² /AWG 18...16		
$I_{\Delta n}$ (Currents detected)	 AC, pulsed AC, DC	 AC, pulsed AC	 AC, pulsed AC
Type Bender CT	CTUB103 	W20...120 W1-S35...W5-S210 	CTB31...41 
CT: Terminal k	NGRM500: 50 mA	NGRM500: 50 mA	NGRM500: 5 A
CT: Terminal I	NGRM500: C	NGRM500: C	NGRM500: C

Menu structure

1. Data meas. values

R_{NGR} , R_{NGR} rel, Method, R_{sense} , I_{rms} , I_{rms} rel, U_{rms} , U_{rms} rel, I_{fund} , I_{fund} rel, U_{fund} , U_{fund} rel, I_{harm} , I_{harm} rel, U_{harm} , U_{harm} rel,

2. Harmonics



3. History

History, Delete

4. Pulser

Pulser, t_{impuls}

5. Display

R_{NGR} , I_{NGR}

6. HRG settings

HRG system — U_{sys} (L-L), f , I_{NGR} nom, R_{NGR} nom

CT — CT primary, CT secondary, CT connection

NGR — Method, PT primary, PT secondary

Response values — U_{NGR} Trip, I_{NGR} Trip, $>R_{NGR}$, $<R_{NGR}$, t_{NGR} trip, GF trip, t_{GF} trip, Alarm stored, $t_{restart}$, Max. no. of restarts, Trip signal, Upper limit harmonics, Lower limit harmonics

System settings —

Earth fault relay		Mode, Relay test
NGR relay		Mode, Relay test
Trip relay		Mode, Relay test
Analogue		Mode, Function
Digital in/out		Device OUT, Pulser OUT, Pulser IN, Reset IN, Test IN
Buzzer		Buzzer alarm, Buzzer test

Field calibration

7. Device settings

Language, Clock, Interface, Display, Password, Factory setting, Software, Service

8. Commissioning

Setting Language, Clock, U_{sys} L-L, f , I_{NGR} nom, R_{NGR} nom, $CT_{primary}$, $CT_{secondary}$, $CT_{connection}$, Field calibration

9. Info

Device information, Software information, Clock and date information, Ethernet information

10. Alarm

Acknowledge, Reset, Test

Recommended minimum value R_{NGR} (tripping level 50 %)

 Temperature range $-40...+70\text{ }^{\circ}\text{C}$, field calibration at $25\text{ }^{\circ}\text{C}$

 (Values shown in brackets: Limited temperature range $0...+40\text{ }^{\circ}\text{C}$, field calibration at $25\text{ }^{\circ}\text{C}$)

	CD1000/CD1000-2			CD1000-2	CD5000		CD14400					CD25000
U_{sys}	400 V	600 V	690 V	1000 V	2400 V	4200 V	6000 V	6600 V	7200 V	11000 V	14400 V	25000 V
I_{NGR}												
1 A	231 Ω	346 Ω	398 Ω	577 Ω	1386 Ω	—	—	—	—	—	—	—
5 A	46 Ω	69 Ω	80 Ω	115 Ω	277 Ω	485 Ω	693 Ω	762 Ω	831 Ω	1270 Ω	1663 Ω	—
10 A	(23 Ω)	35 Ω	40 Ω	58 Ω	139 Ω	242 Ω	346 Ω	381 Ω	416 Ω	635 Ω	831 Ω	1443 Ω
15 A	(15 Ω)	(23 Ω)	(27 Ω)	38 Ω	92 Ω	162 Ω	231 Ω	254 Ω	277 Ω	423 Ω	554 Ω	962 Ω
20 A	—	(17 Ω)	(20 Ω)	29 Ω	69 Ω	121 Ω	(173 Ω)	191 Ω	208 Ω	318 Ω	416 Ω	722 Ω
25 A	—	—	(16 Ω)	(23 Ω)	55 Ω	97 Ω	(139 Ω)	(152 Ω)	(166 Ω)	254 Ω	333 Ω	577 Ω
30 A	—	—	—	(19 Ω)	(46 Ω)	81 Ω	(115 Ω)	(127 Ω)	(139 Ω)	212 Ω	277 Ω	481 Ω
40 A	—	—	—	—	(35 Ω)	61 Ω	(87 Ω)	(95 Ω)	(104 Ω)	(159 Ω)	208 Ω	361 Ω
50 A	—	—	—	—	(28 Ω)	(48 Ω)	—	(76 Ω)	(83 Ω)	(127 Ω)	(166 Ω)	289 Ω
100 A	—	—	—	—	—	(24 Ω)	—	—	—	—	(83 Ω)	(144 Ω)

Maximum trip times $t(\text{GFtrip})$ for the used CD-NGRM

The setting for $t_{\text{GF trip}}$ must not be longer than the maximum operating time of the CD series... coupling device. The table shows an overview of the $t(\text{GFtrip})$ settings for the coupling device used:

U_{sys}	Coupling device	Ground-fault trip settings (menu 6.5.6) (Select Off for ground-fault alarm-only systems)	max. tGF trip (menu 6.5.7) (For ground-fault tripping systems)
400...690 V	CD1000	on or off	24 h
	CD1000-2		
691...1000 V	CD1000	on	300 s
	CD1000-2	on or off	24 h
	CD5000		
1001...4300 V	CD5000	on or off	24 h
4301...14550 V	CD14400	on	60 s
	CD25000		
14551...25000 V	CD25000	on	10 s

Initial commissioning

The commissioning wizard (**menu 8**) queries the following parameters

(additional settings: menu 6):

Language (8.2)	Select	RNGR nom (8.8)	
Date (8.3)	Set	CT primary (8.9)	
Time (8.4)	Set	CT secondary (8.10)	
Usys L-L (8.5)	System voltage	CT connection (8.11)	50 mA or 5 A
Frequency (8.6)	50 or 60 Hz	Field calibration (8.12)	
INGR nom (8.7)			Start or do not start

1. Setting the response values (menu 6.4)

- Trip threshold for voltage (U_{NGR})
 - Trip threshold for current (I_{NGR})
 - Trip threshold for resistance (R_{NGR})
- i** Low trip threshold values: may lead to false tripping.
High trip threshold values: the device may not trip.

2. System settings of the relay -output modes (menu 6.5)

The factory setting for the relay outputs is fail-safe. The relays only change state when a test is initiated if so configured.

- i** **Fail-safe:** The relay is energised during normal operation and is de-energised in the event of a fault ("fail-safe").
- Non-fail-safe:** The relay is de-energised in normal operation and is energised in the event of a fault ("non-fail-safe").

3. Field calibration (menu 6.6)

After the parameters have been entered, a field calibration can be carried out to set $R_{NGR} = R_{NGRnom}$. For the field calibration the device must run in auto mode (menu 6.3.1 = auto).

4. Trip signal RMS, fundamental frequency, harmonics

The frequency response for neutral current and voltage trips or alarms can be selected via the "Trip signal" parameter (menu 6.4.11). Trip signal can be:

- **RMS:** The r.m.s. value of I or U over the entire frequency range (up to approx. 3.8 kHz).
- **Fundamental frequency:** The r.m.s. value of the fundamental frequency component (50 or 60 Hz) of I or U .
- **Harmonics:** The filtered r.m.s. value of the selected frequency range where $H0 = DC$; $H1 =$ fundamental frequency; $H2 = 2 \times$ fundamental frequency (second harmonic); ... $H32 = 32 \times$ fundamental frequency (32nd harmonic)

i In the "Harmonics" measured value display (menu 2) all frequencies are always displayed. This is independent of the trip signal setting.

i On the data measured values display (menu 1), the measured resistance can be shown in Ω or % of nominal, and the measured current can be shown in A or % of nominal. (in A or %). The selection is entered in "Display" (menu 5).

5. Initial measurement

During device start, all measured values are recorded.

Factory settings

Menu 6.1: HRG system		Menu 6.4: Response values		Menu 6.5: System settings	
1. U_{sys} (L-L)	400 V	1. $U_{\text{NGR trip}}$	60 %	1. Ground-fault relay	Mode: Fail-safe Relay test: on
2. CD-NGRM	CD1000	2. $I_{\text{NGR trip}}$	60 %	2. NGR relay	Mode: Fail-safe Relay test: on
3. Frequency	50 Hz	3. $> R_{\text{NGR}}$	150 %	3. Trip relay	Mode: Fail-safe
4. $I_{\text{NGR nom}}$	5 A	4. $< R_{\text{NGR}}$	50 %		Relay test: on
5. $R_{\text{NGR nom}}$	470 Ω	5. $t_{\text{NGR trip}}$	0 s	4. Analogue	Mode: 4-20 mA
Menu 6.2: CT		6. Ground fault trip	on		Function: R NGR
1. CT primary	600	7. $t_{\text{GF trip}}$	5 s	5. Dig. in/out	Device OUT: Fail-safe
2. CT secondary	1	8. Alarm stored	on		Pulser OUT: Non-fail-safe
3. CT connection	50 mA	9. t_{restart}	5 s		Pulser IN: Active high
Menu 6.3: NGR		10. Restart count	2		RESET IN: Active high
1. Method	auto	11. Trip signal	RMS		TEST IN: Active high
2. PT primary	1	12. Upper limit harmonic	32	6. Buzzer	Buzzer alarm: off
3. PT secondary	1	13. Lower limit harmonic	0		Buzzer test: on

Technical data

Rated voltage.....250 V
 Overvoltage category..... III
 Nominal supply voltage U_s AC/DC, 48...240 V
 for UL applications AC/DC, 48...240 V
 for AS/NZS 2081 applications AC/DC, 48...230 V
 Tolerance U_s ± 15 %
 Tolerance U_s (for UL applications) $-50...+15$ %
 Tolerance U_s (for AS/NZS 2081 applications) $-25...+20$ %
 Frequency range U_s DC, 40...70 Hz
 Power consumption (max.) ≤ 7 W / 16 VA

Switching elements (Ground-fault, NGR, trip relay)

..... Changeover contacts, configurable fail-safe/non-fail-safe
 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



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