Operating Manual

RC48N-70-10 A
RC48N-70-50 A

Ground-fault and neutral-grounding monitoring system

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1. How to get the most out of this manual

1.1 How to use this manual

This operating manual describes how to operate the RC48N-70… ground-fault and neutral-grounding monitoring system, which is designed for use with high-resistance earthed installations. It is designed for skilled personnel working in the field of electrical engineering and in particular for those designing, installing and operating electrical equipment.

Please read this operating manual and the enclosed sheet entitled "Important safety instructions for BENDER products" before using the equipment. This document must be kept in an easily accessible location near to the equipment.

Should you have any questions, please do not hesitate to contact us. Please contact our Technical Sales Department. We are also happy to provide on-site service. Please contact our Service Department for more information.

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Although great care has been taken in the drafting of this operating manual, it may nevertheless contain errors and mistakes. The BENDER Group cannot accept any liability for injury to persons or damage to property resulting from errors or mistakes in this operating manual.

1.2 Explanations of symbols and notes

The following terms and symbols are used to denote hazards and instructions in BENDER documentation:

This symbol indicates an immediate risk to life and limb.
Failure to observe the associated instructions and take appropriate precautions will result in death, serious physical injury or substantial damage to property.

This symbol indicates a potential risk to life and limb.
Failure to observe the associated instructions and take appropriate precautions may result in death, serious physical injury or substantial damage to property.

This symbol indicates a potentially dangerous situation.
Failure to observe the associated instructions and take appropriate precautions may result in minor physical injury or damage to property.

This symbol indicates important information about the correct use of the equipment purchased.
Failure to observe the associated instructions can result in equipment malfunctioning or cause problems in the environment in which it is being used.

This symbol indicates tips for using the equipment and particularly useful information. This type of information will help you to optimise your use of the equipment.

2. Safety instructions

2.1 Intended use

The RC48N-70... ground-fault and neutral-grounding monitoring system is solely intended for use with high-resistance earthed installations, where it is used to monitor the following:

- Residual current in the protective earth conductor
- Voltage between the transformer neutral and earth
- Neutral earthing resistor continuity (NER).

Please note the limits of the area of application indicated in the technical data. Use deviating from or beyond the scope of this is considered non-compliant.

In order to comply with intended use, all instructions in this manual must be observed.

2.2 Qualified personnel

Only appropriately qualified personnel may work on BENDER products. Qualified means personnel who are familiar with the assembly, first use and operation of the equipment and have undergone appropriate training. Such personnel must have read this manual and understood all instructions relating to safety.

2.3 General safety instruction

BENDER equipment is designed and built in accordance with the state of the art and accepted rules in respect of technical safety. However, the use of such devices may introduce risks to the life and limb of the user or third parties and/or result in damage to BENDER equipment or other property.

- Only use BENDER equipment:
  - As intended
  - If in perfect working order
  - In accordance with the accident prevention regulations and guidelines applicable in the location of use
- Rectify any faults that may endanger safety immediately.
- Do not make any unauthorised changes and only use replacement parts and optional accessories purchased from or recommended by the manufacturer of the equipment. Failure to observe this requirement can result in fire, electric shock and injury.
- Reference plates must always be clearly legible. Replace damaged or illegible plates immediately.

2.4 Warranty and liability

In the event of physical injury or damage to property, no claims in respect of warranty or liability can be accepted if such injury or damage can be attributed to one or more of the following causes:

- Non-compliant use
- Incorrect assembly, commissioning, operation and maintenance.
- Operation of equipment with faulty safety devices or safety and protection devices which have been fitted incorrectly or are not in perfect working order.
- Non-observance of instructions in this operating manual and the supplement entitled "Important safety instructions for BENDER products" in respect of transport, storage, installation, commissioning, operation and maintenance.
- Constructional changes 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
- Uncontrollable external factors and force majeure.

2.5 Guarantee

BENDER provides a guarantee of error-free design and perfect material quality lasting 24 months from date of delivery for equipment stored or operated under standard conditions.

The guarantee does not cover maintenance work of any type. It is only valid for the first buyer and does not cover products or individual components used other than as intended or to which changes have been made. Using the equipment other than as intended or under abnormal operating conditions will render any guarantee null and void.

The guarantee obligation is restricted to repairing or replacing equipment returned to BENDER within the guarantee period. In order for claims made under the terms of the guarantee to be accepted, BENDER must acknowledge that the product is faulty and that the fault concerned cannot be attributed to the incorrect handling or modification of equipment, non-compliant use or abnormal operating conditions.

Any guarantee will be rendered null and void if repairs or changes have been made to equipment by persons other than those authorised to do so by BENDER. These guarantee provisions are valid exclusively and supersede all other contractual or legal warranty obligations, including, but not restricted to, the legal warranty in respect of marketability, fitness for purpose and serviceability for a specific application. BENDER does not accept any liability for direct and indirect collateral or consequential damage, regardless of whether this can be attributed to action considered permissible, impermissible or otherwise.

3. System description

3.1 Features

3.1.1 Areas of application

Installations featuring high-resistance neutral-earthing are used whenever power supply failure would incur significant costs due to production downtimes (e.g. the automotive industry, chemicals industry). With this type of installation, an insulation fault between a phase and the earth will not result in failure of the power supply. However, the insulation fault must be located and rectified as quickly as possible to avoid tripping the overcurrent protective device as a result of an additional insulation fault in a second phase.

3.1.2 Description of function

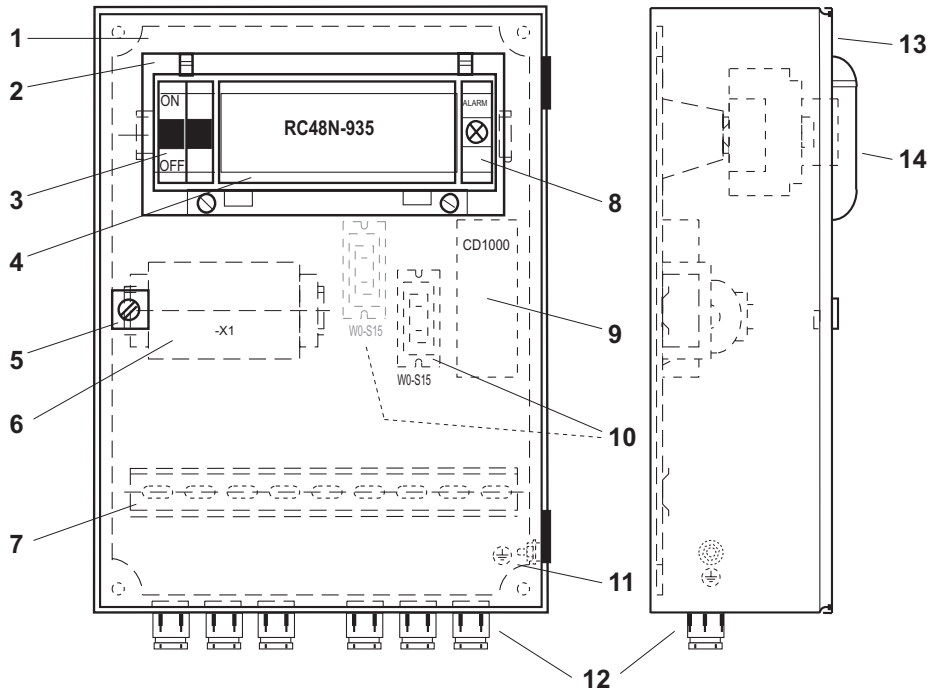
In the case of high-resistance earthed installations, the maximum earth-fault current between the transformer neutral and earth is limited by means of a neutral earthing resistor (NER). The RC48N-70... ground-fault and neutral-grounding monitoring system monitors the status of the NER and the earth-fault current flowing through this resistor.

The safe operation of the system can only be ensured if the maximum earth-fault current is smaller than the trip current for the overcurrent protective device. In the event of a malfunction, the earth-fault current is detected by a W0-S15 measuring current transformer. If the set response values and delay are exceeded, the RC48N-70... will signal an alarm. Alarm messages are indicated by means of the “ALARM Ground Fault” and “ALARM Resistor Fault” LEDs on the RC48N as well as by the integrated H3 alarm lamp. There is also the option of connecting an external indicator (alarm annunciator panel). In this case, the H1 and H2 alarm lamps signal the relevant alarm messages.

The alarm remains pending (i.e. is stored) until it is reset using the integrated RESET key. The alarm relay can be used to trip a circuit-breaker. Depending on the type of circuit-breaker’s tripping coil, the operating mode can be set either to N/O operation or N/C operation.

3.1.3 Mechanical design

The RC48N-70... ground-fault and neutral-grounding monitoring system consists of a steel plate housing containing the following built-in components. Assembly plan RC48N-70-10A:



1	Mounting plate: Used for mounting all the components directly or by means of DIN-rails.
2	A transparent window ensures access to all operating elements even when the housing door is closed.
3	Master switch S1: Monitoring ON/OFF
4	RC48N-935 ground-fault and neutral-grounding monitor
5	Housing door lock
6	Terminal strip for connecting the RC48N-70...
7	If necessary, additional terminals or relays can be mounted on the 35 x 7.5 mm DIN-rail.
8	In the event of an alarm, alarm lamp H3 will light up
9	Coupling device CD1000 enables the voltage to be measured between the transformer neutral and earth up to a maximum of 1000 V AC.
10	Measuring current transformer W0-S15 to detect the current flowing through the NER. The RC48N-70-50A features two measuring current transformers. The second measuring current transformer generates a measurement signal reduced by a factor of 100. As a result, currents of up to 100 A can be detected with the RC48N-70-50A.
11	Earthing terminal M6
12	Cone cable glands M20 for connecting cables
13	Housing door (right-hand stop)
14	Transparent trap window. To open, loosen knurled screws.

4. Installation and connection

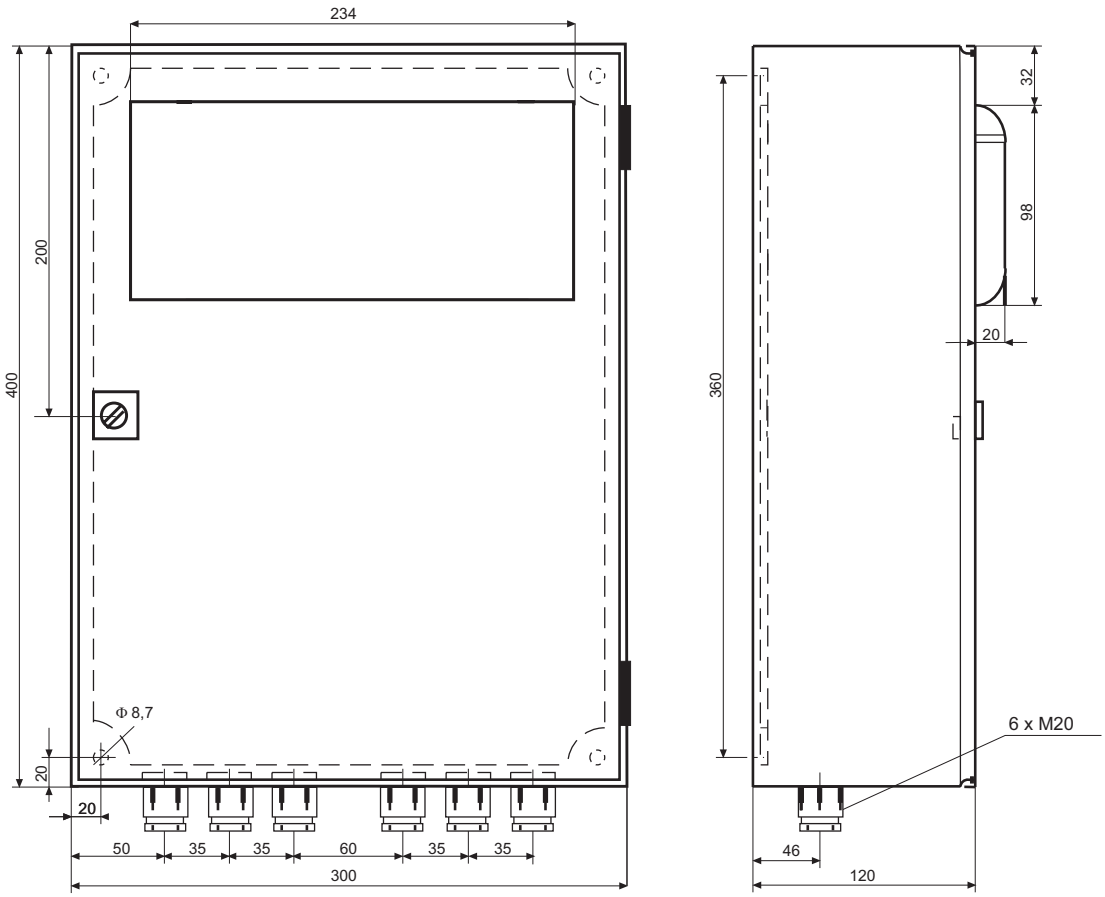
Danger !

Before mounting the device and working on the device connections, make sure that the voltage has been disconnected. Failure to comply with this requirement will expose personnel to the risk of electric shock.
Furthermore, the electrical installation may sustain damage and the device be destroyed beyond repair.

4.1 Installation

Install the RC48N-70... ground-fault and neutral-grounding monitoring system using four screws (∅ max. 8 mm, see outline drawing).

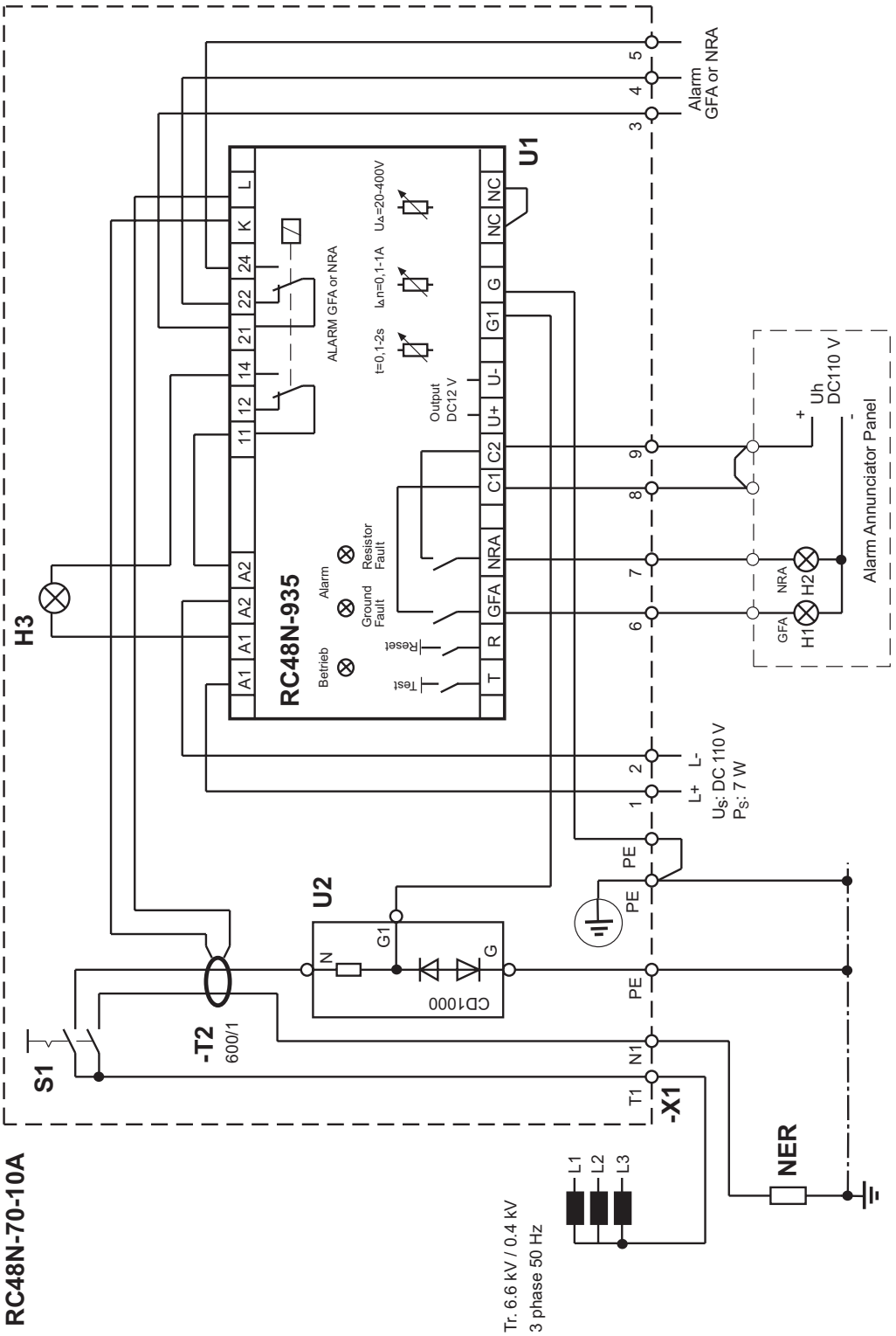
Outline drawing



Dimensions in mm

4.2 Connection

4.2.1 Connection diagram RC48N-70-10A



Key for connection diagram RC48N-70-10A

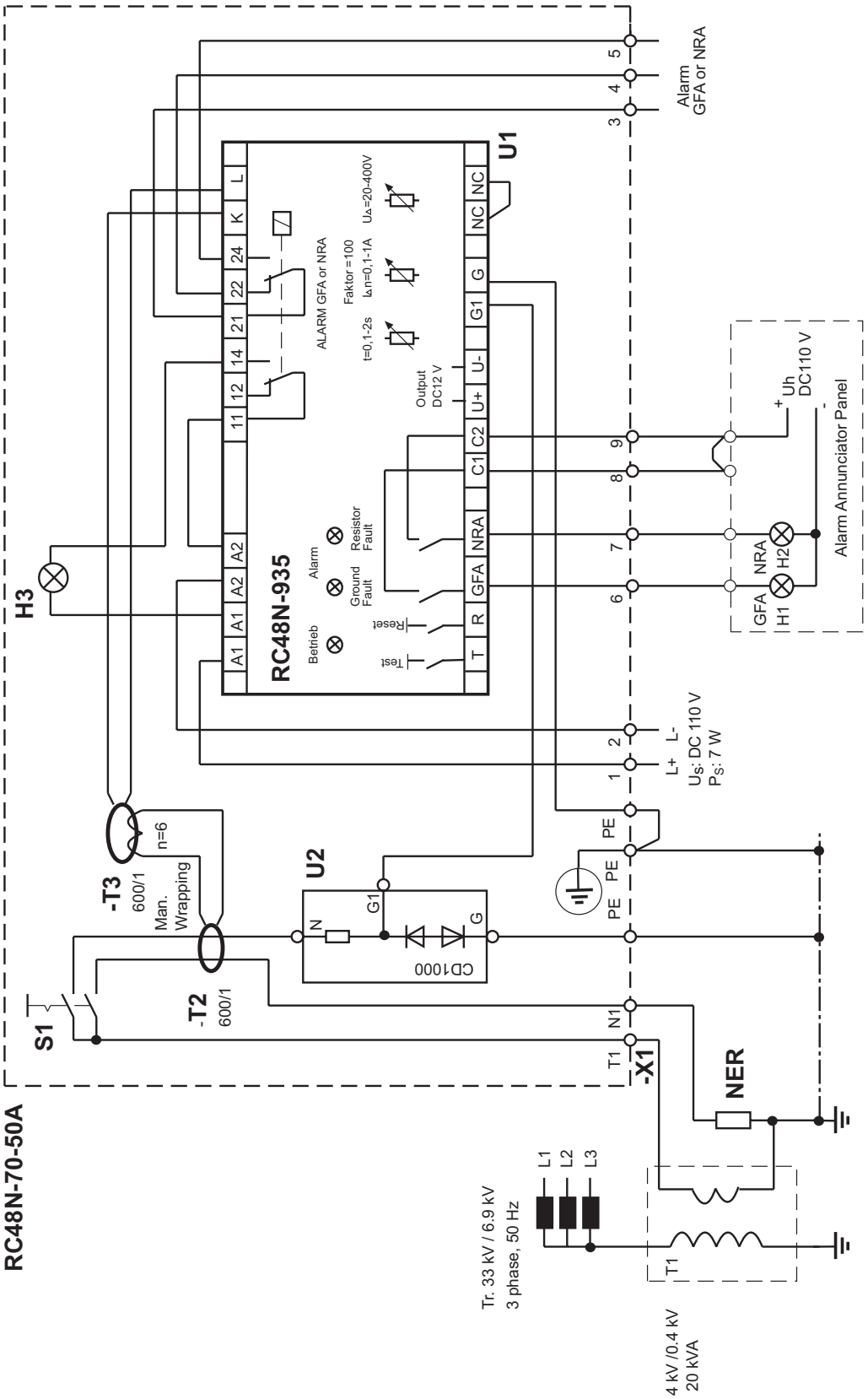
Devices

U1	RC48N-935 ground-fault and neutral-grounding monitor
U2	Coupling device CD1000 enables the voltage to be measured between the transformer neutral and earth up to a maximum of 1000 V AC.
-T2	Measuring current transformer W0-S15 to detect the current flowing through the NER.
NER	Neutral earthing resistor.
S1	Master switch monitoring ON/OFF
H3	In the event of an alarm, alarm lamp H3 will light up
H1, H2	Optional, external indicator (alarm annunciator panel) with alarm lamps H1 “ALARM Ground Fault” (GFA) and H2 “ALARM Resistor Fault” (NRA).
-X1	Connection terminals T1, N1 rigid 2.5 ... 25 mm^2 flexible 4 ... 16 mm^2 1 x PE rigid 0.5 ... 16 mm^2 flexible 0.5 ... 10 mm^2 2 x PE rigid 0.2 ... 6 mm^2 1 ... 9 flexible 0.2 ... 4 mm^2

Connections

T1	Connection to transformer star point
N1	Connection to NER (neutral earthing resistor)
PE	Connections to PE (protective earth)
1, 2	Connection of supply voltage U_s = 110 V DC Recommended fuse: 6 A fuse as short-circuit protection for supply voltage
6	Connection of external alarm lamp GFA (H1). H1 lights up if the residual current response value and the response time are exceeded.
7	Connection of external alarm lamp NRA (H2). H2 lights up if the voltage across the neutral earthing resistor exceeds the response value or if the NER’s resistance exceeds 2 KΩ.
8, 9	Connection of external auxiliary supply (e.g. 110 V DC) for external alarm lamps
3, 4, 5	Alarm relays (free changeover contacts) trip in the event of an alarm. Alarm relay can be used to trigger an acoustic signal or switching operation. Set using NC-NC bridge, either N/C or N/O operation can be selected.

4.2.2 Connection diagram RC48N-70-50A



Key for connection diagram RC48N-70-50A

Devices

U1	RC48N-935 ground-fault and neutral-grounding monitor
U2	Coupling device CD1000 enables the voltage to be measured between the transformer neutral and earth up to a maximum of 1000 V AC.
-T2, -T3	Measuring current transformer W0-S15 to detect the current flowing through the NER.
NER	Neutral earthing resistor.
S1	Master switch monitoring ON/OFF
H3	In the event of an alarm, alarm lamp H3 will light up
H1, H2	Optional, external indicator (alarm annunciator panel) with alarm lamps H1 “ALARM Ground Fault” (GFA) and H2 “ALARM Resistor Fault” (NRA).
-X1	Connection terminals T1, N1 rigid 2.5 ... 25 mm^2 flexible 4 ... 16 mm^2 1 x PE rigid 0.5 ... 16 mm^2 flexible 0.5 ... 10 mm^2 2 x PE rigid 0.2 ... 6 mm^2 1 ... 9 flexible 0.2 ... 4 mm^2

Connections

T1	Connection to transformer star point
N1	Connection to NER (neutral earthing resistor)
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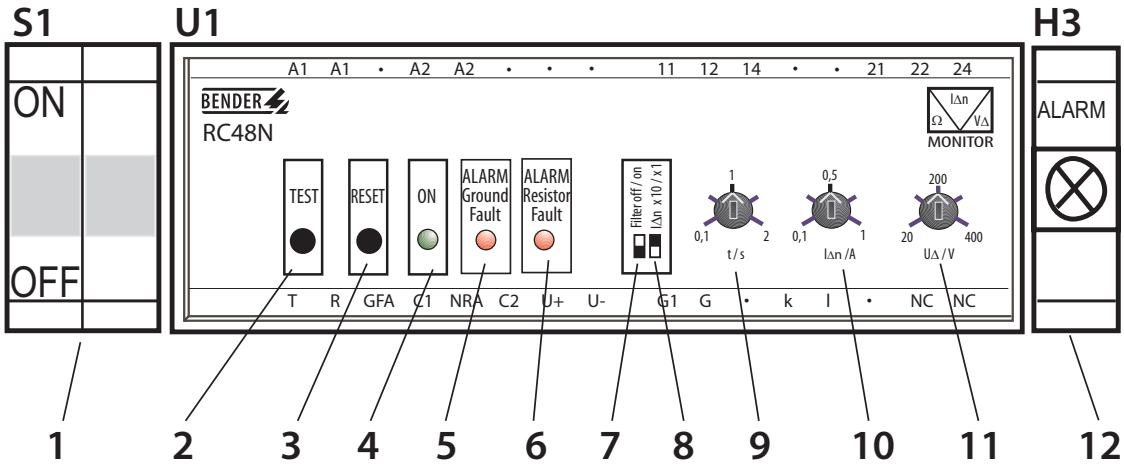
1, 2	Connection of supply voltage U_s = 110 V DC Recommended fuse: 6 A fuse as short-circuit protection for supply voltage
6	Connection of external alarm lamp GFA (H1). H1 lights up if the residual current response value and the response time are exceeded.
7	Connection of external alarm lamp NRA (H2). H2 lights up if the voltage across the neutral earthing resistor exceeds the response value or if the NER’s resistance exceeds 2 KΩ.
8, 9	Connection of external auxiliary supply (e.g. 110 V DC) for external alarm lamps
3, 4, 5	Alarm relays (free changeover contacts) trip in the event of an alarm. Alarm relay can be used to trigger an acoustic signal or switching operation. Set using NC-NC bridge, either N/C or N/O operation can be selected.

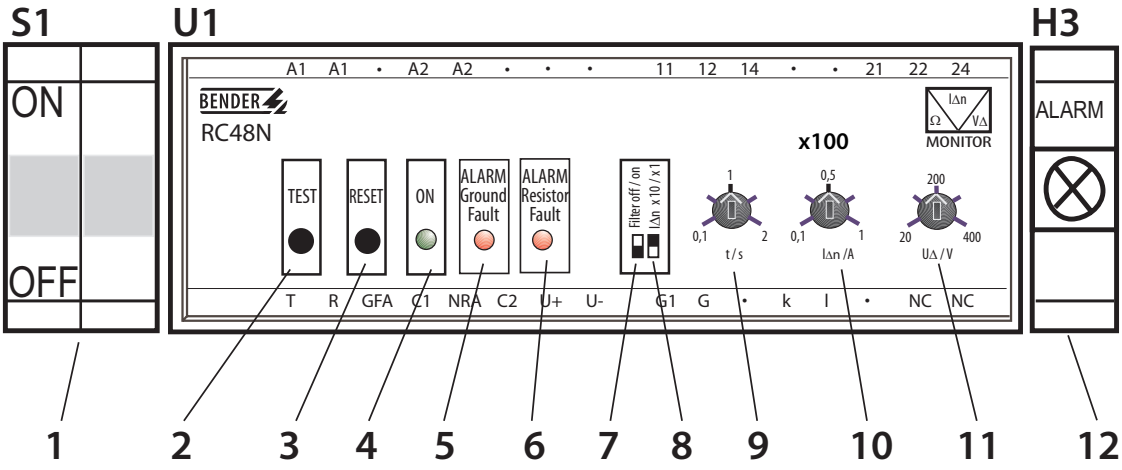
5. Operation and configuration

5.1 Operating elements RC48N-70-10A



1	Master switch S1: Monitoring ON/OFF
2	Press the TEST key to initiate the following sequence: A test residual current is simulated and once the response time has elapsed, an alarm is recognised; which causes the alarm relay to switch and the “ALARM Ground Fault” LED and alarm lamp H3 to light up. The alarm message is stored.
3	Press the RESET key to delete alarm messages
4	ON LED (green) lights up to indicate that the RC48N is in operation.
5	The “ALARM Ground Fault” LED (red) lights up if the residual current response value and the response time are exceeded.
6	The “ALARM Resistor Fault” LED (red) lights up if the voltage across the neutral earthing resistor exceeds the response value or if the NER’s resistance exceeds 2 KΩ..
7	DIP switch “Filter OFF/ON”: Bandpass filter 50 ... 60 Hz. When the bandpass filter is switched on, only the narrow-band 50 ... 60 Hz components of the residual current are detected. This function can be used to prevent erroneous tripping as a result of harmonics and transient components in the residual current.
8	DIP switch “IΔn x 10 / x 1”: For configuring the setting range of the residual current response value IΔn/A x1: 0.1 A ... 1 A x10: 1 A ... 10 A
9	For setting the response delay t/s for the residual current measurement from 0.1 to 2 seconds.
10	For setting the residual current response value from 0.1 A to 1 A and 1 A to 10 A respectively.
11	For setting the response value for voltages across the neutral earthing resistor from 20 to 400 V.
12	In the event of an alarm, alarm lamp H3 will light up.

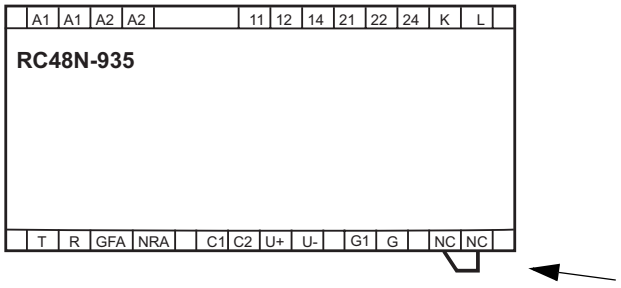
5.2 Operating elements RC48N-70-50A



1	Master switch S1: Monitoring ON/OFF
2	Press the TEST key to initiate the following sequence: A test residual current is simulated and once the response time has elapsed, an alarm is recognised; which causes the alarm relay to switch and the "ALARM Ground Fault" LED and alarm lamp H3 to light up. The alarm message is stored.
3	Press the RESET key to delete alarm messages
4	ON LED (green) lights up to indicate that the RC48N is in operation.
5	The "ALARM Ground Fault" LED (red) lights up if the residual current response value and the response time are exceeded.
6	The "ALARM Resistor Fault" LED (red) lights up if the voltage across the neutral earthing resistor exceeds the response value or if the NER's resistance exceeds 2 KΩ.
7	DIP switch "Filter OFF/ON": Bandpass filter 50 ... 60 Hz. When the bandpass filter is switched on, only the narrow-band 50 ... 60 Hz components of the residual current are detected. This function can be used to prevent erroneous tripping as a result of harmonics and transient components in the residual current.
8	The second measuring current transformer generates a measurement signal reduced by a factor of 100. Set this DIP switch to x1. The response value set at the potentiometer (0.1... 1 A) is multiplied by the factor x100.The response range is 10 A ... 100 A.
9	For setting the response delay t/s for the residual current measurement from 0.1 to 2 seconds.
10	For setting the residual current response value from 10 A to 100 A. Example: On the device, select 0.1 A for an actual response value of 10 A.
11	For setting the response value for voltages across the neutral earthing resistor from 20 to 400 V.
12	In the event of an alarm, alarm lamp H3 will light up.

5.3 Setting the alarm relay operating mode

You can set the operating mode for the alarm relay via a bridge between the NC-NC contacts on the RC48N-935:



Bridge open	N/O operation
Bridge closed	N/C operation (factory setting)

5.4 Factory settings

	RC48N-70-10A	**RC48N-70-50A**
Filter: DIP switch "Filter off / on"	on	on
Response range: DIP switch "IΔn x 10 / x 1"	x10 => 1...10 A	x1 => 0.1...1 A
Response delay t/s for alarm IΔn	0.1 s (left-hand stop)	0.1 s (left-hand stop)
Residual current response value IΔn/A	0.1 A (left-hand stop)	0.1 A (left-hand stop) x factor 100 => 10 A
Response value for voltage drop UΔ/V at the neutral earthing resistor NER	20 V (left-hand stop)	20 V (left-hand stop)
Operating principle of alarm relay: NC-NC bridge	closed (N/C operation)	closed (N/C operation)
Response value for interruption of the neutral earthing resistor (permanent setting)	> 2 kΩ	> 2 kΩ
Response delay for interruption of NER and voltage drop at the NER (permanent setting)	5 s	5 s

6. Data

6.1 Technical data

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage ..... AC 250 V
Rated impulse withstand voltage/contamination level 2.5 kV/3

Voltage ranges

Supply voltage U_S ..... AC/DC 60 ... 264 V, 50 ... 60 Hz,
Fuse ..... recommended: 6 A slow fuse
Power consumption ..... approx. 5.8 VA at AC 60 V
..... approx. 8.5 VA at AC 264 V

Residual current monitoring

Response value, residual current ..... RC48N-70-10A: adjustable 0.1 ... 1 A resp. 1 ... 10 A
..... RC48N-70-50A: adjustable 10 ... 100 A (Scale value x Factor 100)
Accuracy ..... + 0 ... - 25 %
Response delay ..... adjustable 0.1 ... 2 s
Accuracy of response delay ..... ± 20 %
Continuous short circuit current ..... 200 A
..... 2500 A for 2 s
Operating mode ..... latching

Neutral earthing resistor monitoring

Response value, voltage measurement ..... adjustable 20 ... 400 V
Accuracy ..... ± 10 %
Response value, neutral grounding resistor at $U_N = 0$ V ..... 2 kΩ
Accuracy ..... + 5 ... - 2 % of the coupling resistance
Response time ..... 5 s ± 20 %
Operating mode ..... latching

Outputs

Switching elements (alarm relay) ..... 1 changeover contact
Rated contact voltage ..... AC 250 V / DC 300 V
Limited making capacity ..... AC/DC 5 A
Limited breaking capacity AC/DC ..... 2/0.2 A
Permissible number of operations ..... 12000 cycles
Operating mode, alarm relay, selectable (bridge) ..... N/O operation / N/C operation
Switching elements (GFA, NRA) ..... 2 NO contacts
Rated contact voltage ..... AC 250 V / DC 300 V
Limited making capacity ..... AC/DC 5 A
Limited breaking capacity AC/DC ..... 2/0.2 A
Permissible number of operations ..... 12000 cycles

Type tests

Test of the electromagnetic compatibility (EMC)
Immunity ..... according to IEC 62020
Emissions ..... according to EN 50081
Emissions according to EN 55011/CISPR11 ..... Class A

General data

Operating temperature ..... - 40 °C ... + 60 °C (233 K ... 333 K)
Storage temperature ..... - 55 °C ... + 80 °C (218 ... 353 K)
Climatic class according to IEC 60721 ..... 3K5
Operating mode ..... continuous operation
Mounting ..... upright position
Connection ..... screw terminals
Protection class according to DIN EN 60529
Built-in components ..... IP 30
Housing/Window with knurled head screws ..... IP 66
Flammability class UL94V-0
Colour of the housing ..... RAL 7035
Dimensions (W x H x D) ..... 300 x 400 x 120mm
Weight ..... approx. 9 Kg

6.2 Applied standards

- CSA M421-00: Juli 2000: Use of electricity in mines
- AS 2081.1 - AS2081.5: Electrical equipment for Coal and Shale Mines
- IEC 62020:1998-08: Residual Current Monitors

6.3 Ordering details

Type	Designation	Art. No.
RC48N-70-10A	ground-fault and neutral-grounding monitoring system	B 9401 3010
RC48N-70-50A	ground-fault and neutral-grounding monitoring system	B 9401 3011

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