Ground-Fault & Neutral Grounding Resistor Monitor

Intended use
The RC48N ground-fault neutral-grounding-resistor monitor is used to monitor high-resistance grounded systems up to and including 5kVac. It is designed to monitor the presence of the neutral-grounding resistor and does this through monitoring of the current and voltage in the transformer neutral.

The RC48N ground-fault and neutral-grounding-resistor monitor combines three functions in one device:
- Monitoring the residual current.
- Monitoring the voltage between the transformer neutral and ground.
- Monitoring the grounding resistor for continuity (NGR).

If a value is not within the thresholds, a relay with two voltage-free changeover contacts will be activated. These contacts can be jumper selected for shunt or UV operation.

Alarm messages of the RC48N ground-fault and neutral-grounding monitor can also be displayed on a remote RC2000NC alarm indicator and operator panel.

Safety Information
The connection to the power system’s neutral point is made via BENDER’s coupling devices CD1000 or CD5000. The enclosure of the CD1000 and CD5000 must be connected to the system ground. Failure to comply with this information may cause electric shock to personnel. Furthermore, substantial damage to the electrical installation and destruction of the RC48N might occur.

Function
The RC48N ground-fault and neutral-grounding-resistor monitor:
- Measures the residual current in the respective circuit or branch of the system with BENDER residual current transformers. For that purpose, the neutral grounding conductor and the connection of the coupling device to the neutral have to be passed through the residual current transformer. Alternatively, all active conductors (phases + N) can be passed through the residual current transformer. If the residual current exceeds the response value, the “Alarm Ground Fault” LED lights and the alarm relay switches. The trip time is adjustable.
- Monitors the resistance of the neutral grounding resistor (NGR), connections through the transformer, and the connections to ground. Also monitors the voltage drop on the neutral grounding resistor via the coupling device CD1000 and CD5000. Coupling device CD1000 is suitable for system voltages AC 0 .. 1000 V. Coupling device CD5000 is suitable for system from voltages AC 0 ... 5000 V. An alarm is indicated when the ground-fault current or the transformer neutral and ground voltage exceeds the RC48N set point. This alarm has no time delay feature.

Alarm messages are indicated by the “Alarm Ground Fault” and ”Alarm Resistor Fault” LEDs on the RC48N or on the remote RI2000NC alarm indicator and operator panel. The alarm message remains stored until the built-in or the external RESET button is pressed.

The alarm relay can be used for the tripping of a contactor or load switch. Depending on the type of load switch the operating mode of the alarm relay can be set to N/O (shunt) operation or N/C (UV) operation.
Operating and display elements

Legend to operating and display elements

1. Pressing the TEST button initiates the following sequence: a test residual current is simulated, after the expiry of the response time an alarm is recognized which causes the alarm relay to switch and the red “Alarm Ground Fault” LED to light. The alarm message is stored.

2. Pressing the RESET button deletes alarm messages.

3. ON LED (green) indicates that the RC48N is in operation.

4. “Alarm Ground Fault” (red) LED lights when the ground fault current exceeds the alarm response value and the time delay. It flashes if a CT is not connected.

5. “Alarm Resistor Fault” LED (red) lights when the voltage across the neutral grounding resistor exceeds the preset value or when the NGR’s resistance exceeds 2 KΩ.

6. DIP switch:
   - Filter off / on: bandpass filter 60 Hz
   - When the bandpass filter is switched on, only the narrow-band 60 Hz components of the residual current are detected. This function can be used to avoid false trippings caused by the occurrence of harmonics and transient components in the residual current.

7. Setting the time delay t/s for the residual current measurement from 0.1 to 2 seconds.

8. Setting the residual current response value to 0.1 A ... 1 A respectively 1 A ... 10 A.

9. Setting of the response value for voltages across the neutral grounding resistor from 20 to 400 V.

Setting the response value: Formula $E = Ri$

$E =$Response Voltage Set Point
$I = $RC48N Ground-fault-trip set point
$R =$NGR Resistance

IE: A 5-A NGR on a 480V system with the RC48N set to trip at 2 A would use a CD1000 with a response voltage setting of $2 \times 55 \text{ ohms} = 110 \text{ Volts}$. Therefore the response voltage set point would have to be 110 volts minimum.

Prior to installation and before work activities are carried out on the connecting cables, make sure that the mains power is disconnected.

Failure to comply with this safety information may cause electric shock to personnel.

Furthermore, substantial damage to the electrical installation and destruction of the device might occur.
Connection
Connect the RC48C as described in the diagram below

**Components**

CD... Coupling devices CD1000 or CD5000 allow for voltage measurement across the neutral grounding resistor. Install the coupling device CD. as close as possible to the neutral grounding resistor.

CT Residual current transformers to detect the current flowing through the neutral grounding resistor. Place the residual current transformer as shown in the wiring diagram. The residual current transformer can also be placed between the neutral grounding resistor and ground provided that no insulation fault exists in the neutral grounding resistor. Connect the residual current transformer to the terminals k and l on the RC48N. Do not ground any of the CT connections. The residual current transformer is equipped with overcurrent protection.

R12000NC Remote alarm indicator and operator panel with TEST button (T), RESET button (R), “Alarm Ground Fault” LED (GFA) and “Alarm Resistor Fault” LED (NRA). The functions of the buttons and LEDs and the designations correspond to the respective operating elements on the RC48N.

F Fuse Short-circuit protection supply voltage: a 6 A fuse is recommended.

K1 External load switch, disconnects the system being monitored in case of an alarm.

A1, A2 Connection supply voltage Us.

11, 12, 14, and 21, 22, 24 Two voltage free changeover contacts, trip in case of alarm.

NC, NC Select N/O operation or N/C operation for the free changeover contacts:
Bridge open: N/O (shunt) operation
Bridge closed: N/C operation (UV) (factory setting)

G, G1 Connection, coupling devices CD1000 or CD5000

k, l Connection residual current transformer, alarm LED flashes if the CT connection is interrupted.

Connection of the remote alarm indicator and operator panel R12000NC:

T Connection external TEST button
R Connection external RESET button
GFA Connection external “Alarm Ground Fault” LED
NRA Connection external “Alarm Resistor Fault” LED
U+, U- Output DC 12 V, supplying the remote alarm indicator and operator panel R12000NC.

C1, C2, U+ Bridge supplies the remote alarm indicator and operator panel R12000NC with supply voltage from the RC48N.
**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: adjustable 0.1 ... 1 A respectively 1 ... 10 A
- 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

**Ground conductor 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

**Inputs**
- Connection to the residual current transformer:
  - Single wire, 0.75 mm² (AWG 18) up to 1 m (3’)
  - Single wire, twisted 0.75 mm² (AWG 18) 1 ... 10 m (3 ... 30’)
  - Shielded cable 0.75 mm² (AWG 18) (shield to Ground) 10 ... 25m (30 ... 75’)

**Outputs**
- Switching elements (alarm relay): 2 Form C 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
- Operating mode, alarm relay, selectable: N/O (Shunt) or N/C (UV) operation

**Switching elements (GFA, NRA)**
- 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 60721K5:
  - Continuous operation
- Mounting: any position
- Connection: screw terminals
- Wire cross section, single wire: 0.2 ... 4 mm² (AWG 24 to 12)
- Wire cross section, flexible: 0.2 ... 2.5 mm² (AWG 24 to 14)
- Protection class according to DIN EN 60529: IP 30
- Built-in components: IP 30
- Terminals: IP 20
- Flammability class: UL94V-0
- Weight: approx. 350 g

**Applied standards**
- CSA M421-00: July 2000: Use of electricity in mines
- AS 2081.1 - AS2081.5: Electrical equipment for Coal Mines
- IEC 62020:1998-08: Residual Current Monitors
Accessories

Dimensions in mm (inches)

Coupling device CD1000

Coupling device CD5000

Remote alarm indicator and operator panel RI2000NC

(Installation into standard "one-gang (G1) box").
## Ordering details

<table>
<thead>
<tr>
<th>Type</th>
<th>Designation</th>
<th>Part.No</th>
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<tr>
<td>RC-48N-935</td>
<td>Ground-Fault and NGR Monitor</td>
<td>B9401 3005</td>
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<tr>
<td>CD1000</td>
<td>Coupling device for RC48N</td>
<td>B98039010</td>
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<tr>
<td>CD5000</td>
<td>Coupling device for RC48N</td>
<td>B98039011</td>
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<tr>
<td>RI2000NC</td>
<td>Remote alarm indicator and operator panel for RC48N</td>
<td>B9407 1001</td>
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<td>CT-M70</td>
<td>Residual current transformer ID= 2.8&quot;</td>
<td>B911 777</td>
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<td>CT-M105</td>
<td>Residual current transformer ID= 4.2&quot;</td>
<td>B911 778</td>
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