



# RCM420

## Residual current monitor

for AC current monitoring in TN and TT systems

Software version: D240 V1.2x



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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 **electrocution** 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.

This manual has been compiled with great care. It might nevertheless contain errors and mistakes. Bender cannot accept any liability for injury to persons or damage to property resulting from errors or mistakes in this manual.

## 1.2 Technical support: service and support

For commissioning and troubleshooting Bender offers you:

### 1.2.1 First level support

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

- Questions concerning 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

- Repairing, calibrating, testing and analysing Bender products
- Hardware and software update for Bender devices
- Delivery of replacement devices in the event of faulty or incorrectly delivered Bender devices
- Extended guarantee for Bender devices, which includes an in-house repair service or replacement devices at no extra cost

**Telephone:** +49 6401 807-780\*\* (technical issues)  
+49 6401 807-784\*\*, -785\*\* (sales)  
**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 Str. 65,  
35305 Grünberg

### 1.2.3 Field service

On-site service for all Bender products

- Commissioning, configuring, maintenance, troubleshooting of Bender products
- Analysis of the electrical installation in the building (power quality test, EMC test, thermography)
- Training courses for customers

**Telephone:** +49 6401 807-752\*\*, -762 \*\*(technical issues)

+49 6401 807-753\*\* (sales)

**Fax:** +49 6401 807-759

**E-mail:** [fieldservice@bender-service.de](mailto:fieldservice@bender-service.de)

**Internet:** [www.bender-de.com](http://www.bender-de.com)

\*Available from 7.00 a.m. to 8.00 p.m. 365 days a 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.com](http://www.bender-de.com) -> Know-how -> Seminars.

### 1.4 Delivery conditions

Bender sale and delivery conditions 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 Manufacturer's Association) also applies.

Sale and delivery conditions 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 they are protected from dust, damp, and spray and dripping water, and in which the specified storage temperatures can be ensured.

## 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:

- Electrical and electronic equipment are not part of household waste.
- Batteries and accumulators are not part of household waste and 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 13 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.com](http://www.bender-de.com) -> 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 AC and pulsed DC sensitive residual current monitor RCM420 (Type A) from Bender is designed for fault and residual current monitoring in earthed power supply systems (TN/TT systems) where an alarm is to be activated in the event of a fault, but disconnection must be prevented. In addition, the device can be used to monitor single conductors, such as PE conductors, N-PE connections and PE-PAS connections.

Two separately adjustable response ranges  $I_{\Delta n1}$  and  $I_{\Delta n2}$  allow to distinguish between prewarning and alarm ( $I_{\Delta n1} = 50 \dots 100$  % of the set response value  $I_{\Delta n2}$ ).

In order to meet the requirements of the 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 use other than that described in this manual is regarded as improper.

## 3. Function

### 3.1 Device features

- AC and pulsed DC sensitive residual current monitor Type A according to IEC 62020
- Adjustable switching hysteresis
- r.m.s. value measurement
- Starting delay, response delay and delay on release
- Measured value display via multi-functional LC display
- Alarm indication via LEDs (AL1, AL2) and changeover contacts (K1, K2)
- N/C operation or N/O operation selectable
- Password protection against unauthorized parameter changing
- Fault memory function can be switched off
- CT connection monitoring

### 3.2 Function

Once the supply voltage  $U_s$  is applied, the starting delay "t" is activated. Measured values exceeded during this time do not influence the switching state of the alarm relays. Residual current monitoring takes place via an external measuring current transformer. The currently measured value is shown on the LC display. In this way any changes can be recognized easily, for example, when circuits are connected to the system. If the measured value exceeds one or both response values, the response delay  $t_{on1/2}$  starts running. After the expiry of the response delay  $t_{on1/2}$ , the selected alarm relay switches and the alarm LEDs light. If the release value is not reached before the expiry of  $t_{on}$ , no alarm will be signalled: the LEDs AL1, AL2 do not light and the alarm relays do not switch. The set release time  $t_{off}$  begins when the measured value again falls below the release value (response value plus hysteresis) after the switching of the alarm relays. After the expiry of  $t_{off}$ , the alarm relays switch back to their initial position. With the fault memory activated, the alarm relays do not change their actual state until the reset button R is pressed. The device

function can be tested using the test button T. The parameterization of the device can be carried out via the LC display and the function keys integrated in the front plate and can be password-protected.

### 3.2.1 Connection monitoring

The CT connections are continuously monitored. In the event of a fault, the alarm relays K1 / K2 switch without delay, the alarm LEDs AL1 / AL2 / ON flash (Error Code E.01). After eliminating the fault, the alarm relays automatically return to their initial position, provided that the fault memory M is deactivated. With the fault memory activated, K1/K2 return to their initial position by pressing the reset button R. A second cascaded measuring current transformer will not be monitored.

### 3.2.2 Additional cascaded measuring current transformer

For applications where residual currents higher than 10 A occur, a second external transformer can be cascaded. The transformer's transmission ratio can be adapted using the correction factor  $n_{RCM}$  in the SEt menu. Refer to page 21 and page 34.

### 3.2.3 Fast response value query

With the display in standard mode, the currently measured response values  $I_{\Delta n1}$  and  $I_{\Delta n2}$  can be queried pressing the Up and Down keys (< 1.5 s). Switchover to the Menu mode is not required. If you want to exit the fast response value query, press the enter key.

### 3.2.4 Automatic self test

The device automatically carries out a self test after connecting to the system to be monitored and later every 24 hours. During the self test internal functional faults will be detected and appear in form of an error code on the display. The alarm relays are not checked during this test.

### 3.2.5 Manual self test

After pressing the test button for > 1.5 s, the device carries out a self test. During this test, internal functional faults are detected and will be displayed in form of an error code. The alarm relays are not checked during this test.



While the test button T is pressed and held down, all device-related display elements appear on the display.

### 3.2.6 Functional faults

If an internal functional fault occurs, all three LEDs flash. An error code will appear on the display (E01...E32). In such a case please contact the Bender Service.

### 3.2.7 Set the number of reload cycles

If faults occur only temporarily, but recurrently, in the system being monitored, with the fault memory M deactivated, the alarm relays would switch synchronously to the error status.

RL in the out menu can be used to limit the number of these changeover processes. As soon as the preset number of switching cycles is exceeded, the fault memory will come on and an activated alarm remains stored.

### 3.2.8 Assigning alarm categories to alarm relays K1/K2

The alarm categories device error, residual current  $I_{\Delta n1}$ , residual current  $I_{\Delta n2}$  or device test can be assigned to the alarm relay via the "out" menu.

### 3.2.9 Time delays $t$ , $t_{on}$ and $t_{off}$

The times  $t$ ,  $t_{on}$  and  $t_{off}$ , described below, delay the output of alarms via LEDs and relays.

#### Starting delay $t$

After connection to the supply voltage  $U_s$ , the alarm indication is delayed by the preset time  $t$  (0...10 s).

#### Response delay $t_{on1/2}$

If the response value is exceeded or not reached, the residual current monitor requires the response time  $t_{an}$ . After the expiry of the response time an alarm is signalled. A set response delay  $t_{on1/2}$  (0...10 s) adds up to the device-related operating time  $t_{ae}$  and delays alarm signalling (total delay time  $t_{an} = t_{ae} + t_{on}$ ). If the residual current fault changes from a value above the response value to a value below the response value, an alarm will not be signalled.

### **Delay on release $t_{\text{off}}$**

When no alarm exists after deactivating the fault memory, the alarm LEDs go out and the alarm relays switch back to their initial position. After activating the delay on release (0...300 s), the alarm state is continuously maintained for the selected period.

### **3.2.10 Residual current monitoring in window discriminator mode**

Change the measuring principle by selecting the window mode (SEt / In). In the window discriminator mode, the threshold values I1 and I2 represent the upper and the lower value. If the measured value is not within this area, an alarm is initiated by the device. See page 34.

### **3.2.11 Password protection (on, OFF)**

When the password protection is activated (on), settings are only possible after entering the correct password (0...999).

### **3.2.12 Factory setting FAC**

After activating the factory setting, all settings previously changed are reset to delivery status.

### **3.2.13 Erasable history memory**

The first alarm value that occurs will be saved in this memory. The memory can be cleared via the menu HiS.

### **3.2.14 External, combined test respectively reset button T/R**

Reset = Pressing the external button < 1.5 s

Test = Pressing the external button > 1.5 s

### **3.2.15 Fault memory**

The fault memory can be activated, deactivated or set to continuous mode (con). If the fault memory is set to "con" mode, the alarm parameters remain stored even on failure of the supply voltage. Stored alarms can be reset by means of the reset button R.

## 4. Installation and connection



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



**DANGER**

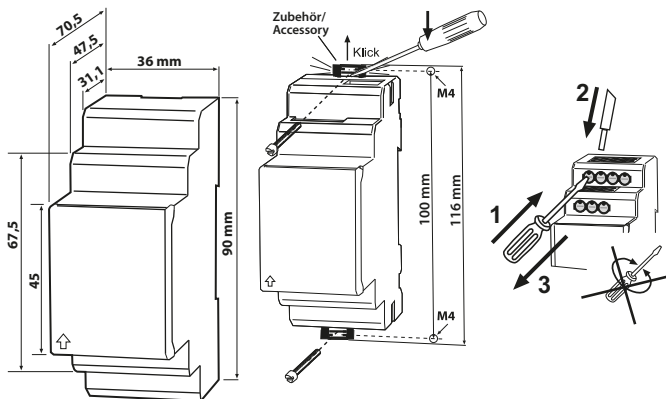
### **Risk of electrocution due to electric shock!**

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.

Dimension diagram, drawing for screw mounting, push-wire terminal connection



The front plate cover is easy to open at the lower part marked by an arrow.

### 1. DIN rail mounting:

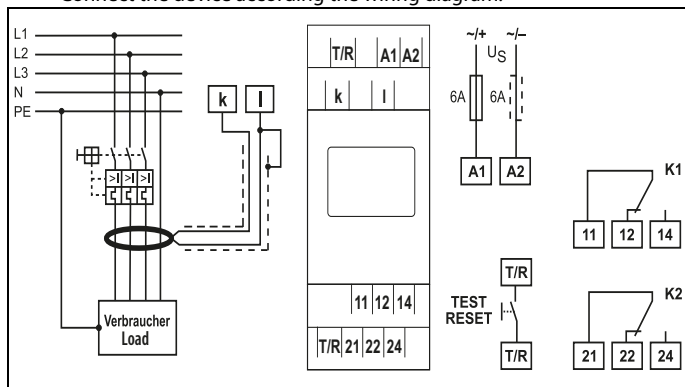
Snap the rear mounting clip of the device into place in such a way that a safe and tight fit is ensured.

#### Screw fixing:

Use a tool to move the rear mounting clips (a second mounting clip required, see ordering information) to a position that it projects beyond the enclosure. Then fix the device using two M4 screws.

### 2. Wiring

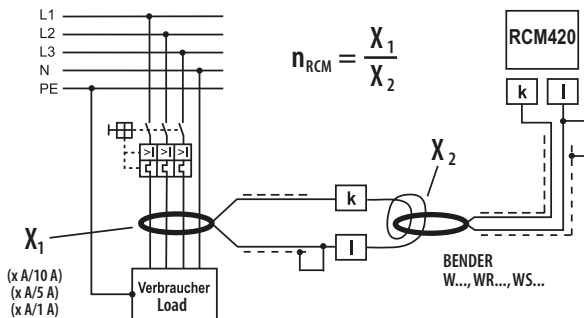
Connect the device according the wiring diagram.



| Terminal   | Connections                                      |
|------------|--|
| A1, A2     | Connection to supply voltage $U_S$               |
| k, I       | Connection of measuring current transformers     |
| T / R      | Connection to the combined test and reset button |
| 11, 12, 14 | Alarm relay K1                                   |
| 21, 22, 24 | Alarm relay K2                                   |

## Connection of an additional cascaded measuring current transformer

If the residual current range of 10 A is not sufficient, an additional measuring current transformer can be cascaded. Connect the measuring current transformer as illustrated in the drawing below.



### Example:

An additionally cascaded transformer on the load side has a transmission ratio of  $X_1 = 100$  (500 A / 5 A). That means, when the lowest value of 10 mA is set at the RCM420, a current of 1 A can only just be detected on the primary side of the transformer on the load side. In order to reduce the value that can be detected to 100 mA, 10 turns of the supply cable has to be routed through the transformer on the RCM side.

Hence, the correction factor to be set is

$$n_{RCM} = X_1 : X_2 = 100 : 10 = 10.$$

The correction factor can be set via the S E t / n menu. Refer to page 34.

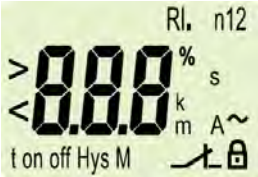


The correction factor is factory set to 1 and relates to normal operation with one Bender measuring current transformer only ( $X = 600:1$ ).



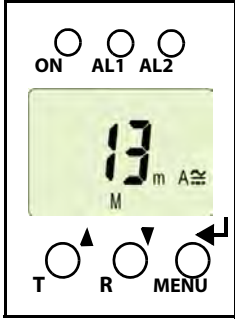
## 5. Operation and setting

### 5.1 Display elements

A detailed description of the meaning of the display elements is given in the table below.

| Display elements   | Element   | Function  |
|--|---|---|
|  | RL  | Reload function with memory = off (L = I.)  |
|  | n   | Transformation ratio factor for a second external measuring current transformer.  |
|  | I2  | Response value $I_{\Delta n2}$ as mA (Alarm 2)  |
|  | I1  | Response value $I_{\Delta n1}$ as % of $I_{\Delta n2}$ (Alarm 1, prewarning.)   |
|  | r1, 1<br>r2, 2  | Alarm relay K1<br>Alarm relay K2  |
|  | I Hys, %  | Response value hysteresis as %.   |
|  | ton1,<br>ton2,<br>t,<br>toff  | Response delay $t_{on1}$ (K1)<br>Response delay $t_{on2}$ (K2)<br>Starting delay $t$ ,<br>Delay on release $t_{off}$ for K2 |
|  | M   | fault memory active   |
|  |  | Relay operating mode K2   |
|  |  | Password protection enabled   |






## 5.2 Function of the operating elements


| Device front   | Element          | Function   |
|--|------------------|--|
|  | <b>ON, green</b> | lights continuously: Power On LED flashes:<br>System fault or connection monitoring fault  |
|  | <b>AL1, AL2</b>  | LED Alarm 1 lights (yellow): Response value 1 reached ( $I_{\Delta n1}$ )<br>LED Alarm 2 lights (yellow): Response value 2 reached ( $I_{\Delta n2}$ )                     |
|  | <b>13 mA M</b>   | 13 mA flow through the measuring current transformer, fault memory active  |
|  | <b>T, ▲</b>      | Test button (> 1.5 s): To indicate the available display elements, to start a self test;<br>Up key (< 1.5 s): Menu items/values  |
|  | <b>R, ▼</b>      | Reset button (> 1.5 s): Deleting the fault memory;<br>Down key (< 1.5 s): Menu items/values  |
|  | <b>MENU, ◀</b>   | MENU key (> 1.5 s): Starting the menu mode;<br>Enter key (< 1.5 s): Confirm menu item, submenu item and value.<br>Enter key (> 1.5 s): Back to the next higher menu level. |



### 5.3 Menu structure

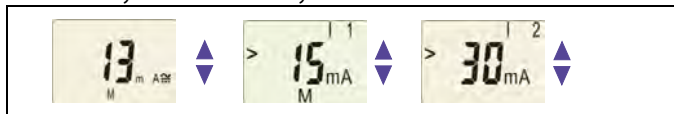
All adjustable parameters are listed in the columns "menu item" and "adjustable parameters". A display-like representation is used to illustrate the parameters in the column menu item. Different alarm categories can be assigned to the alarm relays K1, K2 via the submenus r1, r2. This is done by activation or deactivation of the respective function.

| Menu                      | Sub Menu  | Menu item   | Activation | Adjustable parameter   |
|---------------------------|---|---|------------|--|
| AL<br>(response - values) |    | > I2  | - (HI)     | $I_{\Delta n2}$ (Alarm 2)  |
|                           |   | > I1  | - (HI)     | $I_{\Delta n1}$ as % of $I_{\Delta n2}$<br>(Alarm 1, prewarning) |
|                           |   | Hys   | -          | Hysteresis $I_{\Delta n1} / I_{\Delta n2}$                       |
| out<br>(output control)   |    | M   | ON         | Fault memory   |
|                           |   |  1 | -          | Operating mode K1 (n.c.)   |
|                           |   |  2 | -          | Operating mode K2 (n.c.)   |
|                           |   | RL  | -          | Reload function (memory = off)                                   |
|                           | r1<br>(K1: (assignment alarm category))   | 1 Err   | ON         | Device error at K1   |
|                           |   | r1 I1   | ON         | Prewarning $I_{\Delta n1}$ at K1                                 |
|                           |   | r1 I2   | off        | Alarm $I_{\Delta n2}$ at K1                                      |
|                           |   | 1 tES   | ON         | Device test  |
|                           | r2<br>(K2: (assignment alarm category))   | 2 Err   | ON         | Device error at K2   |
|                           |   | r2 I1   | off        | Prewarning $I_{\Delta n1}$ at K2                                 |
|                           |   | r2 I2   | ON         | Alarm $I_{\Delta n2}$ at K2                                      |
|                           |   | 2 tES   | ON         | Device test  |
| t<br>(timing check)       |  | t on 1  | -          | Response delay K1  |
|                           |   | t on 2  | -          | Response delay K2  |
|                           |   | t   | -          | Starting delay   |
|                           |   | t off   | -          | Delay on release K1/K2   |

| Menu                    | Sub Menu | Menu item   | Activation | Adjustable parameter   |
|-------------------------|----------|---|------------|--|
| Set<br>(device control) | →        | I 12  | HI         | Selectable parameters: High, window function, low                                |
|                         |          | n   | 1          | Transformation ratio factor for a second external measuring current transformer. |
|                         |          |  | off        | Parameter setting via password   |
|                         |          | FAC   | -          | Re-establish factory settings  |
|                         |          | SYS   | -          | Function blocked   |
| InF                     | →        |   | -          | Display hard / software version  |
| HiS                     | →        | Clr   | -          | History memory for the first alarm value, erasable                               |

## 5.4 Display in standard mode

By default, the currently measured residual current is displayed. The current response values I1 (prewarning) and I2 (alarm) can be displayed using the Up and Down key. Press the Enter key to return to the measured value.



*In the standard mode, the currently set response values I 1 and I 2 can be displayed using the Up and Down keys.*

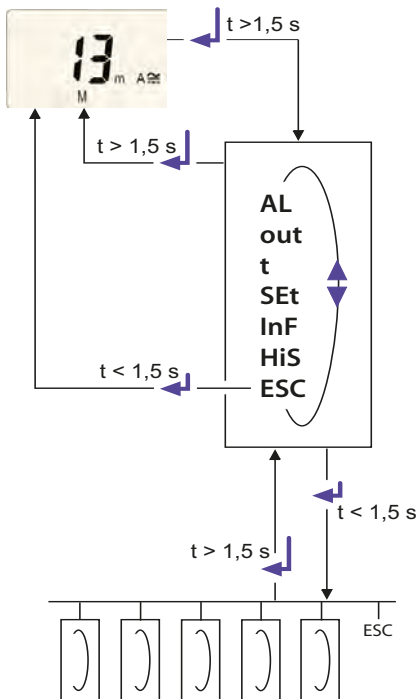
## 5.5 Display in menu mode

### 5.5.1 Parameter query and setting: Overview

| Menu item | Adjustable parameter  |
|-----------|---|
| AL        | Response values query and setting: <ul style="list-style-type: none"> <li>– Residual current I2 (<math>I_{\Delta n2}</math>) (AL2)</li> <li>– Residual current I1 (<math>I_{\Delta n1}</math>) (AL1)</li> <li>– Hysteresis of the response values: % Hys</li> </ul>   |
| out       | Configuration of the fault memory and the alarm relays: <ul style="list-style-type: none"> <li>– Activating/deactivating the fault memory or assign continuous mode (on/off/con)</li> <li>– Select N/O operation (n.o.) or N/C operation (n.c.) individually for each K1/K2</li> <li>– Specify the number of the reload cycles</li> <li>– Assign the alarm category I1 (<math>I_{\Delta n1}</math>) or I2 (<math>I_{\Delta n2}</math>), relay test or device error individually to K1/K2 (1, r1/ 2, r2).</li> </ul> |
| t         | Set delays: <ul style="list-style-type: none"> <li>– Response delay <math>t_{on1}/t_{on2}</math></li> <li>– Starting delay <math>t</math></li> <li>– Delay on release <math>t_{off}</math> (LED, relay)</li> </ul>  |
| SEt       | Device control parameter setting: <ul style="list-style-type: none"> <li>– Select the appropriate parameter for response values: overcurrent mode (HI), undercurrent mode (Lo) or window mode (In).</li> <li>– Set the correction factor <math>n_{RCM}</math> (n) for additional cascaded current transformer.</li> <li>– Enable or disable password protection, change the password.</li> <li>– Re-establish factory settings.</li> <li>– Service menu SyS blocked</li> </ul>                                      |
| InF       | Query hard and software version   |
| HiS       | Query the first stored alarm value.   |

|     |   |
|-----|---|
| ESC | Move to the next higher menu level (back) |
|-----|---|

### Menu structure



## Parameter settings

The following description is based on the fact that the device is in the standard mode and that the measured value of the residual current is being indicated, refer to page 26.

An example is given here on how to change the alarm response value  $I_{\Delta n1}$ . It is presumed that the option overcurrent (HI) has been selected in the SEt/I 12 menu (factory setting). Proceed as follows:

1. To access the menu mode, press the MENU/Enter key for more than 1.5 seconds. The flashing short symbol AL appears on the display.
2. Confirm with Enter. The parameter response value  $> I_2$  flashes, in addition the associated overcurrent value  $> 30$  mA appears.
3. Use the Down key to select the parameter response value I 1. The parameter I 1 flashes, in addition the associated percentage value for prewarning 50 % of  $I_2$  appears.
4. Confirm with Enter. The current value for prewarning appears on the flashing display.
5. Use the Up or Down key to set the appropriate response value. Confirm with Enter. I 1 flashes.
6. You can exit the menu by:
  - Pressing the Enter key for more than 1.5 seconds to reach the next higher level or
  - Selecting the menu item ESC and confirming with Enter to reach the next higher level.



*The currently active segments are flashing! In the figures below, the segments where device settings can be carried out are highlighted by an oval. The menu mode can be reached by pressing the MENU key for more than 1.5 seconds.*

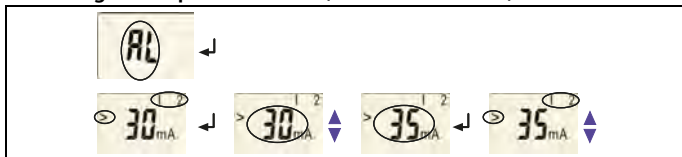
### 5.5.2 Changeover from overcurrent to undercurrent mode or to window mode

The operating mode can be changed in the SEt/I 12 menu using the parameters HI, Lo and In. By default, overcurrent operation (HI) is set. Refer to page 34 for a detailed description on how to change over to the window mode.

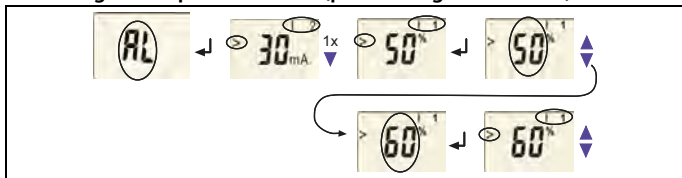
### 5.5.3 Response value setting for overcurrent:

- Response value I2 (overcurrent  $I_{\Delta n2}$ )
- Response value I1 (overcurrent  $I_{\Delta n1}$ )
- Hysteresis (Hys) of the response values  $I_{\Delta n1}$ ,  $I_{\Delta n2}$

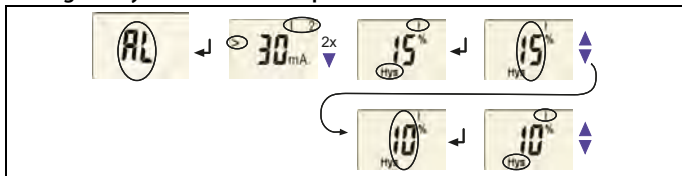
#### Increasing the response value I2 (alarm overcurrent)



#### Increasing the response value I1 (prewarning overcurrent).

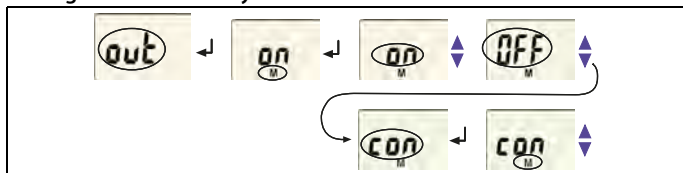


#### Setting the hysteresis of the response value

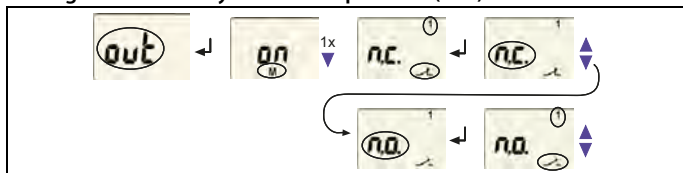


### 5.5.4 Setting the fault memory and alarm relay operating mode

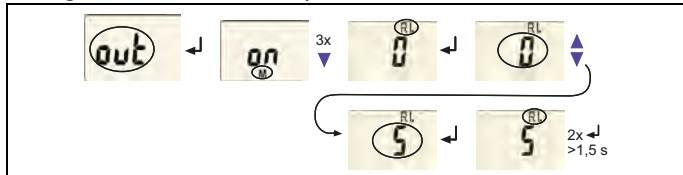
### Setting the fault memory to con mode



### Setting the alarm relay K1 to N/O operation (n.o.)

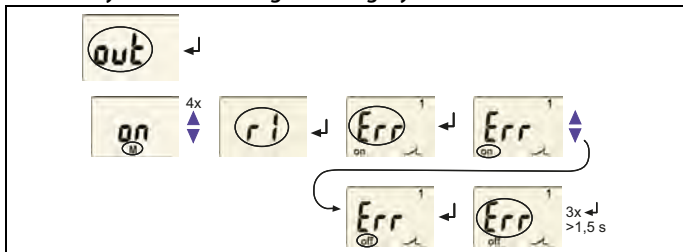
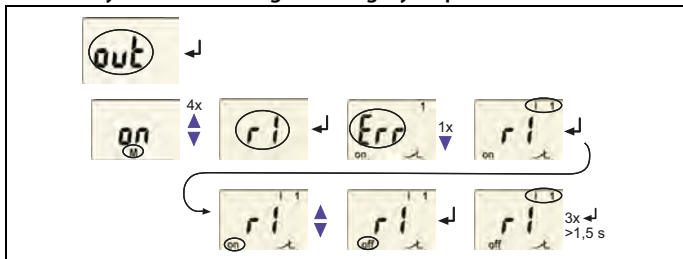
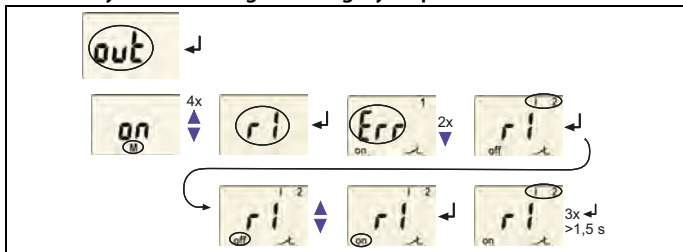


### Setting the number of reload cycles



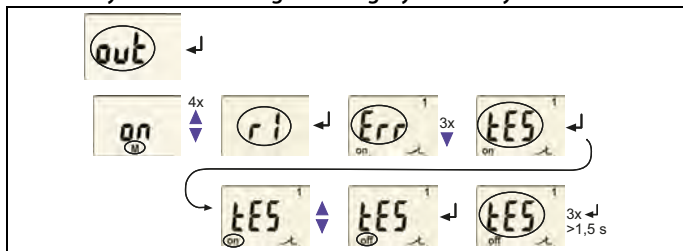
#### 5.5.5 Assigning alarm categories to the alarm relays

Overcurrent, undercurrent and device-related errors of the residual current monitor can be assigned to the alarm relays K1 (r1, 1) and K2 (r2, 2). By default, the alarm relays K1 and K2 signal prewarning and alarm in case of overcurrent and device-related errors.

**Alarm relay K1: Deactivating the category device error**

**Alarm relay K1: Deactivating the category response value I1**

**Alarm relay K1: Activating the category response value I2**




## Alarm relay K1: Deactivating the category "Alarm by device test"



**CAUTION**

*When an alarm relay (K1/K2) has been deactivated in the menu, an alarm will not be signalled by the respective changeover contact! An alarm will only be indicated by the respective alarm LED (AL1/AL2)!*

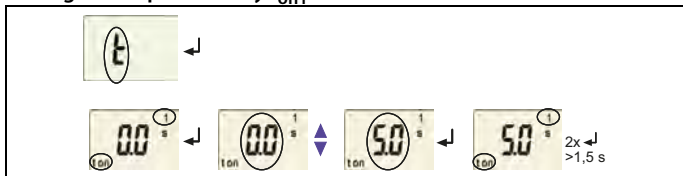
### 5.5.6 Set the time delays

The following delays can be set:

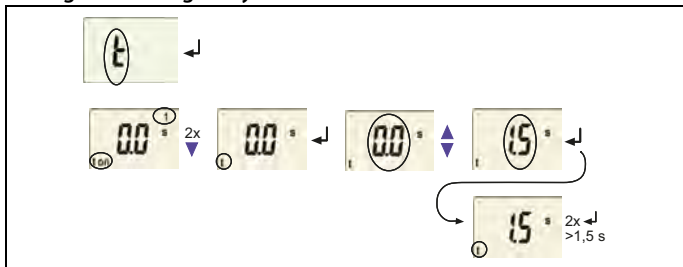
- Response delay  $t_{on1}$  (0...10 s) for K1, and  $t_{on2}$  (0...10 s) for K2
- Starting delay  $t$  (0...10 s) when the device is being started
- Common delay on release  $t_{off}$  (0...300 s) for K1, K2. The setting  $t_{off}$  is only relevant when the fault memory M is deactivated.

The operating steps for the setting of the response delay  $t_{on1}$  and the starting delay  $t$  are illustrated by way of example.

### Setting the response delay $t_{on1}$

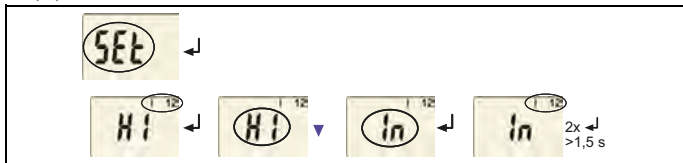


### Setting the starting delay $t$



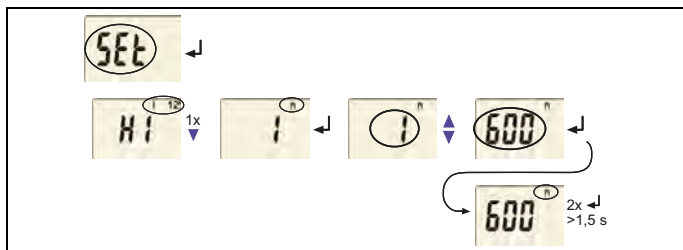
## 5.5.7 Changing from overcurrent operation to window operation

Use this menu item to set whether the response values of the device apply to overcurrent (HI) or undercurrent operation (Lo). In addition, window operation (In) can be selected.



## 5.5.8 Setting the correction factor for an additional cascaded

### current transformer

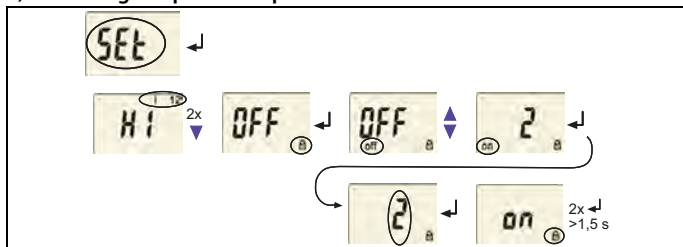


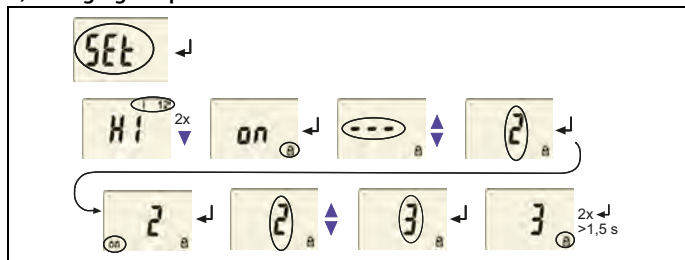
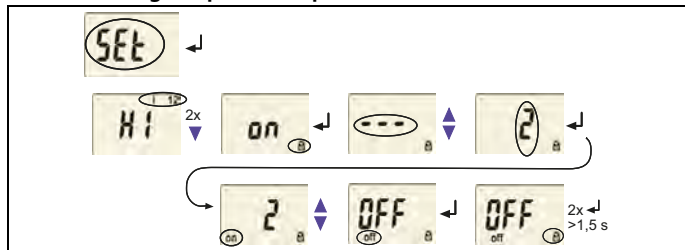
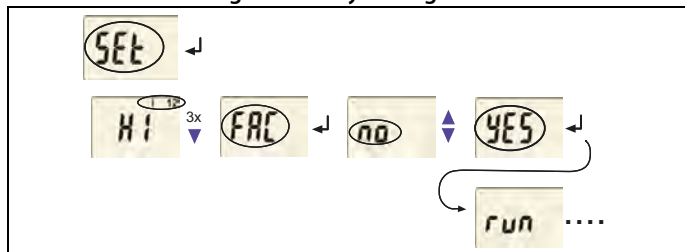
Factory setting without cascaded transformer:  $n = 1$ .

### 5.5.9 Factory setting and password protection

Use this menu to activate the password protection, to change the password or to deactivate the password protection. In addition, you can reset the device to its factory settings.

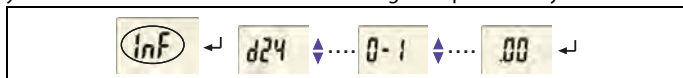
#### a) Activating the password protection



**b) Changing the password**

**c) Deactivating the password protection**

**5.5.10 Re-establishing the factory settings**


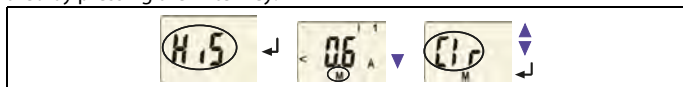
### 5.5.11 Device information query

This function is used to query the software (1.xx) versions. After activating this function, data will be displayed as a scrolling text. Once one pass is completed you can select individual data sections using the Up/Down keys.



### 5.5.12 History memory query

The history memory can be selected via the menu HiS. Use the Up and Down keys to view the next display. If Clr is flashing, the history memory can be cleared by pressing the Enter key.



## 5.6 Commissioning

Prior to commissioning, check proper connection of the residual current monitor.

## 5.7 Factory setting



|   |  |
|---|--|
| Response value overcurrent I1<br>(prewarning)   | 15 mA (50 % of I2)                                 |
| Response value overcurrent I2 (alarm)           | 30 mA  |
| Hysteresis:                                     | 15 %   |
| Fault memory M:                                 | activated (on)                                     |
| Operating mode K1/K2                            | N/C operation (n.c.)                               |
| Starting delay:                                 | $t = 0.5 \text{ s}$                                |
| Response delay:                                 | $t_{on1} = 1 \text{ s}$<br>$t_{on2} = 0 \text{ s}$ |
| Delay on release:                               | $t_{off} = 1 \text{ s}$                            |
| Transformer correction factor $n$ ( $n_{RCM}$ ) | 1  |
| Password:                                       | 0, deactivated (Off)                               |

## 5.8 Error codes

Should, contrary to all expectations, a device error occur, error codes will appear on the display. Typical error codes are described below:

| Error code | Meaning:  |
|------------|---|
| E.01       | Fault CT connection monitoring<br><b>Appropriate action:</b> Check CT connection for short-circuit or interruption. After eliminating the fault, the error code will be automatically deleted.  |
| E.02       | Fault CT connection monitoring during manual self test.<br><b>Appropriate action:</b> Check CT connection for short-circuit or interruption. After eliminating the fault, the error code will be automatically deleted.                                   |
| E....      | Appropriate action when error codes > 02 occur:<br>Carry out a reset. Reset the device to factory setting. After eliminating the fault, the error code will be automatically deleted. If the fault continues to exist, please contact the Bender Service. |

## 6. Technical data

### 6.1 Data in tabular form

( \*) = factory setting

#### Insulation coordination acc. to IEC 60664-1/IEC 60664-3

RCM420-D-1:

|   |        |
|---|--------|
| Rated insulation voltage .....              | 100 V  |
| Overvoltage category/pollution degree ..... | III/3  |
| Rated impulse voltage .....                 | 2,5 kV |

RCM420-D-2:

|   |       |
|---|-------|
| Rated insulation voltage .....              | 250 V |
| Overvoltage category/pollution degree ..... | III/3 |
| Rated impulse voltage .....                 | 4 kV  |

#### Supply voltage

RCM420-D-1:

|                                  |                              |
|----------------------------------|------------------------------|
| Supply voltage range $U_s$ ..... | AC 24...60 V / DC 24...78 V  |
| Operating range $U_s$ .....      | AC 16...72 V / DC 9.6...94 V |
| Frequency range $f_s$ .....      | DC, 42...460 Hz              |

RCM420-D-2:

|                                  |                   |
|----------------------------------|-------------------|
| Supply voltage range $U_s$ ..... | AC/DC 100...250 V |
| Operating range $U_s$ .....      | AC/DC 70...300 V  |
| Frequency range $f_s$ .....      | 42...460 Hz       |

Protective separation (reinforced insulation) between..... (A1, A2) - (k/I, T/R) - (11, 12, 14) - (21, 22, 24)

Voltage test according to IEC 61010-1 .....

Power consumption .....

#### Measuring circuit

External measuring current transformer type..... W... , WR... , WS...

Load..... 68  $\Omega$

Rated insulation voltage (measuring current transformer) .....

Operating characteristic acc. to IEC 62020..... type A

Frequency range .....

Measuring range .....

|                             |             |
|-----------------------------|-------------|
| Relative uncertainty .....  | 0 ... -20 % |
| Operating uncertainty ..... | 0 ... 30 %  |

### Response values

|  |   |
|--|---|
| Rated residual operating current $I_{\Delta n1}$ (prewarning, AL1) ..... | 50 ... 100 % $\times I_{\Delta n2}$ , (50 %)* |
| Rated residual operating current $I_{\Delta n2}$ (Alarm, AL2) .....      | 10 mA ... 10 A (30 mA)*                       |
| Hysteresis .....   | 10 ... 25 % (15%)*                            |

### Specified time

|  |                               |
|--|-------------------------------|
| Starting delay $t$ .....   | 0 ... 10 s (0.5 s)*           |
| Response delay $t_{on2}$ (Alarm) .....                                     | 0 ... 10 s (0 s)*             |
| Response delay $t_{on1}$ (prewarning) .....                                | 0 ... 10 s (1 s)*             |
| Delay on release $t_{off}$ .....   | 0 ... 300 s (1 s)*            |
| Operating time $t_{ae}$ at $I_{\Delta n} = 1 \times I_{\Delta n1/2}$ ..... | $\leq 180$ ms                 |
| Operating time $t_{ae}$ at $I_{\Delta n} = 5 \times I_{\Delta n1/2}$ ..... | $\leq 30$ ms                  |
| Response time $t_{an}$ .....   | $t_{an} = t_{ae} + t_{on1/2}$ |
| Recovery time $t_b$ .....  | $\leq 300$ ms                 |
| Number of reload cycles .....  | 0 ... 100 (0)*                |

### Cable lengths for measuring current transformers

|   |                       |
|---|-----------------------|
| Single wire $\geq 0.75$ mm <sup>2</sup> .....   | 0 ... 1 m             |
| Single wire, twisted $\geq 0.75$ mm <sup>2</sup> .....  | 0 ... 10 m            |
| Shielded cable $\geq 0.75$ mm <sup>2</sup> .....  | 0 ... 40 m            |
| Recommended cable<br>(shielded, shield on one side connected to terminal I of the RCM420, not connected to earth) ..... | J-Y(St)Y min. 2 x 0.8 |
| Connection .....  | screw terminals       |

### Displays, memory

|   |                             |
|---|-----------------------------|
| Display range, measured value .....         | 3 mA ... 16 A               |
| Error of indication .....                   | $\pm 15$ % / $\pm 2$ digit  |
| Measured-value memory for alarm value ..... | data record measured values |
| Password .....                              | off / 0 ... 999 (OFF)*      |
| Fault memory alarm relay .....              | on / off (off)*             |

### Inputs/outputs

|   |            |
|---|------------|
| Cable length for external test / reset button ..... | 0 ... 10 m |
|---|------------|



## Switching elements

|   |   |       |       |       |       |
|---|---|-------|-------|-------|-------|
| Number of switching elements .....                            | 2 x 1 changeover contact                      |       |       |       |       |
| Operating principle .....                                     | N/C operation/ N/O operation (N/O operation)* |       |       |       |       |
| Electrical service life under rated operating conditions..... | 10 000 switching operations                   |       |       |       |       |
| Contact data acc. to IEC 60947-5-1:                           |   |       |       |       |       |
| Utilization category  | AC-13   | AC-14 | DC-12 | DC-12 | DC-12 |
| Rated operational voltage                                     | 230 V   | 230 V | 24 V  | 110 V | 220 V |
| Rated operational voltage UL                                  | 200 V   | 200 V | 24 V  | 110 V | 200 V |
| Rated operational current                                     | 5 A   | 3 A   | 1 A   | 0.2 A | 0.1 A |
| Minimum contact load .....                                    | 1 mA at AC / DC ≥ 10 V                        |       |       |       |       |

## Environment/EMC

|  |  |  |  |  |  |
|--|--|--|--|--|--|
| EMC .....  | IEC 62020                                      |  |  |  |  |
| Operating temperature .....                                | -25 °C ... +55 °C                              |  |  |  |  |
| Classification of climatic conditions IEC 60721            |  |  |  |  |  |
| Stationary use (IEC 60721-3-3) .....                       | 3K5 (except condensation and formation of ice) |  |  |  |  |
| Transportation (IEC 60721-3-2) .....                       | 2K3 (except condensation and formation of ice) |  |  |  |  |
| Storage (IEC 60721-3-1) .....                              | 1K4 (except condensation and formation of ice) |  |  |  |  |
| Classification of mechanical conditions acc. to IEC 60721: |  |  |  |  |  |
| Stationary use (IEC 60721-3-3) .....                       | 3M4  |  |  |  |  |
| Transportation (IEC 60721-3-2) .....                       | 2M2  |  |  |  |  |
| Storage (IEC 60721-3-1) .....                              | 1M3  |  |  |  |  |

## Option "W" data different from the standard version

|  |   |  |  |  |  |
|--|---|--|--|--|--|
| Classification of climatic conditions acc. to IEC 60721:   |   |  |  |  |  |
| Stationary use (IEC 60721-3-3) .....                       | 3K5 (condensation and formation of ice is possible) |  |  |  |  |
| Classification of mechanical conditions acc. to IEC 60721: |   |  |  |  |  |
| Stationary use (IEC 60721-3-3) .....                       | 3M7   |  |  |  |  |

## Connection

|  |   |  |  |  |  |
|--|---|--|--|--|--|
| For UL application .....               | use 60/70 °C copper conductors only                     |  |  |  |  |
| Connection type .....                  | <b>screw-type terminals</b>                             |  |  |  |  |
| Connection properties:                 |   |  |  |  |  |
| rigid/ flexible/ conductor sizes ..... | 0.2 ... 4 / 0.2 ... 2.5 mm <sup>2</sup> / AWG 24 ... 12 |  |  |  |  |

Multi-conductor connection (2 conductors with the same cross section):

|                                 |   |
|---------------------------------|---|
| rigid, flexible.....            | 0.2...1.5 / 0.2...1.5 mm <sup>2</sup>     |
| Stripping length .....          | 8...9 mm                                  |
| Tightening torque .....         | 0.5...0.6 Nm                              |
| Connection type .....           | <b>push-wire terminals</b>                |
| Connection properties:          |   |
| Rigid .....                     | 0.2...2.5 mm <sup>2</sup> ( AWG 24...14)  |
| Flexible without ferrules ..... | 0.75...2.5 mm <sup>2</sup> ( AWG 19...14) |
| Flexible with ferrules.....     | 0.2...1.5 mm <sup>2</sup> ( AWG 24...16)  |
| Stripping length .....          | 10 mm                                     |
| Opening force.....              | 50 N                                      |
| Test opening, diameter.....     | 2.1 mm                                    |

## Other

|  |                           |
|--|---------------------------|
| Operating mode .....                                       | continuous operation      |
| Position of normal use .....                               | any                       |
| Protection class, internal components (DIN EN 60529) ..... | IP 30                     |
| Degree of protection, terminals (DIN EN 60529) .....       | IP 20                     |
| Enclosure material .....                                   | polycarbonate             |
| Flammability class .....                                   | UL94V-0                   |
| DIN rail mounting acc. to.....                             | IEC 60715                 |
| Screw mounting.....  | 2 x M4 with mounting clip |
| Weight .....   | ≤ 150 g                   |

( )\* = factory setting

## 6.2 Standards, approvals and certifications



### 6.3 Ordering information

|  |  |  |
|--|--|--|
|  | RCM420-D-1   | RCM420-D-2                                       |
| Response range $I_{\Delta n}$                | 10 mA...10 A   | 10 mA...10 A                                     |
| Rated frequency                              | 42...2000 Hz   | 42...2000 Hz                                     |
| Measuring current transformers               | W..., WR..., WS... series                                  | W..., WR..., WS... series                        |
| Supply voltage $U_s^*$                       | DC 9.6 V...94 V /<br>AC 42...460 Hz, 16...72 V             | DC 70...300 V /<br>AC 42...460 Hz,<br>70...300 V |
| Art. No.:<br>(B 7... = push-wire terminal)   | B 7401 4001<br>B 9401 4001<br>B 7401 4001W<br>B 9401 4001W | B 7401 4002<br>B 9401 4002                       |
| <b>*Absolute values of the voltage range</b> |  |  |

### External measuring current transformers

| Type      | Inside diameter (mm) | Art. No.    |
|-----------|----------------------|-------------|
| W20       | 20                   | B 9808 0003 |
| W35       | 35                   | B 9808 0010 |
| W60       | 60                   | B 9808 0018 |
| W120      | 120                  | B 9808 0028 |
| W210      | 210                  | B 9808 0034 |
| WR70x175  | 70 x 175             | B 9808 0609 |
| WR115x305 | 115 x 305            | B 9808 0610 |
| WS50x80   | 50 x 80              | B 9808 0603 |
| WS80x120  | 80 x 120             | B 9808 0606 |

### RCM420 accessories

Mounting clip for screw fixing (1 piece per device) ..... B 9806 0008

### Measuring current transformers accessories

Snap-on mounting for DIN rail: W20.../W35... ..... B 9808 0501

Snap-on mounting for DIN rail: W60 ..... B 9808 0502



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