EN Manual

LINETRAXX® RCMS150

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

for COMTRAXX 2.1, Option C

RCMS150_D00259_00_M_XXEN/08.2016

Bender GmbH & Co. KG
P.O. Box 1161 • 35301 Gruenberg • Germany
Londorfer Strasse 65 • 35305 Gruenberg • Germany
Tel.: +49 6401 807-0 • Fax: +49 6401 807-259
E-Mail: info@bender.de • www.bender.de

Photos: Bender archives

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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:

DANGER

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

WARNING

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

CAUTION

*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 Gruenberg

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
Internet:	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 -> 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 -> 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 device RCMS150 is suitable for measuring residual currents up to I_{Δ} = 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. 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 monitor type B with 6 channels K1…6 (each channel features 2 measuring channels: 1 x RMS, 1 x DC)
- Compatible with RCMS460/490 in a system setup
- 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, CP700
- Up to 534 measuring channels in the monitored system that can be combined via BMS bus
- RS-485 interface with BMS bus (Modbus RTU on request)
- BMS address range 2…90

3.2 Function description

The residual currents are recorded and evaluated as r.m.s. values in the frequency range DC…2 kHz. The response values can be set via the connected gateways.
The user can set four response values per channel K1…6:

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

The response values $I_{\Delta n\mathbf{1}...}$ apply to the **prewarnings**, the response values $I_{\Delta n\mathbf{2}...}$ apply to the **alarms**.

If one of the four set response values $I_{\Delta N...}$ is exceeded, the assigned response delay $\boldsymbol{t_{on...}}$ starts. If the response value continues to be exceeded, the corresponding message (prewarning or alarm) is displayed on the gateway after the response delay $t_{on...}$ has elapsed.
In the event of an alarm, the alarm LED of the respective channel K1…6 lights up yellow.

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

A pending response value violation is emitted via the BMS interface with address and measuring channel indication and can be evaluated by means of a gateway.
All devices can be accessed via the network from any PC using a standard web browser (Firefox, Internet Explorer). 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, all alarm LEDs flash.

3.3 Approvals and certifications

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

4. Installation, connection and commissioning

*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 you are familiar with the configuration of computer networks, you can carry out the connection of 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 RCMS150 is designed for screw mounting.
As an alternative, it can also be mounted on a DIN rail using the optionally available fastening set.

4.1.3 Dimension diagram

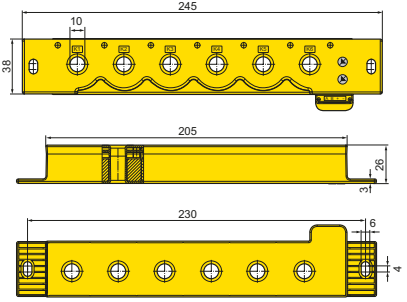


Fig. 4.1: Dimension diagram RCMS150

4.2 Connecting the device

DANGER

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

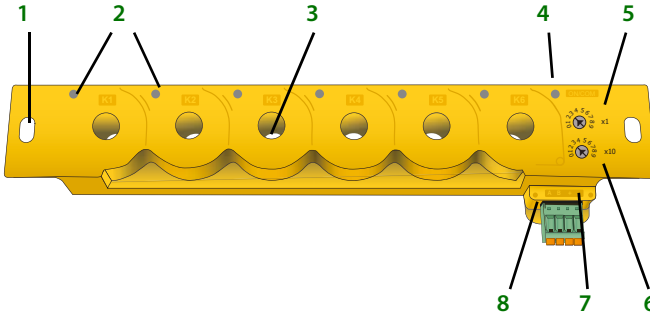


Fig. 4.2: Display and operating elements

Display and operating elements legend	
1	Slot for screw mounting
2	Alarm LEDs for the channels K1…6
3	Line feed-through of the measuring current transformers for the channels K1…6
4	ON LED: Power on LED
5	Potentiometer with detents: Determination of ones' position of the BMS address
6	Potentiometer with detents: Determination of tens' position of the BMS address
7	Connection to the supply voltage
8	Connection RS-485, BMS bus

4.3 Wiring diagram

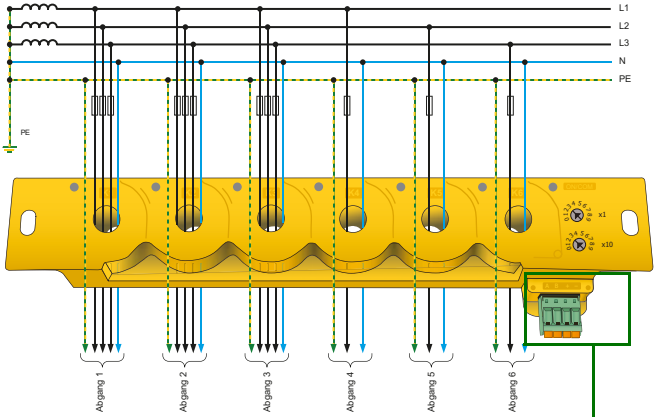


Fig. 4.3: Wiring diagram RCMS150

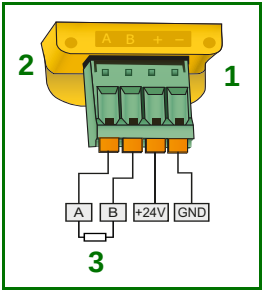
Detail: terminal		
1	Supply voltage U_S DC 24 V	
2	RS-485 interface (BMS bus) (Modbus RTU on request)	
3	Terminating resistor 120 Ω (required at the beginning and at the end of the bus)	

Fig. 4.4: Detail: terminal

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.

4.4 Commissioning

1. **Mount the RCMS**

2. **Set the BMS address** (set the detent potentiometers 5 and 6 to the corresponding position using a screwdriver). Address range: 2…90

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

*The beginning and the end of the BMS bus require a 120 Ω **terminating resistor**!*

On the BMS bus, the transmission of alarm messages takes priority over the transmission of all other messages. The messages are cyclically scanned every 1…2 s. In bus systems with many bus devices, the update of operational status messages may take several seconds.

3. Route **outgoing circuits** to be monitored **through the current transformers**.

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.

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

4. Connect the RCMS150 to the **supply voltage** (DC 24 V)

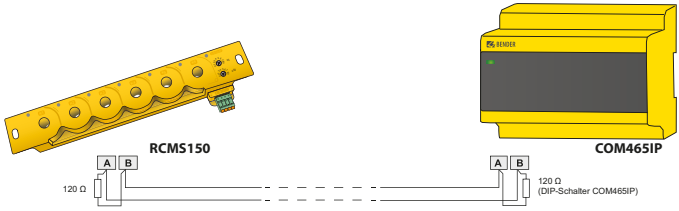
The ON LED flashes to indicate the set BMS bus address after the device has been switched on or after the address has been changed: ones' position - pause - ten's position.
*Example: ***** *** designates the BMS bus address 35.*
After indicating the address, the RCMS150 changes automatically into display state.
If the ON LED flashes quickly, the BMS bus address has been set incorrectly.

5. Connect the RCMS150 to the **master** CP700/COM465IP (software version ≥ 2.1, option C)

5. Indication via web server

The measured values (measuring channels) of the individual measuring current transformers of the RCMS 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 (CP700 or COM465IP). You can find the RCMS150 in the bus overview.

5.3 User interface web browser

Basic operation: refer to CP700/COM465IP manual.

5.4 Web application: Menu overview RCMS150

Overview
Current measured values and alarm states of the 12 measuring channels (1...6: RMS; 7...12: DC)

Configure e-mail
Generating e-mails to report device failures
Determining addressees for each channel via the gateway
Details: refer to CP700/COM465IP manual

Report
Generating a report of all active devices

Menu

Settings

Edit texts
Editing device texts for display indication and printouts

Device
Specifying message text indicated in the event of a prewarning or an alarm for measuring channel 1…12

Channel 1 - 12
Specifying message text for device and device failure

Channel

General
Channel K1…6: Hysterese, t_{off}, t_{Anlauf}

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 setting
Restoring factory settings; texts are not affected by this action.

Control

TEST
Running a device test

Info
Information regarding device, software and manufacturer

Fig. 5.1: Web application: Menu overview RCMS150

6. 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
Alarm	In the event of an alarm, a message is sent via the bus and the respective LED lights up on the RCMS. Is triggered by: • Exceeding the set response value during residual current measurement • Fault of measuring current transformer • Device fault
Response value alarm	Response value of the ($I_{\Delta n2}$) alarm
Response value prewarning	Indication of the response value alarm (50…100 %) ($I_{\Delta n1}$) as a percentage value
Configure e-mail	Functionality of the gateway: To which user group should a device failure be reported?
Device failure (under > Edit texts)	Specification of the text that is indicated in the event of a device **failure**
Device fault (under > Edit texts)	Specification of the text that is indicated in the event of a device **fault**

Terms	Explanation
Hysteresis	If the measured value were to oscillate around the response value, the RCMS150 would constantly change from alarm to normal status and back again. If 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 %
Info	Device name, software version, manufacturer
$I_{\Delta n}$	Response value residual current $I_{\Delta n1\ RMS}$: Response value prewarning RMS $I_{\Delta n2\ RMS}$: Response value alarm RMS $I_{\Delta n1\ DC}$: Response value prewarning DC $I_{\Delta n2\ DC}$: Response value alarm DC
Channel	The 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: Measuring channel 1…6: residual current AC/DC sensitive (RMS) Measuring channel 7…12: residual current DC
Message	2 message levels are distinguished: prewarning and alarm.
Menu > Settings > Channel > General	For each channel K1…6: Set hysteresis, t_{off} , $t_{start\text{-}up}$
Menu > Settings > Channel > RMS	Response value alarm, $t_{on2\ RMS}$ Response value prewarning, $t_{on1\ RMS}$

Terms	Explanation
Menu > Settings > Channel > DC	Response value alarm, $t_{on2\ DC}$ Response value, prewarning, $t_{on1\ DC}$
Report	The report includes: - The current measured values for each channel - Values of the general settings hysteresis, t_{off}, $t_{start\text{-}up}$ - Response values and t_{on} for prewarnings and alarms - Information regarding the RCMS150
RMS	**R**oot **M**ean **S**quare: The currents are detected and evaluated as true r.m.s. values in the frequency range of 0…2000 Hz.
Control -> Test	The **self test** is used to test the device functions of the RCMS150 (measuring function, generation of alarm messages, report via the BMS bus, indication on the gateway). The test current ($I_{test} > I_{\Delta n2\ldots}$) generated in the measuring current transformers starts $t_{on2\ldots}$ and sets the alarm after $t_{on2\ldots}$ has elapsed. The LED of the tested channel lights up. Since every channel is tested separately, the self test takes at least as long as the number of set $t_{on2\ldots}$. After completing the manual self tests, all 12 measuring channels must be listed in the history memory of the gateway.

Terms	Explanation
T(start-up)	Start-up delay $t_{start-up}$ 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. Setting range: 500…10 minutes.
t(off)	Delay on release t_{off} Starts when the condition that triggers the message (for prewarning or 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. Setting range: 0…10 minutes.
t(on)	Response delay t_{on} Starts when a condition that triggers the message (for prewarning and alarm) exists. Signalling is only done by the RCMS150 if the condition that triggers the message still exists after the response delay has elapsed. Setting range: 0…10 minutes.
Edit texts	It is essential that each measuring channel is clearly identified in the overview or in the reports. The message texts that are indicated in the event of prewarnings/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.

Terms	Explanation
Overview	The current state and the measured value are indicated for all 12 measuring channels (#) No residual current measured  Prewarning  Alarm 
Prewarning	Preliminary stage to alarm, the less severe response value has been reached (e.g. 50 % of the alarm response value)
Factory settings	All settings are reset

7. Technical data

( )* = factory settings

7.1 Tabular data

Insulation coordination according to IEC 60664-1

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

Output circuit ..... (+, -, A, B)
Rated insulation voltage ..... 300 V
Overvoltage category III
Rated impulse withstand voltage monitored circuit/output circuit ..... 4 kV
Range of use ..... ≤ 2000 m AMSL
Rated insulation voltage ..... 250 V
Pollution degree 3
Insulation ..... BI: Overvoltage category III
..... DI: Overvoltage category II

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

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

Power supply

Nominal supply voltage U_S with galvanic separation ..... DC 24 V
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 3 . . . 300 mA (30 mA)*
Residual current $I_{\Delta n2}$ ..... 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 % (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 $t_{start-up}$ ..... 0.5 . . . 600 s (0.5 s)*
Response delay
$t_{on1\ RMS/DC}$ ..... 0 . . . 600 s (1 s)*
$t_{on2\ RMS/DC}$ ..... 0 . . . 600 s (0 s)*
Delay on release
t_{off1} ..... 0 . . . 600 s (1 s)*

Indication (LEDs)

ON
green ..... normal operation indication
green (flashing quickly) ..... internal device fault or BMS bus address set incorrectly
green (flashing slowly) ..... indication BMS bus address (after device start/address modification)
ALARM K1 . . . K6
yellow ..... $I_{\Delta} > I_{\Delta n}$
yellow (flashing) ..... measured value range exceeded

Interface

Interface/protocol RS-485/BMS
Connection ..... terminals A/B
Shielded cable (one end of shield connected to PE) ..... twisted pair, e.g.: J-Y(St)Y 2x0.8
Cable length ..... ≤ 1200 m
Bus terminating resistor external ..... 120 Ω (0.25 W)
Device address, BMS bus ..... 2 . . . 90 (2)*

Environment/EMC

EMC:
Immunity ..... IEC 61000-6-2
Emission ..... IEC 61000-6-3
Operating temperature ..... -25 . . . +70 °C
Classification of climatic conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) 3K5
Transport (IEC 60721-3-2) 2K3
Long-term storage (IEC 60721-3-1) 1K4

Classification of mechanical conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) 3M4
Transport (IEC 60721-3-2) 2M2
Long-term storage (IEC 60721-3-1) 1M3

Connection

Connection type ..... pluggable push-wire terminal
Connection properties:
rigid, flexible/conductor sizes 0.2 . . . 1.5 mm²/AWG 24 . . . 16
Multi-conductor connection (2 conductors with the same cross section):
rigid ..... 0.2 . . . 1.5 mm²
flexible ..... 0.2 . . . 1.5 mm²
flexible with ferrule without plastic sleeve ..... 0.25 . . . 1.5 mm²
flexible with ferrule with plastic sleeve ..... 0.25 . . . 0.75 mm²
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
Software ..... COMTRAXX 2.1, option C
( )* = Factory settings

7.2 Standards, approvals, certifications

UL508 in preparation
CSA in preparation

7.3 Ordering information

Type	Supply voltage U_S	Art. No.
RCMS150	DC 24 V	B 9405 3025
Mounting clip for DIN rail mounting		B 9108 0110

Accessories

Description	Type	Art. No.
Condition Monitor with integrated gateway	COM465IP	B 9506 1065
Condition Monitor	CP700	B 9506 1030
RS-485 repeater	DI-1DL	B 9501 2047
Power supply	AN410	B 924 209
Residual current monitor*	RCMS460-D-1	B 9405 3001
	RCMS460-D-2	B 9405 3002
	RCMS490-D-1	B 9405 3005
	RCMS490-D-2	B 9405 3006

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

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Optec AG | Guyer-Zeller-Strasse 14 | CH-8620 Wetzikon ZH

Telefon: +41 44 933 07 70 | Telefax: +41 44 933 07 77
E-Mail: info@optec.ch | Internet: www.optec.ch

BENDER
The Power in Electrical Safety©

Bender GmbH & Co. KG
P.O. Box 1161 • 35301 Gruenberg • Germany
Londorfer Strasse 65 • 35305 Gruenberg • Germany
Tel.: +49 6401 807-0 • Fax: +49 6401 807-259
E-Mail: info@bender.de • www.bender.de

Photos: Bender archives

BENDER Group