# MRCDB425-D

AC/DC sensitive modular residual current device
for MRCD applications


## Intended Use

Modular residual current devices of type MRCDB425-D 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 or the assignment of a PIN in the display.*

**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
- TFT display for convenient operation and configuration
- 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 (MRCD) 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$^{th}$ 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
- TFT display
  - Device status LED
  - Alarm LED
  - Full text menu
  - 4-button navigation
- 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.

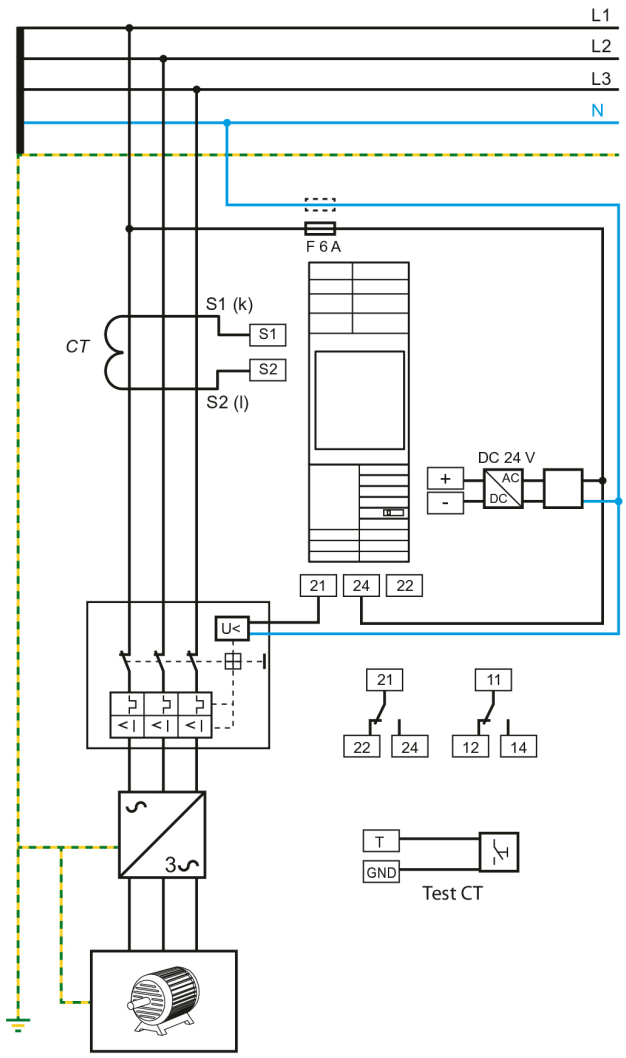
To a **de-energised** device, a parameter setting can be transferred via the Bender Connect app. This setting is then activated automatically when the device is connected to the current supply.

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-D.

## Connection diagram with undervoltage release




*Wiring diagram for undervoltage release*

**DC 24 V**

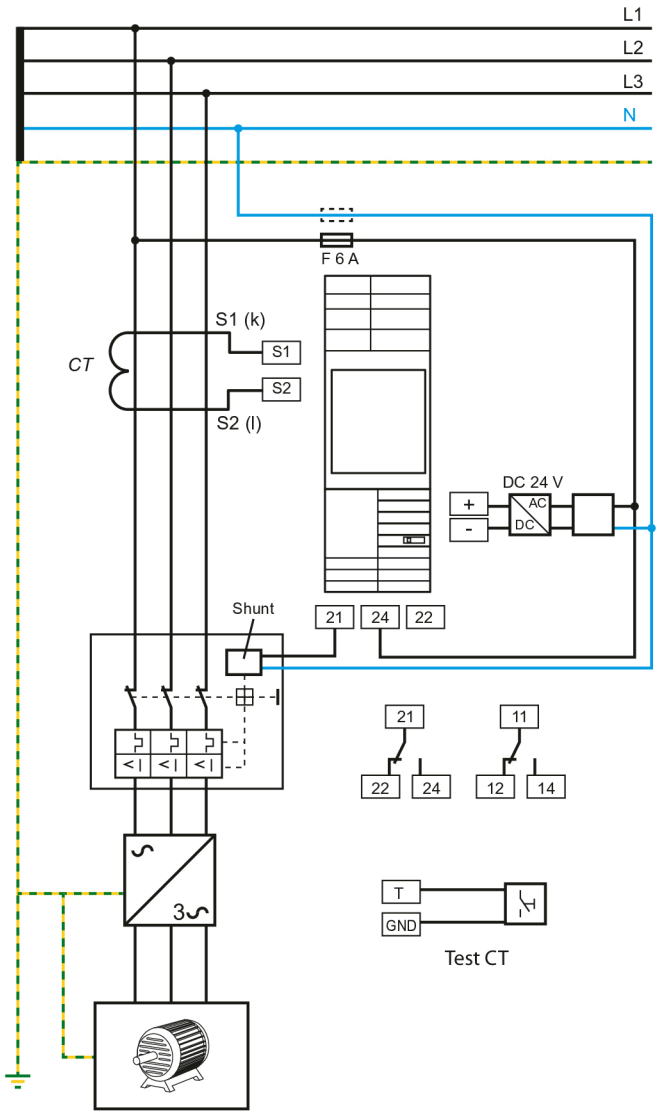
MRCDB425-D and the connected CTUB102-CTBCxx must be supplied from the same power supply unit. **Alternatively**, a MRCDB425-D can be connected via terminals A1/A2 with AC 100…240 V. Fuses for US: 6 A fast

**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




*Wiring diagram for shunt release*

**DC 24 V**

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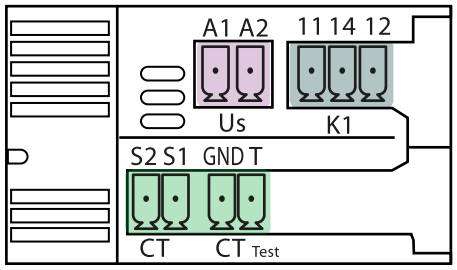
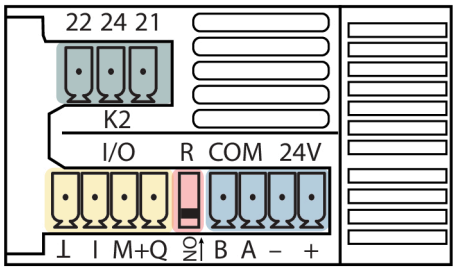
**ADVICE**

*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.*

## 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 |
| 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…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 % x $I_{\Delta n}$ (70 %)* |
| Operating uncertainty | ±10 % (at 0.5…5 x $I_{\Delta n}$) |
| Relative response uncertainty | -20…0 % |
| for Lloyd´s applications | -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 | ≤ 10 m |

### Test connection

| | |
|---|---|
| Connection | T, GND |
| Cable length | ≤ 10 m |

### Time response

| | |
|---|---|
| Start-up delay $t$ | 0…900 s (0 s)* |
| Response delay $t_{on}$ | |
| with $I_{\Delta n}$ ≤ 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 x $I_{\Delta n}$ | ≤ 180 ms |
| with 2 x $I_{\Delta n}$ | ≤ 130 ms |
| with 5 x $I_{\Delta n}$ | ≤ 20 ms |
| with 10 x $I_{\Delta n}$ | ≤ 20 ms |
| Response time $t_{an}$ | $t_{an} = t_{ae} + t_{on}$ |
| Recovery time $t_b$ | ≤ 500 ms |
| Response time for CT connection monitoring | ≤ 5 s |

### Operation

| | |
|---|---|
| Display | status LED, alarm LED, display |
| Taster | ESC |
| | ∧ / T (< 2.5 s) |
| | ∨ / R (> 2.5 s) |
| | OK/MENU |
| 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 (modulating; in 0 m distance, e.g.)[1] | 0 W |

[1]
- 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, ⊥ |
| 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 | ≥ 20 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<br>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 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 | -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 | ≤ 125 g |

## Approvals

### Standards & certifications

The MRCDB425-D 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:

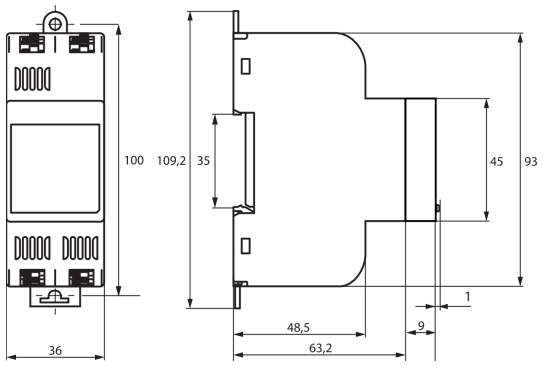
EU declaration of conformity MRCDB425

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-D-2 | DC 24 V<br>AC/DC 100…240 V | CTUB102-CTBC…(P) | B84606030 |

Suitable measuring current transformers

| Type | Shielding | ø 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) | | B80609299 |
| 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.