



# LINETRAXX® RCMS150 series

## Residual current monitor type B

with integrated measuring current transformers for earthed AC/DC systems (TN and TT systems)





**Bender GmbH & Co. KG**

Londorfer Str. 65 • 35305 Grünberg • Deutschland

PO Box 1161 • 35301 Grünberg • Deutschland

Tel.: +49 6401 807-0 • Fax: +49 6401 807-259

Email: [info@bender.de](mailto:info@bender.de) • [www.bender.de](http://www.bender.de)

© Bender GmbH & Co. KG

All rights reserved.

Reprinting only with permission of the publisher.

Subject to change!

Photos: Bender archives

# Table of Contents

<b>1. Important information .....</b>	<b>5</b>
1.1 How to use this manual .....	5
1.2 Technical support: service and support .....	6
1.2.1 First level support .....	6
1.2.2 Repair service .....	6
1.2.3 Field service .....	6
1.3 Training courses .....	7
1.4 Delivery conditions .....	7
1.5 Inspection, transport and storage .....	7
1.6 Warranty and liability .....	8
1.7 Disposal .....	8
<b>2. Safety instructions .....</b>	<b>9</b>
2.1 General safety instructions .....	9
2.2 Work activities on electrical installations .....	9
2.3 Intended use .....	10
<b>3. Product description .....</b>	<b>11</b>
3.1 Device features .....	11
3.2 Functional description .....	11
3.3 Approvals and certifications .....	12
<b>4. Mounting, connection and commissioning .....</b>	<b>13</b>
4.1 Mounting the device .....	13
4.1.1 Important information on mounting .....	13
4.1.2 Type of mounting .....	14
4.1.3 Dimension diagram (mm) .....	14
4.2 Connecting the device .....	14
4.2.1 Display and operating elements .....	15

4.3	Wiring diagram .....	16
4.4	Commissioning .....	18
<b>5.</b>	<b>Display via web server .....</b>	<b>20</b>
5.1	Example of a system design .....	20
5.2	Starting the web browser .....	20
5.3	User interface web browser .....	20
5.4	Web application: Menu overviews .....	21
<b>6.</b>	<b>Overview Modbus registers (RCMS150-01 only) .....</b>	<b>24</b>
6.1	General overview .....	24
6.1.1	Read and write permissions .....	24
6.1.2	Used formats .....	24
6.1.3	Overview of the register ranges .....	25
6.2	Device information .....	25
6.3	Measured values .....	27
6.4	Interface parameters .....	32
6.5	Parameters .....	33
6.6	Control commands .....	38
<b>7.</b>	<b>Glossary .....</b>	<b>40</b>
<b>8.</b>	<b>Technical data .....</b>	<b>43</b>
8.1	Tabular data .....	43
8.2	Factory settings of the Modbus interface .....	46
8.3	Standards, approvals, certifications .....	46
8.4	Ordering information .....	46
8.5	Document revision history .....	47
<b>INDEX</b>	<b>.....</b>	<b>49</b>

# 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 will 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 Straße 65,  
35305 Grünberg

### 1.2.3 Field service

On-site service for all Bender products

- Commissioning, configuring, maintenance, troubleshooting for 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](http://www.bender.de)

\*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](http://www.bender.de) > **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](http://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 RCMS150... devices are suitable for measuring residual currents up to  $I_{\Delta} = 500$  mA in a frequency range of DC...2 kHz. The monitored circuit is rated for a voltage of 300 V and a load current of 32 A. If cables with double or reinforced insulation are routed through the measuring current transformers, higher voltages may occur. The device can be operated at an altitude of up to 2000 m above mean sea level.

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.

## 3. Product description

### 3.1 Device features

- Continuous residual current monitoring by means of periodic verification
- AC/DC sensitive residual current monitoring system type B with 6 channels K1...6 (each channel features 2 measuring channels: 1 x RMS, 1 x DC)
- Ideal for applications with space limitations
- Easy DIN rail or screw mounting to standard distribution panels
- 2 separately adjustable response values (DC or RMS) per channel
- Continuous self monitoring
- Fully shielded measuring current transformers to avoid external influences due to magnetic fields that may cause disturbances
- Compatible with Bender gateways of type COM465IP or CP9...
- **RCMS150** (RS-485 interface with BMS protocol)
  - Compatible with RCMS460/490 in a system setup
  - Address range 2...90, can be adjusted directly on the device
  - Up to 89 RCMS150 can be used on the bus
- **RCMS150-01** (RS-485 interface with Modbus RTU protocol)
  - Compatible with other Modbus RTU-capable device series from Bender, such as the RCMB300 series and RCMB13...-01 in a system setup
  - Address range 1...99, can be adjusted directly on the device via detent potentiometers
  - Address range 1...247, can be adjusted via the bus
  - Up to 247 RCMS150-01 can be used on the bus

### 3.2 Functional description

The residual currents are recorded and evaluated as RMS values in the frequency range DC...2 kHz. The response values can be set via the interface.

The user can set four response values per channel K1...6:

$$I_{\Delta n1 \text{ RMS}}, I_{\Delta n2 \text{ RMS}}, I_{\Delta n1 \text{ DC}}, I_{\Delta n2 \text{ DC}}$$



*The response values  $I_{\Delta n1...}$  apply to the **prewarnings**, the response values  $I_{\Delta n2...}$  apply to the **main alarms**.*

If one of the four set response values  $I_{\Delta N...}$  is exceeded, the assigned response delay  $t_{on...}$  starts. If the response value continues to be exceeded, the corresponding alarm message (prewarning or main alarm) is indicated on the gateway after the response delay  $t_{on...}$  has elapsed.

In the event of a main alarm, the alarm LED of the respective channel K1...6 lights up yellow.

A pending alarm message is emitted via the BMS or Modbus interface with address and measuring channel indication and can be evaluated by means of a gateway.

If the recorded residual current falls below the release value (response value minus hysteresis) the delay on release  $t_{off}$  begins. If the value remains below the release value after  $t_{off}$  has elapsed, the LED of the respective channel goes out. The alarm message is reset on the interface.

If the fault memory is enabled (only applicable to RCMS150-01), the alarm message remains on the bus despite the LED going out.

All devices can be accessed via the network from any PC using a standard web browser. Like this, all relevant measurement data of the monitored system are available. All device-related parameters of the RCMS150... can be set via the gateway technology.

To ensure the device function, a continuous automatic self test is run, which monitors the function of all measuring current transformers. In the event of a device error, the alarm LED of the respective channel flashes and an error message is output via the interface.

During the manual self test, a residual current is induced in the respective current transformer at each individual channel K1...6 one after the other via test windings and it is checked whether the corresponding main alarm is triggered. The duration of the test depends on the response delays of the main alarms.

### 3.3 Approvals and certifications

- **UL508**
- **CSA**
- **LR** in preparation

## 4. Mounting, connection and commissioning



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



### **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 you are familiar with the configuration of computer networks, you can connect the RCMS150... yourself.  
Otherwise please contact your EDP administrator!

### 4.1 Mounting the device

#### 4.1.1 Important information on mounting

- Mounting is to be carried out with suitable equipment and tools according to the documentation.
- The device must only be installed by appropriately qualified personnel in de-energised state. Disconnect the switchboard cabinet from the power supply and protect the system against accidental switch-on.
- The general safety conditions as well as the prevailing national accident prevention regulations are to be adhered to. Electrical installation is to be carried out according to all applicable local laws (e.g. wire cross section, protection, PE connection).
- The climatic conditions must be complied with. The device is only permitted to be used in closed rooms.

### 4.1.2 Type of mounting

The devices of the RCMS150 series are intended for screw mounting.

As an alternative, they can also be mounted on a DIN rail using the optionally available fastening set.

### 4.1.3 Dimension diagram (mm)

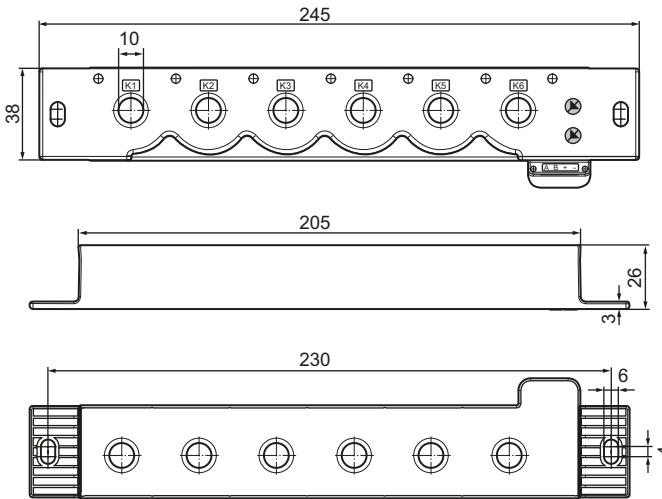


Fig. 4.1: Dimension diagram RCMS150

## 4.2 Connecting the device



### **Risk of electric shock!**

Follow the basic safety rules when working with electricity. Observe the information on **rated voltage and supply voltage** specified in the technical data!

### 4.2.1 Display and operating elements

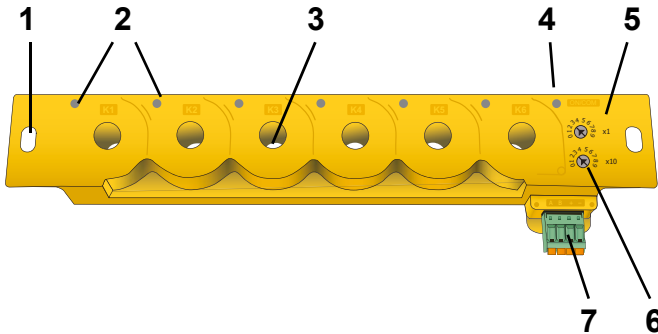


Fig. 4.2: Display and operating elements

Display and operating elements legend	
1	Slot for screw mounting
2	Alarm LEDs for channels K1...6 (yellow)
3	Line feed-through of the measuring current transformers for the channels K1...6
4	ON LED: Power on LED (green)
5	Detent potentiometer: Setting the <b>unit place</b> of the bus address (BMS bus or Modbus RTU)
6	Detent potentiometer: Setting the <b>tens place</b> of the bus address (BMS bus or Modbus RTU)
7	Plug: Connection to the supply voltage Connection RS-485 (BMS bus or Modbus RTU)



#### **RCMS150-01**

*If both detent potentiometers are set to 0, the device uses the address parameterised via Modbus (1...247).*

## Meaning of the LEDs

	LED	Meaning
ON (green)	lights	Normal operation indicator
	flashes quickly	RCMS150: Device error or BMS bus address set incorrectly
	flashes slowly	RCMS150-01: Device error
	flashes very quickly	RCMS150-01: Identify device (via Modbus RTU)
	Flash code	Interface address output (see page 19)
ALARM K1...K6 (yellow)	lights	Main alarm (response value $I_{\Delta n}$ exceeded)
	flashes	Device error channel

Tab. 4.1: Description of the LEDs

## 4.3 Wiring diagram



CAUTION

### **Risk of short circuit!**

Only insulated conductors with an insulation that is suitable for at least the monitored voltage may be routed through the measuring current transformer.

The rated voltage of the RCMS150... must not be exceeded.



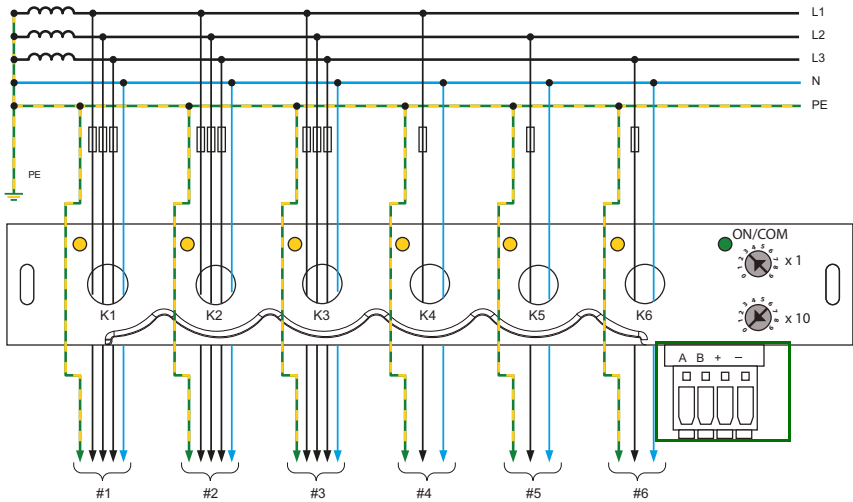


Fig. 4.3: Wiring diagram RCMS150...

Detail: terminal		
1	RS-485 interface (BMS bus or Modbus RTU)	
2	Supply voltage $U_5$ DC 24 V	
3	Terminating resistor 120 $\Omega$ (required for both the first and the last bus device)	

Fig. 4.4: Detail: terminal

## 4.4 Commissioning

1. **Mount the RCMS150...**
2. **Set the bus address**



*When assigning the bus addresses make sure that each address is only assigned once on the bus!*

<b>Address setting RCMS150 (BMS bus)</b>	
Factory setting bus address	2
Setting range BMS bus	2...90
Adjustment on the device	Move the detent potentiometers to the corresponding position using a screwdriver.
<b>Address setting RCMS150-01 (Modbus RTU)</b>	
Factory setting bus address (Detent potentiometers to 00)	Last two digits of the serial number + 100
Setting range Modbus RTU	1...247
Addresses 1...99: Adjustment on the device	Move the detent potentiometers to the corresponding position using a screwdriver.
Addresses 1...247: Adjustment via the bus	Set the detent potentiometers to 00 using a screwdriver. Now the internally stored address (factory setting) is active. It can be changed via the interface.

### 3. Bus installation

Please note that both the beginning and end of the bus require a 120-Ω terminating resistor.

#### 4. Route outgoing circuits to be monitored through the current transformers



##### **Risk of short circuit!**

*Only insulated conductors with an insulation that is suitable for at least the monitored voltage may be routed through the measuring current transformer. The rated voltage of the RCMS150... must not be exceeded.*



*Do not route any protective earth conductors through the measuring current transformers (see wiring diagram)!*

#### 5. Connect the RCMS150... to the supply voltage (DC 24 V)

##### *RCMS150 (BMS bus)*

The ON LED flashes to indicate the set BMS bus address after the device has been switched on or after the address has been changed:

Unit place - Pause - Tens place.

Example: \*\*\*\*\* \*\*\* designates the BMS bus address 35.

After indicating the address, the RCMS150 automatically switches to the standard display state. If the ON LED flashes quickly, the BMS bus address has been set incorrectly.

##### *RCMS150-01 (Modbus RTU)*

The set Modbus address is only indicated by the ON LED flashing after an address change via the detent potentiometers on the device:

Hundreds place – Pause – Tens place – Pause – Unit place.

Example: \* \*\*\*\*\* \*\*\* designates the Modbus address 153.

After indicating the address, the RCMS150-01 automatically switches to the standard display state.

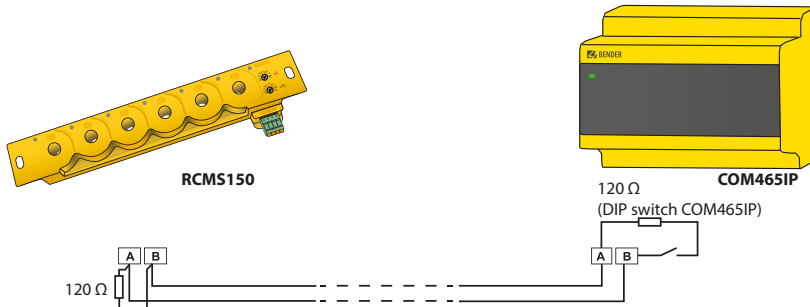
The ON LED does not indicate address changes via the bus.

#### 6. Connect RCMS150... to master (e.g. COM465IP, software version $\geq$ 2.1, option C or CP9...).

## 5. Display via web server


The measured values (measuring channels) of the individual measuring current transformers of the RCMS150... can be displayed in the web browser.

### 5.1 Example of a system design



### 5.2 Starting the web browser

After commissioning the RCMS150..., start the web browser. Enter the IP address of the gateway (CP9... or COM465IP).

- |            |   |
|------------|---|
| BMS bus    | You can find the RCMS150 in the bus overview.   |
| Modbus RTU | You can add the RCMS150-01 to your system in the browser:<br> <b>Tools &gt; Device management &gt; Modbus devices &gt; Manage devices &gt; Add device &gt; Search and configure devices</b> |

### 5.3 User interface web browser

Basic operation: see manual of the gateway (CP9... or COM465IP).

## 5.4 Web application: Menu overviews

Menu overview RCMS150 (BMS bus)				Description
Overview				Current measured values and alarm states of the 12 measuring channels (1...6: RMS; 7...12: DC)
Configure e-mail				Generate e-mails to report device failure. Set recipients via the gateway for each channel. Details: refer to gateway manual
Report				Create a report of all active devices
Menu	Settings	Edit texts	Device	Screen and printout: Specify alarm text for device and device failure
			Channel 1 - 12	Screen and printout: Specify alarm text for measuring channel 1...12 for prewarning and main alarm
		Channel	General	Channel K1...6: Hysteresis, $t_{off}$ , $t_{start-up}$
			RMS	Channel K1...6: $t_{on1/2 RMS}$ , $I_{\Delta n1/2 RMS}$ (measuring channels 1...6)
			DC	Channel K1...6: $t_{on1/2 DC}$ , $I_{\Delta n1/2 DC}$ (measuring channels 7...12)
		Factory settings		Reset to factory settings; texts are not affected by this action.
	Control	TEST	Run device test	
	Info		Device, software and manufacturer information	

Tab. 5.1: Web application: Menu overview RCMS150



When setting the response values  $I_{\Delta n2}$ , the ratio of  $I_{\Delta n2RMS}$  to  $I_{\Delta n2DC}$  must only be between 0.2 and 5.

Menu overview RCMS150-01 (Modbus RTU)			Description	
Overview of the 12 measuring channels			Current measured values/alarm states, software	
Alarms/ measured values	Graphical representation K1...6, each $I_{\Delta RMS}$ and $I_{\Delta DC}$			
Settings	Edit texts	Device	Alarm text device/device failure	
		Measuring channel 1...12	Description	Alarm texts of the measuring channels in the event of a prewarning/main alarm
			Main alarm	
	Alarm settings	Channel K1...6	General	Hysteresis, $t_{off}$ , $t_{start-up}$ , fault memory
			RMS	$t_{on1/2 RMS}$ , $I_{\Delta n1/2 RMS}$ (measuring channel 1...6)
			DC	$t_{on1/2 DC}$ , $I_{\Delta n1/2 DC}$ (measuring channel 7...12)
System	Interface	Device address	The address set here is only used if both detent potentiometers are set to 0.	
		Baud rate		
		Parity/Stop bits		
		Identify devices	LED flashes green very quickly	
	Clock	Clock		
		UTC offset		
		Summer time		
	Factory settings	Write access	This box must be ticked for security reasons.	
		Channel 1...6	Reset to factory settings; texts are not affected by this action.	
		Without interface		
With interface				

Menu overview RCMS150-01 (Modbus RTU)			Description	
Control	Test	Channel 1...6	Run response test. A current is induced in the measuring current transformers via a test winding.	
	Reset	Channel 1...6	Clear fault memory	
	Communication test	Measuring channel 1...12	A test alarm is set at the selected measuring channel on the interface.	
	Offset calibration	Write access		This box must be ticked for security reasons.
		Channel 1...6		Perform offset calibration
Info			Device name, article number, serial number, installation location, operating time, manufacturer	

Tab. 5.2: Web application: Menu overview RCMS150-01



When setting the response values  $I_{\Delta n2}$ , the ratio of  $I_{\Delta n2RMS}$  to  $I_{\Delta n2DC}$  must only be between 0.2 and 5.

## 6. Overview Modbus registers (RCMS150-01 only)

This chapter provides a complete description of the Modbus registers to facilitate access to information.

RCMS150-01 supports the following Modbus functions:

1. Register for reading values  
(Read Holding Register; function code 0x03)
2. Register for writing values  
(Write Multiple Registers; function code 0x10)

The device exchanges the data in big-endian order. The counting method of the registers is 0-based. To check these properties, the UINT32 register 0 can be read and compared with the target value 0x12345678.

For a complete Modbus protocol specification, visit

<https://www.modbus.org>.

### 6.1 General overview

#### 6.1.1 Read and write permissions

RO	Read Only (read permission only)
RW	Read/Write (read and write permission)
WO	Write Only (write permission only)

#### 6.1.2 Used formats

Float32	IEEE754 32 Bit (single precision floating point number)
INT16	Signed 16-bit Integer
INT32	Signed 32-bit Integer
UINT16	Unsigned 16-bit Integer
UINT32	Unsigned 32-bit Integer
String-UTF8	ASCII string - String terminated with null character \0 - 16-bit Word: one character in HiByte, one character in LoByte



### 6.1.3 Overview of the register ranges

Range	Start address	End address
Info	0	999
Measured values	1000	31999
Interface parameters	32000	32099
Parameters	32100	57999
Control commands	59000	59999

## 6.2 Device information

Register	Property	Description	Format	Comment/Factory settings*
00000	RO	Modbus test register	UINT32	0x12345678* Is used to configure the interface (endianess, byte order, etc.).
00002	RO	Device name	String UTF8	RCMS150-01\0*
00018	RO	Article number	String UTF8	B94053026\0*
00034	RO	Serial number	String UTF8	—
00050	RO	Manufacturer name	String UTF8	Bender\0*
00066	RO	Manufacturer Internet address	String UTF8	www.bender.de\0*
00082	RO	Device version	UINT16	Version number multiplied by 100. Example: 123 = V1.23
00083	RO	Device patch version	UINT16	—
00084	RO	IU application D number	UINT16	657*
00085	RO	IU application Version	UINT16	—
00086	RO	IU application Build number	UINT16	—
00087	RO	IU application Modbus module version	UINT16	—
00088	RO	IU Bootloader D number	UINT16	711*
00089	RO	IU Bootloader Version	UINT16	—
00090	RO	IU Bootloader Build number	INT16	—

Register	Property	Description	Format	Comment/Factory settings*
00091	RO	MU1 Application D number	UINT16	489*
00092	RO	MU1 Application Version	UINT16	—
00093	RO	MU1 Application Build number	INT16	0
00094	RO	MU1 Bootloader D number	UINT16	0
00095	RO	MU1 Bootloader Version	UINT16	0
00096	RO	MU1 Bootloader Build number	INT16	0
00097...00126		Reserved		
00127	RW	Installation location <sup>1)</sup>	String UTF8	<location>\0*
00143...00999		Reserved		

*Tab. 6.1: Modbus registers: Device information*

*Notes Tab. 6.1*

- 1) When writing this parameter, it must be ensured that the entire character string is structured in 8-character blocks and that one block must always be written completely with one Modbus command. This means that the characters 1...8, 9...16, 17...24 and/or 25...32 must be written in each case. If the string does not fill a block completely, it must be filled with NULL characters.

### 6.3 Measured values

Register	Property	Description	Format	Comment/unit
01000	RO	Residual current measured value (K1 RMS)	Float32	Current instantaneous value. For status, refer to Tab. 6.3
01002	RO	Residual current measured value (K1 DC)	Float32	
01004	RO	Status K1	UINT32	
01006	RO	Residual current measured value (K2 RMS)	Float32	
01008	RO	Residual current measured value (K2 DC)	Float32	
01010	RO	Status K2	UINT32	
01012	RO	Residual current measured value (K3 RMS)	Float32	
01014	RO	Residual current measured value (K3 DC)	Float32	
01016	RO	Status K3	UINT32	
01018	RO	Residual current measured value (K4 RMS)	Float32	
01020	RO	Residual current measured value (K4 DC)	Float32	
01022	RO	Status K4	UINT32	
01024	RO	Residual current measured value (K5 RMS)	Float32	
01026	RO	Residual current measured value (K5 DC)	Float32	
01028	RO	Status K5	UINT32	
01030	RO	Residual current measured value (K6 RMS)	Float32	
01032	RO	Residual current measured value (K6 DC)	Float32	
01034	RO	Status K6	UINT32	
01036	RO	Device error and status information	Float32	If device errors are present, the error code is output here with a factor of 100, see Tab. 6.4. If there are several errors, the error with the highest error number is output. Example: 800 = 8.00 (hardware error)

Register	Property	Description	Format	Comment/unit
01038	RO	Residual current measured value min (K1 RMS)	Float32	Indicates the smallest value since the last readout. In the case of signed measured values, the lowest value is stored temporarily.
01040	RO	Residual current measured value min (K1 DC)	Float32	
01042	RO	Status K1 min	UINT32	
01044	RO	Residual current measured value min (K2 RMS)	Float32	
01046	RO	Residual current measured value min (K2 DC)	Float32	
01048	RO	Status K2 min	UINT32	
01050	RO	Residual current measured value min (K3 RMS)	Float32	
01052	RO	Residual current measured value min (K3 DC)	Float32	
01054	RO	Status K3 min	UINT32	
01056	RO	Residual current measured value min (K4 RMS)	Float32	
01058	RO	Residual current measured value min (K4 DC)	Float32	
01060	RO	Status K4 min	UINT32	
01062	RO	Residual current measured value min (K5 RMS)	Float32	
01064	RO	Residual current measured value min (K5 DC)	Float32	
01066	RO	Status K5 min	UINT32	
01068	RO	Residual current measured value min (K6 RMS)	Float32	
01070	RO	Residual current measured value min (K6 DC)	Float32	
01072	RO	Status K6 min	UINT32	
01074	RO	Device error and status information min	Float32	

Register	Property	Description	Format	Comment/unit
01076	RO	Residual current measured value average (K1 RMS)	Float32	Indicates the arithmetic average value since the last read-out.
01078	RO	Residual current measured value average (K1 DC)	Float32	
01080	Reserved			
01082	RO	Residual current measured value average (K2 RMS)	Float32	
01084	RO	Residual current measured value average (K2 DC)	Float32	
01086	Reserved			
01088	RO	Residual current measured value average (K3 RMS)	Float32	
01090	RO	Residual current measured value average (K3 DC)	Float32	
01092	Reserved			
01094	RO	Residual current measured value average (K4 RMS)	Float32	
01096	RO	Residual current measured value average (K4 DC)	Float32	
01098	Reserved			
01100	RO	Residual current measured value average (K5 RMS)	Float32	
01102	RO	Residual current measured value average (K5 DC)	Float32	
01104	Reserved			
01106	RO	Residual current measured value average (K6 RMS)	Float32	
01108	RO	Residual current measured value average (K6 DC)	Float32	
01110	Reserved			
01112				

Register	Property	Description	Format	Comment/unit
01114	RO	Residual current measured value max (K1 RMS)	Float32	Indicates the highest value since the last readout. In the case of signed measured values, the highest value is stored temporarily.
01116	RO	Residual current measured value max (K1 DC)	Float32	
01118	RO	Status K1 max	UINT32	
01120	RO	Residual current measured value max (K2 RMS)	Float32	
01122	RO	Residual current measured value max (K2 DC)	Float32	
01124	RO	Status K2 max	UINT32	
01126	RO	Residual current measured value max (K3 RMS)	Float32	
01128	RO	Residual current measured value max (K3 DC)	Float32	
01130	RO	Status K3 max	UINT32	
01132	RO	Residual current measured value max (K4 RMS)	Float32	
01134	RO	Residual current measured value max (K4 DC)	Float32	
01136	RO	Status K4 max	UINT32	
01138	RO	Residual current measured value max (K5 RMS)	Float32	
01140	RO	Residual current measured value max (K5 DC)	Float32	
01142	RO	Status K5 max	UINT32	
01144	RO	Residual current measured value max (K6 RMS)	Float32	
01146	RO	Residual current measured value max (K6 DC)	Float32	
01148	RO	Status K6 max	UINT32	
01150	RO	Device error and status information max	Float32	
01152...31999		Reserved		

*Tab. 6.2: Modbus registers: Measured values*

## Status K1...6

Bit number	Description
0	DC prewarning
1	DC main alarm
2	RMS prewarning
3	RMS main alarm
4	Manual self test
5	Device error
6...31	Reserved

Tab. 6.3: Status K1...6

## Error codes

Register 01036

Error code	Error	Description	Action
3.40	Channel error	Possible error cause: Temperature too high.	Check if ambient temperature is within the permissible range. Check if supply voltage DC 24 V is within the permissible range. Check if the residual current through the channel is too high or if there are high pulses. If the above points do not apply and the error occurs frequently, return the device.
6.00	Calibration error	Calibration data faulty.	Switch the device off and on again. If the error persists, return the device.
6.50	Production data faulty	Values outside the limits or checksum incorrect.	Error is only cleared by switching the device off/on. If the error persists, return the device.
7.10	Internal communication error	Device-internal communication is disturbed.	Switch the device off and on again. If the error persists, return the device.
7.62			
8.46	Internal supply voltage	Impermissible deviation	If the error occurs frequently, return the device.

Error code	Error	Description	Action
9.10	µC parameter error	Parameters outside permissible limits or error while saving. Affected channel: Gateway > Overview measuring channels or Modbus registers 1004...1034 (5 = device error)	Switch the device off and on again. Reset the corresponding channel to factory settings: via the gateway or Modbus registers 59013...59018. If the error persists, return the device.
9.60	µC parameter error	Parameter outside permissible limits	Switch the device off and on again. Reset device to factory settings: Modbus register 59020. If the error persists, return the device.
9.70	µC task/ programme sequence	General software error	Switch the device off and on again. If the error persists, return the device.
9.90	Error µC cycle generation	Unacceptable deviation or failure of the µC cycle source.	

Tab. 6.4: Error codes

## 6.4 Interface parameters

Register	Property	Description	Format	Unit	Setting range	Factory setting
32000	RW	Modbus address*	UINT16	—	1...247	The last two digits of the serial number + 100
32001	RW	Modbus baud rate	UINT32	Baud	1200 / 2400 / 4800 / 9600 / 19200 / 38400 / 57600	19200
32003	RW	Modbus parity/ stop bit	UINT16	—	0 = 8N2 1 = 8O1 2 = 8E1 3 = 8N1 4 = 8O2 5 = 8E2	2 (8E1)
32004...32099		Reserved				

Tab. 6.5: Interface parameters

\* The address is only used if both detent potentiometers are set to 0.



## 6.5 Parameters

Register	Property	Description	Format	Unit	Setting range	Step size	Factory setting
32100	Reserved						
32102	RW	Response value Hysteresis	Float32	%	10...25 %	0.1 %	15 %
32104	RW	$t_{off}$	Float32	s	0 s ... 10 min	10 ms	1 s
32106	RW	$t_{start-up}$	Float32	s	0.5 s ... 10 min	10 ms	0.5 s
32108	RW	Fault memory	UINT16	—	0 = off; 1 = on	—	0 (off)
32109	Reserved						
32110	RW	$I_{\Delta n2}$ RMS	Float32	A	3...300 mA	0.1 mA	30 mA
32112	RW	$t_{on}$ main alarm RMS	Float32	s	0 s ... 10 min	10 ms	0 s
32114	RW	$I_{\Delta n1}$ RMS	Float32	%	50...100 %	0.1 %	50 %
32116	RW	$t_{on}$ prewarning RMS	Float32	s	0 s ... 10 min	10 ms	1 s
32118	RW	$I_{\Delta n2}$ DC	Float32	A	3...300 mA	0.1 mA	6 mA
32120	RW	$t_{on}$ main alarm DC	Float32	s	0 s ... 10 min	10 ms	0 s
32122	RW	$I_{\Delta n1}$ DC	Float32	%	50...100 %	0.1 %	50 %
32124	RW	$t_{on}$ prewarning DC	Float32	s	0 s ... 10 min	10 ms	1 s
32126	Reserved						

Register	Property	Description	Format	Unit	Setting range	Step size	Factory setting
32128	RW	Response value hysteresis	Float32	%	10...25 %	0.1 %	15 %
32130	RW	$t_{\text{off}}$	Float32	s	0 s...10 min	10 ms	1 s
32132	RW	$t_{\text{start-up}}$	Float32	s	0.5 s...10 min	10 ms	0.5 s
32134	RW	Fault memory	UINT16	—	0 = off; 1 = on	—	0 (off)
32135		Reserved					
32136	RW	$I_{\Delta n2}$ RMS	Float32	A	3...300 mA	0.1 mA	30 mA
32138	RW	$t_{\text{on}}$ main alarm RMS	Float32	s	0 s...10 min	10 ms	0 s
32140	RW	$I_{\Delta n1}$ RMS	Float32	%	50...100 %	0.1 %	50 %
32142	RW	$t_{\text{on}}$ prewarning RMS	Float32	s	0 s...10 min	10 ms	1 s
32144	RW	$I_{\Delta n2}$ DC	Float32	A	3...300 mA	0.1 mA	6 mA
32146	RW	$t_{\text{on}}$ main alarm DC	Float32	s	0 s...10 min	10 ms	0 s
32148	RW	$I_{\Delta n1}$ DC	Float32	%	50...100 %	0.1 %	50 %
32150	RW	$t_{\text{on}}$ prewarning DC	Float32	s	0 s...10 min	10 ms	1 s
32152		Reserved					
32154	RW	Response value hysteresis	Float32	%	10...25 %	0.1 %	15 %
32156	RW	$t_{\text{off}}$	Float32	s	0 s...10 min	10 ms	1 s
32158	RW	$t_{\text{start-up}}$	Float32	s	0.5 s...10 min	10 ms	0.5 s
32321	RW	Fault memory	UINT16	—	0 = off; 1 = on	—	0 (off)
32161		Reserved					
32162	RW	$I_{\Delta n2}$ RMS	Float32	A	3...300 mA	0.1 mA	30 mA
32164	RW	$t_{\text{on}}$ main alarm RMS	Float32	s	0 s...10 min	10 ms	0 s
32166	RW	$I_{\Delta n1}$ RMS	Float32	%	50...100 %	0.1 %	50 %
32168	RW	$t_{\text{on}}$ prewarning RMS	Float32	s	0 s...10 min	10 ms	1 s
32170	RW	$I_{\Delta n2}$ DC	Float32	A	3...300 mA	0.1 mA	6 mA
32172	RW	$t_{\text{on}}$ main alarm DC	Float32	s	0 s...10 min	10 ms	0 s
32174	RW	$I_{\Delta n1}$ DC	Float32	%	50...100 %	0.1 %	50 %
32176	RW	$t_{\text{on}}$ prewarning DC	Float32	s	0 s...10 min	10 ms	1 s

Register	Property	Description	Format	Unit	Setting range	Step size	Factory setting
32178	Reserved						
32180	RW	Response value hysteresis	Float32	%	10...25 %	0.1 %	15 %
32182	RW	$t_{off}$	Float32	s	0 s...10 min	10 ms	1 s
32184	RW	$t_{start-up}$	Float32	s	0.5 s...10 min	10 ms	0.5 s
32186	RW	Fault memory	UINT16	—	0 = off; 1 = on	—	0 (off)
32187	Reserved						
32188	RW	$I_{\Delta n2 RMS}$	Float32	A	3...300 mA	0.1 mA	30 mA
32190	RW	$t_{on main alarm RMS}$	Float32	s	0 s...10 min	10 ms	0 s
32192	RW	$I_{\Delta n1 RMS}$	Float32	%	50...100 %	0.1 %	50 %
32194	RW	$t_{on prewarning RMS}$	Float32	s	0 s...10 min	10 ms	1 s
32196	RW	$I_{\Delta n2 DC}$	Float32	A	3...300 mA	0.1 mA	6 mA
32198	RW	$t_{on main alarm DC}$	Float32	s	0 s...10 min	10 ms	0 s
32200	RW	$I_{\Delta n1 DC}$	Float32	%	50...100 %	0.1 %	50 %
32202	RW	$t_{on prewarning DC}$	Float32	s	0 s...10 min	10 ms	1 s
32204	Reserved						

Register	Property	Description	Format	Unit	Setting range	Step size	Factory setting
32206	RW	Response value hysteresis	Float32	%	10...25 %	0.1 %	15 %
32208	RW	$t_{\text{off}}$	Float32	s	0 s...10 min	10 ms	1 s
32210	RW	$t_{\text{start-up}}$	Float32	s	0.5 s...10 min	10 ms	0.5 s
32212	RW	Fault memory	UINT16	—	0 = off; 1 = on	—	0 (off)
32213		Reserved					
32214	RW	$I_{\Delta n2}$ RMS	Float32	A	3...300 mA	0.1 mA	30 mA
32216	RW	$t_{\text{on}}$ main alarm RMS	Float32	s	0 s...10 min	10 ms	0 s
32218	RW	$I_{\Delta n1}$ RMS	Float32	%	50...100 %	0.1 %	50 %
32220	RW	$t_{\text{on}}$ prewarning RMS	Float32	s	0 s...10 min	10 ms	1 s
32222	RW	$I_{\Delta n2}$ DC	Float32	A	3...300 mA	0.1 mA	6 mA
32224	RW	$t_{\text{on}}$ main alarm DC	Float32	s	0 s...10 min	10 ms	0 s
32226	RW	$I_{\Delta n1}$ DC	Float32	%	50...100 %	0.1 %	50 %
32228	RW	$t_{\text{on}}$ prewarning DC	Float32	s	0 s...10 min	10 ms	1 s
32230		Reserved					
32232	RW	Response value hysteresis	Float32	%	10...25 %	0.1 %	15 %
32234	RW	$t_{\text{off}}$	Float32	s	0 s...10 min	10 ms	1 s
32236	RW	$t_{\text{start-up}}$	Float32	s	0.5 s...10 min	10 ms	0.5 s
32238	RW	Fault memory	UINT16	—	0 = off; 1 = on	—	0 (off)
32239		Reserved					
32240	RW	$I_{\Delta n2}$ RMS	Float32	A	3...300 mA	0.1 mA	30 mA
32242	RW	$t_{\text{on}}$ main alarm RMS	Float32	s	0 s...10 min	10 ms	0 s
32244	RW	$I_{\Delta n1}$ RMS	Float32	%	50...100 %	0.1 %	50 %
32246	RW	$t_{\text{on}}$ prewarning RMS	Float32	s	0 s...10 min	10 ms	1 s
32248	RW	$I_{\Delta n2}$ DC	Float32	A	3...300 mA	0.1 mA	6 mA
32250	RW	$t_{\text{on}}$ main alarm DC	Float32	s	0 s...10 min	10 ms	0 s
32252	RW	$I_{\Delta n1}$ DC	Float32	%	50...100 %	0.1 %	50 %
32254	RW	$t_{\text{on}}$ prewarning DC	Float32	s	0 s...10 min	10 ms	1 s

Register	Property	Description	Format	Unit	Setting range	Step size	Factory setting
32256	RW	Copy parameters	UINT32	—	1)		0
32258	RW	Time <sup>2) 3)</sup>	UINT32	Unix time	0... 0xFFFFFFFF	1	0
32260	RW	Time zone <sup>2) 4)</sup>	Float32	h	-12 ... +14	0.25	0
32262	RW	Summer time <sup>2) 5)</sup>	UINT16	—	0 = off 1 = on 2 = CEST 3 = DST	—	0 (off)
32263...57999	Reserved						

Tab. 6.6: Modbus registers: Parameters

Notes Tab. 6.6

- 1) Used to copy the parameters of one channel to other channels. Source channel and target channels are binary coded. In the low word, the source is indicated and in the high word, the targets are indicated. The source channel may also be set for the target channels (it is automatically omitted during the copying process). Bit 0 is reserved (must not be set), bit 1 corresponds to channel 1, bit 2 corresponds to channel 2, etc.

Timeout:

Up to 200 ms are required per selected target channel. If all 5 channels are selected as target, the process can take up to one second.

- 3) Unix time: Second count since 01.01.1970, 00:00 h
- 2) Lost when the device is switched off.
- 4) Offset of the time zone
- 5) CEST = automatic switching: Central Europe  
DST = automatic switching: USA, CDN



*Wait for at least 10 s before changing the response values. If the measured values do not normalise afterwards, a device restart/reset (or similar) must be carried out.*



*When setting the response values  $I_{\Delta n2}$ , the ratio of  $I_{\Delta n2RMS}$  to  $I_{\Delta n2DC}$  must only be between 0.2 and 5.*

## 6.6 Control commands

Register	Property	Description		Format	Setting range	Factory setting	Comment
59000	RW	Allow register write access		UINT16	0 = Deny 1 = Allow	0	1)
59001	RW	K1	Test	UINT16	<b>Read</b> 0 = No test performed yet 1 = Test running 2 = Test successful 3 = Test failed <b>Write</b> 1 = Start test	0	2)
59002	RW	K2		UINT16			
59003	RW	K3		UINT16			
59004	RW	K4		UINT16			
59005	RW	K5		UINT16			
59006	RW	K6		UINT16			
59007	WO	K1	Fault memory reset	UINT16	1 = Perform reset	—	3)
59008	WO	K2		UINT16		—	
59009	WO	K3		UINT16		—	
59010	WO	K4		UINT16		—	
59011	WO	K5		UINT16		—	
59012	WO	K6		UINT16		—	
59013	WO	K1	Load factory settings	UINT16	1 = Apply factory settings	—	4)
59014	WO	K2		UINT16		—	
59015	WO	K3		UINT16		—	
59016	WO	K4		UINT16		—	
59017	WO	K5		UINT16		—	
59018	WO	K6		UINT16		—	
59019	WO	Load channel-independent factory settings (without interface)		UINT16	1 = Apply factory settings	—	5)
59020	WO	Load channel-independent factory settings (with interface)		UINT16	1 = Apply factory settings	—	6)
59021	RW	Device signalling		UINT16	0 = off 1 = on	0	7)
59022	RW	Test alarm		UINT16	0...12	0	8)

Register	Property	Description		Format	Setting range	Factory setting	Comment
59023	WO	K1	Offset measurement	UINT16	1 = Perform offset measurement	—	9)
59024	WO	K2		UINT16		—	
59025	WO	K3		UINT16		—	
59026	WO	K4		UINT16		—	
59027	WO	K5		UINT16		—	
59028	WO	K6		UINT16		—	
59029...59999		Reserved					

Tab. 6.7: Modbus registers: Control commands

Notes Tab. 6.7

- 1) Flag to allow modification of important registers. Is automatically deactivated after five seconds.
- 2) Manual test on corresponding channel. The duration of the test depends on the set response times.
- 3) Reset the fault memory on the corresponding channel.
- 4) Loads all factory settings of the corresponding channel (e.g. parameters of channel 1: registers 32100 to 32124). Secured via register 59000.
- 5) Loads the following channel-independent factory settings without interface parameters:
  - Register 1269: Installation location
  - Register 16162: Time
  - Register 16164: Time zone
  - Register 16166: Summer time
  - Secured via register 59000.
- 6) Loads the following channel-independent factory settings with interface parameters (secured via register 59000)
  - Register 1269: Installation location
  - Register 16158: Modbus address
  - Register 16159: Modbus baud rate
  - Register 16161: Modbus parity/stop bit
  - Register 16162: Time
  - Register 16164: Time zone
  - Register 16166: Summer time
- 7) The Power on LED flashes green quickly to identify the device more quickly in a cluster of devices. Is automatically deactivated after one minute.
- 8) Output a test alarm on a measuring channel.  
 The test alarm is deactivated after 1 minute (= 0).  
 0 no test alarm/end test alarm  
 1...12 Output test alarm on corresponding channel/active
- 9) Perform an offset measurement on the corresponding channel.  
 Secured via register 59000.

## 7. Glossary

Terms	Explanation
#	In the overview: measuring channel number 1...12 1...6: RMS of channels K1...6 7...12: DC of channels K1...6
Channel	RCMS150...has 6 measuring current transformers (= channels). 2 measuring channels (RMS and DC) are available for each channel, which makes 12 measuring channels in total: 1...6: residual current AC/DC sensitive (RMS) 7...12: residual current DC
Configure e-mail	Functionality of the gateway: To which user group should a device failure be reported?
Device error (at > Edit texts)	Specification of the text that is displayed in the event of a device <b>error</b>
Device failure (under > Edit texts)	Specification of the text that is indicated in the event of a device <b>failure</b>
Edit texts	It is essential that each measuring channel is clearly identified in the overview or in the reports. The alarm texts that are indicated in the event of prewarnings/main alarms can be identical or different for all channels. If no individual text is assigned, the general text will be indicated in the event of an alarm.
Factory settings	All settings are reset.
Hysteresis	The hysteresis prevents constant setting and resetting of the alarm when the measured value varies around the response value. If, for example, a hysteresis of 20 % is set, the alarm state will not be exited until the measured value is 20 % below the response value. Setting range: 10...25 %, resolution of setting 0.1 %
$I_{\Delta n}$	Response value residual current $I_{\Delta n1}$ RMS : Response value prewarning RMS $I_{\Delta n2}$ RMS : Response value main alarm RMS $I_{\Delta n1}$ DC : Response value prewarning DC $I_{\Delta n2}$ DC : Response value main alarm DC



Terms	Explanation
Main alarm	<p>In the event of a main alarm, a message is sent via the bus and the respective LED lights up on the RCMS. Is triggered by:</p> <ul style="list-style-type: none"> <li>• Exceeding the set response value during residual current measurement</li> <li>• Fault of measuring current transformer</li> <li>• Device error</li> </ul>
Message	2 message levels are distinguished: prewarning and main alarm.
Overview	The current state and the measured value are indicated for all 12 measuring channels (#)
Prewarning	<p>Preliminary stage to main alarm, the less severe response value has been reached (e.g. 50 % of the main alarm response value). If there is a prewarning, a message is sent via the bus. Is triggered by:</p> <ul style="list-style-type: none"> <li>• Exceeding the set response value during residual current measurement</li> <li>• Fault of measuring current transformer</li> <li>• Device error</li> </ul>
Report	<p>The report includes:</p> <ul style="list-style-type: none"> <li>- The current measured values for each channel</li> <li>- Values of the general settings Hysteresis, <math>t_{off}</math>, <math>t_{start-up}</math></li> <li>- Response values and <math>t_{on}</math> for prewarnings and main alarms</li> <li>- Information regarding the RCMS150...</li> </ul>
Response value main alarm	Response value of the main alarm ( $I_{\Delta n2}$ )
Response value prewarning	Indication of the response value alarm (50...100 %) ( $I_{\Delta n1}$ ) as a percentage value
RMS	<b>Root Mean Square:</b> The currents are detected and evaluated as RMS values in the frequency range of 0...2000 Hz.

Terms	Explanation
t(off)	<p>Delay on release <math>t_{\text{off}}</math></p> <p>Starts when the condition that triggers the message (for pre-warning or main alarm) no longer exists. The RCMS150... only stops signalling if the condition that triggers the message no longer exists after the delay on release has elapsed.</p> <p>Setting range: 0...10 minutes.</p>
t(on)	<p>Response delay <math>t_{\text{on}}</math></p> <p>Starts when a condition that triggers the message (for pre-warning and main alarm) exists. Signalling is only done by the RCMS150... if the condition that triggers the message still exists after the response delay has elapsed.</p> <p>Setting range: 0...10 minutes.</p>
t(start-up)	<p>Start-up delay <math>t_{\text{start-up}}</math></p> <p>Time delay after the RCMS150 has been switched on. No alarm message is generated during this time period. This time delay is required if the RCMS150... and the system to be monitored are switched on simultaneously. Currents caused by switching operations are ignored.</p> <p>Setting range: 500 ms...10 minutes.</p>

## 8. Technical data

( ) \* = factory settings

### 8.1 Tabular data

#### Insulation coordination according to IEC 60664-1

The data are valid for the monitored primary circuit to the output circuit

Primary circuit .....	Primary conductors routed through the current transformer
Output circuit .....	(+, -, A, B)
Rated insulation voltage .....	300 V
Overtoltage category .....	III
Rated impulse withstand voltage monitored circuit/output circuit .....	4 kV
Range of use .....	≤ 2000 m above sea level
Rated insulation voltage .....	250 V
Pollution degree .....	3

#### Insulation

To achieve double insulation (DI) for overvoltage category III, insulated primary conductors with sufficient rated voltage must be used on the application side.

BI .....	Overtoltage category III
DI .....	Overtoltage category II

Voltage test acc. to IEC 61010-1 .....	AC 2.2 kV
--	-----------

#### Power supply

Nominal supply voltage $U_S$ .....	DC 24 V
Operating range $U_S$ .....	±20 %
Power consumption .....	< 4 W

#### Residual current measuring range

Frequency range .....	0 . . . 2000 Hz
Measuring range .....	±500 mA
Resolution measured value .....	1 % of the set response value

#### Response values

Residual current $I_{\Delta n2 RMS}$ .....	RMS 3 . . . 300 mA (30 mA)*
Residual current $I_{\Delta n2 DC}$ .....	DC 3 . . . 300 mA (6 mA)*
Ratio $I_{\Delta n2 RMS} / I_{\Delta n2 DC}$ .....	0.2 . . . 5
Prewarning $I_{\Delta n1 RMS/DC}$ .....	50 . . . 100 % of $I_{\Delta n2}$ (50%)*

Response tolerance $I_{\Delta n1/2}$	
DC, 10...500 Hz .....	-20...0 %
500 Hz...2 kHz .....	-20...+100 %
Hysteresis .....	10...25 % (15%)*

### Time response

Start-up delay $t_{\text{start-up}}$ .....	0.5...600 s (0.5 s)*
Response delay	
$t_{\text{on1 RMS/DC}}$ .....	0...600 s (1 s)*
$t_{\text{on2 RMS/DC}}$ .....	0...600 s (0 s)*
Delay on release	
$t_{\text{off}}$ .....	0...600 s (1 s)*

### Indication (LEDs)

For a description of the LEDs, refer to page 16

ON .....	green
ALARM K1...K6.....	yellow

### Interface

Interface .....	RS-485
Connection .....	terminals A/B
Cable shielded, shield on one side to PE	
recommended.....	CAT6/CAT7 min. AWG23
alternative .....	J-Y(St)Y min. 2 x 0.8
Bus terminating resistor external .....	(2 x) 120 $\Omega$ (0.25 W)
Protocol.....	BMS
Cable length .....	$\leq$ 1200 m
Device address .....	2...90 (2)*
Protocol.....	Modbus RTU
Cable length .....	$\leq$ 1200 m
Device address .....	1...247 (last 2 digits of the serial number + 100)*
Environment/EMC	
EMC	
Immunity .....	IEC 62020-1
Emission .....	IEC 62020-1
Operating temperature.....	-25...+70 $^{\circ}\text{C}$
for UL applications .....	-25...+65 $^{\circ}\text{C}$

Classification of climatic conditions acc. to IEC 60721	
Stationary use (IEC 60721-3-3) .....	3K23
Transport (IEC 60721-3-2) .....	2K11
Long-term storage (IEC 60721-3-1) .....	1K22
Classification of mechanical conditions acc. to IEC 60721	
Stationary use (IEC 60721-3-3) .....	3M11
Transport (IEC 60721-3-2) .....	2M4
Long-term storage (IEC 60721-3-1) .....	1M12

**Connection**

Connection type .....	dual plug-in push-wire terminal
Connection properties	
rigid/flexible/conductor sizes .....	0.2 . . 1.5 mm <sup>2</sup> / AWG 24 . . 16
Multi-conductor connection (2 conductors with the same cross section)	
rigid .....	0.2 . . 1.5 mm <sup>2</sup>
flexible .....	0.2 . . 1.5 mm <sup>2</sup>
flexible with ferrule without plastic sleeve .....	0.25 . . 1.5 mm <sup>2</sup>
flexible with ferrule with plastic sleeve.....	0.25 . . 0.75 mm <sup>2</sup>
Stripping length .....	10 mm

**Other**

Operating mode .....	continuous operation
Position of normal use .....	any
Enclosure material .....	polycarbonate
Flammability class .....	UL94 V-0
Screw mounting to standard distribution panels with 12 TE.....	2 x M6
DIN rail mounting .....	mounting clip (accessories)
Tightening torque .....	1.5 Nm
Weight.....	170 g

**Measuring current transformer**

Diameter cable gland .....	10 mm
Load current .....	32 A

**Bus parameters**

Alarm.....	threshold value exceeded, system fault
Measured value.....	measured value, DC component, r.m.s. (resolution 0.1 mA)
Times .....	response delay, delay on release, start-up delay

( )\* = Factory settings

## 8.2 Factory settings of the Modbus interface

For an overview of the factory-set parameters, see table 6.6.

## 8.3 Standards, approvals, certifications



LR in preparation

## 8.4 Ordering information

Type	Supply voltage $U_S$	Protocol	Art. No.
RCMS150	DC 24 V	BMS	B94053025
RCMS150-01		Modbus RTU	B94053026
Mounting clip for DIN rail mounting			B91080110

### Suitable system components

The use of the listed power supply units is recommended. The use of a surge protection device is mandatory for these power supply units.

Description	Type	Art. No.
Power supply	STEP-PS/1 AC/24 DC/0.5	B94053110
	STEP-PS/1 AC/24 DC/1.75	B94053111
	STEP-PS/1 AC/24 DC/4.2	B94053112

## Accessories

Description	RCMS 150	RCMS 150-01	Type	Art. No.
Condition monitor with integrated gateway	X	X	COM465IP	B95061065
	X	X	CP907-I (flush-mounted enclosure)	B95061031
	X	X	CP907-I (control cabinet door mounting)	B95061032
RS-485 repeater	X	X	DI-1DL	B95012047
Residual current monitoring system (In this case, no condition monitor/gateway is necessary)*	X	—	RCMS460-D-1	B94053001
	X	—	RCMS460-D-2	B94053002
	X	—	RCMS490-D-1	B94053005
	X	—	RCMS490-D-2	B94053006

\* Suitable for measured value and alarm indication only, not suitable for parameter setting

## 8.5 Document revision history

Date	Document version	State/Changes
08/2016	00	First edition
07/2021	01	<i>Added</i> Device variant RCMS150-01 with Modbus RTU interface UKCA logo
08/2022	02	<i>Added</i> Chapter 8.1: Operating temperature UL Chapter 8.3: UL logo





# INDEX

## A

Address setting 18  
Approvals and certifications 12, 46

## C

Commissioning 13, 18

## D

Device features 11  
Dimension diagram 14  
Display elements 15  
Disposal 8

## E

Error codes 31

## F

Functional description 11

## G

Glossary 40

## H

How to use this manual 5

## I

Installation, preliminary considerations 13  
Intended use 9, 10

## L

LED 31

## M

Menu overview 21  
Menu overview RCMS150 21  
Menu overview RCMS150-01 22  
Menu structure of the web user interface 43  
Modbus registers  
- Control commands 38  
- Device information 26  
- Interface parameters 32  
- Parameters 33

Mounting 13

Mounting the device 13

## O

On-site service 6  
Operating elements 15  
Ordering information 46

## P

Periodic verification 11  
Product description 11

## Q

Qualified personnel 9, 13  
Quick reference guide 11

## R

Readout of the info list 43  
Repair service 6

**S**

- Scope of delivery 11
- Screw mounting 14
- Service 6
- Standards 46
- Start page, web user interface 43
- Starting the web browser 20
- Support 6
- System design 20

**T**

- Technical data 43
- Technical support 6
- Terminal details 17
- Training courses 7

**W**

- Web user interface 43
- Wiring diagram 16
- Work activities on electrical installations 9
- Workshops 7





Alle Rechte vorbehalten.  
Nachdruck und Vervielfältigung  
nur mit Genehmigung des Herausgebers.  
Änderungen vorbehalten!

### **Bender GmbH & Co. KG**

Postfach 1161 • 35301 Grünberg • Deutschland  
Londorfer Str. 65 • 35305 Grünberg • Deutschland  
Tel.: +49 6401 807-0 • Fax: +49 6401 807-259  
E-Mail: [info@bender.de](mailto:info@bender.de) • [www.bender.de](http://www.bender.de)

Fotos: Bender Archiv



**BENDER Group**

All rights reserved.  
Reprinting and duplicating  
only with permission of the publisher.  
Subject to change!

### **Bender GmbH & Co. KG**

PO Box 1161 • 35301 Grünberg • Germany  
Londorfer Str. 65 • 35305 Grünberg • Germany  
Tel.: +49 6401 807-0 • Fax: +49 6401 807-259  
E-Mail: [info@bender.de](mailto:info@bender.de) • [www.bender.de](http://www.bender.de)

Photos: Bender Archive