

# MRCDB425-L

AC/DC sensitive modular residual current device  
for MRCD applications





### Intended Use

Modular residual current devices of type MRCDB425-L are designed for AC/DC sensitive residual and fault current measurement in earthed TN and TT networks. The devices can be used as an additional protective measure for the following protection goals, among others:

- Protection against indirect contact (DIN VDE 0100-410, IEC60364-4-41)
- Protection against thermal effects (DIN VDE 0100-420, IEC60364-4-42)
- System protection (DIN VDE 0100-430, IEC60364-4-43)
- Protection against fire risks (DIN VDE 0100-530, IEC60364-5-53)

According to IEC 60364-5-53 and DIN VDE 0100-530, it is intended for use in earthed power supplies (TN and TT systems).

Please note that the standards mentioned may contain further requirements for use.

A modular fault current device according to product standard IEC60947-2 Annex M is completed by a measuring current transformer designed for this purpose and a circuit breaker with undervoltage release (device combination).



#### ADVICE

*According to the product standard IEC60947-2 Annex M.7.1, it must only be possible to adjust the response value by means of an intentional action. This requires a cover that can be sealed.*

#### **The supplied sealing cover must be installed!**

Suitable measuring current transformers are listed in the technical data. The switching time of the circuit breaker with undervoltage release incl. tripping device under load must not exceed 20 ms.

The requirements of the system and operating conditions on site and the application must be taken into account by selecting a suitable device combination and individual parameterisation. Furthermore, the notes, instructions and specifications in this manual must be observed and implemented.

The devices are intended for operation in control cabinets or similarly protected environments.

For intended operation, observe the specifications in this manual. Any other use than that described in this manual is regarded as improper.

## Device features

### Special features

- 1 measuring channel for AC/DC sensitive measuring
- Configurable frequency response
- Functionality can be expanded with unlockable software modules
- Simple configuration with Bender Connect App via NFC interface
- Customer-specific factory settings possible

### Residual current measurement

- Modular residual current device (MRCDB) in accordance with DIN EN IEC 60947-2 Annex M
- 1 channel for residual current measurement
- AC/DC-sensitive measurement with response characteristics type B and type B+ according to IEC 60755 (or VDE 0664-400) adjustable
- 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 400<sup>th</sup> harmonic (with optional function module A: harmonic analysis (FFT))
- 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 30 mA...3 A
- Configurable frequency response
- Adjustable time delays
- Fault-memory behaviour
- Start-up delay configurable
- Continuous CT-connection monitoring
- Immediate release for response value 30 mA

### Display and operation

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

## Interfaces

- Digital input (I)
- Digital input/output (Q)
- 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

### NFC interface



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



*This function is available only via the Bender Connect App. You can find this app in the App-stores 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.

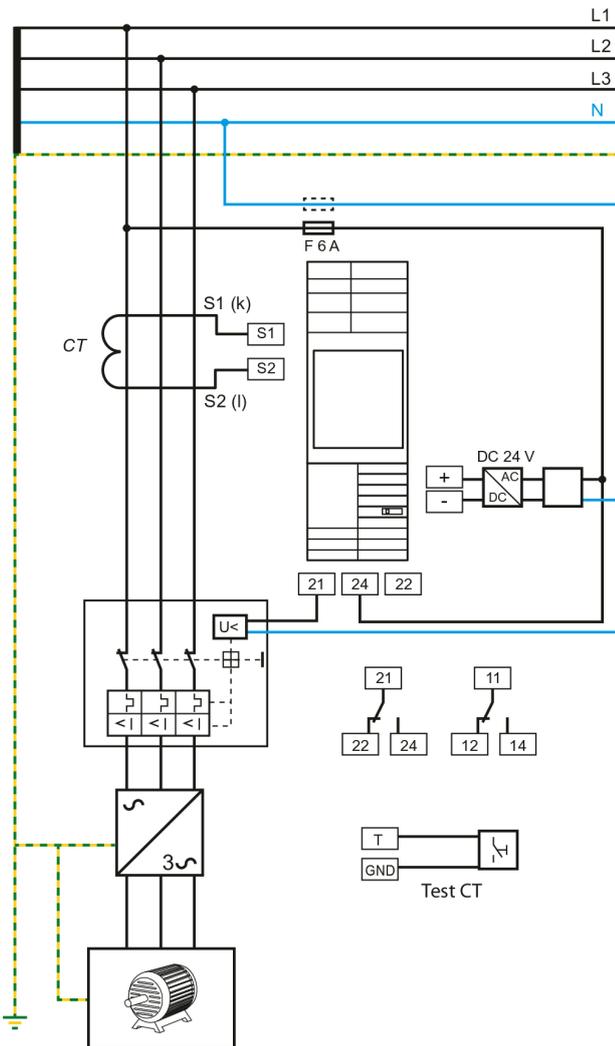
To a **de-energised** device, a parameter setting can be transferred via the Bender Connect app. This setting is then activated automatically when the device is connected to the current supply.

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.

The NFC antenna is located at the front on the righthand side of the MRCDB425-L.

**Connection diagram with undervoltage release**



Wiring diagram for undervoltage release

**DC 24 V**

MRCDB425-L and the connected CTUB102-CTBCxx must be supplied from the same power supply unit. **Alternatively**, a MRCDB425-L can be connected via terminals A1/A2 with AC 100...240 V. Fuses for US: 6 A fast

**ADVICE**



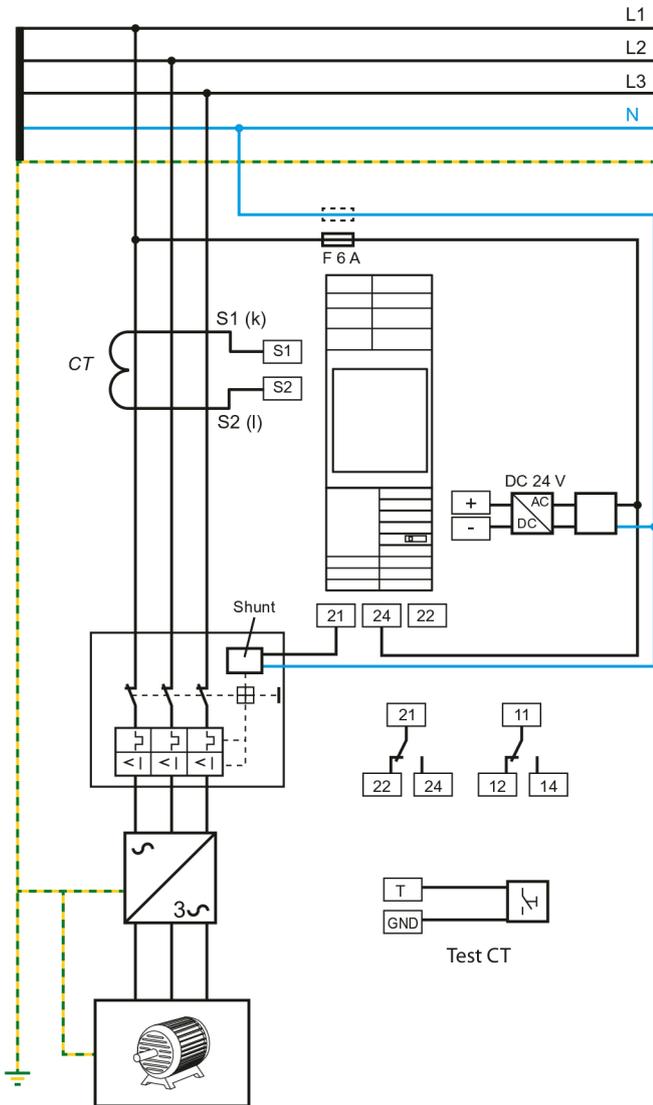
The supply voltage of the device must always be taken **before** the circuit breaker.



**For UL applications:**

The measuring current transformer must be connected **before** operation.

Connection diagram with shunt release



**DC 24 V**

MRCDB425-L and the connected CTUB102-CTBCxx must be supplied from the same power supply unit. **Alternatively**, a MRCDB425-L can be connected via terminals A1/A2 with AC 100...240 V. Fuses for US: 6 A fast

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Wiring diagram for shunt release

**Connections overview**

Top	Terminal	Description
	A1, A2	Supply voltage AC/DC
	11, 14, 12	Relay K1
	S1, S2 (CT)	Measuring-current transformer CT
	GND, T	Test measuring-current transformer

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**

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

**Definitions**

Supply circuit (IC1)	A1, A2
Measuring circuit (IC2)	+, -, A, B, M+, Q, I, GND, CT, CT Test
Control circuit (IC3)	11, 12, 14
Control circuit (IC4)	21, 22, 24
Rated voltage	250 V
Overtoltage 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...28 A
Measuring range rms	2 mA...20 A
Rated residual operating current (Type B)	3 A
Response value main alarm $I_{\Delta n}$ (Type B)	30 mA...3 A (30 mA)*
Prewarning	10...100 % $\times I_{\Delta n}$ (70 %)*
Operating uncertainty	$\pm 10$ % (at 0.5...5 $\times I_{\Delta n}$ )
Relative response uncertainty for Lloyd's applications	-20...0 % -50...0 %
Hysteresis	10...25 % (15 %)*
Fault-memory alarm messages	on/off (on)*
Permissible continuous residual current	30 A

### Measuring-current transformers

Connection	CT (S1, S2)
Measuring-current transformer series	CTUB-CTBC
CT connection monitoring	Yes
Rated voltage $U_n$	See manual of the measuring current transformer
Connecting wires	See manual of the measuring current transformer
Cable length	$\leq 10$ m

### Test connection

Connection	T, GND
Cable length	$\leq 10$ m

### Time response

Start-up delay $t$	0...900 s (0 s)*
Response delay $t_{on}$	
with $I_{\Delta n} \leq 30$ mA	0 s (fixed)
with $I_{\Delta n} > 30$ mA	0...10 s (0 s)*
Delay on release $t_{off}$	0...900 s (1 s)*
Operating time $t_{ae}$	
with 1 $\times I_{\Delta n}$	$\leq 180$ ms
with 2 $\times I_{\Delta n}$	$\leq 130$ ms
with 5 $\times I_{\Delta n}$	$\leq 20$ ms
with 10 $\times I_{\Delta n}$	$\leq 20$ ms
Response time $t_{an}$	$t_{an} = t_{ae} + t_{on}$
Recovery time $t_b$	$\leq 500$ ms
Response time for CT connection monitoring	$\leq 5$ s

### Operation

Display	status LED, alarm LEDs, channel LEDs
Display range measured value	25 / 50 / 75 / 100 %
Button T/R	reset / test / NFC / address setting
Terminating resistor DIP switches	on/off (off)*
Potentiometer $I_{\Delta n}$	0.03 A / 0.05 A / 0.1 A / 0.2 A / 0.3 A / 0.5 A / 1 A / 2 A / 3 A / EXT (EXT)*
Potentiometer $t_{on}$	0 s / 0.2 s / 0.4 s / 0.6 s / 0.8 s / 1 s / 2 s / 4 s / 10 s / EXT (EXT)*

### 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)	$\leq 1200$ m
Recommended lines, shield on one side connected to PE	
CAT6/CAT7	Min. AWG23
min. J-Y(St)Y 2 $\times$ 0.6 mm <sup>2</sup>	Twisted pair
Device address	1...247 (100 + last two digits of serial number)*

### NFC interface

Frequency	13.56 MHz
Transmitting power (modulating; in 0 m distance, e.g.) <sup>1</sup>	0 W

- <sup>1</sup>
- EMC influences may lead to communication interruptions at the NFC interface.
  - The device does not transmit any radio waves when used as intended.

### Input I

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

### Input/output Q

Connection	Q, $\perp$
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+, $\perp$
Max. cable length (recommended)	10 m
Max. load	20 mA
Burden	
Current output	$\leq 600$ Ω
Voltage output	$\geq 20$ kΩ
Tolerance with respect to final current/voltage value	$\pm 20$ %
External voltage (passive mode)	DC 0... $U_S$

### Switching elements

Relays	2 changeover contacts
Connection	11, 12, 14 21, 22, 24
Operating principle	Fail-safe or Non-fail-safe (Fail-safe)*
Maximum permitted voltage	AC 250 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 mm <sup>2</sup>
Flexible, without plastic sleeve	0.25...2.5 mm <sup>2</sup>
Flexible, with plastic sleeve	0.25...2.5 mm <sup>2</sup>
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 mm <sup>2</sup>
Flexible, without plastic sleeve	0.25...1.5 mm <sup>2</sup>
Flexible, with plastic sleeve	0.25...0.5 mm <sup>2</sup>
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	
At U <sub>S</sub> = DC 24 V	-25...+70 °C
At U <sub>S</sub> = 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**

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 MRCDB425-L device has been developed in accordance with the following standards:

- DIN EN IEC 60947-2
- 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:

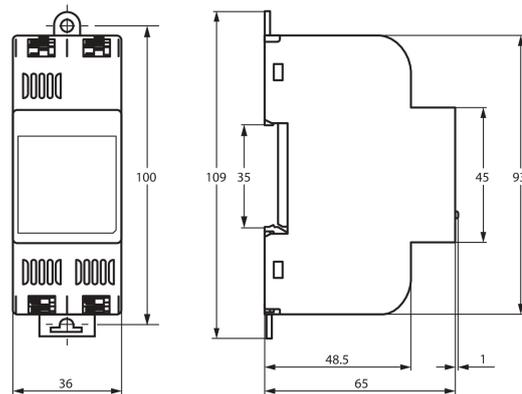
[EU declaration of conformity MRCDB425](#)

Hereby, Bender GmbH & Co. KG declares that this radio equipment complies with Radio Equipment Regulations 2017 (S.I. 2017/1206). The full text of the UK declaration of conformity is available at the following internet address:

[UKCA-Declaration of Conformity MRCDB425](#)

**Dimension diagrams**

Dimensions in mm



**Ordering information**

Type	Supply voltage $U_s$	Measuring current transformers that can be used	Art. No.
MRCDB425-L-2	DC 24 V AC/DC 100...240 V	CTUB102-CTBC...(P)	B84605030

## Suitable measuring current transformers

Type	Shielding	∅ Measuring current transformer	Supply voltage $U_s$	Art. No.
CTUB102-CTBC20	-	20 mm	DC 24 V	B78120011
CTUB102-CTBC20P	X			B78120021
CTUB102-CTBC35	-	35 mm		B78120013
CTUB102-CTBC35P	X			B78120023
CTUB102-CTBC60	-	60 mm		B78120015
CTUB102-CTBC60P	X			B78120025
CTUB102-CTBC120	-	120 mm		B78120017
CTUB102-CTBC120P	X			B78120027
CTUB102-CTBC210	-	210 mm		B78120019
CTUB102-CTBC210P	X			B78120029

Accessories		Art. No.
Sealable transparent cover (spare part)		B80609199
External 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



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Subject to change!  
The specified standards take into account the  
edition valid until 02.2026 unless otherwise  
indicated.