BENDER CONNECT

LINETRAXX® SmartDetect RCMS425-L

Four-channel residual current monitor sensitive to AC, pulsed DC, and smooth DC

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Product description

The LINETRAXX® SmartDetect RCMS425-L is an AC, pulsed DC, and smooth DC sensitive residual-current monitor for earthed power-supply systems. It measures residual currents between 2 mA and 70 A with direct voltage as well as alternating voltage in a frequency range from 15 Hz to 20 kHz.

Corresponding measuring-current transformers (e.g. CTUB100 and CTAC series) must be connected to the residual-current inputs.

Individual response values for prewarning and main alarm can be set for each channel, and the response value can be chosen from the RMS value of AC and DC or the individual AC and DC components.

The alarm is indicated by alarm LEDs. Alarm signalling is also possible via the digital outputs Q and M+ and simultaneously via the Modbus RTU interface. In addition, the alarm is output via the two alarm relays K1 (pre-warning) and K2 (main alarm).

Alarms can also be triggered via message assignment for device errors and transformer connection monitoring errors.

Digital inputs and outputs I, Q and M+ can be used in a variety of ways. Q can be used either as a digital input or digital output.

The test and/or reset functions can be triggered by external buttons or remote control via the digital inputs I and Q. This is also possible directly on the device using the T/R button.

Outputs Q and M+ can be used for prewarning or main alarm signalling. Alternatively, the residual current can be output as an analogue signal via M+.

The RCMS425-L has a Modbus RTU interface for communication with higher-level systems. The parameters required for electrical systems can be set either via Modbus RTU or via the NFC interface using the Bender Connect App (which is also possible even when the device is powered off). It is also possible to preset the operating parameter ex factory.

Various functions can be added to the devices using function modules. These include harmonic analysis (FFT) up to the 400th harmonic (function module A), AC/DC sensitive measurement and evaluatikon of values (function module B) and the connection of external type A current transformers (function module C).

Device features

Special features

- Four measuring channels for AC, pulsed DC, or AC/DC sensitive measuring
- Configurable frequency response
- Expansion/retrofit or change of functions in the event of changed monitoring requirements
- Simple configuration with Bender Connect App via NFC interface
- Customer-specific factory settings possible

Residual current measurement

- Residual current measurement device (RCM) in accordance with DIN EN 62020-1 (IEC 62020-1)
- Four channels for residual current measurement
- Every channel can alternatively also be configured as digital input
- Either AC, pulsed DC, or AC/DC sensitive measuring for every channel
- Type A, type F, type B and type B+ characteristics can be set in accordance with IEC 60755 (or VDE 0664-400)
- Measurement of AC/DC (r.m.s. value) and AC and DC components
- Frequency range: DC, 15 Hz…20 kHz
- Frequency analysis up to the 400th harmonic, calculation of the THD value

Response value monitoring

- Main alarm with adjustable residual response value $I_{\Delta n}$
- Prewarning: 10…100 % of the residual response value $I_{\Delta n}$
- Separate evaluation of AC/DC (RMS) or AC and DC components
- Response value
  - Type A: 6 mA…30 A
  - Type F: 6 mA…30 A (15 Hz…20 kHz)
  - Type B/Tyep B+: 10 mA…10 A (only with function module B “AC/DC sensitive measuring and evaluation of values“)
- Configurable frequency response
- Measurement modes for each channel: overcurrent (standard), undercurrent, or window mode (out-of-range-values)
- Adjustable time delays (response delay and delay on release)
- Fault-memory behaviour per channel selectable
- Preset function
- Reload function
- Starts in alarm status and start-up delay configurable
- Continuous CT-connection monitoring

Display and operation

- NFC interface for parameter setting with the Bender Connect App
- LED bargraph with
  - Device status LED
  - LEDs for prewarning and main alarm
  - Alarm LED for each channel
- Integrated combined test/reset button, connection for external buttons
- Sealable transparent cover (optional)

Interfaces

- One digital input (I), one digital input/output (Q), and one multifunctional digital/analogue output (M+)
- Alarm relays K1 and K2
- Modbus RTU (RS-485)
- NFC interface for device parameter setting via Bender Connect App with the device energised or de-energised

Supply voltage

- Supply voltage DC 24 V
- Wide range power supply AC/DC 100…240 V

NFC interface

The NFC interface can be used to transmit a previously configured device parameter setting directly to the device.

i This function is available only via the Bender Connect App. You can find this app in the Appstores for iOS and Android.

In the Bender Connect app the device first needs to be made known. Then the device-specific setting options are shown so that they can be configured. When the data is transferred, feedback is given whether the parameter configuration has been successful.

Parameter settings can be transmitted to the device via the Bender Connect app by holding the mobile phone close to the device.

To a **de-energised** device, a parameter setting can be transferred via the Bender Connect app. This setting is then activated automatically when the device is connected to the current supply.

When a device is **plugged in**, too, parameters can be configured via the Bender Connect App. To this end, the NFC interface first needs to be activated in the device.

The NFC interface is activated via the T/R button at the front of the device or via the Modbus interface.

Function modules

To expand its application range, optionally function modules can be enabled for the RCMS425-L. These function modules can be ordered and activated both when first ordering the device and also later on.

Function module A: Harmonic analysis (FFT)

Function module A permits analysing harmonics.

i With ordering number B84605042 the harmnoic analysis is already enabled as a default.

Function module B: AC/DC sensitive measuring and evaluation of values

All RCMS425-L devices evaluate measuring-current transformers of the types "A" and "F". With function module B also measuring-current transformers ot the types "B" and "B+" can be used.

i With ordering numbers B84605041 and B84605042 the AC/DC-sensitive measuring and evaluation of values is already enabled as a default.

⚠ **ADVICE**

If the function module B is activated at a later date, the settings for each channel under Settings > Measuring points > Channel must be checked and adjusted.

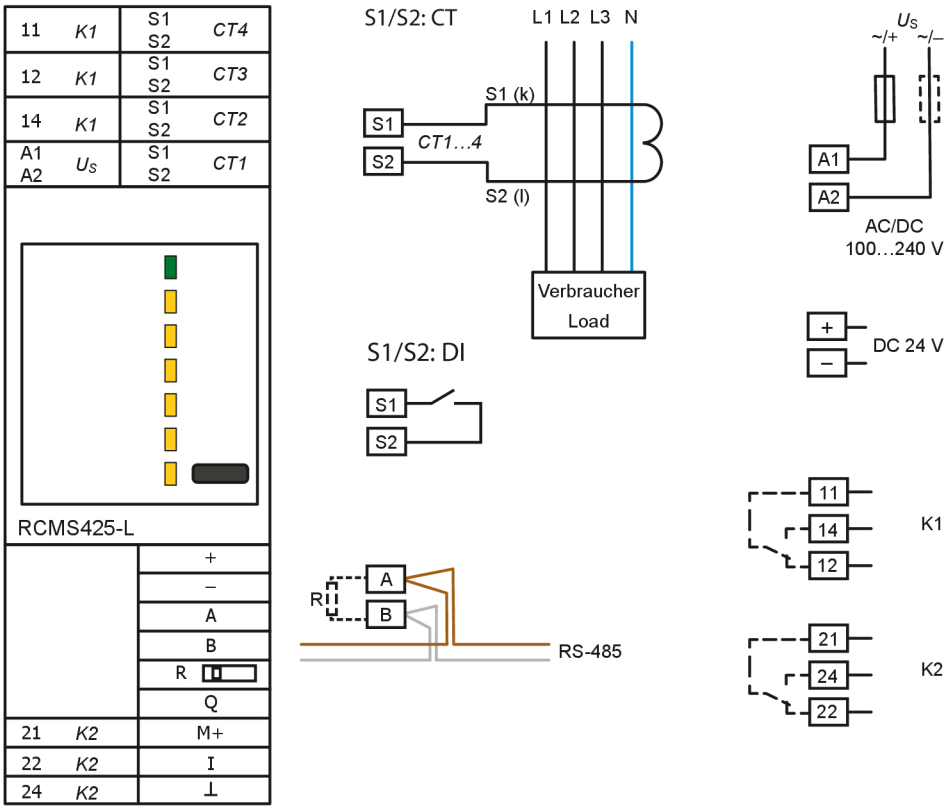
Function module C: Connection of Type A external current transformers

Function module C permits the use of measuring-current transformers by manufacturers other than Bender. When an external current transformer is used, a number of turns must be selected in the corresponding Modbus register (33104…33107).

i With ordering number B84605042 the connection of external current transformers is already enabled as a default.

Function module D: History memory (in preparation)

Wiring diagram



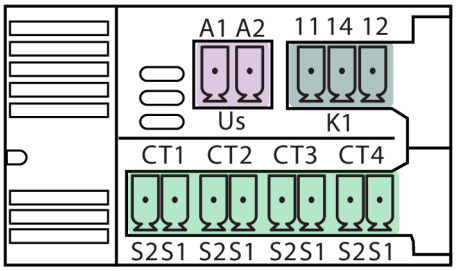
AC/DC 100…240 V
Back-up fuse for U_S: 6 A

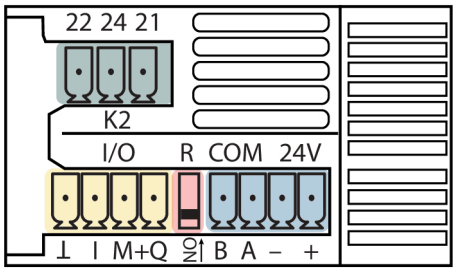
DC 24 V
RCMS425-L and all connected CTUB102-CTBCxx devices must be supplied from the same power supply.

For UL applications:
The measuring current transformers must be connected before operation.

Cable lengths to the measuring current transformer: See technical data.

Connections overview

Top	Terminal	Description
	A1, A2	Supply voltage AC/DC
	11, 14, 12	Relay K1
	S1, S2 (CT1)	Measuring-current transformer CT1
	S1, S2 (CT2)	Measuring-current transformer CT2
	S1, S2 (CT3)	Measuring-current transformer CT3
	S1, S2 (CT4)	Measuring-current transformer CT4

Bottom	Terminal	Description
	21, 24, 22	Relay K2
	⊥	GND
	I	Digital input
	M+	Multifunctional output
	Q	Digital input/output
	ON (R)	Termination of RS-485 interface
	A, B	RS-485 interface: Modbus RTU
	+, -	Supply voltage DC

Technical data

()* = Factory setting

Insulation coordination (IEC 60664-1/ IEC 60664-3)

Definitions

Supply circuit (IC1)	A1, A2
Measuring circuit (IC2)	+, –, A, B, M+, Q, I, GND, CT1…4
Control circuit (IC3)	11, 12, 14
Control circuit (IC4)	21, 22, 24
Rated voltage	250 V
Overvoltage category	III
Operating altitude	≤ 2000 m AMSL

Rated impulse voltage

IC1/(IC2-4)	6 kV
IC2/(IC3-4)	6 kV
IC3/IC4	6 kV

Rated insulation voltage

IC1/(IC2-4)	250 V
IC2/(IC3-4)	250 V
IC3/IC4	250 V
Pollution degree	2

Protective separation (reinforced insulation) between

IC1/(IC2-4)	300 V
IC2/(IC3-4)	300 V
IC3/IC4	300 V

Voltage test (routine test) acc. to IEC 61010-1

IC1/(IC2-4)	AC 2.2 kV
IC2/(IC3-4)	AC 2.2 kV
IC3/IC4	AC 2.2 kV

Supply voltage (+, -)

Connection	+, –
Supply voltage U_s	DC 24 V
Protection class of power supply unit	2 or 3
Permissible tolerance	–30…+25 %
Permissible ripple	5 %
Power consumption	≤ 2 W
Inrush current (< 5 ms)	< 10 A

Supply voltage (A1, A2)

Connection	A1, A2
Supply voltage U_S	AC/DC 100…240 V
Tolerance of U_S	-30…+15 %
Frequency range of U_S	DC/47…460 Hz
Power consumption	≤ 15 VA at 50 Hz
Inrush current (< 5 ms)	< 25 A

Measuring circuit

Burden (internal)	33 Ω
Frequency range	DC, 15 Hz…20 kHz
Measuring range (peak)	3 mA…100 A
Measuring range rms	2 mA…70 A
Rated residual operating current	
Type A, Type F	30 A
Type B, Type B+	10 A
Response value main alarm $I_{\Delta n}$ [1)]	
Type A, Type F	6 mA…30 A (30 mA)*
Type B, Type B+	10 mA…10 A (30 mA)*
Prewarning	10…100 % x $I_{\Delta n}$ (50 %)*
Operating uncertainty	±10 % (at 0.5…5 x $I_{\Delta n}$)
Relative response uncertainty	
Type A, Type F	6 mA…20 A: -20...0 % 20…30 A: -50...0 %
Type B, Type B+	-20…0 %
Hysteresis	10…25 % (15 %)*
Fault-memory alarm messages	on/off (on)*
Permissible continuous residual current with	
single-channel use	85 A
dual-channel use	60 A
use of three channels	49 A
use of four channels	42 A

1) The requirements of the respective standards are only met with a response value from 30 mA to 9.9 A.

Measuring-current transformers

Connection	CT1…4 (S1, S2)
Measuring-current transformer series	
Type A	CTAC, CTAS, W, WR, WS
Type F	CTAC
Type B, Type B+	CTUB-CTBC, CTBS
CT connection monitoring	yes
Rated voltage U_n	see measuring-current-transformer manual
Connecting wires	see measuring-current-transformer manual
Cable length	
CT Type B	≤ 10 m
CT Type A (single wire ≥ 0.75 mm²)	≤ 10 m
CT Type A (shielded cabel ≥ 0.75 mm²)	≤ 40m
For UL applications	60/75 °C copper conductors
External transformers	
Permissible continuous secondary current with	
Single-channel use	140 mA
Dual-channel use	100 mA
Use of three channels	80 mA
Use of four channels	70 mA
Permissible number of windings	100…2000

Time response

Start-up delay t	0…999 s (0 s)*
Response delay t_{on}	0…10 s (0 s)*
Delay on release t_{off}	0…999 s (1 s)*
Operating time t_{ae}	
with 1 x $I_{\Delta n}$	≤ 260 ms
with 5 x $I_{\Delta n}$	40…100 ms
Response time t_{an}	$t_{an} = t_{ae} + t_{on}$
Recovery time t_b	≤ 500 ms
Response time for CT connection monitoring	≤ 10 s

Operation

Display	status LED, alarm LEDs, channel LEDs
Button T/R	reset / test / NFC / address setting / protect
Terminating resistor DIP switches	on/off (off)*

RS-485 interface

Connection	A, B
Protocol	Modbus RTU
Baud rate	Max. 115.2 kbits/s (19.2 kbits/s)*
Parity	even, no, odd (even)*
Stop bits	1/2/auto (auto)*
Cable length (at 9.6 kbits/s)	≤ 1200 m
Recommended lines, shield on one side connected to PE	
CAT6/CAT7	Min. AWG23
min. J-Y(St)Y 2 x 0.6 mm²	Twisted pair
Device address	1…247 (100 + last two digits of serial number)*

NFC interface

Frequency	13.56 MHz
Transmitting power **	0 W

** EMC influences may lead to communication interruptions at the NFC interface.

Input I

Connection	I, ⊥
Max. cable length (recommended)	10 m
External connections	Potential-free contact

Input/output Q

Connection	Q, ⊥
Max. cable length (recommended)	10 m
Max. load	20 mA
Low voltage level (output)	0…2 V
High voltage level (output)	10 V…U_S
External voltage (passive mode)	DC 0…(U_S - 1 V)

Output M+

Connection	M+, ⊥
Max. cable length (recommended)	10 m
Max. load	20 mA
Burden	
Current output	≤ 600 Ω
Voltage output	≥ 10 kΩ
Tolerance with respect to final current/voltage value	±20 %
External voltage (passive mode)	DC 0…U_S

Switching elements

Relays	2 changeover contacts
Connection	11, 12, 14 21, 22, 24
Operating principle	N/C or N/O operation (N/C operation)*
Maximum permitted voltage	AC 380 V / DC 30 V
Switching capacity	1250 VA / 150 W
Minimum current	10 mA at DC 10 V
Electrical endurance, number of cycles	10000

Connections (A1, A2, relays)

Terminals	Plug-in screw-type terminals
Terminal series	Phoenix Contact MSTBT 2,5/…-ST-5,08 BK
Connection properties	
Rigid	0.2…2.5 mm²
Flexible, without plastic sleeve	0.25…2.5 mm²
Flexible, with plastic sleeve	0.25…2.5 mm²
Stripping length	7 mm
Tightening torque	0.5…0.6 Nm
Conductor cross section AWG	24…12

Connections (other)

Terminals	Plug-in screw-type terminals
Terminal series	Phoenix Contact MC 1,5/ -ST-3,5 BK
Connection properties	
Rigid	0.14…1.5 mm²
Flexible, without plastic sleeve	0.25…1.5 mm²
Flexible, with plastic sleeve	0.25…0.5 mm²
Stripping length	7 mm
Tightening torque	0.22…0.25 Nm
Conductor cross section AWG	28…16

EMC/Environment

EMC	DIN EN IEC 62020-1
Operating temperature	
AtU_S = DC 24 V	-25…+70 °C
AtU_S = AC/DC 100…240 V	-25…+55 °C
Transport	-40…+85 °C
Long-time storage	-40…+70 °C

Classification of climatic conditions acc. to IEC 60721 (except condensation and formation of ice)

Stationary use (IEC 60721-3-3)	3K22
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

Other

Operating mode	Continuous operation
Mounting	Vertical
Degree of protection (DIN EN 60529)	
terminals	IP20
internal components	IP30
Enclosure material	Polycarbonate
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94 V-0
Weight	≤ 110 g

Approvals

Standards & certifications

The RCMS425-L device has been developed in accordance with the following standards:

- DIN EN IEC 62020-1
- UL508

Licences

For a list of the open-source software used see our Homepage.

Declaration regarding the radio system

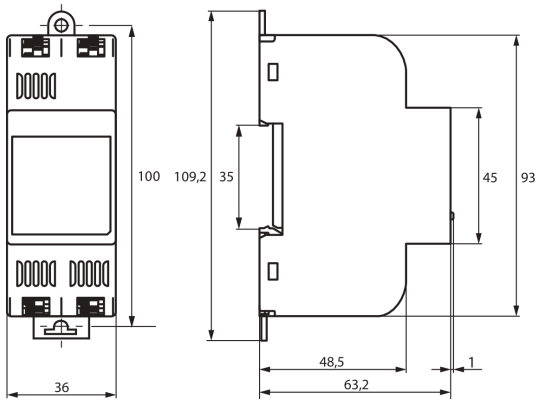
EU declaration of conformity

Bender GmbH & Co. KG hereby declares that the device covered by the Radio Equipment Directive complies with Directive 2014/53/EU. The full text of the EU Declaration of Conformity is available at the following internet address:

EU declaration of conformity

Dimension diagrams

Dimensions in mm



Ordering information

Type	Supply voltage U_s	Measuring current transformers that can be used		Configurable at the factory	Enabled function modules *	Art. No.
		Type A Type F	Type B Type B+			
RCMS425-L-2	DC 24 V AC/DC 100…240 V	X	(X) with function module B	In preparation	In preparation: Customised ex factory (A, B, C can be bought later)	B84605040
		X	X	-	B (A and C can be bought later)	B84605041
		X	X	-	A, B, C	B84605042

* Function modules
A: Harmonic analysis (FFT)
B: AC/DC sensitive measuring and evaluation of values
C: Connection of type A external current transformers

Accessories	Art. No.
Sealable transparent cover	B80609199

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