NGRM700 (HRG)
NGRM750 (LRG)

Neutral Grounding Resistor Monitor

NGRM7xx_D00292_08_M_XXEN/11.2022

Manual EN

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1. Important information

1.1 How to use this manual

*This manual is intended for **qualified personnel** working in electrical engineering and electronics!*

Always keep this manual within easy reach for future reference. To make it easier for you to understand and revisit certain sections in this manual, we have used symbols to identify important instructions and information. The meaning of these symbols is explained below:

*This signal word indicates that there is a **high risk of danger** that will result in **death** or **serious injury** if not avoided.*

*This signal word indicates a **medium risk** of danger that can lead to **death** or **serious injury**, if not avoided.*

*This signal word indicates a **low-level risk** that can result in minor or **moderate injury** or **damage to property** if not avoided.*

*This symbol denotes information intended to assist the user in making **optimum use** of the product.*

1.2 Technical support: service and support

For commissioning and troubleshooting Bender offers:

1.2.1 First level support

Technical support by phone or e-mail for all Bender products

- Questions about specific customer applications
- Commissioning
- Troubleshooting

Telephone: +49 6401 807-760*
Fax: +49 6401 807-259
In Germany only: 0700BenderHelp (Tel. and Fax)
E-mail: support@bender-service.de

1.2.2 Repair service

Repair, calibration, update and replacement service for Bender products

- Repair, calibration, testing and analysis of Bender products
- Hardware and software update for Bender devices
- Delivery of replacement devices for faulty or incorrectly delivered Bender devices
- Extended warranty for Bender devices with in-house repair service or replacement devices at no extra cost

Telephone: +49 6401 807-780** (technical issues)
+49 6401 807-784**, -785** (commercial issues)
Fax: +49 6401 807-789
E-mail: repair@bender-service.de
Please send the devices for **repair** to the following address:

Bender GmbH, Repair-Service,
Londorfer Straße 65,
35305 Grünberg

1.2.3 Field 4service

On-site service for all Bender products

- Commissioning, parameter setting, maintenance, troubleshooting
- Analysis of the electrical installation in the building (power quality test, EMC test, thermography)
- Practical training courses for customers

Telephone: +49 6401 807-752**, -762 **(technical issues)
+49 6401 807-753** (commercial issues)
Fax: +49 6401 807-759
E-mail: fieldservice@bender-service.de
Internet: www.bender.de

*Available from 7.00 a.m. to 8.00 p.m. on 365 days of the year (CET/UTC+1)
**Mo-Thu 7.00 a.m. - 8.00 p.m., Fr 7.00 a.m. - 13.00 p.m

1.3 Training courses

Bender is happy to provide training regarding the use of test equipment.

The dates of training courses and workshops can be found on the Internet at **www.bender.de > Know-how > Seminars.**

1.4 Delivery conditions

The conditions of sale and delivery set out by Bender apply.

For software products, the "Softwareklausel zur Überlassung von Standard- Software als Teil von Lieferungen, Ergänzung und Änderung der Allgemeinen Lieferbedingungen für Erzeugnisse und Leistungen der Elektroindustrie" (software clause in respect of the licensing of standard software as part of deliveries, modifications and changes to general delivery conditions for products and services in the electrical industry) set out by the ZVEI (Zentralverband Elektrotechnik- und Elektronikindustrie e.V., (German Electrical and Electronic Manufacturers' Association) also applies.

Conditions of sale and delivery can be obtained from Bender in printed or electronic format.

1.5 Inspection, transport and storage

Inspect the dispatch and equipment packaging for damage, and compare the contents of the package with the delivery documents. In the event of damage in transit, please contact Bender immediately.

The devices must only be stored in areas where it is protected from dust, humidity and spray or dripping water, and in which the specified storage temperatures can be assured.

1.6 Warranty and liability

Warranty and liability claims in the event of injury to persons or damage to property are excluded if they can be attributed to one or more of the following causes:

- Improper use of the device.
- Incorrect mounting, commissioning, operation and maintenance of the device.
- Failure to observe the instructions in this operating manual regarding transport, commissioning, operation and maintenance of the device.
- Unauthorised changes to the device made by parties other than the manufacturer.
- Non-observance of technical data.
- Repairs carried out incorrectly and the use of replacement parts or accessories not approved by the manufacturer.
- Catastrophes caused by external influences and force majeure.
- Mounting and installation with device combinations not recommended by the manufacturer.

This operating manual, especially the safety instructions, must be observed by all personnel working on the device. Furthermore, the rules and regulations that apply for accident prevention at the place of use must be observed.

1.7 Disposal

Abide by the national regulations and laws governing the disposal of this device. Ask your supplier if you are not sure how to dispose of the old equipment.

The directive on waste electrical and electronic equipment (WEEE directive) and the directive on the restriction of certain hazardous substances in electrical and electronic equipment (RoHS directive) apply in the European Community. In Germany, these policies are implemented through the "Electrical and Electronic Equipment Act" (ElektroG). According to this, the following applies:

- Electric and electronic equipment are not to be included in household waste.
- Batteries and accumulators are not to be included in household waste but must be disposed of in accordance with the regulations.
- Old electrical and electronic equipment from users other than private households which was introduced to the market after 13th August 2005 must be taken back by the manufacturer and disposed of properly.

For more information on the disposal of Bender devices, refer to our homepage at **www.bender.de > Service & support.**

2. Safety instructions

2.1 General safety instructions

Part of the device documentation in addition to this manual is the enclosed "Safety instructions for Bender products".

2.2 Work activities on electrical installations

*Only **qualified personnel** are permitted to carry out the work necessary to install, commission and run a device or system.*

DANGER

Risk 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*

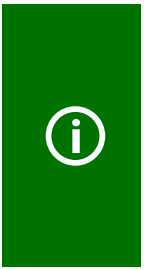
***Before installing and connecting the device, make sure** that the **installation** has been **de-energised**. Observe the rules for working on electrical installations.*

If the device is used outside the Federal Republic of Germany, the applicable local standards and regulations must be complied with. The European standard EN 50110 can be used as a guide.

2.3 Intended use

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.



*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.

Any other use than that described in this manual is regarded as improper. Intended use includes following all the instructions in this manual.

2.4 Glossary

CD	**C**oupling **D**evice CD-series
CT	**C**urrent **T**ransformer
FFT	**F**ast **F**ourier **T**ransformation
HMI	**H**uman **M**achine **I**nterface, display unit
HRG	**H**igh **R**esistance **G**rounding
I_{NGR}	NGR rated current
$I_{NGR\ nom}$	Nominal current through the NGR
LRG	**L**ow **R**esistance **G**rounding
NER	**N**eutral **E**arthing **R**esistor (NER = NGR)
NGR	**N**eutral **G**rounding **R**esistor
NTP	**N**etwork **T**ime **P**rotocol
PT	**P**otential **T**ransformer
R_{NGR}	NGR resistance value
$R_{NGR\ nom}$	NGR nominal resistance
R_S	Sense resistor; CD-series coupling device
PLC	**P**rogrammable **L**ogic **C**ontroller
U_{NGR}	Voltage on the NGR
$U_{NGR\ nom}$	Nominal voltage across the NGR
U_{sys}	System voltage
UTC	**U**niversal **T**ime **C**oordinated

3. Function

3.1 Device features

- Determination of R_{NGR} with passive and active measurement methods
- Continuous monitoring of the R_{NGR} even if the installation is de-energized;
- Alarm or trip on ground fault
- Monitoring of the current I_{NGR}
- Monitoring of the voltage U_{NGR}
- 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
$U_{sys\ LL}$	400…25000 V			
$I_{NGR\ nom}$	0…100 A		10…2000 A	
$R_{NGR\ nom}$	15…5000 Ohm		0.1…200 Ohm	

3.2 Functional description

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-energized.
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-fail-safe) to the alarm state when the measured resistance R_{NGR} 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.

3.3 NGRM700: Recommended minimum value R_{NGR} (tripping level 50 %)

Temperature range –40…+70 °C, field calibration at 20 °C

() = Limited temperature range at any field calibration temperature ±20 K

The temperatures must be within the limits of the operating temperature range of –40…+70 °C [–40…+60 °C for UL applications].

3.3.1 Recommended R_{NGR} for system voltage U_{sys} ≤ 4300 V (HRG system)

	CD1000/CD1000-2			CD1000-2	CD5000	
U_{sys}	**400 V**	**600 V**	**690 V**	**1000 V**	**2400 V**	**4200 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
10 A	(23 Ω)	35 Ω	40 Ω	58 Ω	139 Ω	242 Ω
15 A	(15 Ω)	(23 Ω)	(27 Ω)	38 Ω	92 Ω	162 Ω
20 A	—	(17 Ω)	(20 Ω)	29 Ω	69 Ω	121 Ω
25 A	—	—	(16 Ω)	(23 Ω)	55 Ω	97 Ω
30 A	—	—	—	(19 Ω)	(46 Ω)	81 Ω
40 A	—	—	—	—	(35 Ω)	61 Ω
50 A	—	—	—	—	(28 Ω)	(48 Ω)
100 A	—	—	—	—	—	(24 Ω)

Tab. 3.1: Recommended R_{NGR} for system voltage U_{sys} ≤ 4300 V (HRG system)

3.3.2 Recommended R_{NGR} for system voltage U_{sys} > 4300 V (HRG system)

	CD14400					CD25000
U_{sys}	6000 V	6600 V	7200 V	11000 V	14400 V	25000 V
I_{NGR}						
1 A	—	—	—	—	—	—
5 A	693 Ω	762 Ω	831 Ω	1270 Ω	1663 Ω	—
10 A	346 Ω	381 Ω	416 Ω	635 Ω	831 Ω	1443 Ω
15 A	231 Ω	254 Ω	277 Ω	423 Ω	554 Ω	962 Ω
20 A	(173 Ω)	191 Ω	208 Ω	318 Ω	416 Ω	722 Ω
25 A	(139 Ω)	(152 Ω)	(166 Ω)	254 Ω	333 Ω	577 Ω
30 A	(115 Ω)	(127 Ω)	(139 Ω)	212 Ω	277 Ω	481 Ω
40 A	(87 Ω)	(95 Ω)	(104 Ω)	(159 Ω)	208 Ω	361 Ω
50 A	—	(76 Ω)	(83 Ω)	(127 Ω)	(166 Ω)	289 Ω
100 A	—	—	—	—	(83 Ω)	(144 Ω)

Tab. 3.2: Recommended R_{NGR} for system voltage U_{sys} > 4300 V (HRG system)

4. Mounting

*Only **qualified personnel** are permitted to carry out the work necessary to install, commission and run a device or system.*

DANGER

Risk 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.*

4.1 Screw mounting

Fix the NGRM7… with four M4 or #10 screws (see dimension diagram NGRM7…).

4.2 Dimension diagrams

4.2.1 Dimension diagram FP200-NGRM

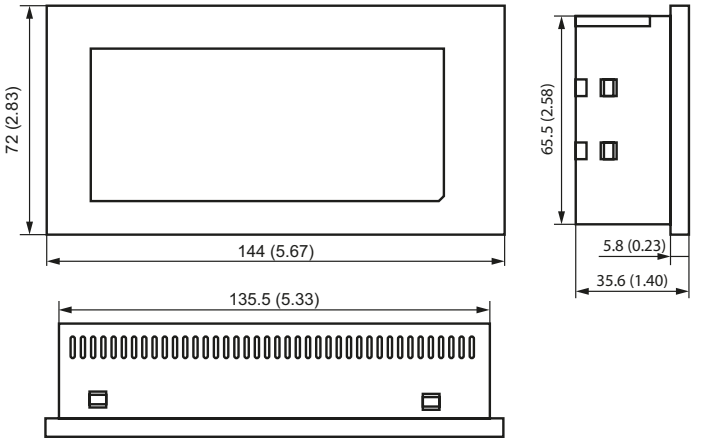


Fig. 4.1: Dimension diagram FP200-NGRM; mm(in)

4.2.2 Dimension diagram NGRM7…

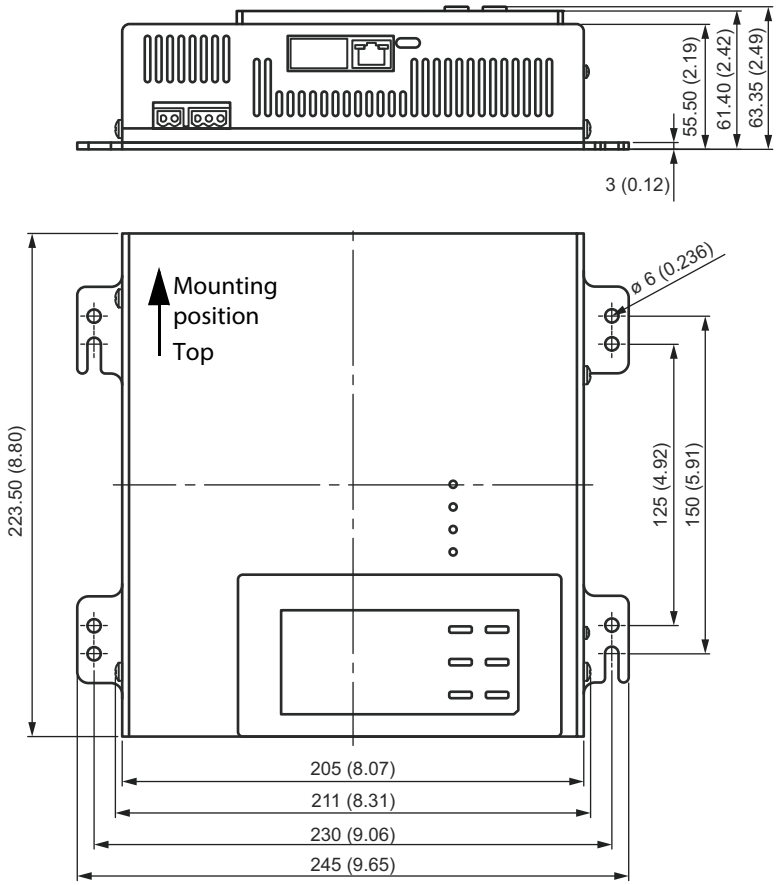


Abb. 4.2: Dimension diagram and mounting position NGRM7…; mm(in)

4.3 Enclosure view

Fig. 4.3: Enclosure view

4.4 Removing FP200-NGRM from enclosure

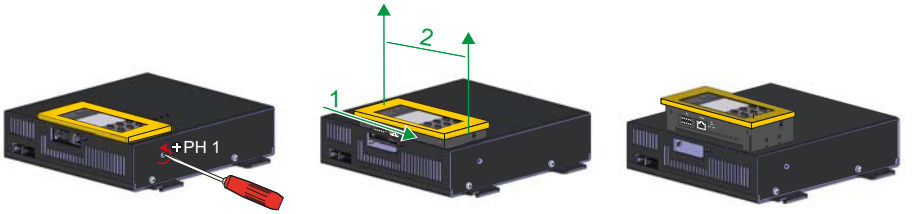


Fig. 4.4: Removing FP200-NGRM from enclosure

4.5 Door mounting

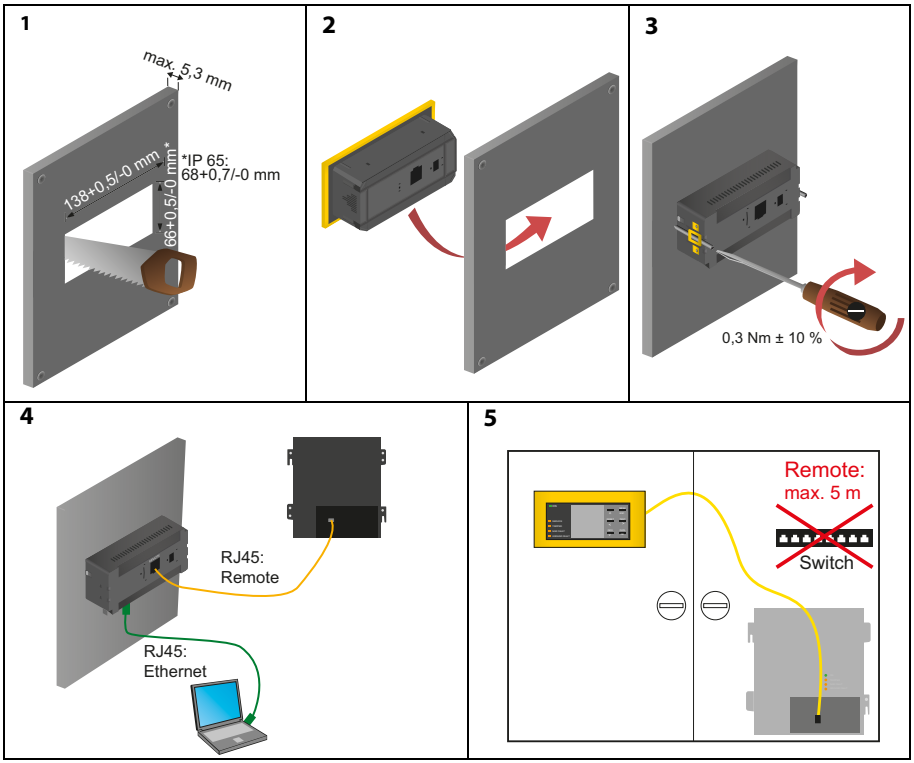
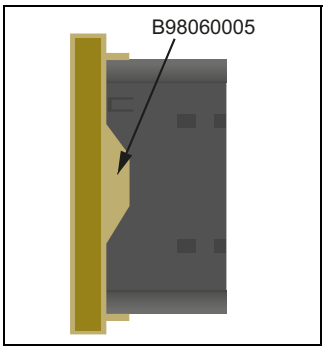


Fig. 4.5: Door mounting

4.6 Front cover for FP200-NGRM

When installed in doors, the degree of protection of the FP200-NGRM operator unit can be increased to IP65 by means of the transparent front plate cover (B98060005).

Place the front cover over the yellow front of the FP200-NGRM **before installing it**.



5. Connection

5.1 Connection requirements

*Only **qualified personnel** are permitted to carry out the work necessary to install, commission and run a device or system.*

DANGER

Risk 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-energized**. Observe the rules for working on electrical installations.*

DANGER

Risk of electrocution due to electric shock!
***A nominal voltage of up to 690 V** may be present at the terminals L1…L3. Direct contact with these will likely result in **electrocution**.*

CAUTION

Provide line protection!
According to DIN VDE 0100-430, a line protection shall be provided for the supply voltage.

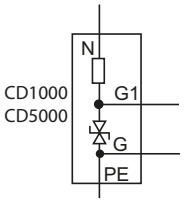
CAUTION

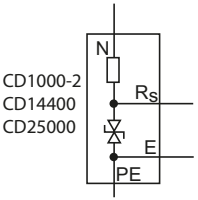
Risk of property damage due to unprofessional installation!
The connecting lines L1, L2, L3 to the system to be monitored must be carried out as spur lines. Inadmissible load current can result in damage to property and personal injury.
Do not apply any load current to the terminals.

Check proper connection.
Prior to commissioning of the installation, check that the device has been properly connected and check that the device functions.

For UL applications:
- *Use 60/70 °C copper lines only.*
- *For UL and CSA applications, the supply voltage must be protected via **5 A** fuses.*

5.2 Connection descriptions of CD-series coupling device





N Connection to star point

G1, R_S Connection to R_S of the NGRM7…

G, E Connection to E of the NGRM7… and to the protective earth conductor of the installation (PE)

5.3 Recommended connecting line for CD… coupling device

CD…	Connection of CD…	Cable lug	Metrical	Imperial
CD1000	N, G1, G	—	1.5 mm²	AWG 16
CD1000-2	N, R_S, E	—	1.5 mm²	AWG 16
	PE	M4	≥ 1.5 mm²	AWG 16 or bigger
CD5000	G1, G	—	1.5 mm²	AWG 16
	N	M8 or M10	≥ 1.5 mm²	AWG 16 or bigger
	PE	M6	≥ 1.5 mm²	AWG 16 or bigger
CD14400 CD25000	R_S, E	—	1.5 mm²	AWG 16
	N	M5 or M10	≥ 1.5 mm²	AWG 16 or bigger
	PE	M5	≥ 1.5 mm²	AWG 16 or bigger

5.4 Star connection

5.4.1 Connection $U_{sys} \leq 690$ V

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

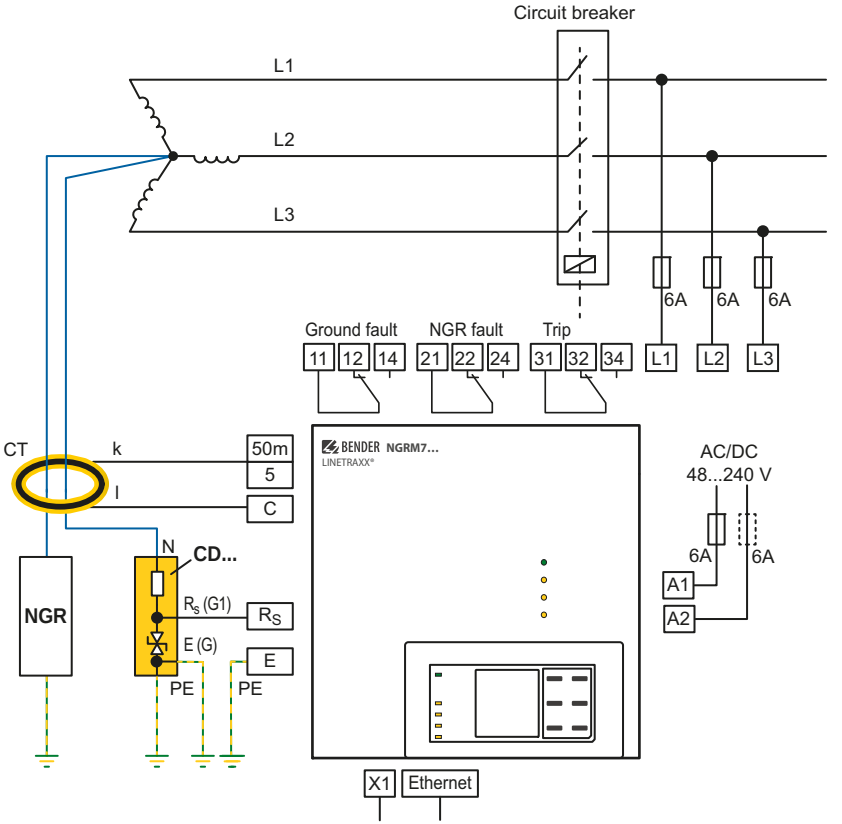


Fig. 5.1: Star configuration (up to 690 V)

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

5.4.2 Connection $U_{sys} \leq 690$ V with pulser

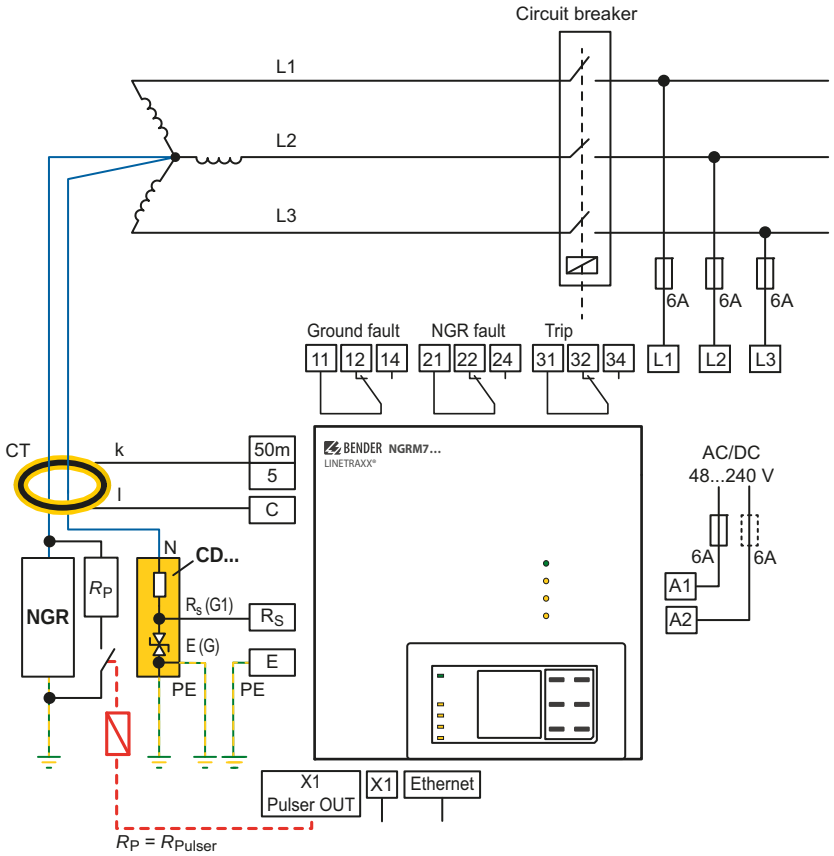


Fig. 5.2: Connection $U_{sys} \leq 690$ V with pulser

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.

5.4.3 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).

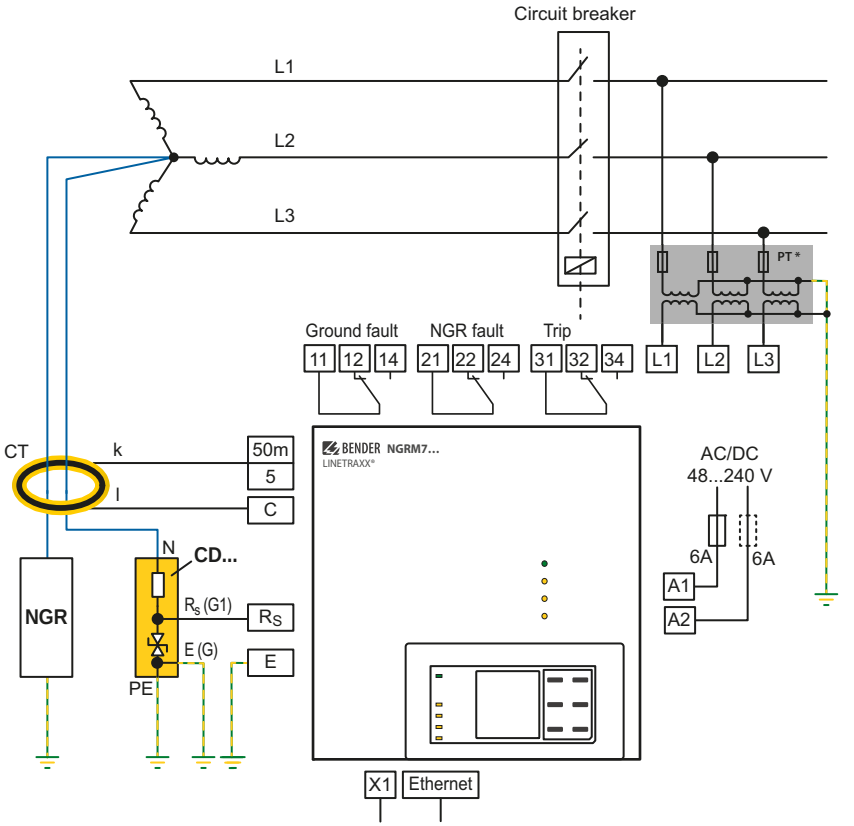


Fig. 5.3: Star configuration (U_{sys} > 690 V)

Note:

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

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

5.4.4 Artificial neutral (delta connection)

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

Connection with a zigzag transformer

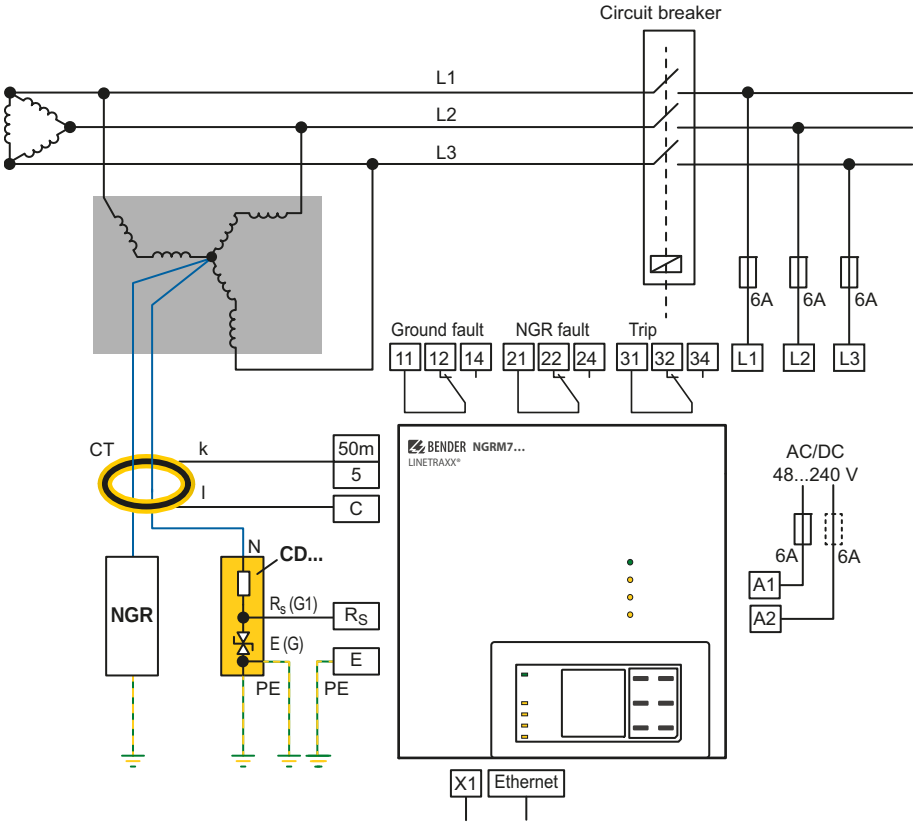
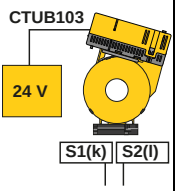
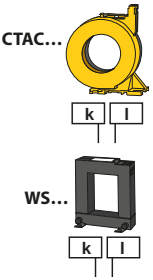
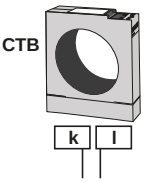


Fig. 5.4: Artificial neutral with a zigzag transformer

5.5 CT connection

Depending on the system to be monitored, a suitable measuring current transformer shall 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_{NGR}	0.5…25 A	5…25 A	5…1000 A	10…2000 A
f	0…3800 Hz	42…3800 Hz	50/60 Hz	50/60 Hz
Transformation ratio, Bender measuring current transformer	Measuring ranges (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/AWG 12 max. 40 m: 6 mm²/AWG 10	
	provided cable or 0.75…1.5 mm² AWG 18/…16			
$I_{\Delta n}$	≂ ⎓	≂	≂	≂
Type	CTUB103 	CTAC …/ WS… 	CTB31…51 	Any standard current transformer can be used.
CT: terminal k	50 mA	50 mA	5 A	5 A
CT: terminal l	C	C	C	C

Tab. 5.1: Selecting the right measuring current transformer

5.6 Connection of relays

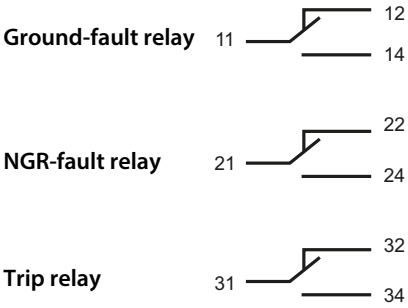
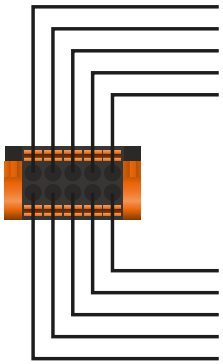


Fig. 5.5: Connection of relays

The delay times of the various relays are not the same. See table 8.1, „Trip times relays," on page 59.

5.7 Connection to the X1 interface

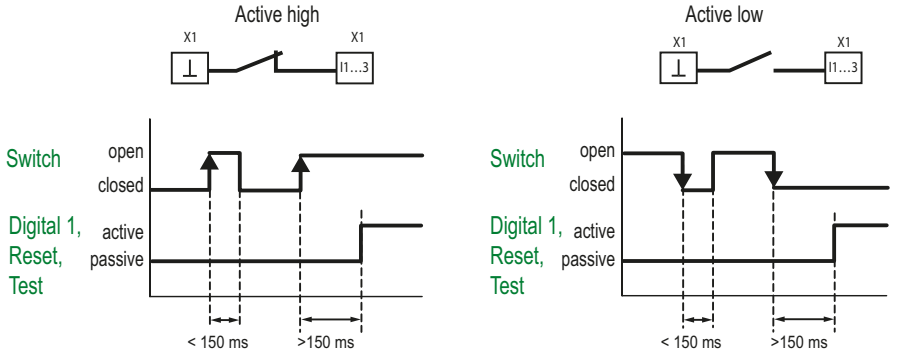


I1	Digital 1 (configurable: pulser, NGR method)
I2	Reset IN
I3	Test IN
A	Modbus RTU (A)
B	Modbus RTU (B)
⊥	Common
M+	Analogue output
Q2	Open Collector: Pulser OUT
Q1	Open Collector: Device health
+	Output for supply of external relays (+24 V, max. 100 mA)

Tab. 5.2: Pin assignment X1 interface

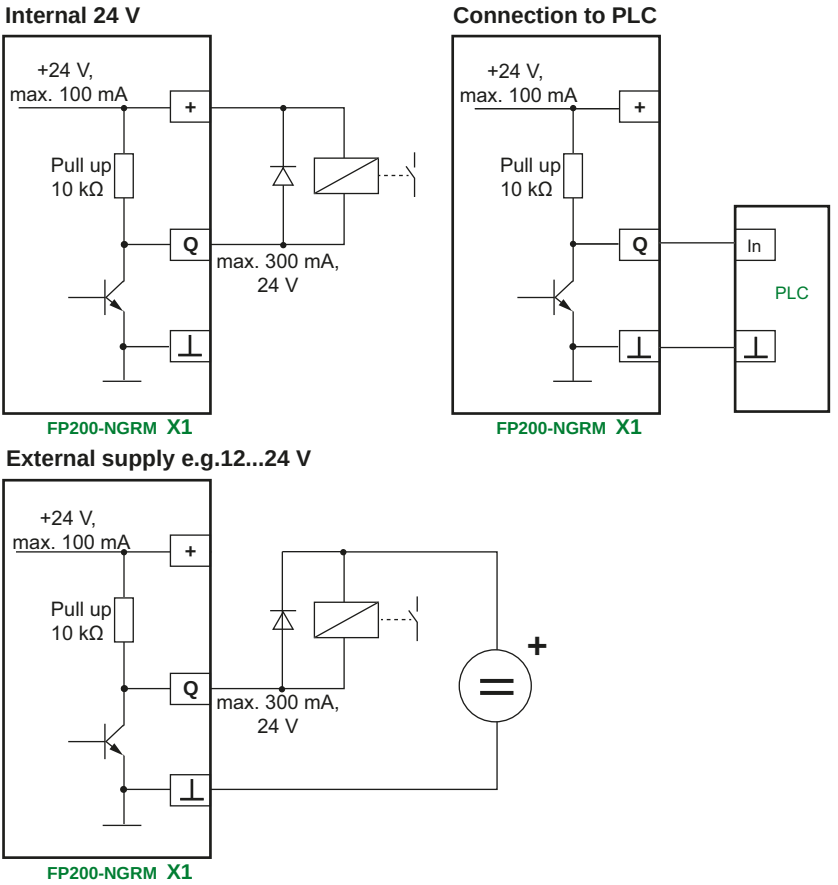
5.7.1 X1: Input I1…3

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 ground or
0 V and 24 V in conjunction with a PLC

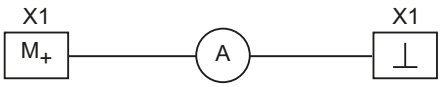
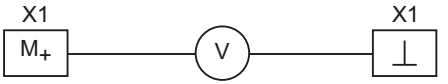
5.7.2 X1: Output Q1…2



Connection to Q1, Q2: external relay or PLC

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**.*

5.7.3 X1: Analogue output

Analogue output	Mode	Permissible load
Current output 	0…20 mA	≤ 600 Ω
	4…20 mA	≤ 600 Ω
	0…400 µA	≤ 4 kΩ
Voltage output 	0… 10 V	≥ 1 kΩ
	2… 10 V	≥ 1 kΩ

Either NGR **current** I_{NGR} or NGR **resistance** R_{NGR} can be assigned to the analogue output. A voltage or current signal proportional to the measured value is applied to the output.

The following overview shows how the output signals (A or V) are proportional to the measured values (Ω or A):

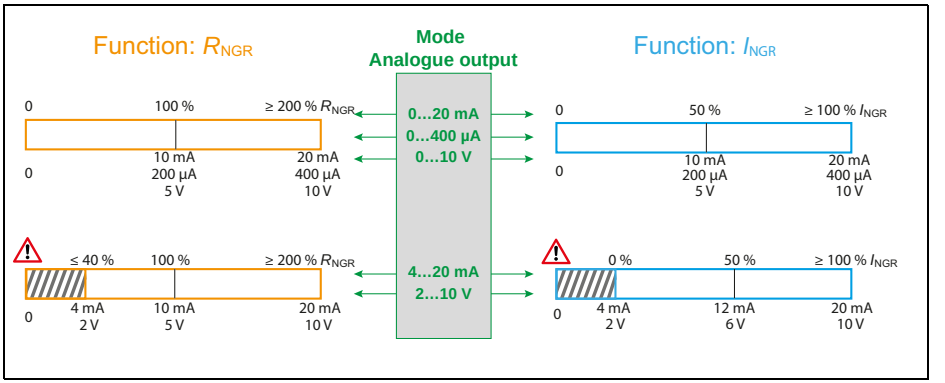
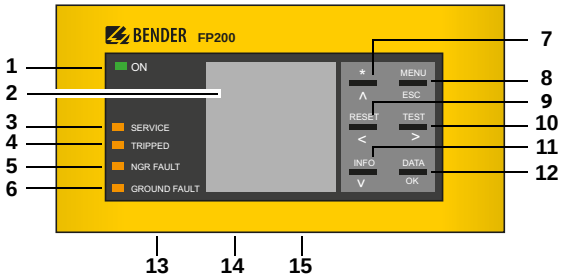


Fig. 5.6: Assignment of measured value to output signal

*In "4…20 mA" and "2…10 V" mode an output signal of 0 mA or 0 V indicates a **wiring error of the analogue interface**.*

6. User interface FP200-NGRM



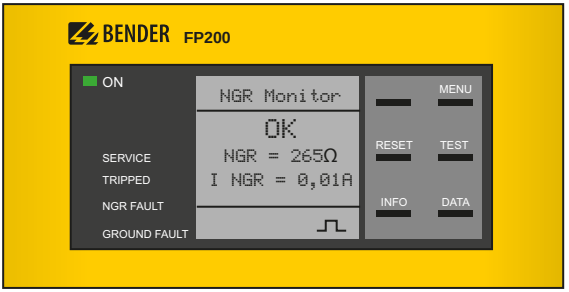
Legend, FP200-NGRM

No.	Description	Explanation
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, a 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 ($t_{NGR\ trip}$ elapses). The LED is on when an NGR fault has been detected. Trip relay and NGR-fault relay have tripped.
6	GROUND FAULT	The LED flashes in case of a prewarning: ground fault detected, ground-fault relay has tripped, trip relay has not tripped yet ($t_{GF\ trip}$ elapses). The LED is on: ground fault detected, trip relay has tripped, installation has not been shut down yet.
Device buttons		
7	^	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.

No.	Description	Explanation
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 (see page 29 ff. for more details)
14	ETH	Ethernet interface
15	R on/off	Terminating resistor for A/B (Modbus RTU)
Buzzer		Active in case of alarm and/or test
Rear side		
	REMOTE	RJ45 port for connection of FP200-NGRM to enclosure
	X3	Without function

Tab. 6.1: Legend, FP200-NGRM

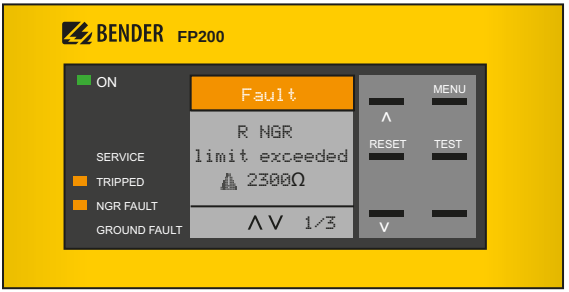
6.1 Standard display



The pulse symbol in the lower part of the display indicates that the resistance of the R_{NGR} **is actively measured**.

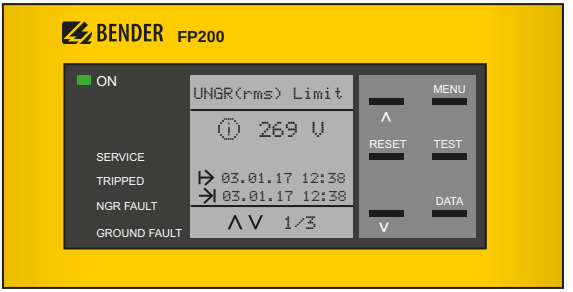
*Return from any (sub)menu to the **standard display** by pressing and holding ESC for more than 2 s.*

6.2 Fault indication (active)



An active fault is indicated on the display with a ⚠ while the upper part of the display turns orange and displays the fault message. Depending on the fault type, the GROUND FAULT, NGR FAULT, TRIPPED or SERVICE LEDs will be on. If several fault messages appear, navigate through the faults using the ∨ and ∧ buttons.

6.3 Fault indication (inactive)



An inactive fault is indicated on the display with a ⓘ. If more than one fault has occurred, the number of faults is also indicated in the lower part of the display.

This message means that there has been a fault in the past but the device is no longer in fault condition. If several fault messages appear, navigate through the faults using the ∨ and ∧ buttons. In addition to the type of fault and the associated alarm value, you can see when the fault occurred and for how long it was active

6.4 Acknowledging a fault message

n order to return to the standard display of the NGR monitor, the fault message must be acknowledged by means of the RESET button. Fault messages can only be reset when the cause of fault has been eliminated.

Acknowledge

Press the RESET button, select "Acknowledge" and then OK to mute the buzzer and delete the messages from the standard display. After this, the NGR monitor returns to the standard display. No restart attempt takes place. The fault messages remain stored in the history memory.

Reset

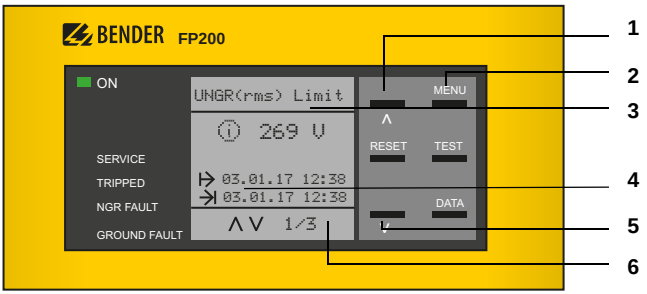
Press the RESET button, select "Reset" and then OK. The buzzer is muted and the fault messages are deleted from the standard display. If the installation is de-energized, restart attempts will be carried out, which will only be successful after the fault has been eliminated. The device returns to the standard display. The faults remain stored in the history.

*A **reset** can also be carried out via the input **I2**. It must be active for more than 150 ms.*

6.5 History memory

Up to 1023 alarm messages and device errors with date and time stamp can be stored in the history memory. If the maximum number of memory entries has been reached, the oldest entry will be overwritten by a new event record.

Display the history memory at MENU > 3. History



Legend, display history memory

No.	Description
1	View next message
2	Exit view
3	Fault description Alarm value
4	Fault appeared (fault start time) Fault disappeared (fault end time)
5	View previous message
6	Number of the selected fault/Fault message count

7. Menu

7.1 Overview

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}, $U_{harm\ rel}$, U_{L1L2}, U_{L2L3}, U_{L3L1}, f, $U_{1\text{-}E\ rms}$, $U_{2\text{-}E\ rms}$, $U_{3\text{-}E\ rms}$, T

2. Harmonics

3. History

History, Delete

4. Pulser

Pulser, t_{Impuls}

5. Display

R_{NGR}, I_{NGR}

6. HRG/LRG settings

- HRG/LRG system — U_{sys} (L-L), CD-NGRM, f, $I_{NGR\ nom}$, $R_{NGR\ nom}$
- CT — CT primary, CT secondary, CT connection
- NGR — Method, Filter, Filter type, Filter size, Ignore values
- Phase monitor — Phase monitor, PT primary, PT secondary
- Response values — $U_{NGR\ Trip}$, $I_{NGR\ Trip}$, $>R_{NGR}$, $<R_{NGR}$ *(HRG only)*, $t_{NGR\ trip}$, GF trip, $t_{GF\ trip}$, Alarm stored, $t_{restart}$, Max. no. of restarts, Trip signal, Upper limit harmonics, Lower limit harmonics
- System settings
  - Ground 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, Digital 1, 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, $U_{sys\ L\text{-}L}$, 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

7.2 Navigating through the menu

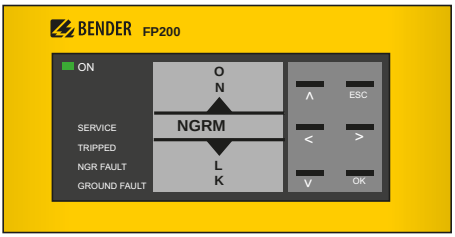
Select a submenu using the ∨ and ∧ buttons and press OK.

Return from any submenu to the main menu by pressing ESC or <.

*Return from any (sub)menu to the **standard display** by pressing and holding ESC for more than 2 s.*

7.3 Changing settings

Enter settings with text/numbers directly on the FP200-NGRM. There is a corresponding representation in the menu items:



∨ and ∧ buttons	Scroll to the letter/number.
< and > buttons	Shift left and right in the word.
ESC	Reject entry
OK	Save entry

7.4 Data measured values (menu 1)

Navigate through the list of current measured values using the ∨ and ∧ buttons.

Parameter	Description
R_{NGR}	NGR resistance value
$R_{NGR\ rel}$	NGR relative[1)] resistance value
Method	Measurement method (see menu 6.3)
R_{Sense}	Resistance value; CD-series coupling device
I_{RMS}	Current; RMS value
$I_{RMS\ rel}$	Current; relative[1)] RMS value
U_{RMS}	Neutral voltage; RMS value
$U_{RMS\ rel}$	Neutral voltage; relative[1)] RMS value
I_{fund}	Current; RMS value (fundamental frequency)
$I_{fund\ rel}$	Current; relative[1)] RMS value (fundamental frequency)
U_{fund}	Neutral voltage; RMS value (fundamental frequency)
$U_{fund\ rel}$	Neutral voltage; relative[1)] RMS value (fundamental frequency)
I_{harm}	Current; RMS value (for selected harmonic frequency range)[2)]
$I_{harm\ rel}$	Current; relative[1)] RMS value (for selected harmonic frequency range)[2)]
U_{harm}	Neutral voltage; RMS value (for selected harmonic frequency range)[2)]
$U_{harm\ rel}$	Neutral voltage; relative[1)] RMS value (for selected harmonic frequency range)[2)]
U_{L1L2}	Line-to-line voltage; RMS value
U_{L2L3}	
U_{L3L1}	
Frequency	System frequency
U_{L1E}	Line-to-ground voltage; RMS value
U_{L2E}	
U_{L3E}	
Temperature	in the NGRM7…

Tab. 7.1: Data measured values (menu 1)

Note

1) Relative measured values always indicate the ratio of the measured value to the nominal value.

2) The selected harmonics are configured in the menu 6.5.

7.5 Harmonics (menu 2)

The measured harmonics are represented in a bar graph as a percentage of the measured value in relation to the nominal value. Change between the harmonic **voltage** and **current** displays using the ∨ and ∧ buttons.

Scroll through the **harmonics up to the 64th order** using the < and > buttons.

All harmonics are always represented, regardless of the settings in the menu 6.5.

Use ESC to return to the main menu.

7.6 History (menu 3)

Alarm messages (since switching on the device or deleting the last history) are saved.

History: Navigate through the list using the ∨ and ∧ buttons.

Delete: After confirming, the history is irreversibly deleted.

7.7 Pulser (menu 4)

A ground fault can be located by means of a measuring clamp-on ammeter and the pulser function. The pulser relay is designed as Open Collector.

Pulser (menu 4.1)

- **Active** - The pulser is continuously active regardless of ground faults that have occurred.
- **External** - If the digital input I1 is set to "Pulser", it can enable the pulser at any time.
- **Auto** - The pulser activates automatically in the event of a ground fault.
- **Inactive** - The pulser output is disabled.

The following diagram shows an overview of the pulser control:

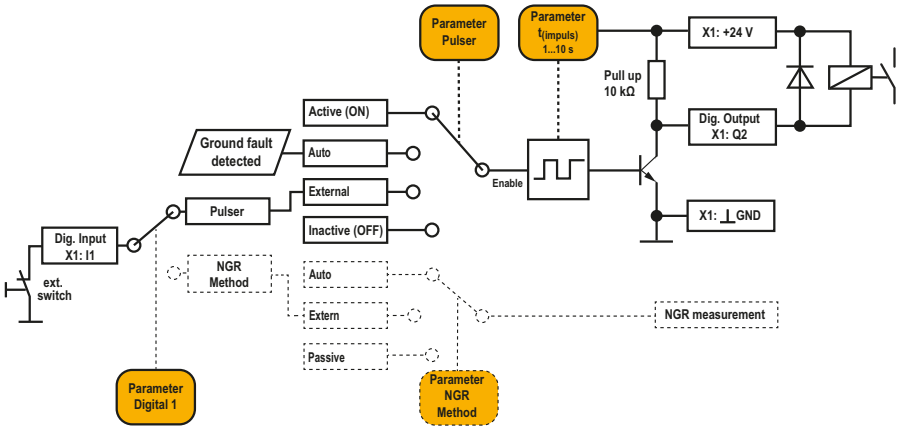


Fig. 7.1: Configuration Digital 1 as pulser

t_{pulse} (menu 4.2)

The pulse period can be set between 1…10 s.

The set pulse period is only effective if the pulser (menu 4.1) is not "inactive".

7.8 Display (menu 5)

Choose whether the measured values for R_{NGR} and I_{NGR} should be displayed as absolute (in Ω or A) or relative (in % to the reference value). The relative value is the ratio of the measured value to the nominal value.

7.9 HRG, LRG settings (menu 6)

7.9.1 HRG, LRG system (menu 6.1)

Menu	Parameter	Setting range	Explanatory notes
6.1.1	$U_{sys\ (L-L)}$	400 V…25 kV	System phase-to-phase voltage
6.1.2	CD-NGRM	CD1000, CD5000, CD14400 CD25000 Other	For CD1000 and CD1000-2, select "CD1000" in the menu. The selection depends on the system voltage $U_{sys.}$
6.1.3	Frequency	50 or 60 Hz	Nominal frequency
6.1.4	$I_{NGR\ nom}$	0.5…100 A (HRG) 10…2000 A (LRG)	Nominal value of the NGR current
6.1.5	$R_{NGR\ nom}$	15…5000 Ω (HRG) 0.1…200 Ω (LRG)	Nominal value of the used NGR resistance

Tab. 7.2: HRG, LRG system (menu 6.1)

7.9.2 CT (menu 6.2)

Menu	Parameter	Setting range	Explanatory notes
6.2.1	CT primary	1…10,000	Ratio of the CT on the primary side
6.2.2	CT secondary	1…10,000	Ratio of the CT on the secondary side
6.2.3	CT connection	5 A, 50 mA	Used CT connection

Tab. 7.3: CT (menu 6.2)

7.9.3 NGR (menu 6.3)

Menu	Parameter	Setting range	Explanatory notes
6.3.1	Method	auto, passive, external	**auto**: automatic changeover between active and passive resistor monitoring; setting for field calibration **passive**: only passive resistor monitoring (see page 15) **external**: If "Digital 1 > NGR method" (menu 6.6.5.3) is set, switching takes place depending on the condition of the digital input I1: I1 active: method is set to "auto" I1 passive: method is set to "passive"

Menu	Parameter	Setting range	Explanatory notes
6.3.2	Filter	off, weak, medium, strong, customer-specific	Filter for active measurement of the NGR's resistance. For instance in installations with a frequency converter.
6.3.3	Filter type*	Mean, RMS	Selection between **mean filter** or **RMS filter**
6.3.4	Filter size*	2…40	Number of filter elements
6.3.5	Ignore values*	0…10	Number of ignored measured-value outliers

Tab. 7.4: NGR (menu 6.3)

*) The filter parameters type, size, and ignore values are only taken into account in the setting "customer-specific".

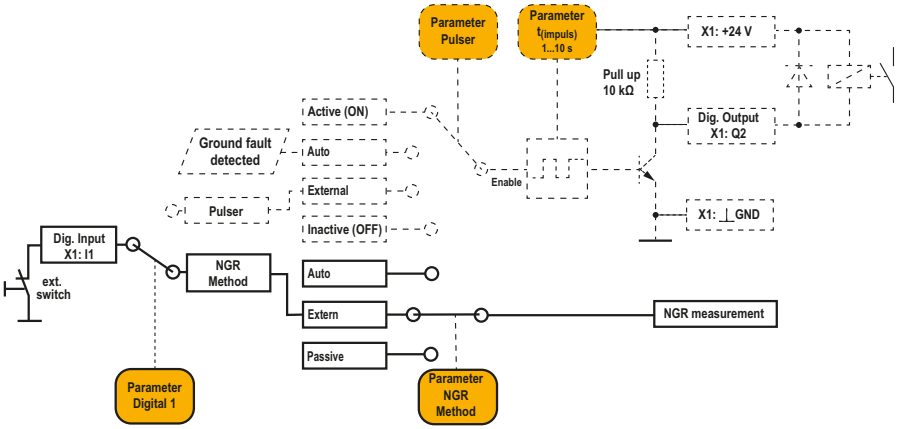


Fig. 7.2: Configuration Digital 1 as NGR method

7.9.4 Phase monitor (menu 6.4)

When phase-voltage monitoring is used, the faulted phase can be determined in the event of a ground fault.

Menu	Parameter	Setting range	Explanatory notes
6.4.1	Phase monitor	on, off	**on**: enable function **off**: disable function (despite wiring, the faulted phase is not signalled)
6.4.2	PT primary	1…10,000	Ratio of the potential transformer on the primary side
6.4.3	PT secondary	1…10,000	Ratio of the potential transformer on the secondary side

Tab. 7.5: Phase monitor (menu 6.4)

7.9.5 Response values (menu 6.5)

Behaviour of the trip relay in the event of a ground fault

Set whether a ground fault (response value violation U_{NGR} and/or I_{NGR}) should switch the trip relay or not. Set the filter type for NGR current and voltage ("total RMS", "fundamental", or "harmonics") that leads to a violation of the response value at "Trip signal".

a) Ground-fault trip "on"

When a *ground fault* is detected

- the **ground-fault relay** (connections 11, 12, 14) switches **immediately** (40 ms).
- the **trip relay** (connections 31, 32, 34) switches **after $t_{GF\ trip}$ has elapsed**.

b) Ground-fault trip "off"

When a *ground fault* is detected

- the **ground-fault relay** (connections 11, 12, 14) switches **immediately** (40 ms).
- the **trip relay** (connections 31, 32, 34) **does not** switch, $t_{GF\ trip}$ is ignored.

When using a coupling device CD14400 or CD25000, the menu item "Ground-fault trip = off" is not available.

Resistor faults

Resistor faults (response value violation R_{NGR}) are independent of the "GR trip" settings: The **NGR-fault relay** (connections 21, 22, 24) switches within the response time of approx. 7.5 s. The **trip relay** (connections 31, 32, 34) switches with a **delay** according to the $t_{NGR\ trip}$ setting.

Restart of the installation (restart attempts)

Restart of the installation (restart attempts)

Set whether the installation should be restarted manually or automatically after a fault.

a) Restart installation manually (alarm stored "on")

In the event of a fault, the trip relay changes state and the installation shuts down. The fault must be eliminated and the installation is restarted via a manual reset (menu 9) or via input I2. If the restart is not successful, it must be retried (after further fault elimination).

b) Restart installation automatically (alarm stored "off")

In the event of a fault, the trip relay changes state and the installation shuts down. The fault must be eliminated. After the configured time delay $t_{restart}$ has elapsed, the NGRM7… attempts to restart the installation automatically. If the restart is not successful, $t_{restart}$ elapses again and another restart attempt takes place. The number of restart attempts can be selected between 1 and 5.

The NGRM7… remains in "Alarm stored" mode (menu 6.5) even after a shutdown.

Response values

For the delay times, see also page 60.

Menu HRG	Menu LRG	Parameter	Setting range	Explanatory notes
6.5.1		U_{NGR} trip	10…90 %	Value in % of the nominal value at which the trip relay and the ground-fault relay trip. **Note**: The trip relay only trips if "Ground-fault trip > on" has been selected.
6.5.2		I_{NGR} trip	10…90 %	
6.5.3		> R_{NGR}	110…200 % (HRG) 200…500 Ω (LRG)	Resistance value in % of the nominal value (HRG) or Ω value (LRG) at which the trip relay and the NGR-fault relay operate.
6.5.4	—	< R_{NGR}	10…90 % (HRG only)	
6.5.5	6.5.4	$t_{NGR\ trip}$ On the device: t(NGRtrip)	0…48 h	Time delay between NGR fault detection and shutdown by the trip relay. $t_{NGR\ trip}$ is added to the response time.
6.5.6	6.5.5	Ground-fault trip	on	**Ground fault**: Trip relay switches after the time delay t_{trip} has elapsed. **NGR fault**: Trip relay switches immediately (< 7.5 s) or after the time delay $t_{NGR\ trip}$ (0…48 h) has elapsed.
			off [1]	**Ground fault**: Trip relay does not switch. **NGR fault**: Trip relay switches immediately (< 7.5 s) or after the time delay $t_{NGR\ trip}$ (0…48 h) has elapsed.
6.5.7	6.5.6	$t_{GF\ trip}$ [2] On the device: t(GFtrip)	100 ms…48 h	Time delay between ground-fault detection and operation of the trip relay; only used when "Ground-fault trip > on" has been selected.
6.5.8	6.5.7	Alarm stored	on	Triggered trip relay must be reset **manually** (RESET or input I2)
			off	**Automatic** restart attempts after $t_{restart}$ has elapsed (max. number like setting "Number restart")
6.5.9	6.5.8	$t_{restart}$ On the device: t(restart)	100 ms…24 h	Time delay between fault elimination and automatic restart of the installation; only used when "Alarm stored > off" has been selected.

Menu HRG	Menu LRG	Parameter	Setting range	Explanatory notes
6.5.10	6.5.9	Max. no. of restarts	1…5	Number of restart attempts within 24 h; only used when "Alarm stored > off" has been selected.
6.5.11	6.5.10	Trip signal	RMS	Trips on the full-spectrum RMS value (*f* = DC…3.8 kHz).
			Fundamental	Trips on the RMS value of the fundamental.
			Harmonics	Trips on the RMS value of the harmonic.
6.5.12	6.5.11	Upper limit harmonic	0…32 0 = DC 1 = fundamental 2 = 2nd Harmonics … 32 = 32nd Harmonics	Indicate range of harmonic that should trigger the trip relay if the threshold value has been exceeded; only active when "Trip signal > Harmonic" has been selected.
6.5.13	6.5.12	Lower limit harmonic		

Tab. 7.6: Response values (menu 6.5)

Note:

1) When using a coupling device CD14400 or CD25000, the menu item "Ground-fault trip > off" is not available.

2) Observe the maximum trip time and the restart time ($t_{restart}$) for the installed CD-series coupling device when setting the time delay t_{trip} (see Tab. 8.2).

7.9.6 System settings (menu 6.6)

Menu	Parameter		Setting range	Explanatory notes
6.6.1	Ground-fault relay	Mode (6.6.1.1)	Fail-safe, non-fail-safe	1)
		Relay test (6.6.1.2)	on, off	2)
6.6.2	NGR-fault relay	Mode (6.6.2.1)	Fail-safe, non-fail-safe	1)
		Relay test (6.6.2.2)	on, off	2)
6.6.3	Trip relay	Mode (6.6.3.1)	Fail-safe, non-fail-safe	1)
		Relay test (6.6.3.2)	on, off	2)
6.6.4	Analogue	Mode (6.6.4.1)	0…20 mA 4…20 mA 0…400 µA 0… 10 V 2… 10 V	3)
		Function (6.6.4.2)	I_{NGR}, R_{NGR}	
6.6.5	Digital inputs/outputs	Device OUT (6.6.5.1)	Fail-safe, non-fail-safe	1)
		Pulser OUT (6.6.5.2)	Fail-safe, non-fail-safe	
		Digital 1 (6.6.5.3) configurable Pulser/ NGR method	Active high Active low	**Active high**: Activation of the function when input level changes from "low" to "high" **Active low**: Activation of the function when input level changes from "high" to "low"
		RESET IN (6.6.5.4)		
		TEST IN (6.6.5.5)		
6.6.6	Buzzer	Buzzer alarm (6.6.6.1)	on, off	**on**: each alarm activates buzzer **off**: alarm does not activate buzzer
		Buzzer test (6.6.6.2)	on, off	**on**: test activates buzzer **off**: test does not activate buzzer

Tab. 7.7: System settings (menu 6.6)

Legend, Tab. 7.7

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

2) When set to "on", the function of the relay is checked during a test by switching it.

3) Analogue output (menu 6.6.4) Either NGR **current** I_{NGR} or NGR **resistance** R_{NGR} (HRG devices only) can be assigned to the analogue output. In doing so, the voltage or current is proportional to the measured value. See „chapter 9.1 Analogue output (menu 6.6.4)“ for more details.

7.9.7 Field calibration (menu 6.7)

During field calibration, all tolerances of the connected CD-series coupling device and the NGR are considered. The current measured value is calibrated to the set nominal value of the NGR ($R_{NGR\ nom}$).

In order to achieve high accuracy, start the device and let it run for at least one hour in the operating environment before carrying out the field calibration.

For the field calibration the device must be in auto mode (menu 6.3.1 = auto).
If the digital input I1 is used with "Digital 1 > NGR method" (menu 6.6.5.3), "Method > external" (menu 6.3.1) must be selected and I1 must be active (refer also to page 43).
The trip relay is switched during field calibration!

7.10 Device settings (menu 7)

Further information on the configurable parameters can be found following the overview in the table.

Menu	Parameter		Note
7.1	Language		German English GB English US Spanish French
7.2	Clock	Time (7.2.1)	Set local time
		Format (7.2.2)	12 h (am/pm) 24 h
		Summer time (7.2.3)	Automatic change? [1]
		Date (7.2.4)	Set date
		Format (7.2.5)	dd.mm.yy mm-dd-yy
		NTP (7.2.6)	Synchronisation on/off [2]
		NTP server (7.2.7)	IP address NTP server
		UTC (7.2.8)	Time zone [3]
7.3	Interface[4]	Write access (7.3.1)	Allow, deny
		Ethernet (7.3.2)	DHCP (7.3.2.1)
			IP (7.3.2.2)
			SN (7.3.2.3)
			Std.GW (7.3.2.4)
			DNS server (7.3.2.5)
			Domain
		BCOM (7.3.3)	System name (7.3.3.1)
			Subsystem (7.3.3.2)
			Device address (7.3.3.3)
			Timeout (7.3.3.4)
			TTL for subscription (7.3.3.5)

Menu	Parameter		Note
7.3	Interface[4)]	Modbus TCP (7.3.4)	Port 502 (7.3.4.1)
		Modbus RTU (7.3.5)	Address (7.3.5.1)
			Baud rate (7.3.5.2)
			Parity (7.3.5.3)
			Stop bits (7.3.5.4)
7.4	Display[5)]	Brightness (7.4.1)	0…100 %
		Decimal separators (7.4.2)	Comma, point
7.5	Password	Password (7.5.1)	Factory setting 0000
		Status	on, off
7.6	Factory settings		Changes are discarded and reset to factory settings
7.7	Software	Update via interface	6)
		UPDATE	
7.8	Service	For Bender service only	

Tab. 7.8: Device settings overview (menu 7)

Explanatory notes Tab. 7.8

1) Summer time (menu 7.2.3)

`off` **No** automatic change between summer time and standard time.

`DST` **Daylight Saving Time**
Automatic change between summer time and standard time according to North American regulation. North American summer time begins on each second Sunday in March at 02:00 local time by setting the clock forward by one hour from 02:00 to 03:00 local time. Summer time always ends the first Sunday in October at 03:00 local time by setting the clock back one hour from 03:00 to 02:00.

`CEST` **Central European Summer Time**
Automatic change between summer time and standard time according to Central European regulation. Central European summer time begins on each last Sunday in March at 02:00 CEST by setting the clock forward by one hour from 02:00 to 03:00. Central European summer time always ends on the last Sunday in October at 03:00 CEST by setting the clock back one hour from 03:00 to 02:00.

When set to "DST" or "CEST", changing between summer time and normal time is only done on the date of the official time change.

[2] NTP (menu 7.2.6)

on Synchronisation via NTP server is enabled. To use this function, configure the NTP server.

off Synchronisation is disabled.

[3] UTC (menu 7.2.8)

Set the time according to UTC (Coordinated Universal Time). For Germany, set +1 for winter-time (MEZ) and +2 for summer time (MESZ).

[4] Interface (menu 7.3)

Set the parameters for connecting other communication devices in the interface menu:

Write access (menu 7.3.1)

Set whether the parameters of the device can be changed via Modbus or web server. Displaying and reading out data via Modbus and web server is always possible, regardless of this setting.

- Allow Allow external parameter setting.
- Deny Deny external parameter setting.

Ethernet (menu 7.3.2)

Set the parameters for communication with other devices via the Ethernet interface. The Ethernet interface can be used for communication with Modbus, web server and BCOM.

DHCP (menu 7.3.2.1)

on Enable automatic IP address assignment (IP address, subnet mask, standard gateway). Manual address settings are ignored.

off Disable automatic IP address assignment. Enter settings (IP address, subnet mask and standard gateway) manually in the menu

The used IP address is displayed in the Info menu (INFO button or menu 9).

IP (menu 7.3.2.2)

Set the appropriate IP address for the NGRM7…

SN (menu 7.3.2.3)

Set the appropriate subnet mask.

Std. GW (menu 7.3.2.4)

If a standard gateway is used, enter the IP address here.

DNS server (menu 7.3.2.5)

If a DNS server is used, enter the server's IP address. For questions regarding the configuration of a DNS server, please contact your network administrator.

Domain (menu 7.3.2.6)

Enter the domain. For questions regarding the configuration of the domain, please contact your network administrator.

BCOM (menu 7.3.3)

Set the parameters for communication with other devices via BCOM. For further information, refer to "BCOM" on page 51.

System name (menu 7.3.3.1)

Enter the system name of the network in which the devices are located. In order to guarantee that all devices are able to communicate via BCOM, all devices must have the same system name.

Subsystem (menu 7.3.3.2)

Configure the subsystem address of the network in which the devices are located. The devices can communicate with subsystems with the same or different subsystem addresses.

Device address (menu 7.3.3.3)

Assign a device address. Each device must have a different address to distinguish it from others in the system and ensure correct communication.

Timeout (menu 7.3.3.4)

Set the timeout for messages between 100 ms…10 s. This time specification defines the maximum permissible time for a device to respond.

TTL for subscription (menu 7.3.3.5)

Set a time between 1 s…1092 min. This time determines in what intervals the NGRM7… sends messages to e.g. a gateway. Severe alarms are always sent immediately.

Modbus TCP (menu 7.3.4)

Settings for communication with other devices via Modbus TCP.

Port 502 (menu 7.3.4.1)

Choose whether Modbus TCP should be used:

`on` Modbus TCP can be used for communication with other devices.

`off` Modbus TCP cannot be used for communication with other devices.

Modbus RTU (menu 7.3.5)

Settings for communication with other devices via Modbus RTU.

Address (menu 7.3.5.1): 1…247

Baud rate (menu 7.3.5.2): the selectable options are

- 9.6 kbaud,
- 19.2 kbaud,
- 38.4 kbaud,
- 57.6 kbaud

Parity: the selectable options are "even", "uneven", "none"

Stop bits: the selectable options are "1", "2", "auto"

[5] Brightness (menu 7.5.1)

Adjust the display brightness between 0…100 % in steps of 10. If no button is pressed on the display for 15 minutes, the brightness of the display decreases. After pressing a button, the display returns to the initial brightness.

[6] Software (menu 7.7)

Update via interface (menu 7.7.1)

`off` No software update is carried out via the web interface

`on` Software updates can be carried out via the web interface

UPDATE (menu 7.7.2)

If a software package has been transferred to the device, the package can be installed (again) here.

7.11 Commissioning (menu 8)

The commissioning wizard queries all relevant parameters.

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

7.12 Info (menu 9)

The current settings of the NGRM7… can be viewed in the Info menu. Navigate through the different views using the arrow buttons:

`Device`	name, serial number, article number
`Software`	Measurement equipment software version, HMI software version
`Clock`	Time, date, summer time
`Ethernet`	IP address, DHCP status, MAC address

7.13 Alarm (menu 10)

Acknowledge	Mute buzzer, delete message from the standard display, fault message remains stored in the history memory. If the installation is de-energized, no restart attempts will take place.
Reset	Mute buzzer, delete message from the standard display, fault message remains stored in the history memory. If the installation is de-energized, restart attempts will be carried out, which will only be successful after the fault has been eliminated. The device returns to the standard display.
Test	Since the relays are not monitored in the hardware or software, the relays must be tested at regular intervals on proper functioning. The frequency of the test cycle is subject to the safety requirements of the operator but it must be carried out at least every six months.

During the test it must be ensured that the relays can actually switch! The following settings are required:

Ground-fault relay	***menu 6.6.1.2** relay test "on"*
NGR-fault relay	***menu 6.6.2.2** relay test "on"*
Trip relay	***menu 6.6.3.2** relay test "on"*

8. Initial commissioning

The following parameters must be entered for initial commissioning:

- **System voltage U_{sys}** (phase-to-phase)
  The corresponding coupling device must be used depending on the system voltage:
  for U_{sys} ≤ 4.3 kV: CD1000, CD1000-2, CD5000 (20 kΩ)
  for U_{sys} > 4.3 kV: CD14400, CD25000 (100 kΩ)
- **Ratio** of the used **potential transformers** ($U_{NGR\ nom}$) if used
- NGR rated current ($I_{NGR\ nom}$)
- **Ratio** of the used **measuring current transformer**
  (600:1 for W… measuring current transformers)
- NGR rated resistance $R_{NGR\ nom}$

Parameters are set in the
Main menu > 6. HRG, LRG settings.
Alternatively, you can follow the setup wizard
*(**Main menu > 8. Commissioning**).*

8.1 Response values

The following parameters can be adjusted:

- Trip threshold for voltage (U_{NGR})
- Trip threshold for current (I_{NGR})
- Trip threshold for resistance (R_{NGR})

***Low trip threshold values** may lead to **false tripping**, while with **high trip threshold values** the device may not trip at all.*

Voltage trip threshold (U_{NGR})

The threshold is set as a percentage of $U_{NGR\ nom}$.
Setting range of trip threshold U_{NGR}: 10…90 % (factory setting 60 %)

Current trip threshold (I_{NGR})

The trip threshold is set as a percentage of $I_{NGR\ nom}$.
Setting range of trip threshold I_{NGR}: 10…90 % (factory setting 60 %).

Resistance trip threshold (R_{NGR})

HRG

Both trip thresholds for the resistance are set as a percentage of the nominal NGR. Setting range of trip threshold R_{NGR}

10…90 % (factory setting 50 %)

110…200 % (factory setting 200 %).

LRG

The upper trip threshold for the resistance is set in Ω.
Setting range trip threshold R_{NGR} 200…500 Ω (factory setting 250 Ω)

In the case of the **passive measurement method** the resistance R_{NGR} is determined using the current and voltage measurements. Accuracy depends on the measuring current transformer.

In the case of the **active measurement method** the device generates an active test pulse and measures R_{NGR} even if the installation is de-energized.

8.2 Output relays operating modes

The factory setting for the relays is fail-safe. In the case of a device test, the relays change state. The settings can be changed in *menu 6.6.1…6.6.6* (see page 49).

8.2.1 Field calibration

After the parameters have been entered, a field calibration must be carried out. During this process, the set resistance value of the NGR calibrates to the measurement equipment of the NGRM.

For the field calibration, the device must be in auto mode (menu 6.3.1 = auto).

Start field calibration in the
Main menu > 6.7 Field calibration.

If calibration is not possible (e.g. due to incorrect settings) an error message appears (6.10).

8.2.2 Trip times

Relay	Trip	Delay	Description
Ground-fault relay	• INGR > Threshold • UNGR > Threshold	**40 ms**, not configurable	For signalling an ground fault without delay
NGR Relay	• RNGR < Threshold [1] • RNGR > Threshold	**100 ms…7,5 s**, not configurable	For signalling a resistance error without delay [2]
Trip Relay	• INGR > Threshold • UNGR > Threshold • RNGR < Threshold [1] • RNGR > Threshold • NGRM device failure	**100 ms…48 h** configurable for ground fault **0…48 h** configurable for NGR fault **Undelayed** for NGR monitor Device error	For switching off the system in the case of ground fault, NGR or device fault with individually adjustable switch-off delay

Tab. 8.1: Trip times relays

1 HRG only
2 When using the NGR filter, the error detection can shift into the minute range.

Explanatory notes on trip relay

1. In case of a ground fault, $t_{GF\ trip}$ is only considered when "Ground-fault trip" (menu 6.5) is enabled. When "Ground-fault trip" is disabled, the trip relay does not switch in the event of a ground fault.
2. In case of an NGR fault, $t_{GF\ trip}$ is ignored, the trip relay switches after time delay $t_{NGR\ trip}$ has elapsed.
3. The setting for $t_{GF\ trip}$ must under no circumstances be longer than the maximum possible operating time of the CD-NGRM coupling device.
   The table shows an overview of the t(GFtrip) settings for the coupling device use

U_{sys}	Coupling device	Max. t_{trip}	Ground-fault trip settings
400…690 V	CD1000	48 h	on or off
	CD1000-2		
691…1000 V	CD1000	300 s	on
	CD1000-2	48 h	on or off
	CD5000		
1001…4300 V	CD5000	48 h	on or off
4301…14550 V	CD14400	60 s	on
	CD25000	90 s	on
14551…25000 V	CD25000	10 s	on

Tab. 8.2: Maximum trip times t(GFtrip) for the used CD-NGRM

Ground-fault relay timing diagram

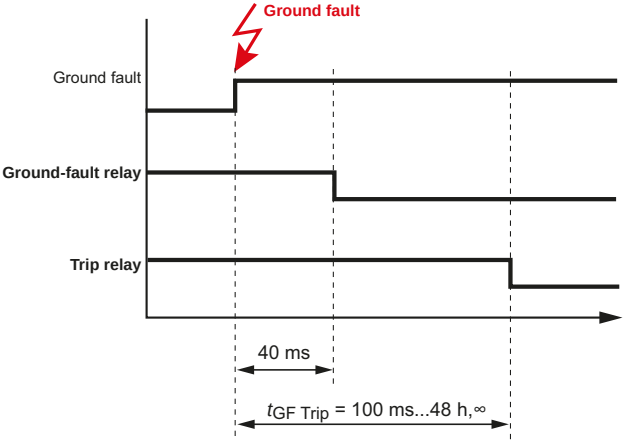


Fig. 8.1: Ground-fault relay timing diagram

NGR-fault relay timing diagram

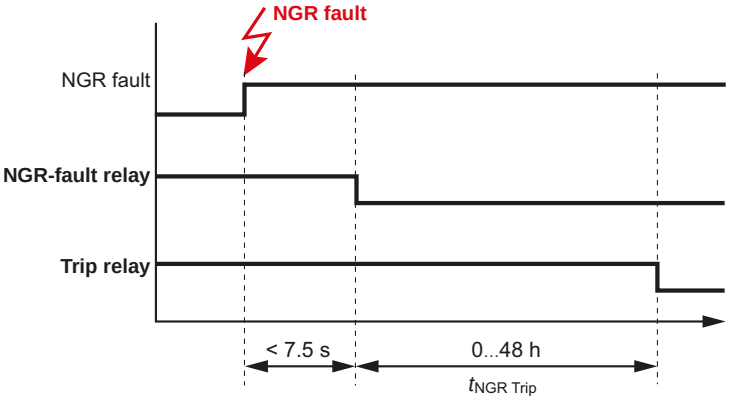


Fig. 8.2: NGR-fault relay timing diagram

Note:
Due to the use of an NGR filter, depending on the chosen setting, the NGR fault detection time of <7.5 s may increase and take more than a minute.

8.3 RMS trip signal, fundamental, harmonics

The measured value which causes tripping can be selected via the "Trip signal" parameter (menu 6.5). Trip signal can be:

RMS	The RMS value of current or voltage over the entire frequency range (up to approx. 3.8 kHz).
Fundamental	Only the RMS value of the fundamental component (50 or 60 Hz).
Harmonics	The filtered RMS value on the selected range of harmonics H0 = DC H1 = fundamental H2 = 2nd harmonic … H32 = 32nd harmonic

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

On the standard display, the trip signal is indicated as:

- *Resistance in Ω or % (HRG devices only)*
- *Current in A or %*

Setting is entered in the main menu > 5: Display.

8.4 Filter NGR measurement

Filter	off	weak	medium	strong	cutstomized
Filter type		Average value	Average value	RMS	Average value, RMS
Filter size		6	8	14	2…40
Ignore values		0	1	3	1…10

Tab. 8.3: Parameter Filter NGR measurement

8.5 Initial measurement

During device start, all measured values are recorded.

Timing diagram device start

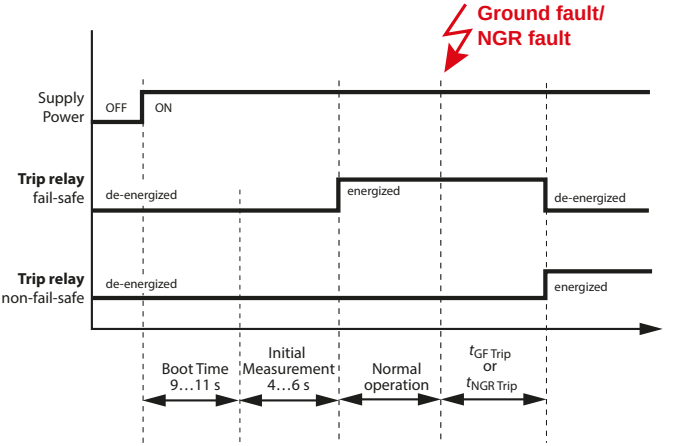


Fig. 8.3: Timing diagram device start

9. Analogue and digital I/O configuration

9.1 Analogue output (menu 6.6.4)

Either NGR **current** I_{NGR} or NGR **resistance** R_{NGR} can be assigned to the analogue output. A voltage or current signal proportional to the measured value is applied to the output. The following settings are possible:

Mode (menu 6.6.4.1)

- 0…20 mA Permissible load ≤ 600 Ω
- 4…20 mA Permissible load ≤ 600 Ω
- 0…400 µA Permissible load ≤ 4 kΩ
- 0…10 V Permissible load ≥ 1 kΩ
- 2…10 V Permissible load ≥ 1 kΩ

For further information, refer to refer to „X1: Analogue output“ on page 32.

Function (menu 6.6.4.2)

Set which measured values are assigned to the analogue output. Setting options:

- I_{NGR}
- R_{NGR} (HRG devices only)

9.2 Digital outputs (Q1, Q2)

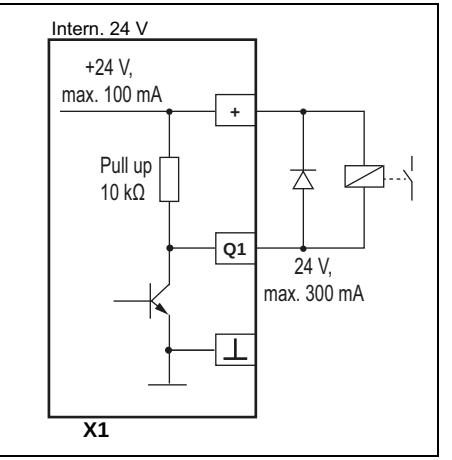
The digital outputs can draw current (sink).

The current rating for the Open-Collector output is 300 mA for each output.

Since the "+24 V" connection can only provide 100 mA, it might be required to use an external voltage supply (+24 V) for the relays

9.2.1 Use of Q1: Device health

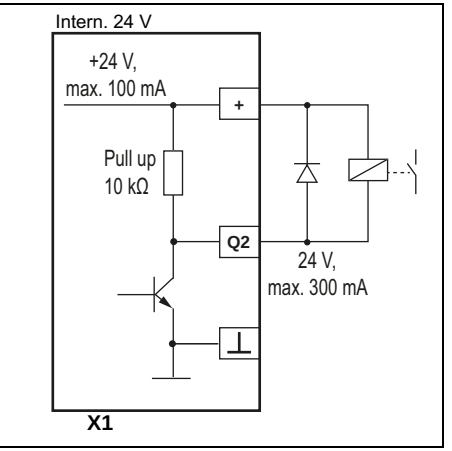
Mode	No device error detected	Device error detected[1)]
Fail-safe	on energized Q1 low	off de-energized Q1 high
Non-fail-safe	off de-energized Q1 high	on energized Q1 low



1) The SERVICE LED is also on

9.2.2 Use of Q2: Pulser

Mode	Inactive	Active
Fail-safe	on energized Q2 low	off de-energized Q2 high
Non-fail-safe	off de-energized Q2 high	on energized Q2 low



9.3 Digital input

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.

For further information, refer to page 30.

10. Test cycle

Since the relays are not monitored in the hardware or software, the relays must be tested at regular intervals to verify proper functioning. The frequency of the test cycle is subject to the safety requirements of the operator but it must be carried out at least every six months.

During the test it must be ensured that the relays can actually switch off!
The following settings are required:

Ground-fault relay	***menu 6.6.1.2** relay test "on"*
NGR relay	***menu 6.6.2.2** relay test "on"*
Trip relay	***menu 6.6.3.2** relay test "on"*

Starting the test

Start the test either by pressing the TEST button or via the menu 10.3 or the input I3 (activate for more than 150 ms).

11. Factory settings

Menu		Factory settings
Menu 6.1: HRG/LRG system		
1. $U_{sys\ (L-L)}$		400 V
2. CD-NGRM		CD1000
3. Frequency		50 Hz
4. $I_{NGR\ nom}$		5 A
5. $R_{NGR\ nom}$		150 Ω
Menu 6.2: CT		
1. CT primary		600
2. CT secondary		1
3. CT connection		50 mA
Menu 6.3: NGR		
1. Method		auto
		off
Menu 6.4: Phase monitor		
1. Phase monitor		on
2. PT primary		1
3. PT secondary		1
Menu 6.5: Response values		
HRG	**LRG**	
1. $U_{NGR\ trip}$		60 %
2. $I_{NGR\ trip}$		60 %
3. > R_{NGR}		150 % (HRG) 250 Ω (LRG)
4. < R_{NGR} (HRG only)	—	50 % (HRG)
5. $t_{NGR\ trip}$	4. $t_{NGR\ trip}$	0 s
6. Ground-fault trip	5. Ground-fault trip	on
7. $t_{GF\ trip}$	6. $t_{GF\ trip}$	5 s
8. Alarm stored	7. Alarm stored	on
9. $t_{restart}$	8. $t_{restart}$	5 s

Menu		Factory settings
10. Restart count	9. Restart count	2
11. Trip signal	10. Trip signal	RMS
12. Upper limit harmonic	11. Upper limit harmonic	32
13. Lower limit harmonic	12. Lower limit harmonic	0
Menu 6.6: System settings		
1. Ground-fault relay		Mode fail-safe Rel. test on
2. NGR relay		Mode fail-safe Rel. test on
3. Trip relay		Mode fail-safe Rel. test on
4. Analogue		Mode 4-20 mA Function R NGR (HRG) I NGR (LRG)
5. Dig. in/out		Device OUT fail-safe Pulser OUT non-fail-safe Digital 1 pulser, active high RESET IN active high TEST IN active high
6. Buzzer		Buzzer alarm off Buzzer test on

12. Error codes

Error code/ Service code	Description/Cause	Action
6.10	Error during field calibration	Restart field calibration. If the error persists, contact service.
6.11	Field calibration could not be started	The installation must operate error-free before starting a field calibration. Restart field calibration. If the error persists, contact service.
7.61…7.63	Connection between measuring equipment and display unit interrupted or disturbed.	Check connection between measuring equipment and display unit. Restart device.
8.03 and 8.12	Error in the measuring signal generation	Restart device. If the error persists, contact service.
8.43	Error in the internal power supply unit (*positive supply voltage*)	Restart device. If the error persists, contact service.
8.44	Error in the internal power supply unit (*negative supply voltage*)	Restart device. If the error persists, contact service.
8.46	Error in the internal power supply unit (*supply voltage*)	Restart device. If the error persists, contact service.
8.48	Error in the internal power supply unit (*reference voltage*)	Restart device. If the error persists, contact service.
All other error codes		Contact service.

13. Technical data

13.1 Tabular 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 III

Rated impulse voltage

IC1 / (IC2...6) ..... 8 kV
IC2 / (IC3...6) ..... 4 kV
IC3 / (IC4...6) ..... 4 kV
IC4 / (IC5...6) ..... 4 kV
IC5 / (IC6) ..... 4 kV

Rated insulation voltage

IC1 / (IC2...6) ..... 800 V
IC2 / (IC3...6) ..... 250 V
IC3 / (IC4...6) ..... 250 V
IC4 / (IC5...6) ..... 250 V
IC5 / (IC6) ..... 250 V
Pollution degree exterior 3

Safe isolation (reinforced insulation) between

IC1 / (IC2...6) ..... overvoltage category III, 800 V
IC2 / (IC3...6) ..... overvoltage category III, 300 V
IC3 / (IC4...6) ..... overvoltage category III, 300 V
IC4 / (IC5...6) ..... overvoltage category III, 300 V
IC5 / (IC6) ..... overvoltage category III, 300 V

Voltage tests (routine test) acc. to IEC 61010-1

IC2 / (IC3...6) ..... AC 2.2 kV
IC3 / (IC4...6) ..... AC 2.2 kV
IC4 / (IC5...6) ..... AC 2.2 kV
IC5 / (IC6) ..... AC 2.2 kV

Supply voltage

Nominal supply voltage U_s

- ≤ 2000 m ..... AC/DC, 24 . . . 240 V
- ≤ 2000 m (for UL applications) ..... AC/DC, 48 . . . 240 V
- ≤ 2000 m (for AS/NZS 208 applications) ..... AC/DC, 48 . . . 230 V
- > 2000 . . . ≤ 5000 m ..... AC/DC, 24 . . . 120 V
- > 2000 . . . ≤ 5000 m (for UL and AS/NZS 2081 applications) ..... AC/DC, 48 . . . 120 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 (typ. 50/60 Hz) ..... ≤ 6.5 W / 13 VA

Phase monitoring

Nominal measuring voltage U_n ..... 3 AC 100 . . . 690 V, CAT III
Measuring range ..... 1.2 x U_n
Measurement accuracy ..... ±1 % of U_n
Power consumption per phase ..... ≤ 0.5 W
Overload capacity ..... 2 x U_n continuous
Input resistance ..... 1.76 MΩ
PT ratio primary ..... 1 . . . 10,000
PT ratio secondary ..... 1 . . . 10,000
Measuring range with PT ..... 100 V . . . 25 kV

Monitoring R_{NGR}

Measuring input R_S ..... < 33 V RMS
Measuring range NGR (with R_S = 20 kΩ) active ..... 0 . . . 10 kΩ
- Measurement uncertainty for T = 0 . . . +40 °C ..... ±20 Ω
- Measurement uncertainty for T = −40 . . . +70 °C ..... ±40 Ω

Measuring range NGR (with R_S = 100 kΩ) active ..... 0 . . . 10 kΩ
- Measurement uncertainty for T = 0 . . . +40 °C ..... ±30 Ω
- Measurement uncertainty for T = −40 . . . +70 °C ..... ±80 Ω

HRG
- Setting range $R_{NGR\ nom}$ ..... 15 Ω . . . 5 kΩ
- Response value < $R_{NGR\ nom}$ ..... 10 . . . 90 % $R_{NGR\ nom}$
- Response value > $R_{NGR\ nom}$ ..... 110 . . . 200 % $R_{NGR\ nom}$

LRG
- Setting range $R_{NGR\ nom}$ ..... 0.1 . . . 200 Ω
- Response value > $R_{NGR\ nom}$ ..... 200 . . . 500 Ω

Response delay, NGR-fault relay ..... 7 s (±2.5 s)
Response delay, trip relay ..... 0 . . . 48 h

Monitoring I_{NGR}

Measuring circuit 5 A

- Nominal measuring current I_n ..... DC / 50/60 Hz / 10 . . . 3200 Hz 5 A
- Maximum continuous current ..... 2 x I_n
- Overload capacity ..... 10 x I_n for 0.03 s
- Measurement accuracy ..... ±2 % of I_n
- Load ..... 10 mΩ

Measuring circuit 50 mA

- Nominal measuring current I_n ..... DC / 50/60 Hz / 10 . . . 3200 Hz 50 mA
- Maximum continuous current ..... 2 x I_n
- Overload capacity ..... 10 x I_n for 2 s
- Measurement accuracy ..... ±2 % of I_n
- Load ..... 68 Ω

Measuring circuits 5 A and 50 mA

- Response value I_{NGR} ..... 10 . . . 90 % $I_{NGR\ nom}$
- Response delay, ground-fault relay ..... ≤ 40 ms (±10 ms)
- Response delay, trip relay (configurable) ..... 100 ms . . . 48 h, ∞

Tolerance t_{trip} when set to

- RMS ..... −20 . . . 0 ms
- Fundamental ..... 0 . . . +150 ms (filter time)
- Harmonics ..... 0 . . . +150 ms (filter time)

Measuring current transformer ratio primary ..... 1 . . . 10,000

Measuring current transformer ratio secondary ..... 1 . . . 10,000

Measuring range ..... 2 x $I_{NGR\ nom}$

Coupling

R_S for $U_{sys} \leq 4.3$ kV ..... CD1000, CD1000-2, CD5000 (20 kΩ)

R_S for $U_{sys} > 4.3$ kV ..... CD14400, CD25000 (100 kΩ)

Monitoring U_{NGR}

U_{NGR} with $R_S = 20$ kΩ ..... DC / 50/60 Hz / 10 . . . 3200 Hz; (400/√3) . . . ≤ (4300/√3) V

U_{NGR} with $R_S = 100$ kΩ ..... DC / 50/60 Hz / 10 . . . 3200 Hz; > (4.3 /√3) . . . (25/√3) kV

Measuring range ..... 1.2 x $U_{NGR\ nom}$

Overload capacity ..... 2 x U_{NGR} for 10 s

Measurement accuracy ..... 2 % of $U_{NGR\ nom}$ with $U_{NGR\ nom} = (U_{sys\ (L\text{-}L)}/\sqrt{3})$

Voltage response value ..... 10 . . . 90 % $U_{NGR\ nom}$

Response delay, ground-fault relay ..... ≤ 40 ms (±10 ms)

Response delay, trip relay (configurable) ..... 100 ms . . . 48 h, ∞

Tolerance t_{trip} when set to
- RMS ..... –20 . . . 0 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 kΩ ..... DC ±12 V
- with R_S = 100 kΩ ..... DC ±60 V

Digital inputs

Galvanic separation ..... no
Length connecting cables ..... max. 10 m
U_{in} ..... 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 principle ..... linear
Functions ..... I_{NGR}, R_{NGR}
Current ..... 0 . . . 20 mA (≤ 600 Ω), 4 . . . 20 mA (≤ 600 Ω), 0 . . . 400 µA (≤ 4 kΩ)
Voltage ..... 0 . . . 10 V (≥ 1 kΩ), 2 . . . 10 V (≥ 1 kΩ)
Tolerance related 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
- Long-term storage 1M12

Connection

Screw-type terminals
- Tightening torque ..... 0.5 . . . 0.6 Nm (5 . . . 7 lb-in)
- Conductor sizes ..... AWG 24-12
- Stripping length ..... 7 mm
- rigid/flexible ..... 0.2 . . . 2.5 mm^2
- flexible with ferrule with/without plastic sleeve ..... 0.25 . . . 2.5 mm^2
- Multiple conductor, rigid ..... 0.2 . . . 1 mm^2
- Multiple conductor flexible ..... 0.2 . . . 1.5 mm^2
- Multiple conductor flexible with ferrule without plastic sleeve ..... 0.25 . . . 1 mm^2
- Multiple conductor, flexible with TWIN ferrule with plastic sleeve ..... 0.5 . . . 1.5 mm^2

Push-wire terminals X1
- Conductor sizes ..... AWG 24-16
- Stripping length ..... 10 mm
- rigid/flexible ..... 0.2 . . . 1.5 mm^2
- flexible with ferrule without plastic sleeve ..... 0.25 . . . 1.5 mm^2
- flexible with ferrule with plastic sleeve ..... 0.25 . . . 0.75 mm^2

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
Weight ..... 1050 g

13.2 Standards, approvals, certifications

The specified standards take into account the edition valid until 09.2021 unless otherwise indicated.

UL File Number: E493737, E173157

13.3 Ordering details

13.3.1 NGR monitor

Type	Supply voltage/Frequency range U_S	Art. No.
NGRM700	AC 24…240 V, 40…70 Hz DC 24…240 V	B94013700
NGRM750		B94013750
Accessory for FP200-NGRM: Transparent front cover 144x72 (for IP65)*		B98060005

*When using the "transparent front cover 144x72 (IP 65)" the cutout in the switchboard cabinet must be extended in height from 66 mm to 68 mm (+0.7/-0 mm). The degree of protection IP65 applies only to the user interface FP200-NGRM when using the front cover. The degree of protection for the complete device is still IP30.

13.3.2 Accessories

Measuring current transformers

Voltage/Current	Type	Art. No.
AC up to 10 A	W20	B98080003
AC up to 25 A	W35	B98080010
	W60	B98080018
	W0-S20	B911787
	W1-S35	B911731
	W2-S70	B911732
AC/DC up to 10 A	CTUB103-CTBC35	B78120030
AC/DC up to 25 A	CTUB103-CTBC60	B78120031
	CTUB103-CTBC120	B78120032

Voltage supply (for CTUB103… measuring current transformers)

max. connected current transformers	Type	Art. No.
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

Connecting cables CTUB103

Length (m)	Type	Art. No.
1	CTXS-100	B98110090
2,5	CTXS-250	B98110091
5	CTXS-500	B98110092
10	CTXS-1000	B98110093

CD-series coupling device

Voltage U_{sys}	Type	Art. No.
400…690 V	CD1000	B98039010
400…1000 V	CD1000-2	B98039053
1000…4200 V	CD5000	B98039011
4300…14550 V	CD14400	B98039054
14551…25000 V	CD25000	B98039055

13.4 Document revision history

Date	Document version	State/Changes
04.2021	06	Editorial revision Distinction between "system" and "device" Deleted W…AB measuring current transformers (discontinued)
10.2021	07	Added LRG variant NGRM750 Digital input I1 switchable Editorial revision Several error corrections
11.2022	08	Changes P.14 Feature item Variants... P.15 Functional description P.24f Connection diagrams P.28 Measuring current transformer table, P.24ff Relay connection diagrams P.42/44 Diagrams for pulse control changed P.44 NGR menu P.56 Table switch-off times added P.62 Chapter 8.4 new with table P.66 Factory settings changed P.70f Technical data changed

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