The Power in Electrical Safety
In the past 75 years we have learnt thinking ahead in a strategic and forward-looking way and to consider today what customers are going to need tomorrow. Innovative solutions and service activities, excellent know-how global expertise when it comes to electrical safety provide answers to the challenges of various application areas. With over 1109 employees we are globally present in over 70 countries.
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<td>AC, 3(N)AC 0…690 V (60 Hz)</td>
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### Suitable system components

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## Insulation monitoring devices | Device overview

### Suitable system components

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**Table 1: Device Overview**

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<th>Installations with a high level of insulation</th>
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<th>Railway</th>
<th>AC, DC or AC/DC medium voltage systems</th>
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<td>AC, 3(N)AC, DC 0…15.5 kV (absolute)</td>
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### Suitable systems

- ISOMETER® iso685-…
- ISOMETER® iso685-…-B
- ISOMETER® iso685-…-P
- ISOMETER® iso685-…
- ISOMETER® isoHR685W-…-B
- ISOMETER® isoRW685W-D
- ISOMETER® isoRW685W-D-B
- ISOMETER® IRDH275BM-7

### Special applications

- Quick response to combined resistance and offset voltage measurement
- De-energised loads/frequency converters
- Installations with a high level of insulation
- Railway AC, DC or AC/DC medium voltage systems

### Voltage system

- 3(N)AC 0…690 V
- AC 0…690 V
- DC 0…1000 V
- AC, 3(N)AC 0…690 V, DC 0…1000 V
- AC, 3(N)AC 0…690 V, DC 0…1300 V
- AC, 3(N)AC, DC 0…15.5 kV

### Nominal system voltage

- Uₙ
- AC, 3(N)AC 0…690 V
- DC 0…1000 V
- AC, 3(N)AC 0…690 V, DC 0…1300 V
- AC, 3(N)AC, DC 0…15.5 kV

### Tolerance of Uₙ

- + 15 %
- + 15 %
- + 15 %
- + 15 %
- + 15 %

### System leakage capacitance Cₑ µF

- ≤ 1000
- ≤ 1000
- ≤ 1000
- ≤ 1000
- ≤ 1000

### Response value Rₑ kΩ

- 1…10000
- 1…10000
- 1…10000
- 100…10000
- 10…10000
- 10…10000
- 10…10000

### Coupled systems

- -
- -
- -
- -

### Locating current injector for insulation fault location

- -
- -
- -
- -

### Installation

- DIN rail
- Screw mounting
- Panel mounting/wall fastening

### Interfaces

- Web server
- Modbus TCP/RTU
- BCOM
- BS
- BMS
- isoData

### Product details

More information available on www.bender.de/en
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<td>AC/DC 0…300 V</td>
<td>AC 0…1000 V, DC 0…1500 V</td>
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**Type C.p. Suitable system components**

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**Suitable system components**

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## Device overview insulation monitoring devices ISOMETER®

<table>
<thead>
<tr>
<th>ISOMETER® IR427</th>
<th>ISOMETER® isoMED427P</th>
<th>ISOMETER® isoLR27S</th>
<th>ISOMETER® isoPV</th>
<th>ISOMETER® isoPV425</th>
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</table>

### Special applications

- **Control circuits**
  - Medical locations
  - Medical locations
  - Installations with a low level of insulation
  - Photovoltaic
  - Photovoltaic

- **Auxiliary circuits**
  - Installations with a low level of insulation
  - Photovoltaic
  - Photovoltaic

- **Main circuits**
  - Installations with a low level of insulation
  - Photovoltaic
  - Photovoltaic

### Voltage system

- **3(N)AC**
  - Installations with a low level of insulation
  - Photovoltaic
  - Photovoltaic

- **AC**
  - Installations with a low level of insulation
  - Photovoltaic
  - Photovoltaic

- **AC/DC**
  - Installations with a low level of insulation
  - Photovoltaic
  - Photovoltaic

- **DC**
  - Installations with a low level of insulation
  - Photovoltaic
  - Photovoltaic

### Nominal system voltage \( U_n \)

- **AC 70…330 V**
- **AC 70…230 V**
- **via AGH-LR 3(N)AC 0…690 V DC 0…1000 V**
- **via AGH-PV 3(N)AC 0…793 V DC 0…1000 V**
- **DC 0…1000 V, AC 0…690 V, 15…460 Hz**
- **DC 0…1000 V**
- **DC 0…1500 V offline (AC 0…400 V)**
- **AC 0…250 V AC 100…250 V 3(N)AC, AC 0…400 V, DC 0…400 V**
- **AC 0…250 V**
- **AC 0…250 V**
- **AC 0…250 V**

### Tolerance of \( U_n \)

- + 15 %
- + 15 %
- + 15 %
- + 10 %
- + 10 %
- + 15 %

### System leakage capacitance \( C_{le} \) µF

- ≤ 5
- ≤ 5
- ≤ 500
- ≤ 2000
- ≤ 500

### Response value \( R_{an} \) kΩ

- 50…500
- 50…500 kΩ
- 0.2…100
- 0.2…100
- 1…990

### Coupled systems

- -
- -
- -
- -

### Locating current injector for insulation fault location

- -
- -
- -
- -

### Installation

- **DIN rail**
  - Installations with a low level of insulation
  - Photovoltaic
  - Photovoltaic

- **Screw mounting**
  - Installations with a low level of insulation
  - Photovoltaic
  - Photovoltaic

- **Panel mounting/wall fastening**
  - Installations with a low level of insulation
  - Photovoltaic
  - Photovoltaic

### Interfaces

- **Web server**
  - Installations with a low level of insulation
  - Photovoltaic
  - Photovoltaic

- **Modbus**
  - Installations with a low level of insulation
  - Photovoltaic
  - Photovoltaic

- **BCom**
  - Installations with a low level of insulation
  - Photovoltaic
  - Photovoltaic

- **BS**
  - Installations with a low level of insulation
  - Photovoltaic
  - Photovoltaic

- **BMS**
  - Installations with a low level of insulation
  - Photovoltaic
  - Photovoltaic

- **isoData**
  - Installations with a low level of insulation
  - Photovoltaic
  - Photovoltaic

### Product details

(Product on [www.bender.de/en](http://www.bender.de/en))

### Suitable system components

<table>
<thead>
<tr>
<th>Type</th>
<th>C. p.</th>
<th>Suitable system components</th>
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<tbody>
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<td>FP200</td>
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<tr>
<td>AGH150W-4</td>
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<td>AGH204S-4</td>
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<tr>
<td>AGH520S</td>
<td>355</td>
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<td>AGH675S-7</td>
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<tr>
<td>AGH676S-4</td>
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### Suitable system components

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<th>Photovoltaic</th>
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<th>Disconnected loads</th>
<th>Mobile generators</th>
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<th>Generators acc. to standard DIN VDE 0100-551</th>
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</tbody>
</table>

**Nominal system voltage**

- **AC** 70…330 V
- **AC** 70…230 V
- 3(N)AC 0…690 V
- DC 0…1000 V
- DC 0…400 V
- DC 0…250 V
- AC 0…400 V
- AC 100…250 V

**System leakage capacitance**

- **C** µF
- ≤ 5
- ≤ 2000

**Response value**

- **R** an k Ω
- 50…500
- 0.2…100
- 0.2…990
- 100…10000
- 46/23
- 5…200

**Coupled systems**

- Locating current injector

**Installation**

- DIN rail
- Screw mounting

**Interfaces**

- Web server
- Modbus RTU
- BCOM
- BMS
- isoData

**Product details**

(Products on www.bender.de/en)
## Device overview insulation monitoring devices ISOMETER®

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<th>123</th>
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<tr>
<td>Special applications</td>
<td>Railway</td>
<td>Unearthed DC systems</td>
<td>Energy storage VDE-AR-E 2510-2</td>
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<td>AC/DC 0…400 V</td>
<td>DC 12…120 V</td>
<td>3(N)AC, AC 0…400 V, DC 0…400 V</td>
<td>with AGH422 AC 0…1000 V, DC 0…1000 V</td>
<td>DC 0…1000 V</td>
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### Coupling devices

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<td>+ 10 % + 15 %</td>
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<td>≤ 5</td>
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<td>10…990</td>
<td>23 kΩ</td>
<td>120 kΩ</td>
<td>30 kΩ…1 MΩ; 40 kΩ…2 MΩ</td>
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<td>46 kΩ</td>
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### Suitable system components

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**ISOMETER® iso685-…**

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems)

### Device features

- ISOMETER® for IT AC systems with galvanically connected rectifiers or inverters and for IT DC systems (IT = unearthed systems)
- Automatic adaptation to the existing system leakage capacitance
- Combination of AMPPlus and other profile-specific measurement methods
- Two separately adjustable response value ranges of 1 kΩ…10 MΩ
- High-resolution graphical LC display
- Connection monitoring (monitoring of the measuring lines)
- Automatic device self test
- Graphical representation of the insulation resistance over time (isoGraph)
- History memory with real-time clock (buffer for three days) for storing 1023 alarm messages with date and time
- Freely programmable digital inputs and outputs
- Remote setting via the Internet or Intranet (Webserver/Option: COMTRAXX® gateway)
- Worldwide remote diagnosis via the Internet (made available by Bender Service only)
- RS-485/BS (Bender sensor bus) for data exchange with other Bender devices
- BCOM, Modbus TCP/RTU and web server
- Voltage expandable via coupling devices

### Device variants

- **iso685-D**
The device version iso685-D features a high-resolution graphic LC display and control elements for direct operating of the device functions.

- **iso685-S**
The device version iso685-S neither features a display nor a control unit. It can only be used in combination with FP200 and is indirectly operated via this front panel.

- **Option “W”**
Device variants with Option “W” are available for extreme climatic and mechanical conditions.

### Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8

### Ordering information

For further information refer to our product range on www.bender.de.
Suitable system components

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<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
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<td>Device version without display</td>
<td>iso685-S</td>
<td>B91067110</td>
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<tr>
<td>Display for front panel mounting</td>
<td>iso685W-S</td>
<td>B91067110W</td>
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<tr>
<td>Coupling devices</td>
<td>AGH130W-4</td>
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<td>AGH9130S-4</td>
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</table>

Suitable measuring instruments on request!

Measuring circuit

<table>
<thead>
<tr>
<th>Measuring voltage $U_n$</th>
<th>profile dependent, $\pm 10 V$, $\pm 50 V$ (see profile overview)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring current $I_m$</td>
<td>$\leq 400 \mu A$</td>
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<tr>
<td>Internal resistance $R$, $Z$</td>
<td>$\geq 124 k \Omega$</td>
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<tr>
<td>Permissible extraneous DC voltage $U_{dc}$</td>
<td>$\leq 1200 V$</td>
</tr>
<tr>
<td>Permissible system leakage capacitance $C_L$</td>
<td>profile dependent, $0 \ldots 1000 \mu F$</td>
</tr>
</tbody>
</table>

Measuring ranges

<table>
<thead>
<tr>
<th>Measuring range $f_n$</th>
<th>0.1 ... 460 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolerance measurement of $f_n$</td>
<td>$\pm 1 % \pm 0.1 Hz$</td>
</tr>
<tr>
<td>Voltage range measurement of $f_n$</td>
<td>$AC 25 ... 690 V$</td>
</tr>
<tr>
<td>Measuring range $f_n$</td>
<td>$AC 25 ... 690 V$</td>
</tr>
<tr>
<td>Tolerance measurement of $f_n$</td>
<td>$DC 25 ... 1000 V$</td>
</tr>
<tr>
<td>Measuring range $C_L$</td>
<td>$DC \ldots 10 V$</td>
</tr>
<tr>
<td>Tolerance measurement of $C_L$</td>
<td>$\pm 10 % \pm 10 \mu F$</td>
</tr>
<tr>
<td>Frequency range measurement of $C_L$</td>
<td>$DC 30 ... 460 Hz$</td>
</tr>
<tr>
<td>Min. insulation resistance measurement of $C_L$</td>
<td>depending on the profile and coupling mode, typ. $&gt; 10 k \Omega$</td>
</tr>
</tbody>
</table>

Display

<table>
<thead>
<tr>
<th>Display range measured value</th>
<th>$0.1 k \Omega ... 20 k \Omega$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating uncertainty (according to IEC 61557-8)</td>
<td>$\pm 15 %$, at least $\pm 1 k \Omega$</td>
</tr>
</tbody>
</table>

LEDs

<table>
<thead>
<tr>
<th>On (operation LED)</th>
<th>green</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service light</td>
<td>yellow</td>
</tr>
<tr>
<td>Alarm 1</td>
<td>yellow</td>
</tr>
<tr>
<td>Alarm 2</td>
<td>yellow</td>
</tr>
</tbody>
</table>

In-/Outputs (X1-Interface)

<table>
<thead>
<tr>
<th>Cable length X1 (unshielded cable)</th>
<th>$\leq 10 m$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total max. supply output current for each output (device supplied by X1+/+X1/GND) max. $1 A$</td>
<td>$\leq 100 m$</td>
</tr>
<tr>
<td>Total max. supply output current on X1 (device supplied by X1+/+X1/GND) max. $1 A$</td>
<td>$\leq 100 m$</td>
</tr>
<tr>
<td>Power consumption, typically DC</td>
<td>$\leq 12 W$</td>
</tr>
<tr>
<td>Power consumption, typically $50/60 Hz$</td>
<td>$\leq 12 W/21 VA$</td>
</tr>
<tr>
<td>Power consumption, typically $400 Hz$</td>
<td>$\leq 12 W/45 VA$</td>
</tr>
</tbody>
</table>

Cable length X1 (shielded cable, shield connected to earth (PE) on one end, recommended: $1.5 \times (XY mm), 2 \times (80 mm)$ |

Digital Inputs (I1, I2, I3)

<table>
<thead>
<tr>
<th>Number</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating mode, adjustable</td>
<td>active high, active low</td>
</tr>
<tr>
<td>Functions</td>
<td>off, test, reset, deactivate device, start initial measurement</td>
</tr>
<tr>
<td>Voltage</td>
<td>Low DC $-3 ... 5 V$, High DC $11 ... 32 V$</td>
</tr>
<tr>
<td>Tolerance Voltage</td>
<td>$\pm 10 %$</td>
</tr>
</tbody>
</table>

Digital Outputs (Q1, Q2)

<table>
<thead>
<tr>
<th>Number</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating mode, adjustable</td>
<td>active, passive</td>
</tr>
<tr>
<td>Functions</td>
<td>off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm $+$, DC+ alarm $-$, symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm</td>
</tr>
<tr>
<td>Voltage</td>
<td>passive DC $0 ... 32 V$, active DC $0/19.2 ... 32 V$</td>
</tr>
</tbody>
</table>

Analog Output (M+–)

<table>
<thead>
<tr>
<th>Number</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating mode</td>
<td>linear, msd scale point $28 k \Omega/120 k \Omega$</td>
</tr>
<tr>
<td>Functions</td>
<td>insulation value, DC offset</td>
</tr>
<tr>
<td>Current</td>
<td>$0 ... 20 mA ($&lt; 600 \Omega$), $4 ... 20 mA ($&lt; 600 \Omega$), $0 ... 400 \mu A ($&lt; 4 \kOmega$)</td>
</tr>
<tr>
<td>Voltage</td>
<td>$0 ... 10 V ($&gt; 1 k \Omega$), $2 ... 10 V ($&gt; 1 k \Omega$)</td>
</tr>
<tr>
<td>Tolerance related to the current/voltage final value</td>
<td>$\pm 20 %$</td>
</tr>
</tbody>
</table>
Technical data (continued)

Interfaces

Field bus:
- Interface/protocol: web server/Modbus TCP/BCOM
- Data rate: 10/100 Mbit/s, autodetect
- Max. amount Modbus requests: ≤ 1000
- Cable length: ≤ 100 m
- Connection: RJ45
- IP address: DHCP/manual 192.168.0.5
- Network mask: 255.255.255.0
- BCOM address: 95system-1-0
- Function: communication interface

Sensor bus:
- Interface/protocol: RS-485/BS/Modbus RTU
- Data rate: 9.6 kBaud/s
- Cable length: ≤ 1200 m
- Connection terminals X1, X2, X3
- Terminating resistor at the beginning and at the end of the transmission path
- Device address, BS bus: 1…90

Switching elements
- Number of switching elements: 2 changeover contacts
- Operating mode: N/C operation/N/O operation
- Contact 1-12-14/21-22-24: off, Ins. alarm 1, Ins. alarm 2, connection fault, DC - alarm 4, symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm
- Electrical endurance under rated operating conditions, number of cycles: 10.000

Contact data acc. to IEC 60947-5-1:
- Utilisation category: AC-13 AC-14 DC-12 DC-12 DC-12 DC-12
- Rated operational voltage: 230 V 230 V 24 V 48 V 110 V 220 V
- Rated operational current: 5 A 3 A 1 A 1 A 0.2 A 0.1 A
- Rated insulation voltage: ≤ 2000 m NN 250 V
- Rated insulation voltage: ≤ 3000 m NN 160 V
- Minimum contact rating: 1 mA at AC/DC ≥ 10 V

Condiciones Ambientales/Compatibilidad electromagnética
- CEM: IEC 61326-2-4 6)
- Ambient temperatures:
  - Operating temperature: -25…+55 °C
  - Transport: -40…+85 °C
  - Long-term storage: -40…+70 °C
- Classification of climatic conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3K23 (except condensation and formation of ice)
  - 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
  - Area of application: ≤ 3000 m NN

Dimensions (dimensions in mm)

Connection to FP200
### Wiring diagram

1. Connection to an AC system $U_n$
2. Connection to a DC system $U_n$
3. Connection to an IT system with coupling device
4. Connection to a 3(N)AC system
5. Connection to the IT system to be monitored (L1/+, L2, L3/-)
6. Separate connection of KE, E to PE
7. (K1) Alarm relay 1, available changeover contacts

**Provide line protection!**

According to DIN VDE 0100-430, a line protection shall be provided for the supply voltage.

**NOTE:**

According to DIN VDE 0100-430, devices for protection against a short circuit can be omitted for the coupling of terminals L1/+ and L3/- to the IT system $\leq 690$ V to be monitored if the wiring is carried out in such a manner as to reduce the risk of a short circuit to a minimum. (Recommendation: Ensure short-circuit-proof and earth-fault-proof wiring).

The connecting lines L1/+, L2, L3/- to the system to be monitored must be carried out as spur lines. No load current may be conducted through the terminals.

**For UL applications:**

Use 60/70°C copper lines only! UL and CSA application require the supply voltage to be protected via 5 A fuses.

### Digital interface X1

<table>
<thead>
<tr>
<th>Digital interface</th>
<th>Terminal</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I1</td>
<td>Input 1</td>
</tr>
<tr>
<td></td>
<td>I2</td>
<td>Input 2</td>
</tr>
<tr>
<td></td>
<td>I3</td>
<td>Input 3</td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>RS-485 A</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>RS-485 B</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>+24 V</td>
</tr>
<tr>
<td></td>
<td>Q1</td>
<td>Output 1</td>
</tr>
<tr>
<td></td>
<td>Q2</td>
<td>Output 2</td>
</tr>
<tr>
<td></td>
<td>M+</td>
<td>Analogue output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ground</td>
</tr>
</tbody>
</table>

For systems $> 690$ V and with overvoltage category III a fuse for the connection to the system to be monitored must be provided. Recommendation: 2A screw-in fuses.
**ISOMETR® iso685-…-B**

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems)

### Device features
- ISOMETR® for IT AC systems with galvanically connected rectifiers or inverters and for IT DC systems (IT = unearthed systems)
- Automatic adaptation to the existing system leakage capacitance
- Combination of AMPplus and other profile-specific measurement methods
- Two separately adjustable response value ranges of 1 kΩ…10 MΩ
- High-resolution graphic LC display for excellent readability and recording of the device status
- Connection monitoring (monitoring of the measuring lines)
- Automatic device self test
- Graphical representation of the insulation resistance over time (isoGraph)
- History memory with real-time clock (buffer for three days) for storing 1023 alarm messages with date and time
- Current or voltage output 0(4)…20 mA, 0…400 μA, 0…10 V, 2…10 V (galvanically separated), which is analogous to the measured insulation value of the system
- Freely programmable digital inputs and outputs
- Remote setting via the Internet or Intranet (Webserver/Option: COMTRAXX® Gateway).
- Worldwide remote diagnosis via the Internet
- RS-485/BS (Bender sensor bus) for communication with other Bender devices
- ISOnet: Internal separation of the ISOMETR® from the IT system to be monitored (e.g. if several IT systems are interconnected)
- BCOM, Modbus TCP/RTU and web server
- Voltage expandable via coupling devices

### Device variants
- iso685-D-B
  This device variant features a high-resolution graphic LC display and operating controls for direct operation of the device functions. It cannot be combined with an FP200.
- iso685-S-B
  This device variant features neither a display nor operating controls. It can only be used in combination with the FP200 and it is operated via this front panel.
- Option “W”
  The ISOMETR®s with and without integrated display are available with option “W” for extreme climatic and mechanical conditions (ISOMETR® iso685W-D-B and iso685W-S-B).

### Standards
The ISOMETR® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8

### Further information
For further information refer to our product range on www.bender.de.

### Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage range $U_n$</th>
<th>Supply voltage $U_s$</th>
<th>Display</th>
<th>Option “W”</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 0…690 V; 1…460 Hz</td>
<td>AC 0…1000 V</td>
<td>iso685-D-B</td>
<td>-</td>
<td>B91067020</td>
<td></td>
</tr>
<tr>
<td>DC 24…240 V; 50…400 Hz</td>
<td>DC 24…240 V</td>
<td>iso685W-D-B</td>
<td>-</td>
<td>B91067020W</td>
<td></td>
</tr>
<tr>
<td>AC iso685-S-B +FP200</td>
<td>-40…+70 °C, 3K23, 3M12</td>
<td>iso685W-S-B +FP200</td>
<td>-</td>
<td>B91067220W</td>
<td></td>
</tr>
<tr>
<td>DC iso685W-S-B +FP200W</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>
**Suitable system components**

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device version without display</td>
<td>iso685S-S-B</td>
<td>B91067120</td>
<td>–</td>
</tr>
<tr>
<td>Display for front panel mounting</td>
<td>iso685W-S-B</td>
<td>B91067120W</td>
<td>–</td>
</tr>
<tr>
<td>Coupling devices</td>
<td>AGH150W-4</td>
<td>B98018006</td>
<td>352</td>
</tr>
<tr>
<td>AGH204S-4</td>
<td>B914013</td>
<td>354</td>
<td></td>
</tr>
<tr>
<td>AGHS205S</td>
<td>B913033</td>
<td>355</td>
<td></td>
</tr>
<tr>
<td>AGH6765-4</td>
<td>B913053</td>
<td>358</td>
<td></td>
</tr>
</tbody>
</table>

**Suitable measuring instruments on request!**

---

**Technical data**

**Insulation coordination according to IEC 60664-1/IEC 60664-3**

Definitions:
- Measuring circuit (IC1) L1/, L2, L3/
- Supply circuit (IC2) A1, A2
- Output circuit 1 (IC3) 11, 12, 14
- Output circuit 2 (IC4) 21, 22, 24
- Control circuit (IC5) (E, KE), (X1, ETH, X3, X4)

**Rated voltage**
- 1000 V

**Overvoltage category**
- III

**Rated impulse voltage:**
- IC1/(IC2-5) 8 kV
- IC3/(IC4-5) 4 kV

**Rated insulation voltage:**
- IC1/(IC2-5) 1000 V
- IC2/(IC3-5) 1000 V
- IC3/(IC4-5) 250 V
- IC4/IC5 250 V
- IC1/(IC2-5) 250 V

**Pollution degree for accessible parts on the outside of the device housing (Un < 690 V):**
- 3

**Pollution degree for accessible parts on the outside of the device housing (Un >690 V):**
- 2

**Protective separation (insulation reinforced) between:**
- Overvoltage category III, 1000 V
- Overvoltage category III, 300 V
- Overvoltage category III, 300 V

**Voltage test (routine test) according to IEC 61010-1:**
- Max. AC voltage
  - Measuring circuit (IC1) L1/+, L2, L3/-
  - Voltage range measurement of Un
    - AC/DC 0…690 V
  - Frequency range of Un
    - DC, 50…400 Hz

**Frequency range measurement of Un:**
- DC, 0…1000 Hz

**Measuring voltage:**
- profile dependent, ≤10 V, ±50 V (see profile overview)

**Measuring current Un:**
- profile dependent, ±10 %, ±10 μF

**Response value an1 (alarm 1):**
- 1 kΩ

**Hysteresis:**
- 25 %

**Time response:**
- Response time tmax at Rl = 0.5 x Rmax (tmax > 10 kΩ) and Cn = 1 μF according to IEC 61557-8
  - profile dependent, typ. 4 s
- Response time DC alarm at Cn = 1 μF
  - profile dependent, typ. 2 s
- Start-up delay 
  - 0…600 s

**Control circuit (IC5) (E, KE), (X1, ETH, X3, X4):**
- Output circuit 2 (IC4) 21, 22, 24
- Supply circuit (IC2) A1, A2
- Internal resistance R, Zn ≥ 124 kΩ
- Internal resistance on decoupled systems (inactive by I/O, inactive by ISOnet or cut-off) typ. 50 MΩ
- Permissible extraneous DC voltage Un ≤ 1200 V
- Permissible system leakage capacitance Cn profile dependent, 0…10 kμF

**Measuring ranges:**
- Measuring range Un
  - 0.1…460 Hz
  - Tolerance measurement of Un
    - ±1 % ±0.1 Hz
  - Voltage range measurement of Un
    - AC 25…690 V
  - Measuring range Un
    - AC 25…690 V
  - Voltage range measurement of Un
    - AC 10…690 V

**Total max. supply output current on X1 (device supplied by X1.+/X1.GND):**
- max. 1 A

**Total max. supply output current on X1 (device supplied by A1+/A2-) max. 200 mA

**Total max. supply output current on X1 (device supplied by A1+/A2- between 16,8 V and 40 V):**
- max. 200 mA

**Total max. supply output current on X1 (device supplied by A1+/A2- between 16,8 V and 40 V):**
- max. 200 mA

**Internal resistance on decoupled systems (inactive by I/O, inactive by ISOnet or cut-off):**
- typ. 50 MΩ

**Permissible extraneous DC voltage:**
- Un ≥ 1200 V

**Supply voltage:**
- Supply voltage range Un
  - AC/DC 24…240 V
  - Tolerance of Un
    - -30…+15 %

**Frequency range of Un:**
- DC, 50…400 Hz

**Tolerance of the frequency range of Un:**
- ±5…+15 %

**Power consumption, typically DC:**
- ≤ 12 W

**Power consumption, typically 56/60 Hz:**
- ≤ 12 W/22 VA

**Power consumption, typically 400 Hz:**
- ≤ 12 W/45 VA

**Supply via X1:**
- Supply voltage Un
  - DC 24 V
  - Tolerance of Un
    - DC -20…+25 %

**IT system being monitored:**
- Nominal system voltage range Un
  - AC 0…690 V
  - DC 0…1000 V
  - AC/DC 0…600 V (for UL applications)

**Tolerance of Un:**
- AC/DC ±15 %

**Frequency range of Un:**
- DC, 0…160 Hz

**Max. AC voltage Ue in the frequency range 0.1…4 Hz:**
- Ue max = 50 V Hz² *(1 + f)²

**Response values:**
- Response value Rn1 (alarm 1)
  - 1 kΩ…10 MΩ
- Response value Rn2 (alarm 2)
  - 1 kΩ…10 MΩ

**Relative uncertainty (acc. to IEC 61557-8):**
- profile dependent, ±15 %, at least ±1 kΩ

**Hysteresis:**
- 25 %, at least ±1 kΩ

**Display range measured value:**
- 0.1 kΩ…200 MΩ

**Operating uncertainty (according to IEC 61557-8):**
- ±15 %, at least ±1 kΩ

**LEDs:**
- ON (operation LED)
  - green
- SERVICE
  - yellow
- ALARM 1
  - yellow
- ALARM 2
  - yellow

**/In-Outs (X1-Interface):**
- Cable length X1
  - Cable length X1 (shielded cable, shield connected to earth (PE) on one end, recommended)
  - ≤ 10 m
  - Cable length X1 (shielded cable, shield connected to earth (PE) on one end, recommended)
  - ≤ 10 m
  - Cable length X1 (shielded cable, shield connected to earth (PE) on one end, recommended)
  - ≤ 10 m
  - Cable length X1 (shielded cable, shield connected to earth (PE) on one end, recommended)
  - ≤ 10 m

**Total max. supply output current on X1 (device supplied by X1.+/X1.GND):**
- max. 1 A

**Total max. power supply output current on X1 (device supplied by A1+/A2-):**
- max. 200 mA

**Total max. power supply output current on X1 (device supplied by A1+/A2- between 16,8 V and 40 V):**
- max. 200 mA

**Display range measured value:**
- 0.1 kΩ…200 MΩ

**Operating uncertainity (according to IEC 61557-8):**
- ±15 %, at least ±1 kΩ

**Digital Inputs (I1, I2, I3):**
- Number
  - 3
- Operating mode, adjustable
  - active high, active low
- Functions
  - off, test, reset, deactivate device, start initial measurement

**Voltage:**
- Low DC 3…5 V
- High DC 11…32 V

**Tolerance Voltage:**
- ±10 %

**Digital Outputs (Q1, Q2):**
- Number
  - 2
- Operating mode, adjustable
  - active, passive
- Functions
  - off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm 3, DC+ alarm 4, symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm

**Voltage:**
- passive DC 0…32 V
- active DC 0/19.2…32 V

**Analogical Output (M+):**
- Number
  - 1
- Operating mode
  - linear, mscale definition 28 kΩ/120 kΩ
- Functions
  - insulation value, DC offset current
  - 0…20 mA (< 600 CL), 4…20 mA (< 600 CL), 0…400 μA (< 4 kΩ)
- Voltage
  - 0…10 V (< 1 kΩ), 2…10 V (< 1 kΩ)

**Tolerance related to the current/voltage final value:**
- ±20 %

---

**Accessories**

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A set of screw terminals</td>
<td>B91067901</td>
</tr>
<tr>
<td>A set of push-wire terminals</td>
<td>B91067902</td>
</tr>
<tr>
<td>Enclosure accessories (terminal cover, 2 mounting clips)</td>
<td>B91067903</td>
</tr>
<tr>
<td>Transparent cover 144x72 (IP65) for FP200</td>
<td>B98060005</td>
</tr>
</tbody>
</table>

---

1. included in the scope of delivery
2. If the "transparent front cover 144x72 (IP65)" is used, the cutout in the control cabinet must be increased in height from 66 mm to 68 mm (+ 0.7 / -0 mm).
Interfaces

Field bus:
- Interface/protocol: web server/Modbus TCP/BCOM
- Data rate: 10/100 Mbit/s, autodetect
- Max. amount Modbus requests: < 1000
- Cable length: ≤ 100 m
- Connection: RS485
- IP address: DHCP/manual 192.168.0.5
- Network mask: 255.255.255.0
- BCOM address: system-1-0
- Function: communication interface

ISOnet:
- Number ISOnet devices: ≤ 20
- Max. nominal system voltage range ISOnet: AC 690 V; DC 1000 V

Sensor bus:
- Interface/protocol: RS-485/BS/Modbus RTU
- Data rate: 9.6 kBaud/s
- Cable length: ≤ 1200 m
- Cable: twisted pair, one end of shield connected to PE
- Terminating resistor at the beginning and at the end of the transmission path
- Cable: recommended: J-Y(St)Y min. 2x0.8
- Cable length: ≤ 1200 m
- Data rate: 9.6 kBaud/s
- Interface/protocol: RS-485/BS/Modbus RTU
- Sensor bus:
  - Max. nominal system voltage range ISOnet AC 690 V; DC 1000 V
  - Number ISOnet devices: ≤ 20
  - ISOnet:
    - Function: communication interface

Technical data (continued)

Switching elements
- Number of switching elements: 2 changeover contacts
- Operating mode: N/C operation/N/O operation
- Contact:
  - 11-12-14/21-22-24
    - off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm 4)
    - symmetrical alarm, device fault, common alarm,
      measurement complete, device inactive, DC offset alarm
- Terminating resistor at the beginning and at the end of the transmission path
- Device address, BS bus: 1…90
- Terminating resistor at the beginning and at the end of the transmission path
- 120 Ω, can be connected internally
- Maximum ambient temperature: 60 °C
- Electrical endurance under rated operating conditions, number of cycles: 10.000

Contact data acc. to IEC 60947-5-1:
- Utilisation category:
  - AC-13
  - AC-14
  - DC-12
  - DC-12
  - DC-12
  - DC-12
- Rated operational voltage:
  - 230 V
  - 230 V
  - 24 V
  - 48 V
  - 110 V
  - 220 V
- Rated operational current:
  - 5 A
  - 3 A
  - 1 A
  - 1 A
  - 0.2 A
  - 0.1 A
- Rated insulation voltage:
  - ≤ 2000 m NN: 250 V
  - ≤ 3000 m NN: 500 V
- Minimum contact rating:
  - 1 mA at AC/DC ≥ 10 V

Environment/EMC
- EMC:
  - IEC 61326-2-4 5)
- Ambient temperatures:
  - Operating temperature:
    - -25...+65 °C
  - Transport:
    - -40...+85 °C
  - Long-term storage:
    - -40...+70 °C
- Classification of climatic conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3):
    - 3K23 (except condensation and formation of ice)
  - Transport (IEC 60721-3-2):
    - 4K11
  - Long-term storage (IEC 60721-3-1):
    - 5K22
- 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
  - Area of application:
    - ≤ 3000 m NN

Connection
- Connection type:
  - pluggable screw-type terminal or push-wire terminal
- Screw-type terminals:
  - Nominal current:
    - ≤ 10 A
  - Tightening torque:
    - 0.5...0.6 Nm (5...7 lb-in)
  - Conductor size:
    - AWG 14-12
  - Stripping length:
    - 7 mm
  - Rigid/flexible:
    - 0.2...2.5 mm²
  - Flexible with ferrules, with/without plastic sleeve:
    - 0.25...2.5 mm²
  - Multiple conductor, rigid:
    - 0.2...1.5 mm²
  - Multiple conductor, flexible:
    - 0.2...1.5 mm²
  - Multiple conductor, flexible with ferrule without plastic sleeve:
    - 0.25...1.5 mm²
  - Multiple conductor, flexible with TWIN ferrule with plastic sleeve:
    - 0.5...1.5 mm²
- Push-wire terminals:
  - Nominal current:
    - ≤ 10 A
  - Conductor sizes:
    - AWG 24-12
  - Stripping length:
    - 10 mm
  - Rigid/flexible:
    - 0.2...2.5 mm²
  - Flexible with ferrules, with/without plastic sleeve:
    - 0.25...2.5 mm²
  - Multiple conductor, flexible with TWIN ferrule with plastic sleeve:
    - 0.5...1.5 mm²
- Push-wire terminals X1:
  - Nominal current:
    - ≤ 8 A
  - Conductor sizes:
    - AWG 24-16
  - Stripping length:
    - 10 mm
  - Rigid/flexible:
    - 0.2...2.5 mm²
  - Flexible with ferrule without plastic sleeve:
    - 0.25...1.5 mm²
  - Flexible with TWIN ferrule with plastic sleeve:
    - 0.25...0.75 mm²

Other
- Operating mode:
  - Continuous operation
  - Mounting (0°)
  - display oriented, cooling slots must be ventilated vertically
- Degree of protection internal components:
  - IP40
- Degree of protection terminals:
  - IP20
- DIN rail mounting acc. to IEC 60715
- Screw fixing:
  - 3 x M4 with mounting clip
- Enclosure material:
  - Polycarbonate
- Flammability class:
  - V-0
- ANSI code:
  - 64
- Dimensions (W x H x D):
  - 108 x 93 x 110 mm
- Documentation number:
  - D00177
- Weight:
  - < 390 g

Option “W” data different from the standard version
- Rated operational current of switching elements:
  - max. 3 A (for UL applications)

Ambient temperatures:
- Rated operational current of switching elements:
  - -40...+70 °C
  - -40...+65 °C (for UL applications)
- Transport:
  - -40...+85 °C
- Long-term storage:
  - -40...+70 °C

Classification of climatic conditions acc. to IEC 60721:
- Stationary use (IEC 60721-3-3):
  - 3K23 (condensation and formation of ice possible)

Classification of mechanical conditions acc. to IEC 60721:
- Stationary use (IEC 60721-3-3):
  - 3M12

1) At a frequency > 200 Hz, the connection of X1 must be insulated. Only permanently installed devices which at least have overvoltage category CA12 (300V) may be connected.
2) Indication limited outside the temperature range -25...+55 °C.
3) At a frequency > 200 Hz, the connection of X1 must be insulated. Only permanently installed devices which at least have overvoltage category CA12 (300V) may be connected.
4) U [V] = supply voltage ISOMETER®
5) This is a class A product. In a domestic environment, this product may cause radio interference. In this case, the user may be required to take corrective actions.
6) Recommendation: Devices mounted at 0° (display-oriented, cooling slots must be ventilated vertically).

For devices mounted at an angle of 45°, the max. working temperature is reduced by 10 °C.
For devices mounted at an angle of 90°, the max. working temperature is reduced by 20 °C.

For devices mounted at an angle of 90°, the max. working temperature is reduced by 20 °C.
For devices mounted at an angle of 45°, the max. working temperature is reduced by 10 °C.

Other
- Degree of protection internal components:
  - IP40
- Degree of protection terminals:
  - IP20
- DIN rail mounting acc. to IEC 60715
- Screw fixing:
  - 3 x M4 with mounting clip
- Enclosure material:
  - Polycarbonate
- Flammability class:
  - V-0
- ANSI code:
  - 64
- Dimensions (W x H x D):
  - 108 x 93 x 110 mm
- Documentation number:
  - D00177
- Weight:
  - < 390 g

Option “W” data different from the standard version
- Rated operational current of switching elements:
  - max. 3 A (for UL applications)

Ambient temperatures:
- Rated operational current of switching elements:
  - -40...+70 °C
  - -40...+65 °C (for UL applications)
- Transport:
  - -40...+85 °C
- Long-term storage:
  - -40...+70 °C

Classification of climatic conditions acc. to IEC 60721:
- Stationary use (IEC 60721-3-3):
  - 3K23 (condensation and formation of ice possible)

Classification of mechanical conditions acc. to IEC 60721:
- Stationary use (IEC 60721-3-3):
  - 3M12

1) At a frequency > 200 Hz, the connection of X1 must be insulated. Only permanently installed devices which at least have overvoltage category CA12 (300V) may be connected.
2) Indication limited outside the temperature range -25...+55 °C.
3) At a frequency > 200 Hz, the connection of X1 must be insulated. Only permanently installed devices which at least have overvoltage category CA12 (300V) may be connected.
4) U [V] = supply voltage ISOMETER®
5) This is a class A product. In a domestic environment, this product may cause radio interference. In this case, the user may be required to take corrective actions.
6) Recommendation: Devices mounted at 0° (display-oriented, cooling slots must be ventilated vertically).

For devices mounted at an angle of 45°, the max. working temperature is reduced by 10 °C.
For devices mounted at an angle of 90°, the max. working temperature is reduced by 20 °C.
**Insulation monitoring device ISOMETER® iso685-...-B**

- **Connection to an AC system $U_n$**
- **Connection to a DC system $U_n$**
- **Linked with two IT systems which can be interconnected via a coupling switch. Information regarding the state of the coupling switch is not necessary.**
- **Connection to an IT system with coupling device**
- **Connection to a 3(N)AC system**
- **Connection to the IT system to be monitored (L1/+, L2, L3/-)**
- **Separate connection of KE, E to PE**

---

**Provide line protection!**

According to DIN VDE 0100-430, a line protection shall be provided for the supply voltage.

**NOTE**

According to DIN VDE 0100-430, devices for protection against a short circuit can be omitted for the coupling of terminals L1/+ and L3/- to the IT system ≤ 690 V to be monitored if the wiring is carried out in such a manner as to reduce the risk of a short circuit to a minimum. Ensure short-circuit-proof and earth-fault-proof wiring.

The connecting lines L1/+, L2, L3/- to the system to be monitored must be carried out as spur lines. No load current may be conducted through the terminals.

**For UL applications:**

Use 60/70°C copper lines only!

UL and CSA application require the supply voltage to be protected via 5 A fuses.

---

### Digital interface X1

<table>
<thead>
<tr>
<th>Digital interface</th>
<th>Terminal</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1</td>
<td>Input 1</td>
<td></td>
</tr>
<tr>
<td>I2</td>
<td>Input 2</td>
<td></td>
</tr>
<tr>
<td>I3</td>
<td>Input 3</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>RS-485 A</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>RS-485 B</td>
<td></td>
</tr>
<tr>
<td>+</td>
<td>+24 V</td>
<td></td>
</tr>
<tr>
<td>Q1</td>
<td>Output 1</td>
<td></td>
</tr>
<tr>
<td>Q2</td>
<td>Output 2</td>
<td></td>
</tr>
<tr>
<td>M+</td>
<td>Analogue output</td>
<td></td>
</tr>
<tr>
<td>⊥</td>
<td>Ground</td>
<td></td>
</tr>
</tbody>
</table>

---

**Wiring diagram**

For systems > 690 V and with overvoltage category III a fuse for the connection to the system to be monitored must be provided. Recommendation: 2A screw-in fuses.
ISOMETER® iso685-…-P
Insulation monitoring device with integrated locating current injector for IT AC systems with galvanically connected rectifiers or converters and for IT DC systems

Device features

iso685-…-P
- ISOMETER® for IT AC systems with galvanically connected rectifiers or inverters and for IT DC systems (IT = unearthed systems)
- Automatic adaptation to the existing system leakage capacitance
- Combination of and other profile-specific measurement methods
- Two separately adjustable response value ranges of 1 kΩ…10 MΩ for Alarm 1 and Alarm 2
- High-resolution graphical LC display
- Connection monitoring (monitoring of the measuring lines)
- Automatic device self test
- Graphical representation of the insulation resistance over time (isoGraph)
- History memory with real-time clock (buffer for three days) for storing 1023 alarm messages with date and time
- Freely programmable digital inputs and outputs
- Remote setting via the Internet or Intranet (Webserver/Option: COMTRAXX® gateway)
- Worldwide remote diagnosis via the Internet (made available by Bender Service only)
- RS-485/BS (Bender sensor bus) for data exchange with other Bender devices
- ISOnet: Internal separation of the ISOMETER® from the IT system to be monitored (e.g. if several IT systems are interconnected)
- BCOM, Modbus TCP and web server
- Locating current injection for selective insulation fault location
- Indication of the insulation faults selectively located by the EDS system
- Parameter setting of EDS systems
- Customer-specific texts for each measuring channel
- RS44x: Insulation fault location in AC, 3AC and DC IT systems
  - Up to 12 measuring current transformers of the CTAC…, WR…, WS… measuring current transformer series can be connected
  - Response sensitivity insulation fault location: EDS440 2…10 mA, EDS441 0.2…1 mA
  - Response sensitivity residual current measurement: EDS440 100 mA…10 A, EDS441 100 mA…1 A
  - Communication of the components via BS bus (RS-485) or BB bus

Device variants

- iso685-D-P
  The device variant ISOMETER® iso685-D-P features a high-resolution graphic LC display and operating controls for direct operation of the device functions. It cannot be combined with an FP200.

- iso685-S-P
  The device variant ISOMETER® iso685-S-P features neither a display nor operating controls. It can only be used in combination with the FP200 and it is operated via this front panel.

- Option “W”
  The ISOMETER®s with and without integrated display are available with option “W” for extreme climatic and mechanical conditions (ISOMETER® iso685W-D-P and iso685W-S-P).

Standards

The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8

Further information

For further information refer to our product range on www.bender.de.
### Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage range $U_n$</th>
<th>Supply voltage $U_s$</th>
<th>Display</th>
<th>Option &quot;W&quot;</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 0…690 V; 0.1…460 Hz</td>
<td>AC 0…1000 V</td>
<td>integrated</td>
<td>–</td>
<td>iso685-D-P</td>
<td>B91067030</td>
</tr>
<tr>
<td>DC 24…240 V; 50…400 Hz</td>
<td>DC 24…240 V</td>
<td>–</td>
<td>–</td>
<td>iso685W-D-P</td>
<td>B91067030W</td>
</tr>
<tr>
<td>AC 0…690 V; 0.1…460 Hz</td>
<td>DC 0…1000 V</td>
<td>detached</td>
<td>–</td>
<td>iso685-S-P + FP200</td>
<td>B91067230</td>
</tr>
<tr>
<td>DC 24…240 V; 50…400 Hz</td>
<td>DC 24…240 V</td>
<td>–</td>
<td>–</td>
<td>iso685SW-S-P + FP200W</td>
<td>B91067230W</td>
</tr>
</tbody>
</table>

#### Insulation fault locators

<table>
<thead>
<tr>
<th>Description</th>
<th>Supply voltage $U_s$</th>
<th>Response value</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation fault locators</td>
<td>AC/DC 24…240 V</td>
<td>2…10 mA</td>
<td>EDS440-S-1</td>
<td>B91080201</td>
<td>148</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>EDS440W-S-1</td>
<td>B91080201W</td>
<td>148</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>EDS440-L-4</td>
<td>B91080202</td>
<td>148</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>EDS440W-L-4</td>
<td>B91080202W</td>
<td>148</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.2…1 mA</td>
<td>EDS441-S-1</td>
<td>B91080204</td>
<td>148</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>EDS441W-S-1</td>
<td>B91080204W</td>
<td>148</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>EDS441-L-4</td>
<td>B91080205</td>
<td>148</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>EDS441W-L-4</td>
<td>B91080205W</td>
<td>148</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>EDS441-LAB-4</td>
<td>B91080207</td>
<td>148</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>EDS441W-LAB-4</td>
<td>B91080207W</td>
<td>148</td>
</tr>
<tr>
<td>Relay module</td>
<td>DC 24 V</td>
<td>–</td>
<td>IOM441-S</td>
<td>B95012057</td>
<td>401</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IOM441W-S</td>
<td>B95012057W</td>
<td>401</td>
</tr>
</tbody>
</table>

#### Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A set of screw-type terminals¹</td>
<td>B91067901</td>
</tr>
<tr>
<td>A set of push-wire terminals</td>
<td>B91067902</td>
</tr>
<tr>
<td>Enclosure accessories (terminal cover, 2 mounting clips)¹</td>
<td>B91067903</td>
</tr>
<tr>
<td>Transparent cover 144x72 (IP65) for FP200 ²</td>
<td>B98060005</td>
</tr>
<tr>
<td>BB bus 6TE connector ²</td>
<td>B98110001</td>
</tr>
</tbody>
</table>

#### Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device version without display</td>
<td>iso685-S-P</td>
<td>B91067130</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>iso685W-S-P</td>
<td>B91067130W</td>
<td>–</td>
</tr>
<tr>
<td>Display for front panel mounting</td>
<td>FP200</td>
<td>B91067904</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td>FP200W</td>
<td>B91067904W</td>
<td>53</td>
</tr>
</tbody>
</table>

¹ included in the scope of delivery
² If the “transparent front cover 144x72 (IP65)” is used, the cutout in the control cabinet must be increased in height from 66 mm to 68 mm (+ 0.7/-0 mm).
³ Necessary for the connection of the ISOMETER®s with an EDS44…-S

Suitable measuring instruments on request!
### Insulation monitoring devices | Main circuits

#### Insulation monitoring device ISOMETER® iso685-…-P

<table>
<thead>
<tr>
<th>Rating voltage</th>
<th>1000 V</th>
</tr>
</thead>
</table>

#### Overvoltage category

<table>
<thead>
<tr>
<th>Overvoltage category</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
</tr>
</tbody>
</table>

#### Frequency range of maximum permissible input current

<table>
<thead>
<tr>
<th>Frequency range</th>
<th>650 mA</th>
</tr>
</thead>
</table>

#### Tolerance of AC/DC 0…600 V (for UL applications)

<table>
<thead>
<tr>
<th>Tolerance</th>
<th>±5 % ±5 V</th>
</tr>
</thead>
</table>

#### Measuring circuit (IC1) (L1/+, L2, L3/-)

<table>
<thead>
<tr>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring current Im</td>
</tr>
</tbody>
</table>

#### Power consumption, typically 400 Hz

| Power consumption | ≤ 12 W/45 VA |

#### Input circuit 1 (IC3)

<table>
<thead>
<tr>
<th>Input circuit</th>
<th>AC 2,2 kV</th>
</tr>
</thead>
</table>

#### Input circuit 2 (IC4)

| Input circuit | AC 2,2 kV |

#### Input circuit 3 (IC5)

| Input circuit | AC 2,2 kV |

#### Protective separation (reinforced insulation) between:

<table>
<thead>
<tr>
<th>Protective separation</th>
<th>Overvoltage category III, 1000 V</th>
</tr>
</thead>
</table>

#### Voltage test (routine test) according to IEC 61010-1:

- Protective separation (reinforced insulation) between:
  - Overvoltage category III, 1000 V
  - Overvoltage category III, 300 V

### Supply voltage

#### Supply via A1+/-, A2/-:

<table>
<thead>
<tr>
<th>Voltage range</th>
<th>AC/DC 24…240 V</th>
</tr>
</thead>
</table>

#### Overvoltage category

<table>
<thead>
<tr>
<th>Overvoltage category</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
</tr>
</tbody>
</table>

#### Pollution degree for accessible parts on the outside of the device housing (U0 < 690 V)

- Pollution degree for accessible parts on the outside of the device housing (U0 > 690 V) |

<table>
<thead>
<tr>
<th>Pollution degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 10 M</td>
</tr>
</tbody>
</table>

#### Pollution degree for accessible parts on the outside of the device housing (U0 > 690 V)

- Pollution degree for accessible parts on the outside of the device housing (U0 > 690 V) |

<table>
<thead>
<tr>
<th>Pollution degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 10 M</td>
</tr>
</tbody>
</table>

### Digital Inputs (I1, I2, I3)

#### Functions

- off, test, reset, deactivate device, start initial measurement, insulation fault location

#### Operating mode

- active, passive

#### Operating mode, adjustable

- active, passive

#### Operating mode

- active, passive

#### Operating mode, adjustable

<table>
<thead>
<tr>
<th>Operating mode</th>
<th>active, passive</th>
</tr>
</thead>
</table>

#### Digital Inputs (Q1, Q2)

#### Number

- 2

#### Function

- insulation alarm, DC- alarm, symmetrical alarm, device fault, common alarm

#### Voltage

- passive DC 0…32 V, active DC 0/19.2…32 V

#### Current

- 0…20 mA (< 600 Ω), 4…20 mA (< 600 Ω), 0…400 μA (< 4 kΩ)

#### Voltage

- 0…10 V (> 1 kΩ), 2…10 V (> 1 kΩ)

#### Time response

- 0…600 s

#### Measuring circuit

<table>
<thead>
<tr>
<th>Measuring circuit</th>
<th>profile dependent, ±10 V, ±50 V (see profile overview)</th>
</tr>
</thead>
</table>

#### Measuring current

| Measuring current | ≤ 403 μA |

#### Internal resistance

<table>
<thead>
<tr>
<th>Internal resistance</th>
<th>Rz1, Z2</th>
</tr>
</thead>
</table>

#### Internal resistance on decoupled systems (inoperative by I/O, inactive by ISOM and cut-off)

| Internal resistance | ≤ 120 kΩ |

#### Permissible extraneous DC voltage U0

| Permissible extraneous DC voltage | ≤ 1200 V |

#### Permissible system leakage capacitance C0

| Permissible system leakage capacitance | profile dependent, 0…1000 μF |

### Measuring ranges

#### Measuring range f1

| Measuring range | 0.1…400 Hz |

#### Tolerance measurement

| Tolerance measurement | ±1 % ±0.1 Hz |

#### Voltage range measurement of f1

| Voltage range measurement | AC 25…690 V |

#### Measuring range of U0

| Measuring range | AC 25…690 V |

#### Voltage measurement range of U0

| Voltage measurement range | DC 0…1000 V |

#### Measuring range of C0

| Measuring range | 0…1000 μF |

#### Frequency range measurement of C0

| Frequency range measurement | ±10 % ±10 μF |

#### Min. insulation resistance measurement of C0

| Min. insulation resistance measurement of C0 | depending on the profile and coupling mode, typ. > 10 kΩ |

#### Display

- Indication: graphic display 127 x 127 pixels, 40 x 40 mm²

#### Display range measured value

| Display range measured value | 0.1 kΩ…20 MΩ |

#### Operating uncertainty (according to IEC 61557-8)

| Operating uncertainty | ±15 %, at least ±1 kΩ |

#### ESDsync:

<table>
<thead>
<tr>
<th>ESDsync</th>
</tr>
</thead>
</table>

#### Status display

- green

#### PGH ON

- yellow

#### SERVICE

- yellow

#### ALARM 1

- yellow

#### ALARM 2

- yellow

#### Main menu

- 0…200 A

#### Interface

- RJ45

#### Data rate

- 10/100 Mbit/s, autodetect

#### Interface/protocol

- web server/Modbus TCP/BCOM

#### Field bus:

- Network mask 255.255.255.0

#### ISOMnet:

- Communication interface

### ISOloop

- Number ISOloop devices | 2…10 devices |

### ISOSync

- Number ISOSync devices | 2…10 devices |
Technical data (continued)

Sensor bus:
Interface/protocol: RS-485/BB-Bus/Modbus RTU
Data rate: 9.6 kBit/s
Cable length: ≤ 1200 m
Connection: terminals X1, X1.8
Terminating resistor: 120 Ω, can be connected internally
Device address: 1…90

Switching elements:
Number of switching elements: 2 changeover contacts
Operation mode: N/C operation/N/O operation
Contact 11-12/14/21-22-24: off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm 4, DC+ alarm 6, symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm

Technical data (continued)

Contact data acc. to IEC 60947-5-1:

<table>
<thead>
<tr>
<th>Utilisation category</th>
<th>AC-13</th>
<th>AC-14</th>
<th>DC-12</th>
<th>DC-12</th>
<th>DC-12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated operational voltage</td>
<td>230 V</td>
<td>230 V</td>
<td>40 V</td>
<td>110 V</td>
<td>220 V</td>
</tr>
<tr>
<td>Rated operational current</td>
<td>5 A</td>
<td>3 A</td>
<td>1 A</td>
<td>1 A</td>
<td>0.2 A</td>
</tr>
<tr>
<td>Rated insulation voltage ≤ 2000 m NN</td>
<td>520 V</td>
<td></td>
<td></td>
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<tr>
<td>Rated insulation voltage ≤ 3000 m NN</td>
<td>160 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum contact rating</td>
<td>1 mA at AC/DC ≥ 10 V</td>
<td></td>
<td></td>
<td></td>
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Environment/EMC:

<table>
<thead>
<tr>
<th>EMC</th>
<th>IEC 61326-2-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperatures:</td>
<td></td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-25…+55 °C</td>
</tr>
<tr>
<td>Transport</td>
<td>-40…+85 °C</td>
</tr>
<tr>
<td>Long-term storage</td>
<td>-40…+70 °C</td>
</tr>
</tbody>
</table>

Classification of climatic conditions acc. to IEC 60721:

| Stationary use (IEC 60721-3-3) | 3K23 (except condensation and formation of ice) |
| 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) | 3M13 |
| Transport (IEC 60721-3-2) | 2M4 |
| Long-term storage (IEC 60721-3-1) | 1M12 |

| Area of application | ≤ 3000 m NN |

Connection:

| Connection type | pluggable screw-type terminal or push-wire terminal |

Screw-type terminals:

| Nominal current | ≤ 10 A |
| Tensile torque | 0.5…0.6 Nm (5…7 lbf-in) |
| Conductor sizes | AWG 24-12 |
| Stripping length | 7 mm |
| Flexible with ferrules, with/without plastic sleeve | 0.2…2.5 mm² |
| Multiple conductor, rigid | 0.2…1.5 mm² |
| Multiple conductor, flexible | 0.2…1.5 mm² |
| Multiple conductor, flexible with ferrule without plastic sleeve | 0.25…1.5 mm² |
| Multiple conductor, flexible with TWIN ferrule with plastic sleeve | 0.5…1.5 mm² |

Push-wire terminals:

| Nominal current | ≤ 8 A |
| Conductor sizes | AWG 24-16 |
| Stripping length | 10 mm |
| Flexible with ferrule without plastic sleeve | 0.25…1.5 mm² |
| Flexible with TWIN ferrule with plastic sleeve | 0.25…0.75 mm² |

Option "W" data different from the standard version:

| Rated operational current of switching elements | max. 3 A (for UL applications) |

Ambient temperatures:

| Operating temperature | -40…+70 °C |
| Transport | -40…+65 °C (for UL applications) |
| Long-term storage | -40…+85 °C |

Classification of climatic conditions acc. to IEC 60721:

| Stationary use (IEC 60721-3-3) | 3K23 (condensation and formation of ice possible) |

Classification of mechanical conditions acc. to IEC 60721:

| Stationary use (IEC 60721-3-3) | 3M12 |

1) At a frequency > 200 Hz, the connection of X1 and Remote must be insulated. Only permanently installed devices which at least have overvoltage category CAT2 (300V) may be connected.

2) Indication limited outside the temperature range -25…+55 °C.

3) This is a class A product. This product may cause radio interference in residential areas. In this case, the user may be required to take corrective actions.

4) For UL ≥ 50 V only.

5) Emissions limited outside the temperature range -25…+55 °C.

6) For UL ≥ 50 V only.

Connection to FP200

Dimension diagram (dimensions in mm)

<table>
<thead>
<tr>
<th>Width (W)</th>
<th>Height (H)</th>
<th>Depth (D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>108 mm</td>
<td>110 mm</td>
<td>93 mm</td>
</tr>
</tbody>
</table>

Option "W" data different from the standard version:

| Rated operational current of switching elements | max. 3 A (for UL applications) |

Ambient temperatures:

| Operating temperature | -40…+70 °C |
| Transport | -40…+65 °C (for UL applications) |
| Long-term storage | -40…+85 °C |

Classification of climatic conditions acc. to IEC 60721:

| Stationary use (IEC 60721-3-3) | 3K23 (condensation and formation of ice possible) |

Classification of mechanical conditions acc. to IEC 60721:

| Stationary use (IEC 60721-3-3) | 3M12 |

1) At a frequency > 200 Hz, the connection of X1 and Remote must be insulated. Only permanently installed devices which at least have overvoltage category CAT2 (300V) may be connected.

2) Indication limited outside the temperature range -25…+55 °C.

3) This is a class A product. This product may cause radio interference in residential areas. In this case, the user may be required to take corrective actions.

4) For UL ≥ 50 V only.

5) Emissions limited outside the temperature range -25…+55 °C.

6) For UL ≥ 50 V only.
**Wiring diagram**

---

**1** Connection to an AC system $U_n$
**2** Connection to a DC system $U_n$
**3** Linked with two IT systems which can be interconnected via a coupling switch. Information regarding the state of the coupling switch is not necessary.
**4** Connection to a 3(N)AC system
**5** Connection to the IT system to be monitored (L1/+, L2, L3/-)
**6** Separate connection of KE, E to PE

**Provide line protection!**

According to DIN VDE 0100-430, a line protection shall be provided for the supply voltage.

**Note**

According to DIN VDE 0100-430, devices for protection against a short circuit can be omitted for the coupling of terminals L1/+ and L3/- to the IT system ≤ 690 V to be monitored if the wiring is carried out in such a manner as to reduce the risk of a short circuit to a minimum. (A short-circuit-proof and earth-fault-proof wiring is recommended).

The connecting lines L1/+, L2, L3/- to the system to be monitored must be carried out as spur lines. No load current may be conducted through the terminals.

---

**Digital interface X1**

<table>
<thead>
<tr>
<th>Digital interface</th>
<th>Terminal</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I1</td>
<td>Input 1</td>
</tr>
<tr>
<td></td>
<td>I2</td>
<td>Input 2</td>
</tr>
<tr>
<td></td>
<td>I3</td>
<td>Input 3</td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>RS-485 A</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>RS-485 B</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>+24 V</td>
</tr>
<tr>
<td></td>
<td>Q1</td>
<td>Output 1</td>
</tr>
<tr>
<td></td>
<td>Q2</td>
<td>Output 2</td>
</tr>
<tr>
<td></td>
<td>M+</td>
<td>Analogue output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ground</td>
</tr>
</tbody>
</table>

**X1**

- High active
- Low active
- Passive adjustable
- Active adjustable

---

[Image of wiring diagram and digital interface diagram]
Connection example ISOMETER® with insulation fault locators

System setup

ISOMETER® iso685-D-P

EDS44...-L

EDS44...-L

EDS195PM

CTAC...

CTAC...

CTAC...

CTAC...

CTAC...

CTAC...

BS

Ethernet

Router

Browser

COM465
ISOMETER® isoNAV685-D
Insulation monitoring device for IT AC systems with galvanically connected rectifiers and converters

Device features
- ISOMETER® for IT AC systems with galvanically connected rectifiers or inverters and for IT DC systems (IT = unearthed systems)
- Automatic adaptation to the existing system leakage capacitance
- Combination of AMPPlus and other profile-dependent measurement methods
- An adjustable response value for insulation monitoring in the range of 1 kΩ…10 MΩ (factory setting = 5 kΩ) and a response value of 150 V for the DC offset voltage
- High-resolution graphic LC display for excellent readability and recording of the device status
- Connection monitoring (monitoring of the measuring lines)
- Automatic device self test
- Graphical representation of the insulation resistance over time (isoGraph)
- History memory with real-time clock (buffer for three days) for storing 1023 alarm messages with date and time
- Current or voltage output 0(4)…20 mA, 0…400 µA, 0…10 V, 2…10 V (galvanically separated) which is analogous to the measured insulation value of the system
- Freely programmable digital inputs and outputs
- Remote setting via the Internet or Intranet (Webserver/Option: COMTRAXX® gateway)
- Worldwide remote diagnosis via the Internet (made available by Bender Service only)
- BCOM, Modbus TCP and web server.

Standards
The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage range U_n</th>
<th>Supply voltage U_s</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 0…690 V; 1…460 Hz</td>
<td>AC 24…240 V</td>
<td>isoNAV685-D</td>
<td>B91067014</td>
</tr>
<tr>
<td>DC 0…1000 V</td>
<td>DC 24…240 V, 50…600 Hz</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A set of screw-type terminals</td>
<td>891067901</td>
</tr>
<tr>
<td>A set of push-wire terminals</td>
<td>891067902</td>
</tr>
<tr>
<td>Enclosure accessories (terminal cover, 2 mounting clips)</td>
<td>891067903</td>
</tr>
</tbody>
</table>

1) included in the scope of delivery
Suitable measuring instruments on request!
Insulation coordination according to IEC 60664-1/IEC 60664-3

Definitions:
- Measuring circuit (IC1) (L1+, L2, L3/-): (L1+, L2, L3/-)
- Supply circuit (IC2): A1, A2
- Output circuit 1 (IC3): 11, 12, 14
- Output circuit 2 (IC4): 21, 22, 24
- Control circuit (IC5): (E, KE), (X1, ETN, X3)

Rated voltage: 1000 V

Overvoltage category: III

Rated impulse voltage:
- IC1/(IC2-5): 8 kV
- IC2/(IC3-5): 4 kV
- IC3/(IC4-5): 4 kV
- IC4/IC5: 4 kV

Rated insulation voltage:
- IC1/(IC2-5): 1000 V
- IC2/(IC3-5): 250 V
- IC3/(IC4-5): 250 V
- IC4/IC5: 250 V

Excluding service weighting:

Pollution degree for accessible parts on the outside of the device housing (Ui < 690 V): 3

Pollution degree for accessible parts on the outside of the device housing (Ui > 690 V < 1000 V): 2

Protective separation (reinforced insulation) between:
- IC1/(IC2-5): Overvoltage category III, 1000 V
- IC2/(IC3-5): Overvoltage category III, 300 V
- IC3/(IC4-5): Overvoltage category III, 300 V
- IC4/IC5: Overvoltage category III, 300 V

Voltage test (routine test) according to IEC 61010-1:
- Overvoltage category III, 1000 V
- Overvoltage category III, 300 V
- Overvoltage category III, 300 V

Supply voltage:

Supply via A1/+, A2/-:
- Supply voltage range: AC/DC 24…240 V
- Tolerance of Ua: ±30…±15 %
- Maximum permissible input current of Ua: 650 mA
- Frequency range of Ua: DC 50…400 Hz
- Tolerance of the frequency range of Ua: ±5…±15 %
- Power consumption, typically 50/60 Hz: ≤ 12 W/21 VA
- Power consumption, typically 400 Hz: ≤ 12 W/45 VA

Supply via X1:

Supply voltage: DC 24 V
- Tolerance of Ua: DC -20…+25 %

IT system being monitored:

Nominal system voltage range: AC 0…690 V; DC 0…1000 V
- Tolerance of Ua: ±15 %
- Frequency range of Ua: 50 Hz

Response values:
- Response value RA+1 (Alarm 1): 1 kΩ…10 MΩ
- Response value DC residual voltage (Alarm 2): 3 V
- Relative uncertainty (acc. to IEC 61557-8): profile dependent, ±15 %, at least ±1 kΩ
- Hysteresis: 25 %, at least 1 kΩ

Time response:
- Response time tdp for DC residual voltage > 1,1xUa+2 and Alarm 1: max. 150 ms
- Response time tdp at Rd = 0,5 x RA+ (RA+ = 10 kΩ) and Ca = 1 μF acc. to IEC 61557-8: profile dependent, typ. 4 s (see diagrams in manual)
- Startup delay: tstart: 0…120 s

Measuring circuit:
- Measuring voltage Ua: ±50 V
- Measuring current: fma: ±403 μA
- Internal resistance: R2: ≥ 124 kΩ
- Permissible stray DC voltage: Ua: ≤ 1200 V
- Permissible system leakage capacitance C0: profile dependent, 0…150 μF

Measuring ranges:
- Measuring range: 10…460 Hz
- Measuring range: fma: ±1 % ±0.1 Hz
- Voltage range measurement of fma: AC 25…690 V
- Measuring range: Ua: AC 25…690 V
- Measuring range: Ua: AC/DC > 10 V
- Tolerance measurement: ±5 % ±5 V
- Measuring range: C0: 0…1000 μF
- Tolerance measurement: ±10 % ±10 μF

Min. insulation resistance measurement of C0: depending on the profile and coupling mode, typ. > 10 kΩ

Display:
- Indication: graphic display 127 x 127 pixels, 40 x 40 mm
- Display range measured value: 0.1 kΩ...20 MΩ
- Operating uncertainty (according to IEC 61557-8): ±15 %, at least ±1 kΩ

LEDs:
- ON (operation LED): green
- SERVICE: yellow
- ALARM 1 (Iso. Alarm 1): yellow
- ALARM 2 (Insulation fault + DC offset fault): yellow

In-Outputs (X1-Interface):
- Cable length X1 (unshielded cable): ≤ 10 m
- Cable length X1 (shielded cable, shield connected to earth (PE) on one end, recommended: 1000 V min. 2x1.5 mm²): ≤ 100 m
- Total max. supply output current for each output (device supplied by X1+ - X1.GND): max. 1 A
- Total max. supply output current on X1 (device supplied by A1+/A2-): max. 200 mA
- Total max. supply output current on X1 (device supplied by A1+/A2- between 16,8 V and 40 V): ≤ 10 mA + 7 mA/V * Ux (negative values are not allowed for Ux)

Digital Inputs (I1, I2, I3):
- Number: 3
- Operation mode, adjustable: active high, active low
- Functions: none, test, reset, device deactivated, initial measurement
- Voltage: Low DC -9…5 V, High DC 11…32 V
- Tolerance Voltage: ±10 %

Digital Outputs (Q1, Q2):
- Number: 2
- Operation mode, adjustable: active, passive
- Functions: none, insulation Alarm 1, insulation fault + DC residual voltage, connection fault, device fault, collective alarm, measurement ended, device inactive
- Voltage: passive DC 0…32 V, active DC 0/19.2…32 V

Analogue Output (M+):
- Number: 1
- Operation mode: linear, ms/dm scale point 28 kΩ/120 kΩ
- Functions: insulation value, DC offset voltage
- Current: 0…20 mA (< 600 Ω), 4…20 mA (< 600 Ω), 0…400 μA (< 4 kΩ)
- Voltage: 0…10 V (> 1 kΩ), 2…10 V (> 1 kΩ)
- Tolerance related to the current/voltage final value: ±20 %

Interfaces:
- Field bus:
  - Interface/protocol: web server/Modbus TCP/BCOM
  - Data rate: 10/100 Mbit/s, autodetect
  - Max. amount Modbus requests: ≤ 100/s
  - Cable length: ≤ 100 m
  - Connection: RJ45
  - IP address: DHCP/manual 192.168.0.5
  - Network mask: 255.255.255.0
  - BCOM address: system-0
  - Function: communication interface

Switching elements:
- Number of switching elements: 2 changeover contacts
- Operating mode: N/C operation/N/O operation
- Contact 11-12-14:
  - None, insulation Alarm 1, insulation fault + DC residual voltage, connection fault, device fault, collective alarm, measurement ended, device inactive
- Contact 21-22-24:
  - None, insulation Alarm 1, insulation fault + DC residual voltage, connection fault, device fault, collective alarm, measurement ended, device inactive

Electric endurance under rated operating conditions, number of cycles: 10.000

Contact data acc. to IEC 60947-5-1:
- Utilisation category: AC-13 AC-14 DC-12 DC-12 DC-12 DC-12 DC-12
- Rated operational voltage: 230 V 230 V 24 V 48 V 110 V 220 V
- Rated operational current: 5 A 3 A 1 A 1 A 0.2 A 0.1 A
- Rated insulation voltage: ≤ 2000 m NN
- Rated insulation voltage: ≤ 3000 m NN
- Minimum contact rating: 1 mA at AC/DC ≥ 10 V

Technical data

Insulation monitoring device ISOMETER® isoNAV685-D

Insulation monitoring devices | Main circuits

01/2021 Insulation monitoring devices | Main circuits
Insulation monitoring device ISOMETER® isoNAV685-D
ISOMETER® isoNAV685-D
Technical data (continued)

Environment/EMC

<table>
<thead>
<tr>
<th>Environment/EMC</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC</td>
<td>IEC 61326-2-4</td>
</tr>
</tbody>
</table>

Ambient temperatures:

<table>
<thead>
<tr>
<th>Temperature Type</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating</td>
<td>-25...+55 °C</td>
</tr>
<tr>
<td>Transport</td>
<td>-40...+85 °C</td>
</tr>
<tr>
<td>Long-term storage</td>
<td>-40...+70 °C</td>
</tr>
</tbody>
</table>

Classification of climatic conditions acc. to IEC 60721:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stationary use (IEC 60721-3-3)</td>
<td>3K23 (except condensation and formation of ice)</td>
</tr>
<tr>
<td>Long-term storage (IEC 60721-3-1)</td>
<td>1K22</td>
</tr>
</tbody>
</table>

Classification of mechanical conditions acc. to IEC 60721:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stationary use (IEC 60721-3-3)</td>
<td>3M11</td>
</tr>
<tr>
<td>Transport (IEC 60721-3-2)</td>
<td>2M4</td>
</tr>
<tr>
<td>Long-term storage (IEC 60721-3-1)</td>
<td>1M12</td>
</tr>
</tbody>
</table>

Area of application ≤ 3000 m NN

Connection:

<table>
<thead>
<tr>
<th>Type</th>
<th>Loosewire/terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal current</td>
<td>≤ 10 A</td>
</tr>
<tr>
<td>Tightening torque</td>
<td>0.5...0.6 Nm (5...7 lb-in)</td>
</tr>
<tr>
<td>Stripping length</td>
<td>7 mm</td>
</tr>
<tr>
<td>Rigid/flexible</td>
<td>0.2...2.5 mm²</td>
</tr>
<tr>
<td>Flexible, with plastic</td>
<td>0.25...2.5 mm²</td>
</tr>
<tr>
<td>Multiple conductor, rigid</td>
<td>0.2...1 mm²</td>
</tr>
<tr>
<td>Multiple conductor, flexible</td>
<td>0.2...1.5 mm²</td>
</tr>
<tr>
<td>Multiple conductor, flexible with plastic sleeve</td>
<td>0.25...1 mm²</td>
</tr>
<tr>
<td>Multiple conductor, flexible with TWIN ferrule with plastic sleeve</td>
<td>0.5...1.5 mm²</td>
</tr>
</tbody>
</table>

Push-wire terminals:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Nominal current</th>
<th>Conductor sizes</th>
<th>Stripping length</th>
<th>Rigid/flexible</th>
<th>Flexible, with plastic</th>
<th>Multiple conductor, flexible with TWIN ferrule with plastic sleeve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal current</td>
<td>≤ 10 A</td>
<td>AWG 24-12</td>
<td>10 mm</td>
<td>0.2...2.5 mm²</td>
<td>0.25...2.5 mm²</td>
<td>0.5...1.5 mm²</td>
</tr>
</tbody>
</table>

Other:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating mode</td>
<td>Continuous operation</td>
</tr>
<tr>
<td>Mounting</td>
<td>Display oriented, cooling slots must be ventilated vertically ¹</td>
</tr>
<tr>
<td>Degree of protection internal</td>
<td>IP40</td>
</tr>
<tr>
<td>Degree of protection terminals</td>
<td>IP20</td>
</tr>
<tr>
<td>DIN rail mounting acc. to</td>
<td>IEC 60715</td>
</tr>
<tr>
<td>Screw fixing</td>
<td>3 x M4 with mounting clip</td>
</tr>
<tr>
<td>Enclosure material</td>
<td>Polycarbonate</td>
</tr>
<tr>
<td>Flammability class</td>
<td>V-0</td>
</tr>
<tr>
<td>ANSI code</td>
<td>64</td>
</tr>
<tr>
<td>Dimensions (W x H x D)</td>
<td>108 x 93 x 110 mm</td>
</tr>
<tr>
<td>Documentation number</td>
<td>D00215</td>
</tr>
<tr>
<td>Weight</td>
<td>&lt; 390 g</td>
</tr>
</tbody>
</table>

¹) At a frequency > 200 Hz, the connection of X1 must be insulated. Only permanently installed devices which at least have overvoltage category CAT2 (300V) may be connected.
²) Fast tripping only works in IT networks with a mains frequency of 60 Hz.
³) Indication limited outside the temperature range -25...+55 °C.
⁴) U [Volt] = supply voltage ISOMETER®
⁵) This is a class A product. In a domestic environment, this product may cause radio interference. In this case, the user may be required to take corrective actions.
⁶) Recommendation: Devices mounted at 0 ° (display-oriented, cooling slots must be ventilated vertically).

For devices mounted at an angle of 45°, the max. working temperature is reduced by 10 °C.
For devices mounted at an angle of 90°, the max. working temperature is reduced by 20 °C.

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Insulation monitoring devices | Main circuits
Insulation monitoring device ISOMETER® isoNAV685-D

01/2021

BENDER
Connection to a 3(N)AC system

Supply voltage $U_s$ (see nameplate) via 6 A fuse

Connection to the IT system to be monitored (L1/+, L2, L3/-)

Separate connection of KE, E to PE

(K1) Alarm relay 1, available changeover contacts

(K2) Alarm relay 2, available changeover contacts

Switchable resistor R for RS-485 bus termination

Ethernet interface

Digital interface

6 A fuse for systems $> 690$ V

NOTE:
According to DIN VDE 0100-430, devices for protection against a short circuit can be omitted for the coupling of terminals L1/+ and L3/- to the IT system $\leq 690$ V to be monitored if the wiring is carried out in such a manner as to reduce the risk of a short circuit to a minimum. (Recommendation: Ensure short-circuit-proof and earth-fault-proof wiring).
The connecting lines L1/+, L2, L3/- to the system to be monitored must be carried out as spur lines. No load current may be conducted through the terminals.

For UL applications:
Use 60/70 °C copper lines only!
UL and CSA application require the supply voltage to be protected via 5 A fuses.
**Digital interface X1**

<table>
<thead>
<tr>
<th>Digital interface</th>
<th>Terminal</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1</td>
<td>Input 1</td>
<td></td>
</tr>
<tr>
<td>I2</td>
<td>Input 2</td>
<td></td>
</tr>
<tr>
<td>I3</td>
<td>Input 3</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>RS-485 A</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>RS-485 B</td>
<td></td>
</tr>
<tr>
<td>+</td>
<td>+24 V</td>
<td></td>
</tr>
<tr>
<td>Q1</td>
<td>Output 1</td>
<td></td>
</tr>
<tr>
<td>Q2</td>
<td>Output 2</td>
<td></td>
</tr>
<tr>
<td>M+</td>
<td>Analogue output</td>
<td></td>
</tr>
<tr>
<td>⊥</td>
<td>Ground</td>
<td></td>
</tr>
</tbody>
</table>

**Connection to X1**

**Danger of damage to property due to faulty connections!**
The device can be damaged if the unit is simultaneously connected to the supply voltage via the X1 interface, and A1/+ and A2/- terminals. Do not connect the device simultaneously via X1, and A1/+ and A2/- to different supply voltages.

**Danger of damage to property due to incorrect nominal voltage!**
When the device is powered via the X1 interface, the nominal voltage must be 24 V否则 the unit may be damaged. Only connect a nominal voltage of 24 V to the X1 interface.
ISOMETER® isoNAV685-D-B
Insulation monitoring device for offline monitoring of de-energised loads

Device features
- ISOMETER® to monitor the insulation resistance in de-energised systems
- Automatic adaptation to the existing system leakage capacitance
- AMP™ measurement method
- An adjustable response value in the range 10 kΩ…1 MΩ (factory setting = 50 kΩ)
- High-resolution graphic LC display for excellent readability and recording of the device status
- Earth connection monitoring
- Automatic device self test
- Graphical representation of the insulation resistance over time (isoGraph)
- History memory with real-time clock (buffer for three days) for storing 1023 alarm messages with date and time
- Freely programmable digital inputs and outputs.
- Remote setting via the Internet or Intranet (Webserver/Option: COMTRAXX® Gateway).
- Worldwide remote diagnosis via the Internet.
- BCOM, Modbus TCP and web server.

Typical applications
- Monitoring of de-energised loads and systems

Approvals

Standards
The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage range $U_n$</th>
<th>Supply voltage $U_s$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
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<tbody>
<tr>
<td>offline</td>
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<td>isoNAV685-D-B</td>
<td>B91067024</td>
</tr>
<tr>
<td>AC 100…240 V; 47…460 Hz</td>
<td>DC 24 V, 100…240 V</td>
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</table>

<table>
<thead>
<tr>
<th>Accessories</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A set of screw-type terminals ¹</td>
<td>B91067901</td>
</tr>
<tr>
<td>A set of push-wire terminals</td>
<td>B91067902</td>
</tr>
<tr>
<td>Enclosure accessories (terminal cover, 2 mounting clips) ¹</td>
<td>B91067903</td>
</tr>
</tbody>
</table>

¹ included in the scope of delivery
Suitable measuring instruments on request!
Technical data

Insulation coordination according to IEC 60664-1/IEC 60664-3

Definitions:
- Measuring circuit (IC1)
- Supply circuit (IC2)
- Output circuit 1 (IC3)
- Output circuit 2 (IC4)
- Control circuit (IC5)

Rated voltage
- 1000 V

Overvoltage category
- III

Rated impulse voltage:
- IC1/(IC2-5): 0 kV
- IC2/(IC3-5): 4 kV
- IC3/(IC4-5): 4 kV
- IC4/KCS: 4 kV

Rated insulation voltage:
- IC1/(IC2-5): 1000 V
- IC2/(IC3-5): 250 V
- IC3/(IC4-5): 250 V
- IC4/KCS: 250 V

Pollution degree for accessible parts on the outside of the device housing (Ua < 690 V)
- 3

Pollution degree for accessible parts on the outside of the device housing (Ua > 690 < 1000 V)
- 2

Protective separation (reinforced insulation) between:
- IC1/(IC2-5): Overvoltage category III, 1000 V
- IC2/(IC3-5): Overvoltage category III, 300 V
- IC3/(IC4-5): Overvoltage category III, 100 V
- IC4/KCS: Overvoltage category III, 100 V

Voltage test (routine test) according to IEC 61010-1:
- IC1/(IC2-5): AC 2.2 kV
- IC2/(IC3-5): AC 2.2 kV
- IC3/(IC4-5): AC 2.2 kV
- IC4/KCS: AC 2.2 kV

Supplied voltage

Supply via A1+/ A2-:
- Supply voltage range Uil AC/DC 24...240 V
- Tolerance of Uil: ±30...+15%
- Maximum permissible input current of Uil: 650 mA
- Frequency range of Uil: DC, 50...400 Hz
- Tolerance of the frequency range of Uil: ±5...+15%
- Power consumption, DC: ≤ 12 W
- Power consumption, typically 50/60 Hz: ≤ 12 W/21 VA
- Power consumption, typically 400 Hz: ≤ 12 W/45 VA

Supply via X1:
- Supply voltage Ull DC 24 V
- Tolerance of Ull: DC -20...+25%

IT system being monitored

Nominal system voltage range Uil offline

Circuit capacity internal mains switch AC 0...690 V; DC 0...1000 V

Response values
- Response value Rmax (alarm 1): 1 kΩ...10 MΩ
- Response value Rmax (alarm 2): 1 kΩ...10 MΩ
- Hysteresis: 25 %, at least 1 kΩ

Time response
- Response time tR = tL (tR = 0.5 x Rmax (Rmax = 10 kΩ))
- C₀ = 1 μF according to IEC 61557-3
- 30s
- Start-up delay t start-up: 0...120 s

Measuring circuit
- Measuring voltage Uim ±5 V
- Measuring current Iim ±13.4 μA
- Internal resistance Rl ∞ ≥ 372 kΩ
- Permissible extraneous DC voltage Uic ≤ 1200 V
- Permissible system leakage capacitance C₀ ≤ 30 μF

Display
- Indication graphic display 127 x 127 pixels, 40 x 40 mm
- Display range measured value: ±0.1 kΩ...20 MΩ
- Operating uncertainty (according to IEC 61557-3): ±15 %, at least ±1 kΩ

LEDs
- ON (operation LED): green
- SERVICE: yellow
- ALARM 1 (L1 and L2): yellow
- ALARM 2 (L3): yellow

In-/Outputs (X1-Interface)
- Cable length X1 (unsheathed cable): ≤ 10 m
- Cable length X1 (shielded cable, shield connected to earth (PE) on one end, recommended: J-5Y(ST min. 2x0.8)) ≤ 100 m
- Total max. supply output current for each output (device supplied by X1+/X1.GND): max. 1 A
- Total max. supply output current on X1 (device supplied by A1+/A2- between 16.8 V and 40 V: Amax = 10 mA + 7 mA/V * Uc)
- (negative values are not allowed for Amax)

Digital Inputs (I1, I2, I3)
- Number: 3
- Operating mode: adjustable
- active, passive
- Functions: none, test, reset, device deactivated
- Voltage: Low DC -3...5 V, High DC 11...32 V
- Tolerance Voltage: ±10 %

Digital Outputs (Q1, Q2)
- Number: 2
- Operating mode: adjustable
- active, passive
- Functions: off, connection fault, Alarm L1, Alarm L2, Alarm L3, device fault, common alarm
- Voltage: passive DC 0...32 V, active DC 0/19.2...32 V

Interfaces
- Field bus:
  - Interface/protocol: web server/Modbus TCP/COM
  - Data rate: 10/100 Mbit/s, autodetect
  - Max. amount Modbus requests: < 1000
  - Cable length: ≤ 100 m
  - Connection: RJ45
  - IP address: DHCP/manual 192.168.0.5
  - Network mask: 255.255.255.0
  - BCD address: system-0
  - Function: communication interface

Switching elements
- Number of switching elements: 2 changeover contacts
- Operating mode: N/C operation/N/O operation
- Contact 11-12/14-21-22-24
  - off, connection fault, Alarm L1, Alarm L2, Alarm L3, device fault, common alarm

Electrical endurance under rated operating conditions, number of cycles: 10.000

Contact data acc. to IEC 60947-5-1:
- Utilisation category: AC-13 AC-14 DC-12 DC-12 DC-12 DC-12
- Rated operational voltage:
  - 230 V 230 V 24 V 48 V 110 V 220 V
- Utilisation category: AC-13 AC-14 DC-12 DC-12 DC-12 DC-12
- Rated operational current:
  - 5 A 3 A 1 A 1 A 0.2 A 0.1 A
- Rated insulation voltage:
  - ≤ 2000 m NN 250 V
  - ≤ 3000 m NN 160 V
- Minimum contact rating:
  - 1 mA at AC/DC ≤ 10 V

Environment/EMC
- EMC: IEC 61326-2-4

Ambient temperatures:
- Operating temperature:
  - -25...+55 °C
  - -40...+85 °C
- Long-term storage:
  - -40...+70 °C

Classification of climatic conditions acc. to IEC 60721:
- Long-term storage (IEC 60721-3-1) 1K22
- Transport (IEC 60721-3-2) 2K11
- Stationary use (IEC 60721-3-3) 3K23 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721:
- Long-term storage (IEC 60721-3-3) 3K23
- Stationary use (IEC 60721-3-3) 3M1
- Transport (IEC 60721-3-2) 2M4
- Area of application:
  - ≤ 3000 m NN

Area of application ≤ 3000 m NN
### Technical data (continued)

#### Connection

<table>
<thead>
<tr>
<th>Connection type</th>
<th>pluggable screw-type terminal or push-wire terminal</th>
</tr>
</thead>
</table>

#### Screw-type terminals:

- **Nominal current**: ≤ 10 A
- **Forging torque**: 0.5…0.6 Nm (5…7 lb-in)
- **Conductor sizes**: AWG 24-12
- **Stripping length**: 7 mm
- **Rigid/flexible**: 0.2…2.5 mm²
  - Flexible with ferrules, with/without plastic sleeve: 0.25…2.5 mm²
  - Multiple conductor, rigid: 0.2…1 mm²
  - Multiple conductor, flexible: 0.2…1.5 mm²
  - Multiple conductor, flexible with ferrule without plastic sleeve: 0.25…1 mm²
  - Multiple conductor, flexible with TWIN ferrule with plastic sleeve: 0.5…1.5 mm²

#### Push-wire terminals:

- **Nominal current**: ≤ 10 A
- **Conductor sizes**: AWG 24-12
- **Stripping length**: 10 mm
- **Rigid/flexible**: 0.2…2.5 mm²
  - Flexible with ferrules, with/without plastic sleeve: 0.25…2.5 mm²
  - Multiple conductor, flexible with TWIN ferrule with plastic sleeve: 0.5…1.5 mm²

#### Push-wire terminals X1:

- **Nominal current**: ≤ 8 A
- **Conductor sizes**: AWG 24-16
- **Stripping length**: 10 mm
- **Rigid/flexible**: 0.2…1.5 mm²
  - Flexible with ferrule without plastic sleeve: 0.25…1.5 mm²
  - Flexible with TWIN ferrule with plastic sleeve: 0.25…0.75 mm²

#### Other

- **Operating mode**: continuous operation
- **Mounting (0°)**: display oriented, cooling slots must be ventilated vertically
- **Degree of protection internal components**: IP40
- **Degree of protection terminals**: IP20
- **DIN rail mounting acc. to**: IEC 60715
- **Screw fixing**: 3 x M4 with mounting clip
- **Enclosure material**: polycarbonate
- **Flammability class**: V-0
- **ANSI code**: 64
- **Dimensions (W x H x D)**: 108 x 93 x 110 mm
- **Documentation number**: D00264
- **Weight**: < 390 g

1) At a frequency > 200 Hz, the connection of X1 must be insulated. Only permanently installed devices which at least have overvoltage category CAT2 (300V) may be connected.
2) Indication limited outside the temperature range -25…+55 °C.
3) \( U_s \) [Volt] = supply voltage ISOMETER®
4) This is a class A product. In a domestic environment, this product may cause radio interference. In this case, the user may be required to take corrective actions.
5) At a frequency > 200 Hz, the connection of X1 must be insulated. Only permanently installed devices which at least have overvoltage category CAT2 (300V) may be connected.
6) Indication limited outside the temperature range -25…+55 °C.
7) \( U_s \) [Volt] = supply voltage ISOMETER®
8) This is a class A product. In a domestic environment, this product may cause radio interference. In this case, the user may be required to take corrective actions.
9) Recommendation: Devices mounted at 0 ° (display-oriented, cooling slots must be ventilated vertically).
10) For devices mounted at an angle of 45°, the max. working temperature is reduced by 10 °C.
11) For devices mounted at an angle of 90°, the max. working temperature is reduced by 20 °C.
Connection to a 3(N)AC system
Supply voltage $U_s$ (see nameplate) via 6 A fuse
Connection to the IT system to be monitored ($L1/+\text{, } L2\text{, } L3/-$)
Separate connection of KE, E to PE
(K1) Alarm relay 1, available changeover contacts
(K2) Alarm relay 2, available changeover contacts
Switchable resistor $R$ for RS-485 bus termination
Ethernet interface
Digital interface

NOTE:
According to DIN VDE 0100-430, devices for protection against a short circuit can be omitted for the coupling of terminals $L1/+\text{ and } L3/-$ to the IT system $\leq 690$ V to be monitored if the wiring is carried out in such a manner as to reduce the risk of a short circuit to a minimum. (Recommendation: Ensure short-circuit-proof and earth-fault-proof wiring).
The connecting lines $L1/+\text{, } L2\text{, } L3/-$ to the system to be monitored must be carried out as spur lines. No load current may be conducted through the terminals.

For UL applications:
Use 60/70 °C copper lines only!
UL and CSA application require the supply voltage to be protected via 5 A fuses.
Digital interface X1

<table>
<thead>
<tr>
<th>Digital interface</th>
<th>Terminal</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1</td>
<td>Input 1</td>
<td></td>
</tr>
<tr>
<td>I2</td>
<td>Input 2</td>
<td></td>
</tr>
<tr>
<td>I3</td>
<td>Input 3</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>RS-485 A</td>
<td></td>
</tr>
<tr>
<td>+</td>
<td>+24 V</td>
<td></td>
</tr>
<tr>
<td>Q1</td>
<td>Output 1</td>
<td></td>
</tr>
<tr>
<td>Q2</td>
<td>Output 2</td>
<td></td>
</tr>
<tr>
<td>M+</td>
<td>Analogue output</td>
<td></td>
</tr>
<tr>
<td>Ground</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Connection to X1

**Danger of damage to property due to faulty connections!**
The device can be damaged if the unit is simultaneously connected to the supply voltage via the X1 interface, and A1/+ and A2/- terminals. Do not connect the device simultaneously via X1, and A1/+ and A2/- to different supply voltages.

![Diagram of X1 interface connections]

**Danger of damage to property due to incorrect nominal voltage!**
When the device is powered via the X1 interface, the nominal voltage must be 24 V otherwise the unit may be damaged. Only connect a nominal voltage of 24 V to the X1 interface.
**ISOMETER® isoHR685W-x-I-B**

Insulation monitoring device for IT AC systems with galvanically connected rectifiers and inverters and for IT DC systems

### Device features
- ISOMETER® for IT AC systems with galvanically connected rectifiers or inverters and for IT DC systems (IT = unearthed systems)
- Automatic adaptation to the existing system leakage capacitance
- Combination of AMPplus and other profile-specific measurement methods
- Two separately adjustable response value ranges of 1 kΩ…3 GΩ
- High-resolution graphic LC display
- Connection monitoring (monitoring of the measuring lines)
- Automatic device self-test
- Graphical representation of the insulation resistance over time (isoGraph)
- History memory with real-time clock (buffer for three days) for storing 1023 alarm messages with date and time
- Current or voltage output 0(4)…20 mA, 0…400 μA, 0…10 V, 2…10 V (galvanically separated), which is analogous to the measured insulation value of the system
- Freely programmable digital inputs and outputs
- Remote setting via the Internet or Intranet (Webservice/Option: COMTRAXX® gateway).
- Worldwide remote diagnosis via the Internet (made available by Bender Service only)
- RS-485/BS (Bender sensor bus) for communication with other Bender devices
- BCOM, Modbus TCP and web server
- Voltage expandable via coupling devices
- isoData – Recording of measured data
- ISOsync – timely synchronization of measurement processes

### Device variants
- **isoHR685W–D–I–B**
  The device version isoHR685W-D-I-B features a high-resolution graphical LC display and control elements for direct operation of the device functions. It cannot be combined with an FP200.

- **isoHR685W–S–I–B**
  The isoHR685W–S–I–B device contains no display and no operating unit. It can only be used in combination with FP200W and is indirectly operated via this front panel.

### Standards
The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8

### Ordering information
For further information refer to our product range on [www.bender.de](http://www.bender.de).

<table>
<thead>
<tr>
<th>Nominal system voltage range $U_n$</th>
<th>Supply voltage $U_s$</th>
<th>Display</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 0…1000 V 0,1…460 Hz 0…1300 V</td>
<td>AC 24…240 V 24…240 V</td>
<td>integrated</td>
<td>isoHR685W–D–I–B</td>
<td>B91067025W</td>
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<tr>
<td>DC 24…240 V</td>
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<tr>
<td></td>
<td></td>
<td>detached</td>
<td>isoHR685W–S–I–B + FP200W</td>
<td>B91067225W</td>
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</table>

1) Only available in combination
### Technical data

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**

#### Definitions:
- Measuring circuit (IC1)
- Supply circuit (IC2)
- Output circuit 1 (IC3)
- Output circuit 2 (IC4)
- Control circuit (IC5)

#### Rated voltage

- Insulation coordination acc. to IEC 60664-1/IEC 60664-3
- Overvoltage category 1

#### Rated impulse voltage:

- IC1/(IC2-5) 8 kV
- IC2/(IC3-5) 8 kV
- IC3/(IC4-5) 8 kV
- IC4/IC5 8 kV

#### Rated impulse voltages:

- IC1/(IC2-5) 1000 V
- IC2/(IC3-5) 250 V
- IC3/(IC4-5) 250 V
- IC4/IC5 250 V

#### Pollution degree for accessible parts on the outside of the device housing

- U1_permissible_extraneous_DC_voltage
- U2_permissible_extraneous_DC_voltage
- U3_permissible_extraneous_DC_voltage

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

- IC2/(IC3-5) 250 V
- IC3/(IC4-5) 250 V
- IC4/IC5 250 V

#### Supply voltage

- Supply via X1:
  - Power consumption, typically 400 Hz ≤ 12 W/45 VA
  - Power consumption, typically 50/60 Hz ≤ 12 W/21 VA
  - Power consumption, typically DC ≤ 12 W

#### Measuring range

- Voltage range measurement of U1: AC 25…690 V
- Voltage range measurement of U2: AC/DC 10…1000 V
- Frequency range measurement of U3, f: 0.1…460 Hz
- Frequency range measurement of U4, f: 0.1…460 Hz
- Min. insulation resistance measurement of U5, R0: 10 MΩ
- Operating uncertainty (according to IEC 61557-8) ±15 %, at least ±1 kΩ

#### Indicators/LEDs

- Display range measured value
- Operating uncertainty (according to IEC 61557-8)

#### Digital inputs (I1, I2, I3)

- Number
- Operating mode, adjustable
- Active, active low
- Functions
- Off, test, reset, deactivate device, start initial measurement
- Voltage
- Low DC 3...5 V, High DC 11...32 V
- Voltage tolerance
- ±10 %

#### Digital outputs (O1, O2)

- Number
- Operating mode, adjustable
- Active, active passive
- Functions
- Off, Ins. alarm 1, Ins. Alarm 2, connection fault, DC alarm 1, DC alarm 2, symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm
- Voltage passive
- DC 0...32 V, active DC 0/19.2...32 V

#### Insulation monitoring devices

- Main circuits

### Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device version without display</td>
<td>isoHR685W-S-I-B</td>
<td>B91067125W</td>
<td>–</td>
</tr>
<tr>
<td>Display for front panel mounting</td>
<td>FF200W</td>
<td>B91067904W</td>
<td>53</td>
</tr>
<tr>
<td>Coupling devices</td>
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<tr>
<td>AGH150N-4</td>
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<td>B98018006</td>
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<td>B913055</td>
<td>358</td>
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</table>

**Suitable measuring instruments on request!**
Interfaces
Field bus:
Interface/protocol: web server/Modbus TCP/BCOM
Data rate: 10/100 Mbit/s, autodetect
Max. number of Modbus requests: <100/s
Cable length: ≤ 100 m
Connection: R4S
IP address: DHCP/manual
Network mask: 255.255.255.0
BCOM address: system-1-0
Function: communication interface

ISOMETER® isoHR685W-x-I-B
Insulation monitoring device ISOMETER® isoHR685W-x-I-B

Technical data (continued)

Switching elements
Number of switching elements: 2 changeover contacts
Operating mode:
- N/C operation/N/O operation
- Contact 11-12, 14-21, 22-24 off, Ins. alarm 1, Ins. Alarm 2, connection fault, DC- alarm 5

Electrical endurance under rated operating conditions, number of cycles: 10,000

Contact data acc. to IEC 60947-5-1:
Utilization category: AC-13, AC-14, DC-12, DC-12, DC-12, DC-12
Rated operational voltage: 230 V
Rated operational current: 5 A
Rated insulation voltage: ≤ 2000 m NN: 250 V
Rated insulation voltage: ≤ 3000 m NN: 160 V
Minimum contact rating: 1 mA at AC/DC ≥ 10 V

Environment/EMC and temperature range

- Operating temperature: -25…+55 °C
- Transport: -40…+65 °C
- Long-term storage: -40…+70 °C

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

- Area of application: ≤ 3000 m NN

Other

- Degree of protection internal components: IP40
- Degree of protection terminals: IP20
- DIN rail mounting acc. to IEC 60715
- Screw fixing: 3 x M4 with mounting clip
- Enclosure material: polycarbonate
- Flammability class: V-0
- ANSI code: 64

Dimensions (W x H x D):
- 108 x 93 x 110 mm
- 108 x 93 x 110 mm
- 108 x 93 x 110 mm

Weight:
- ≤ 390 g

- For devices mounted at an angle of 45°, the max. working temperature is reduced by 20 °C.
- For devices mounted at an angle of 90°, the max. working temperature is reduced by 10 °C.

- At a frequency > 200 Hz, the connection of X1 ande Remote must be insulated. Only permanently installed devices which at least have overvoltage category CAT2 (300V) may be connected.
- Deactivation of voltage metering in a DC system at Uo > DC 1000 V and asymmetric insulation fault at Rf < 500 kΩ. Reactivation of voltage metering if RF > 500 kΩ
- Indication limited outside the temperature range -25…+55 °C.
- At Uo (Volt) = ISOMETER® supply voltage

- For Uo ≤ 50 V only.
- This is a class A product. This product may cause radio interference in residential areas. In this case, the user may be required to take corrective actions.
- Connection: Devices mounted at 0° (display oriented, cooling slots must be ventilated vertically)

- For devices mounted on angle of 45°, the max. working temperature is reduced by 10 °C.
- For devices mounted at an angle of 90°, the max. working temperature is reduced by 20 °C.

- Connection type:
- pluggable screw terminal or push-wire terminal

- Screw-type terminals:
- Nominal current: ≤ 10 A
- Tightening torque:
  - 0.5…0.6 Nm (5…7 lb-in)
- Conductor sizes:
  - AWG 24-12
- Stripping length:
  - 10 mm
- Stripping length:
  - 10 mm
- Data rate:
  - 3) 115.2 kBaud/s
  - 2) 115.2 kBaud/s
  - 1) 9.6 kBaud/s

- ISONet:
  - Maximum nominal system voltage range ISOnet AC, 690 V/DC, 1000 V
  - Number ISOnet devices ≤ 20
  - Number ISOsync devices ≤ 50

- ISOsync:
  - Number ISOsync devices ≤ 50

- Connection to FP200

- Dimension diagram (dimensions in mm)
1. Connection to an AC system $U_n$
2. Connection to a DC system $U_n$
3. Linked with two IT systems which can be interconnected via a coupling switch. Information regarding the state of the coupling switch is not necessary.
4. Connection to an IT system with coupling device
5. Connection to a 3(N)/AC system
6. Connection to the IT system to be monitored (L1/+, L2, L3/–)
7. Separate connection of KE, E to PE

**Provide line protection!**
According to DIN VDE 0100-430, a line protection shall be provided for the supply voltage.

**NOTE**
According to DIN VDE 0100-430, devices for protection against a short-circuit can be omitted for the coupling of terminals L1/+, L2 and L3/- to the IT system ≤ 690 V to be monitored if the wiring is carried out in such a manner as to reduce the risk of a short-circuit to a minimum.
Ensure short-circuit-proof and earth-fault-proof wiring.
The connecting lines L1/+, L2, L3/- to the system to be monitored must be carried out as spur lines. No load current may be conducted through the terminals.

**For UL applications:**
Use 60/70°C copper lines only!
UL and CSA application require the supply voltage to be protected via 5 A fuses.

### Digital Interface X1

<table>
<thead>
<tr>
<th>Digital interface</th>
<th>Terminal</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1</td>
<td>Input 1</td>
<td></td>
</tr>
<tr>
<td>I2</td>
<td>Input 2</td>
<td></td>
</tr>
<tr>
<td>I3</td>
<td>Input 3</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>RS-485  A</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>RS-485  B</td>
<td></td>
</tr>
<tr>
<td>+</td>
<td>+24 V</td>
<td></td>
</tr>
<tr>
<td>Q1</td>
<td>Output 1</td>
<td></td>
</tr>
<tr>
<td>Q2</td>
<td>Output 2</td>
<td></td>
</tr>
<tr>
<td>M+</td>
<td>Analogue output</td>
<td></td>
</tr>
<tr>
<td>⊥</td>
<td>Ground</td>
<td></td>
</tr>
</tbody>
</table>
ISOsync for coupled IT systems

Insulation monitoring devices | Main circuits
Insulation monitoring device ISOMETER® isoHR685W-x-I-B

ISOsync for coupled IT systems
ISOMET® isoRW685W-D
Insulation monitoring device for IT AC systems with galvanically connected rectifiers and converters and for IT systems especially for railway applications

Device features
- ISOMET® for IT AC systems with galvanically connected rectifiers or inverters and for IT DC systems (IT = unearthed systems)
- Nominal system voltage $U_n$ expandable via coupling devices
- Automatic adaptation to the existing system leakage capacitance
- Combination of AMP® and other profile-specific measurement methods
- Two separately adjustable response value ranges of 1 kΩ...10 MΩ for alarm 1 and alarm 2
- High-resolution graphic LC display for excellent readability and recording of the device status
- Connection monitoring (monitoring of the measuring lines)
- Automatic device self test
- Graphical representation of the insulation resistance over time (isoGraph)
- History memory with real-time clock (buffer for three days) for storing 1023 alarm messages with date and time
- Current and voltage output 0(4)...20 mA, 0…400 μA, 0…10 V, 2…10 V (galvanically separated) which is analogous to the measured insulation value of the system
- Freely programmable digital inputs and outputs
- Remote setting via the Internet or Intranet (Webserver / Option: COMTRAXX® Gateway)
- Worldwide remote diagnosis via the Internet (made available by Bender Service only)
- RS-485/BS (Bender sensor bus) for communication with other Bender devices
- BCOM, Modbus TCP and web server

Standards
The ISOMET® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8
- DIN EN 50155

Further information
For further information refer to our product range on www.bender.de.

Typical applications
- AC, DC or AC/DC main circuits
- AC/DC main circuits with directly connected DC components, such as rectifiers, converters, variable-speed drives
- UPS systems, battery systems
- Heaters with phase control
- Systems with switch-mode power supplies
- IT systems with high leakage capacitances

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A set of screw terminals</td>
<td>B91067901</td>
</tr>
<tr>
<td>A set of push-wire terminals</td>
<td>B91067902</td>
</tr>
<tr>
<td>Enclosure accessories (terminal cover, 2 mounting clips)</td>
<td>B91067903</td>
</tr>
</tbody>
</table>

1) included in the scope of delivery

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupling devices</td>
<td>AGH150W-4</td>
<td>B98018006</td>
<td>352</td>
</tr>
<tr>
<td></td>
<td>AGHR204S-4</td>
<td>B914013</td>
<td>354</td>
</tr>
<tr>
<td></td>
<td>AGH520S</td>
<td>B913033</td>
<td>355</td>
</tr>
<tr>
<td></td>
<td>AGH676S-4</td>
<td>B913055</td>
<td>358</td>
</tr>
</tbody>
</table>

Suitable measuring instruments on request!
**Insulation coordination according to IEC 60664-1/IEC 60664-3**

Definitions:
- Measuring circuit (IC1): (L1+, L2, L3-)
- Supply circuit (IC2): A1, A2
- Output circuit 1 (IC3): 11, 12, 14
- Output circuit 2 (IC4): 21, 22, 24
- Control circuit (IC5): (E, KE, X1, ETH, X3, X4)

**Technical data**

- **Rated voltage**: 1000 V
- **Overvoltage category**: III
- **Rated impulse voltage**: (IC1)/(IC2-5): 8 kV
- **Rated insulation voltage**: (IC1)/(IC2-5): 1000 V
- **Rated insulation voltage**: (IC2)/(IC3-5): 250 V
- **Rated insulation voltage**: (IC3)/(IC4-5): 250 V
- **Rated insulation voltage**: (IC4/IC5): 4 kV

**Pollution degree for accessible parts on the outside of the device housing (Un < 690 V)**
- Pollution degree for accessible parts on the outside of the device housing (Un > 690 < 1000 V)
  - Pollution degree for accessible parts on the outside of the device housing (Un > 1000 V)

**Protective separation (reinforced insulation) between:**
- Pollution degree for accessible parts on the outside of the device housing (Un > 690 < 1000 V)
  - Pollution degree for accessible parts on the outside of the device housing (Un > 1000 V)

**Supply via A1+/A2-**

- **Supply voltage**: Un AC/DC 24…240 V
- **Tolerance of the frequency range of Un**: ±0.5 ±5 V
- **Power consumption, typically 50/60 Hz**: ≤ 12 W/21 VA
- **Power consumption, typically 400 Hz**: ≤ 12 W/45 VA

**IT system being monitored**

- **Nominal system voltage range Un**: AC 0…690 V
- **Tolerance of Un**: DC 0…1000 V
- **Frequency range of Un**: AC/DC 0…1000 V (for Un applications)
- **Max. AC voltage**: AC/DC 4…1000 V

**Response values**

- **Response value Rset (alarm 1)**: 1 kΩ ± 10 MΩ
- **Response value Rset (alarm 2)**: 1 kΩ ± 10 MΩ
- **Relative uncertainty (acc. to IEC 61557-8)**: profile dependent, at least ±1 kΩ

**Time response**

- **Response time tset at \( R_0 = 0.5 \times R_{set} \) (R0 = 10 kΩ) and \( C_0 = 1 \) pF according to IEC 61557-8**:
- **Profile dependent, typ. 4 s (see diagram in manual)**
- **Response time DC alarm at \( C_0 = 1 \) pF**: profile dependent, typ. 2 s (see diagram in manual)
- **Start-up delay** tstart-up: 0…600 s

**Measuring circuit**

- **Measuring voltage Un**: profile dependent, ±10 V, ±50 V (see profile overview)
- **Current measurement In**: ±40 mA
- **Internal resistance \( R_e \)**: ±124 kΩ
- **Permissible DC voltage Ue**: ±1200 V
- **Permissible system leakage capacitance \( C_F \)**: profile dependent, 0…1000 μF

**Insulation monitoring devices | Application-specific selection – Railway**

**Insulation monitoring device ISOMETER® isoRW685W-D**

**Maximum permissible input current of Us**: 650 mA

- **AC/DC 0…600 V (for UL applications)**
- **DC 0…1000 V**

**Start-up delay**

**Measuring voltage**

**Measuring circuit**

- **IC1/(IC2-5)**: Overvoltage category III, 1000 V
- **Protective separation (reinforced insulation) between:**
- **Pollution degree for accessible parts on the outside of the device housing (Un > 690 < 1000 V)**
  - Pollution degree for accessible parts on the outside of the device housing (Un > 1000 V)

**Voltage test (routine test) according to IEC 61010-1**:
- **Max. AC voltage**: ±5…+15 %
- **Tolerance of the frequency range of Un**: ±10 % ±50 V (see profile overview)
- **Frequency range of Un**: ±5 % ±5 V
- **Measuring range of \( C_e \)**: 0…1000 μF
- **Measuring range of \( C_T \)**: ±10 % ±10 μF
- **Frequency range measurement of \( C_e \)**: DC 30…460 Hz
- **Min. insulation resistance measurement of \( C_e \)**:
- **depending on the profile and coupling mode, typ. > 10 kΩ**

**Display**

- **Indication**
  - graphic display 127 x 127 pixels, 40 x 40 mm²

**Display range measured value**

- **Operating uncertainty (according to IEC 61557-8)**
- ±15 %, at least ±1 kΩ

**LEDs**

- **ON (operation LED)**
  - green
- **SERVICE**
  - yellow
- **ALARM 1**
  - yellow
- **ALARM 2**
  - yellow

**In-/Outputs (X1-Interface)**

- **Cable length X1 (unshielded cable)**: ≤ 10 m
- **Cable length X1 (shielded cable, shield connected to earth (PE) on one end)**:
  - J-YSKYV mm 2x0.8
  - ≤ 100 m
- **Total max. supply output current for each output (device supplied by X1,+/X1.GND)**: max. 1 A
- **Total max. supply output current on X1 (device supplied by A1+/A2-)**: max. 200 mA
- **Total max. supply output current on X1 (device supplied by A1+/A2- between 16,8 V and 40 V)**:
  - \( I_{max} = 10 \frac{mA}{mA} + 7 mA V^* U_{n} \)
  - (negative values are not allowed for \( I_{max} \))

**Digital Inputs (I1, I2, I3)**

- **Number**: 3
- **Operating mode, adjustable**: active high, active low
- **Voltage**: off, test, reset, deactivate device, start initial measurement
- **Functions**: off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm 4), DC+ alarm 4), symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm
- **Voltage**: passive DC 0…32 V, active DC 0/19…32 V

**Analogical Output (M+)**

- **Number**: 1
- **Operating mode**: linear, midscale point 28 kΩ/120 kΩ
- **Functions**: insulation value, DC offset
- **Current**: 0…20 mA (= 600 Ω), 4…20 mA (= 600 Ω), 0…400 μA (= 4 kΩ)
- **Voltage**: 0…10 V (= 1 kΩ), 2…10 V (> 10 V)
- **Tolerance related to the current/voltage final value**: ±20 %

**Interfaces**

**Field bus**

- **Interface/protocol**: web server/Modbus TCP/BCOM
- **Data rate**: 10/100 Mbit/s, autodetect
- **Max. amount Modbus requests**: < 1000/s
- **Max. cable length**: ≤ 100 m
- **Connection**: RJ45
- **IP address**: DHCP/Manual 192.168.0.1
- **Network mask**: 255.255.255.0
- **BCOM address**: system 1-9
- **Function**: communication interface

**Sensor bus**

- **Interface/protocol**: RS-485/BS
- **Data rate**: 9.6 kbaud/s
- **Max. cable length**: ≤ 1200 m
- **Cable**: twisted pair, one end of shield connected to PE recommended: J-YSKYV mm 2x0.8
- **Connection**: terminals X1.A, X1.B
- **Terminating resistor at the beginning and at the end of the transmission path**: 120 Ω, can be connected internally
- **Device address, BS bus**: 1…90
**Switching elements**

- **Number of switching elements:** 2 changeover contacts
- **Operating mode:** N/C operation/N/O operation
- **Contact 11-12/21-22-24:** off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm 4, DC+ alarm 5, symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm
- **Electrical endurance under rated operating conditions, number of cycles:** 10,000

**Contact data acc. to IEC 60947-5-1:**

- **Utilisation category:** AC-13 AC-14 DC-12 DC-12 DC-12 DC-12
- **Rated operational voltage:** 230 V 230 V 24 V 48 V 110 V 220 V
- **Rated operational current:** 5 A 3 A 1 A 1 A 0.2 A 0.1 A
- **Rated insulation voltage:** ≤ 2000 m NN 250 V
- **Rated insulation voltage:** ≤ 3000 m NN 160 V
- **Minimum contact rating:** 1 mA at AC/DC ≥ 10 V

**Environment/EMC**

- **EMC:** IEC 50121-3-2, IEC 61326-2-4
- **Ambient temperatures:**
  - Operating temperature: -40…+70 °C
  - -40…+65 °C (for UL applications)
  - Transport: -40…+85 °C
  - Long-term storage: -40…+70 °C
- **Classification of climatic conditions acc. to IEC 60721:**
  - Stationary use (IEC 60721-3-3) 3K24 (except condensation and formation of ice)
  - 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) 3M12
  - Transport (IEC 60721-3-2) 2M4
  - Long-term storage (IEC 60721-3-1) 1M12
  - Area of application: ≤ 3000 m NN

**Connection**

- **Connection type:** pluggable screw-type terminal or push-wire terminal

**Screw-type terminals:**

- **Nominal current:** ≤ 10 A
- **Tightening torque:** 0.5…0.6 Nm (5…7 lb-in)
- **Conductor sizes:** AWG 24-12
- **Stripping length:** 9 mm
- **Flexible:** 0.2…2.5 mm²
- **Flexible with ferrules, with/without plastic sleeve:** 0.25…2.5 mm²
- **Multiple conductor, rigid:** 0.2…1 mm²
- **Multiple conductor, flexible:** 0.2…1.5 mm²
- **Multiple conductor, flexible with ferrule without plastic sleeve:** 0.25…1 mm²
- **Multiple conductor, flexible with TWIN ferrule with plastic sleeve:** 0.5…1.5 mm²

**Push-wire terminals:**

- **Nominal current:** ≤ 8 A
- **Conductor sizes:** AWG 24-16
- **Stripping length:** 10 mm
- **Flexible:** 0.2…1.5 mm²
- **Flexible with ferrule without plastic sleeve:** 0.25…1.5 mm²
- **Flexible with TWIN ferrule with plastic sleeve:** 0.25…0.75 mm²

**Push-wire terminals X1:**

- **Nominal current:** ≤ 8 A
- **Conductor sizes:** AWG 24-16
- **Stripping length:** 10 mm
- **Flexible:** 0.2…1.5 mm²
- **Flexible with ferrule without plastic sleeve:** 0.25…1.5 mm²
- **Flexible with TWIN ferrule with plastic sleeve:** 0.25…0.75 mm²

**Other**

- **Operating mode:** continuous operation
- **Mounting:** display oriented, cooling slots must be ventilated vertically
- **Degree of protection internal components:** IP40
- **Degree of protection terminals:** IP20
- **DIN rail mounting acc. to IEC 60715**
- **Screw fixing:** 3 x M4 with mounting clip
- **Enclosure material:** polycarbonate
- **Flammability class:** V-0
- **ANSI code:** 64
- **Dimensions (W x H x D):** 108 x 93 x 110 mm
- **Documentation number:** D00178
- **Weight:** < 390 g

**Technical data (continued)**

**Push-wire terminals:**

- **Nominal current:** ≤ 10 A
- **Conductor sizes:** AWG 24-12
- **Stripping length:** 10 mm
- **Flexible:** 0.2…2.5 mm²
- **Flexible with ferrules, with/without plastic sleeve:** 0.25…2.5 mm²
- **Multiple conductor, flexible with TWIN ferrule with plastic sleeve:** 0.5…1.5 mm²

**Push-wire terminals X1:**

- **Nominal current:** ≤ 8 A
- **Conductor sizes:** AWG 24-16
- **Stripping length:** 10 mm
- **Flexible:** 0.2…1.5 mm²
- **Flexible with ferrule without plastic sleeve:** 0.25…1.5 mm²
- **Flexible with TWIN ferrule with plastic sleeve:** 0.25…0.75 mm²

**Other**

- **Operating mode:** continuous operation
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- **DIN rail mounting acc. to IEC 60715**
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- **Flammability class:** V-0
- **ANSI code:** 64
- **Dimensions (W x H x D):** 108 x 93 x 110 mm
- **Documentation number:** D00178
- **Weight:** < 390 g

1) At a frequency > 200 Hz, the connection of X1 must be insulated. Only permanently installed devices which at least have overvoltage category CAT2 (300V) may be connected.

2) Indication limited outside the temperature range -25…+55 °C.

3) For $U_s$ [Volt] = supply voltage ISOMETER®

4) For $U_n$ ≥ 50 V only.

5) This is a class A product. In a domestic environment, this product may cause radio interference. In this case, the user may be required to take corrective actions.

6) Recommendation: Devices mounted at 0° (display-oriented, cooling slots must be ventilated vertically). For devices mounted at an angle of 45°, the max. working temperature is reduced by 10 °C. For devices mounted at an angle of 90°, the max. working temperature is reduced by 20 °C.
Insulation monitoring devices  |  Application-specific selection – Railway

Insulation monitoring device ISOMETER® isoRW685W-D

**Wiring diagram**

1. Connection to an AC system \( U_n \)
2. Connection to a DC system \( U_n \)
3. Connection to an IT system with coupling device
4. Connection to a 3(N)AC system
5. Connection to the IT system to be monitored (L1/+, L2, L3/-)
6. Separate connection of KE, E to PE
7. (K1) Alarm relay 1, available changeover contacts
8. (K2) Alarm relay 2, available changeover contacts
9. Switchable resistor \( R \) for RS-485 bus termination
10. Ethernet interface
11. Digital interface

**Provide line protection!**
According to DIN VDE 0100-430, a line protection shall be provided for the supply voltage.

**NOTE:**
According to DIN VDE 0100-430, devices for protection against a short circuit can be omitted for the coupling of terminals L1/+ and L3/- to the IT system \( \leq 690 \) V to be monitored if the wiring is carried out in such a manner as to reduce the risk of a short circuit to a minimum. (Recommendation: Ensure short-circuit-proof and earth-fault-proof wiring).

The connecting lines L1/+, L2, L3/- to the system to be monitored must be carried out as spur lines. No load current may be conducted through the terminals.

For **UL applications:**
Use 60/70°C copper lines only!

**Digital interface X1**

<table>
<thead>
<tr>
<th>Digital interface</th>
<th>Terminal</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1</td>
<td>Input 1</td>
<td></td>
</tr>
<tr>
<td>I2</td>
<td>Input 2</td>
<td></td>
</tr>
<tr>
<td>I3</td>
<td>Input 3</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>RS-485 A</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>RS-485 B</td>
<td></td>
</tr>
<tr>
<td>+</td>
<td>+24 V</td>
<td></td>
</tr>
<tr>
<td>Q1</td>
<td>Output 1</td>
<td></td>
</tr>
<tr>
<td>Q2</td>
<td>Output 2</td>
<td></td>
</tr>
<tr>
<td>M+</td>
<td>Analogue output</td>
<td></td>
</tr>
<tr>
<td>Ground</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Digital interface Terminal Colour**

- I1: Input 1
- I2: Input 2
- I3: Input 3
- A: RS-485 A
- B: RS-485 B
- +: +24 V
- Q1: Output 1
- Q2: Output 2
- M+: Analogue output
- Ground

**Provide line protection!**
According to DIN VDE 0100-430, a line protection shall be provided for the supply voltage.

**NOTE:**
According to DIN VDE 0100-430, devices for protection against a short circuit can be omitted for the coupling of terminals L1/+ and L3/- to the IT system \( \leq 690 \) V to be monitored if the wiring is carried out in such a manner as to reduce the risk of a short circuit to a minimum. (Recommendation: Ensure short-circuit-proof and earth-fault-proof wiring).

The connecting lines L1/+, L2, L3/- to the system to be monitored must be carried out as spur lines. No load current may be conducted through the terminals.

**For UL applications:**
Use 60/70°C copper lines only!

**Digital interface X1**

- I1: Input 1
- I2: Input 2
- I3: Input 3
- A: RS-485 A
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**Digital interface Terminal Colour**

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- I2: Input 2
- I3: Input 3
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- B: RS-485 B
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- M+: Analogue output
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**For UL applications:**
Use 60/70°C copper lines only!

**Digital interface X1**

- I1: Input 1
- I2: Input 2
- I3: Input 3
- A: RS-485 A
- B: RS-485 B
- +: +24 V
- Q1: Output 1
- Q2: Output 2
- M+: Analogue output
- Ground
ISOMETER® isoRW685W-D-B
Insulation monitoring device for IT AC systems with galvanically connected rectifiers and converters and for IT DC systems especially for railway applications

Device features

- ISOMETER® for AC IT systems with galvanically connected rectifiers or converters and for DC IT systems (IT = unearthed systems)
- Automatic adaptation to the existing system leakage capacitance
- Combination of AMP™ and other profile-dependent measurement methods
- Two separately adjustable response value ranges of 1 kΩ…10 MΩ
- High-resolution graphic LC display
- Connection monitoring (monitoring of the measuring lines)
- Automatic device self test
- Graphical representation of the insulation resistance over time (isoGraph)
- History memory with real-time clock (buffer for 13 days) for storing a maximum of 1023 alarm messages with date and time
- Current or voltage output 0(4)…20 mA, 0…400 μA, 0…10 V, 2…10 V (galvanically separated) which is analogous to the measured insulation value of the system
- Freely programmable digital inputs and outputs
- Remote setting via the Internet or Intranet (web server/option: COMTRAXX® gateway)
- Remote diagnosis via the Internet (only by Bender service)
- RS-485/BS (Bender sensor bus) for data exchange with other Bender components
- ISOnet: Internal separation of the ISOMETER® from the IT system to be monitored (e.g. if several IT systems are interconnected)
- BCOM, Modbus TCP/RTU and web server
- Nominal system voltage can be expanded via coupling device

Standards

The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8

Further information

For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage range $U_n$</th>
<th>Supply voltage $U_s$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 0…690 V; 0,1…460 Hz</td>
<td>DC 0…1000 V</td>
<td>isoRW685W-D-B</td>
<td>B91067022W</td>
</tr>
<tr>
<td>AC 24…240 V; 50…400 Hz</td>
<td>DC 24…240 V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A set of screw terminals</td>
<td>B91067901</td>
</tr>
<tr>
<td>A set of push-wire terminals</td>
<td>B91067902</td>
</tr>
<tr>
<td>Enclosure accessories (terminal cover, 2 mounting clips)</td>
<td>B91067903</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupling devices</td>
<td>AGH150W-4</td>
<td>B98018006</td>
<td>352</td>
</tr>
<tr>
<td></td>
<td>AGR2045-4</td>
<td>B914013</td>
<td>354</td>
</tr>
<tr>
<td></td>
<td>AGHS205</td>
<td>B913033</td>
<td>355</td>
</tr>
<tr>
<td></td>
<td>AGH6765-4</td>
<td>B913055</td>
<td>358</td>
</tr>
</tbody>
</table>

Suitable measuring instruments on request!
Technical data

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**

- **Definitions:**
  - Measuring circuit (IC1): (L1/+, L2, L3/+)
  - Supply circuit (IC2): A1, A2
  - Output circuit 1 (IC3): 11, 12, 14
  - Output circuit 2 (IC4): 21, 22, 24
  - Control circuit (IC5): (E, KE, X1, ETH, X3, X4)

- **Rated voltage:** 1000 V
- **Overvoltage category:** III
- **Maximum permissible input current:** 650 mA
- **Tolerance of:**
  - AC/DC 0…600 V (for UL applications)
  - DC 0…1000 V
- **Measuring circuit (IC1) (L1/+, L2, L3/+):**
  - DC ±5 % ±0.05 V
  - Tolerance related to the current/voltage final value  
    - +20 %

**Supply voltage**

- **Supply via A1+/+, A2/-:**
  - AC/DC 24…240 V
- **Tolerance of:**
  - Uᵣ: ±20 % ±0.15 V
  - Maximum permissible input current of Uᵣ: 650 mA
  - Frequency range of Uᵣ: DC, 30…400 Hz
  - Tolerance of the frequency range of Uᵣ: ±2.5 % ±0.15 VA
- **Typical power consumption:** DC ≤ 12 W
- **Typical power consumption 50/60 Hz:** ≤ 12 W/21 VA
- **Typical power consumption 400 Hz:** ≤ 12 W/45 VA

**Supply via X1:**

- **Supply voltage Uᵣ:** DC 24 V
- **Tolerance of:**
  - DC: ±20 % ±0.25 %

**Monitored IT system**

- **Nominal system voltage range Uᵣ:** AC 0…690 V DC 0…1000 V AC/DC 0…600 V (for UL applications)
- **Tolerance of:**
  - Uᵣ: ±5 % ±0.15 VA
  - Frequency range of Uᵣ: DC, 0.1…400 Hz
  - Max. AC voltage Uᵣ in the frequency range: 0.1…4 Hz
  - Uᵣ: max. 50 V/Hz² (*1 + *2)

- **Response values:**
  - Response value Rᵣ₃₅ (Alarm 1): 1 kΩ ± 10 %
  - Response value Rᵣ₆₅ (Alarm 2): 1 kΩ ± 10 %
- **Relative uncertainty (acc. to IEC 61557-8):** profile-dependent, ±15 %, min. ±1 kΩ
- **Hysteresis:** 25 %, min. 1 kΩ

**Time response**

- **Response time tᵣ₃₅ at Rᵣ₃₅:** 0.5 x Rᵣ₃₅ (Rᵣ₃₅ = 10 kΩ) and Cᵣ = 1 μF acc. to IEC 61557-8
  - profile-dependent, typ. 4 s (see diagrams in the manual)
- **Response time DC alarm at Cᵣ = 1 μF:**
  - profile-dependent, typ. 2 s (see diagram in the manual)
- **Start-up delay tᵣ₃₅_up:** 0…600 ms

**Measuring circuit**

- **Measuring voltage Uᵣ:** profile-dependent, ±10 V, ±30 V (see profile overview)
- **Measuring current Iᵣ:** ±403 μA
- **Internal resistance Rᵣ:** ≥ 124 kΩ
- **Internal resistance with system isolation (inactive via I/O; inactive via ISOnet; shutdown):** typ. 50 MΩ
- **Permissible extraneous DC voltage Uᵣ:** ≤ 1200 V
- **Permissible system leakage capacitance Cᵣ:** profile-dependent, 0…1000 μF

**Measuring ranges**

- **Measuring range fᵣ:** 0.1…460 Hz
- **Measurement tolerance of fᵣ:** ±1 % ±0.1 Hz
- **Measurement voltage range of fᵣ:** AC 25…690 V
  - DC 25…1000 V
- **Measurement range Uᵣ:**
  - AC 25…690 V
  - DC 25…1000 V
- **Measurement range of Uᵣ:**
  - AC/DC > 10 V
- **Measurement range of Cᵣ:** 0…1000 μF
- **Measurement tolerance of Cᵣ:** ±10 % ±10 μF
- **Measurement frequency range of Cᵣ:** DC, 30…460 Hz
- **Min. measurement insulation resistance of Cᵣ:** depending on profile and coupling mode, typ. > 10 kΩ

**Display**

- **Display:**
  - Graphic display 127 x 127 pixels, 40 x 40 mm
- **Display range measured value:** 0.1 kΩ…200 MΩ
- **Operating uncertainty (acc. to IEC 61557-8):** ±15 %, min. 1 kΩ

**LEDs**

- **ON (operation LED):**
  - SERVICE: yellow
  - ALARM 1: green
  - ALARM 2: yellow

**Inputs/outputs (X1 interface)**

- **Cable length X1 (unshielded cable):** ≤ 10 m
- **Cable length X1 (shielded cable, shield connected to PE on one side, recommended: J-Y(St)Y min. 2x0.8):** ≤ 100 m
- **Max. output current per output (for supply via X1+/-X1.GND):**
  - Typ. 1 A
- **Max. output current in total at X1 (for supply via A1+/-A2-):**
  - max. 1 A
- **Max. output current in total at X1 (for supply via A1+/-A2- between 16.8 V and 40 V):**
  - (Crush) = 10 mA ± 7 mA/V * Uᵣ, 1)
  - (negative values for IUᵣ are not permissible)

**Digital inputs (I₁, I₂, I₃)**

- **Number:** 3
- **Operating mode, adjustable:**
  - active high, active low
- **Functions:**
  - off, test, reset, deactivate device, start initial measurement

**Voltage**

- **Voltage tolerance:**
  - Low DC: –3…+5 V, High DC: 11…32 V
  - ±10 %

**Digital outputs (Q₁, Q₂)**

- **Number:** 2
- **Operating mode, adjustable:**
  - active, passive
- **Functions:**
  - off, ins. alarm 1, ins. alarm 2, connection fault, DC-alarm 4, DC+ alarm 5, symmetrical alarm, device error, common alarm, measurement complete, device inactive, DC offset alarm

**Voltage**

- **Passive DC 0…32 V, active DC 0/19.2…32 V

**Analogue output (M±)**

- **Number:** 1
- **Operating mode:**
  - linear, mid-scale 28 kΩ/120 kΩ
- **Functions:**
  - insulation value, DC offset

**Current**

- **0…20 mA (< 600 Ω), 4…20 mA (< 600 Ω), 0…400 μA (< 4 kΩ)

**Voltage**

- **0…10 V (< 1 kΩ), 2…10 V (> 1 kΩ)

**Tolerance related to the current/voltage final value:**

- ±20 %

**Interfaces**

**IsOnet:**

- **Number of IsOnet devices:** ≤ 20
- **Maximum nominal system voltage IsOnet:**
  - AC, 690 V
  - DC, 1000 V

**Sensor bus:**

- **Interface/protocol:** RS-485/BS/Modbus RTU
- **Data rate:** 9.6 kbaud/s
- **Cable length:** ≤ 1200 m
- **Cable:** twisted pair, one end of shield connected to PE

**Display bus:**

- **Interface/protocol:**
  - ISOnet
  - RS-485/BS/Modbus RTU
- **Data rate:** 9.6 kbaud/s
- **Cable length:** ≤ 1200 m
- **Cable:** twisted pair, one end of shield connected to PE
- **Terminal resistance at the beginning and end of the transmission path:**
  - 120 Ω, can be connected internally

Device address, BS bus 1…90

1) **Number 3**
2) **Number 2**
3) **Number 1**
4) **Number 1**
5) **Number 1**
Switching elements
Switching elements  2 changeover contacts
Operating mode  N/C operation or N/O operation
Contact 11-12/21-22-24  off, ins. alarm 1, ins. alarm 2, connection fault, DC- alarm -6, DC+ alarm -6, symmetrical alarm, device error, common alarm, measurement complete, device inactive, DC offset alarm
Electrical endurance, number of cycles  10000

Contact data acc. to IEC 60947-5-1:
Utilisation category  AC-13 AC-14 DC-12 DC-12 DC-12 DC-12
Rated operational voltage  230 V 230 V 24 V 48 V 110 V 220 V
Rated operational current  5 A 3 A 1 A 1 A 0.2 A 0.1 A
Rated insulation voltage  ≤ 2000 m NN  250 V
Rated insulation voltage  ≤ 3000 m NN  160 V
Minimum contact rating  1 mA at AC/DC 60 V

Environment/EMC
EMC  EN 50121-3-2, IEC 61326-2-4
Ambient temperatures:
Operating temperature  -40…+70 °C
-40…+65 °C (for UL applications)
Transport  -40…+85 °C
Long-term storage  -40…+70 °C
Classification of climatic conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3)  3K24 (except condensation and formation of ice)
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)  3M12
Transport (IEC 60721-3-2)  2M4
Long-term storage (IEC 60721-3-1)  1M12
Area of application  ≤ 3000 m NN

Connection
Connection type  pluggable screw terminal or push-wire terminal
Screw-type terminals:
Nominal current  ≤ 10 A
Tightening torque  0.5…0.6 Nm (5…7 lb-in)
Conductor sizes  AWG 24-12
Stripping length  7 mm
rigid/flexible  0.2…2.5 mm²
Flexible with ferrule with/without plastic sleeve  0.25…2.5 mm²
Multiple conductor rigid  0.2…1 mm²
Multiple conductor flexible  0.2…1.5 mm²
Multiple conductor flexible with ferrule without plastic sleeve  0.25…1.5 mm²
Multiple conductor flexible with TWIN ferrule with plastic sleeve  0.5…1.5 mm²

Push-wire terminals:
Nominal current  ≤ 8 A
Conductor sizes  AWG 24-16
Stripping length  10 mm
rigid/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

Other
Operating mode  Continuous operation
Mounting position (Ø°)  display-oriented, cooling slots must be ventilated vertically
Degree of protection internal components  IP40
Degree of protection terminals  IP20
DIN rail mounting acc. to  IEC 60715
Screw mounting  3 x M4 with mounting clip
Enclosure material  Polycarbonate
Flammability class  V-0
ANSI code  64
Dimensions (W x H x D)  108 x 93 x 110 mm
Documentation number D00419
Weight  < 390 g

1) At a frequency > 200 Hz, the connection of X1 must be insulated. Only permanently installed devices which at least have overvoltage category CAT2 (300 V) may be connected.
2) Indication limited outside the temperature range -25…+55 °C.
3) Us [Volt] = supply voltage ISOMETER®
4) Only for Un  ≥ 50 V.
5) This is a class A product. In a domestic environment, this product may cause radio interference. In this case, the user may be required to take corrective actions.
6) Recommendation: Mounting position 0° (display-oriented, cooling slots must be ventilated vertically).
At mounting position 45°, the max. operating temperature is reduced by 10 °C.
At mounting position 90°, the max. operating temperature is reduced by 20 °C.
Connection to an AC system $U_n$
2 Connection to a DC system $U_n$
3 Connection to two IT systems that can be coupled with a coupling switch. Information about the state of the coupling switch is not necessary.
4 Connection to an IT system using coupling device
5 Connection to a 3(N)AC system
6 Connection to the IT system to be monitored (L1/+, L2, L3/-)
7 Separate connection of KE, E to PE

Provide line protection!
According to DIN VDE 0100-430, line protection shall be provided for the supply voltage.

Note:
According to DIN VDE 0100-430, devices for protection against a short circuit can be omitted for the coupling of terminals L1/+, L2 and L3/- to the IT system ≤ 690 V to be monitored if the wiring is carried out in such a manner as to reduce the risk of a short circuit to a minimum (recommendation: Ensure short-circuit-proof and earth-fault-proof wiring).
The connecting lines L1/+, L2, L3/- to the system to be monitored must be carried out as spur lines. No load current may be conducted through the terminals.

For UL applications:
Use 60/70 °C copper lines only!
UL and CSA applications require the supply voltage to be protected via 5 A fuses.

Digital interface X1

<table>
<thead>
<tr>
<th>Digital interface</th>
<th>Terminal</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I1</td>
<td>Input 1</td>
</tr>
<tr>
<td></td>
<td>I2</td>
<td>Input 2</td>
</tr>
<tr>
<td></td>
<td>I3</td>
<td>Input 3</td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>RS-485 A</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>RS-485 B</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>+24 V</td>
</tr>
<tr>
<td></td>
<td>Q1</td>
<td>Output 1</td>
</tr>
<tr>
<td></td>
<td>Q2</td>
<td>Output 2</td>
</tr>
<tr>
<td></td>
<td>M+</td>
<td>Analogue output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ground</td>
</tr>
</tbody>
</table>

Wiring diagram
Display FP200
Display and operator unit for devices of the iso685 series without display

Device features
• Display for front panel mounting of series iso685
• Various mounting options
• Uniform operation
• Backlit buttons

Typical applications
• Display and operator unit for devices of the iso685 series without display

Approvals

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage/frequency range $U_1$</th>
<th>Power consumption</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td>typ. 3 W</td>
<td>FP200</td>
<td>B91067904</td>
</tr>
<tr>
<td>24 V/-20…+25 %</td>
<td></td>
<td>FP200W(^1)</td>
<td>B91067904W</td>
</tr>
</tbody>
</table>

\(^1\) Device version Option "W" with increased shock and vibration resistance

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FP200 mechanical accessories comprising: 2 screw attachments</td>
<td>B91067907</td>
</tr>
<tr>
<td>Front cover 144x72 transparent (for IP65)</td>
<td>B98060005</td>
</tr>
<tr>
<td>Patch cable CAT5e (without UL, temperature range 0…+60 °C) Included in the scope of delivery</td>
<td>B91067906</td>
</tr>
<tr>
<td>FP200 adapter for front panel mounting IRDHT5</td>
<td>B91067905</td>
</tr>
<tr>
<td>Front cover 144x96 transparent (for IP65)</td>
<td>B98060007</td>
</tr>
</tbody>
</table>
Technical data

Insulation co-ordination (IEC 60664-1/IEC 60664-3)
Rated voltage 50 V
Overvoltage category (OV3) III
Rated impulse voltage 800 V
Rated insulation voltage 50 V
Pollution degree for accessible parts on the outside of the device housing 3

Supply voltage
Supply voltage $U_s$ DC 24 V (via iso685-S variant)
Power consumption 1.2 W

Display
Graphic display 127 x 127 pixel, 40 x 40 mm

LEDs
ON (operation LED) green
SERVICE yellow
ALARM 1 yellow
ALARM 2 yellow

Interfaces
Interface/protocol Internal Bender
Cable length $\leq$ 5 m
REMOTE Cable Patch cable at least CAT5e

Environment/EMC
EMC IEC 61326-2-4; EN 50121-3-2; EN 50121-4

Ambient temperatures
Operating temperature -25...+55 °C
Transport -40...+85 °C
Long-term storage -40...+70 °C

Classification of climatic conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) 3K23 (except condensation and formation of ice)
Transport (IEC 60721-3-2) 2K11
Long-time storage (IEC 60721-3-1) 1K22

Classification of mechanical conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) 3M11
Transportation (IEC 60721-3-2) 2M4
Long-term storage (IEC 60721-3-1) 1M12
Area of application $\leq$3000 m NN

Connection
Connection type plug connectors

Other
Operating mode continuous operation
Mounting (0°) display oriented, cooling slots must be ventilated vertically
Degree of protection, built-in components (DIN EN 60529) IP40
Degree of protection, terminals (DIN EN 60529) IP20
Degree of protection with transparent cover IP65
Panel cut-out 138 x 66 mm
Permissible tolerance of panel cut-out $+0.5/-0$
Screw mounting with mounting brackets
Torque screw mounting 0.3 Nm ±10%
Enclosure material polycarbonate
Flammability class UL94V-0
Dimensions (W x H x D) 144 x 72 x 35.6 mm
Documentation number D00169
Weight < 180 g

Option "W" data different from the standard version
(Only for remote mounting)
Ambient temperatures:
Operating temperature -40...+70 °C
Transport -40...+85 °C
Long-term storage -40...+70 °C
Classification of climatic conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) 3K23 (condensation and formation of ice possible)
Classification of mechanical conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) 3M12

(*) = factory setting
1) Recommendation: Devices mounted at 0° (display-oriented, cooling slots must be ventilated vertically). For devices mounted at an angle $\neq 0^\circ$, the max. working temperature is reduced by 10 °C for devices with a "W" in the device name.

Option "W" data different from the standard version
(Only for remote mounting)
Ambient temperatures:
Operating temperature -40...+70 °C
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Connection to iso685

Option "W" data different from the standard version
(Only for remote mounting)
Ambient temperatures:
Operating temperature -40...+70 °C
Transport -40...+85 °C
Long-term storage -40...+70 °C
Classification of climatic conditions acc. to IEC 60721:
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Connection to iso685

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(Only for remote mounting)
Ambient temperatures:
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Connection to iso685

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(Only for remote mounting)
Ambient temperatures:
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Classification of mechanical conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) 3M12

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Connection to iso685

Option "W" data different from the standard version
(Only for remote mounting)
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Connection to iso685

Option "W" data different from the standard version
(Only for remote mounting)
Ambient temperatures:
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Transport -40...+85 °C
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Classification of mechanical conditions acc. to IEC 60721:
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Connection to iso685

Option "W" data different from the standard version
(Only for remote mounting)
Ambient temperatures:
Operating temperature -40...+70 °C
Transport -40...+85 °C
Long-term storage -40...+70 °C
Classification of climatic conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) 3K23 (condensation and formation of ice possible)
Classification of mechanical conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) 3M12

(*) = factory setting
1) Recommendation: Devices mounted at 0° (display-oriented, cooling slots must be ventilated vertically). For devices mounted at an angle $\neq 0^\circ$, the max. working temperature is reduced by 10 °C for devices with a "W" in the device name.
ISOMETER® IRDH275BM-7 with coupling device AGH675-7 and AGH675-7MV15

Device combination for insulation monitoring in unearthed AC, AC/DC and DC power systems (IT systems)

Device features

- Insulation monitoring for drives including medium voltage converters up to 15.5 kV
- Two separately adjustable response values 100 kΩ … 10 MΩ
- AMP® measurement method (European patent: EP 0 654 673 B1)
- Automatic adaptation to the system leakage capacitance
- Info button to display device settings and the system leakage capacitance
- History memory with real-time clock to store alarm messages with date and time stamp
- BMS interface (Bender Measuring Device Interface) for communication with other Bender devices (RS-485 electrically isolated)
- Current output 0(4)…20mA (electrically isolated) analogously to the measured insulation value
- Self monitoring with automatic alarm
- Automatic self test, selectable
- Connection for external kΩ indication
- Test and reset button
- Connection external test and reset button
- Two separate alarm relays with two potential-free changeover contacts
- N/O or N/C operation, selectable
- Backlit two-line plain text display
- Remote setting of specific parameters via Internet (option; COM460IP with at least Option C required)

Standards

The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- EN 61557-8
- IEC 61557-8
- IEC 61326-2-4
- DIN EN 60664-1 (VDE 0110-1)
- DIN EN 60664-3 (VDE 0110-3)
- ASTM F1669M-96
- ASTM F1207M-96

Further information

For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage $U_n$</th>
<th>Supply voltage $U_s$</th>
<th>Cable length</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC, 3(N)AC/DC</td>
<td>AC</td>
<td>DC</td>
<td>IRDH275BM-727</td>
<td>B91065120</td>
<td>–</td>
</tr>
<tr>
<td>–</td>
<td>19.2…55 V</td>
<td>19.2…72 V</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0…7.2 kV, 0…460 Hz</td>
<td>–</td>
<td>–</td>
<td>2000 mm</td>
<td>AGH675S-7-2000</td>
<td>B913061</td>
</tr>
<tr>
<td></td>
<td>–</td>
<td>–</td>
<td>500 mm</td>
<td>AGH675S-7-500</td>
<td>B913060</td>
</tr>
<tr>
<td>0…15.5 kV, 0…460 Hz</td>
<td>–</td>
<td>–</td>
<td>500 mm</td>
<td>AGH675S-7MV15-500</td>
<td>B913058</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>External kΩ measuring instruments</td>
<td>9620-1421</td>
<td>B986849</td>
<td>397</td>
</tr>
</tbody>
</table>
Insulation monitoring device ISOMETER® IRDH275BM-7

Technical data IRDH275BM-7

Insulation coordination acc. to IEC 60664-1

Rated voltage AC 800 V
Rated impulse voltage/pollution degree 8 kV/pollution degree

Voltage ranges
Nominal voltage range
Via AGH675S-7…
Supply voltage US, (also see nameplate) AC 19.2…55 V
Frequency range US
42…460 Hz
Supply voltage US, (also see nameplate) DC 19.2…72 V
Power consumption ≤ 14 VA

Response values
Response value Ran1 (Alarm 1) 100 kΩ…10 MΩ
Response value Ran2 (Alarm 2) 100 kΩ…10 MΩ
Relative percentage error 100…500 kΩ ±100 kΩ
Relative percentage error 500 kΩ…10 MΩ 0 %…+20 %
Response time tan ≤ 5 min
Hysteresis 25 %

Measuring circuit
Measuring voltage Um ≤ 50 V
Measuring current Im (at RF = 0 Ω) ≤ 21 μA
Internal DC resistance Ri ≥ 2.4 MΩ
Internal impedance Zi, at 50 Hz ≥ 2.4 MΩ
Permissible extraneous DC voltage Ufg with AGH675S-7…
Permissible system leakage capacitance Ce ≤ 5 μF
Factory setting 2 μF

Displays
Display, illuminated two-line display
Characters (number of characters) 2 x 16
Display range, measuring value 50 kΩ…10 MΩ
Relative percentage error 50…500 kΩ ±50 kΩ
Relative percentage error 500 kΩ…10 MΩ ±10 %

Outputs/inputs
TEST/RESET button internal/external
Cable length TEST/RESET button external ≤ 10 m

Current output for measuring instrument SKMP (scale centre point = 1.2 MΩ):
Current output (load) 20 mA (≤ 500 Ω)
Accuracy current output (100 kΩ…10 MΩ) ±10 %, ±100 kΩ

Serial interface
Interface/Protocol RS-485/BMS
Connection terminals A/B
Cable length ≤ 1200 m
Recommended cable (screened, screen on one side connected to PE) J-Y(St)Y 2x0.6
Terminating resistor 120 Ω (0.5 W)
Device address, BMS bus 1…30 (factory setting = 3)

Switching components
Switching components 2 changeover contacts: K1 (Alarm 1), K2 (Alarm 2, system fault)
Operating principle K1, K2 (Alarm 1, Alarm 2) N/O or N/C operation
Factory setting (Alarm 1/Alarm 2) N/O operation
Electrical endurance 12 000 switching operations
Contact class HR (IEC 60255-23)
Rated contact voltage AC 250 V/DC 300 V
Making capacity AC/DC 5 A
Breaking capacity 2 A, AC 230 V, cos φ = 0.4
0.2 A, DC 220 V, L/R = 0.04 s
Minimum contact current at DC 24 V ≥ 2 mA (50 mA)

Environment/EMC
EMC immunity acc. to EN 61326
EMC emission acc. to EN 61326
Shock resistance IEC 60068-2-27 (device in operation) 15 g/11 ms
Bumping IEC 60068-2-29 (during transport) 40 g/6 ms
Vibration resistance IEC 60068-2-6 (device in operation) 1 g/10…150 Hz
Vibration resistance IEC 60068-2-6 (during transport) 2 g/10…150 Hz
Ambient temperature (during operation) -10…+55 °C
Storage temperature range -40…+70 °C
Climatic class acc. to IEC 60721-3-3 3K23

Connection
Connection screw terminals
Connectors rigid, flexible 0.2…4 mm²/0.2…2.5 mm²
flexible with connector sleeve, without/with plastic sleeve 0.25…2.5 mm²
Conductor sizes (AWG) 24…12

Other
Operating mode continuous operation
Mounting as indicated on the display
Protection class, internal components (DIN EN 60529) IP30
Protection class, terminals (DIN EN 60529) IP20
Type of enclosure X112, free from halogen
DIN rail mounting IEC 60715
Flammability class UL94 V-0
Tightening torque 0.5 Nm
Documentation number D00123
Weight approx. 510 g
Insulation monitoring devices | Application-specific selection – Variable-speed drives

Insulation monitoring device ISOMETER® IRDH275BM-7 with coupling device AGH675-7 and AGH675-7MV15

ISOMETER® IRDH275BM-7

<table>
<thead>
<tr>
<th>Dimension diagrams (dimensions in mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRDH275BM-7</td>
</tr>
<tr>
<td>AGH675S-7…</td>
</tr>
</tbody>
</table>

Technical data AGH675S-7…

Insulation coordination acc. to DIN EN 61800-5-1

**AGH675S-7**

- Rated insulation voltage: **AC 7.2 kV**
- Voltage test acc. to DIN EN 61800-5-1
  - Type test:
    - Voltage impulse test: 40 kV
    - AC voltage test: 20 kV
  - Partial discharge test: 14 kV

**AGH675S-7MV15**

- Rated insulation voltage: **AC 15.5 kV**
- Voltage impulse test: 111 kV
- AC voltage test: 70 kV
- Partial discharge test: 29 kV

**Type test:**
- AC voltage test: 40 kV

**Voltage ranges**

**AGH675S-7**

- Nominal system voltage: **U_n**
  - AC, 3(N)AC, DC 0…7.2 kV
- Nominal frequency: **f_n**
  - 0…460 Hz
- Internal DC resistance: **R_i**
  - ≥ 2.39 MΩ

**AGH675S-7MV15**

- Nominal system voltage: **U_n**
  - AC, 3(N)AC, DC 0…15.5 kV
- Nominal frequency: **f_n**
  - 0…460 Hz
- Internal DC resistance: **R_i**
  - ≥ 4.7 MΩ

**Environment**

- Operating temperature (normal operation): -10…+60 °C
- Operating temperature (continuous operation with asymmetrical earth fault): -10…+55 °C

**Classification of climatic conditions acc. to IEC 60721**

- Stationary use (IEC 60721-3-3): 3K23 (no condensation, no formation of ice)
- 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 (3M12 Y shaft)
- Transport (IEC 60721-3-2): 2M4
- Long-term storage (IEC 60721-3-1): 1M12

**Connection**

- Connection terminal 2 (medium voltage): high-voltage cable (encapsulated on the device side)
- Connection, flexible with ring terminal: M4
- Connection 3, 4, 5: screw-type terminals

**Routine test:**
- AC voltage test: 200 kV
- Partial discharge test: 14 kV

**Other**

- Operating mode: continuous operation
- Mounting: any position
- Protection class, internal components (DIN EN 60529): IP64
- Protection class, terminals (DIN EN 60529): IP20
- Type of enclosure: resin-encapsulated block
- Flammability class: UL94 HB
- Documentation number: D00095
- Weight approx.: ≤ 5100 g
**Insulation monitoring devices | Application-specific selection – Variable-speed drives**

**Insulation monitoring device ISOMETER® IRDH275BM-7 with coupling device AGH675-7 and AGH675-7MV15**

1. Supply voltage $U_s$ (see ordering information) via 6 A fuse
2. Terminals L1, L2 are not connected!
3. Connection to the coupling device AGH675S-7 or the two coupling devices AGH675S-7MV15:
   - Connect terminal AK to terminal(s) 5 of the coupling device AGH675S-7 (or the two coupling devices AGH675S-7MV15),
   - Connection with standard low-voltage cable, maximum voltage at terminal S: 200 V
4. Separate connection of $\oplus$ and KE to PE
5. Separate connection of terminals 3 and 4 of the AGH675S-7 or AGH675S-7MV15 to PE
6. External TEST button (NO contact)
7. External RESET button (NC contact or wire jumper), when the terminals are open, the fault message will not be stored
8. STANDBY by means of the function input F1, F2: When the contact is closed, insulation measurement does not take place.
9. Current output, galvanically separated: 0…20 mA or 4…20 mA
10. Serial interface RS-485 (termination 120 Ω resistor)
11. Alarm relay 1; changeover contacts provided
12. Alarm relay 2 (system fault relay); changeover contacts provided
13. Connection of the coupling device AGH675S-7 to the converter: connect the high voltage cable encapsulated on one end to the mid-point of the DC intermediate circuit.
14. Connection of the two coupling devices AGH675S-7MV15 to the converter: connect the high voltage cable encapsulated on L+ and L-.
ISOMETER® iso415R-x
Insulation monitoring device for unearthed 3(N)AC, AC and DC systems (IT systems)

Device features
- Monitoring of the insulation resistance for unearthed 3(N)AC, AC and DC systems with galvanically connected rectifiers
- Automatic adaptation to the system leakage capacitance up to 25 μF
- Response time ≤ 6 s at $C_e = 1\mu F$ and $R_f = R_{an/2}$
- Automatic device self test with connection monitoring
- Two separately adjustable response value ranges from 5 kΩ…1000 kΩ
- Selectable start-up delay, response delay and delay on release
- Fault memory
- RS-485 interface with Modbus RTU protocol
- NFC interface

1 Only adjustable via Modbus RTU or Bender App

Standards
Devices of the iso415R series have been developed according to the following standards:
- IEC 61557-8

Further information
For further information refer to our product range on www.bender.de.

Typical applications
- Unearthed 3(N)AC, AC and DC main and control circuits (IT systems)

Approvals
UL in preparation

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage $U_s$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC DC 24 V</td>
<td>iso415R-24</td>
<td>B71602000</td>
</tr>
<tr>
<td>100…240 V</td>
<td>iso415R-2</td>
<td>B71603000</td>
</tr>
</tbody>
</table>

Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3
Definitions:
- Measuring circuit (IC1) L1, L2
- Control circuit (IC2) E, KE, +, -, A, B
- Output circuit (IC3) 11, 14, 12
- Rated voltage 400 V
- Overvoltage category III
- Operating altitude 2000 m AMSL
- Rated impulse voltage:
  - IC1/(IC2-3) 6 kV
  - IC2/IC3 4 kV
- Rated insulation voltage:
  - IC1/(IC2-3) 400 V
  - IC2/IC3 250 V
- Pollution degree 2
- Protective separation between:
  - IC1/(IC2-3) Overvoltage category III, 600 V
  - IC2/IC3 Overvoltage category III, 300 V
- Voltage tests (routine test) acc. to IEC 61010-1
  - IC3/(IC1-2) AC 2.2 kV

Supply voltage
iso415R-24: Only via galvanically separated power supply (+/-)
- Supply voltage $U_s$ DC 24 V
- Tolerance of $U_s$ ±20…+25 %
- Power consumption ≤ 2 W
- Inrush current (< 5 ms) < 10 A
iso415R-2: Only via the system to be monitored $U_n = U_s (1/l1/2)$
- Monitoring of the insulation resistance $R_{an}$

Monitored IT system iso415R-2
- Nominal system voltage $U_n = U_s$
  - 3(N)AC, AC 0…415 V/DC 0…400 V
- Tolerance of $U_n$ AC +15 %, DC +25 %
- Frequency range of $U_n$ DC 42…460 Hz
- Power consumption (at 50 Hz) ≤ 2 W / ≤ 3.5 VA
- Inrush current (< 2 ms) < 1.8 A

Measuring circuit
- Measuring voltage $U_{m}$ ±16 V
- Measuring current $I_{m}$ at $R_F, Z_F = 0 \Omega$ ≤ 90 μA
- Internal resistance $R_i, Z_i \geq 180 \Omega$
- Permissible system leakage capacitance $C_e \leq 25 \mu F$
- Permissible extraneous DC voltage $U_{fg} \leq 500 \mu V$
- Hysteresis $R_{Hs}$ 25 %, minimum 1 kΩ
- Start-up delay $t_{s}$ ≤ 6 s
- Response delay $t_{on}$ ≤ 0…1800 s (0 s)*
- Delay on release $t_{off}$ ≤ 0…1800 s (0 s)*
- Recovery time ≤ 0.4 s

Response values
- Response time $t_{on}$ at $R_f = 0.5 \times R_{an}$ and $C_e=1 \mu F$
  acc. to IEC 61557-8 ≤ 6 s
- Response value $R_{Hs}$ 10…1000 kΩ (40 kΩ)*
- Response value $R_{on}$ 5…700 kΩ (10 kΩ)*
- Relative uncertainty $U_{m}$ ±15 % ±2 kΩ
- Relative uncertainty $U_{n}$ ±15 % ±2 kΩ
- Hysteresis $R_{Hs}$ 25 %, minimum 1 kΩ
- Power consumption (at 50 Hz) ≤ 2 W / ≤ 3.5 VA
- Inrush current (< 2 ms) < 1.8 A
- Tolerance of $U_n$ AC +15 %, DC +25 %
- Frequency range of $U_n$ DC 42…460 Hz

Displays, memory
- Display status LED incl. LED bar graph (7 LEDs)
- Display range insulation resistance ($R_n$)
  - 1…1000 kΩ
- Measuring range insulation resistance ($R_n$)
  - 1…1000 kΩ
- Operating uncertainty ±15 % ±2 kΩ
- Fault memory alarm messages on/off (off)*
RS-485 interface

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Modbus RTU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baud rate</td>
<td>max. 115.2 kbit/s (19.2 kbit/s)*</td>
</tr>
<tr>
<td>Parity</td>
<td>even, no, odd (even)*</td>
</tr>
<tr>
<td>Stop bits</td>
<td>1/ 2/ auto (auto)*</td>
</tr>
<tr>
<td>Cable length (9.6 kbit/s)</td>
<td>≤ 1200 m</td>
</tr>
<tr>
<td>Cable: twisted pair</td>
<td>min. J-Y(St)Y 2x0.6</td>
</tr>
<tr>
<td>Terminating resistor (external)</td>
<td>120 Ω (0.25 W)</td>
</tr>
<tr>
<td>Device address, Modbus RTU</td>
<td>1…247 (100 + SN)*</td>
</tr>
</tbody>
</table>

Switching elements

<table>
<thead>
<tr>
<th>Switching elements</th>
<th>1 changeover contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating principle</td>
<td>NC operation/NO operation*</td>
</tr>
<tr>
<td>Electrical endurance, number of cycles</td>
<td>10000</td>
</tr>
</tbody>
</table>

Contact data acc. to IEC 60947-5-1:

<table>
<thead>
<tr>
<th>Utilisation category</th>
<th>AC-12</th>
<th>AC-14</th>
<th>DC-12</th>
<th>DC-12</th>
<th>DC-12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated operational voltage</td>
<td>230 V</td>
<td>230 V</td>
<td>24 V</td>
<td>110 V</td>
<td>220 V</td>
</tr>
<tr>
<td>Rated operational current</td>
<td>5 A</td>
<td>3 A</td>
<td>1 A</td>
<td>0.2 A</td>
<td>0.1 A</td>
</tr>
<tr>
<td>Minimum contact rating</td>
<td>1 mA at AC/DC ≥ 10 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Connection

<table>
<thead>
<tr>
<th>Connection type</th>
<th>Push-in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal current</td>
<td>≤ 10 A</td>
</tr>
<tr>
<td>Connection properties</td>
<td></td>
</tr>
<tr>
<td>rigid</td>
<td>0.2…1.5 mm² (AWG 24…16)</td>
</tr>
<tr>
<td>flexible</td>
<td>0.2…1.5 mm² (AWG 24…16)</td>
</tr>
<tr>
<td>with ferrule</td>
<td>0.25…0.75 mm²</td>
</tr>
<tr>
<td>with ferrule*</td>
<td>1.0…1.5 mm²</td>
</tr>
</tbody>
</table>

Environment/EMC

<table>
<thead>
<tr>
<th>EMC</th>
<th>IEC 61326-2-4</th>
</tr>
</thead>
</table>

Ambient temperatures

<table>
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<tr>
<th>Operation</th>
<th>-25...+55 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport</td>
<td>-40...+85 °C</td>
</tr>
<tr>
<td>Storage</td>
<td>-40...+70 °C</td>
</tr>
</tbody>
</table>

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

| 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 |

Other

<table>
<thead>
<tr>
<th>Operating mode</th>
<th>continuous operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting</td>
<td>cooling slots must be ventilated vertically</td>
</tr>
<tr>
<td>Degree of protection, internal components (DIN EN 60529)</td>
<td>IP30</td>
</tr>
<tr>
<td>Degree of protection, terminals (DIN EN 60529)</td>
<td>IP20</td>
</tr>
<tr>
<td>Enclosure material</td>
<td>polycarbonate</td>
</tr>
<tr>
<td>DIN rail mounting acc. to</td>
<td>IEC 60715</td>
</tr>
<tr>
<td>Flammability class</td>
<td>UL 94 V-0</td>
</tr>
<tr>
<td>Documentation number</td>
<td>D00401</td>
</tr>
<tr>
<td>Weight</td>
<td>≤ 100 g</td>
</tr>
</tbody>
</table>

(*) Factory setting

1) Configurable via App and Modbus
2) When supplied by or when monitoring systems with a frequency ≥ 200 Hz, the cable must be laid in a shockproof manner.
3) Refers to relays that have not been operated with high contact currents
4) Use crimping pliers similar to CRIMPFOX 6 / Weidmüller PZ6/PZ6/5 only.
5) Factory setting: 100 + last two digits of serial number
6) Resolution/step size 1 kΩ
Connection to the system to be monitored. ($U_n$)
iso415R-2: Supply voltage $U_s = U_n$ (AC/DC 100…240 V)

Earth, Control earth

Caution! Select correct supply voltage!
Applying an excessive supply voltage $U_s$ can destroy the device.
Correct values are:
iso415R-24: $U_s = DC 24 V$ (floating!)
iso415R-2: $U_s = U_n = AC/DC 100…240 V$

Alarm relay K1
iso415R-24: floating supply voltage $U_s = DC 24 V$

RS-485 interface
ISOMETER® IR420-D4
Insulation monitoring device for unearthed AC control circuits (IT systems)

Device features
- Insulation monitoring for IT control circuits AC 0…300 V
- Two separately adjustable response values
- Preset function (automatic setting of basic parameters)
- Connection monitoring system/earth
- LEDs: Power On, Alarm 1, Alarm 2
- Internal/external test/reset button
- Two separate alarm relays (one changeover contact each)
- N/O or N/C operation, selectable
- Fault memory behaviour, selectable
- Self monitoring with automatic alarm
- Multi-functional LC display
- Adjustable response delay
- Two-module enclosure (36 mm)
- RoHS compliant
- Push-wire terminal (two terminals per connection)

Standards
The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- EN 61557-8
- IEC 61557-8
- ASTM F 1207M-96 (2007)

Typical applications
- AC control circuits in the industrial sector, mechanical engineering, power plants, elevators, automation systems etc.
- AC control and auxiliary circuits in accordance with DIN EN 60204-1 “Electrical equipment of machines”, IEC 60204-1, EN 60204-1
- AC auxiliary circuits in accordance with DIN VDE 0100-725
- Smaller AC IT systems such as lighting systems, mobile generators

Approvals

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>IR420-D4-1</td>
<td>B91016409</td>
</tr>
<tr>
<td>DC</td>
<td>IR420-D4-2</td>
<td>B91016405</td>
</tr>
</tbody>
</table>

1) Absolute values

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
Insulation monitoring devices
Control and auxiliary circuits

Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

**Rated insulation voltage**
250 V

**Rated impulse voltage/pollution degree**
4 kV / 3

**Protective separation (reinforced insulation) between**
(A1, A2) → (L1, L2, E, K1, T/R) → (11, 12, 14) → (21, 22, 24)

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

**Supply voltage**

**IR420-D4-1:**
- Supply voltage \(U_s\)
  - AC 16…72 V / DC 9.6…94 V
- Frequency range \(U_s\)
  - 42…460 Hz / DC

**IR420-D4-2:**
- Supply voltage \(U_s\)
  - AC/DC 70…300 V
- Frequency range \(U_s\)
  - 42…460 Hz, DC

**Power consumption**
≤ 4 VA

**IT system being monitored**

**Nominal system voltage**
\(U_n\)
- AC 0…300 V

**Nominal frequency**
\(f_n\)
- 42…460 Hz

**Response values**

- Response value \(R_{an1}\) (Alarm 1)
  - 1…200 kΩ
- Response value \(R_{an2}\) (Alarm 2)
  - 1…200 kΩ

**Preset mode**

- \(U_n \leq 72 V\)
  - \(R_{an1}\) (ALARM 1)/\(R_{an2}\) (ALARM 2)
    - 20 kΩ/10 kΩ
- \(U_n > 72 V\)
  - \(R_{an1}\) (ALARM 1)/\(R_{an2}\) (ALARM 2)
    - 46 kΩ/23 kΩ

**Relative uncertainty**

- (1…5 kΩ)/ (5…200 kΩ)
  - ±0.5 kΩ/±15 %

**Hysteresis**

- (1…5 kΩ)/ (5…200 kΩ)
  - +1 kΩ/+25 %

**Time response**

- Response time \(t_{an}\) at \(R_F = 0.5 \times R_{an}\) and \(C_e = 1 \mu F\)
  - ≤ 1 s
- Start-up delay (start time) \(t_0\)
  - 0…10 s (0 s)*
- Response delay \(t_{on}\)
  - 0…99 s (0 s)*

**Measuring circuit**

- Measuring voltage \(U_{m}\)
  - ±12 V
- Measuring current \(I_m\) (at \(R_F = 0\ Ω\))
  - ≤ 200 µA
- Internal DC resistance \(R_i\)
  - ≥ 62 kΩ
- Impedance \(Z_i\) at 50 Hz
  - ≥ 60 kΩ
- Permissible extraneous DC voltage \(U_{fg}\)
  - ≤ DC 380 V
- Permissible system leakage capacitance \(C_e\)
  - ≤ 20 µF

**Displays, memory**

- Display
  - LC display, multi-functional, non-illuminated
- Display range, measured value
  - 1 kΩ…1 MΩ
- Operating uncertainty (1…5 kΩ)
  - ±0.5 kΩ
- Operating uncertainty (5 kΩ…1 MΩ)
  - ±15 %
- Password
  - off/f0…999 (off)*
- Fault memory, alarm relay
  - on/off*

**Inputs**

- Cable length test and reset button
  - ≤ 10 m

**Switching elements**

- Number of switching elements
  - 2 x 1 changeover contact

**Operating principle**

- NC/N/O operation (N/O operation)*

**Electrical service life, number of cycles**
10,000

**Contact data acc. to IEC 60947-5-1**

**Utilization category**
- AC-13
- AC-14
- DC-12
- DC-12
- DC-12

**Rated operational voltage**
- 230 V
- 230 V
- 220 V
- 110 V
- 24 V

**Rated operational current**
- 5 A
- 3 A
- 0.1 A
- 0.2 A
- 1 A

**Minimum contact rating**
- 1 mA at AC/DC ≤ 10 V

**Environment/EMC**

- **EMC**
  - IEC 61326-2-4
- **Operating temperature**
  - -25…+55 °C

**Classification of climatic conditions acc. to IEC 60721**

- **Stationary use (IEC 60721-3-3)**
  - JK23 (except condensation and formation of ice)
- **Transport (IEC 60721-3-2)**
  - TK22 (except condensation and formation of ice)

**Classification of mechanical conditions IEC 60721**

- **Stationary use (IEC 60721-3-3)**
  - 3M11
- **Transport (IEC 60721-3-2)**
  - 2M4
- **Long-time storage (IEC 60721-3-1)**
  - 1M12

**Connection**

**Connection type**

- Screw-type terminal or push-wire terminal

**Connection screw terminals**

- **Connection properties**
  - rigid
    - 0.2…4 mm² (AWG 24…12)
  - flexible
    - 0.2…2.5 mm² (AWG 24…14)
- **Two conductors with the same cross section**
  - rigid/flexible
    - 0.2…1.5 mm² (AWG 24…16)

**Stripping length**
8 mm

**Lightening torque, terminal screws**
0.5…0.6 Nm

**Connection push-wire terminals**

- **Connection properties**
  - rigid
    - 0.2…2.5 mm² (AWG 24…14)
  - flexible
    - without ferrules
      - 0.75…2.5 mm² (AWG 19…14)
    - with ferrules
      - 0.2…1.5 mm² (AWG 24…16)
- **Stripping length**
10 mm

**Opening force**
50 N

**Test opening, diameter**
2.1 mm

**Other**

**Operating mode**

- continuous operation

**Mounting**

- any position

**Degree of protection, internal components (DIN EN 60529)**
IP30

**Degree of protection, terminals (DIN EN 60529)**
IP20

**Enclosure material**

- polycarbonate

**Flammability class**

- UL94 V-0

**DIN rail mounting acc. to IEC 60715**

**Screw mounting**
2 x M4 with mounting clip

**Documentation number**
D60037

**Weight**
≤ 150 g

( )* = factory setting

---

**Dimension diagram** (dimensions in mm)

---
Wiring diagram

1. **A1, A2**  
   Supply voltage $U_s$ (see ordering details) via fuse

2. **E, KE**  
   Separate connection of E, KE to PE

3. **L1, L2**  
   Connection of the AC system to be monitored:  
   AC: connect terminals L1, L2 to conductor L1, L2.

4. **11, 12, 14**  
   Alarm relay K1: Alarm 1

5. **21, 22, 23**  
   Alarm relay K2: Alarm 2

6. **T/R**  
   Combined test and reset button "T/R":  
   short-time pressing (< 1.5 s) = RESET,  
   long-time pressing (> 1.5 s) = TEST

* Line protection by a fuse in accordance with IEC 60364-4-43 (6 A fuse recommended). In case of supply (A1/A2) from an IT system, both lines have to be protected by a fuse.
**ISOMETER® IR425**

Insulation monitoring device for unearthed AC/DC control circuits (IT systems)

---

**Device features**
- Insulation monitoring for AC/DC control circuits 0…300 V
- Two separately adjustable response values
- Preset function (automatic setting of basic parameters)
- Connection monitoring system/earth
- LEDs: Power On, Alarm 1, Alarm 2
- Information about the point of fault L+/L-via display
- Internal/external test/reset button
- Two separate alarm relays (one changeover contact each)
- N/O or N/C operation, selectable
- Fault memory behaviour, selectable
- Self monitoring with automatic alarm
- Multi-functional LC display
- Adjustable response delay
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)

---

**Standards**
The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8
- ASTM F 1669M-96

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**Typical applications**
- AC/DC control circuits in the industrial sector, mechanical engineering, power plants, elevators, automation systems etc.
- AC/DC control and auxiliary circuits in accordance with DIN EN 60204-1, "Electrical equipment of machines", IEC 60204-1, EN 60204-1
- AC/DC auxiliary circuits in accordance with DIN VDE 0100-725 (VDE 0100-725)
- Smaller AC/DC IT systems such as lighting systems

---

**Ordering information**

<table>
<thead>
<tr>
<th>Supply voltage</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AC</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16…72 V, 15…460 Hz</td>
<td>IR425-D4-1</td>
<td>B91036403</td>
</tr>
<tr>
<td>70…300 V, 15…460 Hz</td>
<td>IR425-D4W-1</td>
<td>B91036403W</td>
</tr>
<tr>
<td><strong>DC</strong></td>
<td></td>
<td></td>
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<tr>
<td>9.6…94 V</td>
<td>IR425-D4-2</td>
<td>B91036402</td>
</tr>
<tr>
<td>70…300 V</td>
<td>IR425-D4W-2</td>
<td>B91036402W</td>
</tr>
</tbody>
</table>

---

**Accessories**

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B90060008</td>
</tr>
</tbody>
</table>
## Technical data

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**

- Rated insulation voltage: 250 V
- Rated impulse voltage/pollution degree: 4 kV/k
- Protective separation (reinforced insulation) between: (A1, A2) - (L1, L2, E, KE, T/R) - (11, 12, 14) - (21, 22, 24)

**Voltage test acc. to IEC 61010-1**

- 2.2 kV

### Supply voltage

**IRA425-D4-1, IRA425-D4W-1:**
- Supply voltage $U_s$: AC 16…72 V, DC 9.6…94 V
- Frequency range $U_s$: 15…460 Hz, DC

**IRA425-D4-2, IRA425-D4W-2:**
- Supply voltage $U_s$: AC/DC 70…300 V
- Frequency range $U_s$: 15…460 Hz, DC

- Power consumption: $\leq 4$ VA

### IT system being monitored

- Nominal system voltage $U_n$: AC/DC 0…300 V
- Nominal frequency $f_n$: DC 15…460 Hz

### Response values

- Response value $R_{an1}$ (ALARM 1): 1…200 kΩ
- Response value $R_{an2}$ (ALARM 2): 1…200 kΩ
- Preset mode
  - $U_n \leq 72$ V: $R_{an1}$ (ALARM 1)/$R_{an2}$ (ALARM 2) $\leq 20$ kΩ/10 kΩ
  - $U_n > 72$ V: $R_{an1}$ (ALARM 1)/$R_{an2}$ (ALARM 2) $\leq 46$ kΩ/23 kΩ
- Relative uncertainty (1…5 kΩ)/(5…200 kΩ): $\pm 0.5$ kΩ/±15 %
- Hysteresis (1…5 kΩ)/(5…200 kΩ): $+1$ kΩ/+25 %

### Time response

- Response time $t_m$ at $R_F = 0.5 \times R_{an}$ and $C_e = 1$ μF: $\leq 2$ s
- Start-up delay (start time) $t_0$: $0…10$ s
- Response delay $t_{on}$: $0…99$ s

### Measuring circuit

- Measuring voltage $U_m$: $\pm 12$ V
- Measuring current $I_m$: (at $R_F = 0$ Ω): $\leq 200$ μA
- Internal DC resistance $R_i$: $\geq 65$ kΩ
- Impedance $Z_i$ at 50 Hz: $\geq 60$ kΩ

### Displays, memory

- Display: LC display, multi-functional, non-illuminated
- Display range, measured value: 1 kΩ…1 MΩ
- Operating error (1…5 kΩ): $\pm 0.5$ kΩ
- Percentage operating error (5 kΩ…1 MΩ): $\pm 15$ %
- Password: off/0…999
- Fault memory, alarm relay: on/off

### Inputs

- Cable length test and reset button: $\leq 10$ m

## Switching elements

- Number of switching elements: 2 x 1 changeover contact
- Operating principle: NC/N/O operation
- Electrical endurance, number of cycles: 10,000

## Contact data acc. to IEC 60947-5-1

- Utilisation category: AC-13, AC-14, DC-12, DC-12, DC-12
- Rated operational voltage: 230 V, 230 V, 220 V, 110 V, 24 V
- Rated operational current: 5 A, 3 A, 0.1 A, 0.2 A, 1 A
- Minimum contact rating: 1 mA at AC/DC $\geq 10$ V

## Environment/EMC

- IEC 61326-2-4
- EMC: IEC 61326
- Operating temperature: $-25…+55$ °C

## Classification of climatic conditions acc. to IEC 60721

- Stationary use: (IEC 60721-3-3): 3K23 (except condensation and formation of ice)
- Transport: (IEC 60721-3-2): 2K11 (except condensation and formation of ice)
- Long-time storage: (IEC 60721-3-1): 1K22 (except condensation and formation of ice)

## Classification of mechanical conditions IEC 60721

- Stationary use: (IEC 60721-3-3): 3M11
- for option W: 3M12
- Transport: (IEC 60721-3-2): 2M4
- Long-time storage: (IEC 60721-3-1): 1M12

### Connection

- Connection type: screw-type terminal or push-wire terminal
- Connection terminals: screw terminals

### Connectors

- Connection properties
  - rigid: $0.2…4$ mm² (AWG 24…12)
  - flexible: $0.2…2.5$ mm² (AWG 24…14)
- Two conductors with the same cross section
  - rigid/flexible: $0.2…1.5$ mm² (AWG 24…16)
- Stopping length: 8 mm
- Tightening torque, terminal screws: 0.5…0.6 Nm

### Connection push-wire terminals

- Connection properties
  - rigid: $0.2…2.5$ mm² (AWG 24…14)
  - flexible: $0.75…2.5$ mm² (AWG 19…14)

- Stopping length: 16 mm
- Opening force: 50 N
- Test opening, diameter: 2.1 mm

### Other

- Operating mode: continuous operation
- Mounting: any position
- Degree of protection, internal components (DIN EN 60529): IP30
- Degree of protection, terminals (DIN EN 60529): IP20
- Enclosure material: polycarbonate
- Flammability class: UL94 V-0
- DIN rail mounting acc. to: IEC 60715
- Screwing: 2 x M4 with mounting clip
- Documentation number: D00039
- Weight: $\leq 150$ g

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**Dimension diagram (dimensions in mm)**

![Dimension diagram](image_url)

- **SA**: 31.1
- **S**: 42
- **S1**: 41.5
- **S2**: 74.5
- **H1**: 93
- **H2**: 90
- **H3**: 95
- **W1**: 36
Wiring diagram

| 1 A1, A2 | Supply voltage $U_s$ (see ordering details) via fuse |
| 2 KE, E  | Separate connection of $E$, KE to PE  |
| 3 L1, L2 | Connection to the IT system to be monitored |
| 4 11, 12, 14 | Alarm relay K1: Alarm 1 |
| 5 21, 22, 24 | Alarm relay K2: Alarm 2 |
| 6 T/R     | Combined test and reset button:  |
|          | short-time pressing (< 1.5 s) = RESET  |
|          | long-time pressing (> 1.5 s) = TEST |

- Line protection by a fuse in accordance with IEC 60364-4-43 (6 A fuse recommended). In case of supply (A1/A2) from an IT system, both lines have to be protected by a fuse.
ISOMETER® iso1685P
Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems)
up to AC 1000 V/DC 1500 V

Device features
• Insulation monitoring in extensive unearthed power supply systems up to AC 1000 V/DC 1500 V
• Measurement of low-resistance insulation faults
• Separately adjustable response values $R_{an1}$ (Alarm 1) and $R_{an2}$ (Alarm 2) (both 200 $\Omega$…1 M$\Omega$) for prewarning and alarm
• Automatic adaptation to high system leakage capacitances up to 2000 $\mu$F, selectable range
• Integrated locating current injector up to 50 mA
• Device self test with automatic fault message in the event of a fault
• RS-485 interface (BMS bus), e.g. to control insulation fault location
• $\mu$SD card with data logger and history memory for alarms

Typical applications
• Extensive systems up to AC 1000 V/DC 1500 V which are designed as IT systems

Standards
The ISOMETER® has been developed in compliance with the following standards:
• DIN EN 61557-8 (VDE 0413-8)
• IEC 61557-8
• DIN EN 61557-9 (VDE 0413-9)
• IEC 61557-9
• IEC 61326-2-4
• DIN EN 60664-1 (VDE 0110-1)

Approvals

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Response value range</th>
<th>Nominal voltage</th>
<th>Supply voltage</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$200 \Omega$…1 M$\Omega$</td>
<td>$0\ldots1000,V$</td>
<td>$0\ldots1500,V$</td>
<td>$18\ldots30,V$</td>
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<td>iso1685PW-425 B91065801W</td>
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</tbody>
</table>

1) Absolute values
Technical data

Insulation monitoring devices | Main circuits

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Insulation coordination according to IEC 60664-1

- Rated voltage: DC 1500 V
- Overvoltage category (OVC): III
- Rated impulse withstand voltage: 8 kV
- Rated insulation voltage: 1500 V
- Pollution degree exterior: 3
- Voltage test, routine test (IEC 61010-1): 2.2 kV

Voltage ranges

- Nominal system voltage range $U_n$: AC 0...1000 V/DC 0...1500 V
- Tolerance of $U_n$: AC $\pm 10\%$/DC $\pm 6\%$

- Frequency range of $U_n$: DC 1...460 Hz
- Supply voltage $U_s$ (see also device nameplate): DC 18...30 V

- Rated operational voltage: 230 V
- Rated operational current: 5 A
- Rated insulation voltage: 250 V

- Minimum contact rating: 1 mA at AC/DC $\geq 10$ V

Connection (except system coupling)

- Connection type: pluggable push-wire terminals
- Connection:
  - rigid/flexible: $0.2...1.5$ mm²/0.2...4 mm²
  - flexible with ferrule, without/with plastic sleeve: $0.25...6$ mm²/0.25...6 mm²
- Conductor sizes (AWG): 24…8
- Stripping length: $15$ mm
- Opening force: $90...120$ N

Environment/EMC

- EMC:
  - IEC 61326-2-4

Classification of climatic conditions acc. to IEC 60721:

- Stationary use (IEC 60721-3-1) 3K21 (except condensation and formation of ice)
- 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)
  - iso1685P: 3M11
  - iso1685PW: 3M12
- Transport (IEC 60721-3-2): 2M4
- Long-term storage (IEC 60721-3-1): 1M12

Deviation from the classification of climatic conditions:

- Ambient temperature during operation: $-40...+70$ °C
- Ambient temperature for transport: $-40...+80$ °C
- Ambient temperature for long-term storage: $-25...+80$ °C
- Area of application: $\leq 3000$ m AMSL

Other

- Operating mode: continuous operation
- Position of normal use: vertical, system coupling on top
- PCB fixation: lens head screw DIN7985TX
- Tightening torque of the screws for enclosure mounting: 1.0...1.5 Nm
- Degree of protection, internal components: IP30
- Degree of protection, terminals: IP30
- Enclosure material: polycarbonate
- Flammability class: V-0
- Documentation number: D00003
- Weight: $\leq 1600$ g

(*3 = Factory setting

Switching elements

- Switching elements:
  - 3 changeover contacts: K1 (insulation fault alarm 1), K2 (insulation fault alarm 2), K3 (device error)
  - Operating principle K1, K2: N/C operation or N/O operation (N/C operation)*
  - Operating principle K3: N/C operation, cannot be changed

Electrical endurance under rated operating conditions, number of cycles: 100.000

Contact data acc. to IEC 60947-5-1:

- Utilization category:
  - AC13/14
  - DC-12
  - DC-12
- Rated operational voltage:
  - 230 V: 3 A
  - 230 V: 1 A
  - 110 V: 0.2 A

- Rated operational current: 0.1 A
- Rated insulation voltage: 250 V

- Minimum contact rating: 1 mA at AC/DC $\geq 10$ V

Measurement circuit for insulation monitoring

- Measuring voltage $U_m$ (peak value): $\pm 50$ V
- Measuring current $I_m$ (at $R_0 = 0$ Ω): $\leq 1.5$ mA
- Impedance $Z_s$ at 50 Hz: $\geq 70$ kΩ
- Permissible extraneous DC voltage $U_{ex}$: $\leq 1500$ V
- Permissible system leakage capacitance $C_s$: $\leq 500$ μF ($150$ μF)
- Measuring range leakage capacitance: $20...500$ μF
- Tolerance measurement of $C_s$: $\pm 10\%$ $\pm 10$ μF
- Frequency range measurement of $C_s$: DC 30...60 Hz

Response values for insulation monitoring

- Response value $R_{an1}$ (alarm 1): $200$ Ω...1 MΩ (40 kΩ)*
- Response value $R_{an2}$ (alarm 2): $200$ Ω...1 MΩ (10 kΩ)*
- Condition response value $R_{an3} = R_{an2}$
- Upper limit of the measuring range when set to $C_{max} = 500$ μF: $200$ kΩ
- Relative uncertainty (10 kΩ...1 MΩ) (acc. to IEC 61557-8): $\pm 15\%$
- Relative uncertainty (0.2 kΩ...< 10 kΩ): $\pm 200$ Ω $\pm 15\%$
- Hysteresis: $25\%$

Time response

- Response time $t_{res}$ at $R_0 = 0.5 \times R_{an1}$ ($R_{an2}$ = 10 kΩ) and $C_s = 1$ μF acc. to IEC 61557-8: profile dependent, typ. 10 s

Measurement circuit for insulation fault location (EDS)

- Locating current $i_L$, DC: $\leq 50$ mA
- Test cycle/pause: 2 t/s
- Nominal system voltage range $U_S$:
  - AC $\geq 25$ Hz, DC: AC 0...1000 V/DC 0...1500 V
  - AC $< 25$ Hz: AC 0...600 V

Memory

- μSD card for history memory and log files: $\leq 32$ GB

LEDs

- ON (operation LED): green
- PGH ON: yellow
- SERVICE: yellow
- ALARM 1: yellow
- ALARM 2: yellow

Digital inputs

- Operating mode, adjustable: active high, active low
- Functions:
  - digital input 1: test (< 1 s)/standby (> 2 s)
  - digital input 2: reset
- High level: 10...30 V
- Low level: 0...0.5 V

Serial interface

- Interface/protocol: RS-485/BMS
- Connection terminals A/B
- Cable length: $\leq 1200$ m
- Shielded cable (shield to functional earth on one end)
  - 2-core, $\geq 0.6$ mm², e.g. J-Y(ST)Y 2x0.6
  - Shield: terminal $S$
- Terminating resistor, can be connected (Term. RS-485): 120 Ω (0.5 W)
- Device address, BMS bus: 2...32 (2)*

Device address, BMS bus: 2...33 (2)
**Dimension diagram (dimensions in mm)**

**Wiring diagram**

- **1** I2+, I2– Currently has no function, digital input
- **2** I1+, I1– Digital input
- **3** A, B, S Connection to BMS bus, RS-485, S = shield (connect one end to PE), can be terminated with S700
- **4** 31, 32, 34 Alarm relay K3 for internal device errors
- **5** 21, 22, 24 Alarm relay K2 for insulation faults alarm 2
- **6** 11, 12, 14 Alarm relay K1 for insulation faults alarm 1
- **7** E, KE Separate connections of E and KE to PE
- **8** A1, A2 Connection to Us = DC 24 V via fuses, 2 A each
- **9** L1/+, L2– Connection to the IT system to be monitored
ISOMETER® iso1685DP/isoHV1685D/isoLR1685DP
Insulation monitoring device for unearthed AC, AC/DC and DC power supplies (IT systems)

Device features

- ISOMETER® for AC IT systems with galvanically connected rectifiers or inverters and for DC IT systems. (IT = unearthed systems)
- Automatic adjustment to high system leakage capacitances
- Combination of AMP® and other profile-specific measurement method
- Separately adjustable response values \( R_{an1} \) (alarm 1) and \( R_{an2} \) (alarm 2) for prewarning and alarm
- High-resolution graphic LC display for excellent readability and recording of the device status
- Connection monitoring
- Device self test with automatic alarm message in the event of a fault
- Graphical representation of the insulation resistance over time (isoGraph)
- History memory with real-time clock (buffer for 13 days) for storing 1023 alarm messages with date and time
- Freely programmable digital inputs
- Remote setting of certain parameters via the Internet (COMTRAXX® gateway)
- Remote diagnosis by the Bender service via the Internet
- RS-485 interface for data exchange with other Bender devices

iso1685DP-425
- Measurement of insulation faults 200 Ω…1 MΩ, also in photovoltaic systems

isoLR1685Dx-425
- Measurement of low-resistance insulation faults 20 Ω…100 kΩ

isoHV1685D-425
- Measurement of insulation faults 200 Ω…1 MΩ at system voltages AC 2000 V, DC 3000 V

iso1685DP-425 and isoLR1685DP-325
- Integrated locating current injector up to 50 mA for insulation fault location
- Display of insulation faults selectively located by EDS systems
- Parameter setting of EDS systems
- Customer-specific texts for each measuring channel via the menu

Standards

The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8
- IEC 61557-8 Annex C (photovoltaic systems, for Fast 2000 µF profile only)
- DIN EN 61557-9 (VDE 0413-9)
- IEC 61557-9 (not for isoHV1685D)
- IEC 61326-2-4
- DIN EN 60664-1 (VDE 0110-1)

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage 1)</th>
<th>Response value range</th>
<th>Nominal voltage</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 Ω…100 kΩ</td>
<td>0…690 V</td>
<td>0…690 V</td>
<td>isoLR1685D-325</td>
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<tr>
<td></td>
<td>200 Ω…1 MΩ</td>
<td>0…2000 V</td>
<td>0…3000 V</td>
<td>isoHV1685D-425</td>
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<tr>
<td></td>
<td></td>
<td>0…1000 V</td>
<td>0…1500 V</td>
<td>iso1685DP-425</td>
</tr>
</tbody>
</table>

1) Absolute values
**Technical data**

**Insulation monitoring devices | Main circuits**

**Definitions:**
- Measuring circuit (IC1) (L1+/+, L2/-), (E, KE)
- Supply circuit (IC2) A1, A2
- Output circuit 1 (IC4) 11, 12, 14
- Output circuit 2 (IC6) 31, 32, 34
- Control circuit (IC6) (A, B), (I1+, I1-, I2+).

**Rated voltage [for iso1685DP]:** 1500 V [3800 V]

**Overvoltage category:** III

**Rated impulse voltage:**
- IC1/(IC2-5) [for iso1685DP] 10 kV [16.670 kV]
- IC2/(IC3-5) 4 kV
- IC3/(IC4-6) 4 kV
- IC4/(IC5-6) 4 kV
- IC5/K6 4 kV

**Rated insulation voltage:**
- IC1/(IC2-6) [for iso1685DP] 1500 V [3000 V]
- IC2/(IC3-5) 250 V
- IC3/K6 50 V
- IC4/(IC5-6) 250 V
- IC5/K6 250 V

**Pollution degree:** 3

**Protection separation (reinforced insulation) between:**
- IC1/(IC2-5) [for iso1685DP] overvoltage category III, 1500 V [3000 V]
- IC2/(IC3-5) overvoltage category III, 50 V
- IC3/(IC4-6) overvoltage category III, 100 V
- IC4/(IC5-6) overvoltage category III, 250 V
- IC5/K6 overvoltage category III, 100 V

**Voltage range (routine test) acc. to IEC 61010-1:**
- IC2/(IC3-5) AC 2.2 kV
- IC2/K6 DC ±0.50 kV
- IC3/(IC4-6) AC 2.2 kV
- IC4/K6 AC 2.2 kV
- IC5/K6 AC 2.2 kV

**Rated system voltage range**
- iso1685DP 0…1000 V; DC 0…1500 V
- isoHV1685D 0…1000 V; DC 0…1500 V
- isoLR1685DP 0…690 V; DC 0…690 V

**Tolerance of U**: isoLR1685DP ≥ 70 kV iso1685DP, isoHV1685D ≥ 15 kV

**Permissible system leakage capacitance C**:
- iso1685DP ≤ 1500 V 0.8…2000 μF
- isoHV1685D ≤ 1600 V 0.8…2000 μF
- isoLR1685DP ≤ 1200 V 0.8…2000 μF

**Minimum contact rating**:
- iso1685DP, isoHV1685D ≤ 0.1 A
- isoLR1685DP ≤ 0.5 A

**Rated operational voltage**:
- iso1685DP, isoHV1685D 230 V 230 V
- isoLR1685DP 24 V 110 V

**Rated operational current**:
- iso1685DP 5 A 3 A
- isoHV1685D 3 A 1 A
- isoLR1685DP 10 A 0.2 A

**Rated insulation voltage**: 250 V

**Operating principle K1, K2**
- N/C operation or N/O operation (N/C operation)*
- K2 (insulation fault alarm 2), K3 (device error)

**Connection terminals A/B**
- Interface/protocol RS-485/BMS/Modbus RTU
- Serial interface
  - Low level 0…0.5 V
  - High level 10…30 V
- Operating mode, adjustable
  - active high, active low
- Digital inputs
  - PGH ON yellow
  - ALARM 2 yellow
  - ALARM 1 yellow
  - SERVICE yellow
  - ON (operation LED) green
  - LEDs
  - 127x127 pixels, 40x40 mm
  - Device address, BMS bus (1) 2…90 ( 2)*

**Display range measured value**
- iso1685DP, isoHV1685D 200 Ω…50 MΩ
- isoLR1685DP 20 Ω…1 MΩ

**Power consumption**
- ≤ 9 W

**Switching elements**
- Switching elements
  - 3 changeover contacts: K1 (insulation fault alarm 1), K2 (insulation fault alarm 2), K3 (device error)
  - Operating principle K1, K2 N/C operation or N/O operation (N/C operation)*
  - Operating principle K3 N/C operation, not changeable
  - Electrical endurance under rated operating conditions, number of cycles 100,000

**Contact data acc. to IEC 60947-5-1:**
- Utilisation category: AC 13 AC 14 DC-12 DC-12 DC-12
- Rated operational voltage: 230 V 230 V
- Rated operational current: 5 A 3 A
- Rated insulation voltage: 250 V

**Connection (except mains connection)**
- Connection type: pluggable push-wire terminals
- Connection, rigid/semi-flexible 0.2…2.5 mm²/0.02…2.5 mm²
- Connection, flexible with ferrule, without/with plastic sleeve 0.25…2.5 mm²
- Conductor sizes (AWG): 24…12
Technical data (continued)

Mains connection

<table>
<thead>
<tr>
<th>Connection type</th>
<th>pluggable push-wire terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection, rigid/flexible</td>
<td>0.2…10 mm²/0.2…6 mm²</td>
</tr>
<tr>
<td>Connection, flexible with female, without/with plastic sleeve</td>
<td>0.25…6 mm²/0.25…4 mm²</td>
</tr>
<tr>
<td>Conductor sizes (AWG)</td>
<td>24…8</td>
</tr>
<tr>
<td>Stripping length</td>
<td>15 mm</td>
</tr>
<tr>
<td>Opening force</td>
<td>90…120 N</td>
</tr>
</tbody>
</table>

Environment/EMC

| EMC | IEC 61326-2-4 |

Classification of climatic conditions acc. to IEC 60721:

- Stationary use (IEC 60721-3-3): 3K23 (except condensation and formation of ice)
- 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

Deviation from the classification of climatic conditions:

- Ambient temperature during operation (iso1685DP, isoLR1685DP): -40…+70 °C
- Ambient temperature during operation (isoHV1685D): -40…+55 °C
- Ambient temperature transport: -40…+80 °C
- Ambient temperature long-term storage: -25…+80 °C
- Area of application: ≤ 3000 m AMSL

Other

<table>
<thead>
<tr>
<th>Operating mode</th>
<th>continuous operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position of normal use</td>
<td>vertical, mains connection on top</td>
</tr>
<tr>
<td>Tightening torque of the screws (4x M5) for enclosure mounting</td>
<td>1.0…1.5 Nm</td>
</tr>
<tr>
<td>Degree of protection, internal components</td>
<td>IP30</td>
</tr>
<tr>
<td>Degree of protection, terminals</td>
<td>IP30</td>
</tr>
<tr>
<td>Enclosure material</td>
<td>polycarbonate</td>
</tr>
<tr>
<td>Flammability class</td>
<td>V-0</td>
</tr>
<tr>
<td>Documentation number</td>
<td>D00272</td>
</tr>
<tr>
<td>Weight</td>
<td>≤ 1600 g</td>
</tr>
</tbody>
</table>

(*) = Factory settings

1) for Un > 500 V no longer according to IEC61557-8
2) Values in brackets are factory settings for alarm1/alarm 2

Dimension diagram (dimensions in mm)
Insulation monitoring devices | Main circuits

Insulation monitoring device ISOMETER® iso1685DP/isoHV1685D/isoLR1685DP

Wiring diagram

3 AC system  AC system  DC system

1 I2+, I2– Standby, digital input
2 I1+, I1– Test, digital input
3 A, B, S Connection to BMS bus, RS-485, S = shield (connect one end to PE), can be terminated with S700
4 31, 32, 34 Alarm relay K3 for internal device errors
5 21, 22, 24 Alarm relay K2 for insulation faults alarm 2
6 11, 12, 14 Alarm relay K1 for insulation faults alarm 1
7 E, KE Separate connections of E and KE to PE
8 A1, A2 Connection to \( U_s = 24 \text{ V} \) DC via fuses, 2 A each
9 L1/+, L2/- Connection to the IT system to be monitored
ISOMETER® isoHR1685DW–925
Insulation monitoring device for mobile, insulated elevating work platforms

Device features
ISOMETER® for mobile, insulated elevating work platforms
• Continuous monitoring of both insulation levels on elevating work platforms, also during operation
• Storage of data for verification of insulation condition. Where necessary, provision of documentary verification following an electrical accident
• Graphical representation of the insulation resistance over time (isoGraph)
• RS-485 interface with BMS protocol and Modbus RTU for forwarding data, alarms and acknowledgements via existing communication to work platform
• History memory with real-time clock (13-day buffer) for storing 1023 alarm messages with date and timestamp
• Freely programmable digital inputs
• Automatic device self-test with automatic message in the event of a fault
• Connection monitoring
• Separately adjustable response values \( R_{an1} \) (alarm 1) and \( R_{an2} \) (alarm 2) for prewarning and alarm
• High-resolution graphic LC display, for excellent readability and recording of the device status
• Measurement of high-resistance insulation faults 100 kΩ…20 GΩ
• Automatic adjustment to high system leakage capacitances

Typical applications
• Isolationsüberwachung von Hubarbeitsbühnen/Oberleitungs- fahrzeugen.

Approvals

Standards
The ISOMETER® has been developed in compliance with the following standards:
• DIN EN 61557-8 (VDE 0413-8)
• IEC 61557-8
• IEC 61326-2-4
• DIN EN 60664-1 (VDE 0110-1)

Further information
For further information refer to our product range on www.bender.de.

Ordering information
For further information refer to our product range on www.bender.de.

<table>
<thead>
<tr>
<th>Supply voltage 1)</th>
<th>Response value range</th>
<th>Nominal system voltage</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td></td>
<td></td>
<td>isoHR1685DW–925</td>
<td>B91065806W</td>
</tr>
<tr>
<td>1) Absolute values</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Absolute values
Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:
- Measuring circuit (IC1)
  - (L1+/+, L2/-, (E, KE)
- Supply circuit (IC2)
  - A1, A2
- Output circuit 1 (IC3)
  - 11, 12, 14
- Output circuit 2 (IC4)
  - 21, 22, 24
- Output circuit 3 (IC4)
  - 31, 32, 34
- Control circuit (IC6)
  - (A, B), (11+, 11-, 12+, 12-)

Ratings:
- Rated voltage 1500 V
- Overvoltage category III
- Rated impulse voltage:
  - IC1/(IC2-5) 10 kV
  - IC2/(IC3-5) 4 kV
  - IC2/(IC4-6) 800 V
  - IC4/(IC5-6) 4 kV
  - IC5/(IC6) 4 kV

Rated insulation voltage:
- IC1/(IC2-6) 1500 V
- IC2/(IC3-6) 250 V
- IC3/(IC4-6) 50 V
- IC4/(IC5-6) 250 V
- IC5/(IC6) 250 V

Pollution degree 3

Protective separation (reinforced insulation) between:
- IC1/(IC2-5) 1000 V
- IC2/(IC3-5) 1000 V
- IC3/(IC4-6) 300 V
- IC4/(IC5-6) 300 V
- IC5/(IC6) 300 V

Voltage test (routine test) as per IEC 61010-1:
- IC2/(IC3-5) AC 2.2 kV
- IC2/(IC4-6) DC ±0.50 kV
- IC4/(IC5-6) AC 2.2 kV
- IC5/(IC6) AC 2.2 kV

Voltage ranges
- Nominal system voltage range UA
  - AC 0...1000 V
  - DC 0...1500 V
- Tolerance of UA
  - ±10 %/DC ±5 %
- Frequency range of UA
  - DC 0.1...460 Hz
- Supply voltage UB (also see device name plate)
  - DC 18...30 V
- Frequency range of UB
  - DC
- Power consumption
  - ≤ 9 W

Measuring circuit for insulation monitoring
- Measuring voltage UMeas (peak value)
  - ±50 V
- Measuring current IMeas (at f0 = 0 Hz)
  - ≤ 1 μA
- Internal resistance RMeas
  - ≥ 50 MΩ
- Impedance Ze at 50 Hz
  - ≥ 50 MΩ
- Permissible extraneous DC voltage UEx
  - ≤ DC 1600 V
- Permissible system leakage capacitance CisoHR1685DW-925
  - profile-dependent, 0...1 μF

Response values for insulation monitoring
- Response value R11 (alarm 1) and R12 (alarm 2)
  - 100 kΩ...100 MΩ
- Response value condition
  - R11 = R12
- Upper limit of the measuring range when setting measuring profile to
  - “high capacity” TMeas = 5 μF
  - 24 MΩ
- Relative uncertainty (acc. to IEC 61557-8)
  - ±15 %
- 100 kΩ...10 MΩ
  - ±200 kΩ ±15 %
- Hysteresis
  - 25 %

Time response
- Response time tRe at f0 = 0.5 x RMeas (RMeas = 100 kΩ) and CMeas = 1 μF acc. to IEC 61557-8
  - profile-dependent, typ. 10 s

Display
- Display graphic display 127 x 127 pixels, 40 x 40 mm
- Display range, measured value
  - 100 kΩ...20 GΩ

LEDs
- ON (operation LED)
  - green
- PGH ON (no function)
  - yellow
- SERVICE
  - yellow
- ALARM 1
  - yellow
- ALARM 2
  - yellow

Digital inputs
- Operating mode, variable
  - active high, active low
- Functions
  - off, test, reset, disable device, insulation fault location
- High level
  - 10...30 V
- Low level
  - 0...0.5 V

Serial interface
- Interface/Protocol
  - RS-485/BMS/Modbus RTU
- Connection
  - Terminals A/B
- Cable length
  - ≤ 1200 m
- Shielded cable (shield to functional earth on one side)
  - 2-core, ≥ 0.6 mm², e.g. 1-Y(St)F 2x0.6

Protection
- Shield
  - Terminal S
- Terminating resistance, engageable (term. RS-485)
  - 120 Ω (0.5 W)
- Device address, BMS bus
  - (1) 2...90 (2)*
- Device address, Modbus RTU
  - 1...247
- Baud rate
  - 9.6/19.2/38.4/57.6/115.2 Kbps
- Parity
  - even/odd
- Stop bits
  - 1/2/aut

Connection (except mains coupling)
- Type of connection
  - Pluggable push-pin terminals
- Connection, rigid/flexible
  - 0.2...2.5 mm²/0.2...2.5 mm²
- Connection, flexible with ferrule, without/with plastic sleeve
  - 0.25...6.0 mm²/0.25...4.0 mm²
- Conductor sizes (AWG)
  - 24…12

Connection of the mains coupling
- Type of connection
  - Pluggable push-pin terminals
- Connection, rigid/flexible
  - 0.2...6.0 mm²/0.2...6.0 mm²
- Connection, flexible with ferrule, without/with plastic sleeve
  - 0.25...6.0 mm²/0.25...4.0 mm²
- Conductor sizes (AWG)
  - 24…12

Switching elements
- Switching elements
  - 3 changeover contacts: K1 (insulation fault alarm 1), K2 (insulation fault alarm 2), K3 (device fault)
- Operating mode K1, K2
  - N/C operation / N/O operation (N/C operation)*
- Operating mode K3
  - N/C operation, not modifiable

Electrical endurance under rated operating conditions
- 100,000 cycles

Contact data acc. to IEC 60947-5-1:
- Utilisation category
  - AC 13
  - AC 14
  - DC-12
  - DC-12
  - DC-12
- Rated operational voltage
  - 230 V
  - 230 V
  - 24 V
  - 110 V
  - 220 V
- Rated operational current
  - 5 A
  - 3 A
  - 1 A
  - 0.2 A
  - 0.1 A
- Rated insulation voltage
  - 250 V
- Minimum contact rating
  - 1 mA at AC/DC ≥ 10 V

Environment/EMC
- EMC
  - IEC 61326-2-4

Classification of climatic conditions acc. to IEC 60721:
- Stationary use (IEC 60721-3-3)
  - 3K23 (no condensation, no formation of ice)
- Transport (IEC 60721-3-2)
  - 2K11
- Long-term storage (IEC 60721-3-1)
  - 1K22

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

Deviation from climate classes:
- Ambient temperature during long-term storage
  - -40...+70 °C
- Ambient temperature during transport
  - -40...+90 °C
- Ambient temperature during long-term storage
  - -25...+80 °C
- Application range
  - ≤ 3000 m AMSL

Other
- Operating mode
  - Continuous operation
- Position of normal use
  - Vertical, mains connection
- Tightening torque for screws (4x M5) to fasten enclosure
  - 1.0...1.5 Nm
- Degree of protection, terminals
  - IP30
- Degree of protection, terminals
  - IP30
- Enclosure material
  - Polycarbonate
- Flammability class
  - V-0
- Documentation number
  - D00369
- Weight
  - < 1600 g

* = factory setting
**Wiring diagram**

1. **I2+, I2−**: Initial measurement, digital input
2. **I1+, I1−**: Test, digital input
3. **A, B, S**: Connection to RS-485 with BMS bus, Modbus RTU, S = shield (connect to PE on one side), can be terminated with S700
4. **31, 32, 34**: Alarm relay K3 for internal device faults
5. **21, 22, 24**: Alarm relay K2 for insulation faults, alarm 2
6. **11, 12, 14**: Alarm relay K1 for insulation faults, alarm 1
7. **E, KE**: Separate connections of E and KE to PE and/or vehicle chassis
8. **A1, A2**: Connection to $U_s = DC 24 V$ via fuses, 2 A each
9. **L1/+, L2/−**: Connection of both coupling terminals L1/+ and L2/− to lifting arm of the work platform
**ISOMETER® IR1575**

Insulation monitoring device for unearthed AC, 3(N)AC systems up to 480 V and DC systems up to 480 V

### Device features
- Insulation monitoring for unearthed AC, AC/DC systems 0…480 V and DC systems 0…480 V
- Two separately adjustable response values 2 kΩ…1 MΩ
- AMP measurement method
- Automatic adaptation to the system leakage capacitance
- Injection of the locating current required for selective insulation fault location (only IR1575PG1)
- Alarm LEDs for Alarm 1/Alarm 2
- Fault memory selectable
- Connection monitoring system conductor/earth
- Test and reset button
- External test/reset button can be connected
- Two separate alarm relays with one potential-free changeover contact each
- N/O or N/C operation, selectable
- Backlit LC display
- Self monitoring with automatic alarm
- Plug-in terminals
- Door mounting enclosure 96 x 96 mm

### Typical applications
- AC or AC/DC main circuits
- AC/DC main circuits with directly connected DC components
- UPS systems, battery systems
- Heaters with phase control
- Installations including switch mode power supplies

### Standards
The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- EN 61557-8
- IEC 61557-8

### Further information
For further information refer to our product range on www.bender.de.

### Ordering information

<table>
<thead>
<tr>
<th>Design</th>
<th>Supply voltage $U_s$(1)</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>88…264 V 340…460 V</td>
<td>IR1575-435</td>
<td>B91064000</td>
</tr>
<tr>
<td></td>
<td>16…72 V 10.2…84 V</td>
<td>IR1575-434</td>
<td>B91064003</td>
</tr>
<tr>
<td>Increased shock and vibration resistance</td>
<td>88…264 V 340…460 V</td>
<td>IR1575W-435</td>
<td>B91064000W</td>
</tr>
<tr>
<td></td>
<td>77…286 V</td>
<td>IR1575PG1W-435</td>
<td>B91064002W</td>
</tr>
</tbody>
</table>

(1) Absolute values
**Technical data**

- **Insulation coordination acc. to IEC 60664-1**
  - Rated voltage: AC 500 V
  - Rated impulse voltage/pollution degree: 4 kV/3

- **Voltage ranges**
  - **IR1575...**
    - Nominal system voltage $U_n$: AC, 3(N)AC 0…480 V, DC 0…480 V
    - Nominal frequency $f_n$: DC 30…420 Hz
  - **IR1575PG1...**
    - Nominal system voltage $U_n$: AC 30…200 V
    - Nominal frequency $f_n$: 30…460 Hz
  - **IR1575x-435**
    - Supply voltage $U_s$: at A0/A1 (see nameplate) AC 88…264 V
    - Frequency range of $U_s$: 42…460 Hz
    - Supply voltage $U_s$: at A0/A2 (see nameplate) AC 340…460 V
    - Frequency range of $U_s$: 47…63 Hz
  - **IR1575x-434**
    - Supply voltage $U_s$: at A0/A1 (see nameplate) AC 16…72 V
    - Frequency range of $U_s$: 42…460 Hz
    - Supply voltage $U_s$: at A0/A2 (see nameplate) DC 77…286 V

- **Response values**
  - Response value $R_{an1}$ (Alarm1): 2 kΩ…1 MΩ
  - Response value $R_{an2}$ (Alarm2): 2 kΩ…1 MΩ
  - Specified response value (2 kΩ…10 kΩ): $+2\%$
  - Specified response value (10 kΩ…1 MΩ): 0%…+20%

- **Response time**
  - $t_{an}$ at $R_F = 0.5 \times R_{an}$ and $C_e = 1 \mu F$: ≤ 5 s
  - Hysteresis (2 kΩ…10 kΩ): $+2\%
  - Hysteresis (10 kΩ…1 MΩ): 25%

- **Measuring circuit for insulation measurement**
  - Measuring voltage $U_m$: ±20 V
  - Measuring current $I_m$: (bei $R_F = 0 W$) ≤ 170 μA
  - Internal impedance $Z_m$: at 50 Hz
  - IR1575...: ≥ 14 kΩ
  - IR1575PG1...: ≥ 119 kΩ
  - Permissible extraneous DC voltage $U_{fg}$: ≤ DC 680 V
  - Permissible system leakage capacitance $C_e$: ≤ 60 μF

- **Measuring circuit for insulation fault location (EDS) (only IR1575PG1...)**
  - Test current $I_p$: DC 10/25 mA
  - Test pulse/break: 2 s/4 s

- **Displays**
  - Display, illuminated: LC display
  - Characters (number of characters, height): 2 x 16 (4.5 mm)
  - Display range measuring value: 1 kΩ…±5 MΩ
  - Absolute error (1 kΩ…10 kΩ): ±1 kΩ
  - Relative percentage error (1 kΩ…10 kΩ): ±10%

- **Outputs**
  - Test and reset button internal/external

- **Switching elements**
  - Switching elements: 2 x 1 changeover contact
  - Operating principle: N/O or N/C operation
  - Factory setting (Alarm1/Alarm2): N/O operation
  - Admissible number of operations/h: 12 000 cycles
  - Contact class: IIB (DIN EN 60255-23)
  - Rated contact voltage: AC 250 V/DC 300 V
  - Making capacity: 2 A, AC 230 V, cos φ = 0.4
  - Breaking capacity: 0.2 A, DC 220 V, L/R = 0.04 s
  - Minimum contact current at DC 24 V: ≤ 2 mA (50 mW)

- **Environment**
  - EMC immunity: acc. to EN 61326
  - EMC emission: acc. to EN 61326
  - Shock resistance IEC 60068-2-27 (device in operation): 5 g/10…11 ms
  - Bumping IEC 60068-2-29 (transport): 40 g/6 ms
  - Vibration resistance acc. to IEC 60068-2-6 (device in operation): 1 g/10…150 Hz
  - Vibration resistance acc. to IEC 60068-2-6 (transport): 2 g/10…150 Hz
  - Ambient temperature (during operation): -10…+55 °C
  - Ambient temperature (during storage): -40…+70 °C
  - Classification of climatic conditions acc. to DIN IEC 60721-3-3: 3K23

- **Connection**
  - Connection: plug-in terminals
  - Connection properties: rigid/flexible 0.2…4/0.2…2.5 mm²
  - Conductors with ferrule with/without plastic sleeve 0.25…2.5 mm²
  - Conductor sizes (AWG): 24…12
  - Tightening torque: 0.5…0.6 Nm (4.3…5.3 lb-in)

- **Other**
  - Operating mode: continuous operation
  - Mounting: display-oriented
  - Degree of protection, internal components (DIN EN 60529): IP 30
  - Degree of protection, terminals (DIN EN 60529): IP 20
  - Mounting: panel mounting
  - Flammability class: UL94 V-2
  - Document number: D00116
  - IR1575 PG1 D00357
  - Weight: ≤ 400 g

- **Option „W“**
  - Shock resistance acc. to IEC 60068-2-27 (damping operation): 50 g/11 ms
  - Bumping acc. to IEC 60068-2-29 (damping transport): 50 g/6 ms
  - Vibration resistance acc. to IEC 60068-2-6: 1.6 mm/10…25 Hz
  - 4 g/25…150 Hz
  - Ambient temperature (during operation): -10 °C…+55 °C
  - Storage temperature range: -40 °C…+85 °C

---

**Dimension diagram (dimensions in mm)**

![Dimension diagram](image-url)
Connection to the AC system to be monitored:
- connect terminals L1, L2 to conductor L1, L2

Connection to the DC system to be monitored:
- Connect terminal L1 to conductor L+, terminal L2 to conductor L-

Connection to the 3AC system to be monitored:
- Connect terminals L1, L2 to neutral conductor N or
  terminals L1, L2 to conductor L1, L2

Supply voltage $U_s$ (see nameplate) via 6 A fuse:
- $A0 - A1 = AC 88...264 V$, $DC 77...286 V$
- $A0 - A2 = AC 340...460 V$

Separate connection of E and KE to PE

External test button “T1, T2” (N/O contact)

External reset button “R1, R2” (N/C contact or wire jumper), when the terminals are open, the fault message will not be stored

Alarm relay: Alarm 2

Alarm relay: Alarm 1
ISOMETER® IR427 with alarm indicator and test combination MK7

Insulation monitoring device with integrated load and temperature monitoring for medical IT systems in accordance with IEC 60364-7-710, IEC 61557-8 and DIN VDE 0100-710

Device features

**ISOMETER® IR427**
- Insulation monitoring for medical IT systems
- Load and temperature monitoring for IT system transformers
- Adjustable response value for insulation monitoring
- Adjustable load current response value
- Integrated voltage monitoring for four alarm and test combinations MK7
- Temperature monitoring with PTC thermistor or bimetal switch
- Connection monitoring earth
- LEDs: Power On, Alarm 1, Alarm 2
- Internal/external test button
- Configurable alarm relay: N/O or N/C operation selectable
- Self monitoring with automatic alarm
- Compact two-module enclosure (36 mm)
- Four-wire interface for four alarm indicator and test combinations MK7

Typical applications

- Medical IT systems in accordance with IEC 60364-7-710, IEC 61557-8 and DIN VDE 0100-710

Approvals

Standards

The ISOMETER® has been developed in compliance with the following standards:
- IEC 60364-7-710
- IEC 61557-8
- DIN VDE 0100-710

Further information

For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage $U_s$</th>
<th>Nominal system voltage $U_n$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 70…264 V, 42…460 Hz</td>
<td>DC –</td>
<td>AC 70…264 V, 42…460 Hz</td>
<td>IR427-2</td>
</tr>
<tr>
<td>–</td>
<td>18…28 V</td>
<td>–</td>
<td>MK7 Remote alarm indicator and test combination</td>
</tr>
</tbody>
</table>

$^1$ Absolute values

Further information

For further information refer to our product range on www.bender.de.

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
<tr>
<td>MK-cavity-wall-box-60mm</td>
<td>B95100203</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring current transformers</td>
<td>STW2</td>
<td>B942709</td>
</tr>
<tr>
<td>Temperature sensor (PTC)</td>
<td>ES0107</td>
<td>B924186</td>
</tr>
<tr>
<td>Mounting frame</td>
<td>XM420</td>
<td>B990994</td>
</tr>
</tbody>
</table>
## Insulation monitoring device ISOMETER® IR427

### Technical data IR427

<table>
<thead>
<tr>
<th>Property</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage</td>
<td>250 V</td>
</tr>
<tr>
<td>Rated impulse voltage/pollution degree</td>
<td>4 kV/3</td>
</tr>
<tr>
<td>Protective separation (reinforced insulation) between</td>
<td>(L1, L2, E, KE, 1, 2, 3, 4, Z, k)</td>
</tr>
<tr>
<td>Voltage test acc. to IEC 61010-1</td>
<td>2.21 kV</td>
</tr>
</tbody>
</table>

### Insulation monitoring

- **Response time overload, (50 % to 120 %)**: < 5 s
- **Measured value load current (as % of the set response value)**: 10…199 %
- **Operating uncertainty**: ±10 %, ±2 kΩ
- **Measured value insulation resistance**: 10 kΩ
- **LC display multifunctional, not illuminated**
- **Response time connection fault PTC resistors**: < 2 s

### Measuring circuit

- **Measuring circuit**
  - Measuring voltage
  - Measuring current
  - Measuring circuit
  - Transformer
  - Internal DC resistance
  - Hysteresis
  - Measuring time t<sub>meas</sub>, t<sub>an</sub> at R<sub>0</sub> = 0.5 x R<sub>an</sub> and C<sub>z</sub> = 0.5 μF
- **Permissible system leakage capacitance C<sub>z</sub>**: < 5 μF

### Load current monitoring

- **Response value, adjustable**: 5…50 A (7 A)*
- **Relative uncertainty**: ±5 %
- **Hysteresis**: 25 %

### Temperature monitoring

- **Response value (fixed value)**: 4 kΩ
- **Release value (fixed value)**: 1.6 kΩ
- **PTC resistors acc. to DIN 44081**: max. 6 in series
- **Response time overtemperature**: < 2 s
- **Response time connection fault PTC resistors**: < 2 s

### Displays, memory

- **LC display**: multifunctional, not illuminated
- **Measured value insulation resistance**: 10 kΩ +...1 MΩ
- **Operating uncertainty**: ±10 %, ±2 kΩ
- **Measured value load current (as % of the set response value)**: 10…199 %
- **Operating uncertainty**: ±5 %, ±0.2 A
- **Password**: on, off/0…999 (off, 0)*

### Interface for MK7

- **Cable length, twisted in pairs, shielded**: 200 m
- **Cable (twisted in pairs, one end of shield connected to PE)**: recommended: 1-Y(SQ)Y min. 2x0.6

### Power supply (terminals 1 and 2):

- **U<sub>ref</sub>**: DC 24 V
- **f<sub>max</sub> (max. 4 MK7)**: 80 mA

### Communication (terminal 3 and 4):

- **Interface/protocol**: RS-485/proprietary, no BM5
- **Terminating resistor**: 120 (0.25 W), internal, switchable

---

**Cable lengths for the connection of the measuring current transformer STW2 and the temperature sensor**

- Single wire: > 0.5 mm²: ≤ 1 m
- Single wire, twisted: > 0.5 mm²: ≤ 10 m
- Twisted in pairs, twisted: > 0.5 mm²: ≤ 40 m

**Switching elements**

- **Number**: 1 changeover contact
- **Operating principle**: N/C operation or N/O operation (N/C operation)*
- **Electrical endurance, number of cycles**: 10000

**Contact data acc. to IEC 60947-5-1**

- **Utilisation category**: AC-13, AC-14, DC-12, DC-12, DC-12
- **Rated operational voltage**: 230 V, 230 V, 24 V, 110 V, 220 V
- **Rated operational current**: 5 A, 3 A, 1 A, 0.2 A, 0.1 A
- **Minimum contact rating**: 1 mA at AC/DC 10 V

**Environment/EMC**

- **EMC**: IEC 61326-2-4
- **Operating temperature**: -25...+55 °C

**Classification of climatic conditions acc. to IEC 60721:**

- **Stationary use (IEC 60721-3-1)**: 3K23 (except condensation and formation of ice)
- **Transport (IEC 60721-3-2)**: 2K11 (except condensation and formation of ice)
- **Long-term storage (IEC 60721-3-1)**: 1K22 (except condensation and formation of ice)

**Classification of mechanical conditions acc. to IEC 60721:**

- **Stationary use (IEC 60721-3-3)**: 3M11
- **Transport (IEC 60721-3-2)**: 2M4
- **Storage (IEC 60721-3-1)**: 1M12

**Connection**

- **Connection type**: screw-type terminal or push-wire terminal

**Connection**

- **Screw terminals**
  - **Connection properties**: rigid
  - **Minimum contact rating**: 1 mA at AC/DC 10 V
- **Two conductors with the same cross section**: rigid/flexible
- **Shifting length**: 8 mm
- **Tightening torque, terminal screws**: 0.5...0.6 Nm

**Environment/EMC**

- **Environment/EMC**: screw terminals
  - **Connection properties**: rigid
  - **Degree of protection, terminals**: IP20
- **Rated operational current**: 5 A, 3 A, 1 A, 0.2 A, 0.1 A
- **Rated operational voltage**: 230 V, 230 V, 24 V, 110 V, 220 V
- **Utilisation category**: AC-13, AC-14, DC-12, DC-12, DC-12

**Electrical endurance, number of cycles**: 10000

**Operating mode**: continuous operation

**Degree of protection, internal components (DIN EN 60529)**: IP30

**Degree of protection, terminals (DIN EN 60529)**: IP20

**Enclosure material**: polycarbonate

**Flammability class**: UL94V-0

**Screw mounting**: 2 x M4

**DIN rail mounting acc. to**: IEC 60715

**Documentation number**: D00118

**Weight**: ≤ 150 g

(* = Factory setting)
### Technical data MK7

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**
- Rated insulation voltage: 50 V
- Rated impulse voltage/pollution degree: 500 V/3

**Supply voltage**
- Supply voltage $U_s$: DC 18...28 V
- Power consumption: 0.5 VA

**Environment/EMC**
- EMC: IEC 61326
- Operating temperature: -10...+55 °C

**Classification of climatic conditions acc. to IEC 60721:**
- Stationary use (IEC 60721-3-3): 3K23 (except condensation and formation of ice)
- Transport (IEC 60721-3-2): 2K11 (except condensation and formation of ice)
- Long-term storage (IEC 60721-3-1): 1K22 (except condensation and formation of ice)

**Classification of mechanical conditions acc. to IEC 60721:**
- Stationary use (IEC 60721-3-3): 3M11
- Transport (IEC 60721-3-2): 2M4
- Storage (IEC 60721-3-1): 1M12

**Connection**
- Connection: screw-type terminals
- Connection properties:
  - rigid/flexible: 0.2...2.5 mm² (AWG 24...14)
  - Flexible with ferrule: 0.2...1.5 mm² (AWG 24...16)
- Stripping length: 8 mm

**Other**
- Operating mode: continuous operation
- Position of normal use: any
- Degree of protection, internal components (IEC 60529): IP30
- Degree of protection, terminals (IEC 60529): IP20
- Front plate colour: alpine white

**Flush-mounting enclosure, diameter (included in the scope of delivery):** 66 mm

**Weight (including mounting frame):** ≤ 80 g

### Alarm messages LEDs

<table>
<thead>
<tr>
<th></th>
<th>IR427</th>
<th>MK7</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>“ON”</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>“AL1”</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>“AL2”</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ON</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ins. fault</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Overload</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Overtemp.</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Operation
- System fault (1)
- Insulation fault
- Overcurrent
- Overtemperature
- No communication betw. IR 427+MK7

(1) Detailed alarm information on LCD
Connection to the IT system to be monitored = supply voltage $U_s$ via fuse
Temperature sensor
Measuring current transformer for load current monitoring
Connection alarm indicator and test combination MK7 (max. 4 pieces)
Line protection by a fuse in accordance with IEC 60364-4-43 (6 A fuse recommended) in case of supply (L1/L2) from an IT system, both lines have to be protected by a fuse.

**Example of application**

IR427

PE = Protective earth
PA = Equipotential bonding
ZPA = Supplementary equipotential bonding
ISOMETER® isoMED427P
Insulation monitoring device with integrated load and temperature monitoring and locating current injector and insulation fault location systems for medical IT systems

Device features
- Insulation monitoring for medical IT systems
- Adjustable response value for insulation monitoring
- Locating current injector for insulation fault location systems
- Load and temperature monitoring for IT system transformers
- Adjustable load current response value
- Temperature monitoring with PTC thermistor or bimetal switch
- Self monitoring with automatic alarm
- PE connection monitoring
- Internal/external test button
- LEDs: Power On, Alarm 1, Alarm 2
- Configurable alarm relay: N/O or N/C operation selectable
- Compact two-module enclosure (36 mm)
- BMS interface

Typical applications
- Medical IT system in accordance with IEC 60364-7-710, IEC 61557-8, IEC 61557-9 and DIN VDE 0100-710

Approvals

Standards
The ISOMETER® has been developed in compliance with the following standards:
- IEC 60364-7-710
- IEC 61557-8
- IEC 61557-9
- DIN VDE 0100-710

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage $U_s = U_n$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>isoMED427P-2</td>
<td>B72075301</td>
</tr>
</tbody>
</table>

Supply voltage $U_s = U_n$:
- 70…264 V, 42…460 Hz

$U_n$ Absolute values of the voltage range

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring current transformers</td>
<td>STW2</td>
<td>B942709</td>
</tr>
<tr>
<td>Temperature sensor (PTC)</td>
<td>ES0107</td>
<td>B924186</td>
</tr>
<tr>
<td>Three phase load monitor</td>
<td>CMS460-D4-2</td>
<td>B94053030</td>
</tr>
<tr>
<td>Mounting frame</td>
<td>XM420</td>
<td>B990994</td>
</tr>
</tbody>
</table>

Further information
For further information refer to our product range on www.bender.de.
Insulation monitoring devices | Application-specific selection – Medical locations

Insulation monitoring device ISOMETER® isoMED427P

**Technical data**

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**
- Rated insulation voltage: 250 V
- Rated impulse voltage/pollution degree: 4 kV/3
- Protective separation (reinforced insulation) between components: (L1, L2, E, KE, T1, T2, A, B, Z, Z/k, f) – (11, 12, 14)
- Voltage test acc. to IEC 61010-1: 2.21 kV

**Voltage supply**
- Supply voltage: $U_I = U_{oh}$
- Power consumption: $\leq 6.5$ VA

**IT system being monitored acc. to IEC 60364-7-710**
- Nominal system voltage: $U_{nom}$
- Nominal frequency: $f_{nom}$

**Insulation monitoring device ISOMETER® isoMED427P**

**Password**
- on, off/0…999 ($off, 0^*$)

**Operating error**
- $\pm 5 \%$

**Response value**
- $R_{T}$

**Load current monitoring**
- $5 \ldots 500 \ k\Omega$ ($50 \ k\Omega^*$)
- $\pm 10 \%$
- $25 \%$

**Response time for PE connection monitoring**
- $\leq 5 \ s$

**Permissible system leakage capacitance $C$**
- $\leq 5 \ \mu F$

**Permissible extraneous DC voltage $U_D$**
- $\leq DC \ 300 \ V$

**Measuring circuit**
- Measuring voltage: $\leq 12 \ V$
- Measuring current $I_{oh}$ (at $R = 0 \ \Omega$)
- $\leq 50 \ \mu A$

**Internal DC resistance $R$**
- $\geq 240 \ k\Omega$

**Impedance $Z$**
- $\leq 200 \ \Omega$

**Measuring current $I_{oh}$**
- $\leq DC \ 300 \ V$

**Locating current injector acc. to IEC 61557-9**
- Locating current
- $\leq 1 \ mA$
- Test pulse/break
- $2/4 \ s$

**Load current monitoring**
- Response value, adjustable
- $5 \ldots 50 \ A$ ($7 \ A^*$)
- $\pm 5 \%$
- $4 \%$

**Nominal frequency $f_{nom}$**
- $47 \ldots 63 \ Hz$

**Setting values load current measurement:**
- Transformer
  - 3150 VA
  - 4000 VA
  - 5000 VA
  - 6300 VA
  - 8000 VA
  - 10000 VA
- Connection 1
  - 14 A
  - 18 A
  - 22 A
  - 28 A
  - 35 A
  - 45 A
- Response time overload, (50 \% to 120 \%)
- $\leq 5 \ s$

**Response time for measuring current transformer monitoring at restart, test or every 1 h**

**Temperature monitoring:**
- Response value (fixed value)
- $4 \ k\Omega$
- Rated frequency
- $R_{T}$
- $47 \ldots 63 \ Hz$
- Release value
- $f_{nom}$
- $1.6 \ k\Omega$

**PTC resistors acc. to DIN 44081**
- max. 6 in series
- Relative uncertainty
- $\pm 10 \%$

**Response time overtemperature**
- $< 2 \ s$

**Response time connection fault PTC resistors**
- $< 2 \ s$

**Temperature monitoring:**
- Response value (fixed value)
- $4 \ k\Omega$
- Rated frequency
- $R_{T}$
- $47 \ldots 63 \ Hz$
- Release value
- $f_{nom}$
- $1.6 \ k\Omega$

**PTC resistors acc. to DIN 44081**
- max. 6 in series
- Relative uncertainty
- $\pm 10 \%$

**Response time overtemperature**
- $< 2 \ s$

**Displays, memory**
- LC display
- multifunctional, not illuminated
- Measured value insulation resistance
- $10 \ k\Omega \ldots 1 \ M\Omega$
- Operating uncertainty
- $\pm 10 \% \ldots 2 \ k\Omega$
- Measured value load current (as % of the set response value)
- $10 \ldots 199 \%$
- Operating error
- $\pm 5 \% \ldots 0.2 \%$
- Password
- on, off/0…999 (off, 0$^*$)

**Dimension diagram**

---

**Alarm messages LEDs**

<table>
<thead>
<tr>
<th>isomED427P</th>
<th>operation</th>
<th>system fault</th>
<th>overcurrent</th>
<th>insulation fault</th>
<th>overtemperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>“ON”</td>
<td>-</td>
<td>-1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>“AL1”</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>“AL2”</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

* Detailed alarm information on LCD
### Wiring diagram

1. E, KE  
   - Connect the leads E and KE separately to PE

2. L1, L2  
   - Connection to the IT system being monitored. 
   - Supply voltage (see nameplate) 6 A fuse recommended

3. Z, Z/k  
   - Connection to the temperature sensor (PTC)

4. Z/k, I  
   - Connection to the measuring current transformer (STW2)

5. T1, T2  
   - Connection for external test button

6. A, B  
   - RS-485 interface, Terminate the connection with switch R (on, off) if the device is connected at the end of the bus.

7. 11, 12, 14  
   - Alarm relay K1

---

### Example of application

#### EDS10

- **Output:** 0.5 mA
- **LED:** 330 mA
- **Supply voltage:** 24 V DC
- **Dimensions:** 52 x 22 x 44 mm

**Legend:**
- **PE:** Protective earth
- **PA:** Equipotential bonding
- **ZPA:** Supplementary equipotential bonding

**Locations:**
- Operating room
- Technical room
ISOMETER® isoLR275 with coupling device AGH-LR
Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems) for installations with a low level of insulation

Device features

**isoLR275**
- ISOMETER® for IT AC systems with galvanically connected rectifiers or converters and for IT DC systems (IT = unearthed systems)
- Particularly suitable to monitor installations with a low level of insulation
- Use the isoLR275 only combination with the coupling device AGH-LR
- Automatic adaptation to the existing system leakage capacitance
- AMP™ measurement method (European patent: EP 0 654 673 B1)
- Choice of measurement methods to meet different requirements
- Two separately adjustable response ranges of 0.2…100 kΩ (Alarm 1, Alarm 2)
- Two-line LC display
- Automatic device self test
- History memory with real-time clock to store alarm messages with date and time stamp
- BMS interface (Bender Measuring Device Interface) for communication with other Bender devices (RS-485 electrically isolated)
- Internal disconnection of the ISOMETER® from the IT system to be monitored (via control signal; terminals F1/F2) (e.g. if several ISOMETERs® are interconnected)
- Current output 0(4)…20mA (electrically isolated) analogously to the measured insulation value

**AGH-LR**
- Appropriate coupling device for ISOMETER® isoLR275
- Nominal voltage range AC 0…793 V and DC 0…1100 V
- DIN rail mounting

Typical applications

- AC, DC or AC/DC main circuits
- IT systems with directly connected inverters
- IT systems with high system capacitances of up to 500 μF
- IT systems with high but slow voltage fluctuations
- Installations including switch mode power supplies
- Coupled IT systems

Standards

The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8
- IEC 61326-2-4
- DIN EN 60664-1 (VDE 0110-1)
- DIN EN 60664-3 (VDE 0110-3)

For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage Uᵢ</th>
<th>Set comprising</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 19.2…55 V</td>
<td>isoLR275-327</td>
<td>B91065700W</td>
</tr>
<tr>
<td>DC 19.2…72 V</td>
<td>AGH-LR-3</td>
<td>B98039022W</td>
</tr>
<tr>
<td>AC 88…264 V</td>
<td>isoLR275-335</td>
<td>B91065701W</td>
</tr>
<tr>
<td>DC 77…286 V</td>
<td>AGH-LR-3</td>
<td>B98039022W</td>
</tr>
</tbody>
</table>

Devices are available as a set.

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw mounting</td>
<td>B990056</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Suitable system components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
</tr>
<tr>
<td>External kΩ measuring instruments</td>
</tr>
</tbody>
</table>
Technical data ISOMETER® isoLR275

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

- Rated insulation voltage for isoLR275-3: AC 250 V
- Rated impulse voltage/pollution degree: 6 kV/k
- Protective separation (reinforced insulation) between: (A1/+, A2-/ - (11, 12, 14, 21, 22, 24) - (AK1, AK2, KE, PE, T1, T2, R1, R2, F1, F2, M, A, B)
- Voltage test acc. to IEC 601010-1: 3.5 kV
- Rated insulation voltage: AC 250 V
- Rated impulse voltage/pollution degree: 4 kV/k
- Basic insulation between: (11, 12, 14) - (21, 22, 24)
- Voltage test acc. to IEC 61010-1: 2.21 kV

Voltage ranges

- Nominal system voltage \( \Delta U \) via AGH-LR
  - isoLR275-335:
    - Supply voltage \( \Delta U \) (also see nameplate): AC 88...264 V
    - Frequency range \( \Delta f \): 42...460 Hz
    - Power consumption \( \Delta P \) ≤ 21.5 VA
    - Supply voltage \( \Delta U \) (also see nameplate): DC 77...286 V
    - Power consumption \( \Delta P \) ≤ 5.5 W
  - isoLR275-327:
    - Supply voltage \( \Delta U \) (also see nameplate): AC 19.2...55 V
    - Frequency range \( \Delta f \): 42...460 Hz
    - Supply voltage \( \Delta U \) (also see nameplate): DC 19.2...72 V
    - Power consumption \( \Delta P \) ≤ 6 VA

For UL applications:
- Nominal system voltage \( \Delta U \) via AGH-LR
  - isoLR275-335:
    - Supply voltage \( \Delta U \) (also see nameplate): AC 88...250 V
    - Frequency range \( \Delta f \): 42...460 Hz
    - Power consumption \( \Delta P \) ≤ 21.5 VA
    - Supply voltage \( \Delta U \) (also see nameplate): DC 80...250 V
    - Power consumption \( \Delta P \) ≤ 5.5 VA
  - isoLR275-327:
    - Supply voltage \( \Delta U \) (also see nameplate): AC 19.2...250 V
    - Frequency range \( \Delta f \): 42...460 Hz
    - Supply voltage \( \Delta U \) (also see nameplate): DC 19.2...72 V
    - Power consumption \( \Delta P \) ≤ 6 VA

Response values

- Response value \( \Delta R_{1} \):
  - AC: 4 kΩ
  - DC: 4 kΩ
- Factory setting \( \Delta R_{2} \):
  - AC: 1 kΩ
  - DC: 1 kΩ
- Relative uncertainty (0.2...100 kΩ) (acc. to IEC 61557-8):
  - ±15%
- Hysteresis:
  - 25 %, + 1 kΩ

Measuring circuit

- Measuring voltage \( \Delta U_{m} \) (peak value): ±50 V
- Measuring current \( \Delta I_{m} \) (at \( R_{m} = 0 \Omega \)):
  - AC: ≤ 1.5 mA
  - DC: ≤ 35 kA
- Impedance \( Z_{i} \) at 50 Hz:
  - ≤ DC 1 kΩ
- Permissible system leakage capacitance \( \Delta C_{s} \):
  - ≤ 500 pF (150 pF)*

Displays

- Display, illuminated: backlit two-line display
- Characters (number/height):
  - 2 x 16/4 mm
- Display range measured value:
  - 0.2 kΩ...1 MΩ
- Operating uncertainty:
  - ±15%, ±1 kΩ

Outputs/inputs

- TEST / "RESET" button:
  - Internal/external
  - Cable length "TEST" / "RESET" button, external:
    - ≤ 10 m
  - Current output (load): 0/4...20 mA (≤ 500 Ω)
  - Accuracy current output, related to the value indicated (1...100 kΩ):
    - ±15 %, ±1 kΩ

Serial interface

- Interface/protocol RS-485/BMS
- Connection terminals A/B
- Cable length:
  - ≤ 1.2 m
  - Shielded cable (shield to PE on one end):
    - 2-core, ≥ 0.6 mm², e.g. J-Y(St)Y min. 2 x 0.6
- Terminating resistor:
  - ≥ 120 Ω (0.5 W)
- Device address, BMS bus:
  - 1...30 (3)*

Switching elements

- Switching elements:
  - 2 changeover contacts: K1 (Alarm 1), K2 (Alarm 2, device error)
- Operating mode K1, K2 (Alarm 1/Alarm 2):
  - N/C operation/N/O operation (N/O operation)*

Contact data acc. to IEC 60947-5-1:

- Utilisation category:
  - AC 13
  - AC 14
  - DC-12
  - DC-12
  - DC-12
- Rated operational voltage:
  - 230 V
  - 230 V
  - 24 V
  - 110 V
  - 220 V
- Rated operational current:
  - 5 A
  - 3 A
  - 1 A
  - 0.2 A
  - 0.1 A
- Minimum contact rating:
  - 1 mA (AC/DC) ≥ 10 V

Environment/EMC

- EMC:
  - not suitable for household and small companies
  - IEC 61326-2-4 Ed. 1.0
  - Operating temperature:
    - -25...+65 °C

Classification of climatic conditions acc. to IEC 60721:

- Stationary use (IEC 60721-3-3):
  - 3K23 (with condensation and formation of ice)
- Transport (IEC 60721-3-2):
  - 2K11 (with condensation and formation of ice)
- Long-term storage (IEC 60721-3-1):
  - 1K22 (with condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721:

- Stationary use (IEC 60721-3-3):
  - for screw mounting with accessories B990056
  - for DIN rail mounting B991152
- Transport (IEC 60721-3-2):
  - 2M4
- Long term storage (IEC 60721-3-1): 1M12

Connection

- Connection:
  - screw-type terminals
- Connection properties:
  - rigid/flexible:
    - 0.2...4 mm²
    - 0.2...2.5 mm²
- Tightening torque:
  - 0.5 Nm
- Conductor sizes (AWG):
  - 24...12
- Cable length between isoLR275 and AGH-LR:
  - ≤ 0.5 m

Other

- Operating mode:
  - continuous operation
- Mounting:
  - display-oriented
- Distance to adjacent devices:
  - ≥ 30 mm
- Degree of protection, terminals (DIN EN 60529):
  - IP30
- Degree of protection, terminals (DIN EN 60529):
  - IP20
- Type of enclosure:
  - X112, free from halogen
- Screw mounting with mounting clip:
  - 2 x M4
- Flammability class:
  - UL94 V-0
- Document number:
  - D00127
- Weight:
  - ≤ 510 g

( )* = factory setting
Data labelled with ** are absolute values
Insulation monitoring device ISOMETER® isoLR275 with coupling device AGH-LR

**Technical data coupling device AGH-LR**

**Insulation coordination acc. to IEC 60664-1**

- Rated insulation voltage: AC 800 V
- Rated impulse voltage/pollution degree: 8 kV/3

**Voltage ranges**

- Nominal system voltage $U_n$: AC, 3/NAC 0...793 V, DC 0...1100 V
- Nominal frequency $f_n$: DC, 10...460 Hz
- Max. AC voltage $U$ in the frequency range $f_n$: 0.1...10 Hz
- $U_{max} = 110 V/Hz \times f_n$

**Environment/EMC**

- EMC: IEC 61326-2-1 Ed. 1.0
- Operating temperature: -25...+65 °C

**Classification of climatic conditions acc. to IEC 60721:**

- Stationary use (IEC 60721-3-3) 3K23 (with condensation and formation of ice)
- Transport (IEC 60721-3-2) 2K11 (with condensation and formation of ice)
- Long-term storage (IEC 60721-3-1) 1K22 (with condensation and formation of ice)

**Classification of mechanical conditions acc. to IEC 60721:**

- Stationary use (IEC 60721-3-3) 3M12
- Transport (IEC 60721-3-2) 2M4
- Storage (IEC 60721-3-1) 1M12

**Connection**

- Connection: screw-type terminals
- Connection properties: rigid/flexible 0.2...4 mm²/0.2...2.5 mm²
- Connection to the terminals L+, L- and KE to PE
- Connection to the terminals L+, L- and KE to PE

**Other**

- Operating mode: continuous operation
- Mounting: cooling slots must be ventilated vertically
- Distance to adjacent devices: ≥ 30 mm
- Degree of protection, internal components (DIN EN 60529): IP30
- Degree of protection, terminals (DIN EN 60529): IP20
- Type of enclosure: X200, free from halogen
- DIN rail mounting: DIN EN 60715/IEC 60715
- Screw mounting: 2 x M4
- Flammability class: UL94 V-0

**Dimensions diagrams (dimensions in mm)**

**isoLR275**

- Length: 112.5 mm
- Width: 110 mm
- Height: 74 mm
- Depth: 105 mm

**AGH-LR**

- Length: 111 mm
- Width: 109 mm
- Height: 71 mm
- Depth: 50 mm

**Wiring diagrams**

1. Supply voltage $U_s$ (see nameplate) via 6 A fuse; For UL and CSA applications, it is mandatory to use 5 A fuses
2. Connection to the 3AC system to be monitored: Connect the terminals L1, L2 to neutral conductor N or terminals L1, L2 to conductor L1, L2
3. Connection to the AC system to be monitored: Connect terminals L1, L2 to conductor L1, L2
4. Connection to the DC system to be monitored: Connect terminal L1 to conductor L+, terminal L2 to conductor L-
5. Connection to the coupling device AGH-PV
6. Separate connection of KE and KE to PE
7. External test button (N/O contact)
8. External reset button (N/C contact or wire jumper), when the terminals are open, the fault message will not be stored
9. STANDBY by means of the function input F1, F2: when the contact is closed, the insulation resistance is not measured
10. Disconnection from the IT system: Current output, electrically isolated: 0...20 mA or 4...20 mA
11. Serial interface RS-485 (termination by means of a 120-Ω resistor)
12. Alarm relay “K1”: available changeover contacts
13. Alarm relay “K2” (device error relay): available changeover contacts
14. The terminal pairs 7, 8 and 9 have to be wired electrically isolated and do not have to be connected to earth!
ISOMETER® isoPV with coupling device AGH-PV

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems)
for photovoltaic systems up to AC 793 V/DC 1100 V

**Device features**

isoPV
- ISOMETER® for IT AC systems with galvanically connected rectifiers or converters and for IT DC systems (IT = unearthed systems)
- Particularly suitable for monitoring photovoltaic systems
- isoPV is always operated in combination with the coupling device AGH-PV
- Automatic adaptation to the existing system leakage capacitance
- Choice of measurement methods to meet different requirements
- Two separately adjustable response ranges of 0.2…100 kΩ each (Alarm 1, Alarm 2)
- Two-line LC display
- Automatic device self test
- Memory with real-time clock to store alarm messages with date and time stamp
- BMS interface (Bender Measuring Device Interface) for communication with other Bender devices (RS-485 galvanically isolated)
- Internal disconnection of the ISOMETER® (via control signal; terminals F1/F2) from the IT system to be monitored (e.g. if several ISOMETER®s are interconnected)
- Current output 0(4)…20 mA (electrically isolated) in relation to the measured insulation value

AGH-PV
- Coupling device required for ISOMETER® isoPV, each AGH-PV is specially designed for the corresponding isoPV
- Nominal voltage range AC 0…793 V and DC 0…1100 V
- DIN rail mounting

**Typical applications**

- AC, DC or AC/DC main circuits
- Solar systems with directly connected inverters
- Solar systems with large system capacitances of up to 2000 µF
- Solar systems with high but slow voltage fluctuations
- Installations including switch mode power supplies
- Coupled IT systems

**Approvals**

**Standards**
The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8
- IEC 61326-2-4
- DIN EN 60664-1 (VDE 0110-1)
- DIN EN 60664-3 (VDE 0110-3)
- UL 508
- UL 1998 (Software)

**Additional functions**
- History memory with real-time clock to store all alarm messages with date and time stamp
- Electrically isolated RS-485 interface (BMS protocol) for communication with other Bender devices
- Isometer disconnecting relays for the operation of several ISOMETER®s in coupled IT systems
- Current output 0(4)…20 mA (electrically isolated)

**Ordering information**

For further information refer to our product range on www.bender.de.

<table>
<thead>
<tr>
<th>Nominal voltage $U_n$</th>
<th>Supply voltage $U_s$</th>
<th>Set comprising</th>
<th>Art. No.</th>
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</thead>
<tbody>
<tr>
<td>3(N)AC 0…793 V</td>
<td>19.2…35 V</td>
<td>isoPV-327 B91065130W</td>
<td></td>
</tr>
<tr>
<td>DC 0…1100 V</td>
<td>19.2…72 V</td>
<td>AGH-PV B98039020W</td>
<td></td>
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<tr>
<td></td>
<td>88…264 V</td>
<td>isoPV-335 B91065131W</td>
<td></td>
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<tr>
<td></td>
<td>77…286 V</td>
<td>AGH-PV B98039020W</td>
<td></td>
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</tbody>
</table>

Devices are available as a set.

<table>
<thead>
<tr>
<th>Accessories</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw mounting</td>
<td>B990056</td>
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</tbody>
</table>

**Suitable system components**

<table>
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<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
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<td>9620-1421</td>
<td>B986841</td>
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<tr>
<td>instruments</td>
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</tbody>
</table>
### Technical data ISOMETER® isoPV

#### Insulation coordination acc. to IEC 60664-1

**Definitions:**
- Supply circuit (IC2): A1, A2
- Output circuit (IC3): 1, 14, 24
- Control circuit (IC4): Up, KE, T/R, A, B, AK1, GND, AK2

**Rated voltage:** 240 V

**Overvoltage category:** III

**Rated impulse voltage:**
- (IC2)/(IC3-4): 4 kV
- IC 3/(IC4): 4 kV

**Rated insulated voltage:**
- IC2/(IC3-4): 250 V
- IC 3/(IC4): 250 V

**Polution degree:** 3

**Protective separation (reinforced insulation) between:**
- Overvoltage category III, 100 V
- Overvoltage category III, 300 V

**Voltage test (routine test) according to IEC 61010-1:**
- (IC2)/(IC3-4): AC 2.2 kV
- IC 3/(IC4): AC 2.2 kV

**Voltage ranges:**

<table>
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<th>Range</th>
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</thead>
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<tr>
<td>Supply voltage</td>
<td>UisoPV-335:</td>
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<tr>
<td>Power consumption</td>
<td></td>
</tr>
<tr>
<td>Supply voltage</td>
<td>ES1</td>
</tr>
<tr>
<td>Power consumption</td>
<td></td>
</tr>
</tbody>
</table>

**Factory setting:**

**Internal DC resistance DC:** 1 kΩ

**Permissible extraneous DC voltage UES:** ≤ DC 1100 V

**Max. system leakage capacitance CE:** ≤ 2000 µF (2000 µF²)

### Displays

- Displays, illuminated: two-line display
- Characters (number/height): 2 x 16/4 mm
- Display range measured value: 0.2 kΩ...1 MΩ
- Operating uncertainty: ± 15%, ± 1 kΩ

### Outputs/Inputs

- Test/reset button: internal/external
- Cable length test/reset button, external: ≤ 10 m
- Current output (load): 0/4...20 mA (≤ 500 Ω)
- Accuracy current output, related to the value indicated (1...100 kΩ): ± 15 %, ± 1 kΩ

### Serial interface

- Interface/protocol: RS-485/BMS
- Connection: terminals A/B
- Cable length: ≤ 1200 m
- Shielded cable (shield to PE on one end): 2-core, ≥ 0.6 mm², z. B. J-Y(St)Y 2 x 0.6
- Terminating resistor: 120 Ω (0.5 Ω)
- Device address, BMS bus: 1...30 (3)'

### Environment/EMC

- EMC: not suitable for household and small companies
- Operating temperature: -25...+65 °C
- Classification of climatic conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3K23 (with condensation and formation of ice)
  - Transport (IEC 60721-3-2): 2K11 (with condensation and formation of ice)
  - Long-term storage (IEC 60721-3-1): 1K22 (with condensation and formation of ice)
- Classification of mechanical conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): for screw fixing with accessories B990056
  - DIN rail mounting: B9911
  - Transport (IEC 60721-3-2): 2M4
  - Long-time storage (IEC 60721-3-1): 1M12

### Connection

- Connection: screw-type terminals
- Connection, rigid/flexible: 0.2...4 mm²/0.2...2.5 mm²
- Connection flexible with connector sleeve, without/plastic sleeve: 0.25...2.5 mm²
- Tightening torque: 0.6...0.8 Nm
- Conductor sizes (AWG): 24...12
- Cable length between isoPV and AGH-PV: ≤ 0.5 m

### Other

- Operating mode: continuous operation
- Mounting: display oriented
- Distance to adjacent devices: ≥ 30 mm
- Degree of protection, internal components (DIN EN 60529): IP30
- Degree of protection, terminals (DIN EN 60529): IP20
- Type of enclosure: X112, free from halogen
- DIN rail mounting: DIN EN 60715/IEC 60715
- Screw mounting by means of screw (see Seite 67 in manual): 2 x M4
- Flammability class: UL94 V-0
- Software version: D351 V2.0
- Weight: < 310 g

*(*) = factory setting
The values marked with ** are absolute values
Insulation monitoring devices | Application-specific selection – photovoltaic

**Technical data coupling device AGH-PV**

**Insulation coordination acc. to IEC 60664-1**
- Rated insulation voltage: AC 800 V
- Rated impulse voltage/pollution degree: 8 kV/3

**Voltage ranges**
- Nominal system voltage $U_n$: AC, 3(N)AC 0…793 V, DC 0…1100 V
- Nominal frequency $f_n$: DC, 10…460 Hz
- Max. AC voltage $U_{\sim}$ in the frequency range $f_n = 0.1…10$ Hz: $U_{\sim} \text{max} = 110 \text{V/Hz} * f_n$

**Environment/EMC**
- EMC: IEC61326-2-4
- Operating temperature: -25…+65 °C

**Classification of climatic conditions acc. to IEC 60721:**
- Stationary use (IEC 60721-3-3) 3K23 (with condensation and formation of ice)
- Transport (IEC 60721-3-2) 2K11 (with condensation and formation of ice)
- Long-term storage (IEC 60721-3-1) 1K22 (with condensation and formation of ice)

**Classification of mechanical conditions acc. to IEC 60721:**
- Stationary use (IEC 60721-3-3): 3M12
- Transport (IEC 60721-3-2): 2M4
- Long-time storage (IEC 60721-3-1): 1M12

**Connection**
- Connection: screw-type terminals
- Connection, rigid/flexible: 0.2…4 mm²/0.2…2.5 mm²
- Connection flexible with connector sleeve, without/with plastic sleeve: 0.25…2.5 mm²
- Tightening torque: 0.5 Nm
- Conductor size (AWG): 24…12
- Cable length between isoPV and AGH-PV: ≤ 0.5 m

**Other**
- Operating mode: continuous operation
- Mounting: cooling slots must be ventilated vertically!
- Distance to adjacent devices: ≥ 30 mm
- Degree of protection, internal components (DIN EN 60529): IP30
- Degree of protection, terminals (DIN EN 60529): IP20
- Type of enclosure: X200, free from halogen
- DIN rail mounting: DIN EN 60715/IEC 60715
- Screw fixing: 2 x M4
- Flammability class: UL94 V-0
- Weight: < 230 g

The values marked with ** are absolute values

**Dimension diagrams (dimensions in mm)**

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ISO METER® isoPV with AGH-PV with coupling device AGH-PV 01/2021
**Typical application**

1. Supply voltage $U_s$ (see nameplate) via 6 A fuse; For UL and CSA applications, it is mandatory to use 5 A fuses
2. Connection to the 3 AC system to be monitored: Connect the terminals L1, L2 to neutral conductor N or terminals L1, L2 to conductor L1, L2.
3. Connection to the 3 AC system to be monitored: Connect the terminals L1, L2 to conductor L1, L2.
4. Connection to the 3 AC system to be monitored: Connect terminals L1, L2 to conductor L1, L2.
5. Connection to the DC system to be monitored: Connect terminal L1 to conductor L+, terminal L2 to conductor L-.
6. Connection to the coupling device AGH-PV
7. Separate connection of $\frac{1}{1}$ and KE to PE
8. External test button “T1, T2” (N/O contact)
9. External reset button (N/C contact or wire jumper), when the terminals are open, the fault message will not be stored.
10. STANDBY by means of the function input “F1, F2”; when the contact is closed, the insulation resistance is not measured. Disconnection from the IT system
11. Current output, electrically isolated: 0...20 mA or 4...20 mA
12. Serial interface RS-485 (termination by means of a 120 Ω resistor)
13. Alarm relay “K1”: available changeover contacts
14. Alarm relay “K2” (device error relay); available changeover contacts

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**Wiring diagrams**

PV generator unearthed (IT system) with nominal voltage ≤ DC 1100 V and ISOMETER isoPV with coupling device AGH-PV
ISOMETER® isoPV425 with coupling device AGH420

Insulation monitoring device for unearthed DC circuits (IT systems) for photovoltaic installations up to 3(N)AC, AC 690 V/DC 1000 V

**Device features**
- Monitoring for unearthed AC and DC systems with galvanically connected rectifiers or inverters
- Measurement of the nominal system voltage (r.m.s.) with undervoltage and overvoltage detection
- Measurement of DC voltages system to earth (L+/PE and L-/PE)
- Automatic adaptation to the system leakage capacitance up to 500 μF
- Automatic device self-test with connection monitoring
- Selectable start-up delay, response delay and delay on release
- Two separately adjustable response value ranges of 1…500 kΩ (Alarm 1, Alarm 2)
- Alarm signalling via LEDs (AL1, AL2), a display and alarm relays (K1, K2)
- N/C operation or N/O operation selectable
- Measured value indication via multi-functional LCD
- Fault memory can be activated
- RS-485 (galvanically isolated) including the following protocols:
  - MBus interface (Bender measuring device interface) for data exchange with other Bender components
  - Modbus RTU
  - isoData (for continuous data output)
- Password protection to prevent unauthorised parameter changes

**Standards**
The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8

**Further information**
For further information refer to our product range on www.bender.de.
Technical data isoPV425

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:
- Supply circuit (IC2) A1, A2
- Output circuit (IC3) 1, 14, 24
- Control circuit (IC4) E, KE, TR, A, B, AK1, GND, AK2
- Rated voltage 240 V
- Overvoltage category III
- Rated impulse voltage: (IC2)/(IC3-4) 4 kV
  (IC3)/(IC4) 4 kV
- Rated insulated voltage: (IC2)/(IC3-4) 250 V
  (IC3)/(IC4) 250 V
- Polulation degree 3
- Protective separation (reinforced insulation) between: (IC2)/(IC3-4) Overvoltage category III, 300 V
  (IC3)/(IC4) Overvoltage category III, 300 V
- Voltage test (routine test) according to IEC 61010-1:
  (IC2)/(IC3-4) AC 2.2 kV
  (IC3)/(IC4) AC 2.2 kV

Supply voltage
- Supply voltage U1 AC 100...240 V/DC 24...240 V
- Tolerance of U1 -30...+15 %
- Frequency range U1 47...63 Hz
- Power consumption ≤ 3 W, ≤ 9 VA
- Nominal current ≤10 A
- Utilisation category AC-12 AC-14 DC-12 DC-12 DC-12
- Rated operational voltage 230 V 230 V 24 V 110 V 220 V
- Rated operational current 5 A 2 A 1 A 0.2 A 0.1 A
- Minimum contact rating 1 mA at AC/DC ≥ 10 V

Contact data acc. to IEC 60947-5-1:
- Utilisation category AC-12 AC-14 DC-12 DC-12 DC-12
- Rated operational voltage 230 V 230 V 24 V 110 V 220 V
- Rated operational current 5 A 2 A 1 A 0.2 A 0.1 A
- Minimum contact rating 1 mA at AC/DC ≥ 10 V

Environment/EMC
- EMC IEC 61326-2-4
- Ambient temperatures:
  - Operation -40...+70 °C
  - Transport -40...+85 °C
  - Storage -40...+70 °C
- Classification of climatic conditions acc. to IEC 60721
  - Stationary use (IEC 60721-3-3) 3K24 (except condensation and formation of ice)
  - Transport (IEC 60721-3-2) 2K11 (except condensation and formation of ice)
  - Long-term storage (IEC 60721-3-1) 1K22 (except condensation and formation of ice)

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 screw-type terminal or push-wire terminal

TechniCAL DATA | Application-specific selection – photovoltaic

Switching elements
- Switching elements 2 x 1 N/O contacts, common terminal 11
- Operating principle N/C operation/N/O operation (N/O operation)*
- Electrical endurance, number of cycles 10000

Other
- Cooling: cooling slots must be ventilated vertically
- Degree of protection, built-in components (DIN EN 60529): IP30
- Degree of protection, terminals (DIN EN 60529): IP20
- Enclosure material: polycarbonate
- DIN rail mounting acc. to IEC 60715
- Screw fixing 2 x M4 with mounting clip
- Documentation number D00028
- Weight ≤ 150 g

Other
- Continuous operation
- Mounting
- Degree of protection, terminals (DIN EN 60529): IP20
- Degree of protection, terminals (DIN EN 60529): IP30
- Enclosure material: polycarbonate
- DIN rail mounting acc. to IEC 60715
- Screw fixing 2 x M4 with mounting clip
- Documentation number D00028
- Weight ≤ 150 g

(*1) Factory setting

*1 Factory setting

Weight ≤ 150 g

10/2021

Insulation monitoring device ISOmeter isoPV425

Interface/protocol
- RS-485/BMS, Modbus RTU, ISOdata
- Baud rate: 9.6 kBit/s, Modbus RTU (selectable), ISOdata (115.2 kBit/s)
- Cable length: 1200 m
- Terminating resistor: 120 Ω (0.25 W), internal, can be connected
- Device address, BMS bus, Modbus RTU 3...90 (3)

Fault current monitoring devices | Application-specific selection – photovoltaic

Insulation monitoring device ISOmeter isoPV425
**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**

Definitions:
- Measuring circuit (IC1) L1/+, L2/–
- Control circuit (IC2) AK1, GND, AK2, Up, E

**Rated voltage** 1000 V

**Overvoltage category** III

**Rated impulse voltage:**
- IC1/(IC2) 8 kV

**Rated insulated voltage:**
- IC1/(IC2) 1000 V

**Pollution degree** 3

**Protective separation (reinforced insulation) between:**
- IC1/(IC2) Overvoltage category III, 1000 V

**Monitored IT system**

**Nominal system voltage range** Un AC/DC 0…1000 V

**Tolerance of** Un AC/DC +10 %

**Nominal system voltage range** Un (UL508) AC/DC 0…600 V

**Measuring circuit**

**Measuring voltage** Um ± 45 V

**Measuring current** Im at Rf ≤ 400 μA

**Internal resistance DC** Ri ≥ 120 kΩ

**Environment/EMC**

**EMC** IEC 61326-2-4

**Ambient temperatures:**
- Operation -40…+70 °C
- Transport -40…+85 °C
- Storage -40…+70 °C

**Classification of climatic conditions acc. to IEC 60721:**

- Stationary use (IEC 60721-3-3) 3K24 (except condensation and formation of ice)
- Transport (IEC 60721-3-2) 2K11 (except condensation and formation of ice)
- Long-term storage (IEC 60721-3-1) 1K22 (except condensation and formation of ice)

**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** Screw-type terminal or push-wire terminal

**Screw-type terminals:**

- **Nominal current** ≤ 10 A
- **Conductor sizes** AWG 24–12
- **Stripping length** 8 mm
- **Rigid/Flexible** 0.2…2.5 mm²
- **Flexible with ferrules with/without plastic sleeve** 0.25…2.5 mm²
- **Multi-conductor rigid** 0.2…1.5 mm²
- **Multi-conductor flexible** 0.2…1.5 mm²
- **Multi-conductor flexible with ferrules without plastic sleeve** 0.25…1.5 mm²
- **Multi-conductor flexible with TWIN ferrules with plastic sleeve** 0.25…1.5 mm²

**Push-wire terminals:**

- **Nominal current** ≤ 10 A
- **Conductor sizes** AWG 24–14
- **Stripping length** 10 mm
- **Rigid** 0.2…2.5 mm²
- **Flexible without ferrules** 0.75…2.5 mm²
- **Flexible with ferrules with/without plastic sleeve** 0.25…2.5 mm²
- **Multi-conductor flexible with TWIN ferrules with plastic sleeve** 0.5…1.5 mm²
- **Opening force** 50 N
- **Test opening, diameter** 2.1 mm
- **Connection type** Terminals Up, AK1, GND, AK2

**Simple cables for terminals Up, AK1, GND, AK2:**

- **Cable lengths** ≤ 0.5 m
- **Connection properties** ≥ 0.75 mm²

**Other**

- **Operating mode** Continuous operation
- **Mounting** Cooling slots must be ventilated vertically
- **Distance to adjacent devices from Un > 800 V** ≥ 30 mm
- **Degree of protection internal components (DIN EN 60529)** IP30
- **Degree of protection terminals (DIN EN 60529)** IP20
- **Enclosure material** Polycarbonate
- **DIN rail mounting acc. to** IEC 60715
- **Screw mounting** 2 x M4 with mounting clip
- **Weight** ≤ 150 g
1 **A1, A2** Connection to the supply voltage via fuse (line protection). If being supplied from an IT system, both lines have to be protected by a fuse.*

2 **E, KE** Connect each terminal separately to PE. The same wire cross section as for A1, A2 must be used.

3 **L1/+, L2/-** Connection to the 3(N)AC, AC or DC system to be monitored.

4 **Up, AK1, GND, AK2** Connect the terminals of the AGH420 to the corresponding terminals of the isoPV425

5 **T/R** Connection for external combined test and reset button

6 **11, 14** Connection to alarm relay K1

7 **11, 24** Connection to alarm relay K2

8 **A, B** RS-485 communication interface with selectable terminating resistance.

*For UL applications:
Only use 60/75°C copper lines!
For UL and CSA applications, it is mandatory to use 5 A fuses for the protection of the supply voltage.
ISOMETER® isoPV1685...
Insulation monitoring device for unearthed systems in photovoltaic installations up to AC 1000 V/DC 1500 V

Device features
- Only device version isoPV1685P provide a locating current injector.
- Insulation monitoring of large-scale photovoltaic systems
- Measurement of low-resistance insulation faults
- Separately adjustable response values $R_{an1}$ (alarm 1) and $R_{an2}$ (alarm 2) (both 200 $\Omega$…1 M$\Omega$) for prewarning and alarm. $R_{an1} \geq R_{an2}$ applies.
- Automatic adjustment to high system leakage capacitances up to 2000 $\mu$F, selectable range
- Connection monitoring of L+, L- for reverse polarity (DC only)
- Integrated locating current injector up to 50 mA (isoPV1685P only)
- Device self test with automatic message in the event of a fault
- Alarm relays separately adjustable for insulation fault 1, insulation fault 2
- CAN interface to output measured values, statuses and alarms
- RS-485 interface
  - isoPV1685P: BMS bus, e.g. to control the insulation fault location
  - isoPV1685RTU: BMS bus or Modbus (can be switched using the DIP switch)
- $\mu$SD card with data logger and history memory for alarms

Standards
- The ISOMETER® has been developed in compliance with the following standards:
  - DIN EN 61557-8 (VDE 0413-8)
  - IEC 61557-8
  - IEC 61557-9
  - IEC 61326-2-4
  - IEC 60730-1
  - DIN EN 60664-1 (VDE 0110-1)
  - UL1998 (software, isoPV1685RTU only)

Typical applications
- Large PV systems designed as IT systems up to AC 1000V/DC 1500 V

Approvals
- for isoPV1685RTU only

Further information
- For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Response value range</th>
<th>Supply voltage $U_s$</th>
<th>Nominal system voltage $U_n$</th>
<th>Ind. $\mu$SD card</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 $\Omega$…1 M$\Omega$</td>
<td>DC 18…30 V</td>
<td>DC 0…1000 V</td>
<td>DC 0…1500 V</td>
<td>–</td>
<td>isoPV1685RTU-425 B9165603</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>isoPV1685SP-425 B9165604</td>
</tr>
</tbody>
</table>

$^1$ Absolute values
Technical data

Insulation monitoring devices | Application-specific selection – photovoltaic

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Insulation coordination acc. to IEC 60664-1
Rated voltage
DC 1500 V
Rated impulse voltage/pollution degree
8 kV/2

Voltage ranges
Nominal system voltage $U_n$
isoPV1685RTU
AC 0…1000 V/DC 0…1500 V
isoPV1685P
DC 0…1500 V
Nominal frequency
50/60 Hz ± 1 Hz
Tolerance of $U_n$
AC ±10%/DC ± 6 %
Supply voltage $U_s$ (refer also to device name plate)
DC 18…30 V
Power consumption
≤ 7 W

Measuring circuit for insulation monitoring
Measuring voltage $U_m$ (peak value)
±50 V
Measuring current $I_m$ (at $R_m = 0$ Ohm)
≤ 5 mA
Internal DC resistance $R_i$
≥ 70 kOhm
Impedance $Z_m$ at 50 Hz
≥ 70 kOhm
Permissible extraneous DC voltage $U_f$
≤ 1500 V
Permissible system leakage capacitance $C_f$
≤ 2000 μF (500 μF)*

Response values for insulation monitoring
Response value $R_{res}$ (Alarm 1)
200 Ohm ±1 MΩ (10 kΩ)*
Response value $R_{res}$ (Alarm 2)
200 Ohm ±1 MΩ (1 kΩ)*
Upper limit of the measuring range when set to $C_{max} = 2000 \mu$F
50 kOhm
Relative uncertainty (10 kΩ ±1 MΩ) (acc. to IEC 61557-8)
± 15 %
Relative uncertainty (0.2 kΩ ±10 kΩ)
±200Ω ±15 %
Response time $t_{res}$
see graphic in the manual
Hysteresis
25 %, +1 kΩ

isoPV1685P only:
Measuring circuit for insulation fault location (EDS)
Locating current I DC
≤ 50 mA
Test cycle/pause
2/4 s
Number of turns of test winding
10

Displays, memory
LEDs for alarms and operating states
2x green, 4x yellow
μSD card (Spec. 2.0) for history memory and log files
≤ 32 GByte

Inputs
Digital inputs DigIn1/DigIn2:
μSD card (Spec. 2.0) for history memory and log files
≤ 32 GByte

Sequential interfaces
BMS/Modbus:
Interface/protocol
isoPV1685RTU:
RS-485/BMS(Slave)/Modbus RTU (Slave), Protocol switchable
isoPV1685P:
RS-485/BMS
Connection
terminals A/B
Shield: Terminal S
Cable length
≤ 1200 m
Shielded cable (shield to functional earth on one end)
2-core, ≥ 0.6 mm², e.g. J-Y(St)Y 2 x 0.6
Terminating resistor, switchable (RS-485 Term.)
120 Ohm (0.5 W)
Device address, BMS bus or Modbus adjustable (DIP switch)
isoPV1685RTU: 2…17
Device address, BMS bus adjustable (DIP switch)
isoPV1685P: 2…33 W

CAN:
Protocol
acc. to SMA/Bender specification V2.5
Frame format
CAN 2.0A 11-bit identifier
Baud rate
500 kbit/s
Connection via 2 x RJ45 acc. to GA-383-1 connected in parallel
Pin 1: CAN-H
Pin 2: CAN-L
Pin 3, 7: CAN-N/D
CAN identifier
permanently set acc. to the specification above
Cable length
≤ 130 m
Shielded cable
CAT 5 with RJ45 plug
Terminating resistor, can be connected (Term. CAN)
120 Ohm (0.5 W)
Potential of the socket housing
functional-earth potential

Switching elements
Switching elements
3 changeover contacts
K1 (insulation fault alarm 1),
K2 (insulation fault alarm 2)
K3 (device error)

Operating principle K1, K2
N/C operation or N/O operation (N/C operation)*
Operating principle K3
N/C operation, not changeable

Contact data acc. to IEC 60947-5-1:
Utilisation category
AC 13
AC 14
DC-12
DC-12
DC-12
Rated operational voltage
230 V
230 V
24 V
110 V
220 V
Rated operational current
5 A
3 A
1 A
0.2 A
0.1 A
Minimum contact rating
1 mA at AC/DC ≥ 10 V

For UL application:
Utilisation category for AC control circuits with 50/60 Hz (Pilot duty)
B300
AC load of the alarm relay outputs
AC 240 V, 1.5 A in case of a power factor of 0.55
AC load of the alarm relay outputs
AC 120 V, 3 A in case of a power factor of 0.35
AC load of the alarm relay outputs
AC 250 V, 8 A in case of a power factor of 0.75 to 0.80
DC load of the alarm relay outputs
DC 30 V, 8 A in case of ohmic load

Connection (except system coupling)
Connection type
pluggable push-wire terminals
Connection
rigid/flexible
0.2…2.5 mm²/0.2…2.5 mm²
flexible with ferrule, without/with plastic sleeve
0.25…6 mm²/0.25…4 mm²
Conductor sizes (AWG)
24…12

Connection of the system coupling
Connection type
pluggable push-wire terminals
Connection
rigid/flexible
0.2…10 mm²/0.2…6 mm²
flexible with ferrule, without/with plastic sleeve
0.25…6 mm²/0.25…4 mm²
Conductor sizes (AWG)
24…8

Stripping length
15 mm
Opening force
90…120 N

Environment/EMC
EMC
IEC 61326-2-4 Ed. 1.0
Classification of climatic conditions acc. to IEC 60721:
Without solar radiation, precipitation, water, icing. Condensation possible temporarily:
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

Deviation from the classification of climatic conditions:
Ambient temperature during operation
-40…+70 °C
Ambient temperature for transport
-40…+80 °C
Ambient temperature for long-term storage
-25…+80 °C
Relative humidity
10…100 %
Atmospheric pressure
700…1060 hPa (max. height 4000 m)

Other
Operating mode
continuous operation
Position of normal use
vertical, system coupling on top
PCB fixation
lens head screw DIN7985Tk
Opening force
4.9 Nm
Degree of protection, internal components
IP30
Degree of protection, terminals
IP30
Documentation number
D00007
Weight
≤ 1300 g
Insulation monitoring devices | Application-specific selection – photovoltaic

Insulation monitoring device ISOMETER® isoPV1685...

### Dimension diagram (dimensions in mm)

![Dimension diagram](image)

### Wiring diagram

#### 3 AC system

- **Ua**: Connection to the IT system to be monitored
- **L1+, L2-**: Connection to the IT system to be monitored

#### AC system

- **Ua**: Connection to Modbus or BMS bus, RS-485, S= shield (connect one end to PE), can be terminated with RS-485 Term. switch.
- **A, B, S**: Connection to Modbus or BMS bus, RS-485, S= shield (connect one end to PE), can be terminated with RS-485 Term. switch.

#### DC system

- **E, KE**: Separate connections for E and KE to PE.
- **A1, A2**: Connection to Ua = DC 24 V via a 6 A fuse on each line.

#### Table

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Digital input 1: isoPV1685RTU: Test/Standby isoPV1685P: Starting the insulation fault location in the manual mode</td>
</tr>
<tr>
<td>2</td>
<td>Digital input 2: isoPV1685RTU: Reset/(Memory) isoPV1685P: No function</td>
</tr>
<tr>
<td>3</td>
<td>CAN2, CAN1: Connection to CAN bus, 2 x RJ-45, can be terminated with CAN 120-Ω termination plug.</td>
</tr>
<tr>
<td>4</td>
<td>RS-485 Term.: DIP switch for the termination of the RS-485 interface</td>
</tr>
<tr>
<td>5</td>
<td>k, l/kT, IT: No function</td>
</tr>
<tr>
<td>6</td>
<td>31, 32, 34: Alarm relay K3 for internal device errors</td>
</tr>
<tr>
<td>7</td>
<td>21, 22, 24: Alarm relay K2 for insulation faults.</td>
</tr>
<tr>
<td>8</td>
<td>11, 12, 14: Alarm relay K1 for insulation faults.</td>
</tr>
<tr>
<td>9</td>
<td>E, KE: Separate connections for E and KE to PE.</td>
</tr>
<tr>
<td>10</td>
<td>A1, A2: Connection to Ua = DC 24 V via a 6 A fuse on each line.</td>
</tr>
<tr>
<td>11</td>
<td>L1+/, L2-/: Connection to the IT system to be monitored</td>
</tr>
</tbody>
</table>
ISOMETER® IR420-D6
Offline monitor for de-energised AC, DC and 3(N)AC loads in TN, TT and IT systems

Device features
- Insulation monitoring for de-energised TN, TT and unearthed systems AC, 3(N)AC and DC
- Nominal voltage extendable via coupling device
- Two separately adjustable response values 100 kΩ...10 MΩ
- LEDs: Power On LED, LEDs Alarm 1, Alarm 2 for signalling insulation faults
- Combined test/reset button
- Two separate alarm relays with one changeover contact each
- Fault memory behaviour, selectable
- Push-wire terminal (two terminals per connection)

Typical applications
- De-energised loads such as automatic fire extinguisher pumps, emergency drives, ship cranes, slide-valve drives in supply lines (gas, water, oil), motor-driven closing systems, diving pumps, drives for anchors, elevators, flue-gas valves and emergency power generators

Standards
The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- EN 61557-8
- IEC 61557-8
- IEC 61326-2-4
- DIN EN 60664-1 (VDE 0110-1)
- DIN EN 60664-3 (VDE 0110-3)

Approvals
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage 1) U_s</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Screw-type terminal</td>
<td>Push-wire terminal</td>
</tr>
<tr>
<td><strong>AC</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16...72 V, 42...460 Hz</td>
<td>IR420-D6-1</td>
<td>B91016415</td>
</tr>
<tr>
<td>70...300 V, 42...460 Hz</td>
<td>IR420-D6-2</td>
<td>B91016407</td>
</tr>
<tr>
<td><strong>DC</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.6...94 V</td>
<td>IR420-D6-3</td>
<td>B91016408</td>
</tr>
</tbody>
</table>

1) Absolute values

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B 9806 0008</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Nominal voltage U_n 1)</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupling device</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC 0...1150 V, DC 0...1100 V</td>
<td>A6H150W</td>
<td>B915576</td>
<td>352</td>
<td></td>
</tr>
<tr>
<td>AC 0...1650 V AC + DC 0...1300 V</td>
<td>A6H2045-4</td>
<td>B914013</td>
<td>354</td>
<td></td>
</tr>
<tr>
<td>AC 50...400 Hz, 0...7200 V</td>
<td>A6H520S</td>
<td>B913033</td>
<td>355</td>
<td></td>
</tr>
<tr>
<td>AC 230 V, 50 Hz</td>
<td>AG70</td>
<td>B984718</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>3 AC 50...400 Hz, 0...500 V</td>
<td>DS2-31</td>
<td>B984092</td>
<td>–</td>
<td></td>
</tr>
</tbody>
</table>

1) Absolute values
## Technical data

### Insulation coordination acc. to IEC 60664-1/IEC 60664-3

<table>
<thead>
<tr>
<th>Rated insulation voltage</th>
<th>300 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A1, A2) - (L1, AK, E, KE, T/R)</td>
<td>300 V</td>
</tr>
<tr>
<td>Rated impulse voltage</td>
<td>6 kV</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>II</td>
</tr>
<tr>
<td>Pollution degree</td>
<td>3</td>
</tr>
</tbody>
</table>

### Protective separation (reinforced insulation) between: (A1, A2) - (L1, AK, E, KE, T/R) - (11, 12, 14) - (21, 22, 24)

Voltage test acc. IEC 61010-1  2.2 kV

### Supply voltage

**IR420-D6-1:**
- Supply voltage $U_s$  AC 16…72 V/DC 9.6…94 V
- Frequency range $U_s$  42…460 Hz/DC

**IR420-D6-2:**
- Supply voltage $U_s$  AC/DC 70…300 V
- Frequency range $U_s$  42…460 Hz, DC

### Power consumption

≤ 3 VA

### System being monitored

<table>
<thead>
<tr>
<th>Nominal system voltage $U_n$</th>
<th>AC 0…400 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolerance of $U_n$</td>
<td>± 25 %</td>
</tr>
<tr>
<td>Frequency range of $U_n$</td>
<td>42…460 Hz</td>
</tr>
</tbody>
</table>

Without AGH:
- Nominal contact voltage of the N/C contact K3 (switch-on contactor) 230 V

With AGH520S:
- AC 0…1150 V
- DC 0…1100 V

With AGH204S-4:
- Including DC components 0…1300 V

### Response values

<table>
<thead>
<tr>
<th>Response value $R_{an1}$ (AL 1)</th>
<th>100 kΩ…10 MΩ (1 MΩ*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response value $R_{an2}$ (AL 2)</td>
<td>100 kΩ…10 MΩ (100 kΩ*)</td>
</tr>
<tr>
<td>Operating error (≤ 1 MΩ)</td>
<td>± 15 %</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>+ 25 %</td>
</tr>
</tbody>
</table>

### Time response

<table>
<thead>
<tr>
<th>Response time $t_{an}$ at $R_F = 0.5 \times R_{an}$ and $C_e = 1 \mu F$</th>
<th>≤ 4 s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start-up delay $t_{on}$</td>
<td>0…10 s (0 s)*</td>
</tr>
<tr>
<td>Response delay $t_{on}$</td>
<td>0…99 s (0 s)*</td>
</tr>
</tbody>
</table>

### Measuring circuit

- Measuring voltage $U_m$  +12 V
- Measuring current $I_m$  ($R_F = 0$ Ω) ≤ 10 μA
- Internal d.c. resistance $R_{ad}$  ≤ 1.2 MΩ
- Internal impedance $Z_{ad}$ (50 Hz)  ≤ 1.1 MΩ
- Admissible external d.c. voltage $U_{ad}$  ≤ 120 V
- System leakage capacitance $C_e$  ≤ 10 μF

### Displays, memory

<table>
<thead>
<tr>
<th>Display</th>
<th>LC display, multi-functional, non-illuminated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display range, measuring value</td>
<td>10 kΩ…200 MΩ</td>
</tr>
<tr>
<td>Percentage operating error (≤ 1 MΩ)</td>
<td>± 15 %</td>
</tr>
<tr>
<td>Password</td>
<td>off/0…999 (off)*</td>
</tr>
<tr>
<td>Fault memory (alarm relay)</td>
<td>on/off (off)*</td>
</tr>
</tbody>
</table>

### Contact data according IEC 60947-5-1

<table>
<thead>
<tr>
<th>Utilization category</th>
<th>AC-13 AC-14 DC-12 DC-12 DC-12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated operational voltage</td>
<td>230 V 230 V 220 V 110 V 24 V</td>
</tr>
</tbody>
</table>

### Environment/EMC

<table>
<thead>
<tr>
<th>EMC</th>
<th>acc. to IEC 61326</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>-25…+55 °C</td>
</tr>
</tbody>
</table>

### Climatic classes acc. to IEC 60721 (without condensation and formation of ice)

- Stationary use (IEC 60721-3-3)  3K24
- Transport (IEC 60721-3-2)  2K11
- Storage (IEC 60721-3-1)  1K12

### Classification of mechanical conditions acc. to IEC 60721:

- Stationary use (IEC 60721-3-3)  3M11
- Transport (IEC 60721-3-2)  2M4
- Storage (IEC 60721-3-1)  1M12

### Connection

**Connection screw terminals**

- Connection properties
  - Rigid 0.2…4 mm² (AWG 24…12)
  - Flexible 0.2…2.5 mm² (AWG 24…14)

- Two conductors with the same cross section
  - Rigid/flexible 0.2…1.5 mm² (AWG 24…16)

- Stripping length 8 mm

- Tightening torque, terminal screws 0.5…0.6 Nm

**Connection push-wire terminals**

- Connection properties
  - Rigid 0.2…2.5 mm² (AWG 24…14)
  - Flexible 0.75…2.5 mm² (AWG 19…14)

- Stripping length 10 mm

- Opening force 50 N

- Test opening, diameter 2.1 mm

### Other details

<table>
<thead>
<tr>
<th>Operating mode</th>
<th>continuous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>any position</td>
</tr>
<tr>
<td>Degree of protection internal components (EN 60529)</td>
<td>IP30</td>
</tr>
<tr>
<td>Degree of protection terminals (EN 60529)</td>
<td>IP20</td>
</tr>
<tr>
<td>Enclosure material</td>
<td>polycarbonat</td>
</tr>
<tr>
<td>Flammability class</td>
<td>UL94 V-0</td>
</tr>
<tr>
<td>DIN rail mounting acc. to</td>
<td>IEC 60715</td>
</tr>
<tr>
<td>Screw mounting</td>
<td>2 x M4 with mounting clip</td>
</tr>
<tr>
<td>Documentation number</td>
<td>D00117</td>
</tr>
<tr>
<td>Weight</td>
<td>approx. 150 g</td>
</tr>
</tbody>
</table>

(*) = Factory setting

---

### Dimension diagram (dimensions in mm)

![Dimension diagram](image-url)
**Description**

**A** Monitoring of disconnected DC loads up to 400 V with a low-resistance connection between L+ and L- via the load.

**B** Monitoring of disconnected 3-phase AC loads up to 400 V with a low-resistance connection between L1, L2 and L3 via the load.

**C** Monitoring of disconnected AC loads up to Un with a low-resistance connection between L1, L2, and L3 via the load.

**D** Monitoring of disconnected lines or disconnected loads with high resistance between the active conductors L1 and L2. The inductive load AG70 connects the lines L1 and L2 via an inductance so that both lines can be monitored.

**E** Monitoring of disconnected lines or disconnected loads with high resistance between the active conductors L1, L2 and L3. The inductive star-point coupling device DS2-31 connects lines L1, L2 and L3 via an inductance so that four lines can be monitored.

**Terminal Connection**

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>E, KE</td>
<td>Connect the leads E and KE separately to PE</td>
</tr>
<tr>
<td>A1, A2</td>
<td>Supply voltage Ue (see nameplate) via 6 A fuse</td>
</tr>
<tr>
<td>11, 12, 14</td>
<td>Alarm relay K1</td>
</tr>
<tr>
<td>21, 22, 23</td>
<td>Alarm relay K2 (system fault relay)</td>
</tr>
<tr>
<td>K3</td>
<td>Relay for isolating the ISOMETER®</td>
</tr>
<tr>
<td>AG…</td>
<td>Coupling device for the monitoring of loads up to Ue</td>
</tr>
<tr>
<td>AG70</td>
<td>For the monitoring of loads with an undefined internal resistance or an open single conductor in cables</td>
</tr>
<tr>
<td>DS2-31</td>
<td>For combined external test/reset button</td>
</tr>
<tr>
<td>L1, AK</td>
<td>Connection to the system being monitored</td>
</tr>
</tbody>
</table>
Insulation monitoring device ISOMETER® IR423
Insulation monitoring device for mobile generators

Device features
- Insulation monitoring for mobile generators AC 0…300 V
- Protection by electrical separation with insulation monitoring and disconnection
- Version “W” for protection against high mechanical stress
- Two separately adjustable response values
- Connection monitoring system/earth
- Power On LED, alarm LEDs: Alarm 1, Alarm 2
- Internal/external test/reset button
- Two separate alarm relays (one changeover contact each)
- N/O or N/C operation, selectable
- Fault memory behaviour, selectable
- Self monitoring with automatic alarm
- Multi-functional LC display
- Adjustable response delay
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)

Standards
The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- EN 61557-8
- IEC 61557-8
- IEC 61326-2-4
- DIN EN 60664-1 (VDE 0110-1)
- DIN EN 60664-3 (VDE 0110-3)
- ASTM F1669M-96
- ASTM F1207M-96

Further information
For further information refer to our product range on www.bender.de.

Typical applications
- IEC 60364-7-717, DIN VDE 0100-717 (2005) Electrical installations in mobile or transportable units
- DIN VDE 0100-551 (VDE 0100-551), IEC 60364-5-551 Low-voltage generating sets (mobile generators)
- GW 308 “Mobile Stromerzeuger für Rohrleitungsbaustellen 8/00” (Mobile auxiliary power generators on pipeline site) (DVGW)
- BGI 867 (German Berufsgenossenschaft Information) Auswahl und Betrieb von Ersatzstromerzeugern auf Bau- und Montagestellen (Selecting and operating standby generators on construction and installation sites)

Approvals

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

<table>
<thead>
<tr>
<th>Rated insulation voltage</th>
<th>250 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated impulse voltage/pollution degree</td>
<td>4 kV/3</td>
</tr>
<tr>
<td>Protective separation (reinforced insulation) between</td>
<td>(A1, A2)-(L1, L2, E, KE, T/R)- (11, 12, 14)- (21, 22, 24)</td>
</tr>
<tr>
<td>Voltage test acc. to IEC 61010-1</td>
<td>2.21 kV</td>
</tr>
</tbody>
</table>

Supply voltage

<table>
<thead>
<tr>
<th>Supply voltage U_s</th>
<th>see ordering information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency range U_s</td>
<td>30…460 Hz</td>
</tr>
<tr>
<td>Power consumption</td>
<td>≤ 4 VA</td>
</tr>
</tbody>
</table>

IT system being monitored

<table>
<thead>
<tr>
<th>Nominal system voltage U_n</th>
<th>AC 0…300 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal frequency f_n</td>
<td>30…460 Hz</td>
</tr>
</tbody>
</table>

Response values

<table>
<thead>
<tr>
<th>Response value R_an1 (Alarm 1)</th>
<th>1…200 kΩ (46 kΩ)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response value R_an2 (Alarm 2)</td>
<td>1…200 kΩ (23 kΩ)*</td>
</tr>
<tr>
<td>Relative uncertainty (1…5 kΩ)</td>
<td>±10 %</td>
</tr>
<tr>
<td>Relative uncertainty (5…100 kΩ)</td>
<td>±15 %</td>
</tr>
<tr>
<td>Hysteresis (1…5 kΩ)</td>
<td>+1 kΩ</td>
</tr>
<tr>
<td>Hysteresis (5…100 kΩ)</td>
<td>+25 %</td>
</tr>
</tbody>
</table>

Time response

| Time response t_an2 at R_F = 0.5 x R_an and C_e = 1 µF | ≤ 1 s |
| Start-up delay (start time) t | 0…10 s (0 s)* |
| Response delay t_on | 0…99 s (0 s)* |

Measuring circuit

| Measuring voltage U_m | ±12 V |
| Measuring current I_m (at R_F = 0 Ω) | ≤ 200 µA |
| Internal DC resistance R_i | ≥ 62 kΩ |
| Impedance Z_i at 50 Hz | ≥ 60 kΩ |
| Permissible extraneous DC voltage U_fg | ≤ DC 300 V |
| Permissible system leakage capacitance | ≤ 5 µF |

Displays, Memory

| Display | LC display, multi-functional, non-illuminated |
| Display range, measured value | 1 kΩ…1 MΩ |
| Operating uncertainty (1…5 kΩ) | ±0.5 kΩ |
| Operating uncertainty (5 kΩ…1 MΩ) | ±15 % |
| Password | off/0…999 (off)* |
| Fault memory (alarm relay) | on/off |

Outputs

| Cable length test and reset button | ≤ 10 m |

Switching elements

| Number of switching elements | 2 x 1 changeover contact |
| Operating principle | NC or N/O operation (N/O operation)* |
| Electrical endurance, number of cycles | 10,000 |

Contact data acc. to IEC 60947-5-1

<table>
<thead>
<tr>
<th>Utilisation category</th>
<th>AC-13 AC-14 DC-12 DC-12 DC-12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated operational voltage</td>
<td>230 V 230 V 220 V 110 V 24 V</td>
</tr>
<tr>
<td>Rated operational current</td>
<td>5 A 3 A 0.1 A 0.2 A 1 A</td>
</tr>
<tr>
<td>Contact rating</td>
<td>1 mA at AC/DC ≥ 10 V</td>
</tr>
</tbody>
</table>

Environment/EMC

| EMC | acc. to IEC 61326 |
| Operating temperature | -25…+55 °C |

Classification of climatic conditions acc. to IEC 60721

| Stationary use (IEC 60721-3-3) | 3K23 (except condensation and formation of ice) |
| Transport (IEC 60721-3-2) | 2K11 (except condensation and formation of ice) |
| Long-time storage (IEC 60721-3-1) | 1K22 (except condensation and formation of ice) |

Classification of mechanical conditions IEC 60721

| Stationary use (IEC 60721-3-3) | 3M11 |
| Transport (IEC 60721-3-2) | 2M4 |
| Long-time storage (IEC 60721-3-1) | 1M12 |

Connection

<table>
<thead>
<tr>
<th>Connection screw terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection properties</td>
</tr>
<tr>
<td>Two conductors with the same cross section</td>
</tr>
<tr>
<td>Stripping length</td>
</tr>
<tr>
<td>Tightening torque, terminal screws</td>
</tr>
</tbody>
</table>

Connection push-wire terminals

<table>
<thead>
<tr>
<th>Connection screw terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection properties</td>
</tr>
<tr>
<td>Two conductors with the same cross section</td>
</tr>
<tr>
<td>Stripping length</td>
</tr>
<tr>
<td>Opening force</td>
</tr>
<tr>
<td>Test opening, diameter</td>
</tr>
</tbody>
</table>

Other

| Operating mode | continuous operation |
| Mounting | any position |
| Degree of protection, internal components (DIN EN 60529) | IP30 |
| Degree of protection, terminals (DIN EN 60529) | IP20 |
| Enclosure material | polycarbonate |
| Flammability class | UL94 V-0 |
| DIN rail mounting acc. to IEC 60715 | 2 x M4 with mounting clip |
| Documentation number | D00038 |
| Weight | ≤ 150 g |

Option "W"

| Ambient temperature | -40…+70 °C |

Classification of climatic conditions acc. to IEC 60721:

| Stationary use (IEC 60721-3-3) | 3K23 (with condensation and formation of ice) |
| Classification of mechanical conditions acc. to IEC 60721:
| Stationary use (IEC 60721-3-3) | 3M12 |

Vibration resistance

| For DIN rail mounting | acc. to IEC 60668-2-6 |
| For DIN rail mounting | 3 g/30…150 Hz |
| For screw mounting | 6 g/30…150 Hz |

( )* = factory setting
Wiring diagram

Protective measure for mobile generators: “Protection by electrical separation with insulation monitoring and disconnection”

Setting K1/K2 for **overvoltage release**: N/O operation (n.o.); fault memory setting: OFF

Setting K1/K2 for **contactor**: N/C operation (n.c.); fault memory setting: ON

1. E, KE - Connect the leads E and KE separately to PE.
2. A1, A2 - Supply voltage $U_s$ (see nameplate) via 6 A fuse
3. 11, 12, 14 - Alarm relay K1
4. 21, 22, 24 - Alarm relay K2 (system fault relay)
5. T/R für kombinierte, externe Test/Reset-Taste
6. L1, L2 - $U_n \leq 230V$: Terminals L1/L2 to L1/L2 of the generator
   - $U_n \leq 3AC 400V$: Terminals L1/L2 to N of the generator
ISOMETER® IR123P
Insulation monitoring device for mobile generators

Device features
- Insulation monitoring for unearthed DC systems (IT systems) 100…300 V
- Automatic adaptation to the existing system leakage capacitance
- Optimised measurement technique for low-frequency control processes
- Electrically isolated PWM output for the kΩ measuring value
- Optocoupler output for signalling the device status
- Automatic device self test
- Certonal coating
- Permanently set response value for the insulation resistance 23/46 kΩ
- Second response range 40/80 kΩ selectable via a jumper

Typical applications
- Monitoring of unearthed AC systems (IT systems) in mobile generators

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Connection</th>
<th>Nominal system voltage $U_n$</th>
<th>Supply voltage $U_s$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connectors</td>
<td>100…300 V, 22…460 Hz</td>
<td>$U_s = U_n$</td>
<td>IR123P-4-2</td>
<td>891016300</td>
</tr>
</tbody>
</table>

1) Absolute values
#### Technical data

**Insulation coordination acc. to IEC 60664-1**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage</td>
<td>250 V</td>
</tr>
<tr>
<td>Rated impulse voltage/pollution degree</td>
<td>2.5 kV/3</td>
</tr>
<tr>
<td>Protective separation (reinforced insulation) between:</td>
<td>(A1/L1, A2/L2, E, KE, T/R, T, R, M+, M-/OK, OK+) -(11-12-14) -(21-22-24)</td>
</tr>
<tr>
<td>Voltage test acc. to IEC 60360-1</td>
<td>2.23 kV</td>
</tr>
</tbody>
</table>

**Supply voltage**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage $U_s$</td>
<td>$U_n$</td>
</tr>
<tr>
<td>Power consumption</td>
<td>$\leq 3$ VA</td>
</tr>
</tbody>
</table>

**IT system being monitored**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal system voltage $U_n$</td>
<td>AC 100…300 V</td>
</tr>
<tr>
<td>Nominal frequency $f_n$</td>
<td>22…460 Hz</td>
</tr>
</tbody>
</table>

**Response values**

- Response value $R_{402}$ (Alarm 2): (46 kΩ)*
- Response value $R_{401}$ (Alarm 1): (23 kΩ)*
- Second response range, adjustable via jumper JP1: 80/40 kΩ
- Relative percentage error: $\pm 15 %$
- Hysteresis: $+25 %$

**Time response**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response time $t_{Ry}$ at $R_F = 0.5 \times R_{404}$ and $C_r = 1 \mu F$</td>
<td>$\leq 1 s$</td>
</tr>
</tbody>
</table>
**Wiring diagrams**

**Application example with overvoltage release or contactor**

**Setting K1/K2 for overvoltage release:** N/O operation

**Setting K1/K2 for contactor:** N/C operation
ISOMETER® isoGEN423

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems) up to 3(N)AC, AC 400 V, DC 400 V, suitable for the application of generators acc. to standard DIN VDE 0100-551

Device features

• Monitoring the insulation resistance for unearthed AC/DC systems
• Measurement of the system voltage (true r.m.s.) with undervoltage and overvoltage detection
• Measurement of DC system voltages to earth (L1+/PE and L2-/PE)
• Two operating modes: GEn and DC
• Automatic adaptation to the system leakage capacitance up to 5 μF
• Selectable start-up delay, response delay and delay on release
• Two separately adjustable response value ranges of 5…200 kΩ (Alarm 1, Alarm 2)
• Alarm signalling via LEDs (AL1, AL2), a display and alarm relays (K1, K2)
• Automatic device self test with connection monitoring
• Selectable N/C or N/O relay operation
• Measured value indication via multifunctional LCD
• Fault memory can be activated
• RS-485 (galvanically isolated) including the following protocols:
  – BMS interface (Bender measuring device interface) for data exchange with other Bender components
  – Modbus RTU
  – IsoData (for continuous data output)
• Password protection to prevent unauthorised parameter changes

Standards

The ISOMETER® has been developed in compliance with the following standards:
• DIN EN 61557-8 (VDE 0413-8)
• IEC 61557-8

Typical applications

• AC main circuits up to 400 V
• DC main circuits up to 400 V
• Generators according to DIN VDE 0100-551

Approvals

Further information

For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Version</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Push-wire terminal</td>
<td>isoGEN423-D4-4</td>
<td>B71036325</td>
</tr>
<tr>
<td></td>
<td>isoGEN423-D4W-4</td>
<td>B71036325W</td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:
- Measuring circuit (IC1)
- Supply circuit (IC2)
- Output circuit (IC3)
- Control circuit (IC4)
- Rated voltage
- Overvoltage category
- Rated impulse voltage
- Rated insulation voltage
- Supply voltage
- Measuring voltage
- Permissible extraneous DC voltage
- Frequency range
- Permissible system leakage capacitance
- Measuring current
- Internal resistance
- Operating uncertainty
- Response value
- Response delay
- Hysteresis
- Relative uncertainty
- Overvoltage detection
- Nominal system voltage
- Display range measured value nominal system voltage
- Response delay
- Time response
- Switching elements
- Environment/EMC
- Climatic class acc. to IEC 60721:
- Classification of mechanical conditions acc. to IEC 60721:
- Connection
- Other

Interface
- Interface/protocol
- Baud rate
- Cable length
- Cable: twisted pairs, shield connected to PE on one side
- Terminating resistor
- Device address
- Switching elements
- Switching elements
- Operating principle
- Electrical endurance, number of cycles
- Contact data acc. to IEC 60947-5-1:
- Utilisation category
- Rated operational voltage
- Rated operational current
- Minimum contact rating
- Ambient temperatures:
- Climatic class acc. to IEC 60721:

Technical data

Supply voltage
- Supply voltage U
- Tolerance of U
- Frequency range
- Power consumption

IT system being monitored
- Rated insulation voltage
- Overvoltage category
- Voltage test (routine test) according to IEC 61010-1:
- Protective separation (reinforced insulation)

Measuring circuit
- Measuring voltage U
- Measuring current I
- Internal resistance R
- Permissible leakage capacitance C
- Permissible extraneous DC voltage U

Response values
- Response value R
- Relative uncertainty
- Hysteresis
- Overvoltage detection
- Relative uncertainty
- Hysteresis

Time response
- Response time
- Start-up delay
- Response delay
- Delay on release

Displays, memory
- Display
- Display range measured value insulation resistance R
- Operating uncertainty
- Display range measured value nominal system voltage U
- Operating uncertainty
- Display range measured value system leakage capacitance C
- Operating uncertainty of RF
- Password
- Fault memory alarm messages

Hysteresis
- Response value
- Absolute uncertainty depending on the frequency

Interface/protocol
- Baud rate
- Cable: twisted pairs, shield connected to PE on one side
- Terminating resistor
- Device address
- Switching elements
- Switching elements
- Operating principle
- Electrical endurance, number of cycles
- Contact data acc. to IEC 60947-5-1:
- Utilisation category
- Rated operational voltage
- Rated operational current
- Minimum contact rating
- Ambient temperatures:
- Climatic class acc. to IEC 60721:
- Classification of mechanical conditions acc. to IEC 60721:

Connection
- Connection type
- Push-wire terminal

Other
- Operating mode
- Mounting
- Degree of protection, built-in components
- Degree of protection, terminals
- Enclosure material
- DIN rail mounting
- Screw fixing
- Document number
- Weight

<table>
<thead>
<tr>
<th>Measuring circuit (IC1)</th>
<th>L1/+, L2/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply circuit (IC2)</td>
<td>A1, A2</td>
</tr>
<tr>
<td>Output circuit (IC3)</td>
<td>11, 14, 24</td>
</tr>
<tr>
<td>Control circuit (IC4)</td>
<td>E, K1, R1, A, B</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>400 V</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>III</td>
</tr>
<tr>
<td>Rated impulse voltage:</td>
<td></td>
</tr>
<tr>
<td>(IC1/IC2-4)</td>
<td>6 kV</td>
</tr>
<tr>
<td>(IC2/IC3-4)</td>
<td>4 kV</td>
</tr>
<tr>
<td>(IC3/IC4)</td>
<td>4 kV</td>
</tr>
<tr>
<td>Rated insulation voltage:</td>
<td></td>
</tr>
<tr>
<td>(IC1/IC2-4)</td>
<td>400 V</td>
</tr>
<tr>
<td>(IC2/IC3-4)</td>
<td>250 V</td>
</tr>
<tr>
<td>(IC3/IC4)</td>
<td>250 V</td>
</tr>
<tr>
<td>Pollution degree</td>
<td>3</td>
</tr>
<tr>
<td>Protective separation (reinforced insulation):</td>
<td></td>
</tr>
<tr>
<td>(IC1/IC2-4)</td>
<td>Overvoltage category III, 600 V</td>
</tr>
<tr>
<td>(IC2/IC3-4)</td>
<td>Overvoltage category III, 300 V</td>
</tr>
<tr>
<td>(IC3/IC4)</td>
<td>Overvoltage category III, 100 V</td>
</tr>
<tr>
<td>Voltage test (routine test) according to IEC 61010-1:</td>
<td></td>
</tr>
<tr>
<td>(IC2/IC3-4)</td>
<td>AC 2.2 kV</td>
</tr>
<tr>
<td>(IC3/IC4)</td>
<td>AC 2.2 kV</td>
</tr>
<tr>
<td>Supply voltage</td>
<td></td>
</tr>
<tr>
<td>Supply voltage U</td>
<td>AC 100…240 V/DC 24…240 V</td>
</tr>
<tr>
<td>Tolerance of U</td>
<td>-30…+15 %</td>
</tr>
<tr>
<td>Frequency range U</td>
<td>47…63 Hz</td>
</tr>
<tr>
<td>Power consumption</td>
<td>≤ 3 W, ≤ 9 VA</td>
</tr>
<tr>
<td>Nominal system voltage U₀</td>
<td>0…400 V/DC 0…400 V</td>
</tr>
<tr>
<td>Tolerance of U₀</td>
<td>±25 %</td>
</tr>
<tr>
<td>Frequency range of U₀</td>
<td>DC, 35…460 Hz</td>
</tr>
<tr>
<td>Measuring circuit</td>
<td></td>
</tr>
<tr>
<td>Measuring voltage U₀</td>
<td>±12 V</td>
</tr>
<tr>
<td>Measuring current I₀</td>
<td>≤ 110 μA</td>
</tr>
<tr>
<td>Internal resistance Z₀</td>
<td>≥ 115 kΩ</td>
</tr>
<tr>
<td>Permissible leakage capacitance C₀</td>
<td>≤ 5 μF</td>
</tr>
<tr>
<td>Permissible extraneous DC voltage U₀</td>
<td>≤ 700 V</td>
</tr>
<tr>
<td>Response value R₀1</td>
<td>R₉12…200 kΩ (46 kΩ)*</td>
</tr>
<tr>
<td>Response value R₀2</td>
<td>5 kΩ…R₉11 (23 kΩ)*</td>
</tr>
<tr>
<td>Relative uncertainty R₀</td>
<td>±15 %, at least ±2 kΩ</td>
</tr>
<tr>
<td>Hysteresis R₉0</td>
<td>25 %, at least 1 kΩ</td>
</tr>
<tr>
<td>Undervoltage detection U&lt;</td>
<td>10 V…0 V (off/10 V)*</td>
</tr>
<tr>
<td>Overvoltage detection U&gt;</td>
<td>U&lt;…500 V (off/500 V)*</td>
</tr>
<tr>
<td>Relative uncertainty U</td>
<td>±5 %, at least ±5 V</td>
</tr>
<tr>
<td>Hysteresis U</td>
<td>5 %, at least 5 V</td>
</tr>
<tr>
<td>Time response</td>
<td></td>
</tr>
<tr>
<td>Response time t₀ of R₀</td>
<td>0.5 x R₀ and C₀=1 μF according to IEC 61557-8</td>
</tr>
<tr>
<td>Start-up delay t</td>
<td>0…10 s (0 s)*</td>
</tr>
<tr>
<td>Response delay t₀</td>
<td>0…99 s (0 s)*</td>
</tr>
<tr>
<td>Delay on release t₀</td>
<td>0…99 s (0 s)*</td>
</tr>
<tr>
<td>Display</td>
<td>LC display, multi-functional, not illuminated</td>
</tr>
<tr>
<td>Display range measured value insulation resistance (R₀)</td>
<td>1 kΩ, 2, 5 MΩ</td>
</tr>
<tr>
<td>Operating uncertainty</td>
<td>±15 %, at least ±2 kΩ</td>
</tr>
<tr>
<td>Display range measured value nominal system voltage (U₀)</td>
<td>0…500 V/MS</td>
</tr>
<tr>
<td>Operating uncertainty</td>
<td>±5 %, at least ±5 V</td>
</tr>
<tr>
<td>Display range measured value system leakage capacitance (C₀)</td>
<td>only “dc” mode</td>
</tr>
<tr>
<td>Operating uncertainty of RF</td>
<td>≥ 20 kΩ and C₀ ≤ 5 μF</td>
</tr>
<tr>
<td>Password</td>
<td>off/0…999 (0, off)*</td>
</tr>
<tr>
<td>Fault memory alarm messages</td>
<td>on (off)*</td>
</tr>
</tbody>
</table>

( )* = factory setting
1 A1, A2 Connection to the supply voltage via fuse (line protection).
   If supplied from an IT system, both lines have to be protected by a fuse.*
2 E, KE Connect each terminal separately to PE:
   The same wire cross section as for A1, A2 is to be used.
3 L1/+, L2/- Connection to the IT system to be monitored
4 T/R Connection for the external combined test and reset button.
5 11, 14 Connection to alarm relay K1
6 11, 24 Connection to alarm relay K2
7 A, B RS-485 communication interface with connectable terminating resistance.

* For UL applications:
   Only use 60/75°C copper lines!
   For UL and CSA applications, it is mandatory to use 5 A fuses for the protection of the supply voltage.
**ISOMETER® isoRW425**

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems) for railway applications up to 3(N)AC, AC/DC 440 V

### Device features
- Monitoring of the insulation resistance (R mode) or the insulation impedance (Z mode) of unearthed 3(N)AC, AC and DC systems (IT systems) with galvanically connected rectifiers or inverters
- Insulation impedance (Z mode) for 50 Hz or 60 Hz
- Measurement of the nominal system voltage (RMS) with undervoltage and overvoltage detection
- Measurement of DC voltages system to earth (L+/PE and L-/PE)
- Automatic adaptation to the system leakage capacitance up to 300 μF in R mode and 1 μF in Z mode
- Automatic device self test with connection monitoring
- Selectable start-up delay, response delay and delay on release
- Two separately adjustable response ranges of 1...990 kΩ (Alarm 1, Alarm 2)
- Alarm signalling via LEDs (AL1, AL2), a display and alarm relays (K1, K2)
- N/C operation or N/O operation selectable
- Measured value indication via multi-functional LCD
- Fault memory can be activated
- RS-485 (galvanically isolated) interface including the following protocols:
  - BMS interface (Bender measuring device interface) for data exchange with other Bender components
  - Modbus RTU
  - isoData (for continuous data output)
- Password protection to prevent unauthorised changes of parameters

### Typical applications
- AC control circuits in rolling stock according to EN 50155
- AC, DC or AC/DC circuits
- Systems including switched-mode power supplies
- Small AC-IT systems e.g. lighting systems

### Approvals

The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- DIN EN 50155
- IEC 61557-8
- DIN EN 45545-2

### Standards

For further information refer to our product range on www.bender.de.

### Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage Un</th>
<th>Supply voltage Us</th>
<th>System leakage capacitance Ce</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3(N)AC, AC/DC</td>
<td>AC</td>
<td>DC</td>
<td>&lt; 300 μF</td>
<td>isoRW425-D4W-4</td>
</tr>
<tr>
<td>0...440 V, 15...460 Hz</td>
<td>100...240 V, 47...63 Hz</td>
<td>24...240 V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
Insulation monitoring device ISOMETER® isoRW425

**Technical data**

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**

Definitions:
- Measuring circuit (IC1)
- Supply circuit (IC2)
- Output circuit (IC3)
- Control circuit (IC4)

**Rated voltage**

- 440 V

**Overvoltage category**

- III

**Rated impulse voltage:***

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

**Rated insulated voltage:**

- IC1/(IC2-4): 500 V
- IC2/(IC3-4): 250 V
- IC3/(IC4): 250 V

**Solution degree**

- 3

**Hysteresis**

- Response value $R_{an}$: $\pm 25\%$, at least $1 \Omega$
- Relative uncertainty $R_{an}$ (R mode or Z mode) $\pm 15\%$, at least $1 \Omega$
- Hysteresis $R$: $25\%$, at least $1 \Omega$
- Response value $Z_{an}$: $11…500 \Omega$ (off)*
- Overvoltage category III, $600 \Omega$
- Relative uncertainty $Z_{an}$: $\pm 15\%$, at least $1 \Omega$
- Hysteresis $Z_{an}$: $25\%$, at least $1 \Omega$
- Undervoltage detection: $10…499 \Omega$ (off)*
- Overvoltage detection: $11…500 \Omega$ (off)*
- Relative uncertainty $U$: $\pm 5\%$, at least $5\Omega$
- Relative uncertainty depending on the frequency $\geq 400 \text{Hz}$: $-0.015\%$/Hz
- Hysteresis $U$: $5\%$, at least $5 \Omega$

**Time response**

- Response time $t$ of $R_{an}$: 0.5 s $\times$ $R_{an}$ and $C_{w}=1 \mu F$ according to IEC 61557-8 $\leq 10 \text{s}$
- Response time $t$ of $Z_{an}$: 0.5 s $\times$ $Z_{an}$ $\leq 5 \text{s}$
- Start-up delay $t_{0}$: $0…10 \text{s} (0 \mu F)$
- Response delay $t_{0}$: $0…99 \text{s} (0 \mu F)$
- Delay on release $t_{off}$: $0…99 \text{s} (0 \mu F)$

**Displays, memory**

- LC display, multi-functional, not illuminated
- Display range measured value of insulation resistance ($R_{an}$) 1 kΩ…4 MΩ
- Display range measured value of impedance ($Z_{an}$) with $L_{s}=50/60 \text{Hz}$ 1 kΩ…1 MΩ
- Operating uncertainty $R_{an}$ in R mode, $Z_{an}$ in Z mode $\pm 15\%$, at least $1 \Omega$
- Display range measured value nominal system voltage ($U$) 0…500 V r.m.s.
- Operating uncertainty $\pm 5\%$, at least $5 \Omega$
- Display range measured value system leakage capacitance of $R_{an}$ $> 10 \text{kΩ}$ 0…300 μF
- Operating uncertainty $\pm 15\%$, at least $2 \mu F$
- Display range measured value system leakage capacitance of $Z_{an}$ $> 10 \text{kΩ}$ 1 μF…1 μF
- Operating uncertainty $Z_{an}$ $= X_{an}$ $\pm 15\%$, at least $2 \mu F$
- Password: off/0…999 (off)*
- Fault memory alarm messages: on/(off)*

**Interface**

- Interface/protocol: RS-485/BMS, Modbus RTU, isoData
- Baud rate: BMS (9.6 kbit/s), Modbus RTU (selectable), isoData (115.2 kbit/s)
- Cable length: 9.6 kbit/s: $\leq 1200 \text{m}$
- Cable: twisted pair, shielded connecting PE on one side
- Minimum J-Y5/UY 2x0.6
- Termination resistor: $120 \Omega$ (0.25 W), internal, can be connected
- Device address, BMS bus, Modbus RTU: 3…90 (3)*

**Switching elements**

- Switching elements: 2 x 1 NO contacts, common terminal 11
- Operating principle: N/C operation/N/O operation (N/O operation)*
- Electrical endurance, number of cycles: 10000

**Contact data acc. to IEC 60947-5-1**

- Utilization category: AC-12, AC-14, DC-12, DC-12, DC-12
- Rated operational voltage: 230 V, 230 V, 24 V, 110 V
- Rated operational current: 5 A, 2 A, 1 A, 0.2 A, 0.1 A
- Minimum contact rating: 1 mA at AC/DC $\geq 10 \text{V}$

**Environment/EMC**

- EMC: IEC 61326-2-4, DIN EN50121-3-2
- Ambient temperatures:
  - Operation: -40…+70 °C
  - Transport: -50…+85 °C
  - Storage: -55…+80 °C

**Climatic class acc. to IEC 60721**

- Stationary use (IEC 60721-3-3): 3K24
- Transport (IEC 60721-3-2): 2K11
- Long-term storage (IEC 60721-3-1): 1K23

**Classification of mechanical conditions acc. to IEC 60721**

- Stationary use (IEC 60721-3-3): 3M12
- Transport (IEC 60721-3-2): 2M4
- Long-term storage (IEC 60721-3-1): 1M12

**Connection**

- Connection type: screw-type terminal or push-wire terminal

**Screw-type terminal:**

- Nominal current: $\leq 10 \text{A}$
- Tightening Torque: 0.5…0.6 Nm (5…7 lb-in)
- Conductor sizes: AWG 24-12
- Stripping length: 8 mm
- Rigid/flexible: 0.2…2.5 mm²
- Flexible with ferrules with/without plastic sleeve: 0.25…2.5 mm²
- Multi-conductor rigid: 0.2…1.5 mm²
- Multi-conductor flexible: 0.2…1.5 mm²
- Multi-conductor flexible with ferrules without plastic sleeve: 0.25…1.5 mm²
- Multi-conductor flexible with TWIN ferrules with plastic sleeve: 0.25…1.5 mm²

**Push-wire terminal:**

- Nominal current: $\leq 10 \text{A}$
- Conductor sizes: AWG 24-14
- Stripping length: 10 mm
- Rigid: 0.2…2.5 mm²
- Flexible without ferrules: 0.75…2.5 mm²
- Flexible with ferrules with/without plastic sleeve: 0.25…2.5 mm²
- Multi-conductor flexible with TWIN ferrules with plastic sleeve: 0.5…1.5 mm²
- Opening force: 50 N
- Test opening, diameter: 2.1 mm

**Other**

- Operating mode: continuous operation
- Cooling: cooling slots must be ventilated vertically
- Degree of protection, built-in components (DIN EN 60529): IP30
- Degree of protection, terminals (DIN EN 60529): IP20
- Enclosure material: polycarbonate
- DIN rail mounting acc. to IEC 60715
- Screw fixing: 2 x M4 with mounting clip
- Flammability class: UL94 V-0
- Documentation number: DD0052
- Weight: $\leq 150 \text{g}$

*(*) = factory setting
1 A1, A2 Connection to the supply voltage via fuse (line protection). If supplied from an IT system, both lines have to be protected by a fuse. *

2 E, KE Connect each terminal separately to PE: The same wire cross section as for A1, A2 is to be used.

3 L1/+, L2/– Connection to the 3(N)AC, AC or DC system to be monitored

4 T/R Connection for the external combined test and reset button.

5 11, 14 Connection to alarm relay K1

6 11, 24 Connection to alarm relay K2

7 A, B RS-485 communication interface with connectable terminating resistance.

* For UL applications: Only use 60/75°C copper lines! For UL and CSA applications, it is mandatory to use 5 A fuses for the protection of the supply voltage.
ISOMETER® isoUG425
Insulation monitoring device for unearthed DC systems (IT systems) up to 120 V

Device features
- Monitoring of asymmetrical insulation resistances for unearthed DC systems
- Measurement of the system voltage (r.m.s. and DC) with undervoltage and overvoltage detection
- Measurement of the system DC voltages to earth (L+/PE and L-/PE)
- Configurable adaptation to the system leakage capacitance up to 5 μF
- Selectable start-up delay, response delay and delay on release
- Two separately adjustable response value ranges of 1…100 kΩ (Alarm 1, Alarm 2)
- Alarm signalling via LEDs (AL1, AL2), a display and alarm relays (K1, K2)
- N/C operation or N/O operation of the relays selectable
- Measured value indication via multi-functional LCD
- Fault memory can be activated
- RS-485 (galvanically isolated) including the following protocols:
  - BMS interface (Bender measuring device interface) for data exchange with other Bender components
  - Modbus RTU
  - IsoData (for continuous data output)
- Password protection to prevent unauthorised parameter changes

Standards
The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 50155

Accessories
- Mounting clip for screw mounting (1 piece per device)

Further information
For further information refer to our product range on www.bender.de.

Typical applications
- Simple battery systems
- Conveniently sized DC control voltage systems
- DC lamp circuits

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage $U_s$</th>
<th>Nominal voltage $U_n$</th>
<th>System leakage capacitance</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 100…240 V, 47…63 Hz</td>
<td>DC 24…240 V</td>
<td>DC 12…120 V</td>
<td>≤ 50 μF</td>
<td>isoUG425-D4-4</td>
</tr>
</tbody>
</table>

BENDER 01/2021
**Technical data**

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**

Definitions:
- Measuring circuit (IC1) L1/+ , L2/-
- Supply circuit (IC2) A1, A2
- Output circuit (IC3) 11, 14, 24
- Control circuit (IE4) E, KE, R, U, A, B

**Rated voltage**

- Overvoltage category III
- Rated impulse voltage: 400 V
- Rated insulated voltage: 400 V
- Rated operational voltage: 230 V
- Rated operational current: 5 A
- Minimum contact rating: 1 mA at AC/DC ≥ 10 V

**Display range measured value insulation resistance (R)**

- DC 12…120 V
- Resistance uncertainty ±5 %, at least ±0.5 V
- Hysteresis ±5 %, at least ±0.5 V

**Time response**

- Response time t32 at R50 = 0.5 x R50 and C7 = 1 μF acc. to IEC 61557-8 ≤ 1 s
- Start-up delay t ≥ 0…10 s (0 s)*
- Delay on release t50 ≥ 0…59 s (0 s)*

**Display range measured value nominal system voltage (Un)**

- 0…150 V (Un = 100 V: 0 kΩ : 150 V)
- Operating uncertainty ±5 %, at least ±0.5 V
- Password off/0…999 (0, off)*
- Fault memory alarm messages on/off)*

**Interface**

- Interface/protocol RS-485/BMS, Modbus RTU, isoData
- Baud rate BMS (9.6 kbit/s), Modbus RTU (selectable), isoData (115.2 kbit/s)
- Cable length (9.6 kbit/s) ≤ 1200 m
- Cable: twisted pairs, shield connected to PE on one side
- Min. 3- Wires 2x0.6
- Terminating resistor 120 Ω (0.25 W), internal, can be connected
- Device address, BMS bus, Modbus RTU 3… 90 (3)*

**Switching elements**

- Switching elements 2 x 1 N/O contacts, common terminal T1
- Operating principle N/C operation/N/O operation (N/O operation)*
- Electrical endurance, number of cycles 10,000

**Contact data acc. to IEC 60947-5-1:**

- Utilisation category AC-12 AC-14 DC-12 DC-12 DC-12
- Rated operational voltage 230 V 230 V 24 V 110 V 220 V
- Rated operational current 5 A 2 A 1 A 0.2 A 0.1 A
- Minimum contact rating 1 mA at AC/DC ≥ 10 V

**Environment/EMC**

- EMC IEC 61326-2-4
- Ambient temperatures:
  - Operation -40… +70 °C
  - Transport -40… +85 °C
  - Storage -40… +70 °C

**Classification of climatic conditions acc. to IEC 60721**

- Stationary use (IEC 60721-3-3) 3K24 (except condensation and formation of ice)
- Transport (IEC 60721-3-3) 2K11 (except condensation and formation of ice)
- Long-term storage (IEC 60721-3-1) 1K22 (except condensation and formation of ice)

**Classification of mechanical conditions acc. to IEC 60721**

- Stationary use (IEC 60721-3-3) 3M11
- Transport (IEC 60721-3-3) 2M4
- Long-term storage (IEC 60721-3-1) 1M12

**Other**

- Operation mode continuous operation
- Degree of protection, built-in components (DIN EN 60529) IP40
- Degree of protection, terminals (DIN EN 60529) IP20
- Enclosure material polycarbonate
- DIN rail mounting acc. to IEC 60715
- Screw fixing 2 x M4 with mounting clip
- Documentation number D00220
- Weight ≤ 150 g

(*) = Factory setting
1 A1, A2 Connection to the supply voltage via fuse (line protection). If being supplied from an IT system, both lines have to be protected by a fuse.*
2 E, KE Connect each terminal separately to PE. The same wire cross section as for A1, A2 is to be used.
3 L1/+, L2/- Connection to the DC system to be monitored.
4 T/R Connection for the external combined test and reset button.
5 11, 14 Connection to alarm relay K1.
6 11, 24 Connection to alarm relay K2.
7 A, B RS-485 communication interface with connectable terminating resistor. Example: Connection of a BMS Ethernet gateway COM465IP.

* For UL applications:
Only use 60/75°C copper lines! For UL and CSA applications, it is mandatory to use 5 A fuses for the protection of the supply voltage.

The supply voltage \( U_s \) applied to A1/A2 can be provided by the system voltage \( L_+/L_- \) when the system voltage is 24V DC. Otherwise a separate power supply is needed.
ISOMETER® isoES425
Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems)
for energy storage devices up to AC/DC 400 V

Device features

- Insulation monitoring for unearthed systems AC/DC
- Measurement of the mains voltage (r.m.s.) with undervoltage and overvoltage detection
- Measurement of DC voltages system to earth (L1+/PE und L2-/PE)
- Automatic adaptation to the system leakage capacitance up to 100 µF
- Selectable start-up delay, response delay and delay on release
- Two separately adjustable response value ranges of 1…990 kΩ (Alarm 1, Alarm 2)
- Alarm signalling via LEDs (AL1, AL2), a display and alarm relays (K1, K2)
- Automatic device self test with connection monitoring
- N/C operation or N/O operation of the relays selectable
- Measured value indication via multifunctional LCD
- Fault memory can be activated
- RS-485 (galvanically isolated) including the following protocols:
  - BMS interface (Bender measuring device interface) for data exchange with other Bender components
  - IsoData (for continuous data output)
- Password protection to prevent unauthorised parameter changes

Standards
The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8

Further information
For further information refer to our product range on www.bender.de.

Typical applications
- Monitoring the earth connection during network operation and
  monitoring the electrical installation during isolated operation.

Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage $U_n$</th>
<th>Supply voltage $U_s$</th>
<th>System leakage capacitance $C_e$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC</td>
<td>AC</td>
<td>DC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0…400 V, 15…460 Hz</td>
<td>100…240 V, 47…63 Hz</td>
<td>24…240 V</td>
<td>&lt; 100 µF</td>
<td>isoES425-D4-4</td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:
- Measuring circuit (IC1)
- Supply circuit (IC2)
- Output circuit (IC3)
- Control circuit (IC4)

Rated voltage: 400 V

Overvoltage category: III

Rated impulse withstand voltage:
- IC1/(IC2-4): 6 kV
- IC2/(IC3-4): 4 kV
- IC3/(IC4): 4 kV

Rated insulation voltage:
- IC1/(IC2-4): 400 V
- IC2/(IC3-4): 250 V
- IC3/(IC4): 250 V

Pollution degree: 3

Protective separation (reinforced insulation) between:
- IC1/(IC2-4): Overvoltage category III, 600 V
- IC2/(IC3-4): Overvoltage category III, 300 V
- IC3/(IC4): Overvoltage category III, 300 V

Voltage tests (routine test) acc. to IEC 61010-1:
- IC2/(IC3-4): DC 2.2 kV
- IC3/(IC4): AC 2.2 kV

Supply voltage:
- Supply voltage $U_{in}$: AC 100…240 V/DC 24…240 V
- Tolerance of $U_{in}$: -3%...+15%
- Frequency range $U_{in}$: 47…63 Hz
- Power consumption: ≤ 3 W, ≤ 9 VA

Measuring circuit:
- Measuring voltage $U_{m}$: ± 12 V
- Measuring current $I_{m}$ at $R_i$: ≤ 100 μA
- Internal resistance $R_i$: ≥ 115 kΩ
- Permissible leakage capacitance $C_L$: ≤ 100 μF
- Permissible external DC voltage $U_{OH}$: ≤ 700 V

Response values:
- Response value $R_{OH}$: 2…990 kΩ (69 kΩ)*
- Response value $R_{OH}$: 1…980 kΩ (23 kΩ)*
- Operating uncertainty $R_{an}$: ± 15 %, at least ± 1 kΩ
- Hysteresis $R_{hs}$: 25 %, at least 1 kΩ
- Undervoltage detection $U_{L}$: 10…499 V (off)*
- Overvoltage detection $U_{OH}$: 11…500 V (off)
- Operating uncertainty $U_{an}$: ± 5 %, at least ± 5 V
- Frequency dependent operating uncertainty ≥ 400 Hz: -0.015 %/Hz
- Hysteresis $U_{H}$: 5 %, at least 5 V

Time response:
- Response time $t_{R}$ at $R_i = 0.5 < R_{an}$, and $C_G = 1 \mu F$ acc. to IEC 61557-8: ≤ 10 s
- Start-up delay $t$: 0…10 s (0 s)*
- Response delay $t_{R}$: 0…99 s (0 s)*
- Delay on release $t_{R}$: 0…99 s (0 s)*

Displays, memory:
- Display: LC display, multi-functional, not illuminated
- Display range measured value insulation resistance ($R_i$): 1 kΩ…4 MCΩ
- Operating uncertainty: ± 15 %, at least ± 1 kΩ
- Display range measured nominal system voltage value ($U_{Sn}$): 0…500 V ± 1 mV/s
- Operating uncertainty $U_{Sn}$: ± 5 %, at least ± 5 V
- Display range measured leakage capacitance value for $R_i > 10$ kΩ: 0…105 μF
- Operating uncertainty: ± 15 %, mindestens ± 2 μF
- Password: off/0…999 (0, off)*
- Fault memory alarm message: on/(off)*

Interface:
- Interface/protocol: RS-485/BMS,_isoData

Baud rate: 960 kBit/s, _isoData_ (115.2 kBit/s)
- Cable length: 1200 m
- Cable: twisted pair, shield connected to PE
- Terminating resistor: 120 Ω (0.25 W), internal, can be connected
- Device address, BMS bus: 3…90 (3)*

Switching elements:
-Switching elements: 2 x 1 NO contacts, common terminal 11
- Operating principle: N/C operation/N/O operation (N/C operation)*
- Electrical endurance, number of cycles: 10000

Contact data acc. to IEC 60947-5-1:
- Utilisation category: AC-12 AC-14 DC-12 DC-12 DC-12
- Rated operational voltage: 230 V 230 V 24 V 110 V 220 V
- Rated operational current: 5 A 2 A 1 A 0.2 A 0.1 A
- Minimum contact rating: 1 mA at AC/DC ≥ 10 V

Environment/EMC:
- EMC: IEC 61326-2-4

Ambient temperatures:
- Operation: -25…+70 °C
- Transport: -40…+85 °C
- Storage: -25…+70 °C

Climatic class acc. to IEC 60721:
- Stationary operation (IEC 60721-1-3): 3K23 (without condensation and icing)
- Transport (IEC 60721-1-3): 2K11 (without condensation and icing)
- Long-time storage (IEC 60721-1-3): 1K22 (without condensation and icing)

Classification of mechanical conditions acc. to IEC 60721:
- Stationary operation (IEC 60721-3-1): 3M11
- Transport (IEC 60721-3-3): 2M4
- Long-term storage (IEC 60721-3-1): 1M12

Connection:
- Connection type: Push-wire terminal
- Nominal current: ≤ 10 A
- Conductor sizes: AWG 24-14
- Stripping length: 10 mm
- Rigid: 0.2…2.5 mm²
- Flexible without ferrules: 0.75…2.5 mm²
- Flexible with ferrules, with /without plastic collar: 0.25…2.5 mm²
- Multiple conductor, flexible with TWIN ferrule with plastic sleeve: 0.5…1.5 mm²
- Opening force: 50 N
- Test opening, diameter: 2.1 mm

Other:
- Operating mode: Continuous operation
- Mounting: Cooling slots must be ventilated vertically
- Degree of protection, built-in components (DIN EN 60529): IP 30
- Degree of protection, terminals (DIN EN 60529): IP 20
- Enclosure material: Polycarbonate
- DIN rail mounting acc. to IEC 60715
- Screw fixing: 2 x M4 with mounting clip
- Weight: ≤ 150 g

(*) = Factory setting

01/2021

Insulation monitoring devices | Application-specific selection – Energy storage
Insulation monitoring device ISOMETER® isoES425

BENDER
A1, A2  Connection to the supply voltage via a fuse. If supplied from an IT system, both lines have to be protected by a fuse. *

E, KE  Connect each terminal separately to PE. The same wire cross section as for A1, A2 is to be used.

L1/+, L2/-  Connection to the AC or DC system to be monitored.

T/R  Connection for external combined test and reset button.

11, 14  Connection to alarm relay K1

11, 24  Connection to alarm relay K2

A, B  RS-485 communication interface with selectable terminating resistance.

For UL applications:
Only use 60/75°C copper lines!
For UL and CSA applications, it is mandatory to use 5 A fuses for the protection of the supply voltage.
ISOMETER® isoHV425… with coupling device AGH422

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT system) up to 3(N)AC, AC 1000 V, DC 1000 V

Device features

- Monitoring the insulation resistance for unearthed AC/DC systems
- Measurement of the system voltage (true r.m.s.) with undervoltage and overvoltage detection
- Measurement of DC system voltages to earth (L1+/PE and L2-/PE)
- Automatic adaptation to the system leakage capacitance up to 150 μF
- Selectable start-up delay, response delay and delay on release
- Two separately adjustable response value ranges of 10…500 kΩ (Alarm 1, Alarm 2)
- Alarm signalling via LEDs (AL1, AL2), a display and alarm relays (K1, K2)
- Automatic device self test with connection monitoring
- Selectable N/C or N/O relay operation
- Measured value indication via a multifunctional LC display
- Fault memory can be activated
- Password protection to prevent unauthorised parameter changes

isoHV425-D4-4

- RS-485 (galvanically separated) including the following protocols:
  - BMS interface (Bender measuring device interface) for data exchange with other Bender components
  - Modbus RTU
  - IsoData (for continuous data output)

isoHV425-D4M-4

- 0(4)…20 mA, 0…400 μA, 0…10 V analogue output (galvanically separated)

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- DIN EN 50155
- IEC 61557-8
- DIN EN 45545-2

Further information

For further information refer to our product range on www.bender.de.

Ordering information

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<th>Nominal voltage $U_n$</th>
<th>Version</th>
<th>Type</th>
<th>Art. No.</th>
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<td>AC 100…240 V, 47…63 Hz</td>
<td>0…1000 V</td>
<td>Serial interface</td>
<td>isoHV425-D4-4 with AGH422</td>
<td>B71036501</td>
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<tr>
<td>DC 24…240 V</td>
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<td>isoHV425-D4-4 with AGH422W</td>
<td>B71036501W</td>
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<tr>
<td>AC, 3(N)AC, DC</td>
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<td>Analogue output</td>
<td>isoHV425-D4M-4 with AGH422</td>
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<td>isoHV425W-D4M-4 with AGH422W</td>
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Accessories

<table>
<thead>
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<th>Description</th>
<th>Art. No.</th>
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</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
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</table>
Technical data ISOMETER® isoHV425

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**

**Definitions:**
- Supply circuit (IC2): A1, A2
- Output circuit (IC3): 11, 14, 24
- Control circuit (IC4): Up, KE, T/R, A, B, AK1, GND, AK2, M+, M-
- Rated voltage: 20 V
- Overvoltage category: III
- Rated impulse voltage: (IC2)/(IC3-4): 4 kV
  (IC 3/IC4): 4 kV
- Rated insulation voltage: (IC2)/(IC3-4): 250 V
  (IC 3/IC4): 250 V
- Pollution degree: 3
- Overvoltage protection (reinforced insulation) between: (IC2)/(IC3-4): overvoltage category III, 200 V
  (IC 3/IC4): overvoltage category III, 200 V
- Voltage tests (routine test) acc. to IEC 61010-1:
  (IC2)/(IC3-4): AC 2.2 kV
  (IC 3/IC4): AC 2.2 kV
- Supply voltage:
  - Supply voltage $U_s$: AC 100…240 V/DC 24…240 V
  - Tolerance of $U_s$: -30…+15%
  - Frequency range $U_s$: 47…63 Hz
  - Power consumption: $\leq 3$ W, $\leq 9$ VA
- IT system being monitored:
  - Nominal system voltage $U_s$ with AGH422: AC 0…1000 V/DC 0…1000 V
  - Tolerance of $U_s$: $\pm 10\%$, DC $\pm 10\%$
  - Frequency range of $U_s$: DC 15…400 Hz
- Measuring circuit:
  - Permissible system leakage capacitance $C_{fg}$: $\leq 150$ µF
  - Permissible extraneous DC voltage $U_{02}$: $\leq 1600$ V
- Response values:
  - Response value $R_{01}$: 11…500 kΩ (50 kΩ)*
  - Response value $R_{02}$: 10…490 kΩ (25 kΩ)*
  - Relative uncertainty $R_{0u}$: $\pm 15\%$, at least $\pm 3$ kΩ
  - Hysteresis $R_{H}$: 25 %, at least 1 kΩ
  - Undervoltage detection: $30…1.09$ kV (off)*
  - Overvoltage detection: $31…1.10$ kV (off)*
  - Relative uncertainty $U$: $\pm 5\%$, at least 5 V
  - Relative uncertainty depending on the frequency $\geq 200$ Hz: $-0.075$ %/Hz
  - Hysteresis $U$: $5\%$, at least 5 V
- Time response:
  - Response time $t_{R}$ at $R_0 = 0.5 \times R_{01}$ and $C_{fg}=1$ µF acc. to IEC 61557-8: $\leq 20$ s
    - Start-up delay $t_{0}$: 0…10 s (0 s)*
    - Response delay $t_{R}$: 0…99 s (0 s)*
    - Delay on release $t_{0r}$: 0…99 s (0 s)*
- Displays, memory:
  - Display: LC display, multi-functional, not illuminated
  - Display range measured value insulation resistance ($R_0$): $1 \text{ kΩ}…4 \text{ MΩ}$
  - Operating uncertainty: $\pm 15\%$, at least $\pm 3$ kΩ
  - Display range measured value nominal system voltage ($U_s$): $30…1.15$ kV RMS
  - Operating uncertainty: $\pm 5\%$, at least 5 V
  - Display range measured value system leakage capacitance for $R_0 > 20$ kΩ: $0…200$ µF
  - Operating uncertainty: $\pm 15\%$, at least $\pm 2$ µF
  - Password: off/0…999 (0, off)*
  - Fault memory alarm messages on/off)*

**Analogue output (valid for isoHV425-D4M-4 only)**

- Operating mode: mid-scale $R$ or full-scale $U$ ($R = 120$ kΩ)*
- Functions: insulation value $R_0$ or mains voltage $U_0$ ($R_0$)*
- Max. no load voltage (open terminals): DC 12 V
- Max. short-circuit current: 25 mA short-circuit-proof circuit
- Voltage output: DC $0…10$ V, load $\geq 20$ kΩ*
- Current output: DC $0/4…20$ mA, load $\leq 130$ Ω
- Current output: DC $0…400$ µA, load $\leq 3$ kΩ

**Switching elements**

- Switching elements: 2 x 1 N/O contact, common terminal 11
- Operating principle: N/C operation/N/O operation (N/C operation)*
- Electrical endurance under rated operating conditions, number of cycles: 10,000

**Contact data acc. to IEC 60947-5-1:**

- Utilisation category: AC-12
- AC-14
- DC-12
- DC-12
- DC-12
- Rated operational voltage: 230 V
  230 V
  24 V
  24 V
  110 V
  220 V
- Rated operational current: 5 A
  2 A
  1 A
  0.2 A
  0.1 A
- Minimum contact rating: 1 mA at AC/DC $\geq 10$ V

**Environment/EMC**

- EMC: IEC 61326-2-4, EN 50121-3-2
- Ambient temperatures:
  - Operation: $-40…+70$ °C
  - Transport: $-40…+85$ °C
  - Storage: $-40…+70$ °C

**Classification of climatic conditions acc. to IEC 60721:**

- Stationary use (IEC 60721-3-3): SK23 (except condensation and formation of ice)
  - for W variant: SK24
- Transport (IEC 60721-3-2): 2K11 (except condensation and formation of ice)
- Long-term storage (IEC 60721-3-1): 1K22 (except condensation and formation of ice)

**Classification of mechanical conditions acc. to IEC 60721:**

- Stationary use (IEC 60721-3-3):
  - for W variant: 3M11
  - Transport (IEC 60721-3-2): 2M4
  - Long-term storage (IEC 60721-3-1): 1M12

**Connection**

- Connection type: push-wire terminal
- Nominal current: $\leq 10$ A
- Conductor sizes: AWG 24-14
- Stripping length: 10 mm
- Rigid:
  - 0.1…2.5 mm²
  - 0.1…2.5 mm²
- Flexible without ferrules:
  - 0.1…2.5 mm²
  - Flexible with ferrule with/without plastic sleeve:
  - 0.1…2.5 mm²
  - Multiple conductor, flexible with TWIN ferrule with plastic sleeve:
  - 0.1…1.5 mm²
- Opening force: 50 N
- Test opening, diameter: 2.1 mm

**Other**

- Operating mode: continuous operation
- Mounting: cooling slots must be ventilated vertically
- Minimum horizontal distance between the devices (DIN EN 45545): see note **
- Degree of protection, built-in components (DIN EN 60529): IP30
- Degree of protection, terminals (DIN EN 60529): IP20
- Enclosure material: polycarbonate
- DIN rail mounting acc. to IEC 60715
- Screw mounting: 2 x M4 with mounting clip
- Documentation number: D00082
- Weight: $\leq 150$ g

**Factory setting**

="* Factory setting

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**Environmental monitoring devices | Main circuits**

**Insulation monitoring device ISOMETER® isoHV425... with AGH422**
Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:
- Measuring circuit (IC1) - L1/+, L2/-
- Control circuit (IC2) - AK1, GND, AK2, Up, E

Rated voltage: 1000 V

Overvoltage category: III

Rated impulse voltage:
- IC1/IC2: 8 kV

Rated insulation voltage:
- IC1/IC2: 1000 V

Pollution degree: 3

Protective separation (reinforced insulation) between:
- IC1/IC2: Overvoltage category III, 1000 V

IT system being monitored
- Nominal system voltage range: U_n AC 0…1000 V/DC 0…1000 V
- Tolerance of U_n: ±10 %

Measuring circuit:
- Measuring voltage U_m: ±45 V
- Measuring current I_m: ≤ 120 μA
- Internal resistance R_i: ≥ 390 kΩ

Environment/EMC
- EMC: IEC 61326-2-4, EN 50121-3-2

Ambient temperatures:
- Operation: U_n < 700: -40…+70 °C
  U_n > 700: -40…+55 °C
- Transport: -40…+85 °C
- Storage: -40…+70 °C

Classification of climatic conditions acc. to IEC 60721:
- Stationary use (IEC 60721-3-3) 3K23 (except condensation and formation of ice) for W variant
- Transport (IEC 60721-3-2) 2K11 (except condensation and formation of ice)
- Long-term storage (IEC 60721-3-1) 1K22 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721:
- Stationary use (IEC 60721-3-3) 3M11 for W variant
- Transport (IEC 60721-3-2) 2M4
- Long-term storage (IEC 60721-3-1) 1M12

Connection

Connection type: push-wire terminal

Push-wire terminals:
- Nominal current: 10 A
- Conductor sizes: AWG 24 - 14
- Stripping length: 10 mm
- Rigid: 0.2…2.5 mm²
- Flexible without ferrules: 0.75…2.5 mm²
- Flexible with ferrule with/without plastic sleeve: 0.25…2.5 mm²
- Multiple conductor, flexible with TWIN ferrule with plastic sleeve: 0.5…1.5 mm²
- Opening force: 50 N
- Test opening, diameter: 2.1 mm

Single cables for terminals Up, AK1, GND, AK2 – Requirement for connecting cables between isoHV425xx and AGH422
- Cable length: ≤ 0.5 m
- Wire cross-section: ≥ 0.75 mm²

Other
- Operating mode: continuous operation
- Mounting: cooling slots must be ventilated vertically
- Distance to adjacent devices from U_n > 800 V: ≥ 30 mm
- Minimum horizontal distance between the devices (DIN EN 45545): see note *
- Degree of protection, built-in components (DIN EN 60529): IP30
- Degree of protection, terminals (DIN EN 60529): IP20
- Enclosure material: polycarbonate
- DIN rail mounting acc. to IEC 60715
- Screw mounting: 2 x M4 with mounting clip
- Weight: 150 g

** Application in rail vehicles / DIN EN 45545-2:2016!
If the distance to neighbouring components that do not meet the requirements of the DIN EN 45545-2 Table 2 standard is < 20 mm horizontally or < 200 mm vertically, these are to be regarded as grouped. See DIN EN 45545-2 Chapter 4.3 Grouping rules.

Dimension diagram (dimensions in mm)
1 A1, A2 Connection to the supply voltage via fuse (line protection).
   If being supplied from an IT system, both lines have to be protected by a fuse.
2 E, KE Connect each terminal separately to PE:
   The same wire cross section as for A1, A2 is to be used
3 L1/+, L2/- Connection to the IT system to be monitored
4 Up, AK1, GND, AK2 Connect the terminals of the AGH422 to the corresponding terminals of the ISOMETER®.
5 T/R Connection for the external combined test/reset button
6 11, 14 Connection to alarm relay K1
7 11, 24 Connection to alarm relay K2
8 A, B RS-485 communication interface with connectable terminating resistor.
9 M+, M- Analogue output
ISOMETER® IR155-3203/IR155-3204
Insulation monitoring device for unearthed DC drive systems (IT systems) in electric vehicles

**Device features**
- Suitable for 12 V and 24 V systems
- Automatic device self test
- Continuous measurement of the insulation resistance 0…10 MΩ
  - Response time for the first measurement of the system state (SST) is < 2 s after switching the supply voltage on
  - Response time < 20 s for insulation resistance measurement (DCP)
- Automatic adaptation to the existing system leakage capacitance (≤ 1 μF)
- Detection of earth faults and interruption of the earth connection
- Insulation monitoring of AC and DC insulation faults for unearthed systems (IT systems) 0…1000 V
- Undervoltage detection for voltages below 500 V (adjustable at factory by Bender)
- Short circuit proof outputs for:
  - Fault detection (high-side output)
  - Measured value (PWM 5…95 %) and status (f = 10…50 Hz) at high or inverted low-side driver (MHS/MLS output)
- Protective coating (SL 1301ECO-FLZ)

**Typical applications**
- Monitoring for unearthed DC drive systems (IT systems) in electric vehicles

**Standards**
- IEC 61557-8
- IEC 61010-1
- IEC 60664-1
- ISO 6469-3
- ISO 23273-3
- ISO 16750-1
- ISO 16750-2
- ISO 16750-4
- E1 (ECE regulation No. 10 version 5)
  - acc. 72/245/EWG/EEC
- DIN EN 60068-2-38
- DIN EN 60068-2-30
- DIN EN 60068-2-14
- DIN EN 60068-2-64
- DIN EN 60068-2-27

**Ordering information**

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<thead>
<tr>
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<th>Response value $R_{\text{an}}$</th>
<th>$f_{\text{ave}}$</th>
<th>Undervoltage detection</th>
<th>Measured value output</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuously set value</td>
<td>100 kΩ</td>
<td>10</td>
<td>300 V</td>
<td>Low-side</td>
<td>IR155-3203</td>
<td>B91068138V4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0 V (inactive)</td>
<td>High-side</td>
<td>IR155-3204</td>
<td>B91068139V4</td>
</tr>
<tr>
<td>Customer-specific setting</td>
<td>100 kΩ…1 MΩ</td>
<td>1…10</td>
<td>0 V…500 V</td>
<td>Low-side</td>
<td>IR155-3203</td>
<td>B91068138CV4</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>High-side</td>
<td>IR155-3204</td>
<td>B91068139CV4</td>
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**Accessories**

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<th>Description</th>
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<tbody>
<tr>
<td>Fastening set</td>
<td>B91068500</td>
</tr>
<tr>
<td>Connector set IR155-32xx</td>
<td>B91068501</td>
</tr>
</tbody>
</table>

**Normative exclusion**
The device went through an automotive test procedure in combination with multi customer requirements reg. ISO16750-x.
The standard IEC61557-8 will be fulfilled by creating the function for LED warning and test button at the customer site if necessary.
The device includes no surge and load dump protection above 50 V. An additional central protection is necessary.

**Further information**
For further information refer to our product range on www.bender.de.
Technical data

Insulation monitoring devices | Application-specific selection – eMobility

**Insulation monitoring device** ISOMETER® IR155-3203/IR155-3204

**Supply voltage**
- DC 10…36 V

**Max. operating current**
- 150 mA

**Max. current**
- 2 A

**HV voltage range (L+/L-)**
- AC 0…1000 V (peak value)
- 0…660 V r.m.s. (10 Hz…1 kHz)

**Supply voltage**
- DC 0…1000 V

**Power consumption**
- < 2 W

**Response values**

- **Response value hysteresis (DCP)**: 25 %
- **Response value Rref**: 100 kΩ…2…10 MΩ

**Undervoltage detection**
- 0…500 V

**Measuring range**

- **Measuring range**: 0…10 MΩ
- **Undervoltage detection**: 0…500 V default setting: 0 V (inactive)

**Relative uncertainty**

- **SST (≤ 2 s)**
- **Relative uncertainty DCP**
- **Relative uncertainty output M (fundamental frequency)**
  - ±5 % at each frequency
  - (10 Hz; 20 Hz; 30 Hz; 40 Hz; 50 Hz)

**Relative uncertainty**

- **Undervoltage detection**: U ≤ 100 V  ± 10 %; at Un ≥ 300 V  ± 5 %
- **Relative uncertainty (SST)**
  - "Good condition": 2° Rref
  - "Bad condition": ≤ 0.5° Rref

**Time response**

- **Response time tref (OK/ST, SST)**: tref ≤ 2 s (typ. < 1 s at Un > 100 V)
- **Response time tref (OK/ST, DCP)**
  - (when changing over from Rref = 10 MΩ to Rref/2; at Cref = 1 µF; Uref = DC 1000 V)
    - tref = 20 s (at Fave = 10°)
    - tref = 17.5 s (at Fave = 9°)
    - tref = 17.5 s (at Fave = 8°)
    - tref = 15 s (at Fave = 7°)
    - tref = 12.5 s (at Fave = 6°)
    - tref = 12.5 s (at Fave = 5°)
    - tref = 10 s (at Fave = 4°)
    - tref = 7.5 s (at Fave = 3°)
    - tref = 7.5 s (at Fave = 2°)
    - tref = 5 s (at Fave = 1°)

- **Switch-off time tref (OK/ST, DCP)**
  - (when changing over from Rref/2 to Rref/10; at Cref = 1 µF; Uref = DC 1000 V)
    - tref ≤ 5 s (at Fave = 1°)
    - tref ≤ 5 s (at Fave = 2°)
    - tref ≤ 5 s (at Fave = 3°)
    - tref ≤ 5 s (at Fave = 4°)
    - tref ≤ 5 s (at Fave = 5°)
    - tref ≤ 5 s (at Fave = 6°)
    - tref ≤ 5 s (at Fave = 7°)

**Duration of the self test**
- 10 s
  - (every five minutes; should be added to tref/2s)

**Measuring circuit**

- **System leakage capacitance Cref**: ≤ 1 µF
  - > 1 µF
- **Smaller measurement range and increased measuring time at**
  - PWM 47.5…52.5 %
  - PWM 47.5…52.5 %
- **First successful insulation measurement at**
  - ≤ 17.5 s
  - ≤ 2 s
  - ≤ 17.5 s
  - ≤ 17.5 s

**Measuring voltage Uref**
- ±40 V

**Measuring current Iref**
- ±10 mA

**Impedance Zref at 50 Hz**
- ≥ 1.2 MΩ

**Internal DC resistance Rref**
- ≥ 1.2 MΩ

**Output**

- **Measurement output (M)**

  - **Mref switches to Kl. 31 +2 V (3204)**
    - (external pull-down resistor to Kl. 31 necessary 2.2 kΩ)
  - **Mref switches to Kl. 31 -2 V (3203)**
    - (external pull-up resistor to Kl. 31 required 2.2 kΩ)

**0 Hz**
- Hi > short circuit to Uref + (Kl. 15); Low > IMD off or short circuit to Kl. 31

**10 Hz**
- Normal condition
  - Insulation measurement DCP;
  - starts two seconds after power on;
  - First successful insulation measurement at ≤ 17.5 s
  - PWM active 5…95 %

**20 Hz**
- Undervoltage condition
  - Insulation measurement DCP (continuous measurement);
  - starts two seconds after power on;
  - PWM active 5…95 %
  - First successful insulation measurement at ≤ 17.5 s
  - Undervoltage detection 0…500 V
  - (Bender configurable)

**30 Hz**
- Speed start measurement
  - Insulation measurement (only good/bad evaluation)
  - starts directly after power on ≤ 2 s
  - PWM 5…10 % (good) and 90…95 % (bad)

**40 Hz**
- Device error
  - Device error detected; PWM 47.5…52.5 %

**50 Hz**
- Connection fault earth
  - Fault detected on the earth connection (Kl. 31)
  - PWM 47.5…52.5 %

* Fave = 10 is recommended for electric and hybrid vehicles
### Status output (OKs)

- OKs switches to $U_1 = 2 \text{ V}$
- (external pull-down resistor to Kl. 31 required 2.2 kΩ)

### High
- No fault; $R >$ response value
- Insulation resistance $\leq$ response value detected;
- Device error; Fault in the earth connection
- Undervoltage detected or device switched off

### Operating principle PWM driver

- Condition “Normal” and “Undervoltage detected” (10 Hz; 20 Hz)

\[
R_T = \frac{90 \% \times 1200 \text{ kΩ}}{\text{duty cycle} - 5\%} - 1200 \text{ kΩ}
\]

- Duty cycle 5% $\Rightarrow > 50$ MΩ (≈)
- Duty cycle 50% $\Rightarrow 1200$ kΩ
- Duty cycle 95% $\Rightarrow 0$ kΩ

### Load current $I_L$

- 80 mA

### Turn-on time

- to 90% $V_{OUT}$
- max. 125 µs

### Turn-off time

- to 10% $V_{OUT}$
- max. 175 µs

### Slew rate on

- 10…30% $V_{OUT}$
- max. 6 V/µs

### Slew rate off

- 70…40% $V_{OUT}$
- max. 8 V/µs

### Timing 3204 (inverse to 3203)

- $V_{OUT}$
- $\frac{dV}{dt}$
- $t_{on}$
- $t_{off}$

### Connection

- On-board connectors

\[
\begin{align*}
&1 \times 2-1445088-8 \\
&2 \times 2-1445088-2 \ (L^+, L^-); \ The \ connection \ between \ the \ respective \ connecting \ pins \ at \ L^+ \ or \ L^- \ may \ only \ be \ used \ as \ redundancy. \ Cannot \ be \ used \ for \ looping \ through!
\end{align*}
\]

- Crimp contacts

\[
\begin{align*}
&14 \times 2-394606-1 \\
&\text{Conductor cross section: AWG} \ 20-24
\end{align*}
\]

### EMC

- Load dump protection $< 50 \text{ V}$
- Measurement method Bender-DCP technology
- Factor averaging $F_{ave} = 1 \ldots 10$ (factory set: 10)

### ESD protection

- Contact discharge – directly to terminals $\leq 10 \text{ kV}$
- Contact discharge – indirectly to environment $\leq 25 \text{ kV}$
- Air discharge – handling of the PCB $\leq 6 \text{ kV}$

### Load dump protection $< 50 \text{ V}$

### Measurement method Bender-DCP technology

### Factor averaging $F_{ave} = 1 \ldots 10$ (factory set: 10)

### General data

- Necessary crimp tongs (TYCO) 91501-1
- Operating mode/mounting continuous operation/any position
- Temperature range $-40 \ldots +105 ^\circ \text{ C}$
- Voltage failure $\leq 2 \text{ ms}$
- Flammability class acc. to UL 94 V-0

### Mounting

- 4 metal screws with locking washers between screw head and PCB. Torx, T20 with a maximum tightening torque of 4 Nm for the screws. Furthermore, a maximum of 10 Nm tightening torque to the PCB at the mounting points.

### Mounting and connector kits are not included in delivery, but are available as accessories. The maximum diameter of the mounting points is 10 mm.

### Before mounting the device, ensure sufficient insulation between the device and the vehicle or the mounting points (min. 11.4 mm to other parts). If the device is mounted on a metal or conductive subsurface, this subsurface has to be at earth potential (Kl.31; vehicle mass).

### Deflection max. 1% of the length or width of the PCB

### Coating thick-film lacquer

### Documentation number D00115

### Weight 52 g ± 2 g

### Technical data (continued)
### Dimension diagrams (dimensions in mm)

![Dimension diagram]

### Wiring diagram

**Notice:**
- MHS only on variants -3204 and -3210
- MLS only on variant -3203

#### Connectors XLA+
- Pin 1+2 L+ Line voltage

#### Connectors XLA-
- Pin 1+2 L- Line voltage

#### Connectors XK1A
- Pin 1 Kl. 31 Chassis ground/electronic ground
- Pin 2 Kl. 15 Supply voltage
- Pin 3 Kl. 31 Chassis ground
- Pin 4 Kl. 31 Chassis ground (separate line)
- Pin 5 MHS Data Out, PWM (high side)
- Pin 6 MLS Data Out, PWM (low side)
- Pin 7 n.c.
- Pin 8 OKHS Status Output (high side)

### Example of application

![Example of application diagram]
ISOMETER® isoEV425 with coupling device AGH420
Insulation monitoring device for unearthed DC circuits (IT systems) for charging electric vehicles

Device features

- Monitoring for DC charging stations (mode 4 according to IEC 61851-23) for charging electric vehicles
- Mains voltage measurement (r.m.s.) with under-/overvoltage detection
- DC voltage measurement to earth (L+/PE and L-/PE)
- Automatic adaptation to the system leakage capacitance up to 5 μF
- Automatic device self-test with connection monitoring
- Selectable start-up delay, response delay and delay on release
- Two separately adjustable response value ranges of 1…500kΩ (Alarm 1, Alarm 2)
- Alarm signalling via LEDs (AL1, AL2), a display and alarm relays (K1, K2)
- N/C operation or N/O operation selectable
- Measured value indication via multi-functional LCD
- Fault memory can be activated
- RS-485 (galvanically isolated) including the following protocols:
  - BMS interface (Bender measuring device interface) for data exchange with other Bender components
  - Modbus RTU
  - IsoData (for continuous data output)
- Password protection to prevent unauthorised parameter changes

Standards

The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8

Further information

For further information refer to our product range on www.bender.de.

Typical applications

- DC charging stations for electric vehicles according to IEC 61851-23

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage $U_s$</th>
<th>System leakage capacitance $C_e$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100…240 V, 47…63 Hz</td>
<td>$\leq 5 \ \mu$F</td>
<td>isoEV425-D4-4 with AGH420</td>
<td>B91036401</td>
</tr>
<tr>
<td>DC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24…240 V</td>
<td>$\leq 20 \ \mu$F</td>
<td>isoEV425HC-D4-4 with AGH420</td>
<td>–</td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
Insulation monitoring devices | Application-specific selection – eMobility

Insulation monitoring device ISOMETER® isoEV425 with coupling device AGH420

Operating uncertainty

R

Response value

R

Response values

R

Response value R_{o1}

isoEV425

2…500 kΩ (500 kΩ*)

2…500 kΩ (200 kΩ*)


Response value R_{o2}

1…490 kΩ (100 kΩ*)

Operating uncertainty R_{u1} (≤ 5 μF)

≤ ± 15 %, at least ± 1 kΩ

Operating uncertainty R_{u2} > 100 kΩ (≤ 5 μF, isoEV425HC)

≤ ± 5 %, at least ± 5 V

Hysteresis R_{h}

25 %, at least ± 1 kΩ

Undervoltage detection

30…1.14 kV (off*)

Overvoltage detection

1…1.15 kV (off*)

Relative uncertainty U

± 5 %, at least ± 5 V

Relative uncertainty depending on the frequency ≥ 200 Hz

-0.03 %/Hz

Hysteresis U

5 %, at least ± 5 V

Time response

Response time t_{set} at 0.5 x R_{u1} and C=1 μF acc. to IEC 61557-8

≤ 10 s

Start-up delay t

0…10 s (0 s)*

Delay on release t_{set}

0…99 s (0 s)*

Display panel

Display

LC display, multi-functional, not illuminated

Display range measured value insulation resistance (R_i)

1 kΩ…1 MΩ

Operating uncertainty R_i (≤ 5 μF)

≤ ± 15 %, at least ± 1 kΩ

Operating uncertainty R_i > 100 kΩ (≤ 5 μF, isoEV425HC)

≤ ± 5 % * R_i /100 kΩ + 10%)

Display range measured value nominal system voltage (U_{n})

30…1.15 kV rms.

Operating uncertainty

≤ ± 5 %, at least ± 5 V

Relative uncertainty depending on the frequency ≥ 200 Hz

-0.03 %/Hz

Display range measured value system leakage capacitance R_i > 10 kΩ

isoEV425

0…10 μF

isoEV425HC

0…25 μF

Operating uncertainty

≤ ± 5 %, at least ± 2 μF

Password

0фф/0…999 (0, off*)

Fault memory alarm messages

on/(off*)

Interface

Interface/protocol

RS-485/BMS, Modbus RTU, isoData

Baud rate

BMS (9.6 kBit/s), Modbus RTU (selectable), isoData (115.2 kBit/s)

Cable length (9.6 kBit/s) ≤ 1200 m

Cable: twisted pairs, shield connected to PE on one side

min. 6-20x6

Terminating resistor

120 Ω (0,25 W), internal, can be connected

Device address, BMS bus, Modbus RTU

3…90 (3)*

Swimming elements

Switching elements

2 x 1 N/O contacts, common terminal T1

Operating principle

N/C operation/N/O operation (N/O operation)*

Electrical endurance, number of cycles

10000

Contact data acc. to IEC 60947-5-1:

Utility category

AC-12 AC-14 DC-12 DC-12 DC-12

Rated operational voltage

230 V 230 V 24 V 110 V 220 V

Rated operational current

5 A 2 A 1 A 0.2 A 0.1 A

Minimum contact rating

1 μA at AC/DC ≥ 10 V

Environment/EMC

EMC

IEC 61326-2-4

Ambient temperatures:

Operation

-40…+70 °C

Transport

-40…+85 °C

Storage

-40…+70 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3) 3K24 (except condensation and formation of ice)

Storage (IEC 60721-3-3) 3K11 (except condensation and formation of ice)

Long-term storage (IEC 60721-3-3) 1K22 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3) 3M11

Transport (IEC 60721-3-3) 2M11

Long-term storage (IEC 60721-3-3) 1M12

Connection

Connection type

screw-type terminal or push-wire terminal

Screw-type terminals:

Nominal current

≤ 10 A

Connecting torque

0.5…0.6 Nm (5…7 lb-in)

Conductor sizes

AWG 24-12

Rigid/flexible

0.2…2.5 mm²

Flexible with ferules with/without plastic sleeve

0.25…2.5 mm²

Multi-conductor rigid

0.2…1.5 mm²

Multi-conductor flexible

0.2…1.5 mm²

Multi-conductor flexible with ferules without plastic sleeve

0.25…2.5 mm²

Multi-conductor flexible with TWIN ferules with plastic sleeve

0.5…1.5 mm²

Push wire terminals:

Nominal current

≤ 10 A

Conductor sizes

AWG 24-14

Flexible without ferules

0.75…2.5 mm²

Flexible with ferules without/with plastic sleeve

0.25…2.5 mm²

Multi-conductor flexible

0.5…1.5 mm²

Flexible with TWIN ferules without plastic sleeve

0.5…1.5 mm²

Opening force

50 N

Control panel:

Test opening, diameter

2.1 mm

Wiring of the terminals Up, AK1, GND, AK2

refer to technical data AGH420 under the heading "Connection"

Other

Operating mode

continuous operation

Mounting

cooling slots must be ventilated vertically

Degree of protection, built-in components (DIN EN 60529)

IP30

Degree of protection, terminals (DIN EN 60529)

IP20

Enclosure material

polycarbonate

DIN rail mounting acc. to

IEC 60715

Screw fixing

2 x M4 with mounting clip

Documentation number

D00126

Weight

≤ 150 g

( )* = factory setting
## Technical data coupling device AGH420

### Insulation coordination acc. to IEC 60664-1/IEC 60664-3

**Definitions:**
- Measuring circuit (IC1): L1/+, L2/-
- Control circuit (IC2): AK1, GND, AK2, Up, E

**Rated voltage:** 1000 V
**Overvoltage category:** III
**Rated impulse voltage:** IC1/(IC2) 8 kV
**Rated insulated voltage:** IC1/(IC2) 1000 V
**Pollution degree:** 3

**Protective separation (reinforced insulation) between:**
- IC1/(IC2) Overvoltage category III, 1000 V

### Monitored IT system

- **Nominal system voltage range** $U_n$ AC/DC 0…1000 V
- **Tolerance of** $U_n$ AC/DC ±10 %
- **Nominal system voltage range** $U_n$ (UL508) AC/DC 0…600 V

### Measuring circuit

- **Measuring voltage** $U_m$ ± 45 V
- **Measuring current** $I_m$ at $R_F$ ≤ 400 μA
- **Internal resistance** DC $R_i$ ≥ 120 kΩ

### Environment/EMC

- **EMC** IEC 61326-2-4

#### Ambient temperatures:

- **Operation** -40…+70 °C
- **Transport** -40…+85 °C
- **Storage** -40…+70 °C

### Classification of climatic conditions acc. to IEC 60721:

- **Stationary use** (IEC 60721-3-3) 3K24 (except condensation and formation of ice)
- **Transport** (IEC 60721-3-2) 2K11 (except condensation and formation of ice)
- **Long-term storage** (IEC 60721-3-1) 1K22 (except condensation and formation of ice)

### 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** screw-type terminal or push-wire terminal

#### Screw-type terminals:
- **Nominal current** ≤ 10 A
- **Tightening torque** 0.5…0.6 Nm (5…7 lb-in)
- **Conductor sizes** AWG 24-12

#### Push-wire terminals:
- **Nominal current** ≤ 10 A
- **Conductor sizes** AWG 24-14

### Single cables for terminals Up, AK1, GND, AK2:

- **Cable lengths** ≤ 0.5 m
- **Connection properties** ≥ 0.75 mm²

### Other

- **Operating mode** Continuous operation
- **Mounting** cooling slots must be ventilated vertically
- **Distance to adjacent devices from** $U_n > 800 V$ ≥ 30 mm
- **Degree of protection internal components** (DIN EN 60529) IP30
- **Degree of protection terminals** (DIN EN 60529) IP20
- **Enclosure material** polycarbonate
- **DIN rail mounting** acc. to IEC 60715
- **Screw mounting** 2 x M4 with mounting clip
- **Weight** ≤ 150 g

---

**Dimension diagram** (dimensions in mm)
**Wiring diagram**

1. **A1, A2** Connection to the supply voltage via a fuse. If supplied from an IT system, both lines have to be protected by a fuse.\(^*\)
2. **E, KE** Connect each terminal separately to PE. The same wire cross section as for A1, A2 is to be used.
3. **L1+/-, L2/-** Connection to the 3(N)AC, AC or DC system to be monitored.
4. **Up, AK1, GND, AK2** Connect the terminals of the AGH420 to the corresponding terminals of the ISOMETER\(^*\).
5. **T/R** Connection for external combined test and reset button.

**Example of application**

**TN-C-S system**

<table>
<thead>
<tr>
<th>Source</th>
<th>Distribution</th>
<th>Installation</th>
<th>Feeder/ Input</th>
<th>DC charger</th>
<th>Cable assembly</th>
<th>Vehicle connector</th>
<th>Vehicle inlet</th>
<th>Electric vehicle</th>
</tr>
</thead>
</table>

**Mode 4 IT system**

- **RCD required by IEC 60364**
- **Isolating transformer**
- **Note:** Only use RCDs with a maximum of 6 mA DC (Option)
- **Only one IMD may be active in each interconnected IT system**

**For UL applications:**
- Only use 60/75°C copper lines!
- UL and CSA applications require the supply voltage to be protected via 5 A fuses.

---

\(^*\) For UL applications:

- Only use 60/75°C copper lines!
- UL and CSA applications require the supply voltage to be protected via 5 A fuses.
ISOMETER® isoCHA425

Insulation monitoring device for unearthed DC systems (IT systems) DC 50 V up to 400 V
Suitable for the charging of electric vehicles acc. to Japanese charging standard CHAdeMO

Device features
- Monitoring the insulation resistance for DC charging stations according to Japanese charging standard CHAdeMO
- Detection of asymmetrical insulation faults in the DC system voltage range between 50 V und 400 V within 1 s
- Detection of symmetrical insulation faults within 10 s
- Measurement of the system voltage (true RMS) with undervoltage and overvoltage detection
- Measurement of DC system voltages to earth (L+/PE and L-/PE)
- Automatic adaptation to the system leakage capacitance up to 2 μF
- Selectable start-up delay, response delay and delay on release
- Two separately adjustable response value ranges of 5…250 kΩ (Alarm 1, Alarm 2)
- Alarm signalling via LEDs (AL1, AL2), a display and alarm relays (K1, K2)
- Automatic device self test with connection monitoring
- Selectable N/C or N/O relay operation
- Measured value indication via multifunctional LCD
- Fault memory can be activated
- RS-485 (galvanically isolated) including the following protocols:
  – BMS interface (Bender measuring device interface) for data exchange with other Bender components
  – Modbus RTU
  – IsoData (for continuous data output)
- Password protection to prevent unauthorised parameter changes

Standards
The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8
- CHAdeMO Spec V1.0

Typical applications
- DC charging stations for electric vehicles according the Japanese charging standard CHAdeMO

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage $U_s$</th>
<th>System leakage capacitance $C_e$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>DC</td>
<td>$\leq 2 \mu F$</td>
<td>isoCHA425-D4-4</td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
**Technical data**

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**

**Definitions:**
- Measuring circuit (IC1)
- Supply circuit (IC2)
- Output circuit (IC3)
- Control circuit (IC4)
- Rated voltage
- Overvoltage category
- Rated impulse voltage:
  - IC1/(IC2-4)
  - IC2/(IC3-4)
  - IC3/IC4
- Rated insulation voltage:
  - IC1/(IC2-4)
  - IC2/(IC3-4)
  - IC3/IC4
- Pollution degree

**Protection separation (reinforced insulation) between:**
- Overvoltage category III
- Overvoltage category III
- Overvoltage category III

**Voltage test (routine test) according to IEC 61010-1:**
- IC1/(IC2-4)
- IC2/(IC3-4)
- IC3/IC4

**Supply voltage**
- Supply voltage $U_s$
- AC 100 ... 240 V/DC 24 ... 280 V
- Tolerance of $U_s$
- ±30 ... +15 %
- Frequency range $U_s$
- 47 ... 63 Hz
- Power consumption
- $\leq 3 \text{ W}, \leq 9 \text{ VA}$

**IT system being monitored**
- Nominal system voltage $U_n$
- DC 50 ... 400 V
- Tolerance of $U_n$
- ±25 %

**Measuring circuit**
- Measuring voltage $U_{meas}$
- ±12 V
- Measuring current $I_{meas}$ at $R_1, Z_1 = 0$
- $\leq 110 \mu A$
- Internal resistance $R_i, Z_i$
- $\geq 115 \text{ k} \Omega$
- Permissible system leakage capacitance $C_1$
- $\leq 2 \mu F$

**Response values**
- Response value $R_{n1}$
- $R_{n2} = 250 \text{ k} \Omega (46 \text{ k} \Omega)^*$
- Response value $R_{n2}$
- $5 \text{ k} \Omega ... R_{n1} (23 \text{ k} \Omega)^*$
- Relative uncertainty $R_m$
- ±15 %, at least ±2 kΩ
- Hysteresis $R_{hy}$
- ±25 %, at least ±1 kΩ
- Voltages $U_{<}$
- $50 \text{ V} ... U_{<} (\text{off}/50 \text{ V})^*$
- Overvoltage $U_{>}$
- $U_{>} ... 400 \text{ V} (\text{off}/400 \text{ V})^*$
- Relative uncertainty $U_{rel}$
- ±5 %, at least ±5 V
- Hysteresis $U_{hy}$
- ±5 %, at least ±5 V

**Time response**
- Response time $t_{rst}$ of $R_1 = 0.5 \times R_{n1}$ and $C_1 = 1 \mu F$ according to IEC 61557-8
- $\geq 1 \text{ s}$
- Start-up delay $t_p$
- 0 ... 30 s (0 s)^*$
- Response delay $t_{rbr}$
- 0 ... 99 s (8 s)^*$
- Delay on release $t_{rel}$
- 0 ... 99 s (8 s)^*$

**Displays, memory**
- LC display, multi-functional, not illuminated
- Display range measured value insulation resistance ($R_i$)
- 1 kΩ ... 2 MΩ
- Operating uncertainty
- ±15 %, at least ±2 kΩ
- Display range measured value nominal system voltage ($U_n$)
- 50 ... 400 Vrms
- Operating uncertainty
- ±5 %, at least ±5 V
- Display range measured value system leakage capacitance of $R_i > 10$ kΩ (“dc” mode)
- 0 ... 17 μF
- Operating uncertainty of $R_i$ ≥ 20 kΩ and $C_0 \leq 5 \mu F$
- ±5 %, at least ±0,1 μF
- Password
- off/0 ... 999 (0, off)^*$
- Fault memory alarm messages
- on/(off)^*$

**Interface**
- Interface/protocol
- RS-485/BMS, Modbus RTU, isoData
- Baud rate
- BMS (9.6 kbits/s), Modbus RTU (selectable), isoData (115.2 kbits/s)
- Cable length (9.6 kbits/s)
- $\leq 1200 \text{ m}$
- Cable: twisted pairs, shield connected to PE on one side
- min. 3 x 2 x 0.6 mm
- Terminating resistor
- 120 Ω (0.25 W), internal, can be connected
- Device address, BMS bus, Modbus RTU
- 3 ... 90 (3)^*

**Switching elements**
- Switching elements
- 2 x 1 contacts, common terminal T1
- Operating principle
- N/C operation/N/O operation (N/C operation)^*
- Electrical endurance, number of cycles
- 10 000

**Contact data acc. to IEC 60947-5-1:**
- Utilisation category
- AC-12, AC-14, DC-12, DC-12, DC-12
- Rated operational voltage
- 230 V, 230 V, 24 V, 110 V, 220 V
- Rated operational current
- 5 A, 2 A, 1 A, 0.2 A, 0.1 A
- Minimum contact rating
- 1 mA at AC/DC $\geq 10$ V

**Environmental**
- EMC
- IEC 61326-2-4

**Ambient temperatures:**
- Operation
- 0 ... +70 °C
- Transport
- 0 ... +85 °C
- Storage
- 0 ... +70 °C

**Climatic class acc. to IEC 60721:**
- Stationary use (IEC 60721-3-3)
- 3K23 (without condensation and formation of ice)
- Transport (IEC 60721-3-3)
- 2K11 (without condensation and formation of ice)
- Long-time storage (IEC 60721-3-1)
- 1K23 (without condensation and formation of ice)

**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
- push-wire terminal
- Nominal current
- $\leq 10$ A
- Conductor sizes
- AWG 24 – 14
- Stripping length
- 10 mm
- rigid
- 0.2 ... 2.5 mm²
- flexible without ferrules
- 0.75 ... 2.5 mm²
- flexible with ferrules with/without plastic sleeve
- 0.25 ... 2.5 mm²
- Multi-conductor flexible with TWIN ferrules with plastic sleeve
- 0.5 ... 1.5 mm²
- Opening force
- 50 N
- Test opening, diameter
- 2.1 mm

**Other**
- Operating mode
- continuous operation
- Mounting
- cooling slots must be ventilated vertically
- Degree of protection, built-in components (DIN EN 60529)
- IP30
- Degree of protection, terminals (DIN EN 60529)
- IP20
- Enclosure material
- polycarbonate
- DIN rail mounting acc. to
- IEC 60715
- Screw fixing
- 2 x M4 with mounting clip
- Documentation number
- D00352
- Weight
- $\leq 150$ g

(* = factory setting)
1. A1, A2  Connection to the supply voltage via fuse (line protection): If supplied from an IT system, both lines have to be protected by a fuse.*

2. E, KE  Connect each terminal separately to PE. The same wire cross section as for A1, A2 is to be used.

3. L+, L–  Connection to the IT system to be monitored.

4. T/R  Connection for the external combined test and reset button

5. 11, 14  Connection to alarm relay K1

6. 11, 24  Connection to alarm relay K2

7. A, B  RS-485 communication interface with connectable terminating resistance.

Example: Connection of a BMS-Ethernet-Gateway COM465IP

* For UL applications:
   Only use 60/75 °C copper lines!
   For UL and CSA applications, it is mandatory to use 5 A fuses for the protection of the supply voltage.
**ISOMETER® isoCHA425HV with AGH420-1**

Insulation monitoring device with coupling device for unearthed DC systems (IT systems) 0 V to 1000 V. Suitable for DC charging stations according to CCS or CHAdeMO

### Device features

- Monitoring of the insulation resistance $R_f$ of DC charging stations according to CHAdeMO standard or Combined Charging System (CCS) in the system voltage range up to 1000 V
- CHAdeMO (Mode Chd):
  - Detection of insulation faults in the system voltage range 50 V to 1000 V, single-pole insulation faults $R_{FU}$ up to 100 kΩ with a response time of 1 s and up to 2 MΩ with a response time of 10 s
  - Two-pole, symmetrical insulation faults $R_{FS}$ up to a maximum of 160 kΩ and with a response time of 10 s
  - Maximum system leakage capacitance 1.6 μF per conductor
- CCS (Mode dc):
  - Detection of insulation faults up to 2 MΩ with a response time of 10 s
  - Maximum system leakage capacitance 5 μF
- Measurement of the system leakage capacitance $C_e$
- Measurement of the nominal system voltage $U_n$ (True RMS) with undervoltage/overvoltage detection
- Measurement of the residual voltages $U_{L1e}$ (between L1/+ and earth) as well as $U_{L2e}$ (between L2/- and earth)
- DC residual voltage
- Selectable start-up delay, response delay and delay on release
- Two separately adjustable response value ranges of $5\ldots600$ kΩ (Alarm 1, Alarm 2)
- Alarm signalling via LEDs (“AL1”, “AL2”), a display and alarm relays (“K1”, “K2”)
- Automatic device self test with connection monitoring
- Selectable N/C or N/O relay operation
- Measured value indication via a multifunctional LC display
- Fault memory can be activated
- RS-485 (galvanically isolated) including the following protocols:
  - BMS interface (Bender measuring device interface) for data exchange with other Bender components
  - Modbus RTU
  - IsoData (for continuous data output)
- Password protection to prevent unauthorised parameter changes
- Stop mode to deactivate the measuring pulse generator

### Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8: 2014/COR1
- IEC 61851-21-2
- IEC 61851-23

### Further information

For further information refer to our product range on www.bender.de.

### Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage $U_n$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC 0 (50*)...1 000 V</td>
<td>isoCHA425HV-D4-4 + AGH420-1</td>
<td>B71036396</td>
</tr>
</tbody>
</table>

* Value for CHAdeMo

### Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B90860008</td>
</tr>
</tbody>
</table>

Typical applications

- DC charging stations for electric vehicles in accordance with the Japanese charging standard CHAdeMO
- DC charging stations for electric vehicles according to CCS (Combined Charging System) in compliance with IEC 61851-23

Approvals

- CE
- UK
- CA
- CHAdeMO
Technical data isoCHA425HV

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:
- Supply circuit (IC1): A1, A2
- Output circuit (IC2): 11, 14, 24
- Control circuit (IC4): Up, KE, T/R, A, B, AK1, GND, AK2
- Rated voltage: 240 V
- Overvoltage category: III
- Rated impulse voltage:
  - IC2/IC3-4: 4 kV
  - IC3/IC4: 4 kV
- Rated insulation voltage:
  - IC2/IC3-4: 250 V
  - IC3/IC4: 250 V
- Pollution degree: 3
- Protective separation (reinforced insulation) between:
  - IC2/IC3-4: overvoltage category III, 300 V
  - IC3/IC4: overvoltage category III, 300 V

Voltage tests (routine test) acc. to IEC 61010-1:
- IC2/IC3-4: DC ±3.1 kV
- IC3/IC4: AC ±2.2 kV

Supply voltage
- Supply voltage U:</p>

IT system being monitored
- Nominal system voltage U:</p>

Response values
- Response value R</p>

System voltage
- Nominal voltage U:</p>

Mode CCS (dc)
- Permissible system leakage capacitance Cs:
  - Measuring and display range R</p>

Mode ChaDemo (Chd)
- Nominal system voltage U:</p>

Displays, memory
- Password:
  - Fault memory alarm messages:
  - Display:
  - Time response:
  - Interface:
  - Switching elements:
  - Classification of climatic conditions acc. to IEC 60721:
    - Stationary use (IEC 60721-3-3):
      - Classification of mechanical conditions acc. to IEC 60721:
        - Stationary use (IEC 60721-3-3):
          - Classification of climatic conditions acc. to IEC 60721:
            - Classification of mechanical conditions acc. to IEC 60721:
              - Connection:
                - Other:

Connection type: push-wire terminal
- Nominal current:
- Cross-section:
- Stripping length:
- Rigid:
- Flexible without ferrules:
- Flexible with ferrules with/without plastic sleeve:
- Multi-conductor flexible with TWIN ferrules with plastic sleeve:
- Opening force:
- Test opening, diameter:
- Weight:
- DIN rail mounting acc. to IEC 60715
- Screw mounting:
- Documentation number:
- Degree of protection, terminals (DIN EN 60695):
- Degree of protection, cooling slots must be ventilated vertically:
- Degree of protection, built-in components (DIN EN 60529):
- IP20
- IP40
- IP65
- IP67
- IP69
- Degree of protection:
- Enclosure material:
- DIN rail mounting acc. to IEC 60715
- Screw mounting:
- Documentation number:
- Weight:
- DIN rail mounting acc. to IEC 60715
- Screw mounting:
- Documentation number:
- Weight:
Insulation monitoring devices | Application-specific selection – eMobility

Technical data AGH420-1

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:
- Measuring circuit (IC1)
- Control circuit (IC2)

Rated voltage
- 1 000 V

Overvoltage category
- III

Rated impulse voltage:
- IC1/IC2: 8 kV

Rated insulation voltage:
- IC1/IC2: 1000 V

Pollution degree
- 3

Protective separation (protective impedance) between:
- IC1/IC2: overvoltage category III, 1000 V

IT system being monitored
- Nominal system voltage range: DC 0…1000 V
- Nominal system voltage range: U_n (UL508) DC 0…600 V

Measuring circuit
- Measuring voltage U_m: ±45 V
- Measuring current I_m at R_F: ≤ 400 µA
- Internal DC resistance R_i: ≥ 120 kΩ

Environment/EMC
- EMC: IEC 61326-2-4

Ambient temperatures:
- Operation: -40…+70 °C
- Transport: -40…+85 °C
- Storage: -40…+70 °C

Classification of climatic conditions acc. to IEC 60721:
- Stationary use (IEC 60721-3-3): 3K24 (except condensation and formation of ice)
- Transport (IEC 60721-3-2): 2K11 (except condensation and formation of ice)
- Long-term storage (IEC 60721-3-1): 1K22 (except condensation and formation of ice)

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: push-wire terminal

Push-wire terminals:
- Nominal current: ≤ 10 A
- Cross section: AWG 24-14
- Stripping length: 10 mm
- Rigid: 0.2…2.5 mm²
- Flexible without ferrules: 0.25…2.5 mm²
- Flexible with ferrules with/without plastic sleeve: 0.25…2.5 mm²
- Multi-conductor flexible with TWIN ferrules with plastic sleeve: 0.5…1.5 mm²
- Opening force: 50 N
- Test opening, diameter: 2.1 mm

Single cables for terminals Up, AK1, GND, AK2:
- Cable length (AGH420-1 ‒ isoCHA425HV): ≤ 0.5 m
- Cross section: ≥ 0.75 mm²

Other
- Operating mode: continuous operation
- Mounting: cooling slots must be ventilated vertically
- Distance to adjacent devices from U_n > 800 V: ≥ 30 mm
- Degree of protection, built-in components (DIN EN 60529): IP30
- Degree of protection, terminals (DIN EN 60529): IP20
- Enclosure material: polycarbonate
- DIN rail mounting acc. to: IEC 60715
- Screw mounting: 2 x M4 with mounting clip
- Weight: ≤ 150 g

Dimension diagram (dimensions in mm)
**Wiring diagram**

1. **A1, A2**  
   Connection to the supply voltage via fuse.  
   If being supplied from an IT system, both lines must be protected by a fuse.  
2. **E, E, KE**  
   Connect each terminal separately to PE.  
   The same wire cross section as for A1, A2 is to be used.  
3. **L+, L−**  
   Connection to the IT system to be monitored.  
4. **Up, AK1, GND, AK2**  
   Connect the terminals of the AGH420-1 to the corresponding terminals of the ISOMETER® isoCHA425HV.  
5. **T/R**  
   Connection for external combined test and reset button.  
6. **11, 14**  
   Connection to alarm relay K1  
7. **11, 24**  
   Connection to alarm relay K2  
8. **A, B**  
   RS-485 communication interface with connectable terminating resistor.  
   Example: Connection of a BMS Ethernet gateway COM465IP.  
   For UL applications:  
   Use 60/75 °C copper lines only!  
   UL and CSA applications require the supply voltage to be protected via 5 A fuses.
Device features

- Insulation monitoring of AC and DC insulation faults for unearthed systems (IT systems) from 0...600 V peak
- Power supply for all internal voltages
- Continuous measurement of insulation resistance from 0 Ω...50 MΩ
- Response time of ≤ 20 s for measured insulation resistance (using Direct Current Pulse (DCP))
- Automatic adaptation to the existing system leakage capacitance (≤ 1 μF)
- Detection of ground faults and lost ground line
- Measurement of a second voltage
- The device works when:
  - HV is unstable
  - HV is powered off
  - There are symmetric or asymmetric insulation faults
  - Faults exist between HV lines and the supply voltage
- Galvanic insulation of all signals from the HV side
- HV coupled network
- CAN bus interface
- Light weight: < 220 g (including housing and connection frame)
- iso165C-1 only: The iso165C-1 variant features Error and Warning signals on the separated high-side driver

Typical applications

- Monitoring for unearthed DC drive systems (IT systems) in electric vehicles

Approvals

Standards – corresponding norms and regulations

General
IEC 61557-8; IEC 60664-1; ISO 6469-3; ISO 23273-3

EMV
CISPR 25; ISO 7637-2; ISO 11452-2; ISO 11452-4; ISO 11452-8; ISO 10605; IEC 61326-2-4; IEC 61000-4-4; E1 gem. 72/245/EWG/EEC; ISO 16750-2

Environmental
ISO 16750-1; ISO 20653; ISO 16750-3; IEC 60068-2-14; IEC 60668-2-27; IEC 60068-2-32; IEC 60068-2-64; ISO 16750-4; IEC 60068-2-1; IEC 60068-2-2; IEC 60068-2-38; IEC 60068-2-60; IEC 60068-2-78

Normative exclusion
The device has gone through an automotive test procedure in accordance with multi customer requirements as outlined by reg. ISO 16750-x. IEC 61557-8 will be fulfilled by creating an LED warning function and test button at the customer site if necessary.

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Nominal voltage</th>
<th>Supply voltage</th>
<th>Response value range</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC 0…600 V</td>
<td>DC 12 V</td>
<td>Alarm 1 (Error): 30 kΩ…1 MΩ (default: 300 kΩ); Alarm 2 (Warning): 40 kΩ…2 MΩ (default: 55 kΩ)</td>
<td>iso165C</td>
<td>B91068175</td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>iso165C connecting kit</td>
<td>B 9106 8503</td>
</tr>
</tbody>
</table>
### Technical Data

#### Supply voltage
- Supply voltage $U_S$: DC 9...16 V
- Nominal supply voltage: DC 12 V
- Max. operational current $I_S$: 300 mA (typ. 185 mA)
- Max. current $I_K$: 5 A
- Power dissipation $P_S$: < 2.5 W

#### Supervised IT system
- Rated voltage range $U_n$: DC 0...600 V
- Tolerance: +15 %
- Frequency range: 10 Hz...1 kHz
- System leakage capacitance $C_L$: ≤ 1 μF
- Withstand voltage test: AC 1.9 kV/1 min

#### Measuring circuit
- Measurement method: Bender DCP technology
- Measuring voltage $U_m$: ±40 V
- Measuring current $I_m$: ±33 μA
- Impedance $Z_i$: ≥ 1.2 MHz (HV1) (≥ 2.4 MHz each, each line, high resistance in off state)
- Internal resistance $R_i$: ≥ 1.2 MHz (HV1) (≥ 2.4 MHz each, each line, high resistance in off state)

#### Measuring ranges
- Insulation resistance range: 0 Ω...50 MΩ
- Insulation resistance duration/Pulse (normal operation): ~ 1.6 s (≤ 1 μF/0 MΩ)
- ~ 6 s (≤ 1 μF/10 MΩ)
- Relative error (DCP): 100 kΩ...5 MΩ, ±15 %
- Absolute error (DCP): 0 Ω...100 kΩ, ±15 %
- High-voltage range: 0...600 V
- High-voltage tolerance: ±5 %

#### High-side driver output (iso165C-1)
- HST_1*: High-side driver 1, iso Warning
- Maximum current, $I_{out,max}$: 80 mA
- HST_2*: High-side driver 2, iso Error
- Maximum current, $I_{out,max}$: 80 mA

#### Response values
##### iso165C
- Response value Alarm 1 (Error): 30 kΩ...1 MΩ (default: 300 kΩ)
- Response value Alarm 2 (Warning): 40 kΩ...2 MΩ (default: 55 kΩ)

##### iso165C-1
- Response value Alarm 1 (Error): 30 kΩ...1 MΩ (default: 400 kΩ)
- Response value Alarm 2 (Warning): 40 kΩ...2 MΩ (default: 250 kΩ)

#### Dimension diagram (dimensions in mm)

---

### iso165C and iso165C-1
- Response uncertainty (according to IEC 61557-8): ±15 %
- Hysteresis: ±25 %
- Factor averaging $F_{ave}$: 1...10 (default: 3)
- Response time $t_{SP}$ (DCP):
  - Changeover $R$: 10 MΩ - $R_{out}$; at $C_L$: 1 μF; $U_n$: DC 600 V
  - $t_{SP}$: ≤ 20 s (at $F_{ave}$ = 10)**
  - during self test $t_{SP}$: +10 s
- Measurement time after power on and after HV relays are closed: ≤ 3 s (≤ 1 μF/150 kΩ)
  - Switch-off time tab (DCP):
    - Changeover $R$: $R_{out}$ - 10 MΩ; at $C_L$: 1 μF; $U_n$: DC 600 V
    - $t_{SP}$: ≤ 40 s (at $F_{ave}$ = 10)
  - during self test $t_{SP}$: +10 s

#### Interface
- Protocol: HS-CAN

##### iso165C
- Data rate: 250 kbaud
- Terminating resistance: 124 Ω internally

##### iso165C-1
- Data rate: 500 kbaud
- Terminating resistance: None

#### Environment/EMC
- EMC: IEC 61326-2-4
- Overvoltage category/degree of pollution: II/2
- Temperature range: -40...+85 °C
- Range of application: 5,000 m above sea level

#### Connectors (Tyco)
- Receptacle housing type: 1719183-1, 1719183-2, 1719183-3 (black, white, blue)
- Receptacle drawing number: C-1719183
- Contact type (tin plated): 5-963715-1
- Contact wire range: 0.50...0.75 mm²
- Contact drawing number: 929454
- Crimp hand tool: 539635-1

#### Other
- Operating mode: Continuous operation
- Degree of protection: IP5K0

#### Software version
- iso165C: V1.0 - Release S010 (VIFC: V5.0, IMC V5.0)
- iso165C-1: V2.0 - Release S010 (VIFC: V10.0, IMC V5.0)

#### Mounting
- Recommended screws for mounting: 4 x M5 (not included)
- Max. tightening torque: 2.25 ± 0.25 Nm (XX lbs-in)
- Documentation number: D00154

---

** External 2.2 kΩ pull-down resistor to chassis ground (KL.31) is required. Not protected against a short circuit in the event that KL.31 is missing. Therefore, a 100 Ω resistor is required on each driver output.

** $F_{ave}$ = 10 is recommended for electric vehicles.
Typical application

Connectivity

Wiring diagram

Section view A-A
Scale: 2:1

recommended screws (not included)
4 x M5
fastening torque: 2.25 ± 0.25 Nm

Typical application

Connector ¹)

<table>
<thead>
<tr>
<th>Connector</th>
<th>Type</th>
<th>Code</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1719183-1</td>
<td>A</td>
<td>Black</td>
</tr>
<tr>
<td>2</td>
<td>1719183-2</td>
<td>B</td>
<td>White</td>
</tr>
<tr>
<td>3</td>
<td>1719183-3</td>
<td>C</td>
<td>Blue</td>
</tr>
</tbody>
</table>

¹) Please refer to “Technical Data” for detailed connector information.
Insulation monitoring devices
ISONET®

Equipment for insulation fault location
ISOSCAN®

Residual current monitoring systems
LINETRAXX®

Neutral Grounding Resistor Monitor (NGR)
LINETRAXX®

Charge Controller

Power Quality and Energy Measurement
LINETRAXX®

Measuring and monitoring relays
LINETRAXX®

System components
Coupling devices
Measuring current transformers
Transformers
Relay modules
Power supply units
Measuring instruments
Interface converters
Interface repeaters
COMTRAXX® Gateways
COMTRAXX® Alarm indicator and test combinations
COMTRAXX® condition monitors
Visualisation

Switching equipment
ATICS® transfer switching and monitoring devices

Test systems
UNIMET® Safety analyser

Annex
Technical terms
Alphabetical list of devices
Service
# Device overview

**Equipment for insulation fault location ISOSCAN®**

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## Special applications

- High-resistance insulation faults in case of high system leakage capacitances and low test current value
- Use with flexible strap transformers CTAF

## Application

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<tr>
<th>Control circuits</th>
<th>stationary</th>
<th>stationary</th>
<th>stationary</th>
<th>stationary</th>
<th>stationary</th>
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<tbody>
<tr>
<td>Main circuits</td>
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</tr>
</tbody>
</table>

## Voltages

- 3N1AC
- AC
- AC/DC
- DC

## Nominal voltage $U_{\text{max}}$

- See locating current injector (e.g. ISOMETER® iso685-D-P)
- AC 20...276 V, DC 20...308 V
- AC 20...276 V, DC 20...308 V
- See locating current injector (e.g. ISOMETER® iso685-D-P)
- AC 230 V, DC 220 V

## System leakage capacitance $C_{\text{le}}$

- Acc. to characteristic curve
- Acc. to characteristic curve
- Acc. to characteristic curve
- Acc. to characteristic curve
- Acc. to characteristic curve

## Response value $R_{\text{an k}}$

- Acc. to characteristic curve
- Acc. to characteristic curve
- Acc. to characteristic curve
- Acc. to characteristic curve
- Acc. to characteristic curve

## Installation

- DIN rail
- Screw mounting

## Interfaces

- BB: EDS440-S, EDS441-S
- BS: EDS440-L, EDS441-L
- BMS

## Product details

(Products on [www.bender.de/en](http://www.bender.de/en))

## Suitable system components

<table>
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<tr>
<th>Type</th>
<th>C. p.</th>
<th>Suitable system components</th>
</tr>
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<tbody>
<tr>
<td>Iso685-D-P</td>
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</tr>
<tr>
<td>IsoMED427P</td>
<td>85</td>
<td></td>
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<td>IsoPV1685P</td>
<td>99</td>
<td></td>
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<tr>
<td>Iso1685DP</td>
<td>71</td>
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<td>CTBS25</td>
<td>371</td>
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<tr>
<td>WS...</td>
<td>373</td>
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<tr>
<td>WS...-8000</td>
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<tr>
<td>Power supply unit</td>
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<tr>
<td>AN410</td>
<td>395</td>
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<td>AN450</td>
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<tr>
<td>STEP-PS</td>
<td>390</td>
<td></td>
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<tr>
<td>Relay module</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IOM441</td>
<td>401</td>
<td></td>
</tr>
</tbody>
</table>
### ISOSCAN®
- **EDS461/491**
- **EDS440**
- **EDS441**
- **EDS440-LAF**
- **EDS460/490**
- **EDS461/491**
- **EDS150**
- **EDS151**
- **EDS30…**

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<td>–</td>
<td>–</td>
<td>Medical locations</td>
<td>EDS3096PG for de-energised systems</td>
</tr>
</tbody>
</table>

#### Special applications
- High-resistance insulation faults in case of high system leakage capacitances and low test current value
- Use with flexible strap transformers CTAF – – – Medical locations EDS3096PG for de-energised systems

<table>
<thead>
<tr>
<th>Application</th>
<th>Stationary</th>
<th>Stationary</th>
<th>Stationary</th>
<th>Portable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circuits</td>
<td>–</td>
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<tr>
<td>Control</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Main circuits</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

#### Voltage system
- 3(N)AC
- AC
- AC/DC
- DC
- see Locating current injector (e.g. ISOMETER® iso685-D-P)
- AC 20…276 V, DC 20…308 V
- AC 230 V, DC 220 V
- see Locating current injector (e.g. ISOMETER® iso685-D-P)
- AC 20…276 V, DC 20…308 V dependent on type

#### System leakage capacitance
- C
- see Locating current injector (e.g. ISOMETER® iso685-D-P)
- AC 20…276 V, DC 20…308 V
- see Locating current injector (e.g. ISOMETER® iso685-D-P)
- AC 20…276 V, DC 20…308 V dependent on type

#### Response value
- R
- see Locating current injector (e.g. ISOMETER® iso685-D-P)
- AC 20…276 V, DC 20…308 V dependent on type

<table>
<thead>
<tr>
<th>Installation</th>
<th>DIN rail</th>
<th>Screw mounting</th>
<th>–</th>
<th>–</th>
</tr>
</thead>
</table>

#### Interfaces
- BB EDS440-S EDS441-S
- BS EDS440-L EDS441-L
- BMS

#### Suitable system components
- Suitable ISOMETER®s with integrated PGH iso685-D-P
- isoMED427P
- isoPV1685P
- iso1685DP

#### Measuring current transformers
- CTAC… 362
- CTUB100 365
- WR…S(P) 369
- CTBS25 371
- WS… 373
- WS…-8000
- CTAF…

#### Power supply unit
- AN410 393
- AN450 395
- STEP-PS 390

#### Relay module
- IOM441 401
ISOSCAN® EDS440/441

Insulation fault locators for localisation of insulation faults in unearthed DC, AC and three-phase power supply systems (IT systems)

Device features
- Universal system concept
- Modular design, therefore easily adjustable to the given circumstances
- Measuring current transformers available in various sizes and versions
- CT connection monitoring
- 12 measuring channels for measuring current transformer series CTAC…, WR…, WS…
- Optional extension by 12 relay channels
- Fault memory behaviour selectable
- Up to 50 EDS insulation fault locators in the system, 600 measuring channels
- Response sensitivity: EDS440 2…10 mA, EDS441 0.2…1 mA
- AC residual current measurement with configurable response value
- Two alarm relays with one N/O contact each
- N/O or N/C operation selectable
- External test/reset
- Central display of faulty outgoing circuits
- Serial interface RS-485, BS bus address range 2…79, Modbus RTU
- Connection to higher-level control and visualisation systems possible

Typical applications
- Insulation fault location in AC, 3AC and DC IT systems
- Main circuits and control circuits in industrial plants and ships
- Diode-decoupled DC IT systems in power plants
- Systems for medical locations

Standards
Observe the applicable national and international standards. The EDS44x series meets the device standards:
- DIN VDE 0100-410 (VDE 0100-410)
- DIN EN 61557-9 (VDE 0413-9)
- IEC 61557-9
- DIN EN 50155 (VDE 0115-200)

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Response value</th>
<th>Supply voltage U_s</th>
<th>LED display</th>
<th>Option “W”</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2…10 mA</td>
<td>DC 24 V</td>
<td>–</td>
<td>–</td>
<td>EDS440-S-1</td>
<td>B91080201</td>
</tr>
<tr>
<td></td>
<td>AC/DC 24…240 V</td>
<td>■</td>
<td></td>
<td>EDS440W-S-1</td>
<td>B91080201W</td>
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<tr>
<td>0.2…1 mA</td>
<td>DC 24 V</td>
<td>–</td>
<td>–</td>
<td>EDS441-S-1</td>
<td>B91080204</td>
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<tr>
<td></td>
<td>AC/DC 24…240 V</td>
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<td></td>
<td>EDS441W-S-1</td>
<td>B91080204W</td>
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<tr>
<td>10 mA</td>
<td>AC/DC 24…240 V</td>
<td>■</td>
<td>–</td>
<td>EDS440-LAF-4</td>
<td>B91080209</td>
</tr>
</tbody>
</table>

1) Absolute values

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plug kit, screw terminals</td>
<td>B91080901</td>
</tr>
<tr>
<td>Plug kit, push-wire terminals</td>
<td>B91080902</td>
</tr>
<tr>
<td>Mechanical accessories (terminal cover, 2 mounting clips)</td>
<td>B91080903</td>
</tr>
<tr>
<td>BB bus 4TE Connector</td>
<td>B98110002</td>
</tr>
</tbody>
</table>

1) included in the scope of delivery
2) included in the scope of delivery of EDS44x-S-4
Response time residual current measurement (IΔL) EDS44...-S DC 24 V
Supply voltage range
Power consumption, typically (DC via BB bus) EDS44...-S ≤ 1 W
Power consumption, typically 50 Hz (400 Hz) EDS44...-L ≤ 4 W/7 VA (≤ 4 W, 28 VA)
IΔL ) EDS440 2...10 mA
Response values
IΔn ) EDS44x (42...60 Hz) ±5 %
Relative uncertainty (UΔn) EDS441
Nominal system voltage
Measuring circuit
Response time for measuring current transformer monitoring max. 18 min
Hysteresis
Function none, alarm, device error, transformer connection fault, insulation fault location active, common alarm
Load resistance R ≤ 500 Ω/PR ≥ 0.25 W
Buzzer Number 1
Function none, alarm, device error, transformer connection fault, insulation fault location active, common alarm
Interfases Interface/protocol RS-485 | BS bus | Modbus RTU
Data rate Modbus RTU 9.6 | 19.2 | 37.4 | 57.6 | 115 kbaud/s
Cable length ≤ 1200 m
Cable: twisted pair, one end of shield connected to PE recommended: J-Y (50) Y min. 2 x 0.8
Connection RJ-11, X1, X3
Terminating resistor 120 Ω, can be activated internally
Device address, BS bus 0, 2…79 (optional 0, 2…159)
Terminating resistor 120 Ω
Connection X1.A, X1.B
Cable length ≤ 1200 m
Data rate Modbus RTU 9.6 | 19.2 | 37.4 | 57.6 | 115 kbaud/s
Cable length ≤ 1200 m
Cable: twisted pair, one end of shield connected to PE recommended: J-Y (50) Y min. 2 x 0.8
Connection RJ-11, X1, X3
Terminating resistor 120 Ω, can be activated internally
Device address, BS bus 0, 2…79 (optional 0, 2…159)
Digital inputs Number 2
Operating mode, adjustable active high, active low
Function none, test, reset
Voltage level Low DC -5...5 V, High DC 11...32 V
Digital current output Number 1
Function none, alarm, alarm, device error, current transformer connection fault, common alarm, BS bus malfunction
Current 0 mA DC inactive, 20 mA DC active
Tolerance ±10 %
Load resistance R ≤ 500 Ω/PR ≥ 0.25 W
Buzzers Number 1
Function none, alarm, alarm, device error, transformer connection fault, insulation fault location active, common alarm
LEDs ON (operation LED) green
SERVICE yellow
IΔn ALARM yellow
IΔL ALARM green
... 12 channel indication yellow

### Technical data

#### Insulation coordination acc. to IEC 60664-1/IEC 60664-3

<table>
<thead>
<tr>
<th>Definitions</th>
<th>Supply circuit (IC1)</th>
<th>A1, A2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output circuit 1 (IC2)</td>
<td>13, 14</td>
<td></td>
</tr>
<tr>
<td>Output circuit 2 (IC3)</td>
<td>23, 24</td>
<td></td>
</tr>
<tr>
<td>Control circuit (IC4)</td>
<td>(A1, A2), (13,14)-(23,24)-(00, X3)</td>
<td></td>
</tr>
<tr>
<td>Rated voltage category</td>
<td>III</td>
<td></td>
</tr>
<tr>
<td>Range of use</td>
<td>≤ 2000 m AMSL</td>
<td></td>
</tr>
<tr>
<td>Rated impulse voltage</td>
<td>4 kV</td>
<td></td>
</tr>
<tr>
<td>Rated insulation voltage</td>
<td>250 V</td>
<td></td>
</tr>
<tr>
<td>Rated degree outside (UΔn &lt; 690 V)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Rated degree outside (UΔn &gt; 690 V)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Protective separation (reinforced insulation) between</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage tests (routine test) acc. to IEC 61010-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IC1/(IC2-4)</td>
<td>AC 250 V</td>
<td></td>
</tr>
<tr>
<td>IC2/(IC3-4)</td>
<td>250 V</td>
<td></td>
</tr>
<tr>
<td>IC3/IC4</td>
<td>250 V</td>
<td></td>
</tr>
<tr>
<td>Pollution degree outside (UΔn &lt; 690 V)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Pollution degree outside (UΔn &gt; 690 V)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Protective separation (reinforced insulation) between</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage tests (routine test) acc. to IEC 61010-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IC2/(IC3-4)</td>
<td>AC 2.2 kV</td>
<td></td>
</tr>
<tr>
<td>IC3/IC4</td>
<td>AC 2.2 kV</td>
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</tr>
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</table>

#### Insulation fault locator

<table>
<thead>
<tr>
<th>Device address, BS bus</th>
<th>0, 2…79 (optional 0, 2…159)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Termination resistor</td>
<td>120 Ω, can be activated internally</td>
</tr>
<tr>
<td>Device address, BS bus</td>
<td>0, 2…79 (optional 0, 2…159)</td>
</tr>
</tbody>
</table>

#### Interfaces

<table>
<thead>
<tr>
<th>Interface/protocol</th>
<th>RS-485</th>
<th>BS bus</th>
<th>Modbus RTU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data rate Modbus RTU</td>
<td>9.6</td>
<td>19.2</td>
<td>37.4</td>
</tr>
<tr>
<td>Cable length</td>
<td>≤ 1200 m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable: twisted pair, one end of shield connected to PE</td>
<td>recommended: J-Y (50) Y min. 2 x 0.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>RJ-11, X1, X3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminating resistor</td>
<td>120 Ω, can be activated internally</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Device address, BS bus</td>
<td>0, 2…79 (optional 0, 2…159)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Technical data (continued)

**Switching elements**

| Number | 2 N/O contacts |
| Operating mode | N/C operation / N/O operation |
| Function contact 13, 14 | none, \( I_\Delta L \) alarm, \( I_\Delta n \) alarm, device error, current transformer connection fault, common alarm, BS bus malfunction |
| Function contact 23, 24 | none, \( I_\Delta L \) alarm, \( I_\Delta n \) alarm, device error, current transformer connection fault, common alarm, BS bus malfunction |

Electrical endurance under rated operating conditions: 30000 switching cycles

**Rated operational voltage** | AC 250 V |
| **Rated operational current** | 7 A |
| **Rated insulation voltage** | 4 kV |
| **Max. switching capacity** | 300 W/2270 VA |
| **Max. switching voltage** | DC 30 V/AC 227 V |

**Environment/EMC**

| **EMC** | IEC 61326-2-4 |

**Ambient temperatures**

| Operating temperature | -25...+55 °C |
| Transport | -40...+85 °C |
| Storage | -25...+70 °C |

**Classification of climatic conditions acc. to IEC 60721:**

- **Stationary use (IEC 60721-3-3)**: 3K23 (no condensation, no formation of ice)
- **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** | pluggable screw-type terminal or push-wire terminal |

**Screw-type terminals:**

| Tightening torque | 0.5...0.6 Nm (5...7 lb-in) |
| Conductor sizes | AWG 24-12 |
| Stripping length | 7 mm |
| rigid/flexible | 0.2...2.5 mm² |
| flexible with ferrule, with/without plastic sleeve | 0.25...2.5 mm² |
| Multiple conductor, rigid | 0.2...1.1 mm² |
| Multiple conductor, flexible | 0.2...1.5 mm² |
| Multiple conductor, flexible with ferrule without plastic sleeve | 0.25...1.1 mm² |
| Multiple conductor, flexible with TWIN ferrule with plastic sleeve | 0.5...1.5 mm² |

**Push-wire terminals:**

- **Conductor sizes**: AWG 24-16
- **Stripping length**: 10 mm
- **rigid/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

**Other**

**Operating mode** | continuous operation |
| Mounting | at an ambient temperature > 55 °C vertical mounting required |
| at an ambient temperature < 55 °C mounting optional |

| **Degree of protection internal components** | IP40 |
| **Degree of protection terminals** | IP20 |
| **DIN rail mounting acc. to** | IEC 60715 |
| **Screw fixing** | 2 x M4 with mounting clip |
| **Enclosure material** | polycarbonate |
| **Flammability class** | UL 94V-0 |
| **Dimensions (W x H x D)** | 72 x 93 x 63 |
| **Documentation number** | D00201 |
| **Weight** | approx. 122 g (EDS44x-S) approx. 242 g (EDS44x-L, ...-LAB, ...-LAF) |

**“W” option data deviating from the standard version**

Devices with the suffix “W” feature increased shock and vibration resistance. The electronics is covered with a special varnish to provide increased protection against mechanical stress and moisture.

**Ambient temperatures:**

| Operating temperature | -40...+70 °C |
| Transport | -40...+85 °C |
| Long-term storage | -25...+70 °C |

**Classification of climatic conditions acc. to IEC 60721:**

- **Stationary use (IEC 60721-3-3)**: 3K23 (condensation and formation of ice possible)

**Classification of mechanical conditions acc. to IEC 60721:**

- **Stationary use (IEC 60721-3-3)**: 3M11

1) ~ At a frequency > 200 Hz, the connection of X1 and k1-12/l1-12 must be insulated.

2) ~ Only 50/60 Hz are permitted for UL applications.

3) ~ Residual current effect of > 100 mA results in a greater relative uncertainty.
**Connection to the voltage supply**

\[ U_4 = \text{AC/DC 24...240 V} \]

**Connection of relays**

<table>
<thead>
<tr>
<th>Alarm relay 1</th>
<th>Alarm relay 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 N/O contact</td>
<td>23 N/O contact</td>
</tr>
<tr>
<td>14</td>
<td>24</td>
</tr>
</tbody>
</table>

**Connection to the X1 interface**

- I1: Input 1
- M+: Dig. current output
- I2: Input 2
- 1: Ground
- A: RS-485 A (input)
- A: RS-485 A (output)
- B: RS-485 B (input)
- B: RS-485 B (output)

**BS bus termination**

Activating a terminating resistor to define the first and the last device in the bus system.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>ON</td>
</tr>
</tbody>
</table>

**Connection to the k1-12/l1-12 interface**

- I1: Measuring CT 1
- k1
- I4: Measuring CT 4
- k4
- I2: Measuring CT 2
- k2
- ... : ... ...
- I3: Measuring CT 3
- k3
- I12: Measuring CT 12
- k12

Alarm relay 1

13 14

Alarm relay 2

23 24

First and last device in a bus

All devices between the first and the last device in the bus system.
Connection measuring current transformer CTAC..., WR..., WS... series

For insulation fault location, the measuring current transformers of the CTAC... (closed), WR... (rectangular) and WS... (split-core) series are used.

Connection of CTAF...SET series measuring current transformers to EDS440-LAF-4

For insulation fault location, the measuring current transformers of the CTAF...SET series are used.
For systems > 690 V and with overvoltage category III a fuse for the connection to the system to be monitored must be provided. Recommendation: 2A fuses.

* Communication between iso685-x-P and EDS44x-L only via BS bus (RS-485).

* Communication between iso685-x-P and EDS44x-L only via BS bus (RS-485).

* Communication between iso685-x-P and EDS44x-L only via BS bus (RS-485).
**Wiring diagram to AC system with iso685-D-P**

* Communication between iso685-x-P and EDS44x-L only via BS bus (RS-485).

**Connection example: iso685-D-P, EDS440-S and EDS440-L**

* Communication between iso685-x-P and EDS44x-L only via BS bus (RS-485).
ISOSCAN® EDS460/490 – EDS461/491
Insulation fault locators with control and display function for EDS systems (insulation fault location systems)

Device features
- Insulation fault location in IT systems
- For AC, 3AC, DC and IT systems
- Control and display function in a single device (EDS…-D)
- 12 measuring channels (circuits) for measuring current transformers of the CTAC, WR, WS series
- Up to 90 EDS insulation fault locators in the system (1080 measuring channels)
- Scanning time max. 10 s for all measuring channels (parallel scanning)
- Response sensitivity EDS460/490 2…10 mA, EDS461/491 0.2…1 mA
- History memory to store 300 events
- Two alarm relays with one changeover contact each
- N/O or N/C operation, selectable
- Connection external test/reset button
- Indication via graphical display resp. 7-segment display and alarm LEDs
- BMS address range 1…90
- Serial interface RS-485
- Continuous CT connection monitoring
- Fault memory behaviour selectable
- Device version EDS490/491 with one alarm contactor per channel
- Additional AC residual current measurement

Typical applications
- Insulation fault location in AC, AC/DC and DC IT systems
- Main and control circuits in industrial plants and ships
- Diode-decoupled DC IT systems in power stations
- Systems for medical locations

Approvals

Standards
Observe the applicable national and international standards. The EDS… series meets the requirements of the following equipment standards:
- IEC 60364-4-41
  Low-voltage electrical installations - Part 4-41: Protection for safety – Protection against electric shock;
- IEC 61557-9
  Electrical safety in low voltage distribution systems up to 1000 V a.c. and 1500 V d.c. - Equipment for testing, measuring or monitoring of protective measures - Part 9: Equipment for insulation fault location in IT systems

Further information
For further information refer to our product range on www.bender.de.

Ordering information EDS460/490-D, EDS461/491-D

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>Common alarm relay for all channels</th>
<th>Alarm relay per channel</th>
<th>Supply voltage ( U_s )</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDS-Funktion</td>
<td>RCM-Funktion</td>
<td>AC</td>
<td>DC</td>
<td>AC/DC</td>
<td></td>
</tr>
<tr>
<td>2…10 mA</td>
<td>100 mA…10 A</td>
<td>2 x 1 changeover contact</td>
<td>16…72 V, 42…460 Hz</td>
<td>EDS460-D-1</td>
<td>B91080001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>16…94 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>42…460 Hz</td>
<td>EDS460-D-2</td>
<td>B91080002</td>
</tr>
<tr>
<td>0.2…1 mA</td>
<td>10 mA…1 A</td>
<td>2 x 1 changeover contact</td>
<td>16…72 V, 42…460 Hz</td>
<td>EDS461-D-1</td>
<td>B91080005</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>16…94 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>42…460 Hz</td>
<td>EDS461-D-2</td>
<td>B91080006</td>
</tr>
<tr>
<td>2…10 mA</td>
<td>100 mA…10 A</td>
<td>2 x 1 changeover contact</td>
<td>16…72 V, 42…460 Hz</td>
<td>EDS490-D-1</td>
<td>B91080009</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>16…94 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>42…460 Hz</td>
<td>EDS490-D-2</td>
<td>B91080010</td>
</tr>
<tr>
<td>0.2…1 mA</td>
<td>10 mA…1 A</td>
<td>2 x 1 changeover contact</td>
<td>16…72 V, 42…460 Hz</td>
<td>EDS491-D-1</td>
<td>B91080013</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>16…94 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>42…460 Hz</td>
<td>EDS491-D-2</td>
<td>B91080014</td>
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</tbody>
</table>

1) Absolute values

Ordering information EDS460/490-L, EDS461/491-L

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>Common alarm relay for all channels</th>
<th>Alarm relay per channel</th>
<th>Supply voltage ( U_s )</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDS-Funktion</td>
<td>RCM-Funktion</td>
<td>AC</td>
<td>DC</td>
<td>AC/DC</td>
<td></td>
</tr>
<tr>
<td>2…10 mA</td>
<td>100 mA…10 A</td>
<td>2 x 1 changeover contact</td>
<td>16…72 V, 42…460 Hz</td>
<td>EDS460-L-1</td>
<td>B91080003</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>16…94 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>42…460 Hz</td>
<td>EDS460-L-2</td>
<td>B91080004</td>
</tr>
<tr>
<td>0.2…1 mA</td>
<td>10 mA…1 A</td>
<td>2 x 1 changeover contact</td>
<td>16…72 V, 42…460 Hz</td>
<td>EDS461-L-1</td>
<td>B91080007</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>16…94 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>42…460 Hz</td>
<td>EDS461-L-2</td>
<td>B91080008</td>
</tr>
<tr>
<td>2…10 mA</td>
<td>100 mA…10 A</td>
<td>2 x 1 changeover contact</td>
<td>16…72 V, 42…460 Hz</td>
<td>EDS490-L-1</td>
<td>B91080011</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>16…94 V</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
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<td>42…460 Hz</td>
<td>EDS490-L-2</td>
<td>B91080012</td>
</tr>
<tr>
<td>0.2…1 mA</td>
<td>10 mA…1 A</td>
<td>2 x 1 changeover contact</td>
<td>16…72 V, 42…460 Hz</td>
<td>EDS491-L-1</td>
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<td></td>
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<td>16…94 V</td>
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<td></td>
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<td></td>
<td>42…460 Hz</td>
<td>EDS491-L-2</td>
<td>B91080016</td>
</tr>
</tbody>
</table>

1) Absolute values
### Technical data

#### Insulation coordination acc. to IEC 60664-1/IEC 60664-3 for versions with a supply voltage of AC/DC 70...276 V/AC 42...460 Hz

- **Rated insulation voltage**: AC 250 V
- **Rated impulse voltage/pollution degree**: 6 kV/3
- **Technical data**

#### Insulation coordination acc. to IEC 60664-1/IEC 60664-3 for versions with a supply voltage of DC 16...94 V, AC 16...72 V/AC 42...460 Hz

- **Rated insulation voltage**: AC 100 V
- **Rated impulse voltage/pollution degree**: 2.5 kV/3

#### Voltage test acc. to IEC 61010-1

- **Voltage test**: 3.56 kV
- **Rated insulation voltage**: AC 250 V

#### Protective separation (reinforced insulation) between:

- (A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4, D1, D2, D3, D4, E1, E2, E3, E4, F1, F2, F3, F4, G1, G2, G3, G4, H1, H2, H3, H4, I1, I2, I3, I4, J1, J2, J3, J4, K1, K2, K3, K4, L1, L2, L3, L4, M1, M2, M3, M4, N1, N2, N3, N4, O1, O2, O3, O4, P1, P2, P3, P4, Q1, Q2, Q3, Q4, R1, R2, R3, R4, S1, S2, S3, S4, T1, T2, T3, T4, U1, U2, U3, U4, V1, V2, V3, V4, W1, W2, W3, W4, X1, X2, X3, X4, Y1, Y2, Y3, Y4, Z1, Z2, Z3, Z4)

#### Technical data

- **Temperature range**: -25...+55 °C
- **Operating principle**: NC or N/O operation (N/O operation)*

#### Outputs/inputs

- **Test/reset button**: internal/external
- **Connection**: EDS -measuring current transformer
- **Connection**: EDS -measuring current transformer

#### Interface

- **Interface/protocol**: RS-485/BMS
- **Baud rate**: 9.6 kbit/s
- **Cable length**: 0...1200 m

#### Ratings

- **Rated operational current (alarm relay)**: 2 A
- **Rated operational current (common alarm relays)**: 0.5 A
- **Rated operational current (alarm relay)**: 5 A

#### Classification of climatic conditions acc. to IEC 60721

- **Operating temperature**: -25...+55 °C
- **Classification**: Suitable for outdoor use.
- **Classification of climatic conditions acc. to IEC 60721**: 2K12
- **Classification of climatic conditions acc. to IEC 60721**: 2K12

#### Classification of mechanical conditions acc. to IEC 60721

- **Stationary use (IEC 60721-3-3)**: 3M11
- **Stationary use (IEC 60721-3-3)**: 3M11

#### Contact data acc. to IEC 60947-5-1

- **Rated operational voltage**: 230 V
- **Rated operational voltage**: 110 V

#### Classification of electrical conditions acc. to IEC 60664-1/IEC 60664-3

- **Rated operational voltage**: 230 V
- **Rated operational voltage**: 24 V

#### Rated impulse voltage/pollution degree

- **Rated impulse voltage/pollution degree**: 4.5 kV/3
- **Rated impulse voltage/pollution degree**: 4.5 kV/3

#### Technical data

- **Reference**: 1M12
- **Reference**: 1M12

#### Language

- **Language**: D, GB, F (GB)*
- **Language**: D, GB, F (GB)*

#### Password

- **Password**: off/0...999 (off)*
- **Password**: off/0...999 (off)*

#### History memory

- **History memory**: 300 data records (EDS4...-D)
- **History memory**: 300 data records (EDS4...-D)

#### LED display

- **LED display**: backlit graphical display (EDS4...-D)
- **LED display**: backlit graphical display (EDS4...-D)

#### Password

- **Password**: on/off (off)*
- **Password**: on/off (off)*

#### Operating principle

- **Operating principle**: NC or N/O operation (N/O operation)*
- **Operating principle**: NC or N/O operation (N/O operation)*

#### Number of measuring channels

- **Number of measuring channels**: 12/1080
- **Number of measuring channels**: 12/1080

#### Terminal connections

- **Terminal connections**: seeiso685-D-P (EDS460, EDS490)
- **Terminal connections**: seeiso685-D-P (EDS460, EDS490)

#### Measuring circuit

- **Measuring circuit**: seeiso685-D-P (EDS460, EDS490)
- **Measuring circuit**: seeiso685-D-P (EDS460, EDS490)

#### Measuring current transformers

- **Measuring current transformers**: pulsed DC sensitive
- **Measuring current transformers**: pulsed DC sensitive

#### Technical data

- **Technical data**: seeiso685-D-P (EDS460, EDS490)
- **Technical data**: seeiso685-D-P (EDS460, EDS490)
Technical data (continued)

<table>
<thead>
<tr>
<th>Connection</th>
<th>Description</th>
<th>EDS460-D/EDS461-D</th>
<th>EDS460-L/EDS461-L</th>
<th>EDS490-D/EDS491-D</th>
<th>EDS490-L/EDS491-L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection</td>
<td>screw-type terminals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>rigid/flexible</td>
<td>0.2…4/0.2…2.5 mm² (AWG 24…12)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>Multi-conductor connection (2 conductors with the same cross section): rigid/flexible</td>
<td>0.2…1.5/0.2…1.5 mm²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stripping length</td>
<td>8…9 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tightening torque</td>
<td>0.5…0.6 Nm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dimension diagrams (dimensions in mm)

Overview of device types

<table>
<thead>
<tr>
<th>Distinctive device features</th>
<th>EDS460-D/EDS461-D</th>
<th>EDS460-L/EDS461-L</th>
<th>EDS490-D/EDS491-D</th>
<th>EDS490-L/EDS491-L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response value</td>
<td>EDS460: 2…10 mA</td>
<td>EDS490: 2…10 mA</td>
<td>EDS461: 0.2…1 mA</td>
<td>EDS491: 0.2…1 mA</td>
</tr>
<tr>
<td>Residual current indication</td>
<td>EDS460: 100 mA…10 A</td>
<td>EDS490: 100 mA…10 A</td>
<td>EDS461: 10 mA…1 A</td>
<td>EDS491: 10 mA…1 A</td>
</tr>
<tr>
<td>Backlit graphics LC display</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>7-segment display and LED line</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Parameter setting function</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Error code indication</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Address range</td>
<td>1…I0</td>
<td>1…I0</td>
<td>1…I0</td>
<td>1…I0</td>
</tr>
<tr>
<td>Internal clock</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>History memory</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Alarm contact “Common alarm” for all channels</td>
<td>2 x 1 changeover contact</td>
<td>2 x 1 changeover contact</td>
<td>2 x 1 changeover contact</td>
<td>2 x 1 changeover contact</td>
</tr>
<tr>
<td>Alarm contact per channel</td>
<td>–</td>
<td>12 x 1 N/O contact</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Enclosure</td>
<td>XM460</td>
<td>XM490</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1 A1, A2 Supply voltage $U_s$ (see ordering information), 6 A fuse recommended; two-pole fuses should be used on IT systems. For UL and CSA applications, the use of 5 A fuses is mandatory.

2 k1, l...k12, l Connection of measuring current transformers 1…12

3 A, B BMS bus (RS-485 interface with BMS protocol)

4 R, R/T External reset button (N/O contact)*

5 T, R/T External test button (N/O contact)*

6 C11, C12, C14, C21, C22, C24 Common alarm relay K1: Alarm 1, common alarm for alarm or device error.

7 $R_{on/off}$ Activate or deactivate the BMS bus terminating resistor (120 Ω).

* The external test/reset buttons of several devices must not be connected to one another.
ISOSCAN® EDS150/EDS151
Insulation fault locator with integrated measuring current transformers for EDS systems

Device features
- Insulation fault location in AC, AC/DC and DC IT systems
- 6 measuring channels with measuring current transformer per EDS150/151
- Up to 528 measuring channels can be combined by the BMS bus in the IT system being monitored:
  - 88 x 6 measuring channels
- Response sensitivity EDS150: 5 mA, EDS151 0.5 mA
- A response time of up to 8 s in the AC system acc. to IEC 61557-9
- RS-485 interface with BMS protocol
- BMS address range 3…90
- Cyclical self test

Typical applications
- Insulation fault location in AC, AC/DC and DC IT systems
- DC main circuits in industrial plants, power stations and ships
- IT systems for medical locations and control circuits (EDS151)

Standards
The ISOSCAN® EDS150/151 series complies with the requirements of the device standards:
- IEC 61557-9

Further information
For further information refer to our product range on www.bender.de.

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>Response value</th>
<th>Supply voltage 1) ( U_s )</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
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<tbody>
<tr>
<td>EDS function</td>
<td>RCM function</td>
<td>AC</td>
<td>DC</td>
<td></td>
</tr>
<tr>
<td>5…25 mA</td>
<td>5 mA</td>
<td>10 A</td>
<td>17…24V/50…60Hz</td>
<td>14…28 V</td>
</tr>
<tr>
<td>0.5…2.5 mA</td>
<td>0.5 mA</td>
<td>1 A</td>
<td>14…28V</td>
<td>B91080101</td>
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</tbody>
</table>

1) Absolute values

Accessories

<table>
<thead>
<tr>
<th>Type designation</th>
<th>Art. No.</th>
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<tbody>
<tr>
<td>Mounting clip for DIN rail mounting</td>
<td>B91080110</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Voltage supply</th>
<th>Output voltage</th>
<th>Explanation</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply unit</td>
<td>AC 90…264 V/DC 120…370 V/47…63 Hz</td>
<td>DC 24 V, 420 mA</td>
<td>For the supply of max. 6 EDS15…</td>
<td>AN410</td>
<td>B924209</td>
<td>393</td>
</tr>
<tr>
<td></td>
<td>AC 230 V/50…60 Hz</td>
<td>AC 20 V, 500 mA</td>
<td>For the supply of max. 6 EDS15…</td>
<td>AN450</td>
<td>B924201</td>
<td>395</td>
</tr>
<tr>
<td></td>
<td>AC 127 V/50…60 Hz</td>
<td>AC 20 V, 500 mA</td>
<td>For the supply of max. 6 EDS15…</td>
<td>AN450-133</td>
<td>B924203</td>
<td>395</td>
</tr>
</tbody>
</table>

According to IEC 60364-7-710 only power supply units providing “Safe separation” (reinforced insulation) may be used for the supply voltage between the primary and secondary side. All power supply units listed above comply with this requirement!
**Technical data**

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**
- Rated insulation voltage: AC 250 V
- Rated impulse voltage/pollution degree: 6 kV/3

**Voltage ranges**

**IT system being monitored:**
- Nominal system voltage $U_n$ see Locating current injector (e.g. ISOMETER® iso685-D-P) (EDS150): AC 20…276 V, DC 20…308 V (EDS151)
- Nominal frequency $f_n$: 42…460 Hz

**Supply voltage:**
- Supply voltage $U_s$: AC 17…24 V, DC 14…28 V
- Frequency range of the supply voltage: 50…60 Hz
- Power consumption AC: ≤ 3 VA
- Power consumption DC: ≤ 1.5 VA

**Measuring circuit**
- Number of measuring channels (per device/system): 6/528

**EDS function:**
- Response value: EDS150: 5 mA, EDS151: 0.5 mA
- Relative uncertainty: ±30 %
- Rated frequency: 42…460 Hz
- Measuring range EDS function: EDS150: 5…25 mA, EDS151: 0.5…2.5 mA
- Response time in the AC system acc. to IEC 61557-9: ≤ 8 s

**RCM function:**
- Response value: EDS150: 10 A, EDS151: 1 A
- Relative uncertainty: ±30 %
- Frequency range: 42…68 Hz

**Displays**
- LEDs:
  - ON/COM, green: operation indicator/bus activity
  - Alarm K1…K6, yellow: EDS and RCM function

**Interface**
- Interface/protocol: RS-485/BMS
- Connection terminals A/B
- Cable (twisted pair, one end of shield connected to PE): two-core, recommended: J-Y(St)Y min. 2x0.8
- Cable length: ≤ 1200 m
- Terminating resistor: 120 Ω (0.25 W)
- Device address, BMS bus: 3…90 (3)*

**Environment/EMC**
- EMC: IEC 61326-2-4
- Operating temperature: -25…+55 °C

**For UL application:**
- Maximum ambient temperature: 55 °C

**Classification of climatic conditions acc. to IEC 60721:**
- Stationary use (IEC 60721-3-3): 3K23 (except condensation and formation of ice)
- Transport (IEC 60721-3-2): 2K11 (except condensation and formation of ice)
- Long-term storage (IEC 60721-3-1): 1K22 (except condensation and formation of ice)

**Classification of mechanical conditions acc. to IEC 60721:**
- Stationary use (IEC 60721-3-3): 3M11
- Transport (IEC 60721-3-2): 2M4
- Storage (IEC 60721-3-1): 1M12

**Connection**
- Connection type: pluggable push-wire terminal

**Other**
- Operating mode: continuous operation
- Position of normal use: any
- Enclosure material: polycarbonate
- Flammability class: UL94 V-0
- Screw mounting: 2 x M6
- Tightening torque: 1.5 Nm
- Multi-conductor connection (2 conductors of the same cross section):
  - rigid: 0.2…1.5 mm² (AWG 24…16)
  - 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
- 3 * = factory setting

**Documentation number**
- EDS150: D00106
- EDS151: D00107

**Weight**
- ≤ 340 g

---

**Dimension diagrams (dimensions in mm)**

---
<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Transformer for the IT system to be monitored</td>
</tr>
<tr>
<td>2</td>
<td>Circuit breakers for the circuits</td>
</tr>
<tr>
<td>3</td>
<td>AN410 for DC 24 V supply voltage</td>
</tr>
<tr>
<td>4</td>
<td>Alarm indicator and test combination MK2430 for indication of alarm messages from the EDS150/151 (BMS master)</td>
</tr>
<tr>
<td>5</td>
<td>Insulation monitoring devices with locating current injector for insulation fault location systems</td>
</tr>
<tr>
<td>6</td>
<td>Insulation fault locator EDS150/151 with integrated measuring current transformers</td>
</tr>
<tr>
<td>7</td>
<td>Supply voltage $U_s$, DC 24 V</td>
</tr>
<tr>
<td>8</td>
<td>Serial interface BMS</td>
</tr>
<tr>
<td>9</td>
<td>Terminating resistor BMS bus (120 Ω, internally connected)</td>
</tr>
<tr>
<td>10</td>
<td>Terminating resistor BMS bus</td>
</tr>
</tbody>
</table>

**Wiring diagrams**

1. Transformer for the IT system to be monitored
2. Circuit breakers for the circuits
3. AN410 for DC 24 V supply voltage
4. Alarm indicator and test combination MK2430 for indication of alarm messages from the EDS150/151 (BMS master)
5. Insulation monitoring devices with locating current injector for insulation fault location systems
6. Insulation fault locator EDS150/151 with integrated measuring current transformers
7. Supply voltage $U_s$, DC 24 V
8. Serial interface BMS
9. Terminating resistor BMS bus (120 Ω, internally connected)
10. Terminating resistor BMS bus
**ISOSCAN® EDS30...**
Portable equipment for insulation fault location for unearthed and earthed systems (IT and TN systems) to be used in conjunction with or without equipment for insulation fault location

**Device features**
- Portable insulation fault location systems for IT systems AC 0...790 V/DC 0...960 V/42...460 Hz or de-energised systems
- Residual current measurement in TN/TT systems
- Use in main and control circuits, photovoltaic systems
- Measuring clamps 20/52 mm (115 mm optional)
- Robust aluminium case, convenient to carry
- Locating current injectors PGH18… with variable locating current 1…25 mA
- Integrated locating voltage for de-energised systems (PGH186)

**Typical applications**
- IT systems with or without an incorporated equipment for insulation fault location (EDS)

**Insulation fault locator EDS195PM**
- Backlit LC display, 3 x 16 characters
- Measuring clamps 20/52 mm included in the scope of delivery
- Accumulator (delivered with a power supply unit)
- Response value insulation fault location 2…10 mA for main circuits
- Response value insulation fault location 0.2…1 mA for control circuits
- Response value residual current measurement 10 mA…10 A
- Selectable operating mode insulation fault location/residual current measurement

**Standards**
The ISOSCAN® EDS30… series complies with the requirements of the device standards:

**Ordering information**
For further information refer to our product range on www.bender.de.

**Main circuits**
- EDS440
- EDS3090
- EDS3091
- EDS3092
- EDS3096

**Control circuits**
- EDS441
- EDS195PM

**Nominal voltage U_n**
- AC
- DC

<table>
<thead>
<tr>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSA165</td>
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<tr>
<td>AGE185</td>
<td>B980905</td>
<td>170</td>
</tr>
<tr>
<td>EDS165-SET</td>
<td>B9102007</td>
<td>--</td>
</tr>
</tbody>
</table>

**Supply voltage U_s**
- AC
- DC

<table>
<thead>
<tr>
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<td>EDS3090PG-13</td>
<td>B91082022</td>
</tr>
<tr>
<td>EDS3093PG</td>
<td>B91082025</td>
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<td>EDS3093PV</td>
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<td>B91082030</td>
</tr>
<tr>
<td>EDS3093PV</td>
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</table>

**Scope of delivery**

<table>
<thead>
<tr>
<th>Insulation fault locator</th>
<th>Locating current injector</th>
<th>Measuring clamps 20 mm</th>
<th>Measuring clamps 52 mm</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDS195PM</td>
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<td>PSA1020</td>
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<td>PSA1020</td>
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</tr>
<tr>
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<td>PSA3320</td>
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<td>EDS195PM</td>
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<td>EDS195PM</td>
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<tr>
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<td>2 x PSA1052</td>
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</tr>
</tbody>
</table>

**Further information**
For further information refer to our product range on www.bender.de.

**Typical applications**
- IT systems with or without an incorporated equipment for insulation fault location (EDS)

**Approvals**

**Equipment for insulation fault location**
Portable equipment for insulation fault location ISOSCAN® EDS30…

**Device features**
- Portable insulation fault location systems for IT systems AC 0…790 V/DC 0…960 V/42…460 Hz or de-energised systems
- Residual current measurement in TN/TT systems
- Use in main and control circuits, photovoltaic systems
- Measuring clamps 20/52 mm (115 mm optional)
- Robust aluminium case, convenient to carry
- Locating current injectors PGH18… with variable locating current 1…25 mA
- Integrated locating voltage for de-energised systems (PGH186)

**Insulation fault locator EDS195PM**
- Backlit LC display, 3 x 16 characters
- Measuring clamps 20/52 mm included in the scope of delivery
- Accumulator (delivered with a power supply unit)
- Response value insulation fault location 2…10 mA for main circuits
- Response value insulation fault location 0.2…1 mA for control circuits
- Response value residual current measurement 10 mA…10 A
- Selectable operating mode insulation fault location/residual current measurement

**Standards**
The ISOSCAN® EDS30… series complies with the requirements of the device standards:

**Further information**
For further information refer to our product range on www.bender.de.

**Ordering information**
For further information refer to our product range on www.bender.de.

**Main circuits**
- EDS440
- EDS3090
- EDS3091
- EDS3092
- EDS3096

**Control circuits**
- EDS441
- EDS195PM

**Nominal voltage U_n**
- AC
- DC

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**Supply voltage U_s**
- AC
- DC

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<tr>
<th>Insulation fault locator</th>
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<tr>
<td>EDS195PM</td>
<td>--</td>
<td>2 x PSA1052</td>
<td>PSA1052</td>
<td>EDS3093PV</td>
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</tbody>
</table>
### Technical data EDS309...system

The technical data listed in this chapter apply to the components: PGH18..., EDS195PM, AGH185.

#### Environment/EMC

<table>
<thead>
<tr>
<th>EMC</th>
<th>IEC 61326-2-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>-10...+55 °C</td>
</tr>
</tbody>
</table>

#### Classification of climatic conditions acc. to IEC 60721

| Stationary use (IEC 60721-3-3) | 3K23 (except condensation and formation of ice) |
| Transport (IEC 60721-3-2) | 2K11 (except condensation and formation of ice) |
| Storage (IEC 60721-3-1) | 1K22 (except condensation and formation of ice) |

#### Classification of mechanical conditions acc. to IEC 60721

| Stationary use (IEC 60721-3-3) | JM11 |
| Transport (IEC 60721-3-2) | 2M4 |
| Long-time storage (IEC 60721-3-1) | 1M12 |

#### Technical data EDS309

<table>
<thead>
<tr>
<th>Environment/EMC</th>
<th>Operating temperature: -10...+55 °C</th>
</tr>
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<tbody>
<tr>
<td>Stationary use</td>
<td>3K23 (except condensation and formation of ice)</td>
</tr>
<tr>
<td>Transport</td>
<td>2K11 (except condensation and formation of ice)</td>
</tr>
<tr>
<td>Storage</td>
<td>1K22 (except condensation and formation of ice)</td>
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</tbody>
</table>

#### Technical data PGH18...

### Insulation coordination acc. to IEC 60664-1/IEC 60664-3

- **Rated insulation voltage**: AC 500 V
- **Rated impulse withstand voltage**: AC 500 V

#### Nominal system voltage $U_{n}$

- **PGH183**: AC 20...265 V 42...460 Hz, DC 20...308 V
- **PGH185**: 3AC/AC 20...575 V 42...460 Hz, DC 20...504 V
- **PGH186**: 3AC/AC 0...575 V 42...460 Hz, DC 0...504 V

#### Measuring circuit insulation fault location

- **Nominal system voltage**: conductors uninsulated, including measuring clamp up to 600 V
- **Rated frequency**: DC, 42...2000 Hz

#### Main circuit ($I_{max} = 50 mA$)

- **Measuring range**: 2 mA...50 mA
- **Measuring clamps**: PSA3020, PSA3052, PSA3165
- **Response value $I_{R}$, adjustable**: 2...10 mA (5 mA)*
- **Relative uncertainty**: ±30 %/±2 mA of the reference value

#### Control circuit ($I_{max} = 5 mA$)

- **Measuring range**: 0.2 mA...5 mA
- **Measuring clamps**: PSA3320, PSA3352
- **Response value $I_{R}$, adjustable**: 0.2...1.0 mA (0.5 mA)*
- **Relative uncertainty**: ±30 %/±0.2 mA of the reference value

#### Measuring circuit residual current

- **with measuring clamps**: PSA3020, PSA3052, PSA3165
- **Measuring range**: 5 mA...10 A (crest factor up to 3)
- **Response value $I_{R}$, adjustable**: 10 mA...10 A (100 mA)*
- **Frequency range**: 42...1000 Hz
- **Relative uncertainty**: ±30 %/±2 mA of the reference value
- **Hysteresis**: ±20 %
- **Harmonics, adjustable**: 1st to 8th harmonic component

#### Connection

- **Type of connection measuring clamp**: BNC plug
- **Power supply unit (DC 5 V)**: µUSB plug

#### Indication

- **LCD**: 3 x 16 characters, selectable illumination
- **LED**: Alarm

#### Other

- **Degree of protection, internal components DIN EN 60529 (VDE 0470-1)**: IP40
- **Protection class acc. to IEC 60947-1, DIN EN 60947-1 (VDE 0660-100)**: Class III
- **Enclosure material**: ABS plastic
- **Flammability class**: UL94 V-0
- **Dimensions WxHxD**: 84 x 197 x 30 mm
- **Weight**: ≤ 350 g

(“*” = Factory settings)
**Technical data measuring clamps**

**Electrical safety**
- **Standard**: IEC 61010-2-030
- **Pollution degree**: 2
- **Installation category**: III
- **Operating voltage**: 600 V
- **Nominal insulation voltage**: AC 600 V CAT III resp. AC 300 V CAT IV

**Transmission ratio**
- **PSA30…**: 10 A/10 mA
- **PSA31…**: 1 A/0.1 mA
- **PSA3165**: 10 A/10 mA

**Other**
- **Degree of protection, internal components DIN EN 60529 (VDE 0470-1)**: IP40
- **Protection class acc. to IEC 60947-1, DIN EN 60947-1 (VDE 0660-100)**: Class III
- **Test port**: BNC plug
- **Dimensions PSA3052/3352**: 216 x 111 x 45 mm
- **Dimensions PSA3020/3320**: 135 x 65 x 30 mm
- **Dimensions PSA3165**: 285 x 179 x 45 mm
- **Permissible cable diameter PSA3052/3352**: 52 mm
- **Permissible cable diameter PSA3052/3320**: 20 mm
- **Permissible cable diameter PSA3165**: 115 mm
- **Weight PSA3052/3352**: ≤ 700 g
- **Weight PSA3020/3320**: ≤ 300 g
- **Weight PSA3165**: ≤ 1300 g

**Technical data AGE185**

**Insulation coordination acc. to IEC 60664-1**
- **Rated insulation voltage**: AC 1000 V
- **Rated impulse voltage/pollution degree**: 4 kV/3
- **Nominal system voltage $U_{n}$**: 3AC, AC 500…790 V, DC 400…960 V/42…460 Hz

**Other**
- **Degree of protection, internal components DIN EN 60529 (VDE 0470-1)**: IP30
- **Type of connection/cable**: safety plug with green-yellow connecting wire 1 mm²
- **Weight**: ≤ 400 g
- **Dimensions W x H x D**: 84 x 197 x 30 mm
- **Weight**: ≤ 200 g
- **Dimensions W x H x D**: 88.5 x 42 x 21 mm

---

**Dimension diagram PSA3020/3320 (dimensions in mm)**

**Dimension diagram PSA3052/3352 (dimensions in mm)**

**Dimension diagram PSA3165 (dimensions in mm)**

**Dimension diagram aluminium case (dimensions in mm)**
Operating elements EDS195PM

1. Micro USB connection for charging the device's rechargeable battery
2. BNC connection for the measuring clamp
3. LC display, backlit, 3 lines à 16 characters
4. LED "ALARM", lights when the response value is exceeded
5. Button for the selection of the operating mode:
   - $I_{DS}$ = insulation fault location in IT systems (EDS mode)
   - $I_{DN}$ = residual current measurement in TN-S systems in (RCM mode)
6. Button for transformer selection
   - for $I_{max} = 50$ mA:
     - P20 = PSA3020
     - PS2 = PSA3052
     - P165 = PSA3165
   - for $I_{max} = 5$ mA:
     - W/WR = CTAC…/WR… = CTAC…
     - WS = WS… = CTAC…
7. "INFO" button: – device type – software version – current response values $I_{DS}$ and $I_{DN}$ – setup status
   - ESC button: to exit the menu function without changing parameters
8. "MENU" button: to toggle between the standard display and the menu selection
9. On-Off button
10. "HOLD" button: to store the currently indicated measured value
    - Arrow up button: Parameter changes, scroll
11. "RESET" button: fault memory acknowledgement
    - Arrow down button: Parameter changes, scroll
12. Illumination button: to switch on the display lighting
Equipment for insulation fault location EDS3090/3091PG for use in unearthed systems (IT systems) without a permanently installed equipment for insulation fault location

Typical applications

Residual current measurement with EDS309… in earthed systems (TN-S systems)

Equipment for insulation fault location EDS3096PG in de-energised systems (IT systems) (Note: TN-S system with all poles disconnected)
Insulation fault location system EDS3096PV in unearthed photovoltaic systems (IT systems)

Insulation fault location system EDS3090/3091 in unearthed systems (IT systems) with permanently installed equipment for insulation fault location EDS
Device selection for IT systems with integrated equipment for insulation fault location

<table>
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<tr>
<th>Type of distribution system</th>
<th>AC, DC, AC/DC (mixed systems)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application range</td>
<td>Main circuits or Control circuits</td>
</tr>
</tbody>
</table>

Insulation monitoring device ISOMETER®/Locating current injector PGH

<table>
<thead>
<tr>
<th>Type</th>
<th>iso685-x-P</th>
<th>isonx1685xP</th>
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</thead>
<tbody>
<tr>
<td>Nominal system voltage $U_n$</td>
<td>AC 0…690 V, DC 0…1000 V</td>
<td>isoL1685DP: AC 0…690 V, DC 0…1000 V</td>
</tr>
<tr>
<td>Locating current $I_L$</td>
<td>1/1.8/2.5/5/10/25/50 mA</td>
<td>1/2.5/5/10/25/50 mA</td>
</tr>
<tr>
<td>Response values</td>
<td>1 kΩ…10 MΩ</td>
<td>isoL1685DP: 20 kΩ…100 kΩ, iso1685DP: 200 kΩ…1 MΩ</td>
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<tr>
<td>LC display</td>
<td>graphic display</td>
<td>graphic display</td>
</tr>
<tr>
<td>Alarm relay</td>
<td>2 changeover contacts</td>
<td>3 changeover contacts</td>
</tr>
<tr>
<td>Interface/protocol</td>
<td>RS-485 (BS)</td>
<td>RS-485 (BS)</td>
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<tr>
<td>Address range</td>
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<td>1…90</td>
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</table>

**Insulation fault locator**

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<thead>
<tr>
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<th>EDS195PM</th>
</tr>
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<tbody>
<tr>
<td>LC display</td>
<td>3 x 16 characters</td>
</tr>
<tr>
<td>Evaluating current $I_{\Delta L}$</td>
<td>0.2…50 mA</td>
</tr>
<tr>
<td>Response value</td>
<td>0.2…1/2…10 mA selectable</td>
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</table>

**Messzangen**

<table>
<thead>
<tr>
<th>Type</th>
<th>PSA3020</th>
<th>PSA3052</th>
<th>PSA3165 (optional)</th>
<th>PSA3320</th>
<th>PSA3352</th>
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</thead>
<tbody>
<tr>
<td>20 mm</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>52 mm</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>115 mm</td>
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**Complete systems**

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<th>EDS3091</th>
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<tr>
<td>Comprising</td>
<td>Aluminium case, EDS195PM, PSA3020, PSA3052, power supply unit</td>
<td>Aluminium case, EDS195PM, PSA3020, PSA3052, power supply unit</td>
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</table>
### Device selection for IT systems without a permanently installed equipment for insulation fault location

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<tr>
<th>Application</th>
<th>Main circuit</th>
<th>Control circuit</th>
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<td>offline</td>
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#### Locating current injector PGH

<table>
<thead>
<tr>
<th>Nominal system voltage $U_n$</th>
<th>3AC, AC 20…75 V DC 20…504 V</th>
<th>3AC, AC 0…75 V DC 0…504 V</th>
<th>AC 20…265 V, DC 20…308 V</th>
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</thead>
<tbody>
<tr>
<td>$U_{e}$, AC 230 V</td>
<td>PGH185</td>
<td>PGH186</td>
<td>PGH183</td>
</tr>
<tr>
<td>$U_{e}$, AC 90…132 V</td>
<td>PGH185-13</td>
<td>PGH186-13</td>
<td>PGH183-13</td>
</tr>
</tbody>
</table>

| Locating current $I_{L, \text{max.}}$ | 10/25 mA | 10/25 mA | 1/2.5 mA |

#### Insulation fault locator

<table>
<thead>
<tr>
<th>Type</th>
<th>EDS195PM</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC display</td>
<td>3 x 16 characters</td>
</tr>
<tr>
<td>Evaluating current $I_{L,L}$</td>
<td>0.2…50 mA</td>
</tr>
<tr>
<td>Response value</td>
<td>0.2…1/2…10 mA selectable</td>
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#### Measuring clamps

<table>
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<tr>
<th>Type</th>
<th>PSA3020</th>
<th>PSA3032</th>
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<tbody>
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<td>52 mm</td>
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<td>115 mm</td>
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</table>

#### Components EDS309...

<table>
<thead>
<tr>
<th>Device type</th>
<th>Aluminium case with carrying handle</th>
<th>Operating manual</th>
<th>Insulation fault locator</th>
<th>Clamping connector on 4 mm</th>
<th>Adapter PK 3/8&quot;, C1, optional</th>
<th>Plug power supply for EDS195PM</th>
<th>Locating current injector</th>
<th>Supply cable for PGH18...</th>
<th>Safety measuring cable, black</th>
<th>Safety measuring cable, green</th>
<th>Safety measuring cable, yellow</th>
<th>Safety measuring cable, grey</th>
<th>Measuring clamps 20 mm</th>
<th>Measuring clamps 52 mm</th>
<th>Measuring clamps 115 mm, optional</th>
<th>EDS-Ski set, optional</th>
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<tbody>
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<td>PSA3020</td>
<td>PSA3032</td>
<td>PSA3165 (optional)</td>
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</tbody>
</table>
Coupling device AGE185

Typical applications
• Monitoring of AC IT systems of up to 790 V and DC IT systems of up to 960 V

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage $U_s$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC, 3(N)AC 500…790 V</td>
<td>AGE185</td>
<td>B980305</td>
</tr>
<tr>
<td>DC 400…960 V</td>
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</tbody>
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Wiring diagram

Locating current injector PGH185 and coupling device AGE185
Residual current monitoring systems
LINETRAXX®

Neutral Grounding Resistor Monitor (NGR)
LINETRAXX®

Charge Controller

Power Quality and Energy Measurement
LINETRAXX®

Measuring and monitoring relays
LINETRAXX®

System components
- Coupling devices
- Measuring current transformers
- Transformers
- Relay modules
- Power supply units
- Measuring instruments
- Interface converters
- Interface repeaters
- COMTRAXX® Gateways
- COMTRAXX® Alarm indicator and test combinations
- COMTRAXX® condition monitors
- Visualisation

Switching equipment
ATICS® transfer switching and monitoring devices

Test systems
UNIMET® Safety analyser

Annex
- Technical terms
- Alphabetical list of devices
- Service
# Device overview residual current monitors LINETRAXX®

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<th>179</th>
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<th>185</th>
<th>192</th>
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<td>Special applications</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>Monitoring of final circuits, DGUV Regulation 3 (German Social Accident Insurance)</td>
</tr>
<tr>
<td>Type of electrical system</td>
<td>TN/TT</td>
<td>IT</td>
<td>–</td>
<td>–</td>
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<tr>
<td>Residual currents</td>
<td>–</td>
<td>–</td>
<td>–</td>
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</tr>
<tr>
<td>Rated frequency range</td>
<td>42…2000 Hz</td>
<td>0…2000 Hz</td>
<td>0…2000 Hz</td>
<td>0…2000 Hz</td>
<td>0…1000 Hz</td>
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<tr>
<td>Number of measuring channels</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>12 (per device) 1080 (per system)</td>
<td>6 virtual 12</td>
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<tr>
<td>Response value ( I_{\text{an1}} )</td>
<td>50…100 % ( \times I_{\text{an2}} )</td>
<td>50…100 % ( \times I_{\text{an2}} )</td>
<td>50…100 % ( \times I_{\text{an2}} )</td>
<td>10…100 % ( \times I_{\text{an2}} ) min. 5 mA</td>
<td>50…100 % ( \times I_{\text{an2}} )</td>
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<td>Response delay ( t_{\text{an}} )</td>
<td>10 mA…10 A</td>
<td>10…500 mA</td>
<td>30 mA…3 A</td>
<td>10 mA…10 A (Type AB) 6 mA…20 A (Type A)</td>
<td>3…300 mA (Type B) 3…300 mA (BC)</td>
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<tr>
<td>Start-up delay</td>
<td>0…10 s</td>
<td>0…10 s</td>
<td>0…10 s</td>
<td>0…99 s</td>
<td>0…600 s</td>
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<td>Delay on release ( t_{\text{off}} )</td>
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<td>0…99 s</td>
<td>0…99 s</td>
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<td>0…600 s</td>
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<td>Operating principle, alarm relays</td>
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<td>N/C operation or N/O operation</td>
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<th>Suitable system components</th>
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<tr>
<td>Measuring current transformers</td>
</tr>
<tr>
<td>CTUB100</td>
</tr>
<tr>
<td>WR…5/J</td>
</tr>
<tr>
<td>CTBS25</td>
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<tr>
<td>WF…</td>
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<tr>
<td>RS-485 repeater</td>
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<td>Power supply units</td>
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<tr>
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</table>

**Residual current monitoring systems | Device overview**

01/2021
### Fault current monitoring of electric vehicle AC charging stations

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<td><strong>Fault current monitoring of electric vehicle AC charging stations</strong></td>
<td>Additional protection (MRCD applications)</td>
<td>Additional protection (MRCD applications)</td>
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</tr>
<tr>
<td>0…2000 Hz</td>
<td>0…2000 Hz</td>
<td>DC…10000 Hz</td>
<td>DC…10000 Hz</td>
<td>DC…10000 Hz</td>
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<tr>
<td>1 (RCMB422EC) or 2 (RCMB422EC)</td>
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<tr>
<td>DC 6 mA</td>
<td>50…100 % Von Iq2</td>
<td>50…100 % x Iq2</td>
<td>50…100 % x Iq2</td>
<td>50…100 % x Iq2</td>
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<tr>
<td>RMS 30 mA</td>
<td>30 mA…3 A</td>
<td>30 mA…3 A</td>
<td>30 mA…3 A</td>
<td>30…500 mA</td>
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<tr>
<td>–</td>
<td>0…10 s</td>
<td>0 s…60 min</td>
<td>50 ms…60 min</td>
<td>50 ms…60 min</td>
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<tr>
<td>–</td>
<td>1 s</td>
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<td>0 s…60 min</td>
<td>0 s…60 min</td>
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<tr>
<td>2 s (after reset)</td>
<td>–</td>
<td>0 s…60 min</td>
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<td>Ruhestrom</td>
<td>N/C operation or N/O operation</td>
<td>N/C operation or N/O operation</td>
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<td>partly</td>
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<td>RTU</td>
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### Suitable system components

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# Device overview residual current monitors LINETRAXX®

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<tr>
<td><strong>Type of distribution system</strong></td>
<td>TN/TT</td>
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<tr>
<td><strong>Rated frequency range</strong></td>
<td>0…2000 Hz</td>
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<td>DC…2000 Hz</td>
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<td><strong>Number of measuring channels</strong></td>
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<td>–</td>
<td>–</td>
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</tr>
<tr>
<td><strong>Response value</strong></td>
<td>DC 6 mA (RCMB104-1) r.m.s. 5 mA (RCMB104-2)</td>
<td>–</td>
<td>3,5…100 mA (DC)</td>
<td>3,5…100 mA (DC)</td>
<td>3,5…100 mA (DC)</td>
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<tr>
<td><strong>Response delay t&lt;sub&gt;on&lt;/sub&gt;</strong></td>
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</tr>
<tr>
<td><strong>Start-up delay t&lt;sub&gt;s&lt;/sub&gt;</strong></td>
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<td>–</td>
<td>–</td>
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<td><strong>Delay on release t&lt;sub&gt;off&lt;/sub&gt;</strong></td>
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<tr>
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<tr>
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<td>–</td>
</tr>
<tr>
<td><strong>BMS</strong></td>
<td>–</td>
<td>–</td>
<td>–</td>
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<tr>
<td><strong>Modbus</strong></td>
<td>–</td>
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<tr>
<td><strong>BMS</strong></td>
<td>–</td>
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<tr>
<td><strong>Product details</strong></td>
<td>(Products on <a href="http://www.bender.de/en">www.bender.de/en</a>)</td>
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## Suitable system components

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<thead>
<tr>
<th>Type</th>
<th>C.p.</th>
<th>Suitable system components</th>
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<td><strong>Measuring current transformers</strong></td>
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<td>CUB…</td>
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<td>CTUB100</td>
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<td>WS…</td>
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<tr>
<td>WE…</td>
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<td><strong>Power supply units</strong></td>
<td>STEP-PS</td>
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</table>
Residual current monitoring systems | Device overview

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<tr>
<th>Type of distribution system</th>
<th>Residual currents</th>
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<tbody>
<tr>
<td>TN/TT</td>
<td>0…2000 Hz</td>
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<td>IT</td>
<td>0…2000 Hz</td>
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<thead>
<tr>
<th>Rated frequency range</th>
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<tbody>
<tr>
<td>DC</td>
<td>0…2000 Hz</td>
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<tr>
<td>DC</td>
<td>0…2000 Hz</td>
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| Number of measuring channels | –                  |

<table>
<thead>
<tr>
<th>Response value</th>
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<tbody>
<tr>
<td>lΔn1</td>
<td>DC 6 mA (RCMB104-1)</td>
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<tr>
<td>r.m.s. lΔn2</td>
<td>r.m.s. 30 mA (RCMB104-1)</td>
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<thead>
<tr>
<th>Response delay t_on</th>
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<tr>
<td>Start-up delay t</td>
<td>–</td>
</tr>
<tr>
<td>Delay on release t_off</td>
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| Operating principle, alarm relays | –                  |

<table>
<thead>
<tr>
<th>Installation</th>
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<tbody>
<tr>
<td>DIN rail</td>
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<th>Interfaces</th>
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<td>BMS</td>
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<td>Modbus</td>
<td>RTU – RTU</td>
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<td>CTAC…</td>
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<td>CTUB100</td>
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<td>CTBS25</td>
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<td>WS…</td>
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<tr>
<td>WF…</td>
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<tr>
<td>RS-485</td>
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<tr>
<td>STEP-PS</td>
<td>390</td>
</tr>
<tr>
<td>Dl-1DL</td>
<td>398</td>
</tr>
</tbody>
</table>

3
LINETRAXX® RCM420
Residual current monitor for AC current monitoring in TN and TT systems

**Device features**
- AC and pulsed DC sensitive residual current monitor Type A according to IEC 62020
- r.m.s. value measurement (AC)
- Two separately adjustable response values
- Frequency range 42...2000 Hz
- Start-up delay, response delay and delay on release
- Restart function
- Digital measured value display via LC display
- Measured value memory for operating value
- CT connection monitoring
- LEDs: Power On, Alarm 1, Alarm 2
- Internal/external test/reset button
- Two separate alarm relays (one changeover contact each)
- N/O or N/C operation and fault memory behaviour selectable
- Password protection for device setting
- Device self monitoring
- Sealable transparent cover
- Internal/external test/reset button
- Two-module enclosure (36 mm)
- RoHS compliant
- Push-wire terminal (two terminals per connection)

**Typical applications**
- Residual current monitoring in earthed 2, 3 or 4-conductor systems
- Current monitoring of, in the normal case, de-energised single conductors
- Socket-outlet circuits for devices which are operated unattended for a long time and which may not fail
- Alarm systems, safety devices
- Air conditioning systems, EDP systems
- Cooling equipment with valuable frozen goods
- Canteen kitchens
- Monitoring of earthed power supplies for stray currents
- Impact on N conductors
- Trace heating systems

**Approvals**

**Further information**
For further information refer to our product range on www.bender.de.

**Ordering information**

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<th>Supply voltage U_s</th>
<th>Type</th>
<th>Art. No.</th>
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</thead>
<tbody>
<tr>
<td>16...72 V, 40...460 Hz (AC)</td>
<td>RCM420-D-1</td>
<td>B94014001</td>
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<tr>
<td>16...72 V, 40...460 Hz (DC)</td>
<td>B74014001</td>
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<tr>
<td>70...300 V, 40...460 Hz (AC)</td>
<td>RCM420-D-2</td>
<td>B94014002</td>
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<tr>
<td>70...300 V, 40...460 Hz (DC)</td>
<td>B74014002</td>
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</table>

**Accessories**
- Mounting clip for screw mounting (1 piece per device)
  - Art. No.: B 9806 0008

**Suitable system components**

<table>
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<th>Description</th>
<th>Type of construction</th>
<th>Type</th>
<th>Art. No.</th>
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<td>circular</td>
<td>CTAC...</td>
<td>B981100...</td>
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<tr>
<td>rectangular</td>
<td>WR...S(P)</td>
<td>B9117...</td>
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<td></td>
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<tr>
<td>split-core</td>
<td>WS...</td>
<td>B980806...</td>
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<tr>
<td>flexible</td>
<td>WF...</td>
<td>B780802...</td>
<td>377</td>
<td></td>
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</tbody>
</table>
Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

RCM420-D-1
- Rated insulation voltage: 100 V
- Rated impulse voltage/pollution degree: 2.5 kV/3

RCM420-D-2
- Rated insulation voltage: 250 V
- Rated impulse voltage/pollution degree: 4 kV/3

Supply voltage
- RCM420-D-1: Supply voltage range $U_s$: AC 24...60 V/DC 24...78 V
- RCM420-D-2: Supply voltage range $U_s$: AC/DC 42...300 V

Overvoltage category
- III

Overvoltage category
- III

Measuring circuit
- External measuring current transformer type: CTAC...WR...SP(P), WS...
- Rated measuring range $I_o$: 800 V
- Rated characteristic acc. to IEC 62020: type D

Response values
- Rated residual operating current $I_{o1}$ (prewarning, AL1): 50...100 mA $\times I_{o2}$, (50 %)$^*$
- Rated residual operating current $I_{o2}$ (Alarm, AL2): 10 mA $\times I_{o2}$ (30 mA)$^*$
- Hysteresis: 10...25 % (15 %)$^*$

Specified time
- Starting delay $t_1$: 0...10 s (0.5 s)$^*$
- Response delay $t_{o2}$ (Alarm): 0...10 s (0 s)$^*$
- Response delay $t_{o1}$ (prewarning): 0...10 s (1 s)$^*$
- Delay on release $t_{o2}$: 0...300 s (1 s)$^*$
- Operating time $t_{o1}$ at $I_{o1}$: ≤ 180 ms
- Operating time $t_{o2}$ at $I_{o2}$: ≤ 50 ms
- Response time $t_2$: $t_{2} = t_{o1} + t_{o2}$
- Recovery time $t_3$: ≤ 300 ms
- Number of reload cycles: 0...100 (0)$^*$

Cable lengths for measuring current transformers
- Single wire: ≥ 0.75 mm²
- Single wire, twisted: ≥ 0.75 mm²
- Shielded cable: ≥ 0.75 mm²
- Recommended cable (shielded, shield on one side connected to terminal 1 of the RCM420, not connected to earth): J/V/50Y/5 mm²
- Connection: screw terminals

Displays, memory
- Display range, measured value: 3 mA...16 A
- Error of indication: ± 15 %/± 2 digit
- Measured-value memory for alarm value: data record measured values
- Password: off/0...999 (OFF)$^*$
- Fault memory alarm relay: on/off (OFF)$^*$

Inputs/outputs
- Cable length for external test/reset button: 0...10 m

Switching elements
- Number of switching elements: 2 x 1 changeover contact
- Operating principle: N/C operation/ N/O operation (N/O operation)$^*$
- Electrical service life under rated operating conditions: 10000 switching operations

Contact data acc. to IEC 60947-5-1:
- Utilization category: AC-13
- AC-14
- DC-12
- DC-12
- Rated operational voltage: 230 V 230 V 24 V 110 V 220 V
- Rated operational voltage UL: 200 V 200 V 24 V 110 V 200 V
- Rated operational current: 0.2 A 0.2 A 0.2 A 0.2 A 0.2 A
- Minimum contact load: 1 mA at AC/DC ≥ 10 V

Environment/EMC
- Operating temperature: -25...+55 °C
- Classification of climatic conditions IEC 60721: Stationary use (IEC 60721-3-3) 3K23 (except condensation and formation of ice)
- Transportation (IEC 60721-3-2) 2K11 (except condensation and formation of ice)
- Storage (IEC 60721-3-1) 1K22 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721
- Stationary use (IEC 60721-3-3) 3M11
- Transportation (IEC 60721-3-2) 2M4
- Storage (IEC 60721-3-1) 1M2

Connection
- UL application: use 60/70°C copper conductors only
- Connection type: screw-type terminal or push-through terminal
- Connection properties
  - rigid/flexible: 0.2...2.5 mm² (AWG 24...12)
  - rigid/flexible: 0.2...2.5 mm² (AWG 24...14)
  - Two conductors with the same cross section: 0.2...1.5 mm² (AWG 24...16)
  - Stripping length: 8 mm
  - Tightening torque, terminal screws: 0.5...0.6 Nm

Contact
- push-through terminals
- Connection properties
  - rigid/flexible: 0.2...2.5 mm² (AWG 24...14)
  - without ferrules: 0.75...2.5 mm² (AWG 19...14)
  - with ferrules: 0.2...1.5 mm² (AWG 24...16)

Stripping length: 10 mm
- Opening force: 50 N
- Test opening, diameter: ≤ 2.1 mm

Other
- Operating mode: continuous operation
- Protection class, internal components (DIN EN 60529): IP30
- Degree of protection, terminals (DIN EN 60529): IP20
- Enclosure material: polycarbonate
- Flammability class: UL94V-0
- DIN rail mounting acc. to DIN 43671: IEC 60715
- Screw mounting: 2 x M4 with mounting clip
- Weight: ≤ 150 g

Dimension diagram (dimensions in mm)
### Wiring diagram

| 1 | A1, A2 | Supply voltage $U_s$ see ordering information, 6 A fuse recommended |
| 2 | k, l | Connection of the external measuring current transformer |
| 3 | 11, 12, 14 | Alarm relay "K1": configurable for alarm $I_{\Delta n1}/I_{\Delta n2}/\text{TEST/ERROR}$ |
| 4 | 21, 22, 24 | Alarm relay "K2": configurable for alarm $I_{\Delta n1}/I_{\Delta n2}/\text{TEST/ERROR}$ |

**Note:**
- **1, 2, 3, 4, 5**
- **A1, A2** Supply voltage $U_s$ see ordering information, 6 A fuse recommended
- **k, l** Connection of the external measuring current transformer
- **11, 12, 14** Alarm relay "K1": configurable for alarm $I_{\Delta n1}/I_{\Delta n2}/\text{TEST/ERROR}$
- **21, 22, 24** Alarm relay "K2": configurable for alarm $I_{\Delta n1}/I_{\Delta n2}/\text{TEST/ERROR}$
- **T/R** Combined test and reset button "T/R"
  - short-time pressing (< 1.5 s) = RESET
  - long-time pressing (> 1.5 s) = TEST

**Additional Notes:**
- * when a shielded cable is used
- Do not route the PE conductor through the measuring current transformer!
LINETRAXX® RCMA420
Residual current monitor for monitoring AC, DC and pulsed DC currents in TN and TT systems

Device features
- AC/DC sensitive residual current monitor Type B acc. to IEC 62020 and IEC/TR 60755
- r.m.s. value measurement (AC+DC)
- Two separately adjustable response values 10…500 mA
- Frequency range 0…2000 Hz
- Start-up delay, response delay and delay on release
- Digital measured value display via LC display
- Measured value memory for operating value
- CT connection monitoring
- LEDs: Power On, Alarm 1, Alarm 2
- Internal/external test/reset button
- Two separate alarm relays (one changeover contact each)
- N/O or N/C operation and fault memory selectable
- Continuous self monitoring
- Multi-functional LC display
- Password protection for device settings
- Sealable transparent cover
- Two-module enclosure (36 mm)
- RoHS compliant

Typical applications
- AC/DC sensitive residual current monitoring in earthed two, three or four conductor systems (TN and TT systems)
- Monitoring of variable-speed drives, UPS systems, construction site equipment, printing machines, battery systems, laboratory equipment, wood working machines, MF welding systems, furniture industry, medical electrical equipment, etc.
- AC/DC sensitive current monitoring of, in the normal case, de-energised single conductors (e.g. N and PE conductors)

Further information
For further information refer to our product range on www.bender.de.

Approvals

Ordering information

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<tr>
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Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Residual current monitor LINETRAXX® RCMA

Residual current monitoring systems | 1-channel AC/DC sensitive residual current monitor RCMA

**LINETRAXX® RCMA420**

180

**Response delay**

Starting delay $t_{on1}$ (prewarning, AL1) 0…10 s (1 s)*

Response delay $t_{on2}$ (alarm) 0…10 s (8 s)*

Delay on release $t_{off}$ 0…99 s (1 s)*

Operating time $t_{on1}$ or $t_{on2}$ = $t_{on1/2}$ $\leq$ 180 ms

Operating time $t_{on2}$ or $t_{on3}$ = $t_{on2/2}$ $\leq$ 30 ms

Response time $t_{on}$ $t_{on1} = t_{on2} + t_{on1/2}$

Recovery time $t_{off}$ $\leq$ 300 ms

**Specified times**

**Display, memory**

Display range, measured value AC 0…1.5 A

Display range, measured value DC 0…600 mA

Error of indication $\pm 17.5 \%$ at $2 \, \text{digit}$

Measured-value memory for alarm value data record measured values

Password off/0…999 (off)*

Fault memory alarm relay on/off (on)*

**Inputs/outputs**

Cable length for external test/reset button 0…10 m

**Cable lengths for measuring current transformers**

Connection CTX... 1 m/2.5 m/5 m/10 m

or alternatively: single wire 6 x 0.75 mm²

0…10 m

**Switching elements**

Number of switching elements 2 x 1 changeover contact

Operating principle N/C operation/N/O operation (N/C operation)*

Electrical service life under rated operating conditions 10000 switching operations

**Contact data acc. to IEC 60947-5-1**

Utilization category AC-13 AC-14 DC-12 DC-12 DC-12

Rated operational voltage 230 V 230 V 24 V 110 V 220 V

Rated operational voltage UL 200 V 200 V 24 V 110 V 200 V

Rated operational current 5 A 3 A 1 A 0.2 A 0.1 A

Minimum contact load 1 mA at AC/DC $\leq$ 10 V

**Environment/EMC**

EMC IEC 62020

Operating temperature -25…+55 °C

Classification of climatic conditions IEC 60721

Stationary use (IEC 60721-3-3) 3K23 (except condensation and formation of ice)

Transportation (IEC 60721-3-2) 2K11 (except condensation and formation of ice)

Storage (IEC 60721-3-1) 1K12 (except condensation and formation of ice)

**Classification of mechanical conditions acc. to IEC 60721**

Stationary use (IEC 60721-3-3) 3M11

Transportation (IEC 60721-3-2) 2M4

Storage (IEC 60721-3-1) 1M12

**Connection**

For UL applications:

use 60°C/70°C copper conductors only

**Connection type**

screw-type terminal or push-wire terminal

**Connection screw terminals**

Connection properties

rigid 0.2…4 mm² (AWG 24…12)

flexible 0.2…2.5 mm² (AWG 24…14)

Two conductors with the same cross section

rigid/flexible 0.2…1.5 mm² (AWG 24…16)

Stripping length 8 mm

Tightening torque, terminal screws 0.5…0.6 Nm

**Connection push-wire terminals**

Connection properties

rigid 0.2…2.5 mm² (AWG 24…14)

flexible without ferrules 0.75…2.5 mm² (AWG 19…14)

with ferrules 0.2…1.5 mm² (AWG 24…16)

Stripping length 10 mm

Opening force 50 N

Test opening, diameter 2.1 mm

**Other**

Operating mode continuous operation

Position of normal use display-oriented

Degree of protection, internal components (IEC 60529) IP30

Degree of protection, terminals (IEC 60529) IP20

Enclosure material polycarbonate

Flammability class UL94V-0

DIN rail mounting acc. to IEC 60715

Screw fixing 2 x M4 with mounting clip

Documentation number D00059

Weight $\leq$ 150 g

( )* = factory setting
Connection to the RCMA423 residual current monitor using the CTX-... connecting cable.

Colour coding for CTX-...: k = yellow, l = green, -12 V = black, GND = brown, +12 V = red, Test (T) = orange
LINETRAXX® RCMA423
Residual current monitor for monitoring AC, DC and pulsed DC currents in TN-and TT systems

Device features
• AC/DC sensitive residual current monitor Type B acc. to IEC 62020 and IEC/TR 60755
• r.m.s. value measurement (AC+DC)
• Two separately adjustable response values 30...3 A
• Frequency range 0...2000 Hz
• Start-up delay, response delay and delay on release
• Digital measured value display via LC display
• Measured value memory for operating value
• CT connection monitoring
• LEDs: Power On, Alarm 1, Alarm 2
• Internal/external test/reset button
• Two separate alarm relays (one changeover contact each)
• N/O or N/C operation and fault memory selectable
• Continuous self monitoring
• Multi-functional LC display
• Password protection for device settings
• Sealable transparent cover
• Two-module enclosure (36 mm)

Typical applications
• AC/DC sensitive residual current monitoring in earthed two, three or four conductor systems (TN and TT systems)
• Monitoring of variable-speed drives, UPS systems, construction site equipment, printing machines, battery systems, laboratory equipment, wood working machines, MF welding systems, furniture industry, medical electrical equipment, etc.
• AC/DC sensitive current monitoring of, in the normal case, de-energised single conductors (e.g. N conductors)

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage $U_s$</th>
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<tr>
<td>16...72 V, 42...460 Hz</td>
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<td>B94043023</td>
</tr>
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<td>70...300 V, 42...460 Hz</td>
<td>RCMA423-D-2</td>
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</tbody>
</table>

1) Absolute values

Accessories

<table>
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<tr>
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<td>CTX...</td>
<td>B9811008...</td>
<td>365</td>
</tr>
</tbody>
</table>
Residual current monitoring system | 1-channel, AC/DC sensitive residual current monitoring RCMA

**Technical data**

### Insulation coordination acc. to IEC 60664-1/IEC 60664-3

**RCMA423-D-1:**
- Rated insulation voltage: 100 V
- Overvoltage category/pollution degree: III/3
- Rated impulse voltage: 2.5 kV

**RCMA423-D-2:**
- Rated insulation voltage: 250 V
- Overvoltage category/pollution degree: III/3
- Rated impulse voltage/pollution degree: 4 kV

### Supply voltage

**RCMA423-D-1:**
- Supply voltage range $U_s$: AC 24…60 V/DC 24…78 V
- Operating range $U_i$: AC 16…72 V/DC 9.6…94 V
- Frequency range $f$: 42…460 Hz

**RCMA423-D-2:**
- Supply voltage range $U_s$: AC/DC 100…250 V
- Operating range $U_i$: AC/DC 70…300 V
- Frequency range $f$: 42…460 Hz

### Response time

- Rated residual operating current $\Delta n_1$ (prewarning, AL1): 50…100 % of $I_{\text{rated}}$(50 %)*
- Rated residual operating current $\Delta n_2$ (alarm, AL2): 30 mA…3 A (30 mA)*

### Hysteresis

$\Delta n_1/2$: $\leq 30$ ms

### Operating time

$\Delta n_2$: $\leq 180$ ms

### Specifications

- Operating time $t_{\text{on}}$ bei $I_{\text{in}}$: 1 x $I_{\text{in}}$/2
- Operating time $t_{\text{off}}$ bei $I_{\text{in}}$: 5 x $I_{\text{in}}$/2
- Response time $t_{\text{on}}$: $t_{\text{on}} = t_{\text{on1}} + t_{\text{on2}}$
- Recovery time $t_{\text{off}}$: $t_{\text{off}} = t_{\text{on1}} + t_{\text{on2}}$

### Displays, memory

- Display range, measured value AC/DC: 0…6 A
- Error of indication: $\pm 17.5$ % $\pm 2$ digit
- Measured-value memory for alarm value: data record measured values
- Password: off/off (off)*
- Fault memory alarm relay: on/off (on)*

### Inputs/outputs

- Cable length for external test/reset button: 0…10 m

### Cable lengths for measuring current transformers

- Connection CTX… 1 m/2.5 m/5 m/10 m
- or alternatively: single wire 6 x 0.75 mm²
- 0…10 m

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**Switching elements**

- Number of switching elements: 2 x 1 changeover contact
- Operating principle: N/C operation/N/O operation (N/C operation)*
- Electrical endurance, number of cycles: 10,000

**Contact data acc. to IEC 60947-5-1**

- Utilisation category: AC 13, AC 14, DC 12, DC 12
- Rated operational voltage: 230 V, 230 V, 24 V, 110 V, 220 V
- Rated operational voltage UL: 200 V, 200 V, 24 V, 110 V, 200 V
- Rated operational current: 5 A, 3 A, 1 A, 0.2 A, 0.1 A
- Minimum contact rating: 1 mA at AC/DC $\geq$ 10 V

**Environment/EMC**

- EMC: EN 61326-1
- Ambient temperatures:
  - Operating temperature: $-25...+55$ °C
  - Transport: $-25...+70$ °C
- Long-term storage: $-25...+55$ °C

**Classification of climatic conditions acc. to IEC 60721:**

- Stationary use (IEC 60204-1):
  - Rating category: 3K23 (no condensation, no formation of ice)
  - Transport (IEC 60204-1):
    - 2K11
- Long-term storage (IEC 60721-3-1):
  - 1K22

**Classification of mechanical conditions acc. to IEC 60721:**

- Stationary use (IEC 60204-1):
  - Rating category: 3M11
- Transport (IEC 60204-1):
  - 2M4
- Long-term storage (IEC 60721-3-1):
  - 1M12

**Connection**

- For UL application:
  use 60/70°C copper conductors only
- Connection type: screw-type terminal or push-wire terminal

**Connection screw terminals**

- Connection properties:
  - rigid
  - flexible
- Connection push-wire terminals:
  - rigid
  - flexible
- Two conductors with the same cross section:
  - rigid/flexible
- Stripping length: 8 mm
- Tightening torque, terminal screws: 0.5…0.8 Nm

**Other**

- Operating mode: continuous operation
- Position of normal use: DIN rail mounting acc. to DIN 43699
- Degree of protection, terminals (IEC 60529): IP30
- Degree of protection, terminals (IEC 60529): IP30
- Enclosure material: polycarbonate
- Flammability class: UL94V-0
- DIM rail mounting acc. to: IEC 60715
- Weight: 100 g

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**Dimension diagram (dimensions in mm)**

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**01/2021**

**D00063**

**Residual current monitoring system | 1-channel, AC/DC sensitive residual current monitoring RCMA**
Connection of measuring current transformers

Connection to the RCMA423 residual current monitor using the CTX… connecting cable.
Colour coding for CTX…: k = yellow, l = green, -12 V = black, GND = brown, +12 V = red, Test (T) = orange
LINETRAXX® RCMS460-D/-L – RCMS490-D/-L
Multi-channel AC, pulsed DC and AC/DC sensitive residual current monitors for earthed AC, DC and AC/DC systems (TN and TT systems)

Device features
- Optional AC, pulsed DC or AC/DC sensitive measurement by selecting the respective measuring current transformer for each channel
- True r.m.s. value measurement
- 12 measuring channels per device for residual current measurement or digital input
- Up to 90 RCMS… monitors, up to 1080 measuring channels in the system
- Fast parallel scanning for all channels
- Response ranges:
  - 10 mA…10 A (0…2000 Hz), 6 mA…20 A (42…2000 Hz), 100 mA…125 A (42…2000 Hz) RCMS…-D4
- Preset function
- Adjustable time delays
- The frequency response characteristics can be set for the protection of persons, fire and plant protection
- History memory with date and time stamp for 300 data records
- Data logger for 300 data records/channel
- Analysis of the harmonics, DC, THF
- Two alarm relays with one changeover contact each
- Device version RCMS490 with one alarm contact per channel
- N/O or N/C operation and fault memory selectable
- Connection external test/reset button
- Backlit graphical display (7-segment display) and alarm LEDs
- Data exchange via BMS bus
- Password protection for device setting
- Continuous CT connection monitoring
- RoHS compliant

Standards
The LINETRAXX® RCMS460/490 series complies with the requirements of the device standards:
- DIN EN 62020 (VDE 0663)

Further information
For further information refer to our product range on www.bender.de.

Typical applications
- Measuring and evaluating residual, fault and rated currents of loads and installations in the frequency range of
  - 0…2000 Hz (CTUB100 or CTB525 series measuring current transformers),
  - 42…2000 Hz (CTAC..., WR..., WS..., WF... series measuring current transformers)
- Monitoring of currents regarded as fire hazards in flammable atmospheres
- EMC monitoring of TN-S systems for “stray currents” and additional N-PE connections
- Monitoring of N conductors for overload caused by harmonics
- Monitoring of PE and equipotential bonding conductors to ensure they are free of current
- Residual current monitoring of stationary electrical equipment and systems to determine test intervals which meet practical requirements in compliance with the DGUV regulation 3 (German Social Accident Insurance).
- Personnel and fire protection due to rapid disconnection
- Monitoring of digital inputs

Approvals
UL File number: E173157
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<td>AC/DC sensitive</td>
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<tr>
<td>6 mA…20 A</td>
<td>10 mA…10 A</td>
<td>2 x 1 changeover contact</td>
<td>16…72 V, 50/60 Hz, 16…94 V</td>
<td>RCMS460-D-1</td>
<td>B94053001</td>
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<td>70…276 V, 50/60 Hz, 70…276 V</td>
<td>RCMS460-D-4-2</td>
<td>B94053010</td>
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<td></td>
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<td>16…72 V, 50/60 Hz, 16…94 V</td>
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<td>70…276 V, 50/60 Hz, 70…276 V</td>
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<td>16…72 V, 50/60 Hz, 16…94 V</td>
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<td>70…276 V, 50/60 Hz, 70…276 V</td>
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<td>AC/DC sensitive</td>
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<td>CTBS25</td>
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<td>Connecting cables for Measuring current transformers CTUB100/series</td>
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<td>✔</td>
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<tr>
<td>Measuring channels per device</td>
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<tr>
<td>CT monitoring</td>
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<td>✔</td>
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<tr>
<td>Measuring current (I&lt;sub&gt;△n&lt;/sub&gt;) (Alarms)</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>AC/DC sensitive 0...2000 Hz (Type A)</td>
<td>10 mA...10 A</td>
<td>10 mA...10 A</td>
<td>10 mA...10 A</td>
<td>10 mA...10 A</td>
</tr>
<tr>
<td>pulsed DC sensitive 0...2000 Hz (Type A)</td>
<td>6 mA...20 A</td>
<td>6 mA...20 A</td>
<td>6 mA...20 A</td>
<td>6 mA...20 A</td>
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<tr>
<td>Rated residual operating current (I&lt;sub&gt;△n&lt;/sub&gt;) (prewarning)</td>
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<td>10...100 %, min. 5 mA</td>
<td>10...100 %, min. 5 mA</td>
<td>10...100 %, min. 5 mA</td>
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<tr>
<td>Time response</td>
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<tr>
<td>Start-up delay</td>
<td>0...99 s</td>
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<td>Response delay, adjustable 0...999 s</td>
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<td>Operating time</td>
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<tr>
<td>Analysis of the harmonics (I&lt;sub&gt;H&lt;/sub&gt;, DC, THF)</td>
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<td>✔</td>
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<td>✔</td>
</tr>
<tr>
<td>Data logger for 300 data records/channel</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Internal clock</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Password</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Language English, German, French, Swedish</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Backlight graphics LC display</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>7-segment display and LED line</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

* only in conjunction with RCMS4xx-D, MK2430 or COM460IP

### Technical data

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3 for the versions:**

#### a) RCMS460-D1
- Supply voltage U<sub>s</sub>: DC 24...75 V/AC 24...60 V (AC/DC ±20 %)
- Supply voltage frequency: DC/50/60 Hz
- Rated insulation voltage: 100 V
- Rated impulse voltage/pollution degree: 2.3 kV/3
- Overvoltage category: III
- Protective separation (reinforced insulation) between: A1, A2 - k1, l1...k12, R, T/R, T, A, B
- Voltage test acc. to IEC 61010-1: 1.344 kV
- Rated insulation voltage: 250 V
- Rated impulse voltage/pollution degree: 4 kV/3
- Overvoltage category: III
- Basic insulation between: A1, A2, k1, l1...k12, R, T/R, T, A, B - (C11, C12, C14), (C21, C22, C24), (11, 14), (21, 24), (31, 34), (41, 44), (51, 54), (61, 64), (71, 74), (81, 84), (91, 94), (11, 14), (111, 114), (112, 124)
- Voltage test acc. to IEC 61010-1: 2.21 kV
- Rated insulation voltage: 250 V
- Rated impulse voltage/pollution degree: 6 kV/3
- Overvoltage category: III
- Protective separation (reinforced insulation) between: (C11, C12, C14) - (C21, C22, C24) - (11, 14) - (21, 24) - (31, 34) - (41, 44) - (51, 54) - (61, 64) - (71, 74) - (81, 84) - (91, 94) - (101, 104) - (111, 114) - (112, 124)
- Voltage test acc. to IEC 61010-1: 3.536 kV

#### b) RCMS460-D2
- Supply voltage U<sub>s</sub>: AC/DC 100...240 V (-20...+15 %)
- Supply voltage frequency: DC/50/60 Hz
- Rated insulation voltage: 250 V
- Rated impulse voltage/pollution degree: 6 kV/3
- Overvoltage category: III
- Protective separation (reinforced insulation) between: A1, A2 - k1, l1...k12, R, T/R, T, A, B - (C11, C12, C14), (C21, C22, C24), (11, 14), (21, 24), (31, 34), (41, 44), (51, 54), (61, 64), (71, 74), (81, 84), (91, 94), (101, 104), (111, 114), (112, 124)
- Voltage test acc. to IEC 61010-1: 3.536 kV
- Rated insulation voltage: 250 V
- Rated impulse voltage/pollution degree: 4 kV/3
- Overvoltage category: III
- Basic insulation between: k1, l1...k12, R, T/R, T, A, B - (C11, C12, C14), (C21, C22, C24) - (11, 14) - (21, 24) - (31, 34) - (41, 44) - (51, 54) - (61, 64)
- Voltage test acc. to IEC 61010-1: 2.21 kV
### Measuring circuit

- External measuring current transformers: CTAC…, WR…, WS…, WF… series (Type A), CTUB100, CTBS25 series (Type B)
- CT monitoring: on/off (on)
- Rated burden RCMS…-D/-L: 60 \( \Omega \)
- Rated burden RCMS…-D4/-L4 (channels 9...12 only): 1 \( \Omega \)
- Rated insulation voltage (measuring current transformer): 800 \( \text{V} \)
- Operating characteristics acc. to IEC/TR 60755: type A and type B depending on measuring current transformer series (Type A)*

#### Rated frequency

- 0...2000 Hz (Type B) / 42...2000 Hz (Type A)

#### Cut-off frequency

- none, IEC, 50 Hz, 60 Hz (none)*

#### Measuring range RCMS…-D/-L

- 0...30 A (measuring current transformer Type A)
- 0...20 A (measuring current transformer Type B)

##### Crest factor

- up to 10 \( A = 4 \), up to 20 \( A = 2 \)

#### Measuring range RCMS…-D4/-L4 (channels 9...12 only)

- 100 mA...125 A

- 10 mA...10 A (Type A)
- 6 mA...20 A (Type B)

- (100 mA overcurrent)*

- 100 mA...125 A (16 A overcurrent)*

- 10...100 \% x \( \Delta n \)

- 2...40\% (20 \%)*

#### Relative uncertainty RCMS…-D/-L

- 0...-20 \%**

- 0...10 \% x \( \Delta n \)

#### Response delay \( t \)

- Start-up delay

#### Time response

- Operating time

<table>
<thead>
<tr>
<th>Number of measuring channels (per device/system)</th>
<th>12/1080</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Digital input</th>
<th>1 : &lt; 500 Ω</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 : &gt; 250 Ω</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reset for alarm</th>
<th>( I_a ) x factor 1...99 (3)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offset</td>
<td>0...20 A (30 mA)*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relative uncertainty RCMS…-D/-L</th>
<th>0...20 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative uncertainty RCMS…-D4/-L</td>
<td>0...20 %</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>2...40% (20 %)*</td>
</tr>
</tbody>
</table>

| Factor for additional CT | \( 1/10 \times 1 \times 1 \times 250 (x \times 1) \* |

| Number of measuring channels   | 12/1080 |

### Time response

- Start-up delay \( t \) (start-up) per device

<table>
<thead>
<tr>
<th>Digital input</th>
<th>1 : &lt; 500 Ω</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 : &gt; 250 Ω</td>
<td></td>
</tr>
</tbody>
</table>

| Operating time \( t_a \) per channel | 0...999 s (200 ms)* |

| Operating time \( t_{al} \) per channel | 0...999 s (200 ms)* |

| Operating time \( t_{al} \) per channel | 0...999 s (200 ms)* |

| Operating time \( t_{al} \) per channel | 0...999 s (200 ms)* |

| Operating time \( t_{al} \) per channel | 0...999 s (200 ms)* |

| Response time \( t_{al} \) for residual current measurement | 0.1 s (1)* |

| Response time \( t_{al} \) for residual current measurement | 0.2 s (2)* |

| Response time \( t_{al} \) for residual current measurement | 0.3 s (3)* |

| Response time \( t_{al} \) for residual current measurement | 0.4 s (4)* |

| Response time \( t_{al} \) for residual current measurement | 0.5 s (5)* |

### Displays, memory

- Measured value display range RCMS…-D /-L

<table>
<thead>
<tr>
<th>Measured value display range RCMS…-D4/-L (channels 9...12)</th>
<th>0...30 A (CT Type A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured value display range RCMS…-D4/-L (channels 9...12)</td>
<td>0...125 A (CT Type A)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Error of indication</th>
<th>± 10 %</th>
</tr>
</thead>
</table>

### LC display

- 7-segment display

- 2 x 7.62 mm (RCM5454-4-L)

### History memory

- 300 data records (RCMS…-D...)

### Data logger

- 300 data records per measuring channel (RCMS…-D...)

### Password

- off / 0...999 (off)*

### Language

- D, GB, F (GB)*

### Fault memory alarm relay

- on/off (off)*

### Inputs/Outputs

<table>
<thead>
<tr>
<th>Test/reset button</th>
<th>internal/external</th>
</tr>
</thead>
</table>

| Cable length for external test/reset button | 0...10 m |

### Interface

- Interface/protocol: RS-485/BMS
- Baud rate: 9.6 kbit/s
- Cable length: 0...1200 m
- Cable: (shielded, shielded connected to PE on one side) recommended: min. 1-Y5SY min. 2x0.8

#### For UL application: Copper lines

- at least 60/70 °C

- Terminating resistor

| 120 Ω (0.25 W) connectable via DIP switch |

### Device address

- BMS bus: 1...90 (2)*

#### Cable lengths for CTUB100 and CTBS25 series measuring current transformers

- Single wire \( > 0.75 \text{ mm}^2 \)

- Single wire, twisted \( > 0.75 \text{ mm}^2 \)

- Shielded cable \( > 0.5 \text{ mm}^2 \)

- Cable: (shielded, shielded connected to terminal I at one end, must not be earthed) recommended: 1-Y5SY min. 2 x 0.8

### Switching elements

- Number: 2 x 1 changeover contact (RCMS460)
- 2 x 1 changeover contact, 12 x N/O contact (RCMS490)
- Operating principle: NC or N/O operation (N/O operation)*
- Electrical endurance under rated operating conditions, number of cycles: 10.000

### Contact data acc. to IEC 60947-5-1

- Utilisation category: AC-13 AC-14 DC-1 DC-12 DC-12
- Rated operational voltage

| 230 V 230 V |
| 24 V 24 V |
| 110 V 220 V |

<table>
<thead>
<tr>
<th>Rated operational current (common alarm relay)</th>
<th>5 A 3 A 1 A 0.2 A 0.1 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated operational current (alarm relay)</td>
<td>2 A 0.5 A 5 A 2 A 0.1 A</td>
</tr>
</tbody>
</table>

### Minimum contact rating

- 10 mA/S 5 V DC

### Environment/EMC

- EMC: DIN EN 62020
- Operating temperature: -25...+ 55 °C

### Climatic class acc. to IEC 60721 (except condensation and formation of ice)

- Stationary use (IEC 60721-3-3)

<table>
<thead>
<tr>
<th>3K23</th>
</tr>
</thead>
<tbody>
<tr>
<td>2K1</td>
</tr>
<tr>
<td>1K2</td>
</tr>
</tbody>
</table>

### Classification of mechanical conditions acc. to IEC 60721

- Stationary use (IEC 60721-3-3)

<table>
<thead>
<tr>
<th>3M11</th>
</tr>
</thead>
<tbody>
<tr>
<td>2M4</td>
</tr>
<tr>
<td>1M12</td>
</tr>
</tbody>
</table>

### Connection

- Connection: screw terminals
- Connection properties:

#### Rigid/flexible/conductor sizes

- 0.2...4/0.2...2.5 mm²/AWG 24...12

#### Multi-conductor connection (2 conductors with the same cross section):

- Rigid/flexible: 0.2...1.5/0.2...1.5 mm²
- Stripping length: 8...9 mm
- Tightening torque: 0.5...0.6 Nm

### Other

- Operating mode: continuous operation
- Degree of protection, internal components (IEC 60529): IP30
- Degree of protection, terminals (IEC 60529): IP20
- Enclosure material: polycarbonate
- Flammability class: UL94V-0
- Screw mounting: 2 x M4
- DIN rail mounting acc. to IEC 60715
- Power consumption: ≤ 10 VA (RCMS460)
- ≤ 12 VA (RCMS490)
- Weight: ≤ 300 g (RCMS460)
- ≤ 510 g (RCMS490)

* Factory setting

** In the frequency range of < 15 Hz, the relative uncertainty is between -35 \% and 100 \%.
Residual current monitors LINETRAXX® RCMS460-D/-L – RCMS490-D/-L

Dimension diagrams (dimensions in mm)

<table>
<thead>
<tr>
<th>Dimension diagrams (dimensions in mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCMS460-D/-L</td>
</tr>
<tr>
<td>RCMS490-D/-L</td>
</tr>
</tbody>
</table>

Wiring diagrams

1 A1, A2
   Connection of supply voltage U, (see ordering information): we recommend the use of 6 A fuses.

2 k1, l, ..., k12, l
   CT1 … CT12. Either Type A or Type B measuring current transformers can be selected for each measuring channel. Six CTUB100 series measuring current transformers require one STEP-PS power supply unit. The channels k9 … k12 of the device versions RCMS460-D4/-L4 require the connection of Type A measuring current transformers.

3 A, B
   BMS bus (RS-485 interface with BMS protocol)

4 R, T/R
   External reset button (N/O contact). The external reset buttons of several devices must not be connected to one another.

5 T, T/R
   External test button (N/O contact). The external test buttons of several devices must not be connected to one another.

6 C11, C12
   Common alarm relay K1: Alarm 1, common message for alarm, prewarning, device error.

7 C21, C22
   Common alarm relay K2: ALARM 2, common message for alarm, prewarning, device error.

8 RunOff
   Activate or deactivate the terminating resistor of the BMS bus (120 Ω).

9 CT
   Measuring current transformers (CTAC…, CTBS25, CTUB100, WR…, WS…, WF… series)
ARMSG460-D/-L
ARMSG490-D/-L

**Digital input**

1. Potential-free contact
   0 △ Resistance between k and l > 250 Ω
   1 △ Resistance between k and l < 100 Ω

2. Measuring current transformers

**Connection CTAC…, WR…S(P), WS… series measuring current transformers (pulsed current sensitive)**

**Connection CTUB100 series measuring current transformer (AC/DC current sensitive)**

**Connection WF… series measuring current transformers**

**Connection CTUB100 series measuring current transformer (AC/DC current sensitive)**

**Analogue output**

Type A

24V GND

S1(k) S2(l)

RCMS460/490

EDS440

DC 24 V

STEP-PS

L1

L2

L3

N
Example for a system design – minimum system consisting of an RCMS460-D and 12 measuring points

Example for a system design of – standard system consisting of an RCMS460-D and RCMS460-L and a protocol converter COM460IP

Note:

1. When using AC/DC current sensitive measuring current transformers of the CTUB100 and CTBS25 series, a DC 24 V power supply unit (e.g. STEP-PS series) is required to supply the measuring current transformers with voltage. For this purpose, the technical data of the respective measuring current transformer series must be observed.

2. The DI-1DL repeater only is required when the length of the cable exceeds 1200 m.
LINETRAXX® RCMS150
Residual current monitor type B with integrated measuring current transformers for unearthed AC/DC systems (TN and TT systems)

Device features
- Continuous residual current monitoring in compliance with DGUV Vorschrift 3 (German Social Accident Insurance Regulation 3)
- AC/DC sensitive residual current monitor type B with 6 channels K1…6 (each channel features 2 measuring channels: 1 x r.m.s., 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 r.m.s.) 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, CP9…-I
- 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

Typical applications
- Residual current monitoring system for current outlets and final circuits
- Monitoring residual currents of stationary electrical installations and equipment to determine practice-oriented test intervals in accordance with DGUV Regulation 3 (German Social Accident Insurance) and BetrSichV (Occupational Safety and Health Regulation)
- EMC monitoring of TN-S systems for „stray“ currents and additional unwanted N-PE bridges
- Monitoring currents regarded as fire hazards in flammable atmospheres
- Monitoring the PE to ensure that there is no current flow

Further information
For further information refer to our product range on www.bender.de.

Approvals
UL508 in preparation
CSA in preparation

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage $U_s$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td>RCMS150</td>
<td>B94053025</td>
</tr>
<tr>
<td>24 V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for DIN rail mounting</td>
<td>B91080110</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition Monitor with integrated gateway</td>
<td>COM465IP1)</td>
<td>B95061065</td>
</tr>
<tr>
<td>Condition Monitor</td>
<td>CP9…-I</td>
<td>B9506103…</td>
</tr>
<tr>
<td>RS-485 repeater</td>
<td>DI-1DL</td>
<td>B95012047</td>
</tr>
<tr>
<td>Power supply</td>
<td>STEP-PS</td>
<td>B940531…</td>
</tr>
<tr>
<td>Residual current monitor2)</td>
<td>RCMS460-D</td>
<td>B940530…</td>
</tr>
<tr>
<td></td>
<td>RCMS490-D</td>
<td>B940530…</td>
</tr>
</tbody>
</table>

1) from function module C
2) suitable for measured value and alarm indication only, not suitable for parameter setting
Technical 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: ≤ 2000 m AMSL
Range of use: ≤ 2000 m AMSL
Rated insulation voltage: 250 V
Pollution degree: 3
Insulation:
B1: Overvoltage category III
D1: 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 with galvanic separation: DC 24 V
Power consumption: < 4 W

Residual current measuring range
Frequency range: 0 ... 1000 Hz
Measuring range: ± 500 mA
Resolution measured value: 1 % of the set response value

Response values
Residual current (I\(\Delta\)N2)
RMS: 0 ... 300 mA (30 mA)*
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\(\Delta\)N2 RMS/DC): 500 Hz ... 1 kHz -20 ... 0 %
-20 ... +100 %
Hysteresis: 10 ... 25 % (15 %)

Time response
Start-up delay (t\(\text{start-up}\)): 0.5 ... 600 s (0.5 s)*
Response delay:
I\(\Delta\)N2 RMS/DC: 0 ... 600 s (0 s)*
I\(\Delta\)N2 RMS/DC: 0 ... 600 s (0 s)*
Delay on release:
I\(\Delta\)N1 DC: 0 ... 600 s (1 s)*
I\(\Delta\)N2 RMS: 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 ... 6
yellow: I\(\Delta\) > I\(\Delta\)n
yellow (flashing): measured value range exceeded

Interface
Interface/protocol: RS-485/BMS
Connection:
terminals A/B
Shieded 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

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

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

Connection
Connection type:
pluggable push-wire terminal

Connection properties:
rigid, flexible/conductor sizes AWG 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:
mounting clip (accessories)
DIN rail mounting:
1.5Nm
Tightening torque:
1.5Nm
Documentation number:
D00259
Weight:
170 g

Measuring current transformer
Diameter cable gland: 10 mm
Load current: 32 A

Bus parameter
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
Residual current monitors LINETRAXX® RCMS150

1 Residual current monitor RCMS150
2 Supply voltage U_s DC 24 V
3 RS-485 interface with BMS bus (Modbus RTU on request)
4 Terminating resistor (required at the beginning and at the end of the bus)

Note:
Only insulated primary conductors suited for the indicated rated voltages are to be used!
LINETRAXX® RCMB42…
AC/DC sensitive residual current monitor

Device features
- DC sensor with additional AC tripping (type B characteristic)
- Response value 2 – AC/DC 30 mA: r.m.s. value measurement
- Response value 1: DC 6 mA
- Frequency range residual current 0…2000 Hz
- Frequency range load current 45…65 Hz
- Monitoring of the connection to the measuring current transformer
- Fully shielded residual current transformer to avoid influences due to external disturbances
- Connection via push-wire terminals
- Variants: One-channel and two-channel residual current measurement

Typical applications
- Residual current monitoring of AC charging stations for electric vehicles

Approvals

Standards
The LINETRAXX® RCMB42… series complies with the following device standard:
- IEC 62752

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>Frequency range</th>
<th>Number of measuring current transformers (Ø 15 mm, 1.5 m cable)</th>
<th>Channels</th>
<th>Supply voltage U_s</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td>r.m.s.</td>
<td>0…6 mA</td>
<td>0…30 mA</td>
<td>0…2000 Hz</td>
<td>2</td>
<td>2 x residual current</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>–</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1 x residual current</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>–</td>
<td></td>
</tr>
</tbody>
</table>

Delivery incl. measuring current transformers.
Measuring current transformers available with shorter cable on request (minimum order quantity 250 pcs.)

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
Technical data

Residual current monitoring system | 1-and 2-channel, AC/DC sensitive residual current monitoring RCMB

**Residual current monitoring system**

- **Insulation coordination according to IEC 60664-1**
  - Definitions:
    - Supply circuit (IC1): A1, A2
    - Measuring circuit (IC2): Id1, Id2, Err, Test, GND
    - Output circuit 1 (IC3): 13, 14
    - Output circuit 2 (IC4): 23, 24
    - Monitored current circuit (IC5): Un
  - Rated voltage: 250 V
  - Overvoltage category (OPVC): III
  - Pollution degree: 2

### LINETRAXX® RCMB42...

**Rated insulation voltage**
- IC1/IC2: 40 V
- IC3/IC4-IC5: 250 V
- IC4/IC5: 250 V

**Rated impulse voltage**
- IC1/IC2: 800 V
- IC3/IC4-IC5: 4 kV
- IC4/IC5: 4 kV

**Safe isolation (reinforced insulation) between**
- IC1/IC2-IC3/IC5: OVC III, 250 V
- IC3/IC4-IC5: OVC III, 250 V
- IC4/IC5: OVC III, 250 V

**Basic insulation between**
- IC3/IC4: OVC III, 250 V

**Functional insulation between**
- IC1/IC2: DC 1 kV 60 s

**Voltage tests (routine test) acc. to IEC 61010-1**
- IC1-IC2/(IC3-IC5): AC 2.2 kV
- IC2-IC5: AC 2.2 kV
- IC3/IC4: AC 2.2 kV

**Rated insulation voltage**
- IC1/(IC2-IC5): 250 V
- IC2/(IC3-IC5): 250 V
- IC3/(IC4-IC5): 250 V

**Rated impulse voltage**
- IC1/(IC2-IC5): 4 kV
- IC2/(IC3-IC5): 4 kV
- IC3/IC4-IC5: 4 kV

**Safe isolation (reinforced insulation) between**
- IC1/(IC2-IC5): OVC III, 250 V
- IC2/(IC3-IC5): OVC III, 250 V
- IC3/(IC4-IC5): OVC III, 250 V

**Basic insulation between**
- IC3/IC4: OVC III, 250 V

**Voltage tests (routine test) acc. to IEC 61010-1**
- IC1/(IC2-IC5): AC 2.2 kV
- IC2/(IC3-IC5): AC 2.2 kV
- IC2/(IC3-IC4): AC 2.2 kV
- IC4-IC5: AC 2.2 kV

**Supply voltage**
- RCMB42…-2: DC 24 V
- RCMB42…-25: DC 18…36 V

**Nominal voltage range Un:**
- AC 110...240 V, 50/60 Hz
- DC 150...220 V

**Tolerance of the nominal voltage range of Un:**
- ±5...+15 %

**Nominal current:**
- 110 mA (RCMB420-25)
- 70 mA (RCMB422-25)

**Internal protection against reverse polarity and short circuit**
- DC 6 mA
- < 3 mA

**Restart sequence value**
- DC 6 mA
- < 3 mA

**Restart sequence value**
- for f ≤ 1 kHz
- ≤ 20 mA
- for f > 1 kHz
- ≤ 20...+100 %

**Inputs and operation**
- Test button: on front side
- Test: internal/external
- Cable length Test/Err, GND: < 10 m

**Switching elements**
- Alarm relays K1, K2
  - IΔn ≥ 6 mA DC
  - IΔn ≥ 30 mA r.m.s.

**Switching elements**
- 2 x 1 N/O contacts
- Operating principle: N/C operation
- Electrical endurance, number of cycles: 10,000

**Contact data according to IEC 60947-5-1**
- AC-14/DC-13
- AC/DC
- Minimum contact rating: 1 mA at AC/DC ≥ 10 V

**Environment/EMC**
- EMC: IEC 61851-1, IEC 61851-22
- Operating temperature: -30...+75 °C

**Classification of climatic conditions acc. to IEC 60721**
- Stationary use: IEC 60721-3-3
- 3K23 (except condensation and formation of ice)
- Transport: IEC 60721-3-2
- 2K11
- Long-term storage: IEC 60721-3-1
- 1K21

**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: push-wire terminals
- Connection properties:
  - Rigid: 0.2...2.5 mm² (AWG 24...14)
  - Flexible without ferrules: 0.75...2.5 mm² (AWG 19...14)
  - Flexible with ferrules: 0.2...1.5 mm² (AWG 24...16)
- Stripping length: 10 mm
- Opening force: 50 N
- Test opening, diameter: 2.1 mm
Ein wichtiges Zukunftsthema für die Automobilindustrie ist die Elektromobilität. Elektrofahrzeuge sollen künftig zunehmend dazu beitragen, die Erdölabhängigkeit zu verringern und die CO₂-Belastung zu reduzieren. Mit der Messe eCarTec und dem dazugehörigen Kongress wurde eine internationale Plattform ins Leben gerufen, die sich ausschließlich mit dem Thema Elektromobilität beschäftigt.

Vom 13. bis 15. Oktober präsentiert KEBA auf der eCarTec erstmals in Deutschland die outdoorfähige Stromladestation KeContact, mit der alle Arten von elektrobetriebenen Fahrzeugen, wie Autos, Motorroller, Fahrräder, Segways oder Rollstühle einfach und sicher aufgeladen werden können – und das rund um die Uhr.

LINETRAXX® MRCDB423
Modular residual current device type B for additional protection (protection against indirect contact) in earthed systems (TN and TT systems)

Device features
• AC/DC sensitive MRCD type B in accordance with IEC 60947-2 Annex M
• Use as modular residual current protective device for additional protection in earthed systems
• Operating characteristic type B in accordance with IEC 60755
• RMS value measurement of the residual current
• Alarm and prewarning indication via LEDs
• Alarm and prewarning output via relays (K1/K2)
• Control of a switching element with isolating properties via relay K2
• Measuring current transformer connection monitoring
• Fault memory

Typical applications
• Additional protection (protection against indirect contact) in earthed systems (TN and TT systems)

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Response range IΔn</th>
<th>Rated frequency</th>
<th>Supply voltage</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 mA…3 A</td>
<td>0…2000 Hz</td>
<td>DC 9.6…94 V, AC 42…460 Hz, 16…72 V</td>
<td>MRCDB423-D-1</td>
<td>B94043055</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DC 70…300 V, AC 42…460 Hz, 70…300 V</td>
<td>MRCDB423-D-2</td>
<td>B94043056</td>
</tr>
</tbody>
</table>

1) Absolute values of the voltage range

External measuring current transformers

<table>
<thead>
<tr>
<th>CT diameter</th>
<th>Shield</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø 20</td>
<td>–</td>
<td>CTUB101-CTBC20</td>
<td>B78120010</td>
<td>365</td>
</tr>
<tr>
<td></td>
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<td>CTUB101-CTBC20P</td>
<td>B78120020</td>
<td>365</td>
</tr>
<tr>
<td>ø 35</td>
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<td>CTUB101-CTBC35</td>
<td>B78120012</td>
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<td>CTUB101-CTBC35P</td>
<td>B78120022</td>
<td>365</td>
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<tr>
<td>ø 60</td>
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<td>CTUB101-CTBC60</td>
<td>B78120014</td>
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<tr>
<td></td>
<td></td>
<td>CTUB101-CTBC60P</td>
<td>B78120024</td>
<td>365</td>
</tr>
</tbody>
</table>

Technical data MRCDB423

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

MRCDB423-D-1:
- Rated voltage: 100 V
- Overvoltage category/pollution degree: III/2
- Rated impulse voltage: 2.5 kV

MRCDB423-D-2:
- Rated voltage: 250 V
- Overvoltage category/pollution degree: III/2
- Rated impulse voltage: 4 kV

Supply voltage
- DC, AC 24…60 V
- AC 16…72 V
- DC 42…460 Hz
- AC/DC 100…250 V

Measuring circuit
External measuring current transformer type
<table>
<thead>
<tr>
<th>CTUB101 - CTBC20</th>
<th>CTUB101 - CTBC35</th>
<th>CTUB101 - CTBC210</th>
</tr>
</thead>
<tbody>
<tr>
<td>B78120010</td>
<td>B78120012</td>
<td>B78120014</td>
</tr>
</tbody>
</table>

Rated voltage (measuring current transformer): 800 V
- Operating characteristic type B in accordance with IEC 60755 type B
- Rated frequency: 0…2000 Hz
- Operating uncertainty: 0…35 %

Response values
- Rated residual operating current IΔn1: 50…100 % of IΔn2 (50 %)*
- Rated residual operating current IΔn2: 30 mA…3 A (30 mA)*

Time response
- Start-up delay t1: (1 s)*
- Response delay t2: 0…10 s (10 s)*
- Response delay t3: 0…10 s (10 s)*
- Operating time t4: at IΔn1 = 1 x IΔn1/2 ≤ 180 ms
- Operating time t5: at IΔn2 = 5 x IΔn2/2 ≤ 23 ms
- Response time t6: t6 = t4 + t5/2 ≤ 300 ms

Recovery time t7: ≤ 300 ms

Further information
For further information refer to our product range on www.bender.de.

External measuring current transformers

<table>
<thead>
<tr>
<th>CT diameter</th>
<th>Shield</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø 120</td>
<td>–</td>
<td>CTUB101-CTBC120</td>
<td>B78120016</td>
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<td>CTUB101-CTBC120P</td>
<td>B78120026</td>
<td>365</td>
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<tr>
<td>ø 210</td>
<td>–</td>
<td>CTUB101-CTBC210</td>
<td>B78120018</td>
<td>365</td>
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<tr>
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<td>CTUB101-CTBC210P</td>
<td>B78120028</td>
<td>365</td>
</tr>
</tbody>
</table>

1) Absolute values of the voltage range

External measuring current transformers

<table>
<thead>
<tr>
<th>CT diameter</th>
<th>Shield</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø 20</td>
<td>–</td>
<td>CTUB101-CTBC20</td>
<td>B78120010</td>
<td>365</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CTUB101-CTBC20P</td>
<td>B78120020</td>
<td>365</td>
</tr>
<tr>
<td>ø 35</td>
<td>–</td>
<td>CTUB101-CTBC35</td>
<td>B78120012</td>
<td>365</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CTUB101-CTBC35P</td>
<td>B78120022</td>
<td>365</td>
</tr>
<tr>
<td>ø 60</td>
<td>–</td>
<td>CTUB101-CTBC60</td>
<td>B78120014</td>
<td>365</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CTUB101-CTBC60P</td>
<td>B78120024</td>
<td>365</td>
</tr>
</tbody>
</table>
Technical data MRCD423 (continued)

**Displays, memory**

- Display range measured value AC/DC: 0...6 A
- Error of measured value indication: ±17.5 %/±2 digits
- Measured-value memory for alarm value: Data record measured values
- Password: off/0...999 (on)*
- Fault memory output relay: yes

**Inputs/outputs**

- Cable length for external test/reset button: 0...3 m
- Cable length for measuring current transformer connection: 0...3 m

**Switching elements**

- Number of switching elements: 2 x 1 changeover contact
- Operating principle: N/C operation
- Electrical endurance, number of cycles: 10000

**Contact data acc. to IEC 60947-5-1:**

- Utilisation category: AC-13, AC-14, DC-12
- Rated operational voltage: 230 V, 230 V, 24 V, 110 V, 220 V
- Rated operational current: 5 A, 3 A, 1 A, 0.2 A, 0.1 A
- Minimum contact rating: 1 mA at AC/DC ≥ 10 V

**Environment/EMC**

- EMC: IEC 60947-2 annex M (combined with MRCDB423)
- Operating temperature: -25...+70 °C
- Classification of climatic conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3K23 (except condensation and formation of ice)
  - Transport (IEC 60721-3-2): 2K11 (except condensation and formation of ice)
  - Long-term storage (IEC 60721-3-1): 1K22 (except condensation and formation of ice)

**Classification of climatic conditions acc. to IEC 60721**

- Stationary use (IEC 60721-3-3): 3K23 (except condensation and formation of ice)
- Transport (IEC 60721-3-2): 2K11 (except condensation and formation of ice)
- Long-term storage (IEC 60721-3-1): 1K22 (except condensation and formation of ice)

**Connection**

- Position of normal use: display-oriented
- 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**

- Screw fixing: M5 lens-head screw acc. to DIN 7985
- Weight: CTUB10x-CTBC20: 230 g, CTUB10x-CTBC20P: 290 g, CTUB10x-CTBC35: 310 g, CTUB10x-CTBC35P: 390 g, CTUB10x-CTBC60: 530 g, CTUB10x-CTBC60P: 690 g, CTUB10x-CTBC120: 1460 g, CTUB10x-CTBC120P: 1820 g, CTUB10x-CTBC210: 4290 g, CTUB10x-CTBC210P: 4940 g

**Technical data measuring current transformers**

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**

- Rated insulation voltage: 800 V
- Rated impulse voltage: 8 kV
- Overvoltage category/pollution degree: III/2

**Supply voltage**

- Supply voltage U0: DC –12 V
- Operating range of U0: ±2 %
- Power consumption: ≤ 2.5 VA

**Current transformer circuit**

- Rated current IΔn: 30 mA
- Rated current Ith: 2.4 kA/40 ms
- Rated continuous thermal current Ict: 30 A
- Rated short-time thermal current Ith: 2.4 kA/40 ms
- Rated dynamic current IΔn: 6.0 kA/40 ms

**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: screw-type terminals
- Classification of protection, internal components (IEC 60529): IP40
- Degree of protection, terminals (IEC 60529): IP20
- Enclosure material: polycarbonate
- Flammability class: UL94V-O
- Wiring type: DIN rail mounting acc. to IEC 60715
- Screw fixing: 2 x M4 with mounting clip
- Document number: D00396

**Other**

- Degree of protection, internal components (IEC 60529): IP40
- Degree of protection, terminals (IEC 60529): IP20
- Screw mounting: MS lens-head screw acc. to DIN 7985
- Weight: ≤ 150 g

**Environment/EMC**

- EMC: IEC 60947-2 annex M (combined with MRCDB423)
- Operating temperature: -25...+70 °C
- Classification of climatic conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3K23 (except condensation and formation of ice)
  - Transport (IEC 60721-3-2): 2K11 (except condensation and formation of ice)
  - Long-term storage (IEC 60721-3-1): 1K22 (except condensation and formation of ice)

**Classification of climatic conditions acc. to IEC 60721**

- Stationary use (IEC 60721-3-3): 3K23 (except condensation and formation of ice)
- Transport (IEC 60721-3-2): 2K11 (except condensation and formation of ice)
- Long-term storage (IEC 60721-3-1): 1K22 (except condensation and formation of ice)
### Dimension diagram (dimensions in mm)

![Dimension diagram](image)

### Dimension diagram CTUB10…-CTBC…

![Dimension diagram CTUB10…-CTBC…](image)

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
</tr>
<tr>
<td>CTUB10…-CTBC20(P)</td>
</tr>
<tr>
<td>CTUB10…-CTBC35(P)</td>
</tr>
<tr>
<td>CTUB10…-CTBC60(P)</td>
</tr>
<tr>
<td>CTUB10…-CTBC120(P)</td>
</tr>
<tr>
<td>CTUB10…-CTBC210(P)</td>
</tr>
<tr>
<td><strong>D</strong> CTUB10…</td>
</tr>
</tbody>
</table>

Tolerance: ±0.5 mm
Residual current monitoring system | 1-channel, AC/DC sensitive residual current monitoring
Modular residual current device type B LINETRAXX® MRCDB423

1. A1, A2 Connection to supply voltage $U_s$
2. 1 Socket for connection cable of measuring current transformer
3. T/R Connection for a combined external test and reset button
4. 11, 12, 14 Alarm relay K1 (alarm)
5. 21, 22, 24 Alarm relay K2

The measuring range must be set according to the response value in the evaluator.
LINETRAXX® MRCDB300 series
AC/DC sensitive residual current monitoring modules for MRCD applications

Device features
• Structure of a protective device in accordance with IEC 60947-2 Annex M in combination with a circuit breaker providing isolating properties
• Monitoring of the connected circuit breaker by means of contact feedback
• RS-485 interface with Modbus RTU (reading out measured values/setting parameters)
• Integrated switching outputs with two changeover contacts K1 and K2 (galvanically isolated)
• Fulfils the protection goals protection of persons, fire protection and plant protection (depending on the variant)
• Frequency range DC…100 kHz
• Combined test and reset button
• Multicolour LED indicating operation, exceeded response value, disturbances and status messages
• AC/DC sensitive type B measured value acquisition acc. to IEC 60755
• AC/DC sensitive type B+ measured value acquisition acc. to VDE 0664-400
• Exchangeable electronic enclosure without mechanical separation of the primary conductors
• Extension/retrofitting or modification of functionalities in case of changed monitoring requirements
• Insensitive to load currents due to full magnetic shield (CTBC20P …210P only)
• Connection monitoring of the measuring current transformer with cyclical test current
• Use of all MRCDB300 for all CTBC… measuring current transformer sizes
• Supply voltage DC 24

Typical applications
• for MRCD applications

Approvals
CE  UK  CA  UL

Further information
For further information refer to our product range on www.bender.de.

Ordering information

Electronic modules
<table>
<thead>
<tr>
<th>Supply voltage Uₜ</th>
<th>Variant</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td>Protection of persons</td>
<td>MRCDB301</td>
<td>B74043120</td>
</tr>
<tr>
<td>24 V (19.2…28.0 V)</td>
<td>Fire protection</td>
<td>MRCDB302</td>
<td>B74043121</td>
</tr>
<tr>
<td>24 V (19.2…28.0 V)</td>
<td>Protection of persons, fire protection and plant protection (freely configurable)</td>
<td>MRCDB303</td>
<td>B74043122</td>
</tr>
<tr>
<td>24 V (19.2…28.0 V)</td>
<td>Protection of persons for applications with pulsed, very high peak load currents (&gt; 1 kA for &lt; 1 s), e.g. welding applications</td>
<td>MRCDB305</td>
<td>B74043125</td>
</tr>
</tbody>
</table>

Required terminals are included in the scope of delivery.

Measuring current transformers

<table>
<thead>
<tr>
<th>Internal diameter</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mm</td>
<td>CTBC20</td>
<td>B98120001</td>
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<td>CTBC20P</td>
<td>B98120002</td>
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<tr>
<td>35 mm</td>
<td>CTBC35</td>
<td>B98120003</td>
</tr>
<tr>
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<td>CTBC35P</td>
<td>B98120004</td>
</tr>
<tr>
<td>60 mm</td>
<td>CTBC60</td>
<td>B98120005</td>
</tr>
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<td>CTBC60P</td>
<td>B98120006</td>
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<td>120 mm</td>
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<td>CTBC210P</td>
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</table>

P = full magnetic shield

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface converter USB to RS-485</td>
<td>B95012045</td>
</tr>
<tr>
<td>Terminal block for MRCD module ¹</td>
<td>B74043124</td>
</tr>
<tr>
<td>Snap-on mounting for CTBC20 and CTBC20P ¹</td>
<td>B91080111</td>
</tr>
<tr>
<td>Snap-on mounting for CTBC35 and CTBC35P ¹</td>
<td>B91080112</td>
</tr>
</tbody>
</table>

⁹¹ Included in scope of delivery

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>max. connected current transformers</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage supply</td>
<td>4</td>
<td>STEP-PS/1 AC/24 DC/0.5</td>
<td>B94053110</td>
<td>390</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>STEP-PS/1 AC/24 DC/1.75</td>
<td>B94053111</td>
<td>390</td>
</tr>
<tr>
<td></td>
<td>34</td>
<td>STEP-PS/1 AC/24 DC/4.2</td>
<td>B94053112</td>
<td>390</td>
</tr>
</tbody>
</table>
## Insulation coordination acc. to IEC 60664-1/IEC 60664-3

### Definitions:
- Measuring circuit (IC1)
- Secondary (IC2)
- Control circuit 1 (IC3)
- Control circuit 2 (IC4)

### Operating range of Multicolour LED red/green, see table “System states: LED and output relays” on page 204

### Indication

### Response time

### Response value

### Δn

### Measuring range:
- CTBC120, CTBC210 300 mA…10 A
- CTBC20, CTBC20P 10…500 mA
- CTBC120P, CTBC210P 100 mA…10 A

### Characteristics according to IEC 62020 and IEC/TR 60755
- AC/DC sensitive, type B
- Internal diameter measuring current transformer
- see dimension diagrams page 205

### Inrush current
- 1.7 A for 1 ms

### Power consumption
- ≤ 2.5 W

### Technical data

### Area of application
- ≤ 2000 m AMSL

### Overvoltage category
- III

### Rated insulation voltage:
- 800 V

### Overvoltage category:
- 400 V

### Rated impulse voltage:
- ≤ 2000 m AMSL

### Contact data acc. to IEC 60947-5-1

### Utilization category
- AC-13, AC-14, DC-12, DC-12

### Rated operational voltage:
- 250 V

### Rated operational current:
- 5 A

### Minimum current
- 10 mA at DC 1 V

### Contact data

### Technical data

### Contact data

### Technical data

### Classification of climatic conditions acc. to IEC 60721

### Stationary use (IEC 60721-3-3)
- M31

### Transport (IEC 60721-3-2)
- M31

### Classification of mechanical conditions acc. to IEC 60721

### Stationary use (IEC 60721-3-3)
- M31

### Long-term storage (IEC 60721-3-1)
- M31

### Connection

### Required terminals are included or are at the scope of delivery.

### Terminal block 1

### Manufacturer
- Phoenix Contact

### Type
- DFLMC 1.5/3-ST-3.5 SK

### The connection conditions of the manufacturer apply.

### Connection properties

### rigid
- 0.2…1.5 mm² (AWG 24…16)

### flexible
- 0.2…0.75 mm² (AWG 24…19)

### Terminal block 2, 3

### Manufacturer
- Phoenix Contact

### Type
- FCLMV 2.5/3-ST-5.08

### The connection conditions of the manufacturer apply.

### Connection capacity

### rigid
- 0.2…2.5 mm² (AWG 24…13)

### flexible
- 0.2…2.5 mm² (AWG 24…13)

### Mounting CTCB...

### Screw type
- CTCB20...60(P)
- CTCB120...210(P)

### Wither type
- CTCB20...60(P)
- CTCB120...210(P)

### Tightening torque
- 0.25…2.5 Nm

### Mounting CTCB...

### Type
- DIN EN ISO 7089/7090 - 5

### DIN EN ISO 7089/7090 - 6

### Weight

### MRCDB300
- ≤ 100 g

### MRCDB300
- ≤ 160 g

### MRCDB300
- ≤ 220 g

### MRCDB300
- ≤ 240 g

### MRCDB300
- ≤ 320 g

### MRCDB300
- ≤ 460 g

### MRCDB300
- ≤ 620 g

### MRCDB300
- ≤ 1190 g

### MRCDB300
- ≤ 1750 g

### MRCDB300
- ≤ 4220 g

### MRCDB300
- ≤ 4870 g

### Other

### Operating mode
- continuous operation

### Mounting
- any position

### Degree of protection, internal components (DIN 69529)
- IP40

### Degree of protection, terminals (DIN EN 60529)
- IP20

### Flammability class
- UL94 V-0

### Software
- D00579

### Documentation number
- D00343

### Residual current monitoring system | 1-channel, AC/DC sensitive residual current monitoring

### AC/DC sensitive residual current monitoring modules for MRCD applications LINETRAXX® MRCDB300 series

### Manufacturer
- Phoenix Contact

### Terminal block 1 (24 V, GND, D1, DG, T/R, GND, A, B, K1, K2)

### Terminal block 2 (21,22,24)
**System states: LED and output relays**

The LED indicates the system state by means of colours and lighting/flashing. The N/O contacts of relay outputs K1 and K2 have defined switching positions for each system state.

<table>
<thead>
<tr>
<th>System state</th>
<th>LED</th>
<th>Notes</th>
<th>Changeover contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device switched off</td>
<td>off</td>
<td>Device is deenergised, no monitoring, no monitoring function</td>
<td>de-energised</td>
</tr>
<tr>
<td>Normal operating state</td>
<td>lights</td>
<td>The device is supplied with the specified voltage and monitors the primary circuit. No residual current flows which would lead to tripping.</td>
<td>energised</td>
</tr>
<tr>
<td>Prewarning</td>
<td>lights</td>
<td>The device is supplied with the specified voltage and monitors the primary circuit. A fault current flows which exceeds the set limit of the prewarning.</td>
<td>de-energised</td>
</tr>
<tr>
<td>Alarm state</td>
<td>off</td>
<td>The device is supplied with the specified voltage and monitors the primary circuit. A fault current flows which exceeds the set limit of the alarm.</td>
<td>de-energised</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRCD30…-CTBC20(P)</td>
<td>81</td>
<td>112</td>
<td>37</td>
<td>ø 20</td>
</tr>
<tr>
<td>MRCD30…-CTBC55(P)</td>
<td>97</td>
<td>130</td>
<td>47</td>
<td>ø 35</td>
</tr>
<tr>
<td>MRCD30…-CTBC60(P)</td>
<td>126</td>
<td>158</td>
<td>57</td>
<td>ø 60</td>
</tr>
<tr>
<td>MRCD30…-CTBC120(P)</td>
<td>188</td>
<td>232</td>
<td>96</td>
<td>ø 120</td>
</tr>
<tr>
<td>MRCD30…-CTBC210(P)</td>
<td>302</td>
<td>346</td>
<td>153</td>
<td>ø 210</td>
</tr>
<tr>
<td>MRCD30…</td>
<td>74</td>
<td>37</td>
<td>44</td>
<td>ø 2</td>
</tr>
</tbody>
</table>

Tolerance: ±0.5 mm
- The use of a type 2 surge protection device (SPD) is mandatory due to possible impulse voltages and in order to comply with normative requirements.
- The surge protection device must be connected upstream of the power supply unit on the supply side.
- Features of the surge protection device:
  - Nominal discharge current \( I_n \) (8/20 μs): 20 kA
  - Response time: 25 ns
  - Two-stage: 1 varistor + 1 spark gap
- Alternatively, the power supply unit must be connected to a CAT II supply without a surge protection device.
LINETRAXX® RCMB300 series
AC/DC sensitive residual current monitoring modules with an integrated measuring current transformer

**Device features**
- Continuous residual current monitoring in compliance with DGUV Vorschrift 3 (German Social Accident Insurance Regulation 3)
- Easy DIN rail or screw mounting
- RS-485 interface with Modbus RTU (reading out measured values/setting parameters)
- Integrated switching outputs with two changeover contacts K1 and K2 (galvanically isolated)
- Frequency range DC…100 kHz
- Combined test and reset button
- Multicolour LED indicating operation, exceeded response value, disturbances and status messages
- AC/DC sensitive type B measured value acquisition acc. to IEC 60755
- AC/DC sensitive type B+ measured value acquisition acc. to VDE 0664-400
- The AC and DC components as well as the r.m.s. value of the residual current can be evaluated separately
- Exchangeable electronic enclosure without mechanical separation of the primary conductors
- Extension/retrofitting or modification of functionalities in case of changed monitoring requirements
- Insensitive to load currents due to full magnetic shield (CTBC20P…210P only)
- Connection monitoring of the measuring current transformer with cyclical test current
- Use of the RCMB301 for all CTBC… measuring current transformer sizes
- Supply voltage DC 24 V

**Typical applications**
- AC and DC fault currents in earthed systems (TN and TT systems).

**Approvals**
UL File number: E493737, E173157

**Further information**
For further information refer to our product range on www.bender.de.

**Evaluation information**

**Supply voltage electronics**

<table>
<thead>
<tr>
<th>Supply voltage $U_s$</th>
<th>Variant</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC 24V (19.2…28.8V)</td>
<td>Modbus RTU</td>
<td>RCMB301</td>
<td>B74043100</td>
</tr>
</tbody>
</table>

Required terminals are included in the scope of delivery.

**Measuring current transformers**

<table>
<thead>
<tr>
<th>Internal diameter</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mm</td>
<td>CTBC20</td>
<td>B98120001</td>
</tr>
<tr>
<td></td>
<td>CTBC20P</td>
<td>B98120002</td>
</tr>
<tr>
<td>35 mm</td>
<td>CTBC35</td>
<td>B98120003</td>
</tr>
<tr>
<td></td>
<td>CTBC35P</td>
<td>B98120004</td>
</tr>
<tr>
<td>60 mm</td>
<td>CTBC60</td>
<td>B98120005</td>
</tr>
<tr>
<td></td>
<td>CTBC60P</td>
<td>B98120006</td>
</tr>
<tr>
<td>120 mm</td>
<td>CTBC120</td>
<td>B98120007</td>
</tr>
<tr>
<td></td>
<td>CTBC120P</td>
<td>B98120020</td>
</tr>
<tr>
<td>210 mm</td>
<td>CTBC210</td>
<td>B98120008</td>
</tr>
<tr>
<td></td>
<td>CTBC210P</td>
<td>B98120021</td>
</tr>
</tbody>
</table>

$P =$ full magnetic shield

**Accessories**

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface converter USB to RS-485</td>
<td>B95012045</td>
</tr>
<tr>
<td>Terminal block for RCMB301 module</td>
<td>B74043124</td>
</tr>
<tr>
<td>Snap-on mounting for CTBC20 and CTBC20P</td>
<td>B91080111</td>
</tr>
<tr>
<td>Snap-on mounting for CTBC35 and CTBC35P</td>
<td>B91080112</td>
</tr>
</tbody>
</table>

$1^{1)}$ Included in scope of delivery

**Suitable system components**

<table>
<thead>
<tr>
<th>Description</th>
<th>max. connected current transformers</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage supply</td>
<td>4 STEP-PS/1 AC/24 DC/0.5</td>
<td>STEP-PS/1 AC/24 DC/0.5</td>
<td>B94053110</td>
<td>390</td>
</tr>
<tr>
<td></td>
<td>14 STEP-PS/1 AC/24 DC/1.75</td>
<td>STEP-PS/1 AC/24 DC/1.75</td>
<td>B94053111</td>
<td>390</td>
</tr>
<tr>
<td></td>
<td>34 STEP-PS/1 AC/24 DC/4.2</td>
<td>STEP-PS/1 AC/24 DC/4.2</td>
<td>B94053112</td>
<td>390</td>
</tr>
</tbody>
</table>
Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:
- Measuring circuit (IC1)
- Primary conductors routed through the current transformer
- Secondary (IC2)
- Control circuit 1 (IC3)
- Control circuit 2 (IC4)

Rated insulation voltage: 800 V

Overvoltage category: III

Area of application: ≤ 2000 m AMSL

Rated impulse voltage:
- IC1/(IC2-IC4): 8 kV
- IC2/(IC3-IC4): 300 V
- IC3/IC4: AC 2.2 kV

Pollution degree: 2

Safe insulation (refined insulation) between:
- IC1/(IC2-IC4): 300 V
- IC2/(IC3-IC4): 250 V
- IC3/IC4: 250 V

Switching capacity:
- CTBC120, CTBC210: 250 V, 5 A
- CTBC35, CTBC35P, CTUBC60, CTBC60P: 220 V, 1 A
- CTBC60: 110 V, 24 A
- CTBC20P, CTUBC60P: 1500 V, 1/4 A

Contact data acc. to IEC 60947-5-1

Ultratification category:
- AC13: 10 mA at DC 5 V
- AC14: 10 mA
- DC12, DC12: 10 mA
- DC12: 10 mA

Minimum current: 10 mA at DC 5 V

Electrical endurance, number of cycles: 10,000

Environment/EMC

EMC
- Type: IEC 62061-2-2020
- Operating temperature: -25…70 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3):
- 3K23 (except condensation and formation of ice)
- 3K23 (except condensation and formation of ice)
- 1K22 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3):
- 3M11
- 3M11
- 3M12

Connection

Required terminals are included in the scope of delivery.

Terminal block 1

Manufacturer: Phoenix Contact
Type: DFMC 1.5/5-ST-3.5 BK

The connection conditions of the manufacturer apply.

Connection properties:
- rigid: 0.2…1.5 mm² (AWG 24…16)
- flexible: 0.2…1.5 mm² (AWG 24…16)

Mounting CBCC...

Screw type:
- DIN EN ISO 7045 - M6
- DIN EN ISO 7045 - M8

Washer type:
- DIN EN ISO 7049/7090 - 6
- DIN EN ISO 7049/7090 - 5
- DIN EN ISO 7049/7090 - 6

Tightening torque:
- DIN EN ISO 7049/7090 - 5
- DIN EN ISO 7049/7090 - 6

Other

Degree of protection, terminals (DIN EN 60529) IP20

Degree of protection, internal components (DIN EN 60529) IP40

Degree of protection, terminals (DIN EN 60529) IP20

Flammability class:
- UL94 V-0

Software:
- D06310

Documentation number:
- D00372

Residual current monitoring system  |  1-channel, AC/DC sensitive residual current monitoring

AC/DC sensitive residual current monitoring modules LINETRAXX® RCMB300 series

Using LINETRAXX® RCMB300 series

Possible response values (to be set on the evaluator):
- CBCC20, CBCC20P: 10 mA…500 mA
- CBCC35: 30 mA…10 A
- CBCC60: 30 mA…10 A
- CBCC120: 300 mA…10 A

Time response:
- RCMB301: ≤ 100 g
- RCMB20: ≤ 220 g
- CBCC20P: ≤ 220 g
- CBCC20P: ≤ 220 g
- CBCC35: ≤ 220 g
- CBCC60: ≤ 460 g
- CBCC60P: ≤ 620 g
- CBCC120: ≤ 1390 g
- CBCC120P: ≤ 1750 g
- CBCC210: ≤ 4220 g
- CBCC210P: ≤ 4870 g

(*) Factory setting

The use of the power supply units listed at "Accessories" is recommended.

The use of a surge protection device is mandatory for these power supply units.
### System states: LED and output relays

The LED indicates the system state by means of colours and lighting/flashing. The N/O contacts of relay outputs K1 and K2 have defined switching positions for each system state.

<table>
<thead>
<tr>
<th>System state</th>
<th>LED</th>
<th>Notes</th>
<th>Changeover contact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>green (ON)</td>
<td>red (alarm)</td>
<td></td>
</tr>
<tr>
<td>Device switched off</td>
<td>off</td>
<td>off</td>
<td>de-energised</td>
</tr>
<tr>
<td>Normal operating state</td>
<td>lights</td>
<td>off</td>
<td>energised</td>
</tr>
<tr>
<td>Prewarning</td>
<td>lights</td>
<td>Flashes briefly</td>
<td>de-energised</td>
</tr>
<tr>
<td>Alarm state</td>
<td>off</td>
<td>lights</td>
<td>de-energised</td>
</tr>
</tbody>
</table>

### Dimensions (mm)

<table>
<thead>
<tr>
<th>Type</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
<th>f</th>
<th>g</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCMB301-CTBC20(P)</td>
<td>81</td>
<td>112</td>
<td>37</td>
<td>ø 20</td>
<td>46</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>RCMB301-CTBC35(P)</td>
<td>97</td>
<td>130</td>
<td>47</td>
<td>ø 35</td>
<td>46</td>
<td>61</td>
<td></td>
</tr>
<tr>
<td>RCMB301-CTBC60(P)</td>
<td>126</td>
<td>158</td>
<td>57</td>
<td>ø 60</td>
<td>56</td>
<td>78</td>
<td></td>
</tr>
<tr>
<td>RCMB301-CTBC120(P)</td>
<td>188</td>
<td>232</td>
<td>96</td>
<td>ø 120</td>
<td>65</td>
<td>96</td>
<td>139</td>
</tr>
<tr>
<td>RCMB301-CTBC210(P)</td>
<td>302</td>
<td>346</td>
<td>153</td>
<td>ø 210</td>
<td>67</td>
<td>113</td>
<td>277</td>
</tr>
</tbody>
</table>

D

RCMB301

<table>
<thead>
<tr>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
<th>f</th>
<th>g</th>
</tr>
</thead>
<tbody>
<tr>
<td>74</td>
<td>37</td>
<td>44</td>
<td>2</td>
<td>4,6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tolerance: ±0.5 mm
- The use of a type 2 surge protection device (SPD) is mandatory due to possible impulse voltages and in order to comply with normative requirements.
- The surge protection device must be connected upstream of the power supply unit on the supply side.
- Features of the surge protection device:
  - Nominal discharge current $I_n (8/20 \, \mu s): 20 \, kA$
  - Response time: 25 ns
  - Two-stage: 1 varistor + 1 spark gap
- Alternatively, the power supply unit must be connected to a CAT II supply without a surge protection device.
LINETRAXX® RCMB330
AC/DC sensitive residual current monitoring module with integrated split-core measuring current transformer

Device features

- Continuous residual current monitoring in compliance with DGUV Vorschrift 3 (German Accident Prevention Regulation 3)
- Easy DIN rail or screw mounting
- RS-485 interface with Modbus RTU (reading out measured values/setting parameters)
- Frequency range DC…100 kHz
- Multicolour LED for operation and status messages
- Digitally adjustable filters for AC/DC sensitive measured value acquisition (lowpass filters, type B acc. to IEC 60755, type B+ acc. to VDE 0664-400)
- Separate evaluation of the AC and DC components as well as the RMS value of the residual current possible
- Installation without mechanical separation of the primary conductors
- Extension or modification of functionalities through software updates via Modbus
- Insensitive to load currents due to magnetic screen
- Supply voltage DC 24 V

Typical applications

- Measuring AC and DC fault currents in earthed systems (TN and TT systems)

Approvals

The RCMB330 residual current monitoring modules comply with the device standard:
- IEC 62020-1

Further information

For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage $U_s$</th>
<th>Variant</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC 24 V (19.2…28.8 V)</td>
<td>Modbus RTU</td>
<td>RCMB330</td>
<td>B74045160</td>
</tr>
</tbody>
</table>

Ordering information

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-485/USB interface converter</td>
<td>B95012045</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Description</th>
<th>max. connected current transformers</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage supply</td>
<td>4</td>
<td>STEP-PS/1 AC/24 DC/0.5</td>
<td>B94053110</td>
<td>390</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>STEP-PS/1 AC/24 DC/1.75</td>
<td>B94053111</td>
<td>390</td>
</tr>
<tr>
<td></td>
<td>34</td>
<td>STEP-PS/1 AC/24 DC/4.2</td>
<td>B94053112</td>
<td>390</td>
</tr>
</tbody>
</table>
Residual current monitoring system  |  1-channel, AC/DC sensitive residual current monitoring RCMB

AC/DC sensitive residual current monitoring module LINETRAXX® RCMB330

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

<table>
<thead>
<tr>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring circuit (IC1)</td>
</tr>
<tr>
<td>Secondary (IC2)</td>
</tr>
<tr>
<td>Primary conductors routed through the current transformer terminal block (24 V, GND, A, B, X1, X2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rated voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 V</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overvoltage category</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating altitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 2000 m AMSL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rated impulse voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC1/IC2: 4 kV</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rated insulation voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC1/IC2: 300 V</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pollution degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Basic insulation between</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC1/IC2: 300 V</td>
</tr>
</tbody>
</table>

Supply voltage

<table>
<thead>
<tr>
<th>Supply voltage U1</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC 24 V</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating range of U1</th>
</tr>
</thead>
<tbody>
<tr>
<td>±5 %</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ripple U1</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 2 %</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 0.5 W typ. (2.5 W max.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inrush current</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 A for 25 μs</td>
</tr>
</tbody>
</table>

Measuring circuit

<table>
<thead>
<tr>
<th>Measuring current transformer, internal diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Characteristics according to IEC 62020-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC sensitive, type B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measuring range</th>
</tr>
</thead>
<tbody>
<tr>
<td>10…500 mA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Residual operating current IΔn</th>
</tr>
</thead>
<tbody>
<tr>
<td>30…500 mA (freely configurable), (30 mA)*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prewarning</th>
</tr>
</thead>
<tbody>
<tr>
<td>50…100 % IΔn (freely configurable), (60 %)*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rated current I0</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC…50 kHz: ±17.5 %</td>
</tr>
<tr>
<td>50…100 kHz: 0…+55 %</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relative uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC…50 kHz: 0…–35 %</td>
</tr>
<tr>
<td>50...100 kHz: –15…+35 %</td>
</tr>
</tbody>
</table>

Time response

<table>
<thead>
<tr>
<th>Response delay tΔn (preamarning)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 ms…60 min (1 s)*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Response delay tΔm (main alarm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 ms…60 min (50 ms)*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Start-up delay tΔn</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 s…60 min (freely configurable), (0 s)*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Delay on release tΔn</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 s…60 min (freely configurable), (1 s)*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating time tΔn</th>
</tr>
</thead>
<tbody>
<tr>
<td>at 3 x IΔn: ≤ 500 ms</td>
</tr>
<tr>
<td>at 2 x IΔn: ≤ 230 ms</td>
</tr>
<tr>
<td>at 1 x IΔn: ≤ 100 ms</td>
</tr>
</tbody>
</table>

| Response time tΔm = tΔn + tΔm |

<table>
<thead>
<tr>
<th>Recovery time t0</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 1 s</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Insulation coordination acc. to IEC 60664-1/IEC 60664-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definitions</td>
</tr>
<tr>
<td>Measuring circuit (IC1)</td>
</tr>
<tr>
<td>Secondary (IC2)</td>
</tr>
<tr>
<td>Primary conductors routed through the current transformer terminal block (24 V, GND, A, B, X1, X2)</td>
</tr>
<tr>
<td>Rated voltage</td>
</tr>
<tr>
<td>300 V</td>
</tr>
<tr>
<td>Overvoltage category</td>
</tr>
<tr>
<td>III</td>
</tr>
<tr>
<td>Operating altitude</td>
</tr>
<tr>
<td>≤ 2000 m AMSL</td>
</tr>
<tr>
<td>Rated impulse voltage</td>
</tr>
<tr>
<td>IC1/IC2: 4 kV</td>
</tr>
<tr>
<td>Rated insulation voltage</td>
</tr>
<tr>
<td>IC1/IC2: 300 V</td>
</tr>
<tr>
<td>Pollution degree</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>Basic insulation between</td>
</tr>
<tr>
<td>IC1/IC2: 300 V</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Supply voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage U1</td>
</tr>
<tr>
<td>DC 24 V</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating range of U1</th>
</tr>
</thead>
<tbody>
<tr>
<td>±5 %</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ripple U1</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 2 %</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 0.5 W typ. (2.5 W max.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inrush current</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 A for 25 μs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measuring circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring current transformer, internal diameter</td>
</tr>
<tr>
<td>25 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Characteristics according to IEC 62020-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC sensitive, type B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measuring range</th>
</tr>
</thead>
<tbody>
<tr>
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<table>
<thead>
<tr>
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<tbody>
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<td>50…100 % IΔn (freely configurable), (60 %)*</td>
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<table>
<thead>
<tr>
<th>Rated current I0</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 A</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Time response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response delay tΔn (preamarning)</td>
</tr>
<tr>
<td>50 ms…60 min (1 s)*</td>
</tr>
</tbody>
</table>

| Response delay tΔm (main alarm) |
| 50 ms…60 min (50 ms)* |

<table>
<thead>
<tr>
<th>Start-up delay tΔn</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 s…60 min (freely configurable), (0 s)*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Delay on release tΔn</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 s…60 min (freely configurable), (1 s)*</td>
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</tbody>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Recovery time t0</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 1 s</td>
</tr>
</tbody>
</table>

Displays

<table>
<thead>
<tr>
<th>Multicolour LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refer to chapter “LED” in the manual.</td>
</tr>
</tbody>
</table>

Interface

<table>
<thead>
<tr>
<th>Interface/protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-485/Modbus RTU</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Baud rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2…57.6 kbit/s</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cable length</th>
</tr>
</thead>
<tbody>
<tr>
<td>0…1200 m</td>
</tr>
</tbody>
</table>

Environment/EMC

<table>
<thead>
<tr>
<th>EMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC 62020-1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>-25…70 °C</td>
</tr>
</tbody>
</table>

Classification of climatic conditions acc. to IEC 60721

<table>
<thead>
<tr>
<th>Stationary use (IEC 60721-3-3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3K23 (except condensation and formation of ice)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transport (IEC 60721-3-2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2K11 (except condensation and formation of ice)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Long-term storage (IEC 60721-3-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1K22 (except condensation and formation of ice)</td>
</tr>
</tbody>
</table>

Classification of mechanical conditions acc. to IEC 60721

<table>
<thead>
<tr>
<th>Stationary use (IEC 60721-3-3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3M11</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transport (IEC 60721-3-2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2M4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Long-term storage (IEC 60721-3-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1M12</td>
</tr>
</tbody>
</table>

Connection

| Required terminals are included in the scope of delivery |

Terminal block

<table>
<thead>
<tr>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phoenix Contact</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCB plug-in connector - DFMC 0.5/ 8-ST-2.54</td>
</tr>
</tbody>
</table>

| The connection conditions of the manufacturer apply. |

Connection properties

<table>
<thead>
<tr>
<th>rigid</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.14…0.5 mm² (AWG 26…20)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>flexible</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.14…0.5 mm² (AWG 26…20)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>with ferrules</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25…0.34 mm² (AWG 24…22)</td>
</tr>
</tbody>
</table>

Other

<table>
<thead>
<tr>
<th>Operating mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>continuous operation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mounting</th>
</tr>
</thead>
<tbody>
<tr>
<td>any position</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Degree of protection, internal components (DIN EN 60529)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP40</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Degree of protection, terminals (DIN EN 60529)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flammability class (DIN 53439)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL94 V-0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Software</th>
</tr>
</thead>
<tbody>
<tr>
<td>D0609</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Documentation number</th>
</tr>
</thead>
<tbody>
<tr>
<td>D00389</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 170 g</td>
</tr>
</tbody>
</table>

(* factory setting)
By using the jumper, the internal 120 Ω terminating resistor can be connected.

**COM465IP**

By means of the **DIP switch**, the internal 120 Ω terminating resistor can be connected.

The connections for the power supply (X1, X2) and the RS-485 interface (A, B) are **doubled**, so that the wiring can be carried out directly on the device according to the **daisy-chain** principle required for **Modbus**.
**RCMB104**

AC/DC sensitive residual current monitoring module for electric vehicle charging systems

<table>
<thead>
<tr>
<th>Device features</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Three outputs (DC, RMS, Error)</td>
</tr>
<tr>
<td>• Frequency range DC…2 kHz</td>
</tr>
<tr>
<td>• Measuring range ±300 mA</td>
</tr>
<tr>
<td>• Residual current resolution 0.2 mA</td>
</tr>
<tr>
<td>• Load current up to 80 A r.m.s. (single-phase) or 3 x 32 A r.m.s. (three-phase)</td>
</tr>
<tr>
<td>• Fault output (integrated self monitoring and test functions)</td>
</tr>
<tr>
<td>• High insensitivity to external interferences</td>
</tr>
<tr>
<td>• Available variants for application according to DIN EN 61851-1/IEC 62752 and UL 2231-2</td>
</tr>
<tr>
<td>• Wide range of use even in severe environments (e.g. in the event of external interference fields)</td>
</tr>
<tr>
<td>• In applications according to DIN EN 61851-1 or IEC 62752, the RCMB104 can replace a type B RCD when combined with a type A RCD and a suitable switching device (e.g. a power relay).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Typical applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>• AC charging systems for electric vehicles</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Approvals</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE, UL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>The RCMB104… series complies with the following device standards:</td>
</tr>
<tr>
<td>• IEC 60364-7-722 (Low-voltage electrical installations – Part 7-722: Requirements for special installations or locations – Supplies for electric vehicles)</td>
</tr>
<tr>
<td>• DIN EN 61851-1 (Electrical equipment of electric road vehicles – Electric vehicle conductive charging system – Part 1: General requirements)</td>
</tr>
<tr>
<td>• IEC 62752 (In-Cable Residual Current Device for mode 2 charging of electric road vehicles (IC-RCD))</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ordering information RCMB104</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
</tr>
<tr>
<td>---------------</td>
</tr>
<tr>
<td>0…2 kHz IEC 6/30 mA</td>
</tr>
<tr>
<td>0…2 kHz UL2231 5/20 mA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ordering information Measuring current transformer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
</tr>
<tr>
<td>---------------</td>
</tr>
<tr>
<td>Measuring current transformer</td>
</tr>
<tr>
<td>15 mm/1470 ± 30 mm</td>
</tr>
<tr>
<td>15 mm/180 ± 30 mm</td>
</tr>
<tr>
<td>15 mm/325 ± 25 mm</td>
</tr>
<tr>
<td>17 mm/–</td>
</tr>
<tr>
<td>Connection cable CTBC17</td>
</tr>
<tr>
<td>–/180 ± 30 mm</td>
</tr>
<tr>
<td>–/325 ± 25 mm</td>
</tr>
<tr>
<td>–/1470 ± 30 mm</td>
</tr>
</tbody>
</table>

Further information

For further information refer to our product range on www.bender.de.
Residual current monitoring system | AC/DC sensitive residual current monitoring

AC/DC sensitive residual current monitoring module RCMB104

3

**Technical data**

<table>
<thead>
<tr>
<th>Primary circuit (monitored circuit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage $U_{1}$</td>
</tr>
<tr>
<td>Rated current $I_{L}$</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Short-term continuous current $I_{S}$ for 1 s</td>
</tr>
</tbody>
</table>

**Insulation coordination according to IEC 60664-1/IEC 60664-3**

- **Definitions:**
  - Measuring circuit IC1 (L1, L2, L3, N)
  - Electronics IC2 (a…f, Test, Error, RMS, DC, Vcc, GND, PWM)
  - Rated voltage: 250 V
  - Overvoltage category (OVC): III
  - Rated impulse voltage:
    - IC1/IC2  250 V
    - IC1/IC2  4 kV
  - Rated voltage:
    - IC/IC2  OVC III, 250 V
  - Measuring circuit IC1 (L1, L2, L3, N)
  - Insulation coordination according to IEC 60664-1/IEC 60664-3

**Rated residual operating current** r.m.s. 30 mA

**Response values**

- RCMB104-1 (IEC)
  - Rated residual operating current: r.m.s. 30 mA
  - Response tolerance $\Delta I_{1}$: ±5 %
  - Response tolerance $\Delta I_{2}$: ±5 %
  - Restart value:
    - $\Delta I_{1}$: ≤ 5 mA
    - $\Delta I_{2}$: ≤ 5 mA

- RCMB104-2 (UL)
  - Rated residual operating current: r.m.s. 20 mA
  - Response tolerance $\Delta I_{1}$: ±5 %
  - Response tolerance $\Delta I_{2}$: ±5 %
  - Restart value:
    - $\Delta I_{1}$: ≤ 5 mA
    - $\Delta I_{2}$: ≤ 5 mA

**Switching thresholds**

- HIGH: activated state
- LOW: deactivated state

**Outputs DC, RMS, Error**

- Type: Open Collector (NPN)
- DC: 40 V/20 mA
- Switching capacity: ≥ 0.5 A

**Signalling times in the event of module and hardware errors**

- Error: ≤ 1.5 s
- DC: ≤ 2.5 s
- RMS: ≤ 2.5 s

**Measurement output (PWM)**

- Type: PushPull
- HighHi
- LowLo
- Duty cycle: 0…100 %
- PWIM frequency: 8 kHz
- Scaling:
  - RCMB104-1: 0…100 % = DC 0…30 mA
  - RCMB104-2: 0…100 % = r.m.s. 0…50 mA
- Maximum current-carrying ability: 10 mA

**Control input (TEST)**

- Type: LOW: activated state
- HIGH: deactivated state
- Switching thresholds:
  - HIGH: 3.3…5.5 V
  - LOW: 0…0.6 V

**EMC (DIN EN 61851-1, IEC 62752, UL 2231-2)**

**ESD restrictions:** The RCMB104 must be mounted in an enclosure that complies with the mentioned standards.

**Restrictions line-conducted interferences:** The supply conductor must fulfill the requirements of the voltage supply (see page 6 in the manual)

**Inputs/outputs**

- Connection type:
  - PCB plug-in connector 0.5 x 0.5 mm
- Modular dimensions:
  - single row 6 x 2.54 mm
- Contact surface:
  - tinned
- Pin length:
  - 2.5 mm

**Connections**

- Connection type:
  - PCB plug-in connector 0.5 x 0.5 mm
- Arrangement of connections:
  - double row 2 x 4 pins
- Modular dimensions:
  - 2.00 mm
- Contact surface:
  - tinned
- Pin length:
  - 2.5 mm
- Soldering process recommended: selective soldering

**Connection measuring current transformer W15BS**

- Maximum distance RCMB104 to connector 100 mm
- Connection type:
  - PCB plug-in connector
- Number of poles:
  - 6 (2x3 poles)
- Modular dimensions:
  - 3.0 mm
- Number of mating cycles:
  - 30
- Manufacturer type designation:
  - Molex MicroFit 3.0 Header
- Article number:
  - 43045-0607
- The connector is not included in the scope of delivery. For further information, refer to the original data sheet created by Molex.

**Documentation number:** D0294
Wiring diagram

Wallbox

Vcc

Lastschalter

Mains

3AC

RCD Typ A

to load

3S1• 3S2 1S1• 2S1• 1S2 2S2

• = Wicklungsanfang/Start of winding

PWM

Vcc

n.c.

DC1

GND

DC2

ErrorTest

Referenzbohrung

1,60

2,54

20,35

15,89

23,99

26,50

28,00

0,5 x 0,5

0,64 x 0,64

UL: Pin „DC“ = r.m.s. 5 mA
Pin „RMS“ = r.m.s. 20 mA
IEC: Pin „DC“ = DC 6 mA
Pin „RMS“ = r.m.s. 30 mA

PWM

Residual current sensor

OUT

IN

PWM

RMS

DC

Error

RMS

Error

PWM

Laderegler/Charge controller

+5 V

RMS

Error

DC

Vcc

GND

PWM

PWM

n.c.

IN

OUT

Test

Release

IN

OUT

Test

PWM

PWM

n.c.

Residual current monitoring system | AC/DC sensitive residual current monitoring
AC/DC sensitive residual current monitoring module RCMB104

01/2021
RDC104-4
DC sensitive residual current monitoring module for electric vehicle charging systems

Device features
- Three outputs (DC1, DC2, Error)
- Measuring range DC ±300 mA
- Residual current resolution 0.2 mA
- Load current up to 48 A r.m.s. (single-phase) or 3 x 32 A r.m.s. (three-phase)
- Fault output (integrated self monitoring and test functions)
- High insensitivity to external interferences
- Wide range of use even in severe environments (e.g. in the event of external magnetic fields)
- As a RDC-M module in applications according to DIN EN 61851 or IEC 62955, the RCD104-4 can replace a type B RCD when combined with a type A RCD and a suitable switching device (e.g. a power relay).

Typical applications
- DC fault current monitoring of AC charging systems for electric vehicles

Approvals

Standards
The device RDC104-4 series complies with the following device standards:
- IEC 62955 (Residual direct current detecting device (RDC-DD) to be used for mode 3 charging of electric vehicles)
- IEC 60364-7-722 (Low-voltage electrical installations – Part 7-722: Requirements for special installations or locations – Supplies for electric vehicles)
- DIN EN 61851-1 (Electrical equipment of electric road vehicles – Electric vehicle conductive charging system – Part 2-2: AC electric vehicle charging station)

Further information
For further information refer to our product range on www.bender.de.

Ordering information RDC104-4

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RDC-M module acc. to IEC 62955</td>
<td>RDC104-4-1</td>
<td>B94042483</td>
</tr>
</tbody>
</table>

Ordering information Measuring current transformer

<table>
<thead>
<tr>
<th>Description</th>
<th>Diameter/ Connection cable</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring current transformer</td>
<td>15 mm/1470 ± 30 mm</td>
<td>W15BS</td>
<td>B98000665</td>
<td>274</td>
</tr>
<tr>
<td></td>
<td>15 mm/180 ± 30 mm</td>
<td>W15BS-02</td>
<td>B9800067</td>
<td>274</td>
</tr>
<tr>
<td></td>
<td>15 mm/325 ± 25 mm</td>
<td>W15BS-03</td>
<td>B9800068</td>
<td>274</td>
</tr>
<tr>
<td></td>
<td>17 mm/–</td>
<td>CTBC17</td>
<td>B9800070</td>
<td>270</td>
</tr>
<tr>
<td></td>
<td>–/180 ± 30 mm</td>
<td>CTBC17-Kabel180MM</td>
<td>B9800540</td>
<td>270</td>
</tr>
<tr>
<td></td>
<td>–/325 ± 25 mm</td>
<td>CTBC17-Kabel325MM</td>
<td>B9800541</td>
<td>270</td>
</tr>
<tr>
<td></td>
<td>–/1470 ± 30 mm</td>
<td>CTBC17-Kabel1470MM</td>
<td>B9800542</td>
<td>270</td>
</tr>
</tbody>
</table>
### Technical data

#### Primary circuit (monitored circuit)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>250 V</td>
</tr>
<tr>
<td>Rated current $I_n$</td>
<td>48 A (single-phase)</td>
</tr>
<tr>
<td></td>
<td>32 A (three-phase)</td>
</tr>
<tr>
<td>Short-term continuous current for 1 s</td>
<td>200 A</td>
</tr>
</tbody>
</table>

#### Insulation coordination according to IEC 60664-1/IEC 60664-3

**Definitions:**
- Measuring circuit IC1 (L1, L2, L3, N)
- Electronics IC2 (a…f, Test, Error, DC1, DC2, Vcc, GND, PWM)

**Overvoltage category (OVC):** III

**Rated impulse voltage:**
- IC1/IC2: 4 kV

**Rated insulation voltage:**
- IC1/IC2: 250 V

**Pollution degree:** 2

**Protective separation (reinforced insulation) between:**
- IC/IC2: OVC III, 250 V

The data are valid from the monitored primary circuit to the output circuit.

#### Power supply

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal supply voltage $V_{cc}$</td>
<td>DC 5 V</td>
</tr>
<tr>
<td>Tolerance of the supply voltage</td>
<td>±5 %</td>
</tr>
<tr>
<td>Voltage ripple $V_{pc}$</td>
<td>&lt; 100 mV</td>
</tr>
<tr>
<td>Absolute maximum supply voltage</td>
<td>DC 5.5 V</td>
</tr>
<tr>
<td>Supply current $I_{cc}$</td>
<td>45 mA</td>
</tr>
</tbody>
</table>

#### Residual current measuring range

- Measuring range $I_{an}$: DC ±300 mA
- Resolution $I_{an}$: DC 0.2 mA

#### Response values

**RDC104-4 (IEC 62955):**
- Rated DC residual operating current $I_{an}$: 6 mA
- Response value $I_{an}$: DC 6 mA
- Response tolerance $I_{an}$: 0.5…1 x $I_{an}$
- Restart value $I_{an}$: < 3 mA

**Operating time $t_{op}$:**
- DC 6 mA: < 480 ms
- DC 12 mA: < 240 ms
- DC 30 mA: < 120 ms
- DC 60 mA: < 70 ms
- DC 200 mA: < 30 ms
- DC 300 mA: < 30 ms

#### Outputs DC1, DC2, Error

**Type:** Open Collector (NPN)

**Switching capacity:** DC 40 V/20 mA

**Signalling times in the event of module and hardware errors:**
- Error: ≤ 1.5 s
- DC1: ≤ 2.5 s
- DC2: ≤ 2.5 s

#### Measurement output (PWM)

**Type:** PushPull

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH level</td>
<td>3.1…3.5 V</td>
</tr>
<tr>
<td>LOW level</td>
<td>0…0.5 V</td>
</tr>
<tr>
<td>PWM frequency</td>
<td>8 kHz</td>
</tr>
<tr>
<td>Scaling</td>
<td>0…100 % = DC 0…30 mA</td>
</tr>
<tr>
<td>Maximum current-carrying ability</td>
<td>10 mA</td>
</tr>
</tbody>
</table>

#### Control input (TEST)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>LOW: activated state</td>
</tr>
<tr>
<td></td>
<td>HIGH: deactivated state</td>
</tr>
<tr>
<td>Switching thresholds</td>
<td></td>
</tr>
<tr>
<td>HIGH</td>
<td>3…5.5 V</td>
</tr>
<tr>
<td>LOW</td>
<td>0…0.6 V</td>
</tr>
</tbody>
</table>

#### EMV (DIN EN 61851-1, DIN EN 61851)

**ESD restrictions:** The RDC104-4 must be mounted in an enclosure that complies with the mentioned standards.

**Restrictions line-conducted interferences:** The supply conductor must fulfill the requirements of the voltage supply (see page 12 in the manual)

**ESD immunity acc. to Human Body Model IEC61000-4-2:**
- ±2 kV (air)
- ±2 kV (contact)

**Operating temperature:** -30…80 °C

**Storage temperature:** -40…85 °C

**Climatic class**
- Stationary: (IEC 60721-3-3) (except condensation, water and formation of ice) 3K23
- Transport: (IEC 60721-3-2) 2K11
- Long-term storage: (IEC 60721-3-1) 1K21

#### Degree of protection

**RDC-104-4:** IP00

**Measuring current transformer (without connector plug):** IP55

#### Connections

**Measuring current transformer**

**Connection type:** PCB plug-in connector 0.65 x 0.65 mm

**Modular dimensions:** single row 6 x 2.54 mm

**Contact surface:** tinned

**Contact length:** 2.5 mm

**Soldering process for PCB:** recommended: selective soldering

**Connection measuring current transformer CTBC17 or W15BS**

**Maximum distance RDC104-4 to connector:** 100 mm

**Connection type:** PCB plug-in-connector 0.5 x 0.5 mm

**Number of poles:** 6 (2x3 poles)

**Modular dimensions:** 3.0 mm

**Number of mating cycles:** 30

**Manufacturer type designation:** Molex MicroFit 3.0 Header

**Article number:** 43045-0607

**Documentation number:** D00402

The connector is not included in the scope of delivery. For further information, refer to the original data sheet created by Molex.
**RCMB131-01**
AC/DC sensitive residual current monitoring module
for measuring AC and DC currents up to ±100 mA

**Device features**
- AC/DC sensitive leakage and fault current monitoring for preventive maintenance
- Suitable for PCB mounting
- High resolution for implementing equipment leakage current monitoring
- Measured value and alarm transmission via Modbus RTU (RS-485)
- Frequency range DC…2 kHz
- Compact design for monitoring nominal loads up to \( I_n = 32 \) A
- Low load current sensitivity due to fully shielded measuring current transformer
- Continuous monitoring of the connection to the measuring current transformer
- Integrated test function
- Supply voltage DC 12…24 V

**Typical applications**
- Designed for installation in PDUs and outlet boxes
- Communication with a master via an RS-485 interface via Modbus RTU

**Further information**
For further information refer to our product range on www.bender.de.

**Ordering information**

<table>
<thead>
<tr>
<th>Output range</th>
<th>Supply voltage ( U_s )</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td></td>
<td>RCMB131-01</td>
<td>B94042131</td>
</tr>
<tr>
<td>0…100 mA (r.m.s.)</td>
<td>12…24 V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Technical data

Insulation coordination according to IEC 60664-1

<table>
<thead>
<tr>
<th>Primary circuit</th>
<th>monitored primary conductors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary circuit</td>
<td>Connections Vcc, GND, A, B, S1, S2</td>
</tr>
</tbody>
</table>

All following specifications apply to the insulation between the primary and secondary circuit:

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>300 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overvoltage category</td>
<td>III</td>
</tr>
<tr>
<td>Rated impulse voltage</td>
<td>4 kV</td>
</tr>
</tbody>
</table>

Operating altitude:

| up to 3000 m AMSL |

Rated insulation voltage:

| 320 V |

Pollution degree:

| 2 |

Safe separation (reinforced insulation) between primary and secondary circuit:

Voltage test acc. to IEC 61010-1:

| AC 2.2 kV |

Voltage supply:

Supply voltage:

| DC 12...24 V |

Operating range of the supply voltage:

| ±20 % |

Ripple:

| 100 mV |

Power consumption:

| < 0.75 W |

Measuring circuit:

Internal diameter primary conductor opening:

| 15 mm |

Measured value evaluation:

| DC, r.m.s. |

Measuring range:

| AC/DC ±300 mA |

Characteristics according to IEC 61010-1:

| AC/DC sensitive, type B |

Response value (DC): 3.5...100 mA (* 6 mA)

Response tolerance (DC): 0.7...1.0 x IΔn1

Response value (r.m.s.):

| 3.5...100 mA (* 30 mA) |

Response tolerance (r.m.s.):

| 0.7...1.0 x IΔn2 |

| 1.0...2.0 x IΔn2 |

Output range (r.m.s.):

| 0...100 mA |

Resolution:

| < 0.2 mA |

Frequency range:

| DC...2 kHz |

Measuring time:

| 180 ms |

Operating uncertainty:

<table>
<thead>
<tr>
<th>DC...500 Hz</th>
<th>±(5 % +0.5 mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>501...1000 Hz</td>
<td>±(15 % +0.5 mA)</td>
</tr>
<tr>
<td>1...2 kHz</td>
<td>±(50 % ±0.5 mA)</td>
</tr>
</tbody>
</table>

Time response:

Response time tae (relay switching time of 10 ms considered):

<table>
<thead>
<tr>
<th>for 1 x IΔn1</th>
<th>≤ 290 ms</th>
</tr>
</thead>
<tbody>
<tr>
<td>for 2 x IΔn1</td>
<td>≤ 140 ms</td>
</tr>
<tr>
<td>for 5 x IΔn1</td>
<td>≤ 30 ms</td>
</tr>
</tbody>
</table>

Response time tae:

| ≤ 2s |

Disturbances:

Load current:

| 32 A |

Response value assignment:

I01 (DC):

| S1 |

I02 (r.m.s.):

| S2 |

Outputs:

Interface:

| RS-488 |

Protocol:

| Modbus RTU |

Switching outputs:

Open Collector, not short-circuit-proof

Switching capacity:

| 40 V / 50 mA |

Output voltage:

| LOW level: 0...0.6 V |

| HIGH level: 3.1...3.6 V |

Hysteresis:

| ≤ 10 % |

Environment/EMC:

EMC:

| DIN EN 62020:2003 (VDE 0663), where applicable |

Ambient temperature (incl. primary conductors routed through module):

| -25...+70 °C |

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3):

| 3K23 (except condensation and formation of ice) |

Transport (IEC 60721-3-2):

| 2K11 (except condensation and formation of ice) |

Long-term storage (IEC 60721-3-1):

| 1K22 (except condensation and formation of ice) |

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:

| any position |

Protection class:

| IP 30 |

Flammability rating:

| UL94 V-0 |

Service life at 40 °C:

| 10 years |

Software:

| D0604 |

Documentation number:

| D00358 |

* = factory settings

Dimension diagram (dimensions in mm)
Terminating resistor 120 Ω must only be set on the last device in the RS-485 bus chain.
RCMB131-02
AC/DC sensitive residual current monitoring module
for measuring AC and DC currents up to ±100 mA

Device features
• AC/DC sensitive leakage and fault current monitoring for preventive maintenance
• Suitable for PCB mounting
• High resolution for implementing equipment leakage current monitoring
• Measurement signal output via PWM output
• Frequency range DC…2 kHz
• Compact design for monitoring nominal loads up to $I_n = 32$ A
• Low load current sensitivity due to fully shielded measuring current transformer
• Continuous monitoring of the connection to the measuring current transformer
• Integrated test function
• Supply voltage DC 12…24 V

Typical applications
• Designed for installation in PDUs and outlet boxes
• Outputs the r.m.s. value of the residual current via a PWM output, which is read out and evaluated by a higher-level circuit

Further information
For further information refer to our product range on www.bender.de.

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Output range</th>
<th>Supply voltage $U_s$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0…100 mA (r.m.s.)</td>
<td>12…24 V</td>
<td>RCMB131-02</td>
<td>894042112</td>
</tr>
</tbody>
</table>
Technical data

Insulation coordination according to IEC 60664-1

Primary circuit monitored primary conductors
Secondary circuit Connections Vcc, GND, T, PWM, S1, ERR

All following specifications apply to the insulation between the primary and secondary circuit

- Rated voltage: 300 V
- Overvoltage category: III
- Rated impulse voltage: 4 kV
- Operating altitude: up to 3000 m AMSL
- Rated insulation voltage: 320 V
- Pollution degree: 2
- Safe separation (reinforced insulation) between primary and secondary circuit
- Voltage test acc. to IEC 61010-1 AC 2.2 kV

Supply voltage
- Supply voltage U_s: DC 12...24 V
- Operating range of the supply voltage ±20 %
- Ripple: 100 mV
- Power consumption: < 0.75 W

Measuring circuit
- Internal diameter primary conductor opening: 15 mm
- Measured value evaluation: DC, r.m.s.
- Response value I_Δn1 (DC): 3.5...100 mA (* 6 mA)
- Response tolerance I_Δn1: 0.7...1.0 x I_Δn1
- Measuring range: AC/DC ±300 mA
- Resolution: AC/DC ±0.5 mA
- Frequency range: DC...2 kHz
- Measuring time: 180 ms

Operating uncertainty
- DC...500 Hz: ±(5 % + 0.5 mA)
- 501...1000 Hz: ±(15 % + 0.5 mA)
- 1001...2000 Hz: ±(30 % + 0.5 mA)

Time response
- Response time t_α (relay switching time of 10 ms considered)
  - for 1 x I_Δn1: ≤ 20 ms
  - for 2 x I_Δn1: ≤ 140 ms
  - for 5 x I_Δn1: ≤ 30 ms
- Recovery time t_b: ≤ 2s

Disturbances
- Load current I_n: 32 A

Outputs
- Switching outputs S1, ERR: Open Collector, not short-circuit-proof
- Switching capacity: 40 V / 50 mA
- Hysteresis: ≤ 30 %
- PWM
  - Internal resistance PWM signal: 4.7 kΩ
  - Voltage HIGH level: 3.1...3.6 V
  - Voltage LOW level: 0...0.6 V
  - Frequency PWM signal: 8 kHz
  - Specification of the PWM signal (0...100) % = (0...100) mA
  - Output resistance: not short-circuit-proof

Response value assignment
- S1: Internal error

Environment/EMC
- EMC: DIN EN 62020:2003 (VDE 0663), where applicable
  - Ambient temperature (incl. primary conductors routed through module): -25...+70 °C
- Classification of climatic conditions acc. to IEC 60721
  - Stationary use (IEC 60721-3-3): 3K23 (except condensation and formation of ice)
  - Transport (IEC 60721-3-2): 2K11 (except condensation and formation of ice)
  - Long-term storage (IEC 60271-3-1): 1K22 (except condensation and formation of ice)
- Classification of mechanical conditions acc. to IEC 60271
  - Stationary use (IEC 60721-3-3): 3M11
  - Transport (IEC 60721-3-2): 2M4
  - Long-term storage (IEC 60271-3-1): 1M12

Other
- Operating mode: continuous operation
- Mounting: any position
- Protection class: IP 30
- Flammability rating: UL94 V-0
- Service life at 40 °C: 10 years
- Software: D0604
- Documentation number: D00354

* = factory settings

Dimension diagram (dimensions in mm)
**RCMB132-01**

**AC/DC sensitive residual current monitoring module**

for measuring AC and DC currents up to ±100 mA

---

### Device features

- AC/DC sensitive leakage and fault current monitoring for preventive maintenance
- High resolution for implementing equipment leakage current monitoring
- Measured value and alarm transmission via Modbus RTU (RS-485)
- Frequency range DC…2 kHz
- Compact design for monitoring nominal loads up to \( I_n = 32 \) A
- Low load current sensitivity due to fully shielded measuring current transformer
- Continuous monitoring of the connection to the measuring current transformer
- Integrated test function
- Supply voltage DC 12…24 V

### Typical applications

- Designed for installation in PDUs and outlet boxes
- Communication with a master via an RS-485 interface via Modbus RTU
- Connection of several devices in a daisy chain. For this purpose, the RCMB132-01 provides two identical connectors for RS-485 (incl. power supply)

### Further information

For further information refer to our product range on www.bender.de.

---

### Approvals

---

### Ordering information

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>Supply voltage ( U_s )</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC</td>
<td>DC</td>
<td>RCMB132-01</td>
<td>B94042136</td>
</tr>
<tr>
<td>±100 mA</td>
<td>12…24 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mounting foot MCCT20</td>
<td></td>
<td>B91080111</td>
<td></td>
</tr>
</tbody>
</table>
Technical data

**Insulation coordination according to IEC 60664-1**
- **Primary circuit**: monitored primary conductors
- **Secondary circuit**: Connections Vcc, GND, A, B, S1, S2

All following specifications apply to the insulation between the primary and secondary circuit:
- **Rated voltage**: 300 V
- **Overvoltage category**: III
- **Rated impulse voltage**: 4 kV

**Operating altitude**
- up to 3000 m AMSL

**Rated insulation voltage**
- 320 V

**Pollution degree**
- 2

**Safe separation (reinforced insulation)**
- between primary and secondary circuit

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

**Voltage supply**
- **Supply voltage**: DC 12…24 V
- **Operating range of the supply voltage**: ±20 %
- **Ripple**: 100 mV
- **Power consumption**: < 0.75 W

**Measuring circuit**
- **Internal diameter primary conductor opening**: 15 mm
- **Measured value evaluation**: DC, r.m.s.
- **Measuring range**: AC/DC ±300 mA
- **AC/DC sensitive**, type B

- **Iₙ₁**:
  - **Response value**: DC 3.5…100 mA (* 6 mA)
  - **Response tolerance**: 0.7…1.0 x Iₙ₁

- **Iₙ₂**:
  - **Response value**: r.m.s. 3.5…100 mA (* 30 mA)
  - **Response tolerance**: 0.7…1.0 x Iₙ₂
  - **Response tolerance** (r.m.s.): 1.0…2.0 x Iₙ₂

- **Frequency range**: DC…2 kHz
- **Resolution**: < 0.2 mA
- **Measuring time**: 180 ms

**Operating uncertainty**
- **4 kHz**: ±(5 % + 0.5 mA)
- **50 kHz**: ±(15 % + 0.5 mA)
- **2 kHz**: ±(30 % + 0.5 mA)

**Environment/EMC**
- **EMC**: DIN EN 62020:2003 (VDE 0663), where applicable
- **Ambient temperature (incl. primary conductors routed through module)**: -25…+70 °C

**Classification of climatic conditions acc. to IEC 60721**
- **Stationary use (IEC 60721-3-3)**: 3K23 (except condensation and formation of ice)
- **Transport (IEC 60721-3-2)**: 2K11 (except condensation and formation of ice)
- **Long-term storage (IEC 60271-3-1)**: 1K22 (except condensation and formation of ice)

**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 6071-3-1)**: 1M12

**Rail mounting**
- **with mounting foot MCCT20 (accessories, see ordering data)**
Terminating resistor 120 Ω must only be set on the last device in the RS-485 bus chain.

An external protective circuit is especially required for inductive loads.
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<th>Section</th>
<th>Page</th>
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<td>Equipment for insulation fault location</td>
<td>145</td>
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<td>Residual current monitoring systems</td>
<td>171</td>
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<td>Neutral Grounding Resistor Monitor (NGR)</td>
<td>229</td>
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<td>Charge Controller</td>
<td>257</td>
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<td>Power Quality and Energy Measurement</td>
<td>279</td>
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<td>Measuring and monitoring relays</td>
<td>298</td>
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<tr>
<td>System components</td>
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<td>Test systems</td>
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<td>Annex</td>
<td>463</td>
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</tbody>
</table>

Technical terms
Alphabetical list of devices
Service
## Device overview neutral grounding resistance monitoring (NGR) LINETRAXX®

<table>
<thead>
<tr>
<th></th>
<th>LINETRAXX® NGRM500</th>
<th>LINETRAXX® NGRM700</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System type</strong></td>
<td>HRG</td>
<td>HRG</td>
</tr>
<tr>
<td><strong>Fault currents</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Phase monitoring L1, L2, L3</strong></td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>System voltage L-L</strong></td>
<td>600 V…2500 V</td>
<td>600 V…25000 V</td>
</tr>
<tr>
<td><strong>Harmonic analysis</strong></td>
<td>RMS 0…32</td>
<td>RMS 0…32</td>
</tr>
<tr>
<td><strong>Analysis range</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Relay operating mode</strong></td>
<td>Configurable fail-safe or non-fail-safe</td>
<td>Configurable fail-safe or non-fail-safe</td>
</tr>
<tr>
<td><strong>Communication</strong></td>
<td>Webserver, BCOM, Modbus RTU, Modbus TCP</td>
<td>Webserver, BCOM, Modbus RTU, Modbus TCP</td>
</tr>
<tr>
<td><strong>Maximum altitude</strong></td>
<td>2000 m</td>
<td>5000 m</td>
</tr>
<tr>
<td><strong>Mounting</strong></td>
<td>Detachable HMI for front panel mounting</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>DIN rail</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Screw mounting</td>
<td>–</td>
</tr>
</tbody>
</table>

* Freely configurable in the device, taking suitable coupling devices into account.
Device overview coupling devices for NGR monitoring

<table>
<thead>
<tr>
<th>CTUB103</th>
<th>CD1000</th>
<th>CD1000-2</th>
<th>CD5000</th>
<th>CD14400</th>
<th>CD25000</th>
</tr>
</thead>
</table>

**Catalogue page**

| 243 | 246 | 248 | 250 | 252 | 254 |

**Special applications**

- AC-DC sensitive measuring current transformer
- Coupling device for HRG applications
- Coupling device for HRG applications
- Coupling device for HRG applications
- Coupling device for HRG applications
- Coupling device for HRG applications

**System voltage L-L (U_{NGR} voltage)**

- Up to \( U_{LL} = 690 \text{ V} \) (\( U_{NGR} = 400 \text{ V} \))
- Up to \( U_{LL} = 1000 \text{ V} \) (\( U_{NGR} = 600 \text{ V} \))
- Up to \( U_{LL} = 4300 \text{ V} \) (\( U_{NGR} = 2500 \text{ V} \))
- Up to \( U_{LL} = 14400 \text{ V} \) (\( U_{NGR} = 8400 \text{ V} \))
- Up to \( U_{LL} = 25 \text{ kV} \) (\( U_{NGR} = 14.5 \text{ kV} \))

**Mounting**

- Screw mounting

**Product details**

(Products on [www.bender.de/en](http://www.bender.de/en))

<table>
<thead>
<tr>
<th>( U_{sys} )</th>
<th>CD1000</th>
<th>CD1000-2</th>
<th>CD5000</th>
<th>CD14400</th>
<th>CD25000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 A</td>
<td>400 V</td>
<td>400 V</td>
<td>400 V</td>
<td>600 V</td>
<td>1000 V</td>
</tr>
<tr>
<td></td>
<td>231 ( \Omega )</td>
<td>346 ( \Omega )</td>
<td>398 ( \Omega )</td>
<td>231 ( \Omega )</td>
<td>346 ( \Omega )</td>
</tr>
<tr>
<td>5 A</td>
<td>46 ( \Omega )</td>
<td>46 ( \Omega )</td>
<td>46 ( \Omega )</td>
<td>46 ( \Omega )</td>
<td>115 ( \Omega )</td>
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<tr>
<td></td>
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<td>69 ( \Omega )</td>
<td>69 ( \Omega )</td>
<td>69 ( \Omega )</td>
<td>115 ( \Omega )</td>
</tr>
<tr>
<td>10 A</td>
<td>(23 ( \Omega ))</td>
<td>(23 ( \Omega ))</td>
<td>(23 ( \Omega ))</td>
<td>(23 ( \Omega ))</td>
<td>(23 ( \Omega ))</td>
</tr>
<tr>
<td></td>
<td>(35 ( \Omega ))</td>
<td>(40 ( \Omega ))</td>
<td>(35 ( \Omega ))</td>
<td>(40 ( \Omega ))</td>
<td>(58 ( \Omega ))</td>
</tr>
<tr>
<td>15 A</td>
<td>(15 ( \Omega ))</td>
<td>(15 ( \Omega ))</td>
<td>(15 ( \Omega ))</td>
<td>(15 ( \Omega ))</td>
<td>(15 ( \Omega ))</td>
</tr>
<tr>
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<td>(23 ( \Omega ))</td>
<td>(27 ( \Omega ))</td>
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<td>20 A</td>
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<td>(17 ( \Omega ))</td>
<td>(17 ( \Omega ))</td>
<td>(20 ( \Omega ))</td>
<td>(29 ( \Omega ))</td>
</tr>
<tr>
<td></td>
<td>–</td>
<td>–</td>
<td>(16 ( \Omega ))</td>
<td>(16 ( \Omega ))</td>
<td>(16 ( \Omega ))</td>
</tr>
<tr>
<td>25 A</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>(16 ( \Omega ))</td>
<td>(16 ( \Omega ))</td>
</tr>
<tr>
<td></td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>(19 ( \Omega ))</td>
</tr>
<tr>
<td>30 A</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>40 A</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>50 A</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>100 A</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

**Recommended minimum value \( R_{NGR} \) (tripping level 50 \%)**

<table>
<thead>
<tr>
<th>( U_{sys} )</th>
<th>CD1000</th>
<th>CD1000-2</th>
<th>CD5000</th>
<th>CD14400</th>
<th>CD25000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 A</td>
<td>231 ( \Omega )</td>
<td>346 ( \Omega )</td>
<td>398 ( \Omega )</td>
<td>231 ( \Omega )</td>
<td>346 ( \Omega )</td>
</tr>
<tr>
<td>5 A</td>
<td>46 ( \Omega )</td>
<td>46 ( \Omega )</td>
<td>46 ( \Omega )</td>
<td>46 ( \Omega )</td>
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<tr>
<td>15 A</td>
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<td>(15 ( \Omega ))</td>
<td>(15 ( \Omega ))</td>
<td>(15 ( \Omega ))</td>
<td>(15 ( \Omega ))</td>
</tr>
<tr>
<td>20 A</td>
<td>–</td>
<td>(17 ( \Omega ))</td>
<td>(17 ( \Omega ))</td>
<td>(20 ( \Omega ))</td>
<td>(29 ( \Omega ))</td>
</tr>
<tr>
<td>25 A</td>
<td>–</td>
<td>–</td>
<td>(16 ( \Omega ))</td>
<td>(16 ( \Omega ))</td>
<td>(16 ( \Omega ))</td>
</tr>
<tr>
<td>30 A</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>(19 ( \Omega ))</td>
</tr>
<tr>
<td>40 A</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>50 A</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>100 A</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

Temperature range –40…+70 °C, field calibration at 25 °C

(Limited temperature range 0…+40 °C, field calibration at 25 °C)
Device features

- Determination of \( R_{NGR} \) with passive and active measurement methods
- Continuous monitoring of the \( R_{NGR} \) even if the installation is de-energised;
- Alarm or trip on ground fault
- Monitoring of the current \( I_{NGR} \)
- Monitoring of the voltage \( U_{NGR} \)
- Ethernet communication
- Web server
- Language selection (German, English GB and US, Spanish, French)
- Test button (internal, external) with/without tripping
- FFT analysis of the measuring signals
- Pulser for manual ground fault location
- Relay for detection of ground faults and resistor faults
- Relay for shutdown of the installation after a configurable time
- Can be combined with RCMS… for automatic shutdown of feeders
- Graphical user interface
- Wide supply voltage range
- Range of use up to 2000 m AMSL
- Fault/History memory
- Analogue output of measured values (0…10 V, 4…20 mA, etc., selectable parameters)
- Password protection
- Tripping on RMS, fundamental component signal or harmonics
- Detection of AC and DC ground faults

Further information

For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage ( U_s ) / Frequency range Hz</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 48…240 V, 40…70 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC 48…240 V</td>
<td></td>
<td>NGRM500</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B94013500</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupling device</td>
<td>CD…</td>
<td>B980390…</td>
<td>246</td>
</tr>
<tr>
<td>Measuring current transformer</td>
<td>CTUB…</td>
<td>B781200…</td>
<td>365</td>
</tr>
<tr>
<td>Voltage supply for measuring current transformers</td>
<td>STEP-PS</td>
<td>B940531…</td>
<td>390</td>
</tr>
</tbody>
</table>
Technical Data

Insulation coordination according to IEC 60664-1/IEC 60664-3/DIN EN 50187

Definitions

Supply circuit (IC1)
Measuring circuit/Control circuit (IC2)
Output circuit 1 (IC3)
Output circuit 2 (IC4)
Output circuit 3 (IC5)

Rated current
250 V

Overvoltage category
III

Rated impulse voltage
IC1/(IC2…5) 4 kV
IC3/(IC4…5) 4 kV
IC5/(IC6) 4 kV

Rated insulation voltage
IC1/(IC2…5) 250 V
IC3/(IC4…5) 250 V
IC5/(IC6) 250 V

Pollution degree exterior
3

Safe isolation (reinforced insulation) between
IC1/(IC2…5) overvoltage category III, 300 V
IC3/(IC4…5) overvoltage category III, 300 V
IC5/(IC6) overvoltage category III, 300 V

Voltage tests (routine test) acc. to IEC 61010-1
IC1/(IC2…5) AC 2,2 kV
IC3/(IC4…5) AC 2,2 kV
IC5/(IC6) AC 2,2 kV

Supply voltage
Nominal supply voltage $U_{\text{n}}$
AC/DC, 48…240 V
AC/DC, 48…240 V for AS/NZS 2081
AC/DC, 48…230 V

Tolerance $U_{\text{n}}$
±15 %

Tolerance $U_{\text{n}}$ (for UL applications)
-50…+15 %

Tolerance $U_{\text{n}}$ (for AS/NZS 2081)
-25…+20 %

Frequency range $U_{\text{n}}$
DC, 40…70 Hz

Power consumption (max.)
≤ 7 W/16 VA

Monitoring $U_{\text{n}}$

Measuring input $I_{\text{n}}$
< 33 V RMS

Measuring range NGR (with $R_{\text{n}} = 20 \Omega$) active
0…10 kΩ

Measurement uncertainty for $T = 0…+70 ^\circ \text{C}$
±20 Q

Measurement uncertainty for $T = -40…+70 ^\circ \text{C}$
±40 Q

Measuring range NGR (with $R_{\text{n}} = 100 \Omega$) active
0…10 kΩ

Measurement uncertainty for $T = 0…+40 ^\circ \text{C}$
±30 Q

Measurement uncertainty for $T = -40…+70 ^\circ \text{C}$
±80 Q

Setting range $R_{\text{nom}}$
15 Ω…5 kΩ

Response value $R_{\text{nom}}$ (for UL applications)
10…200 % $R_{\text{nom}}$

Response delay NGR relay
7 s (±2.5 s)

Response delay trip relay
0…60 s

Monitoring $I_{\text{n}}$

Measuring circuit 5 A
Nominal measuring current $I_{\text{n}}$
DC / 50/60 Hz / 50…3200 Hz 5 A
Maximum continuous current
2 x $I_{\text{n}}$
Overload capacity
10 x $I_{\text{n}}$ for 0.03 s
Measurement accuracy
±2 % of $I_{\text{n}}$
Load
10 mQ

Measuring circuit 50 mA
Nominal measuring current $I_{\text{n}}$
DC / 50/60 Hz / 50…3200 Hz 50 mA
Maximum continuous current
2 x $I_{\text{n}}$
Overload capacity
10 x $I_{\text{n}}$ for 2 s
Measurement accuracy
±2 % of $I_{\text{n}}$
Load
68 Ω

Measuring circuits 5 A and 50 mA
Response value $R_{\text{n}}$
10…90 % $R_{\text{nom}}$

Response delay NGR relay
≤ 40 ms (±10 ms)

Response delay trip relay (configurable)
100 ms…24 h, ∞

Tolerance $t_{\text{ref}}$ when set to
RMS
-20…0 ms

Fundamental
0…+150 ms (filter time)

Harmonics
0…+150 ms (filter time)

Measuring current transformer ratio primary
1…10,000

Measuring current transformer ratio secondary
1…10,000

Measuring range $2 x R_{\text{nom}}$

Coupling $R_{\text{sys}}$ for $U_{\text{sys}}$
CD1000, CD10000, CD5000 (20 kΩ)

Measuring range $R_{\text{sys}}$ for $U_{\text{sys}}$
CD14400, CD25000 (100 kΩ)

Monitoring $U_{\text{n}}$

$U_{\text{n}}$ with $R_{\text{n}} = 20 \Omega$
DC / 50/60 Hz / 50…3200 Hz; (400/533)…1200 Hz ± (430/333) V

$U_{\text{n}}$ with $R_{\text{n}} = 100 \Omega$
DC / 50/60 Hz / 50…3200 Hz; (4.3/3.33)…325/333 V

Measuring range
1.2 x $U_{\text{NGR}}$

Overload capacity
2 x $U_{\text{NGR}}$ for 10 s

Voltage response value
10…90 % $U_{\text{NGR}}$

Response delay ground-fault relay
≤ 40 ms (±10 ms)

Response delay trip relay (configurable)
100 ms…2h, ∞

Environment/EMC

Minimum current 1 mA at AC/DC > 10 V

Rated operational voltage
250 V 250 V 220 V 110 V 24 V

Rated operational current
5 A 3 A 0.1 A 0.2 A 1 A

Rated operational voltage
250 V 250 V 220 V 110 V 24 V

Minimum current 1 mA at AC/DC > 10 V

Operating temperature
-40…+60 °C

Humidity
≤ 98 %

Classification of climatic conditions acc. to IEC 60721

Long-term storage (IEC 60721-3-1) 1K22 (-40…+70 °C) (except condensation and formation of ice)

Transport (IEC 60721-3-2) 2K11 (-40…+85 °C) (except condensation and formation of ice)

Stationary use (IEC 60721-3-3) 3K23 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3) 3K23 (except condensation and formation of ice)

Transport use (IEC 60721-3-3) 2K11 (-40…+85 °C) (except condensation and formation of ice)

Long-term storage (IEC 60721-3-1) 1K22 (-40…+70 °C) (except condensation and formation of ice)

-neutral grounding resistor monitor (NGR)

-neutral grounding resistor monitor (NGR) LINETRAXX® NGRM500

-neutral grounding resistor monitor (NGR) LINETRAXX® NGRM500
Connection

Screw-type terminals
- Tightening torque: 0.5 ... 0.6 Nm (5 ... 7 lb-in)
- Stripping length: 7 mm

Recommended connecting cables
- Rigid/flexible: 0.2 ... 2.5 mm² (AWG 24 ... 13)
- Flexible with ferrule with/without plastic sleeve: 0.25 ... 2.5 mm² (AWG 24 ... 13)
- Multiple conductor, rigid: 0.2 ... 1 mm² (AWG 24 ... 18)
- Multiple conductor flexible: 0.2 ... 1.5 mm² (AWG 24 ... 16)
- Multiple conductor flexible with ferrule without plastic sleeve: 0.25 ... 1 mm² (AWG 24 ... 18)
- Multiple conductor, flexible with TWIN ferrule with plastic sleeve: 0.25 ... 1.5 mm² (AWG 24 ... 16)

Push-wire terminals X1
- Stripping length: 10 mm
- Rigid/flexible: 0.2 ... 1.5 mm² (AWG 24 ... 16)
- Flexible with ferrule without plastic sleeve: 0.25 ... 1.5 mm² (AWG 24 ... 16)
- Flexible with ferrule with plastic sleeve: 0.25 ... 0.75 mm² (AWG 24 ... 18)

Other
- Operating mode: continuous operation
- Mounting: display-oriented
- Altitude: max. 2000 m AMSL
- Degree of protection, internal components (DIN EN 60529): IP30
- Flammability class: UL 94V-0
- Protective coating measurement equipment: SL1307, UL file E80315
- Documentation number: D00373
- Weight: < 500 g

Dimension diagram (dimensions in mm)

Connection star connection

The "N" connection of the CD-series coupling device should be as close to the transformer star point as possible.
The "N" connection of the CD-series coupling device should be as close to the transformer star point as possible. An intermediate relay may be required between the power contactor of the pulser and the digital output at X1 of the FP200-NGRM.

Connection artificial neutral (delta connection): zigzag transformer

If no star point is available, the following circuit can create an artificial neutral.
Measuring current transformer connection

Depending on the system to be monitored, a suitable measuring current transformer has to be chosen. All common measuring current transformers (50 mA or 5 A on the secondary side) can be used. The following table helps you with the choice:

<table>
<thead>
<tr>
<th>System type</th>
<th>AC + DC</th>
<th>AC</th>
<th>AC</th>
</tr>
</thead>
<tbody>
<tr>
<td>I_{max}</td>
<td>1…25 A</td>
<td>5…25 A</td>
<td>5…100 A</td>
</tr>
<tr>
<td>f</td>
<td>0…3800 Hz</td>
<td>42…3800 Hz</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>Bender CT Ratio</td>
<td>600:1</td>
<td>600:1</td>
<td>60:5</td>
</tr>
<tr>
<td>Connecting cable</td>
<td>max. 30 m</td>
<td>max. 40 m</td>
<td>max. 25 m (4 mm²/AWG 12) max. 40 m (6 mm²/AWG 10)</td>
</tr>
<tr>
<td>I_{dev}</td>
<td>~</td>
<td>~</td>
<td>~</td>
</tr>
</tbody>
</table>

### Type

- **CTUB103**
  - 24 V
  - CT: Terminal k: NGRM500: 50 mA
  - CT: Terminal l: NGRM500: C

- **CTB31…41**
  - W20…120 W1-S35…W5-S210
  - CT: Terminal k: NGRM500: 5 A
  - CT: Terminal l: NGRM500: C

- **AN420**
  - S1(k) S2(l)
  - NGRM500: C
LINETRAXX® NGRM700
Neutral Grounding Resistor Monitor

Device features
• Determination of $R_{NGR}$ with passive and active measurement methods
• Continuous monitoring of the $R_{NGR}$ even if the installation is de-energised;
• Alarm or trip on ground fault
• Monitoring of the current $I_{NGR}$
• Monitoring of the voltage $U_{NGR}$
• Phase-to-ground fault indication (optional; up to 690 V direct coupling, otherwise via potential transformers)
• Ethernet communication
• Web server
• Language selection (German, English GB and US, Spanish, French)
• Test button (internal, external) with/without tripping
• FFT analysis of the measuring signals
• Pulser for manual ground fault location
• Relay for detection of ground faults and resistor faults
• Relay for shutdown of the installation after a configurable time
• Can be combined with RCMS… for automatic shutdown of feeders
• Graphical user interface
• Wide supply voltage range (24 to 240 Vac/Vdc)
• Range of use up to 5000 m AMSL
• Analogue output of measured values (0…10 V, 4…20 mA, etc., selectable parameters)
• Detachable HMI for door mounting
• Password protection
• Tripping on RMS, fundamental component signal or harmonics
• Detection of AC and DC ground faults

Further information
For further information refer to our product range on www.bender.de.

For use in high-resistance grounded systems

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage $U_s$ / Frequency range Hz</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 24…240 V, 40…70 Hz, DC 24…240 V</td>
<td>NGRM700</td>
<td>B94013700</td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessory for FP200-NGRM: Transparent front cover 144x72 (for IP65)</td>
<td>B98060005</td>
</tr>
<tr>
<td>Accessory for FP200-NGRM: Front mounting fixing clips</td>
<td>B91067907</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
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<td>Coupling device</td>
<td>CD…</td>
<td>B980390…</td>
<td>246</td>
</tr>
<tr>
<td>Measuring current transformer</td>
<td>CTUB…</td>
<td>B781200…</td>
<td>365</td>
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<td>Voltage supply for measuring current transformers</td>
<td>STEP-PS</td>
<td>B940531…</td>
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</tr>
</tbody>
</table>

1) When using the "transparent front cover 144x72 (IP 65)" the cutout in the switchboard cabinet must be extended in height from 66 mm to 68 mm (+0.7/-0 mm).

The degree of protection IP65 applies only to the user interface FP200-NGRM when using the front cover. The degree of protection for the complete device is still IP30.
**Technical data**

**Insulation coordination according to IEC 60664-1/IEC 60664-3/DIN EN 50187**

**Definitions**

- Measuring circuit 1 (IC1)
- Supply circuit (IC2)
- Measuring circuit/Control circuit (IC3)
- Output circuit 1 (IC4)
- Output circuit 2 (IC5)
- Output circuit 3 (IC6)

**Rated voltage**

- 690 V

**Overvoltage category**

- III

**Rated impulse voltage**

- IC1/(IC2…6) 800 V
- IC2/(IC3…6) 250 V
- IC3/(IC4…6) 250 V
- IC4/(IC5…6) 250 V
- IC5/(IC6) 250 V

**Pollution degree exterior**

- 3

**Safe isolation (reinforced insulation) between**

- IC1/(IC2…6) overvoltage category III, 800 V
- IC2/(IC3…6) overvoltage category III, 300 V
- IC3/(IC4…6) overvoltage category III, 300 V
- IC4/(IC5…6) overvoltage category III, 300 V
- IC5/(IC6) overvoltage category III, 300 V

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

- IC2/(IC3…6) AC 2.2 kV
- IC3/(IC4…6) AC 2.2 kV
- IC4/(IC5…6) AC 2.2 kV
- IC5/(IC6) AC 2.2 kV

**Supply voltage**

- Nominal supply voltage $U_n$
- $\geq 2000$ V
- $< 2000$ V (for UL applications)

**Measuring range**

- 1.2 x $U_n$

**Response delay**

- NGR relay 7 s (±2.5 s)
- Trip relay 100 ms…24 h, ∞

**Monitoring function**

- Measuring circuit 5 A
- Measuring range 5 A
- Measuring accuracy 2 % of $U_n$
- Measurement accuracy ±20 %
- Overload capacity 10 x $I_n$
- Tolerance related to the current/voltage end value ±20 %

**Digital inputs**

- Galiane separation no
- Length connecting cables max. 10 m
- $U_{in}$ DC 0 V, 24 V
- Overload capacity $-5…-32$ V

**Digital outputs**

- Galiane separation no
- Length connecting cables max. 10 m
- Currents (sink) for each output max. 300 mA
- Voltage 24 V
- Overload capacity $-5…-32$ V

**Analogue output (M+)**

- Operating mode Linear
- Functions $I_{NGR}, U_{NGR}$
- Current 0…20 mA (≤ 600 Ω), 4…20 mA (≤ 600 Ω), 0…400 μA (≤ 4 kΩ)
- Voltage $0…10$ V (≤ 1 kΩ), 2…10 V (≤ 1 kΩ)
- Tolerance related to the current/voltage end value ±20 %

**Ground-fault, NGR, trip relay**

- Switching elements changeover contacts
- Operating mode configurable fail-safe/non-fail-safe
- Electrical endurance, number of cycles 10,000
- Switching capacity 2000 VA/150 W

**Contact data acc. to IEC 60947-5-1**

- Utilization category AC-11 AC-14 DC-12 DC-12 DC-12
- Rated operational voltage 250 V 250 V 220 V 110 V 24 V
- Rated operational current 5 A 3 A 0.1 A 0.2 A 1 A
- (for UL applications) 3 A 3 A
- Minimum current 1 mA at AC/DC > 10 V
### Technical data (continued)

**Environment/EMC**
- EMC immunity (IEC 61000-6-2/IEC 60255-26 Ed. 3.0) DIN EN 61000-6-2
- EMC emission (IEC 61000-6-2/IEC 60255-26 Ed. 3.0) DIN EN 61000-6-4
- Operating temperature: -40...+70 °C (-40...+60 °C for UL applications)
- Humidity: ≤ 98 %

**Classification of climatic conditions acc. to IEC 60721**
- Stationary use (IEC 60721-3-3): 3K23 (except condensation and formation of ice)
- Transport (IEC 60721-3-2): 2K11 (-40...+85 °C) (except condensation and formation of ice)
- Long-term storage (IEC 60721-3-1): 1K22 (-40...+70 °C) (except condensation and formation of ice)

**Classification of mechanical conditions acc. to IEC 60721/IEC 60255-21/DIN EN 60068-2-6**
- Stationary use: 3M12
- Transport: 2M4
- Long-term storage: 1M12

**Connection**
- **Screw-type terminals**
  - Tightening torque: 0.5...0.6 Nm (5...7 lb-in)
  - Conductor sizes: AWG 24-12
  - Stripping length: 7 mm
  - Rigid/flexible: 0.2...2.5 mm²
  - Flexible with ferrule with/without plastic sleeve: 0.25...2.5 mm²
  - Multiple conductor, rigid: 0.2...1 mm²
  - Multiple conductor flexible: 0.2...1.5 mm²
  - Multiple conductor flexible with ferrule without plastic sleeve: 0.25...1.5 mm²
  - Multiple conductor, flexible with TWIN ferrule with plastic sleeve: 0.5...1.5 mm²

- **Push-wire terminals X1**
  - Conductor sizes: AWG 24-16
  - Stripping length: 10 mm
  - Rigid/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

**Other**
- Operating mode: continuous operation
- Mounting: display-oriented
- Altitude: 5000 m AMSL
- Degree of protection, internal components (DIN EN 60529): IP30
- Flammability class: UL 94V-0
- Protective coating measurement equipment: SL1307, UL file E80315
- Documentation number: D00292
- Weight: 1050 g

---

**Dimension diagram NGRM700** (dimensions in mm)

**Dimension diagram FP200-NGRM** (dimensions in mm)
For these voltages, the phase monitor of the NGRM700 can be connected directly to the conductors to be monitored.

The "N" connection of the CD-series coupling device should be as close to the transformer star point as possible.

Connection Star connection: $U_{sys} \leq 690 \, V$ with pulser

The "N" connection of the CD-series coupling device should be as close to the transformer star point as possible. An intermediate relay may be required between the power contactor of the pulser and the digital output at X1 of the FP200-NGRM.
Connection star connection: $U_{sys} > 690\,V$

For these voltages, the phase monitor of the NGRM700 can only be connected to the conductors to be monitored via potential transformers (PT).

Note: * PT ratio „primary:secondary“ can be adjusted in the NGRM700.

* The “N” connection of the CD-series coupling device should be as close to the transformer star point as possible.

Connection artificial neutral (delta connection): zigzag transformer

If no star point is available, the following circuit can create an artificial neutral.
Measuring current transformer connection

Depending on the system to be monitored, a suitable measuring current transformer has to be chosen. All common measuring current transformers (50 mA or 5 A on the secondary side) can be used. The following table helps you with the choice:

<table>
<thead>
<tr>
<th>System type</th>
<th>AC + DC</th>
<th>AC</th>
<th>AC</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_{\text{NGR}}$</td>
<td>1…25 A</td>
<td>5…25 A</td>
<td>5…100 A</td>
</tr>
<tr>
<td>$f$</td>
<td>0…3800 Hz</td>
<td>42…3800 Hz</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>Bender CT Ratio</td>
<td>600:1</td>
<td>600:1</td>
<td>60:5</td>
</tr>
<tr>
<td>Connecting cable</td>
<td>max. 30 m</td>
<td>max. 40 m</td>
<td>max. 25 m (4 mm²/AWG 12) max. 40 m (6 mm²/AWG 10)</td>
</tr>
<tr>
<td>$I_{\text{tn}}$</td>
<td></td>
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| Connecting cable | max. 30 m | max. 40 m | max. 25 m (4 mm²/AWG 12) max. 40 m (6 mm²/AWG 10) |
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</tbody>
</table>
LINETRAXX® CTUB103
AC/DC sensitive measuring current transformer (Type B)

Device features
- Multicolour LED for operation, fault and status messages
- Electronic module can be exchanged without mechanical separation of the primary conductors
- Monitoring of the connection to the measuring current transformer
- Evaluator: NGRM500, NGRM700

Typical applications
- Convert system leakage and fault currents into an evaluable measurement signal.

Approvals

Further information
For further information refer to our product range on www.bender.de.

Ordering details

<table>
<thead>
<tr>
<th>ø current transformers</th>
<th>Permissible measuring range</th>
<th>Set</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>5 A, 10 A</td>
<td>CTUB103-CTBC35</td>
<td>B78120030</td>
</tr>
<tr>
<td>60</td>
<td>5 A, 10 A, 25 A</td>
<td>CTUB103-CTBC60</td>
<td>B78120031</td>
</tr>
<tr>
<td>120</td>
<td>5 A, 10 A, 25 A</td>
<td>CTUB103-CTBC120</td>
<td>B78120032</td>
</tr>
</tbody>
</table>

Ordering details for spare parts and accessories

Electronic modules

<table>
<thead>
<tr>
<th>Supply voltage $U_s$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td>CTUB103</td>
<td>B78120052</td>
</tr>
</tbody>
</table>

Measuring current transformer cores

<table>
<thead>
<tr>
<th>ø current transformers</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>35 mm</td>
<td>CTBC35</td>
<td>B98120003</td>
</tr>
<tr>
<td>60 mm</td>
<td>CTBC60</td>
<td>B98120005</td>
</tr>
<tr>
<td>120 mm</td>
<td>CTBC120</td>
<td>B98120007</td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIN rail mounting clip for CTBC35</td>
<td>B91080112</td>
</tr>
</tbody>
</table>
Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions

- Measuring circuit (IC1) primary conductors routed through the current transformer connections X plug
- Secondary (IC2)  secondary conductors through the current transformer

Rated voltage: 800 V

Overvoltage category: III

Area of application: ≤ 2000 m AMSL

Rated impulse voltage (IC1/IC2): 8 kV

Rated insulation voltage (reinforced insulation; IC1/IC2): 800 V

Pollution degree: 2

Supply voltage CTUB103

- Description: 24 V, GND
- Supply voltage: U_s = DC 24 V
- Operating range of U_s: ±20 %
- Ripple U_s: ≤ 1 %
- Power consumption: ≤ 5.3 W
- Inrush current: 1 A for 1 ms

Measuring ranges

- Measuring range 1: 5 A rms, 14.5 A peak
- Scaling: 5 A/50 mA, 100:1
- Measuring range 2: 10 A rms, 21 A peak
- Scaling: 10 A/50 mA, 200:1
- Measuring range 3: 25 A rms, 59 A peak
- Scaling: 25 A/50 mA, 500:1

Measuring accuracy: ±2 %

Rated continuous thermal current I_cth: 42 A

Rated short-time thermal current I_th: 2.4 kA/1 s

Rated dynamic current I_dyn: 6 kA/40 ms

Display

- Multicolour LED: red, green

Output

- Name: 51 (0), 52 (1)
- Max. voltage: ±10 V
- Max. current: ±100 mA
- Max. cable length: 30 m
- Load: 68 Ω

Environment/EMC

EMC: IEC 61000-6
Operating temperature: -25...55 °C

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

- 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

- Use 60 °C/75 °C copper lines only.
- X plug
- Manufacturer: Phoenix Contact
- Type: DFMC 1.5/4-ST-3.5 BK

The connection conditions of the manufacturer apply.

Connection properties

- rigid: 0.2…1.5 mm² (AWG 24…16)
- flexible: 0.2…1.5 mm² (AWG 24…16)
- with ferrule: 0.25…0.75 mm²

Mounting CTBC...

- Screw type: CTBC35, CTBC60, CTBC120
- Washer type: CTBC35, CTBC60, CTBC120

- Tightening torque: CTCB35 0.6 Nm, CTCB120 1 Nm

Other

- Operating mode: continuous operation
- Degree of protection, built-in components (DIN EN 60529): IP40
- Degree of protection, terminals (DIN EN 60529): IP20
- Flammability class: UL94 V-0
- Software: D591
- Documentation number: D00410
- Weight: CTUB103: ≤ 310 g, CTUB103-CTBC35: ≤ 330 g, CTUB103-CTBC60: ≤ 1460 g
### Dimension diagrams

#### A

#### B

#### C

#### D

<table>
<thead>
<tr>
<th>Dimensions in mm</th>
<th>Type</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
<th>f</th>
<th>g</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong> CTUB10…-CTBC35</td>
<td>97</td>
<td>130</td>
<td>47</td>
<td>ø 35</td>
<td>46</td>
<td>61</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td><strong>B</strong> CTUB10…-CTBC60</td>
<td>126</td>
<td>151</td>
<td>57</td>
<td>ø 60</td>
<td>56</td>
<td>78</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td><strong>C</strong> CTUB10…-CTBC120</td>
<td>188</td>
<td>225</td>
<td>96</td>
<td>ø 120</td>
<td>65</td>
<td>96</td>
<td>139</td>
<td></td>
</tr>
<tr>
<td><strong>D</strong> CTUB103</td>
<td>74</td>
<td>44</td>
<td>30</td>
<td>32</td>
<td>4.6</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
</tbody>
</table>

Tolerance: ±0.5 mm

### Wiring diagram

Neutral Grounding Resistor Monitor (NGR)

AC/DC sensitive measuring current transformer (Type B) LINETRAX® CTUB103
**CD1000**  
**Coupling device**

- **Device features**
  - Coupling device for NGRM
  - Range of use up to AC 690 V/DC 400 V system voltage
  - Range of use up to 2000 m

- **Further information**
  For further information refer to our product range on www.bender.de.

- **Typical applications**
  - The coupling device is suitable for HRG applications up to AC 690 V and/or DC 400 V.

- **Ordering information**

<table>
<thead>
<tr>
<th>Nominal system voltage $U_{LL}$ ($U_{NGR}$)</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to $U_{LL} = 690$ V ($U_{NGR} = 400$ V)</td>
<td>CD1000</td>
<td>B98039010</td>
</tr>
</tbody>
</table>

- **Technical data**

  **Insulation coordination DIN EN 50178:1997**

  - **Definition**
    - Measuring circuit (IC1)
    - Output circuit (IC2)
    - Protective circuit (IC3)
  - **Rated voltage** 400 V
  - **Overvoltage category** III
  - **Pollution degree** 2
  - **Rated insulation voltage**
    - IC1/IC2 – IC3: 400 V
    - IC2/IC3: 50 V

  **Voltage range**

  - $U_{n}$: DC / 50/60 Hz / 50…3200 Hz 400 V
  - $I_{n}$: 30 mA
  - Overload capacity: $1.15 \times U_{n}$ for < 30 minutes

  **Resistance**

  - $20 \Omega$ ±5 %
  - Temperature coefficient: 25 ppm/K

  **Environment**

  - Ambient temperature: $-40...+70$ °C
  - Ambient temperature for UL: $-40...+60$ °C
  - Humidity: ≤ 98 %

  **Classification of climatic conditions acc. to IEC 60721**

  (except condensation and formation of ice)
  - Stationary use (IEC 60721-3-3): 3K21
  - Transport (IEC 60721-3-2): 2K11 (-40...+85 °C)
  - Long-term storage (IEC 60721-3-1): 1K22 (-40...+70 °C)

  **Classification of mechanical conditions acc. to IEC 60721**

  - Stationary use: 3M12
  - Transport: 2M4
  - Long-term storage: 1M12

- **Connection**

  - **Total tightening torque** 0.5...0.6 Nm (5...7 lb-in)
  - **Conductor sizes**
    - AWG 24-12
    - 7 mm
  - **Conductor, rigid** 0.2 ... 4 mm²
  - **Conductor, flexible** 0.2 ... 2.5 mm²
  - **Multiple conductor, flexible with ring cable lug**
    - without plastic sleeve: 0.25 ... 1.5 mm²
    - with plastic sleeve: 0.25 ... 2.5 mm²

  **Other**

  - **Flammability class** UL94 HB
  - **Documentation number** D00397
  - **Weight** < 190 g

**Neural Grounding Resistor Monitor (NGR)**

**Coupling device CD1000**

4
Neutral Grounding Resistor Monitor (NGR)

**Coupling device CD1000**

**Dimension diagram (dimensions in mm)**

- Φi = 4.5
- Φa = 10.0
- t = 3.2

**i = internal**
**a = external**
**t = depth**

**Wiring diagram**

**NGR Monitor** and **RC48N**

**Internal wiring diagram CD1000**

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Use</th>
<th>Connecting cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Connection to the star point of the HRG system</td>
<td>1.5 mm²</td>
</tr>
<tr>
<td>G1</td>
<td>Connection to R₁ of the NGRM . . .</td>
<td>1.5 mm²</td>
</tr>
<tr>
<td>G</td>
<td>Connection to E of the NGRM . . . (internally connected to PE, see internal wiring diagram)</td>
<td>≥ 1.5 mm²</td>
</tr>
<tr>
<td>PE</td>
<td>Connection to enclosure</td>
<td>≥ 1.5 mm²</td>
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</table>

Connection to the star point of the HRG system
Connection to R₁ of the NGRM . . .
Connection to E of the NGRM . . . (internally connected to PE, see internal wiring diagram)
Connection to enclosure
CD1000-2
Coupling device

Device features

- Coupling device for NGRM
- Range of use up to AC 1000 V/DC 600 V system voltage
- Application up to 5000 m

Further information

For further information refer to our product range on www.bender.de.

Typical applications

- The coupling device is suitable for HRG applications up to AC 1000 V and/or DC 690 V.

Ordering information

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<tr>
<td>Up to U_{LL} = 1000 V (U_{NGR} = 600 V)</td>
<td>CD1000-2</td>
<td>B98039053</td>
</tr>
</tbody>
</table>

Technical data

Insulation coordination DIN EN 50178:1997

Definition
- Measuring circuit (IC1)
- Output circuit (IC2)
- Protective circuit (IC3)

Rated voltage
- 600 V

Overvoltage category
- III

Pollution degree
- 2

Rated insulation voltage
- no galvanic separation between the circuits
  - IC1/(IC2 – IC3): 600 V
  - IC2/IC3: 50 V

Voltage range
- U_n: DC / 50/60 Hz / 50…3200 Hz 600 V
- I_n: 30 mA
- Overload capacity: 1.15 x U_n for < 30 minutes

Resistance
- 20 kΩ ±0.5 %
- Temperature coefficient: 20 ppm/K

Environment
- Ambient temperature: -40…+70 °C
- Ambient temperature for U_n: -40…+60 °C
- Humidity: ≤ 98 %

Classification of climatic conditions acc. to IEC 60721
(except condensation and formation of ice)
- Stationary use (IEC 60721-3-3): 3K23
- Transport (IEC 60721-3-2): 2K11 (-40…+85 °C)
- Long-term storage (IEC 60721-3-1): 1K22 (-40…+70 °C)

Classification of mechanical conditions acc. to IEC 60721
- Stationary use: 3M12
- Transport: 2M4
- Long-term storage: 1M12

Connection
- Tightening torque: 0.5…0.6 Nm (5…7 lb-in)
- Conductor sizes: AWG 24-12
- Stripping length: 7 mm
- Conductor, rigid: 0.2…4 mm²
- Conductor, flexible: 0.2…2.5 mm²
- Multiple conductor, flexible with ferrule:
  - without plastic sleeve: 0.25…1.5 mm²
  - with plastic sleeve: 0.25…2.5 mm²
- Multiple conductor, flexible with TWIN ferrule:
  - with plastic sleeve: 0.5…1.5 mm²

Other
- Tightening torque mounting screws (M4x30): 2.5 Nm (22.1 lb-in)
- Operating mode: continuous operation
- Mounting: any position
- Operating altitude: up to 5000 m AMSL
- Degree of protection, internal components (DIN EN 60529): IP30
- Flammability class: UL 94V-0
- Documentation number: D00045
- Weight: < 700 g
**Neutral Grounding Resistor Monitor (NGR)**

**Coupling device CD1000-2**

---

**Dimension diagram** (dimensions in mm)

- Cooling surface
- Dimensions: 300 x 300 mm
- **S**: ø 4.5 M4x30 2.5 Nm

---

**Wiring diagram**

**Internal wiring diagram CD1000-2**

**Wiring diagram**

---

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Use</th>
<th>Connecting cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Connection to the star point of the HRG system</td>
<td>Metrical: 1.5 mm², Imperial: AWG16</td>
</tr>
<tr>
<td>Rs</td>
<td>Connection to Rs of the NGRM... (internally connected to PE)</td>
<td>1.5 mm²</td>
</tr>
<tr>
<td>E</td>
<td>Connection to E of the NGRM... (internally connected to PE, see internal wiring diagram)</td>
<td>1.5 mm²</td>
</tr>
<tr>
<td>PE</td>
<td>Connection to the protective conductor (internally connected to E, see internal wiring diagram)</td>
<td>1.5 mm² or greater</td>
</tr>
</tbody>
</table>

---

**Cable:** 1.5 mm² (AWG16)
CD5000
Coupling device

Device features
- Coupling device for NGRM
- Range of use up to AC 4300 V/DC 2500 V system voltage
- Range of use up to 5000 m

Further information
For further information refer to our product range on www.bender.de.

Typical applications
- The coupling device is suitable for HRG applications up to AC 4300 V and/or DC 2500 V.

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage $U_{LL}$ ($U_{NGR}$)</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to $U_{LL} = 4300$ V ($U_{NGR} = 2500$ V)</td>
<td>CD5000</td>
<td>B98039011</td>
</tr>
</tbody>
</table>

Technical data

Insulation coordination DIN EN 50178:1997

Definition
- Measuring circuit (IC1)
- Output circuit (IC2)
- Protective circuit (IC3)

Rated voltage: 3 kV
Overvoltage category: III
Pollution degree: 2

Rated insulation voltage:
- no galvanic separation between the circuits: IC1/(IC2 – IC3) 3 kV
- IC2/IC3 50 V

Voltage range
- $U_n$ DC / 50/60 Hz / 50…3200 Hz 2500 V
- $I_n$ 125 mA
- Overload capacity: $1.15 \times I_n$ for < 5 minutes

Resistance
- $20 \, \text{k} \Omega \pm 1 \%$
- Temperature coefficient: 20 ppm/K

Environment
- Ambient temperature: -40...+70 °C
- Ambient temperature for $U_n$: -40...+60 °C
- Humidity: $\leq 98 \%$

Classification of climatic conditions acc. to IEC 60721
(except condensation and formation of ice)
- Stationary use (IEC 60721-3-3): 3K21
- Transport (IEC 60721-3-2): 2K11 (-40...+85 °C)
- Long-term storage (IEC 60721-3-1): 1K22 (-40...+70 °C)

Classification of mechanical conditions acc. to IEC 60721
- Stationary use: 3M12
- Transport: 2M4
- Long-term storage: 1M12

Connection
- Tightening torque G1 and G: 0.5...0.6 Nm (5...7 lb-in)
- Conductor sizes: AWG 24-12
- Connection G1 and G: cable lug
- Conductor: $\geq 1.5 \, \text{mm}^2$
- Connection PE: cable lug M6
- Conductor: $\geq 2.5 \, \text{mm}^2$
- Connection N (use minimum 110 °C conductor): cable lug M6, M10

Other
- Operating mode: continuous operation
- Mounting: any position
- Operating altitude: up to 5000 m AMSL
- Degree of protection, internal components (DIN EN 60529): IP0
- Flammability class: UL 94V-0
- Documentation number: D00398
- Weight: < 3800 g
Neutral Grounding Resistor Monitor (NGR)  
Coupling device CD5000

Internal wiring diagram CD5000

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Use</th>
<th>Connecting cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Connection to the star point of the HRG system</td>
<td>via cable lug M6 or M10</td>
</tr>
<tr>
<td>G1</td>
<td>Connection to $A_1$ of the NGRM…</td>
<td>1.5 mm²</td>
</tr>
<tr>
<td>G</td>
<td>Connection to E of the NGRM… (internally connected to PE, see internal wiring diagram)</td>
<td>AWG16</td>
</tr>
<tr>
<td>PE to enclosure</td>
<td>Connection to the protective conductor (internally connected to E, see internal wiring diagram)</td>
<td>$\geq$ 1.5 mm²</td>
</tr>
</tbody>
</table>
CD14400
Coupling device

Device features
- Coupling device for NGRM
- Range of use up to 14400 V system voltage
- Application up to 5000 m
- IP54

Further information
For further information refer to our product range on www.bender.de.

Typical applications
- The coupling device is suitable for HRG applications up to a system voltage of 14400 V.

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage $U_n$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to $U_{LL} = 14400$ V ($U_{NGR} = 8400$ V)</td>
<td>CD14400</td>
<td>B98039054</td>
</tr>
</tbody>
</table>

Technical data

Insulation coordination DIN EN 50178:1997

Definitions:
- Measuring circuit (IC1)
- Output circuit (IC2)
- Protective circuit (IC3)
- Rated voltage 8400 V
- Overvoltage category III
- Pollution degree 2

Rated insulation voltage
- no galvanic separation between the circuits! (IC1)/(IC2 – IC3)
- IC2/IC3 8400 V
- IC1/IC2 50 V

Voltage range
- $U_n$ DC / 50/60 Hz / 50...3200 Hz 8400 V
- $I_n$ 84 mA

Operating time
- without ground fault (1900 V) unlimited
- with ground fault (4200 V) 90 seconds
- with ground fault (8400 V) 60 seconds

Cool-down period 120 minutes

Overload capacity
- without ground fault (1900 V) unlimited
- with ground fault (4200 V) 90 seconds
- with ground fault (8400 V) 60 seconds

Resistance
- $100 \, \text{k}\Omega$ ±0.5 %
- Temperature coefficient 20 ppm/K

Environment
- Ambient temperature $-40...+70$ °C
- Ambient temperature for $U_{LL}$ $-40...+60$ °C
- Humidity ≤ 98 %

Classification of climatic conditions acc. to IEC 60721
(except condensation and formation of ice)
- Stationary use (IEC 60721-3-3) 3K23
- Transport (IEC 60721-3-2) 2K11 (-40...+85 °C)
- Long-term storage (IEC 60721-3-1) 1K22 (-40...+70 °C)

Classification of mechanical conditions acc. to IEC 60721
- Stationary use 3M12
- Transport 2M4
- Long-term storage 1M12

Connection
- Connection $R$ and $E$
  - Tightening torque 0.5...0.6 Nm (4.4...5.3 lb-in)
  - Conductor sizes AWG 24-12
  - Stripping length 7 mm
  - Conductor, rigid 0.2...4 mm²
  - Conductor, flexible 0.2...2.5 mm²

Multiple conductor, flexible with ferrule
- without plastic sleeve 0.25...1.5 mm²
- with plastic sleeve 0.25...2.5 mm²

Multiple conductor, flexible with TWIN ferrule
- with plastic sleeve 0.5...1.5 mm²

Connection $N$ and $PE$
- Tightening torque cable lug M10 17 Nm (150 lb-in)
- Tightening torque cable lug M5 2.2 Nm (19.5 lb-in)

Other
- Tightening torque cover screws 2.5 Nm (22.1 lb-in)
- mounting screws 21 Nm (186 lb-in)
- Operating mode in case of a ground fault maximum 60 s
- Degree of protection, internal components (DIN EN 60529) IP54
- Paintability class UL 94V-0
- Documentation number D00346
- Weight < 4.4 kg
**Dimension diagram (dimensions in mm)**

Tightening torque cover screws: 2.5 Nm

Minimum distance to adjacent devices

**Wiring diagram**

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Use</th>
<th>Connecting cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rs</td>
<td>Connection to Rs of the NGRM . . .</td>
<td>1.5 mm²</td>
</tr>
<tr>
<td>E</td>
<td>Connection to E of the NGRM . . .; internally connected to PE</td>
<td>AWS16</td>
</tr>
<tr>
<td>N</td>
<td>Connection to the star point of the HRG system; via cable lug M5 or M10</td>
<td>≥ 1.5 mm²</td>
</tr>
<tr>
<td>PE</td>
<td>Connection to protective earth conductor; internally connected to E, cable lug M5</td>
<td>AWS16 or greater</td>
</tr>
</tbody>
</table>
CD25000
Coupling device

**Device features**
- Coupling device for NGRM
- Range of use up to AC 25 kV/DC 14.5 kV system voltage
- Application up to 5000 m

**Further information**
For further information refer to our product range on www.bender.de.

**Typical applications**
- The coupling device is suitable for HRG applications up to AC 25 kV and/or DC 14.5 kV

**Ordering information**

<table>
<thead>
<tr>
<th>Nominal system voltage $U_n$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to $U_{NGR} = 25$ kV ($U_{LL} = 14.5$ kV)</td>
<td>CD25000</td>
<td>B98039055</td>
</tr>
</tbody>
</table>

**Technical data**

**Insulation coordination DIN EN 50178:1997**

<table>
<thead>
<tr>
<th>Definition</th>
<th>Measuring circuit (IC1)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output circuit (IC2)</td>
<td>$R_0$</td>
<td></td>
</tr>
<tr>
<td>Protective circuit (IC3)</td>
<td>$E$, $PE$</td>
<td></td>
</tr>
<tr>
<td>Rated voltage</td>
<td>14500 V</td>
<td></td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>III</td>
<td></td>
</tr>
<tr>
<td>Pollution degree</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Rated insulation voltage</td>
<td>no galvanic separation between the circuits!</td>
<td></td>
</tr>
<tr>
<td>(IC1)/(IC2 – IC3)</td>
<td>14500 V</td>
<td></td>
</tr>
<tr>
<td>IC2/IC3</td>
<td>50 V</td>
<td></td>
</tr>
</tbody>
</table>

**Voltage range**

<table>
<thead>
<tr>
<th>$U_n$</th>
<th>DC / 50/60 Hz / 50…3200 Hz</th>
<th>14500 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_n$</td>
<td>145 mA</td>
<td></td>
</tr>
</tbody>
</table>

**Operating time**

- without ground fault (2800 V) unlimited
- with ground fault (14500 V) 10 seconds

**Cool-down period**

- 120 minutes
- 1.15 x $U_n$, for < 10 seconds

**Resistance**

- 100 kΩ ±0.5 %
- Temperature coefficient 20 ppm/K

**Environment**

- Ambient temperature -40…+70 °C
- Ambient temperature for $U_n$ -40…+60 °C
- Humidity ≤ 98 %

**Classification of climatic conditions acc. to IEC 60721**

- Stationary use (IEC 60721-3-3) 3K5 (except condensation and formation of ice)
- Transport (IEC 60721-3-2) 2K3 (-40…+85 °C) (except condensation and formation of ice)
- Long-term storage (IEC 60721-3-1) 1K4 (-40…+70 °C) (except condensation and formation of ice)

**Classification of mechanical conditions acc. to IEC 60721 / IEC 60255-21 / DIN EN 60068-2-6**

- Stationary use 3M7
- Transport 2M2
- Long-term storage 1M3

**Connection**

- Connection $R_0$ and $E$
- Tightening torque $0.5 \ldots 0.6$ Nm (4.4…5.3 lb-in)
- Conductor sizes AWG 24-12
- Stripping length 7 mm
- Conductor, rigid 0.2…4 mm²
- Conductor, flexible 0.2…2.5 mm²
- Multiple conductor, flexible with ferrule without plastic sleeve 0.25…1.5 mm²
- Multiple conductor, flexible with ferrule with plastic sleeve 0.25…2.5 mm²
- Multiple conductor, flexible with TWIN ferrule with plastic sleeve 0.5…1.5 mm²
- Connection PE for cable lug 2.2 Nm (19.5 lb-in)
- Connection $N$
- Connection via HV line with open end
- Tightening torque cable lug M5
- Connection PE for cable lug M5
- Tightening torque cover screws 2.5 Nm (22.1 lb-in)

**Other**

- Operating mode in case of a ground fault maximum 10 s
- Mounting any position
- Operating altitude (when mounted on insulators) up to 5000 m AMSL
- Degree of protection, internal components (DIN EN 60529) IP54
- Flammability class UL 94V-0
- Documentation number D00347
- Weight < 11 kg
- Tightening torque cover screws 2.5 Nm (22.1 lb-in)
**Dimension diagram** (dimensions in mm)

```
300
300
200
200
650
600
120
70
```

**Wiring diagram**

**Terminal** | **Use** | **Connecting cable**
--- | --- | ---
$R_s$ | Connection to $R_s$ of the NGRM... | 1.5 mm$^2$ / AWG16
E | Connection to E of the NGRM... (internally connected to PE, see internal wiring diagram) | 1.5 mm$^2$ / AWG16 or greater
N | Connection to the star point of the HRG system (cable lug M5 or M10) | 1.5 mm$^2$ / AWG16 or greater
PE | Connection to the protective conductor (internally connected to E, cable lug M5) | 1.5 mm$^2$ / AWG16 or greater

**Internal wiring diagram CD25000**

- N: Neutral
- PE: Protective conductor
- E: Earth
- Rs: Resistance
- k: Isolator/Insulator

Terminal Use Connecting cable
--- | --- | ---
$R_s$ | Connection to $R_s$ of the NGRM... | 1.5 mm$^2$ / AWG16
E | Connection to E of the NGRM... (internally connected to PE, see internal wiring diagram) | 1.5 mm$^2$ / AWG16 or greater
N | Connection to the star point of the HRG system (cable lug M5 or M10) | 1.5 mm$^2$ / AWG16 or greater
PE | Connection to the protective conductor (internally connected to E, cable lug M5) | 1.5 mm$^2$ / AWG16 or greater

**Terminal Use Connecting cable**

- Metrical
- Imperial
Insulation monitoring devices
ISOMETER®

Equipment for insulation fault location
ISOSCAN®

Residual current monitoring systems
LINETRAXX®

Neutral Grounding Resistor Monitor (NGR)
LINETRAXX®

Charge Controller

Power Quality and Energy Measurement
LINETRAXX®

Measuring and monitoring relays
LINETRAXX®

System components
Coupling devices
Measuring current transformers
Transformers
Relay modules
Power supply units
Measuring instruments
Interface converters
Interface repeaters
COMTRAXX® Gateways
COMTRAXX® Alarm indicator and test combinations
COMTRAXX® condition monitors
Visualisation

Switching equipment
ATICS® transfer switching and monitoring devices

Test systems
UNIMET® Safety analyser

Annex
Technical terms
Alphabetical list of devices
Service

BENDER 01/2021
## Device overview charge controller

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<td>4G modem (optional)</td>
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<td><strong>Integrated 6 mA DC fault current detection</strong></td>
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<td><strong>Integrated Powerline Communication (PLC)</strong></td>
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<td>–</td>
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<td><strong>Basis for compliance with German calibration law</strong></td>
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<td><strong>Interface</strong></td>
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<td>S0</td>
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<td>Ethernet</td>
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<td>Modbus</td>
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<td><strong>Product details</strong></td>
<td><a href="#">QR Code</a></td>
<td><a href="#">QR Code</a></td>
<td><a href="#">QR Code</a></td>
</tr>
</tbody>
</table>

(Products on [www.bender.de/en](http://www.bender.de/en))
## Device overview accessories charge controller

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<td>Measuring current transformer</td>
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<td>RFID module</td>
<td>RFID module</td>
</tr>
<tr>
<td>For series</td>
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<td>CC613-Hxx</td>
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<tr>
<td>RCMB104</td>
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<td>RCD104</td>
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</tbody>
</table>

### For series

**CC612**

**CC613**

**CC613-Hxx**

**RCMB104**

**RCD104**

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[QR Code for CTBC17]

[QR Code for W15BS]

[QR Code for DPM2x16FP]

[QR Code for RFID114]

[QR Code for RFID117-L1]
**Device features**

- Charge controller acc. to IEC 61851-1 (mode 3)
- It can be configured as either a Master or Slave
- The charge controller can be integrated into a single or three-phase system up to 80 A
- Smart Grid enabled using standard OCPP functionality
- OCPP 1.5 and OCPP 1.6 compliant with JSON, SOAP and Binary implementation
- Supports 4G (LTE), 3G (UMTS) and 2G (GSM) mobile networks with an integrated 4G modem in all data gateways with 4G modem
- Two USB interfaces:
  - CONFIG for local configuration
  - Other is used as an extension port for peripheral USB devices (Ethernet/WiFi home applications)
- Master/Slave hardware configuration
- Control Pilot and Proximity Pilot signal management
- Universal charge plug control (support for different vendors of sockets)
- Configurable support for one additional household socket
- Can connect to eHZ or Modbus meters and to meters with an S0 interface
- User interface board for customer-specific applications
- Configurable 3-channel input/output extension interface for additional functionality
- Only an external RCD type A is required.
- Internal temperature sensors
- A Peer Group Mechanism or Dynamic Load Management where a set current is shared between a group of charge controllers
- Optional integrated ISO/IEC 15118 power line communication (PLC) for plug & charge and load management systems
- Local and remote configuration

**Standards**

The charge controller has been developed in compliance with the following standards:

- EN 50581
- EN 61851-1
- EN 301 489-1: V2.2.0 Draft
- EN 301 511 V12.5.1
- EN 301 908-13 V11.1.2
- EN 62311
- EN 61851-22
- EN 301 489-52 V1.1.0 Draft
- EN 301 908-1 V11.1.1
- EN 301 908-2 V11.1.2

**Further information**

For further information refer to our product range on www.bender.de.

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<th>RDC-MD 1)</th>
<th>Modem</th>
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<th>LEDs</th>
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<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td>Ready, Alarm, PLC</td>
<td>eHZ- and S0 interface</td>
<td>CC612-1M4PR</td>
<td>B94060011</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Modbus and S0 interface</td>
<td>CC612-2M4PR</td>
<td>B94060013</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-</td>
<td>Ready, Alarm</td>
<td>Modbus and S0 interface</td>
<td>CC612-2M4R</td>
<td>B94060015</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>-</td>
<td>Ready, Alarm, PLC</td>
<td>eHZ- and S0 interface</td>
<td>CC612-150PR</td>
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<td>Modbus and S0 interface</td>
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<td>-</td>
<td>Ready, Alarm</td>
<td>Modbus and S0 interface</td>
<td>CC612-250R</td>
<td>B94060010</td>
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</tr>
</tbody>
</table>

1) The charge controller with optional RDC-MD only works in combination with the measuring current transformer, which must be ordered separately.

Various cable lengths are available.

2) Optional and enabled by a software update
Technical data

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**

- Rated voltage: 12.5 V
- Overvoltage category/Pollution degree: III/3
- Rated impulse withstand voltage: 800 V
- Altitude: ≤ 2000 m AMSL

**Supply voltage**

- Nominal voltage: 12 V
- Operating range of the supply voltage: DC 11.4 V…12.6 V
- Nominal current: 1 A

**RDC-MD**

- Measuring range: 100 mA
- Response values:
  - Residual current: DC 6 mA
  - Response tolerance: DC 6 mA
- Restart sequence value: DC 6 mA < 3 mA

**Wireless parameters (Optional for data gateways with 4G modem only)**

- Frequency bands: 800 MHz/850 MHz/900 MHz/1800 MHz/2100 MHz/2600 MHz
- Impedance: 50 Ω
- Data rate:
  - GSM: EDGE: UL 23.8 kBit/s; DL 29.6 kBit/s
  - UMTS: DC-HSDPA: UL 5.76 MBit/s
  - LTE: LTE FDD: UL 5 MBit/s; DL 10 MBit/s
  - LTE TDD: UL 3.1 MBit/s; DL 8.96 MBit/s
- Required antenna: Panorama Antennas B4BE-7-27-05SP

**Inputs/outputs and display**

- LED ALARM: yellow
- LED READY: green
- LED PLC (Optional): green
- USB Extension interface (Ethernet, WLAN, …): USB socket type A
- SIM card (For data gateways with 4G modem only): micro SIM
- Terminal A:
  - IN: Actuator IN
  - OUT: Actuator pull-up output
- Terminal B:
  - 12V: +12 V IN
  - OV: 0 V IN
  - 11: Relay 1 NO
  - 14: Relay 1 NO
- Terminal C:
  - PP: Proximity Pilot
  - CP: Control Pilot (Optional Powerline Communication PLC acc. to ISO/IEC 15118)
- Maximum cable length (PP, CP): < 15 m
- 2T: Relay 2 NO
- 24: Relay 2 NO
- IN1+: Input 1+
- IN2+: Input 2+
- CT: Current transformer

**Input 1 and Input 2:**

- Input voltage: DC 11.4 V…25.2 V
- Input current: 1.7…3.8 mA
- Meter: Meter interface
- User interface: User interface RJ45

**Switching elements**

- Relay 1: configurable
- Relay 2: charging contactor
- Switching elements: 2 x 1 N/O contacts
- Operating principle: N/C operation
- Electrical service life: 10,000 switching cycles

**Contact data acc. to IEC 60947-5-1:**

- Rated operational voltage: U₀ = 30 V
- Rated operational current: I₀ = 1 A
- Minimum contact rating: 1 mA ≥ 10 V
- Rated voltage: Uᵩ = 32 V

**Environment/EMC**

- EMC: EN 61851-1, IEC 61851-21-2 FDIS:2017-09
- Operating temperature: -30…+70°C

**Climatic conditions acc. to IEC 60721:**

- Stationary use (IEC 60721-3-3): 3K23 (except condensation, water and formation of ice)
- Long-term storage (IEC 60721-3-1): 1K21

**Mechanical conditions acc. to IEC 60721:**

- Stationary use (IEC 60721-3-3): 3M11
- Long-term storage (IEC 60721-3-1): 1M12

**Environment**

- Connection cable: RJ45
- Maximum cable length: < 3 m

**Connection type (terminal block C)**

- push-in terminal
- Connection properties: rigid/flexible
- Flexible with ferrule without plastic sleeve: 0.2…1.5 mm² (AWG 24…16)
- Flexible with ferrule with plastic sleeve: 0.25…0.75 mm² (AWG 24…20)
- Stripping length: 10 mm
- Opening force: 0.5…0.6 Nm (4…5 lb-in)

**Connection type (terminal blocks A and B)**

- screw terminal
- Connection properties: rigid/flexible
- Flexible with ferrule without plastic sleeve: 0.2…1.5 mm² (AWG 24…12)
- Flexible with ferrule with plastic sleeve: 0.25…1.5 mm² (AWG 24…16)
- Stripping length: 7 mm

**Other**

- Operating mode: continuous operation
- Degree of protection: IP20
- DIN rail mounting: IEC 60715
- Weight: 160 g

---

**Accessories**

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFID114 with RJ45 cable (length 500 mm)</td>
<td>B94060114</td>
<td>277</td>
</tr>
<tr>
<td>RFID117-L1 with RJ45 cable (length 500 mm)</td>
<td>B94060117</td>
<td>278</td>
</tr>
<tr>
<td>Current transformer CTBC17 (PCB variant)①</td>
<td>B9808007…</td>
<td>270</td>
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<tr>
<td>Connection cable CTBC17-Cable… incl. clip housing</td>
<td>B980805…</td>
<td>270</td>
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<tr>
<td>DPMx216FP (display module)</td>
<td>B94060120</td>
<td>276</td>
</tr>
</tbody>
</table>

① Internal diameter: 17 mm

---

*) Surge test is carried out at Phoenix power supply STEP-PS/1AC/12DC/1.5. The 12V cable length is less than 1 meter.
**Dimension diagram (dimensions in mm)**

![Dimension diagram](image)

**Wiring diagram**

![Wiring diagram](image)

### Assignment of the terminals

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>A1</td>
<td>IN</td>
<td>C1</td>
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<td>C2</td>
<td>CP</td>
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<td>A3</td>
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<td>A4</td>
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<td>C4</td>
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<td>B1</td>
<td>12V</td>
<td>C5</td>
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<td>B2</td>
<td>0V</td>
<td>C6</td>
<td>IN1+</td>
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<td>B3</td>
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</tr>
<tr>
<td>B4</td>
<td>14</td>
<td>C8</td>
<td>IN2+</td>
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</tbody>
</table>

**Symbols**

- **A** Connection locking engine
- **B** Connection socket User Interface
- **C** Connection socket
- **D** Connection Current Transformer (CT)
- **E** Terminal User Interface (RJ45)
- **F** Terminal Modbus/eHZ meter (RJ10)
- **G** RCD Type A
- **H** Voltage supply DC 12 V
- **I** Current Transformer (CT) with plug
- **J** Contactor
- **K** Type 2 socket
- **L** Type 2 plug
- **M** Connection Proximity Pilot
- **N** Connection Control Pilot
- **O** Relay 1: Control pin intermediate relay
- **P** Output relay 2
- **Q** Intermediate relay
- **R** Optocoupler input 1
- **S** Optocoupler input 2

**1 Mennekes Typ-2-socket**
Charge controller CC613

Device features

- Charge controller in accordance with IEC 61851-1 (mode 3 charging)
- Master and slave operation configurable
  - Setting up charging stations with two charging points: 1 charge controller as data gateway with 4G modem and 1 charge controller as slave without 4G modem
- Dynamic load management to optimally distribute the available power among all charging points and signal the maximum power to the vehicle
- Residual direct current monitoring module (external RCD type A required), different cable lengths can be selected
  - Integrated emergency opener for actuator control (locking/unlocking) and monitoring of the 12 V supply voltage
- Can be integrated in single- or three-phase systems up to 80 A
- OCPP 1.5 and OCPP 1.6 compliant with JSON, SOAP
- Supported mobile networks: 4G (LTE), 3G (UMTS) and 2G (GSM) with an integrated 4G modem
  - 3 USB interfaces:
    - 1 CONFIG interface for local configuration and installation of software updates
    - 2 USB host interfaces
  - Control Pilot and Proximity Pilot communication (acc. to IEC 61851-1)
  - Configurable support for additional domestic socket-outlets
  - Meter interface: Modbus TCP and RTU
  - External Modbus interface for remote control via energy management systems
  - User interface modules for customer-specific applications (e.g. RFID, LED, antenna)
  - Configurable 2-channel input/output extension interface for additional functionality
  - Internal temperature sensors to reduce the charging current with regard of the ambient temperature
- ISO 15118 Powerline Communication (PLC) for plug & charge and load management systems

Standards

The charge controller has been developed in compliance with the following standards:
- EN 50581
- EN 61851-1
- EN 301 489-1: V2.2.0 Draft
- EN 301 511 V12.5.1
- EN 301 908-13 V11.1.2
- EN 15118-2
- IEC 62955
- EN 62311
- EN 61851-21-2
- EN 301 489-52 V1.1.0 Draft
- EN 301 908-1 V13.1.1
- EN 301 908-2 V11.1.2
- EN 15118-3
- IEC 62955
- EN 62311
- EN 61851-21-2
- EN 301 489-52 V1.1.0 Draft
- EN 301 908-1 V13.1.1
- EN 301 908-2 V11.1.2
- EN 15118-3

Further information

For further information refer to our product range on www.bender.de.

Ordering information

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<th>RDC-M</th>
<th>LED</th>
<th>PLC</th>
<th>User interface</th>
<th>Modem</th>
<th>External Modbus</th>
<th>Type</th>
<th>Art. No.</th>
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<td>CC613-ELPR-M</td>
<td>B94060021</td>
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</table>

1 Powerline Communication acc. ISO/IEC 15118

The charge controller with residual direct current monitoring module (RDC-M) only works in combination with the measuring current transformer (to be ordered separately).

Different cable lengths are available.
**Technical data**

### Insulation coordination acc. to IEC 60664-1/IEC 60664-3

- **Rated voltage**: 250 V
- **Overvoltage category**
  - III (within terminal H)
  - III (terminal H and all other terminals)
- **Rated impulse voltage**
  - 2.5 kV (within terminal H)
  - 6 kV (terminal H and all other terminals)
- **Double insulation acc. to OVC III between terminal H and all other terminals**
- **Basic insulation acc. to OVC II within terminal H**
- **Operating altitude**: ≤ 2000 m AMSL

### Supply voltage (terminal B (0V, +12V))

- **Nominal voltage**: DC 12 V
- **Operating range of the nominal voltage**: DC 11.4…12.6 V
- **Max. nominal current**: 750 mA
- **Max. nominal current without USB load**: 400 mA
- **Max. nominal current with max. USB load**: 750 mA

### Residual direct current monitoring module (RDC-M, terminal A)

- **Measuring range**: 100 mA
- **Response values**:
  - Residual current $I_R$: DC 6 mA
  - Response tolerance $I_{\Delta n}$: -50…0 %
- **Restart sequence value**:
  - DC 6 mA: < 3 mA

### SMA connector for 4G antenna (optionally with 4G modem, terminal E)

- **Frequency bands**: 800 MHz/850 MHz/900 MHz/1800 MHz/2100 MHz/2600 MHz
- **Impedance**: 50 Ω
- **Data rate**
  - GPRS: UL 8.56 kBit/s, DL 107 kBit/s
  - EDGE: UL 23.6 kBit/s, DL 296 kBit/s
  - UMTS:
  - WCDMA: UL 384 kBit/s, DL 384 kBit/s
  - DC-HSDPA: UL 42 kBit/s, DL 42 kBit/s
  - HSUPA: UL 5.76 kBit/s, DL 5.76 kBit/s
  - LTE:
  - LTE FDD: UL 513.6 kBit/s, DL 513.6 kBit/s
  - LTE TDD: UL 2.8 kBit/s, DL 2.8 kBit/s
- **Specified antenna**: PSI-GSM/UMTS-QB-ANT
- **LED indications**
  - **STATUS (front panel)**
    - Power on/system not ready for operation orange: power on/system not ready for operation
    - System starting green: system started, not ready for operation yet
    - System running flashing green: system running, system ready for operation
    - System error red: system error
  - **Ethernet (terminal D)**
    - No Ethernet connection steady green: Ethernet connection at 100 MHz/s
    - Data exchange at 100 MHz/s steady yellow: Ethernet connection at 10 MHz/s
    - Data exchange at 10 MHz/s

---

**Data interface**

- **USB host 1 (terminal C1)**
  - USB port type A; USB 2.0 max. 250 mA
- **USB host 2 (terminal C2)**
  - USB port type A; USB 2.0 max. 250 mA
- **Ethernet (terminal D)**
  - 10/100 Mbit
- **Modbus meter (terminal B)**
  - 9.6 kBit
- **Modbus external (terminal I)**
  - 9.6 kBit
- **Control Pilot (terminal B (CP))**
  - acc. to IEC 61851
- **Proximity Pilot (terminal B (PP))**
  - acc. to IEC 61851

### Inputs

- **Optocoupler (terminal J (Opto 1 In+, Opto 1 In-))**
  - **Input voltage**: DC 11.4…25.2 V
  - **Input current**: 2.3…6.4 mA

### Weld check (terminal WB, WA)

- **Input voltage**: AC 180…277 V
- **Input current**: 0.6…1.3 mA

### Input PE (terminal B (PE, PE))

### Outputs

- **Contact data acc. to IEC 60947-5-1**: 1)
  - **Relay (12 V) (terminal J (Relais 13, Relais 14))**
    - Rated operational voltage $U_e$: DC 24 V
    - Rated operational current $I_e$: DC 1 A
    - Minimum contact rating: 1 mA at ≥ 10 V
- **Switching contact for contactor (terminal (Relais 23, Relais 24))**
  - Rated operational voltage $U_e$: AC 230 V
  - Rated operational current $I_e$: AC 4 A
  - Minimum contact rating: 50 mA at ≥ 10 V (AC)

### Environment/EMC

- **EMC**: see CE declaration
- **Operating temperature**: -30…+70 °C

### Classification of climatic conditions acc. to IEC 60721:

- **Stationary use (IEC 60721-3-3)**
  - 3K23 (except condensation and formation of ice)
- **Transport (IEC 60721-3-2)**
  - 2K11
- **Long-term storage (IEC 60721-3-1)**
  - 1K21

### 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
## Technical data (continued)

### Cable lengths/cable types

<table>
<thead>
<tr>
<th>HMI (terminal K)</th>
<th>Connection cable</th>
<th>RJ45, shielded</th>
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<tbody>
<tr>
<td>Max. connection cable length</td>
<td>internal 2 m</td>
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<tr>
<th>Ethernet (terminal D)</th>
<th>Connection cable</th>
<th>CAT 6</th>
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<td>Max. connection cable length</td>
<td>100 m</td>
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</table>

### Connection type (terminal blocks B and J)

**push-wire terminal**

Connection specifications:
- rigid / flexible: 0.2...1.5 mm² (AWG 24...16)
- flexible with ferrule without plastic sleeve: 0.25...1.5 mm² (AWG 24...16)
- flexible with ferrule with plastic sleeve: 0.14...0.75 mm² (AWG 26...18)

Stripping length: 10 mm

| Max. connection cable length | 2 m |
| Cross-section | ≥ 0.5 mm² |
| Max. connection cable length (PE) | 4 m |
| Cross-section (PE) | ≥ 1 mm² |

### Connection type (terminal block I)

**push-wire terminal**

Connection specifications:
- rigid / flexible: 0.2...1.5 mm² (AWG 24...16)
- flexible with ferrule without plastic sleeve: 0.25...1.5 mm² (AWG 24...16)
- flexible with ferrule with plastic sleeve: 0.25...0.75 mm² (AWG 24...18)

Stripping length: 10 mm

| Max. connection cable length | 250 m |

### Connection type (terminal block H)

**push-wire terminal**

Connection specifications:
- rigid / flexible: 0.2...1.5 mm² (AWG 24...16)
- flexible with ferrule without plastic sleeve: 0.25...1.5 mm² (AWG 24...16)
- flexible with ferrule with plastic sleeve: 0.25...0.75 mm² (AWG 24...18)

Stripping length: 10 mm

| Max. connection cable length | 2 m |
| Cross-section | ≥ 0.75 mm² |

### Other

**Operating mode**
- continuous operation

**Mounting position**
- front panel orientated, air must pass through cooling slots vertically

**Degree of protection**
- IP20

**DIN rail**
- IEC 60715

**Documentation number**
- D00381

**Weight**
- max. 500 g (depends on variant)

### Dimension diagram (dimensions in mm)

![Dimension diagram](#)

*Dimensions with antenna socket*
**5**

**Charge controller CC613**

The external Modbus (terminal i) is only used for remote control of the CC613 via an energy management system and is not intended for connecting a meter.
Charge controller CC613-Hxx

Home variants

Device features

- Charge controller in accordance with IEC 61851-1 (mode 3 charging)
- Residual direct current monitoring module (external RCD type A required), different cable lengths can be selected
- Integrated emergency opener for actuator control (locking/unlocking) and monitoring of the 12 V supply voltage
- Can be integrated in single- or three-phase systems up to 80 A
- 3 USB interfaces:
  - 1 CONFIG interface for local configuration and installation of software updates
  - 2 USB host interfaces
- Control Pilot and Proximity Pilot communication (acc. to IEC 61851-1)
- Internal temperature sensor to reduce the charging current depending on the ambient temperature
- ISO 15118 Powerline Communication (PLC) for plug & charge or autocharge
- Ethernet interface

Typical applications

- Charging points and wallboxes for private AC charging of electric vehicles

Approvals

Further information

For further information refer to our product range on www.bender.de.

Ordering information

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<thead>
<tr>
<th>LED</th>
<th>RDC-M</th>
<th>PLC&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Meter interface</th>
<th>Ethernet interface</th>
<th>USB host interface</th>
<th>Type</th>
<th>Art. No.</th>
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</table>

<sup>1</sup> Powerline Communication acc. to ISO/IEC 15118

The charge controller with residual direct current monitoring module (RDC-M) only works in combination with the measuring current transformer (to be ordered separately). Different cable lengths are available.

Accessory

<table>
<thead>
<tr>
<th>Description</th>
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<th>Page</th>
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<td>Current transformer CTBC17 (PCB variant)&lt;sup&gt;1&lt;/sup&gt;</td>
<td>B9808007…</td>
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<tr>
<td>Connection cable CTBC17-Cable… incl. clip housing</td>
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<sup>1</sup> Internal diameter: 17 mm

<table>
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<tr>
<th>Plug kit</th>
<th>Content / Quantity</th>
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</thead>
<tbody>
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<tr>
<td>Plug kit bulk pack, HB</td>
<td>4-pole (50 x), 8-pole (50 x)</td>
<td>B94060127</td>
</tr>
<tr>
<td>Plug kit bulk pack, HEM-X2</td>
<td>4-pole (50 x), 8-pole (100 x)</td>
<td>B94060126</td>
</tr>
</tbody>
</table>
**Technical data**

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**

Rated voltage 250 V

Overvoltage category II (within terminal H)

Overvoltage category III (terminal H and all other terminals)

Rated impulse voltage 6 kV (terminal H and all other terminals)

Rated impulse voltage 2.5 kV (within terminal H)

Double insulation acc. to OVC III between terminal H and all other terminals

Basic insulation acc. to OVC II within terminal H

Operating altitude ≤ 2000 m AMSL

**Supply voltage (terminal B (0V, +12V))**

Nominal voltage DC 12 V

Operating range of the nominal voltage DC 11.4 V…12.6 V

Max. nominal current 750 mA

Max. nominal current without USB load 400 mA

Max. nominal current with max. USB load 750 mA

Residual direct current monitoring module (RDC-M, terminal A)

Measuring range 100 mA

Response values:

- Residual current $I_{\Delta n}$: DC 6 mA
- Response tolerance $I_{\Delta n}$: -50…0 %

Restart sequence value:

- DC 6 mA < 3 mA

**LED indications**

- STATUS (front panel)
  - orange: power on/system not ready for operation
  - blue: system is starting
  - green: system running, system ready for operation
  - flashing green: system running, system ready for operation
- Ethernet (terminal D)
  - off: no Ethernet connection
  - steady green: Ethernet connection at 100 Mbit/s
  - flashing green: data exchange at 10 Mbit/s
  - steady yellow: Ethernet connection at 10 Mbit/s
  - flashing yellow: data exchange at 10 Mbit/s

**Data interface**

- USB host 1 (terminal C1) USB port type A; USB 2.0 max. 250 mA
- USB host 2 (terminal C2) USB port type A; USB 2.0 max. 250 mA
- Ethernet (terminal D) 10/100 Mbit/s
- CONFIG (configuration interface, terminal F) micro USB port type AB
- Modbus meter (terminal B) 9.6 kBit
- Control Pilot (terminal B (CP)) acc. to IEC 61851
- Proximity Pilot (terminal B (PP)) acc. to IEC 61851

**Inputs**

- Weld check (terminal H (WB, WA))
  - Input voltage AC 180 V…277 V
  - Input current 0.6…1.3 mA

- Input PE (terminal B (PE, PE))
  - Max. 500 g (depends on variant)

**Outputs**

- Contact data acc. to IEC 60947-5-1:
  - Switching contact for contactor (terminal H (relay 23, relay 24))
    - Rated operational voltage $U_o$ AC 230 V
    - Rated operational current $I_o$ AC 4 A
    - Minimum contact rating 50 mA at ≥ 10 V (AC)

**Environment/EMC**

- Operating temperature -30…+70 °C

**Classification of climatic conditions acc. to IEC 60721:**

- Stationary use (IEC 60721-3-3) 3K23 (except condensation and formation of ice)
- Transport (IEC 60721-3-2) 2K11
- Long-term storage (IEC 60721-3-1) 1K21

**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

**Cable lengths/cable types**

- Ethernet (terminal D)
  - Connection cable CAT 6
  - Max. connection cable length 100 m
  - Connection type (terminal blocks B and J) push-wire terminal
  - Connection specifications:
    - rigid /flexible
    - 0.2…1.5 mm² (AWG 24…16)
    - flexible with ferrule without plastic sleeve
    - 0.25…1.5 mm² (AWG 24…16)
    - flexible with ferrule with plastic sleeve
    - 0.14…0.75 mm² (AWG 26…18)
  - Stripping length
  - 10 mm
  - Max. connection cable length (PE) 4 m
  - Cross-section
  - ≥ 1 mm²

- Connection type (terminal H) push-wire terminal
  - Connection specifications:
    - rigid /flexible
    - 0.2…1.5 mm² (AWG 24…16)
    - flexible with ferrule without plastic sleeve
    - 0.25…1.5 mm² (AWG 24…16)
    - flexible with ferrule with plastic sleeve
    - 0.25…0.75 mm² (AWG 24…18)
  - Stripping length
  - 10 mm
  - Max. connection cable length (PE) 4 m
  - Cross-section
  - ≥ 0.75 mm²

**Other**

- Operating mode continuous operation
- Mounting position front panel orientated, air must pass through cooling slots vertically
- Degree of protection IP20
- DIN rail IEC 60715
- Documentation number D00423
- Weight max. 500 g (depends on variant)

**Dimension diagram** (dimensions in mm)

* Dimensions incl. antenna socket (depending on the variant)
A) Connection measuring current transformer (CT)
B) 12 V supply, PE, Modbus meter, CP, PP
C) 2x USB type A (1, 2)
D) Connection Ethernet (ETH1)
E) Configuration interface
F) Weld check, relay for contactor control rated for 230 V/4 A
G) Locking
H) STATUS LED
I) Voltage supply DC 12 V
J) Measuring current transformer (CT) with plug
K) Contactor
L) Type 2 socket-outlet

Terminal assignment

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<tr>
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<th>J</th>
</tr>
</thead>
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<tr>
<td>0 V</td>
<td>Input 0V</td>
<td></td>
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<tr>
<td>+12 V</td>
<td>Supply voltage +12 V</td>
<td></td>
</tr>
<tr>
<td>PE</td>
<td>Input PE</td>
<td></td>
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<tr>
<td>PE</td>
<td>Input PE</td>
<td></td>
</tr>
<tr>
<td>B Mod.</td>
<td>Modbus meter B</td>
<td></td>
</tr>
<tr>
<td>A Mod.</td>
<td>Modbus meter A</td>
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<tr>
<td>CP</td>
<td>Control Pilot</td>
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<tr>
<td>PP</td>
<td>Proximity Pilot</td>
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| H       | WA         |            |
|         | 23         |            |
|         | Weld check input L1 |     |
|         | Relais 23: Switching contact contactor |   |
|         | WB         |            |
|         | Weld check input N |   |
|         | 24         |            |
|         | Relais 24: Switching contact contactor |   |
CTBC17 series
AC/DC sensitive measuring current transformers

Device features

- Suitable for AC/DC sensitive residual current measurement according to IEC 62752 and IEC 60755
- Suitable for DC fault current monitoring to protect type A RCDs in conjunction with the listed evaluators
- Shield to prevent interferences caused by high load currents and external magnetic fields
- PCB mounting
- Connection cable for direct mounting available
- Can be used in applications according to
  - IEC 62020,
  - IEC 62752,
  - IEC 61851-1,
  - IEC 62995,
  - UL2231.

Typical applications

- Electric vehicle charging stations, wallboxes or street light charging points

Approvals

CE/UKCA conformity for cable variant only

Further information

For further information refer to our product range on www.bender.de.

Ordering information

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<tr>
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<td>CTBC17P-03</td>
<td>B98080070</td>
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<tr>
<td>Cable variant (length 325 mm)</td>
<td>CTBC17P-03-K0325</td>
<td>B98080071</td>
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<thead>
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<th>Cable incl. dip enclosure</th>
<th>Art. No.</th>
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<td>CTBC17-Kabel1470</td>
<td>B98080542</td>
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<td>CTBC17-Kabel325</td>
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<td>180 ±25</td>
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<th>PCB</th>
<th>Type</th>
<th>Art. No.</th>
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<td>CC613</td>
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<td>B94042483</td>
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<td>RCMB4xx</td>
<td>B740424...</td>
<td>195</td>
</tr>
</tbody>
</table>

1) Molex adapter connector required by customer
Insulation coordination according to IEC 60664-1

Definitions
- CT cable feed-through opening on primary side (IC1)
- Measuring circuit; CT on secondary side (IC2)
- Connection cable measuring circuit (IC3)

Operating altitude
- Basic insulation ≤ 4000 m AMSL
- Double insulation ≤ 2000 m AMSL

Rated voltage 600 V

Overvoltage category
- III

Rated impulse voltage
- IC1/IC2 8 kV
- IC3 4 kV

Rated insulation voltage
- IC1/IC2 600 V
- IC3 300 V

Pollution degree
- 2

Safe separation (double insulation) between
- IC1/IC2 OVC III/600 V

Insulation coordination according to IEC 62955
- IC1/IC2 8 mm/400 V

Measuring current transformer circuit
- Diameter cable feed-through opening 17 mm
- Rated load current 80 A
- Rated primary residual current 1000 mA
- Rated DC residual operating current IΔdc acc. to 62955 6 mA
- Rated continuous thermal current Icth 80 A
- Rated short-time thermal current ith 2400 A
- Rated dynamic current Idyn 6000 A

Environment
- Operating temperature with cable -30...+80 °C
- Operating temperature sensor -35...+85 °C
- Temperature in the cable feed-through opening max. 100 °C

Environment (UL applications)
- Operating temperature with cable -30...+75 °C
- Operating temperature sensor -35...+85 °C
- Temperature in the cable feed-through opening max. 100 °C

Classification of climatic conditions acc. to IEC 60721
- Stationary use (IEC 60721-3-3) 3K23 (except condensation and formation of ice)
- 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) 3M12
- Transport (IEC 60721-3-2) 2M4
- Long-term storage (IEC 60721-3-1) 1M12

Technical data

Dimensions diagram (dimensions in mm)

Cable variant

PCB mounting
- Fastening CTBC17P-03 solderable retaining pins
- Pin length from top edge of PCB 3.6 ±0.3 mm
- Connection windings solderable contact pins
- Pin length from top edge of PCB min. 3 mm
- Enclosure retaining pin pull-out forces 50N/PIN
- Soldering profile 260 °C for 10 s
- Recommended PCB thickness 1.6...2.4 mm

Connection
- Tightening torque mounting screw 0.5 Nm
- Drilling diameter 3 mm
- Connection cable with plug connector 6 poles
- Cable length see ordering information
- Suitable PCB connector Molex Micro Fit 3.0 Header Art No. 43045-0607
- Connection cable UL Style 2464
- External diameter of the cable (Da) typ. 5.4 mm

Bending radius of the connection cable
- Once 8 x Da
- Several times 15 x Da

Other
- Degree of protection (DIN EN 60529) IP40
- Degree of protection, connection (DIN EN 60529) IP30
- Fastening connection variant cable ties
- Enclosure sensor black
- Flammability class according to UL94V-0 UL94V-0
- Documentation number D00421

Weight
- CTBC17 cable1470 < 75 g
- CTBC17 cable325 < 30 g
- CTBC17 cable180 < 25 g
- CTBC17P-03 < 40 g
**Charge controller**
Measuring current transformers CTBC17 series

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**Dimension diagram** (dimensions in mm)

**PCB variant**

---

**Wiring diagram – PCB variant**

CTBC17 with RCMB104 evaluato
CTBC17 with CC613 charge controller

Wiring diagram – Cable variant
W15BS series
Measuring current transformer for AC/DC sensitive Type B residual current measurement acc. to IEC 60755

Device features
- Suitable for AC/DC sensitive residual current measurement according to IEC 62752 and IEC 60755
- Suitable for DC fault current monitoring to protect type A RCDs in conjunction with the listed evaluators
- Shield to prevent interferences caused by high load currents and external magnetic fields
- Integrated connecting cable
- Pluggable connector
- Can be used in applications according to IEC 62020,
- IEC 62752,
- IEC 61851-1,
- IEC 62995,
- UL2231.

Standards
W15BS series measuring current transformers comply with the device standard:
- IEC 60664-1

Typical applications
- Power supply systems up to a rated voltage of 600 V and a rated current of 48 A.

Approvals

Further information
For further information refer to our product range on www.bender.de.

<table>
<thead>
<tr>
<th>Connector length (mm)</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
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<tbody>
<tr>
<td>1470 ±30</td>
<td>W15BS</td>
<td>B98080065</td>
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<tr>
<td>325 ±25</td>
<td>W15BS-02</td>
<td>B98080067</td>
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<tr>
<td>180 ±25</td>
<td>W15BS-03</td>
<td>B98080068</td>
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</table>

<table>
<thead>
<tr>
<th>Suitable system components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
</tr>
<tr>
<td>Charge controller</td>
</tr>
<tr>
<td>Residual current monitoring modules</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

1) Molex adapter connector required by customer
Technical data

Insulation coordination acc. to IEC 60664-1

Definitions:
- Insulated primary conductor for rated voltage (IC1)
- CT cable feed-through opening on primary side (IC2)
- Measuring circuit; CT on secondary side (IC3)
- Connecting cable measuring circuit (IC4)

- Operating altitude: (≤ 5000 m) ≤ 2000 m
- Rated voltage: (300 V) 600 V
- Overvoltage category: III

- Rated impulse voltage:
  - IC1/IC2: (4 kV) 6 kV
  - IC1/IC3: (6 kV) 8 kV
  - IC2/IC3: (4 kV) 6 kV
  - IC4: 4 kV

- Rated insulation voltage:
  - IC1/IC2: (300 V) 600 V
  - IC2/IC3: (300 V) 600 V
  - IC4: 300 V

- Pollution degree outside: 3

- Safe separation (double insulation) between
  - IC1/IC3 (OVC III/300 V) OVC III/600 V

- Measuring current transformer circuit
  - Diameter cable feed-through opening: 15 mm
  - Rated load current: 48 A
  - Rated primary residual current: 1000 mA
  - Rated continuous thermal current $I_{\text{ct}}$: 48 A
  - Rated short-time thermal current $I_{\text{th}}$: 2400 A
  - Rated dynamic current $I_{\text{dyn}}$: 6000 A

Environment
- Operating temperature: -30...+80 °C
- Temperature in the cable feed-through opening: max. 100 °C

Classification of climatic conditions acc. to IEC 60721
- Stationary use (IEC 60721-3-3): 3K23 (except condensation and formation of ice)
- 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): 3M4
- Transport (IEC 60721-3-2): 2M3
- Long-term storage (IEC 60721-3-1): 1M3

Connection
- Connecting cable with plug-in connector: 6 poles
- Suitable PCB connector: Molex Micro Fit 3.0 Header (Art No. 43045-0607)
- Suitable cable: UL Style 2464
- External diameter of the cable (Da): typ. 5.4 mm

Bending radius
- Once: 8 x Da
- Several times: 15 x Da

Other
- Degree of protection (DIN EN 60529): IP54
- Degree of protection, connection (DIN EN 60529): IP20
- Fastening: cable ties
- Flammability class: UL94V-0
- Documentation number: D00371

Dimension diagram (dimensions in mm)

Wiring diagram

Charge controller
Measuring current transformers W15BS series
DPM2x16FP Display Module
To visualize the status of the charge controller or charging station/wallbox

Device features
- LED display with 2 x 16 characters
- Two RJ45 interface sockets

Standards
The display module has been developed in compliance with:
- EN 61851-1
- EN 61851-22
- EN 61439-1
- DIN IEC/TS 61439-7

Typical applications
- For use in electric vehicle (EV) charging stations, wall boxes and street light charging points

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPM2x16FP</td>
<td>B94060120</td>
</tr>
</tbody>
</table>

Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3
- Rated voltage: 12.5 V
- Overvoltage category: III
- Pollution degree: 2
- Rated impulse withstand voltage: 800 V
- Rated insulation voltage: 12.5 V
- Altitude: ≤ 2000 m above sea level

Nominal voltage/nominal current
- Nominal voltage: DC 3.3/5 V
- Nominal voltage tolerance: ± 5 %
- Nominal current: < 100 mA

Environment/EMC
- EMC: EN 61851-22
- Operating temperature: -25...+75 °C

Classification of climatic conditions acc. to IEC 60721:
- Stationary use (IEC 60721-3-3) 3K23 (except condensation and formation of ice)
- 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 to charge controller via RJ45 cable
- Connection to RFID module via RJ45 cable
- Cable length: < 1 m

Other
- Brightness of display background illumination: to 0...100 %
- Bus: I2C
- Protection class: IP00
- Documentation number: D00296
- Weight: 150 g
RFID114
RFID module without integrated status LEDs for use in combination with charge controllers used in electric vehicle charging stations, wall boxes or street light charging points

Typical applications
• For use in combination with charge controllers used in electric vehicle charging stations, wall boxes and street light charging points

Standards
The RFID module has been developed in compliance with:
• ISO 14443A/MIFARE
• EN 50364
• EN 60950-1
• EN 61851-1
• EN 61851-22
• ETSI EN 301 489-1 V2.1.1
• ETSI EN 301 489-3 V2.1.1
• EN 300 330 V2.1.1

Further information
For further information refer to our product range on www.bender.de.

Ordering information
<table>
<thead>
<tr>
<th>Type</th>
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<tbody>
<tr>
<td>RFID114 (RJ45 cable (length 500 mm) included)</td>
<td>B94060114</td>
</tr>
</tbody>
</table>

Dimension diagram (dimensions in mm)

Technical data

- Insulation coordination acc. to IEC 60664-1/IEC 60664-3
  - Rated voltage: 12.5 V
  - Overvoltage category: III
  - Pollution degree: 3
  - Rated impulse withstand voltage: 800 V
  - Rated insulation voltage: 12.5 V
  - Altitude: ≤ 2000 m AMSL

- Nominal voltage/nominal current
  - Nominal voltage: DC 3.3 V
  - Nominal voltage tolerance: ±5 %
  - Nominal current: 80 mA

- Frequency
  - Radio frequency: 13.56 MHz

- Environment
  - Operating temperature: -30...+70 °C

- Climatic conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3K23 (except condensation, water and formation of ice)
  - Transport (IEC 60721-3-2): 2K11
  - Long-term storage (IEC 60721-3-1): 1K21

- 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 to charge controller: via RJ45 cable
  - Maximum cable length: 3 m

- Other
  - Degree of protection: IP00
  - Maximum reading distance: 100 mm
  - Documentation number: D00128
  - Weight: 25 g
RFID117-L1

RFID module with integrated status LEDs and reinforced antenna power, for use in combination with charge controllers used in electric vehicle charging stations, wall boxes and street light charging points

Typical applications
- For use in combination with charge controllers used in electric vehicle charging stations, wall boxes and street light charging points
- For e.g. Giro-e applications

Standards
The RFID has been developed in compliance with:
- ISO 14443A/MIFARE
- EN 50364
- EN 60950-1
- EN 61851-1
- EN 61851-22
- EN 50581
- ETSI EN 301 489-1 V2.1.1
- ETSI EN 301 489-3 V2.1.1
- EN 300 330 V2.1.1

Further information
For further information refer to our product range on www.bender.de.

Ordering information

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</table>

Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3
- Rated voltage: 12.5 V
- Overvoltage category: III
- Pollution degree: 2
- Rated impulse withstand voltage: 800 V
- Rated insulation voltage: 12.5 V
- Altitude: ≤ 2,000 m AMSL

Rated voltage/rated current
- Rated voltage: DC 3.3/5 V
- Rated voltage tolerance: ± 5 %
- Rated current: 140/64 mA

Frequency
- Radio frequency: 13.56 MHz

Environment/EMC
- Operating temperature: -30…+70 °C
- Climatic conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3K23 (except condensation, water and formation of ice)
  - Transport (IEC 60721-3-2): 2K11
  - Long-term storage (IEC 60721-3-1): 1K21
- 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 to charge controller: via RJ45 cable
- Maximum cable length: < 3 m

Other
- Protection class: IP00
- Maximum read distance: 100 mm
- Documentation number: D00422
- Weight: 25 g
Insulation monitoring devices
ISOMETER®

Equipment for insulation fault location
ISOSCAN®

Residual current monitoring systems
LINETRAXX®

Neutral Grounding Resistor Monitor (NGR)
LINETRAXX®

Charge Controller

Power Quality and Energy Measurement
LINETRAXX®

Measuring and monitoring relays
LINETRAXX®

Annex
Technical terms
Alphabetical list of devices
Service
# Device overview

**Universal Devices for Power Quality and Energy Measurement PEM**

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<th>LINETRAXX® PEM575</th>
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<td>Displacement factor cos (φ)/ power factor λ</td>
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<td>up to the 63rd</td>
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<td>Harmonic components voltage</td>
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<td>up to the 63rd</td>
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<td>Undervoltage (sag)</td>
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<td>Flicker severity Pₜ</td>
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<td>Data recorder / High Speed data recorder</td>
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<td>16/4</td>
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<td>Waveform recorder</td>
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<td>Digital outputs</td>
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<tr>
<td>Relay outputs (RO)</td>
<td>2 (PEM353, PEM353-N only)</td>
<td>3</td>
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<tr>
<td><strong>Technical aspects</strong></td>
<td></td>
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<tr>
<td>Voltage supply</td>
<td>AC/DC 95...250 V (47...440 Hz)</td>
<td></td>
</tr>
<tr>
<td>Sampling rate</td>
<td>3,2 kHz</td>
<td>12,8 kHz</td>
</tr>
<tr>
<td>Temperature</td>
<td>-25...+55 °C</td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td>Modbus RTU</td>
<td>Modbus RTU &amp; TCP</td>
</tr>
</tbody>
</table>

**Product details**

(Product on www.bender.de/en)
### Energy meter and Measuring current transformer for universal measuring devices

<table>
<thead>
<tr>
<th>Type</th>
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<th>Catalogue page</th>
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<td>1PH./32A MID MODBUS RTU</td>
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<tr>
<td>Energy meter</td>
<td>3PH./65A MID MODBUS RTU</td>
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<tr>
<td>Energy meter</td>
<td>3PH./6A MID MODBUS RTU</td>
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<td>(four-fold) with MODBUS RTU</td>
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<td>Measuring current transformer</td>
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<td>291</td>
</tr>
<tr>
<td>Measuring current transformer</td>
<td>--</td>
<td>291</td>
</tr>
</tbody>
</table>

**Product details**

(Products on [www.bender.de/en](http://www.bender.de/en))
### Device features

- **Accuracy class according to IEC 62053-22:** 0.5 S
- **Measured quantities**
  - Phase voltages \(U_{L1}, U_{L2}, U_{L3}\) in V
  - Line voltages \(U_{L1L2}, U_{L2L3}, U_{L3L1}\) in V
  - Phase currents \(I_1, I_2, I_3\) in A
  - Neutral current (calculated) \(I_4\) in A
  - Frequency \(f\) in Hz
  - Phase angle for \(U\) and \(I\) in \(^\circ\)
  - Power per phase conductor \(S\) in kVA, \(P\) in kW, \(Q\) in kvar
  - Power factor \(\lambda\)
  - Active and reactive energy import in kWh, kvarh
  - Active and reactive energy export in kWh, kvarh
  - Voltage unbalance in %
  - Current unbalance in %
  - Harmonic distortion (THD) for \(U\) and \(I\)
  - k-factor for \(I\)
- **Limit value monitoring (setpoints) with alarm forwarding**
- **Energy and power measurement with log and tariff system**
- **Configurable start page with 4 measured quantities**
- **Measurement and monitoring of the N conductor**
- **Energy and power measurement, e.g. as part of energy data monitoring**

### Standards

PEM353 was designed in accordance with the following standards:

- **DIN EN 62053-22 (VDE 0418 Part 3-22)**
  Electricity metering equipment (a.c.) - Particular requirements - Part 22: Static meters for active energy (classes 0.2 S and 0.5 S) (IEC 62053);
- **DIN EN 61557-12 (VDE 0413-12)**
  Electrical safety in low voltage distribution systems up to 1000 V a.c. and 1500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 12: Performance measuring and monitoring devices (PMD)
- **DIN IEC 61554:2002-08**

### Further information

For further information refer to our product range on www.bender.de.

### Ordering information

<table>
<thead>
<tr>
<th>Property</th>
<th>PEM353</th>
<th>PEM353-P</th>
<th>PEM353-N</th>
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<tr>
<td>Ordering details</td>
<td>B93100355</td>
<td>B93100354</td>
<td>B93100353</td>
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<tr>
<td>Measurement technique</td>
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<tr>
<td>Accuracy class of the active energy (acc. to IEC 62053-22)</td>
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<tr>
<td>Current transformer 5 A: Class 0.5</td>
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<tr>
<td>Current transformer 1 A: Class 1.0</td>
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<tr>
<td>Volatage inputs (L1, L2, L3)</td>
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</tr>
<tr>
<td>45…65 Hz</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>TN and TT system (earthed): AC 230/400…400/690 V, CAT III 600 V</td>
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<td></td>
<td></td>
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<tr>
<td>IT system (unearthed): AC 400…480 V, CAT III 300 V / AC 500…690 V, CAT II 1000 V</td>
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<tr>
<td>Current inputs (I_1, I_2, I_3)</td>
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<tr>
<td>5 A / 1 A</td>
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<td>Harmonic / Distortion U/I</td>
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<tr>
<td>up to the 31(^{th})</td>
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<td>Event log [SOE log], Max./Min. log</td>
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<td>Peak demand log, Energy meter log (monthly values)</td>
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<td>Load data recorder</td>
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<tr>
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<tr>
<td>2 x pulse</td>
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<tr>
<td>95…250 V; DC, AC 47…440 Hz</td>
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<td>Communication interface</td>
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<td>RS-485 (Modbus RTU, BACnet MS/TP, DNP)</td>
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<td>Language</td>
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<tr>
<td>English</td>
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</tbody>
</table>
### Technical data

#### Insulation coordination acc. to IEC 60664-1/IEC 60664-3

- **Pollution degree:** 2
- **Climate category operation:** 3K24
- **Max. installation altitude above NN:** 2000 m

#### Definitions

- **Measuring circuit 1 (IC1)**
  - TN and TT system
  - Nominal voltage: 400/690 V
  - Overvoltage category/Rated insulation voltage: III/500 V
  - Nominal voltage: 480 V
  - Overvoltage category/Rated insulation voltage: III/300 V
  - Nominal voltage: 690 V
  - Overvoltage category/Rated insulation voltage: III/1000 V
- **Measuring circuit 2 (IC2)**
  - Overvoltage category/Rated insulation voltage: III/300 V
- **Supply circuit (IC3)**
  - Overvoltage category/Rated insulation voltage: III/300 V
- **Output circuit 1 (IC4)** at PEM353-N and PEM353
  - Overvoltage category/Rated insulation voltage: III/300 V
- **Output circuit 2 (IC5)** at PEM353-P
  - Overvoltage category/Rated insulation voltage: III/300 V
- **Output circuit 2 (IC5)** at PEM353-N and PEM353
  - Overvoltage category/Rated insulation voltage: III/300 V
- **Control circuit 1 (IC6)**
  - Overvoltage category/Rated insulation voltage: III/50 V
- **Control circuit 2 (IC7)**
  - Overvoltage category/Rated insulation voltage: III/50 V
- **Safe separation (reinforced insulation) between IC1/(IC2…7)**
  - Overvoltage category III, 600 V

#### Measuring range

- **Primary:** 1...1,000,000 V
- **Secondary:** 1...690 V
- **Max. transformation ratio:** 10,000

#### Measuring current transformer inputs

- **Measuring range:** 0.1...200 % of full-scale value
- **Load:** < 0.15 VA
- **Overload range:** 2 x of full-scale value permanently
- **Voltage test (routine test) acc. to IEC 61010-1:**
  - Phase voltage: ±0.2 % OMV, ±0.05 % OFS
  - Current: ±0.2 % OMV, ±0.05 % OFS
  - Neutral current: ±0.2 % OMV
  - Frequency: ±0.02 Hz
  - Phasing: ±1 °
  - Active power, reactive power: ±0.5 % OMV, ±0.05 % OFS
  - Power factor: ±0.5 %
  - Measurement of the active energy acc. to DIN EN 62053-22 (VDE 0418 part 3-22):
    - Accuracy class with 5 A measuring current transformers: 0.5 S
    - Accuracy class with 1 A measuring current transformers: 1 S
  - Measurement of the phase rms values:
    - Measurement of the phase rms values:
      - 1.5 S
    - Frequency measurement:
      - 1.7 S

#### Interface

- **Protocol:**
  - RS-485: Modbus RTU, BACnet MS/TP, DNP
  - Baud rate: 1.2...38.4 kbit/s
  - Interface: Protocol:
    - RS-485: Modbus RTU, BACnet MS/TP, DNP
    - Baud rate: 1.2...38.4 kbit/s
  - Cable length:
    - 0...1200 m
  - Recommended cable (shielded):
    - J-YST(Y) min. 2 x 0.8

#### Switching elements

- **Outputs:**
  - 2 N/O contacts
- **Operating principle:**
  - N/O operation
  - Relay contacts, N/O operation, AC 250 V or DC 30 V
  - 5 A
  - Minimum current: 1 mA at AC/DC ≥ 10 V
  - Pulse output:
    - max. DC 30 V, max. 30 mA
  - Cable length:
    - ≤ 30 m

#### Environment/EMC

- **Classification of climatic conditions acc. to IEC 60721 (stationary use):**
  - Classification of mechanical conditions acc. to IEC 60721 (stationary use)
  - Classification of climatic conditions acc. to IEC 60721 (stationary use)
  - Operating temperature:
    - 25...+65 °C
  - Classification of electromagnetic conditions:
    - EMC: IEC 61326-1
  - Degree of protection, installation:
    - IP20
  - Degree of protection, front (with rubber seal):
    - IP54
  - Degree of protection, installation:
    - IP20
  - Degree of protection, front (with rubber seal):
    - IP54
  - Document number:
    - D00335
  - Weight:
    - ≤ 350 g
1. Measuring voltage inputs:
The measuring leads should be protected with appropriate fuses.

   If being supplied from an IT system, both lines have to be protected by a fuse.

3. Measuring current inputs $I_1$ (only PEM353-N)

4. RS-485 bus connection

5. Digital inputs

6. Digital outputs (N/O contacts)

7. Measuring current inputs $I_1$–$I_3$
**Wiring diagrams direct connection (without voltage transformer)**

**Single-phase 2-wire system 1P2W L-N**
When using this wiring, the connection type (Setup > Basic > Wiring Mode) must be set to **1P2W L-N**.

**3P3W with 3 measuring current transformers**
When used in a 3-wire system, the connection type (Setup > Basic > Wiring Mode) must be set to **3P3W**.

**Single-phase 2-wire system 1P2W L-L**
When using this wiring, the connection type (Setup > Basic > Wiring Mode) must be set to **1P2W L-L**.

**3P3W with 2 measuring current transformers (Aron circuit)**

**Single-phase 3-wire system 1P3W with 2 measuring current transformers**
When used in a 3-wire system, the connection type (Setup > Basic > Wiring Mode) must be set to **1P3W**.

**3P4W with 3 (4) measuring current transformers**
When using this wiring, the connection type (Setup > Basic > Wiring Mode) must be set to **3P4W**.

---

**Y** Isolating terminal of the measuring current transformers

**i₄** Measurement i₄ for PEM353-N only
**Wiring diagrams with voltage transformers (medium and high voltage)**

**Three-phase 3-wire system 3P3W with 3 measuring current transformers**
When used in a 3-wire system, the connection type (Setup > Basic > Wiring Mode) must be set to 3P3W.

**Three-phase 4-wire system (example TN-S system) 3P4W with 3 voltage transformers**
When using this wiring, the connection type (Setup > Basic > Wiring Mode) must be set to 3P4W.

---

Y Isolating terminal of the measuring current transformers

PT The transformation ratio in the PEM353 can be set by specifying the primary and secondary transformation ratio. Odd ratios can also be configured.

Y Isolating terminal of the measuring current transformers

Is Measurement i₄ for PEM353-N only

PT The transformation ratio in the PEM353 can be set by specifying the primary and secondary transformation ratio. Odd ratios can also be configured.
Power Quality and Energy Measurement PEM575

Device features

- Accuracy class according to IEC 62053-22: 0.2 S
- Measured quantities
  - Phase voltages $U_{L1}$, $U_{L2}$, $U_{L3}$ in V
  - Line conductor voltages $U_{L1L2}$, $U_{L2L3}$, $U_{L3L1}$ in V
  - Phase currents $I_1$, $I_2$, $I_3$ in A
  - Neutral current (calculated) $I_0$ in A
  - Neutral current (measured) $I_4$ in A
  - Frequency $f$ in Hz
  - Phase angle for $U$ and $I$ in °
  - Power per phase conductor $S$ in kVA, $P$ in kW, $Q$ in kvar
  - Total power $S$ in kVA, $P$ in kW, $Q$ in kvar
  - Displacement factor cos ($\varphi$)
  - Power factor $\lambda$
  - Active and reactive energy import in kWh, kvarh
  - Active and reactive energy export in kWh, kvarh
  - Voltage unbalance in %
  - Current unbalance in %
  - Harmonic distortion (THD) for $U$ and $I$
  - $k$-Factor for $I$
- Programmable setpoint monitoring
- LED pulse outputs for active and reactive energy
- Modbus RTU and Modbus TCP
- 3 digital outputs
- Requirements of energy and current for particular time frames
- Peak demands with timestamps
- Individual, current/voltage harmonics up to the 63rd harmonic
- Minimum and maximum values
- Waveform recording (12.8 kHz)
- Data recorder
- Sag/swell detection
- High-resolution waveform recording
- Detection of transient events

Standards

PEM575 was designed in accordance with the following standards:

- **DIN EN 62053-22 (VDE 0418 Part 3-22)**
  Electricity meter equipment (AC) - Particular requirements – Part 22: Static meters for active energy (classes 0.2 S and 0.5 S (IEC 62053));

- **DIN EN 61557-12 (VDE 0413-12)**
  Elektrische Sicherheit in Niederspannungsnetzen bis AC 1000 V und DC 1500 V – Geräte zum Prüfen, Messen oder Überwachen von Schutzmaßnahmen – Teil 12: (Electrical safety in low voltage distribution systems up to AC 1000 V and DC 1500 V – Equipment for testing, measuring or monitoring of protective measures – Part 12) Performance measuring and monitoring device (PMD))

Further information

For further information refer to our product range on www.bender.de.

Ordering information

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<th>Current input</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
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<td>3(N)AC</td>
<td></td>
<td>5 A</td>
<td>PEM575</td>
<td>B93100575</td>
</tr>
<tr>
<td>RS-485/Ethernet</td>
<td>230/400 V</td>
<td>1 A</td>
<td>PEM575-251</td>
<td>B93100576</td>
</tr>
<tr>
<td></td>
<td>230/400 V</td>
<td>5 A</td>
<td>PEM575-155</td>
<td>B93100579</td>
</tr>
<tr>
<td></td>
<td>69/120 V</td>
<td>1 A</td>
<td>PEM575-151</td>
<td>B93100580</td>
</tr>
</tbody>
</table>
### Technical data

#### Insulation coordination

**Measuring circuit**
- Rated insulation voltage: 300 V
- Overvoltage category: III
- Pollution degree: 2

**Supply circuit**
- Rated insulation voltage: 300 V
- Overvoltage category: II
- Pollution degree: 2

**Supply voltage**
- Rated supply voltage $U_s$: AC/DC 95...415 V
- Frequency range of $U_s$: DC, 44...440 Hz
- Power consumption: $\leq 11$ VA

**Measuring circuit**
- Measuring voltage inputs
  - $U_{L1-N}, U_{L2-N}, U_{L3-N}$: 230 V, 69 V (only -151, -155)
  - $U_{L1-L2}, U_{L2-L3}, U_{L3-L1}$: 400 V, 120 V (only -151, -155)
- Measuring range: 10...120 % $U_n$
- Rated frequency: 45...65 Hz
- Internal resistance (L-N): $> 500$ kΩ

**Measuring current inputs**
- External measuring current transformer
- Measuring range: 0.1...120 % $I_n$
- Measuring current transformer ratio
  - PEM575/PEM575-155
    - $I_n$: 5 A
    - Measuring current transformer ratio: 1...6000
    - Accuracy class according with 5 A measuring current transformer: 0.2
    - Accuracy class according with 1 A measuring current transformer: 0.5
  - PEM575-251/PEM575-151
    - $I_n$: 1 A
    - Measuring current transformer ratio: 1...30000
    - Accuracy class according with 1 A measuring current transformer: 0.2

**Accuracies (of measured value/of full scale value)**
- Phase voltage $U_{L1-N}, U_{L2-N}, U_{L3-N}$: ±0.2 % of measured value
- Current: ±0.2 % of measured value +0.05 % of full scale value
- Neutral current $I_0$: 0.5 % of full scale value
- Frequency: ±0.01 Hz
- Phase position: ±1°

**Active energy measurement according to**
- DIN EN 62053-22 (VDE 0418 Part 3-22)
**r.m.s. voltage measurement according to**
- DIN EN 61557-12 (VDE 0413-12), chapter 4.7.6
**r.m.s. phase current measurement according to**
- DIN EN 61557-12 (VDE 0413-12), chapter 4.7.5
**Frequency measurement according to**
- DIN EN 61557-12 (VDE 0413-12), chapter 4.7.4

#### Interface

- **Interface/protocol**: RS-485, Modbus RTU
- **Baud rate**: 1.2...19.2 kbits/s
- **Cable length**: 0...1200 m
- **Shielded cable (shield connected to terminal SH on one side)**: recommended: 3-Y5(2)Y min. 2x0.8
- **Interface/protocol**: Ethernet, Modbus TCP
- **Baud rate**: 100 Mbits/s

#### Switching elements

- **Outputs**: 3 N/O contacts
- **Operating principle**: N/O operation
- **Rated operational voltage**: AC 230 V, DC 24 V, AC 110 V, DC 12 V
- **Rated operational current**: 5 A, 5 A, 6 A, 5 A
- **Minimum contact rating**: 1 mA at AC/DC $> 10$ V
- **Inputs**: 6 electrically separated digital inputs
  - $U_{DI}$: 2.4 mA
  - $U_{DI}$: DC 24 V

#### Environment/EMC

- **EMC**: DIN EN 61326-1
- **Operating temperature**: -25...+55 °C
- **Classification of climatic conditions acc. to DIN EN 60721**: Stationary use: 3K23
- **Classification of mechanical conditions acc. to DIN EN 60721**: Stationary use: 3M11
- **Height**: to 4000 m

#### Connection

- **Connection**: screw-type terminals

#### Other

- **Degree of protection, installation**: IP20
- **Degree of protection, front**: IP52
- **Documentation number**: D00016
- **Weight**: $\leq 1100$ g

#### Dimension diagram (dimensions in mm)

![Dimension diagram](image1)

#### Panel cut-out (dimensions in mm)

![Panel cut-out](image2)
1 Connection RS-485 bus
2 Supply voltage. Power protection by a 6 A fuse, quick response. If being supplied from an IT system, both lines have to be protected by a fuse.
3 Digital inputs
4 Digital outputs (N/O contacts)
5 Measuring voltage inputs:
   The measuring leads should be protected by appropriate fuses
6 Connection to the system to be monitored
7 Connection Modbus TCP
The PEM can be used in three-phase 4-wire systems, independent of the type of distribution system (TN, TT, IT system).

The PEM can be used in three-phase 3-wire systems.

The coupling via measuring voltage transformers allows the use of a measuring device in medium and high voltage systems. The transformation ratio in PEM575 can be adjusted (1…10000).
Measuring current transformer for universal measuring devices

Window-type/Split-core current transformer

**Device features**

**CTB41/CTB51**
- Window-type current transformer
- Screwless connection technique
- Maintenance-free, gas-tight connection
- Max. operating voltages up to 1.2 kV
- Can also be used in 690 V systems
- Unbreakable plastic enclosure, self-extinguishing, UL94-V0, flame-resistant

**KBR18/KBR32**
- Split-core current transformer (mounting without disconnecting the primary conductor)
- Incl. connecting cable (2.5 m)
- Max. operating voltages up to 0.72 kV

**Standards**
The measuring current transformers were designed in accordance with the following standards:
- IEC 61869-1
- IEC 61869-2
- IEC 61010-1

**Further information**
For further information refer to our product range on www.bender.de.

**Ordering details window-type current transformer**

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<th>Primary current</th>
<th>Secondary current</th>
<th>Accuracy</th>
<th>Type</th>
<th>Model</th>
<th>Art. No.</th>
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<td>WL605 KL. 1</td>
<td>CTB41</td>
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<td>WL601 KL. 1</td>
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<td>75</td>
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<td>WL1255 KL. 0.5</td>
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<td>WL1251 KL. 1</td>
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<td>WL1505 KL. 0.5</td>
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<td>WL1501 KL. 1</td>
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<td>WL2005 KL. 0.5</td>
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**Ordering details split-core current transformer**

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<th>Primary current</th>
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<th>Accuracy</th>
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<th>Model</th>
<th>Art. No.</th>
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<td>800</td>
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For further information refer to our product range on www.bender.de.
### Ordering details split-core current transformer

<table>
<thead>
<tr>
<th>Primary current</th>
<th>Secondary current</th>
<th>Accuracy</th>
<th>Type</th>
<th>Model</th>
<th>Art. No.</th>
</tr>
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<tr>
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<td>KBR18</td>
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<td>KBR18</td>
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</table>

### Selection guide current transformer/PEM

**Design specifications of the measuring ranges current transformer/PEM**

The secondary current of the current transformer has to be adjusted to the current input of the measuring device. The following table will help you to select the device type.

<table>
<thead>
<tr>
<th>Current transformer secondary current</th>
<th>PEM353(-x) (5 A)</th>
<th>PEMxxx(-xx5) (5 A)</th>
<th>PEMxxx-xx1 (1 A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 A</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Note: In principle, measuring current transformers can also be operated with 1 A secondary current on measuring devices with 5 A current input. In this case, the accuracy class is expected to be reduced by one class (e.g. 0.5 to 1).

### The measurement accuracy classes of the system

The measurement accuracy class of the system is influenced by both the accuracy classes of the measuring current transformers and the measuring device. Refer to DIN EN 61557-12, Annex E.2.

<table>
<thead>
<tr>
<th>Accuracy classes of measuring current transformers</th>
<th>PEMxxx (0.5 S)</th>
<th>PEM5xxx (0.5 S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
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<tr>
<td>0.5</td>
<td>1</td>
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</table>

### Technical Data

#### CTB41

- Rated continuous thermal current $I_{cT}$: $1.2 \times I_N$
- Rated short-time thermal current $I_{th}$: $60 \times I_N$, 1 s
- Max. operating voltage $U_{op}$: $1.2 \times U_{eff}$
- Insulation test voltage: $6 \text{ kV}, U_{eff}, 50 \text{ Hz}, 1 \text{ min}$
- Nominal frequency: $50/60 \text{ Hz}$
- Insulation class: E
- Operating temperature: $-5 \ldots 50 \text{ °C}$

#### CTB51

- Rated continuous thermal current $I_{cT}$: $1.2 \times I_N$
- Rated short-time thermal current $I_{th}$: $60 \times I_N$, 1 s
- Max. operating voltage $U_{op}$: $1.2 \times U_{eff}$
- Insulation test voltage: $6 \text{ kV}, U_{eff}, 50 \text{ Hz}, 1 \text{ min}$
- Nominal frequency: $50/60 \text{ Hz}$
- Insulation class: E
- Operating temperature: $-5 \ldots 50 \text{ °C}$

#### KBR18

- Rated continuous thermal current $I_{cT}$: $1.2 \times I_N$
- Rated short-time thermal current $I_{th}$: $60 \times I_N$, 1 s
- Max. operating voltage $U_{op}$: $0.72 \text{ kV}, U_{eff}$
- Insulation test voltage: $3 \text{ kV}, U_{eff}, 50 \text{ Hz}, 1 \text{ min}$
- Nominal frequency: $50 \text{ Hz}$
- Insulation class: E
- Operating temperature: $-5 \ldots 50 \text{ °C}$

#### KBR32

- Rated continuous thermal current $I_{cT}$: $1.2 \times I_N$
- Rated short-time thermal current $I_{th}$: $60 \times I_N$, 1 s
- Max. operating voltage $U_{op}$: $0.72 \text{ kV}, U_{eff}$
- Insulation test voltage: $3 \text{ kV}, U_{eff}, 50 \text{ Hz}, 1 \text{ min}$
- Nominal frequency: $50 \text{ Hz}$
- Insulation class: E
- Operating temperature: $-5 \ldots 50 \text{ °C}$

Documentation number D00231
### Measuring current transformer for universal measuring devices

#### Dimensions (mm)

**CTB51**
- Busbar 1: 40 x 10
- Busbar 2: 30 x 15
- Circular conductor: 32
- Installation width: 70
- Installation height: 91
- Overall depth: 52

**CTB41**
- Busbar 1: 50 x 12
- Busbar 2: 40 x 30
- Circular conductor: 44
- Installation width: 85
- Installation height: 105.25
- Overall depth: 52

**KBR18**
- Circular conductor: 18
- Installation width: 41.6
- Installation height: 64.5
- Installation depth incl. fixation clips: 67.3

**KBR32**
- Circular conductor: 32.5
- Installation width: 59.2
- Installation height: 96.4
- Installation depth incl. fixation clips: 89.2
6.1 Energy meter

Device features
- Energy meter with Modbus RTU interface
- MID approved
- 7-digit display
- Automatic recognition of bus transmission rate and parity
- Lead seal possible with cap as accessory
- Resettable, partial reading
- In addition to active energy metering, measured data such as current, voltage, power and cos (phi) is also available.
- DIN rail mounting

Application fields
- Registration of relevant energy management data
- Suitable for billing purposes

Standards
The energy meters have been developed in accordance with the following standards:
- Accuracy class B acc. to EN 50470-3
- Accuracy class 1 acc. to IEC 62053-21

Further information
For more information see our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy meter 1Ph/32 A MID Modbus RTU</td>
<td>ALD1</td>
<td>B93101005</td>
</tr>
<tr>
<td>Energy meter 3Ph/65 A MID Modbus RTU</td>
<td>ALE3</td>
<td>B93101006</td>
</tr>
<tr>
<td>Energy meter 3Ph/6 A MID Modbus RTU</td>
<td>AWD3</td>
<td>B93101007</td>
</tr>
<tr>
<td>50 pulse counter (four-fold) with Modbus RTU</td>
<td>PCD7</td>
<td>B93101008</td>
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</table>

Ordering information

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sealable cover for ALD1 (two per counter)</td>
<td>–</td>
<td>B93101009</td>
</tr>
<tr>
<td>Sealable cover for ALE3/AWD3 (four per counter)</td>
<td>–</td>
<td>B93101010</td>
</tr>
</tbody>
</table>

Technical data

**ALD1**
- Accuracy class: B acc. to EN 50470-3
- Operating voltage: AC 230 V, 50 Hz
- Operating voltage: AC 230/400 V, 50 Hz
- Transformer measurement: 5…1500 A
- Reference current/maximum current: $I_{ref} = 5 \text{ A}$, $I_{max} = 32 \text{ A}$
- Starting current/minimum current: $I_{st} = 20 \text{ mA}$, $I_{min} = 0.25 \text{ A}$
- Power consumption: active power 0.4 W
- Counting range: 00'000.00…99'999.99
- Pulses per kWh: 2000 imp/kWh

**ALE3**
- Accuracy class: B acc. to EN 50470-3
- Operating voltage: AC 230 V, 50 Hz
- Operating voltage: AC 230/400 V, 50 Hz
- Transformer measurement: 5…1500 A
- Reference current/maximum current: $I_{ref} = 10 \text{ A}$, $I_{max} = 65 \text{ A}$
- Starting current/maximum current: $I_{st} = 40 \text{ mA}$, $I_{min} = 0.5 \text{ A}$
- Power consumption: active 0.4 W per phase
- Counting range: 000 000.0…999 999.9
- LC display with background illumination: 6 mm high digits
- Display without mains voltage: capacitor supported LCD maximum for two periods of 10 days
- Documentation number: D00230

**AWD3**
- Accuracy class: B acc. to EN 50470-3
- Operating voltage: 3 x AC 230/400 V, 50 Hz
- Operating voltage: 3 x AC 230/400 V, 50 Hz
- Transformer measurement: 5…1500 A
- Reference current/maximum current: $I_{ref} = 10 \text{ A}$, $I_{max} = 65 \text{ A}$
- Starting current/maximum current: $I_{st} = 40 \text{ mA}$, $I_{min} = 0.5 \text{ A}$
- Power consumption: active 0.4 W per phase
- Counting range: 000000.0…999999.9
- LC display with background illumination: 6 mm high digits
- Display without mains voltage: capacitor supported LCD maximum for two periods of 10 days
- Documentation number: D00230
Connections E1 and E2
To switch between tariffs, connect to the control signal of the ripple control receiver.
The secondary current transformer connection on the network side has to be connected to the phase to be measured. For this reason the current transformer must not be earthed.
## Device overview measuring and monitoring relays LINETRAXX®

<table>
<thead>
<tr>
<th>Catalogue page</th>
<th>300</th>
<th>303</th>
<th>306</th>
<th>309</th>
<th>310</th>
<th>313</th>
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<tbody>
<tr>
<td><strong>Special applications</strong></td>
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<td>–</td>
<td>Power plant</td>
<td>Energy backup for device series VMD258</td>
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<tr>
<td><strong>Voltage monitoring</strong></td>
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<td>(U_\text{&lt;}, U_\text{&gt;})</td>
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<td>–</td>
<td>–</td>
<td>–</td>
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<tr>
<td>3AC</td>
<td>–</td>
<td>–</td>
<td>(U_\text{&lt;}, U_\text{&gt;})</td>
<td>–</td>
<td>(U_\text{&lt;}, U_\text{&gt;})</td>
<td>(U_\text{&lt;}, U_\text{&gt;})</td>
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<td>DC</td>
<td>(U_\text{&lt;}, U_\text{&gt;})</td>
<td>(U_\text{&lt;}, U_\text{&gt;})</td>
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<tr>
<td><strong>Measuring range/ nominal system voltage (U_n)</strong></td>
<td>AC/DC systems 0...300 V</td>
<td>VME421H-D-1 AC/DC systems 9,6...150 V</td>
<td>VMD421H-D-2 70...300 V</td>
<td>3AC 690/500/480/440/400/230/110/100 V</td>
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<td>(L-N) 0...288 V (L-L) 0...500 V</td>
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<td>–</td>
<td>(f_\text{&lt;}, f_\text{&gt;})</td>
<td>(f_\text{&lt;}, f_\text{&gt;})</td>
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<td>3 AC with (U_s)</td>
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### Interface Protection System/Decoupling protection relay

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<thead>
<tr>
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<tr>
<td>RS-485 interface, Islanding detection: -ROCOF (df/dt) -Vector shift</td>
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<table>
<thead>
<tr>
<th>Installation</th>
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<td>DIN rail</td>
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### Measuring range/nominal system voltage

#### AC/DC systems

<table>
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<tr>
<th>VME420</th>
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<table>
<thead>
<tr>
<th>VMD420</th>
<th>VMD421H</th>
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<td>0…300 V</td>
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<th>VMD461</th>
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#### (L-N) 0…288 V

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LINETRAXX® VME420
Multi-functional monitoring relay for undervoltage, overvoltage and frequency monitoring in AC/DC systems with separate supply voltage

Device features
• Monitoring AC/DC systems for undervoltage, overvoltage and frequency in the voltage range of 0…300 V
• Various monitoring functions selectable U <, U >, f <, f >
• Start-up delay, response delay and delay on release
• Adjustable switching hysteresis
• r.m.s. value measurement (AC+DC)
• Digital measured value display via multi-functional LC display
• Preset function (automatic setting of basic parameters)
• LEDs: Power On, Alarm 1, Alarm 2
• Measured value memory for operating value
• Continuous self monitoring
• Internal test/reset button
• Two separate alarm relays (one changeover contact each)
• N/C or N/O operation and fault memory behaviour selectable
• Password protection for device setting
• Sealable transparent cover
• Two-module enclosure (36 mm)
• Push-wire terminal (two terminals per connection)
• RoHS compliant

Typical applications
• Voltage and frequency monitoring of single-phase machines and electrical installations
• Earth fault monitoring in medium-voltage systems via voltage transformers
• Monitoring of battery systems
• Switching machinery and equipment on and off at a certain voltage level

Approvals

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage 1) Uₘ</th>
<th>Type</th>
<th>Art. No.</th>
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<tbody>
<tr>
<td></td>
<td>AC</td>
<td>DC</td>
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<tr>
<td>16…72 V, 15…460 Hz</td>
<td></td>
<td>9,6…94 V</td>
</tr>
<tr>
<td>70…300 V, 15…460 Hz</td>
<td></td>
<td>70…300 V</td>
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1) Absolute values

Accessories

<table>
<thead>
<tr>
<th>Description</th>
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<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
### Technical data

#### Insulation coordination acc. to IEC 60664-1/IEC 60664-3
- Rated insulation voltage: 250 V
- Rated impulse voltage/pollution degree: 4 kv/3
- Overvoltage category: III

#### Protective separation (reinforced insulation) between:
- (A1, A2) - (U1/+, U2/-) - (11-12-14) - (21-22-24)

#### Supply voltage
- **VME420-D-1:**
  - Supply voltage \( U_s \): AC 16…72 V/DC 9.6…300 V
  - Frequency range \( f_s \): 15…460 Hz

#### Measuring circuit
- Measuring range (r.m.s. value): AC/DC 0…300 V
- Rated frequency \( f_0 \): DC 15…460 Hz
- Frequency display range: 10…500 Hz

#### Measuring accuracy
- Frequency display range: 10…500 Hz

#### Measurement range (r.m.s. value)
- Rated frequency \( f_0 \): AC 15…460 Hz

#### Frequency range
- \( U_s \): 15…460 Hz

#### Resolution of setting
- Power consumption: ≤ 4 VA
- Frequency range: 15…460 Hz

#### Operating time, voltage
- Operating time: ≤ 300 ms

#### Recovery time
- Recovery time: 2 s

#### Time response
- Start-up delay \( t_{on1/2} \): 0…300 s
- Response delay \( t_{min/2} \): 0…300 s
- Delay on release \( t_{off} \): 0…300 s

#### Resolution of setting
- Resolution of setting: 0.1 Hz
- Resolution of setting: 0.1 Hz

#### Preset function:
- Undervoltage \( U = \frac{U_0}{U_s} \): 196/102/51/20.4 V
- Overvoltage \( U > \frac{U_0}{U_s} \): 253/132/66/26.4 V
- Relative uncertainty at 50/60 Hz: ± 1.5 %, ± 2 digits
- Hysteresis \( U \) for \( 15…460 \) Hz: 1…40 \% (5 \%) ± 1 digit

#### Operating uncertainty, voltage in the range of 15…460 Hz
- Operating uncertainty: ± 3 %, ± 2 digits
- Minimum contact rating: 1 mA at AC/DC ≥ 10 V

#### Contact data acc. to IEC 60947-5-1
- Utilization category:
  - AC-13
  - AC-14
  - DC-12
  - DC-12
  - DC-12

#### Operating principle:
- N/C operation/N/O operation

#### Electrical endurance, number of cycles
- 10,000

#### Environment/EMC
- EMC: IEC 61326-1
- Operating temperature: -25…+ 55 °C

#### Classification of climatic conditions acc. to IEC 60721:
- Stationary use (IEC 60721-3-3) 3K23 (no condensation, no formation of ice)
- Transport (IEC 60721-3-2) 2M4
- 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: screw-type terminal or push-wire terminal
- Connection screw terminals

#### Connection properties
- Connection properties:
  - Rigid: 0.2…4 mm² (AWG 24…12)
  - Flexible: 0.2…2.5 mm² (AWG 24…14)

#### Stripping length
- Stripping length: 8 mm

#### Connection push-wire terminals
- Connection properties:
  - Rigid: 0.2…2.5 mm² (AWG 24…14)
  - Flexible: 0.75…2.5 mm² (AWG 19…14)

#### Stripping length
- Stripping length: 10 mm

#### Other
- Weight: ≤ 150 g

---

### Technical data

#### Switching elements
- Number: 2 x 1 changeover contacts (K1, K2)
- Operating principle:
  - N/C operation/N/O operation

#### Environment/EMC
- EMC: IEC 61326-1
- Operating temperature: -25…+ 55 °C

#### Classification of climatic conditions acc. to IEC 60721:
- Stationary use (IEC 60721-3-3) 3K23 (no condensation, no formation of ice)
- Transport (IEC 60721-3-2) 2M4
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- Stripping length: 8 mm

#### Connection push-wire terminals
- Connection properties:
  - Rigid: 0.2…2.5 mm² (AWG 24…14)
  - Flexible: 0.75…2.5 mm² (AWG 19…14)

#### Stripping length
- Stripping length: 10 mm

#### Operating mode
- Operating mode: continuous operation

#### Mounting
- Degree of protection, internal components (DIN EN 60529):
  - IP 30
- Degree of protection, terminals (DIN EN 60529):
  - IP 20

#### Enclosure material
- Enclosure material:
  - Polycarbonate

#### Screw mounting
- Screw mounting:
  - 2 x M4 with mounting clip

#### DIN rail mounting acc. to IEC 60715
- DIN rail mounting acc. to IEC 60715

#### Flammability class
- Flammability class: UL 94 V-0

#### Documentation number
- Documentation number: D00026

#### Weight
- Weight: ≤ 150 g

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### Technical data

#### Technical data

#### Electrical endurance, number of cycles
- 10,000

#### Contact data acc. to IEC 60947-5-1
- Utilization category:
  - AC-13
  - AC-14
  - DC-12
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  - DC-12

#### Operating principle:
- N/C operation/N/O operation

#### Electrical endurance, number of cycles
- 10,000

#### Contact data acc. to IEC 60947-5-1
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#### Operating principle:
- N/C operation/N/O operation

#### Electrical endurance, number of cycles
- 10,000

#### Contact data acc. to IEC 60947-5-1
- Utilization category:
  - AC-13
  - AC-14
  - DC-12
  - DC-12
  - DC-12

#### Operating principle:
- N/C operation/N/O operation

#### Electrical endurance, number of cycles
- 10,000
Wiring diagram

1. U1/+, U2/- Connection to the system/load being monitored
2. A1, A2 Supply voltage Uₙ (see ordering information)
3. 11, 12, 14 Alarm relay "K1": Configurable for \( U < U \) / \( U > U \) / \( f < f \) / \( f > f \) / ERROR
4. 21, 22, 24 Alarm relay "K2": Configurable for \( U < U \) / \( U > U \) / \( f < f \) / \( f > f \) / ERROR
5. Line protection according to IEC 60364-4-43: A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse.
LINETRAXX® VME421H
Multi-functional monitoring relay for undervoltage, overvoltage and frequency monitoring in AC/DC systems without separate supply voltage

Device features
- Monitoring undervoltage, overvoltage and frequency of AC/DC systems of 9.6…150 V (VME421H-D-1), 70…300 V (VME421H-D-2)
- Without external supply voltage
- Integrated energy backup
- Various monitoring functions selectable $U_<$, $U_>$, $f_<$, $f_>$
- Start-up delay, response delay, delay on release
- Adjustable switching hysteresis
- rms value measurement (AC+DC)
- Digital measured value display via multi-functional LC display
- Preset function (automatic setting of basic parameters)
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays (one changeover contact each)
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device setting
- Sealable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)
- RoHS compliant

Typical applications
- Voltage and frequency monitoring of single-phase machines and electrical installations
- Earth fault monitoring in medium-voltage systems via voltage transformers
- Monitoring of battery systems
- Switching machinery and equipment on and off at a certain voltage level

Approvals

Further information
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<tbody>
<tr>
<td></td>
<td>Screw-type terminal</td>
<td>Push-wire terminal</td>
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<tr>
<td>AC 9.6…150 V, 15…460 Hz</td>
<td>VME421H-D-1</td>
<td>B93010003</td>
</tr>
<tr>
<td>DC 9.6…150 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC 70…300 V, 15…460 Hz</td>
<td>VME421H-D-2</td>
<td>B93010004</td>
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### Technical data

#### Insulation coordination acc. to IEC 60664-1/IEC 60664-3

- **Rated insulation voltage:** 250V
- **Rated impulse voltage/pollution degree:** 4 (F3)
- **Overvoltage category:** III
- **Protective separation (reinforced insulation) between:** (U1/+), (U2/-), (11-12-14)-(21-22-24)
- **Voltage test acc. to IEC 61010-1:** 2.21 kV

#### Supply voltage

- **VME421H-D-1:**
  - Supply voltage $U_s$ none (internally supplied by $U_d$)
  - Power consumption $\leq$ 6 VA
- **VME421H-D-2:**
  - Supply voltage $U_s$ none (internally supplied by $U_d$)

#### Measuring circuit

- **Measuring range (rms value) (VME421H-D-1):**
  - AC/DC 0…150 V
- **Measuring range (rms value) (VME421H-D-2):**
  - AC/DC 0…300 V

- **Rated frequency $f_n$:**
  - DC, 15…460 Hz

- **Frequency display range:**
  - 10…500 Hz

#### Response values

- **VME421H-D-1:**
  - Undervoltage $U < (\text{Alarm } 2)$
    - AC/DC 9.6…150 V
  - Overvoltage $U > (\text{Alarm } 1)$
    - AC/DC 9.6…150 V
  - Preset function:
    - Undervoltage $U < (0.85 \times U_d)$ for $U_d = 120/60/24$ V
      - 102/51/20.4 V
    - Overvoltage $U > (1.1 \times U_d)$ for $U_d = 120/60/24$ V
      - 132/66/26.4 V
    - Resolution of setting $f_n$ 95…49.5 V
      - 0.1 V
    - Resolution of setting 50…150 V
      - 1 V

- **VME421H-D-2:**
  - Undervoltage $U < (\text{Alarm } 2)$
    - AC/DC 70…300 V
  - Overvoltage $U > (\text{Alarm } 1)$
    - AC/DC 70…300 V
  - Resolution of setting $U_{70…300}$ V
    - 1 V

- **VME21H:**
  - Relative uncertainty voltage at 50/60 Hz
    - $1.5 \%$, 2 digits
  - Relative uncertainty voltage in the range 15…460 Hz
    - $\pm 3 \%$, $\pm 2$ digit
  - **Hysteresis $U$:**
    - $1…40 \%$ (5 \%)$^*$
  - **Underfrequency $f$:**
    - $10…500$ Hz$^*$
  - **Overfrequency $f$:**
    - $15…500$ Hz$^*$
  - **Resolution of setting $f$: 100…500 Hz**
    - 1 Hz
  - **Resolution of setting $f$: 100…500 Hz**
    - 1 Hz
  - **Preset function:**
    - Underfrequency for $f_n = 400/60/50/16.7$ Hz
      - 399/59/49/19.7 Hz
    - Overfrequency for $f_n = 400/60/50/16.7$ Hz
      - 401/61/51/17.7 Hz
    - **Hysteresis $f$:**
      - $0.1…2$ (0.2 Hz)$^*$
  - **Relative uncertainty, frequency in the range of 15…460 Hz**
    - $\pm 0.2 \%$, $\pm 1$ digit

#### Time response

- **Start-up delay $t$:**
  - 0…300 s (0.3 \%$^*$
- **Response delay $\tau_{on/2}$:**
  - 0…300 s (0.3 \%$^*$
- **Delay on release $\tau_{off}$:**
  - 0…300 s (0.3 \%$^*$
- **Resolution of setting $\tau_{on/2}$, $\tau_{off}$ (0…10 s):**
  - 0.1 s
- **Resolution of setting $\tau_{off}$ (10…999):**
  - 1 s
- **Resolution of setting $\tau_{off}$ (100…300):**
  - 10 s

- **Operating time, voltage $t_{on}$:**
  - DC/AC 16.7 Hz, $\leq 130$ ms, AC 42…460 Hz, $\leq 70$ ms
  - **Operating frequency $f_{on}$:**
    - AC 15…460 Hz, $\leq 310$ ms
  - **Operating time $t_{on}$:**
    - $f_{on} = f_{AC} + f_{DC}$

- **Discharging time energy backup on power failure (VME421H-D-1):**
  - 3 s
- **Discharging time energy backup on power failure (VME421H-D-1):**
  - 2.5 s at $f_0 < 42$ Hz
  - **Discharging time energy backup (VME421H-D-2):**
    - $\geq 4$ s at DC 70 V
    - $\geq 6$ s at DC 80/AC 70 V

- **Charging time energy backup (VME421H-D-1):**
  - 60 s
  - **Charging time energy backup (VME421H-D-2):**
    - 120 s
  - **Recovery time $t_r$:**
    - $\leq 300$ ms

#### Displays, memory

- **Display:**
  - LC display, multifunctional, not illuminated
- **Display range measured value (VME421H-D-1):**
  - AC/DC 0…150 V
- **Display range measured value (VME421H-D-2):**
  - AC/DC 0…300 V
- **Operating uncertainty at 50/60 Hz:**
  - $\pm 1.5 \%$, $\pm 2$ digits
- **Operating uncertainty voltage in the range of 15…460 Hz:**
  - $\pm 3 \%$, $\pm 2$ digits
- **Operating uncertainty in the frequency range 15…460 Hz:**
  - $\pm 0.2 \%$, $\pm 1$ digit

- **History memory (HS) for the first alarm value:**
  - data record measured values:
  - Password off/0…999 (off)*
  - Fault memory (M) alarm relay on/off/con (on)*

#### Switching elements

- **Number:**
  - 2 x 1 changeover contacts (K1, K2)
- **Operating principle:**
  - N/C operation/N/O operation
  - K2: Err, $U < (U > _Hys)$, Hz <, Hz >, S.AL (undervoltage $U <$/overvoltage $U >$ n.O operation n.O)*
  - K1: $U < (U > _Hys)$, Hz <, Hz >, S.AL (overvoltage $U >$/N/C operation n.C)*

- **Electrical endurance, number of cycles:**
  - 10,000

#### Contact data acc. to IEC 60947-5-1

- **Utilization category:**
  - AC-13 AC-14 DC-12 DC-12 DC-12
- **Rated operational voltage:**
  - 210 V 230 V 24 V 110 V 220 V
- **Rated operational current:**
  - 5 A 3 A 1 A 0.2 A 0.1 A
- **Minimum contact rating:**
  - 1 mA at AC/DC $\leq 10$ V

#### Environment/EMC

- **EMC:**
  - IEC 61326-1
  - IEC 61326-1
- **Operating temperature:**
  - $-25…+55$ °C

#### Classification of climatic conditions acc. to IEC 60721

- **Stationary use (IEC 60721-3-3):**
  - 3K23 (no condensation, no formation of ice)
- **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):**
  - 1M3

#### Connection

- **Connection type:**
  - screw-type terminal or push-wire terminal
- **Connection screw terminals**
- **Connection properties:**
  - rigid
  - flexible
- **Two conductors with the same cross section:**
  - rigid/flexible
- **Stripping length:**
  - 8 mm
- **Lightening torque, terminal screws:**
  - 0.5…0.6 Nm
- **Connection push-wire terminals**
- **Connection properties:**
  - rigid
  - flexible
  - without ferrules
  - with ferrules
- **Stripping length:**
  - 10 mm
- **Opening force:**
  - 50 N
- **Test opening, diameter:**
  - 2.1 mm

Other

- **Operator mode:**
  - continuous operation
- **Mounting $f_{ON}$:**
  - any position
- **Degree of protection, internal components (DIN EN 60529):**
  - IP30
- **Degree of protection, terminals (DIN EN 60529):**
  - IP20
- **Enclosure material:**
  - polycarbonate
- **Screw mounting:**
  - 2 x M4 with mounting clip
- **DIN rail mounting acc. to IEC 60715:**
  - DIN rail mounting acc. to IEC 60715
- **Flammability class:**
  - UL94 V-0
- **Documentation number:**
  - D00141
- **Weight:**
  - $\leq 240$ g

\[ (*) = \text{factory setting} \]
\[ ** = \text{The technical data applies to the operating range of the rated frequency 15…460 Hz only.} \]
Monitoring relay for undervoltage, overvoltage and frequency LINETRAXX® VME421H

**Dimension diagram (dimensions in mm)**

![Dimension diagram](image)

**Wiring diagram**

![Wiring diagram](image)

1. U1/+, U2/-: Connection to the system/load being monitored
2. 11, 12, 14: Alarm relay "K1": Configurable for U< U> / f< f> / ERROR
3. 21, 22, 24: Alarm relay "K2": Configurable for U< U> / f< f> / ERROR
4. Line protection according to IEC 60364-4-43:
   A fuse recommended recommended. If being supplied from an IT system, both lines have to be protected by a fuse.
LINETRAXX® VMD258
Undervoltage/overvoltage relay for monitoring three-phase AC systems (window function) for power plant applications

Device features
- High availability due to purely analogue technology
- Undervoltage and overvoltage monitoring for 3AC systems
- No separate supply voltage required
- Separate alarm relays for undervoltage and overvoltage with two potential-free changeover contacts
- Adjustable response value: 0.7…0.95 x U_n / 1.05…1.3 x U_n
- Nominal system voltages: 3AC 690/500/480/440/400/230/110/100 V
- Adjustable response delay: 0…5 s
- LEDs for operation, overvoltage, undervoltage

Typical applications
- Monitoring of the power supply of machines and electrical installations
- Monitoring of loads
- Switching electrical systems on and off at a certain voltage level
- Monitoring of stand-by and emergency supply systems

Standards
The LINETRAXX® VMD258 series complies with the requirements of the device standards:
- DIN EN 60255-1 VDE 0435-300
- E DIN IEC 60255-127 VDE 0435-3127.

Further information
For further information refer to our product range on www.bender.de.

Ordering details

<table>
<thead>
<tr>
<th>Connection</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3AC, 100 V</td>
<td>VMD258 3AC 100 V</td>
<td>B93010060</td>
</tr>
<tr>
<td>3AC, 110 V</td>
<td>VMD258 3AC 110 V</td>
<td>B93010061</td>
</tr>
<tr>
<td>3AC, 230 V</td>
<td>VMD258 3AC 230 V</td>
<td>B93010062</td>
</tr>
<tr>
<td>3AC, 400 V</td>
<td>VMD258 3AC 400 V</td>
<td>B93010063</td>
</tr>
<tr>
<td>3AC, 440 V</td>
<td>VMD258 3AC 440 V</td>
<td>B93010064</td>
</tr>
<tr>
<td>3AC, 480 V</td>
<td>VMD258 3AC 480 V</td>
<td>B93010065</td>
</tr>
<tr>
<td>3AC, 500 V</td>
<td>VMD258 3AC 500 V</td>
<td>B93010066</td>
</tr>
<tr>
<td>3AC, 690 V</td>
<td>VMD258 3AC 690 V</td>
<td>B93010067</td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional mounting clips (screw mounting)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy backup</td>
<td>ES258</td>
<td>B93010068</td>
<td>309</td>
</tr>
</tbody>
</table>
### Technical data

#### Insulation coordination acc. to DIN EN 60255-27

<table>
<thead>
<tr>
<th>Supply voltage $U_s$ AC (V)</th>
<th>690</th>
<th>480/500</th>
<th>400/440</th>
<th>230</th>
<th>100/110</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage $AC$ (V)</td>
<td>1000</td>
<td>1000</td>
<td>600</td>
<td>300</td>
<td>150</td>
</tr>
<tr>
<td>Rated impulse voltage (kV)</td>
<td>12</td>
<td>12</td>
<td>8</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Pollution degree</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>III</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Voltage ranges

<table>
<thead>
<tr>
<th>Frequency range of $U_s$</th>
<th>45…66 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating range</td>
<td>0.5…1.5 $x U_s$</td>
</tr>
<tr>
<td>Nominal supply voltage $U_{nom}$ AC (V)</td>
<td>690</td>
</tr>
<tr>
<td>Power consumption at 50 Hz, 1.3 $x U_s$ (VA)</td>
<td>19</td>
</tr>
<tr>
<td>Power consumption at 60 Hz, 1.3 $x U_s$ (VA)</td>
<td>11</td>
</tr>
</tbody>
</table>

#### Measuring circuit

<table>
<thead>
<tr>
<th>Nominal system voltage $U_n$</th>
<th>3AC 690/500/480/440/400/230/110/100 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting range</td>
<td>0.7…1.3 $x U_n$</td>
</tr>
<tr>
<td>Frequency range $U_n$</td>
<td>45…66 Hz</td>
</tr>
<tr>
<td>Max. permissible measuring voltage</td>
<td>1.5 $x U_n$</td>
</tr>
<tr>
<td>Response value $U_{response}$ adjustable</td>
<td>$U_{&gt;_&lt;}$</td>
</tr>
</tbody>
</table>

#### Response values

| Undervoltage $U_{<}$ (alarm) | 0.7…0.95 $x U_n$ |
| Overvoltage $U_{>}$ (alarm)  | 1.05…1.3 $x U_n$ |
| Relative uncertainty at the setting limits | 45…66 Hz: ±3 % 47.5…63 Hz: ±2 % |
| Hysteresis                   | < 3 % |
| Repetition accuracy           | ±1 % |
| LED ON                       | LED (green) |
| Alarm for $U_{<}$             | LED (yellow) |
| Alarm for $U_{>}$             | LED (yellow) |

#### Time response

| Start-up delay $t$             | 500 ms ±20 % |
| Delay on release $t_{off}$     | 0…5 s ±10 % |
| Operating time $t_{on}$ at overvoltage | 100 ms ±20 % |
| Operating time $t_{on}$ at undervoltage | 100 ms ±20 % |
| Response time $t_{response}$   | $t_{response} = t_{on} + t_{off}$ |
| Long-term influence            | −10 % |
| Overshoot time $t_{ov}$        | < 60 ms |

#### Connection for external energy storage device

| $U_{max}$                    | DC 24 V |
| $U_{max}$                    | DC 68 V |
| $U_{nom}$ at 1.0 $x U_n$     | 42…47 V ±15 % |
| Short circuit proof ($Z_{<}$, $Z_{>}$) | short time yes |

### Switching elements

- **Number of switching elements**: 2 x 2 changeover contacts
- **Operating mode**:
  - N/C operation (undervoltage)
  - N/O operation (overvoltage)
- **Electrical endurance, number of cycles**: 10,000

#### Contact data acc. to IEC 60947-5-1

<table>
<thead>
<tr>
<th>Utilisation category</th>
<th>AC-13</th>
<th>AC-14</th>
<th>DC-12</th>
<th>DC-12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated operational voltage</td>
<td>230 V</td>
<td>230 V</td>
<td>220 V</td>
<td>110 V</td>
</tr>
<tr>
<td>Rated operational current</td>
<td>4 A</td>
<td>3 A</td>
<td>0.2 A</td>
<td>0.2 A</td>
</tr>
</tbody>
</table>

- **Minimum current**: 1 mA at AC/DC > 10 V

#### Environment/EMC

- **EMC immunity acc. to IEC 60255-26**
- **EMC emission acc. to IEC 60255-25**

- **Operating temperature**: -20…+70 °C

#### Classification of climatic conditions acc. to DIN IEC 60721-3-3

- **Stationary use**: 3K23
- **Long-term storage**: 1K22

#### Classification of mechanical conditions acc. to IEC 60721

- **Stationary use**: 3M11
- **Long-term storage**: 1M12

#### Connection

- **Connection properties**
  - Rigid/flexible: 0.2…2.5 mm²
  - Flexible with connector sleeve: 0.25…2.5 mm²
  - Without/with plastic sleeve: 0.25…2.5 mm²

- **Conductor sizes (AWG)**: 24…13

- **Tightening torque**: 0.5…0.6 Nm

#### Other

- **Operating mode**: continuous operation
- **Position**: any position
- **Degree of protection, internal components (DIN EN 60529)**: IP30
- **Degree of protection, terminals (DIN EN 60529)**: IP20
- **Enclosure material**: polycarbonate
- **Flammability-class**: UL94 V-0
- **DIN rail mounting acc. to IEC 60715**: 4 x M4
- **Screw mounting**: 4 x M4

- **Weight**: 825 g

* Operating time $t_{off}$ overvoltage increase from 100 % to 130 %, switching threshold at 105 %
** Operating time $t_{on}$ undervoltage decrease from 100 % to 0 %, switching threshold at 95 %
Z+, Z- Connection ES258 for a backup time of > 5 s
**ES258**

Energy backup for undervoltage/overvoltage relays

- **Typical applications**
  - Supplementary device for the undervoltage/overvoltage relay VMD258.

- **Further information**
  - For further information refer to our product range on www.bender.de.

---

**Ordering information**

<table>
<thead>
<tr>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES258</td>
<td>B093010068</td>
</tr>
</tbody>
</table>

---

**Technical data**

- **Insulation coordination according to IEC 60664-1**
  - Rated insulation voltage: DC 100 V
  - Rated impulse voltage/pollution degree: 800 V/3
  - Overvoltage category: II

- **Output Z1/Z2**
  - Supply voltage: DC 41...47 V (±30 %)
  - Storage capacity to supply the undervoltage and overvoltage relays: min. 5 s (±0.5 s)
  - Recovery time: ≤ 60 s
  - Internal fuse, triggered in case of incorrect connection: yes

- **Environment/EMC**
  - EMC immunity: acc. to IEC 61000-6-2
  - EMC emission: acc. to IEC 61000-6-4

- **Connection**
  - Connection: screw-type terminal
  - Connection properties:
    - single wire: 2 x (0.5…4) mm²
    - Flexible with end ferrule: 2 x (0.5…2.5) mm²

- **Other**
  - Operating mode: continuous operation
  - Mounting: any position
  - DIN rail mounting acc. to: IEC 60715
  - Flammability class: UL94V-0
  - Documentation number: D00086
  - Weight: ≤ 160 g

---

**Dimension diagram** (dimensions in mm)

![Dimension diagram](image)

**Wiring diagram**

![Wiring diagram](image)

<table>
<thead>
<tr>
<th>1</th>
<th>Energy backup</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Undervoltage/overvoltage relay</td>
</tr>
</tbody>
</table>

---

**Approvals**

- CE
- UK
- CA

---

**Dimension diagram**

- **Dimension (dimensions in mm)**
  - 45
  - 45
  - 70.5
  - 45
  - 44
  - 20
  - 10
  - 45
  - 32.5
  - 52.5

---

**Wiring diagram**

- **ES258**
  - Z+ Z-

- **VMD258**
  - Z+ Z-

- **max. 0,5 m**
**LINETRAXX® VMD420**

Multi-functional voltage relay for 3(N)AC systems, frequency/overvoltage/undervoltage, phase, phase failure, asymmetry

### Device features
- Undervoltage, overvoltage and frequency monitoring in 3(N)AC systems 0…500 V
- Asymmetry, phase failure and phase sequence monitoring
- Various monitoring functions selectable $U_<$, $U_>$, $f_<$, $f_>$
- Start-up delay, response delay and delay on release
- Adjustable switching hysteresis
- RMS value measurement (AC+DC)
- Digital measured value display via multi-functional LC display
- Preset function (automatic setting of basic parameters)
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays (one changeover contact each)
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device setting
- Sealable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)
- RoHS compliant

### Typical applications
- Monitoring of voltage-sensitive machines and electrical installations
- Switching machinery and equipment on and off at a certain voltage level
- Monitoring of stand-by and emergency supply systems
- Supply voltage monitoring of portable loads
- Protection of three-phase motors against phase failure and phase open-circuit
- Transformer protection, asymmetrical load can be recognised

### Approvals

### Further information

For further information refer to our product range on www.bender.de.

### Ordering information

<table>
<thead>
<tr>
<th>Supply voltage $U_s$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$16...72$ V</td>
<td>AC</td>
<td>B73010005</td>
</tr>
<tr>
<td>$9.6...94$, $15...460$ Hz</td>
<td>DC</td>
<td>B93010006</td>
</tr>
<tr>
<td>–</td>
<td>AC/DC</td>
<td>B93010005</td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>B73010005</td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>B93010006</td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>B73010006</td>
</tr>
</tbody>
</table>

$^\text{I}$ Absolute values

### Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

<table>
<thead>
<tr>
<th>Rated insulation voltage</th>
<th>400 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated impulse voltage/pollution degree</td>
<td>4 kV/3</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>III</td>
</tr>
<tr>
<td>Protective separation (reinforced insulation) between</td>
<td>(A1, A2) - (N, L1, L2, L3) - (11, 12, 14) - (21, 22, 24)</td>
</tr>
<tr>
<td>Voltage test acc. to IEC 61010-1:</td>
<td>3.32 kV</td>
</tr>
<tr>
<td>- (N, L1, L2, L3) - (A1, A2), (11, 12, 14) - (21, 22, 24)</td>
<td>2.11 kV</td>
</tr>
</tbody>
</table>

Supply voltage

| VMD420-D-1: |  |
| Supply voltage $U_i$ | AC 16...72 V/DC 9.6...94 V |
| Frequency range $f_i$ | 15...460 Hz |

| VMD420-D-2: |  |
| Supply voltage $U_i$ | AC/DC 70...300 V |
| Frequency range $f_i$ | 15...460 Hz |
| Power consumption | $\leq$ 4 VA |

Measuring circuit

| Measuring range (rms value) (L-L) | 15...460 Hz |
| Measuring range (rms value) (L-N) | 15...460 Hz |
| Rated frequency $f_i$ | 15...460 Hz |
| Frequency display range | 10...500 Hz |

Response values

| Type of distribution system | 3/NAC|VAC (3AC)* |
|----------------------------|------|
| Undervoltage $U_i$ (< Alarms 2) | AC 6...500/6...288 V |
| Overvoltage $U_i$ (> Alarms 1) | AC 6...500/6...288 V |
| Resolution of setting $U$ | 1 V |

Preset function for 3AC measurement:

| Undervoltage $U_i$ (< 0.85 $U_n$)* for $U_n = 400/208$ V | 340/177 V |
| Overvoltage $U_i$ (> 1.0 $U_i$)* for $U_i = 400/208$ V | 440/229 V |
| Resolution of setting $U$ | 1 V |

Display values

| Asymmetry | S...30 % (30 %)* |
| Phase failure | by setting the asymmetry |
| Phase sequence | clockwise/anticlockwise rotation (off)* |
| Relative uncertainty, voltage at 50/60 Hz | $\pm 1.5 \%$, $\pm 2 \%$ digits |
| Relative uncertainty, voltage in the range 15...460 Hz | $\pm 3 \%$, $\pm 2 \%$ digits |
| Hysteresis $U$ | 1...40 Hz (5 %)* |
| Underfrequency Hz < | 1...40 Hz (5 %)* |
| Overfrequency Hz > | 1...40 Hz (5 %)* |
| Resolution of setting $f$ (10.0...99.9 Hz) | 0.1 Hz |
| Resolution of setting $f$ (100...500 Hz) | 1 Hz |

Preset function:

| Underfrequency for $f_i = 400/60/50/16.7$ Hz | 399/59/49/15.7 Hz |
| Overfrequency for $f_i = 400/60/50/16.7$ Hz | 401/61/51/17.7 Hz |
| Hysteresis, frequency $f_i$ | 0...1.2 Hz (0.2 Hz)* |
| Relative uncertainty, frequency range 15...460 Hz | $\pm 0.2 \%, \pm 1 \%$ digit |

Time response

| Time response |  |
| Start-up delay $t_0$ | 0...300 $\mu s$ |
| Response delay for $t = 1/2$ | 0...300 $\mu s$ |
| Delay on release $t_d$ | 0...300 $\mu s$ (0.5 $\mu s$) |
| Resolution of setting $t$, $t_{f0}$, $t_{af}$, $t_{0}$...10 s | 0.1 $s$ |
| Resolution of setting $t$, $t_{f0}$, $t_{af}$, $t_{0}$...99 s | 1 $s$ |
| Resolution of setting $t$, $t_{f0}$, $t_{af}$, $t_{0}$...300 s | 10 s |
| Operating time, voltage $t_{op}$ | $\leq 140$ ms |
| Operating time, frequency $t_{op}$ | $\leq 245$ ms |
| Response time $t_{rw}$ | $t_{aw} = t_{aw} + t_{aw}$ |
| Recovery time $t_{rw}$ | $\leq 300$ ms |

Displays, memory

| Display LC display, multifunctional, not illuminated |
| Display range measured value | AC/DC 0...500 V |
| Operating uncertainty, voltage at 50 Hz/60 Hz | $\pm 1.5 \%$, $\pm 2 \%$ digits |
| Operating uncertainty, voltage in the range of 15...460 Hz | $\pm 3 \%$, $\pm 2 \%$ digits |
| Operating uncertainty, frequency in the range of 15...460 Hz | $\pm 0.2 \%, \pm 1 \%$ digit |
| History memory (HS) for the first alarm value | data record measured values |
| Password | off/0...999 (off/0)* |
| Fault memory (M) alarm relay | on/off/con (on)* |

Switching elements

| Number | 2 x 1 changeover contacts (K1, K2) |
| Operating principle | N/C operation n.c. or N/O operation n.o. |
| K1: Err, U < $U_i$, $A_y$, Hz < $Hz >$, PHS, S.AL (undervoltage $U_i$ < asymmetry $Asy$, N/C operation n.o.)* |
| K1: Err, U < $U_i$, $A_y$, Hz < $Hz >$, PHS, S.AL (overvoltage $U_i$ > asymmetry $Asy$, N/O operation n.o.)* |
| Electrical endurance, number of cycles | 10,000 |

Contact data acc. to IEC 60947-5-1:

| Utilisation category | AC-13 AC-14 DC-12 DC-12 DC-12 |
| Contact data acc. to IEC 60947-5-1: |  |
| Electrical endurance, number of cycles | 10,000 |

Environment/EMC

| Ambient temperatures: |  |
| Operation | -25...+55 °C |
| Transport | -25...+50 °C |
| Storage | -25...+55 °C |

Classification of climatic conditions acc. to IEC 60721

| Stationary use (IEC 60721-3-3) | 3K23 (no condensation, no formation of ice) |
| 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 | screw-type terminal or push-wire terminal |
| Connection properties |  |
| rigid | 0.2...4 $mm^2$ (AWG 24...12) |
| flexible | 0.2...2.5 $mm^2$ (AWG 24...14) |
| Two conductors with the same cross section |  |
| rigid/flexible | 0.2...1.5 $mm^2$ (AWG 24...16) |
| Stripping length | 8 mm |
| Tightening torque, terminal screws | 0.5...0.6 Nm |

Connection properties rigid:

| Connection properties |  |
| without females | 0.75...2.5 $mm^2$ (AWG 19...14) |
| with females | 0.2...1.5 $mm^2$ (AWG 24...16) |
| Stripping length | 10 mm |
| Opening force | 50 N |
| Test opening, diameter | 2.1 mm |

Other

| Operating mode | continuous operation |
| Mounting | any position |
| Degree of protection, internal components (DIN EN 60529) | IP30 |
| Degree of protection, terminals (DIN EN 60529) | IP20 |
| Enclosure material | polycarbonate |
| Screw mounting | 2 x M4 with mounting clip |
| DIN rail mounting acc. to | IEC 60715 |
| Flammability class | UL94 V-0 |
| Screw terminals |  |
| Utilisation category | AC-13 AC-14 DC-12 DC-12 DC-12 |
| Contact data acc. to IEC 60947-5-1: |  |
| Electrical endurance, number of cycles | 10,000 |

| Classification of climatic conditions acc. to IEC 60721 |  |
| Classification of mechanical conditions acc. to IEC 60721 |  |

311
| Dimension diagram (dimensions in mm) |

| Wiring diagram |

1. **L1, L2, L3, (N)** Connection to the system/load to be monitored
2. **A1, A2** Supply voltage $U_s$ (see ordering information)
3. **11, 12, 14** Alarm relay "K1": Configurable for $U<$//$U>/f<f>/Asy/PHS/ERROR
4. **21, 22, 24** Alarm relay "K2": Configurable for $U<$//$U>/f<f>/Asy/PHS/ERROR
5. **Line protection according to IEC 60364-4-43:** A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse.
LINETRAXX® VMD421H
Multi-functional voltage relay for 3(N)AC systems, frequency/overvoltage/undervoltage, phase, phase failure, asymmetry

Device features
• Undervoltage, overvoltage and frequency monitoring in 3(N)AC systems 70…500/288 V
• Without external supply voltage
• Integrated energy backup
• Asymmetry, phase failure and phase sequence monitoring
• Various monitoring functions selectable $U_\text{<}, U_\text{>}, f_\text{<}, f_\text{>}$
• Start-up delay, response delay, delay on release
• Adjustable switching hysteresis
• rms value measurement (AC+DC)
• Digital measured value display via multi-functional LC display
• Preset function (automatic setting of basic parameters)
• LEDs: Power On, Alarm 1, Alarm 2
• Measured value memory for operating value
• Continuous self monitoring
• Internal test/reset button
• Two separate alarm relays (one changeover contact each)
• N/C or N/O operation and fault memory behaviour selectable
• Password protection for device setting
• Sealable transparent cover
• Two-module enclosure (36 mm)
• Push-wire terminal (two terminals per connection)
• RoHS compliant

Typical applications
• Monitoring of voltage-sensitive machines and electrical installations
• Switching machinery and equipment on and off at a certain voltage level
• Monitoring of stand-by and emergency supply systems
• Supply voltage monitoring of portable loads
• Protection of three-phase motors against phase failure and phase open-circuit
• Transformer protection, asymmetrical load can be recognised

Standards
The LINETRAXX® VMD421H series complies with the requirements of the device standards:
• IEC 61010-1

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage $U_\text{n}$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$3$ $\text{AC}$ $70…500/15…460$ $\text{Hz}$</td>
<td>VMD421H-D-3</td>
<td>B93010007</td>
</tr>
</tbody>
</table>

1) Absolute values

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>

6.2
Technical data

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**

- **Rated insulation voltage**: 400 V
- **Rated impulse voltage/pollution degree**: 4kV/3
- **Overvoltage category**: III
- **Protective separation (reinforced insulation)** between:
  - (N, L1, L2, L3) - (11, 12, 14)
  - (N, L1, L2, L3) - (21, 22, 24)
- **Voltage test acc. to IEC 60101-1**:
  - (N, L1, L2, L3) - (11, 12, 14) 3.32 kV
  - (N, L1, L2, L3) - (21, 22, 24) 2.21 kV

**Supply voltage**

- **Supply voltage U_s**: none (internally supplied by U_b)
- **Power consumption**: ≤ 6 VA

**Measuring circuit**

- **Measuring range (rms value) (L-N)**: AC 0…288 V
- **Measuring range (rms value) (L-L)**: AC 0…500 V
- **Rated frequency f_s**: 15…460 Hz
- **Frequency display range**: 10…500 Hz

**Response values**

- **Type of distribution system**: UNIAC/3AC (3AC)*
- **Undervoltage U < (Alarm 1)**: measurement method: 3Ph/3n AC 70…500 V/70…288 V
- **Overvoltage U > (Alarm 1)**: measurement method: 3Ph/3n AC 70…500 V/70…288 V
- **Resolution of setting U**: 1 V
- **Undervoltage category III**:
  - f < (0.85 U) for U_s = 400/208 V 340/177 V
  - f < (0.85 U) for U_s = 400/208 V 440/229 V
- **Undervoltage for (1.1 U) for U_s = 430/215 V**: 196/102 V
- **Overvoltage for (1.1 U) for U_s = 230/120 V**: 253/132 V
- **Asymmetry**: 5…30 % (30 %)*

**Phase failure**

- **Phase sequence**: clockwise/anticlockwise rotation (off)*
- **Relative uncertainty, voltage at 50/60 Hz**: ±1.5 %, ±2 digits
- **Hysteresis U**: 1…40 % (5 %)*

**Underfrequency**

- **Underfrequency H <**: 10…500 Hz
- **Overfrequency H >**: 10…500 Hz
- **Resolution of setting f**: 100 Hz
- **By preset function**: 1 Hz
- **Underfrequency for f_s = 400/600/50/16.7 Hz**: 399/59.5/49.5/16.7 Hz
- **Overfrequency for f_s = 400/600/50/16.7 Hz**: 401/60.5/50.6/17.2 Hz
- **Hysteresis frequency Hz**: 0.2…2 Hz (0.2 Hz)*

**Relative uncertainty, frequency in the range of 15…460 Hz**: ±0.2 %, ±1 digit

**Time response**

- **Start-up delay t**
  - 0…300 s (0 s)*
- **Response delay f_{rel/2}**
  - 0…300 s (0 s)*
- **Delay on release t_{ae}**
  - 0…300 s (0.5 s)*
- **Operating time, voltage f_{op}**
  - ≤ 140 ms
- **Operating time, frequency f_{op}**
  - ≤ 335 ms
- **Response time f_{res} = f_{op} + f_{rel/2}**
  - 2.5 s
- **Discharging time energy backup on power failure**
  - 60 s
- **Recovery time t_e**: ≤ 300 ms

**Displays, memory**

- **Display**: LC display, multifunctional, not illuminated
- **Display range measured value**: AC/DC 0…500 V
- **Operating uncertainty, voltage at 50/60 Hz**: ±1.5 %, ±2 digits
- **Operating uncertainty voltage in the range of 15…460 Hz**: ±3 %, ±2 digits
- **Operating uncertainty, frequency in the range of 15…460 Hz**: ±0.2 %, ±1 digit
- **History memory (H) for the first alarm value**: data record measured values
- **Password**: Off/0…999 (OFF)*
- **Fault memory (M) alarm relay**: on/off (on)*

**Switching elements**

- **Number**: 2 x 1 changeover contacts (K1, K2)
- **Operating principle**: N/C operation n.c. or N/O operation n.o.
- **K2: Err, U <, U >, Hz <, Hz >, PHS (undervoltage U <, asymmetry Asy, N/C operation n.c.)*
- **K1: Err, U <, U >, Hz <, Hz >, PHS (overvoltage U >, asymmetry Asy, N/O operation n.o.)*
- **Electrical endurance, number of cycles**: 10,000
- **Fault memory on/off (on)*

**Contact data acc. to IEC 60947-5-1**

<table>
<thead>
<tr>
<th>Utilisation category</th>
<th>AC-13</th>
<th>AC-14</th>
<th>DC-12</th>
<th>DC-12</th>
<th>DC-12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated operational voltage</td>
<td>230 V</td>
<td>230 V</td>
<td>24 V</td>
<td>110 V</td>
<td>220 V</td>
</tr>
<tr>
<td>Rated operational current</td>
<td>5 A</td>
<td>3 A</td>
<td>1 A</td>
<td>0.2 A</td>
<td>0.1 A</td>
</tr>
<tr>
<td>Minimum contact rating</td>
<td>1 mA at AC/DC ≥ 10 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Environment/EMC**

<table>
<thead>
<tr>
<th>EMC</th>
<th>IEC 61326-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Operating temperature</td>
<td>-25…+55 °C</td>
</tr>
</tbody>
</table>

**Classification of climatic conditions acc. to IEC 60721**

- **Stationary use (IEC 60721-3-3)**: 3K23 (no condensation, no formation of ice)
- **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**: screw-type terminal or push-wire terminal
- **Connection screw terminals**
  - **Connection properties**: rigid
  - **rigid**: 0.2…4 mm² (AWG 24…12)
  - **flexible**: 0.2…2.5 mm² (AWG 24…14)
  - Two conductors with the same cross section
  - **rigid/flexible**: 0.2…1.5 mm² (AWG 24…16)
  - **Stripping length**: 8 mm
  - **Tightening torque, terminal screws**: 0.5…0.6 Nm
- **Connection push-wire terminals**
  - **Connection properties**: rigid
  - **rigid**: 0.2…2.5 mm² (AWG 24…14)
  - **flexible**: 0.75…2.5 mm² (AWG 19…14)
  - **without ferrules**: 0.2…1.5 mm² (AWG 24…16)
  - **Stripping length**: 10 mm
  - **Opening force**: 50 N
  - **Test opening, diameter**: 2.1 mm

**Other**

- **Operating mode**: continuous operation
- **Mounting position**: vertically, see dimension diagram
- **Degree of protection, internal components (IEC 60529)**: IP30
- **Degree of protection, terminals (IEC 60529)**: IP30
- **Enclosure material**: polycarbonate
- **Screw mounting**: 2 x M4 with mounting clip
- **DIN rail mounting acc. to DIN EN 50352**: 8 DIN rail
- **Flammability class**: UL94 V-0
- **Documentation number**: D00138
- **Weight**: ≤ 240 g

(*) = factory setting
### Wiring diagram

1. **L1, L2, L3, (N)**  
   Connection to the system/load to be monitored

2. **11, 12, 14**  
   Alarm relay "K1": Configurable for \( U_< \)/\( U_> \)/\( f_< \)/\( f_> \)/Asy/PHS/ERROR

3. **21, 22, 24**  
   Alarm relay "K2": Configurable for \( U_< \)/\( U_> \)/\( f_< \)/\( f_> \)/Asy/PHS/ERROR

4. Fuse as line protection.  
   6 A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse.
LINETRAXX® VMD423/VMD423H
Three-phase voltage and frequency monitoring relay for CHPs (Combined Heat and Power plants), wind power stations, hydroelectric power plants and photovoltaic systems in accordance with DIN V VDE V 0126-1-1

**Device features**
- VMD423 with separate supply voltage
- VMD423H is supplied by the system being monitored
- Undervoltage, overvoltage and underfrequency and overfrequency monitoring in 3(N)AC systems AC 0…500 V
- Monitoring of overvoltage by average determination of the latest 10-minute measuring interval
- Asymmetry, phase failure and phase sequence monitoring
- Start-up delay, response delay and delay on release
- Adjustable switching hysteresis
- rms value measurement (AC+DC)
- Digital measured value display via multi-functional LC display
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays (one changeover contact each)
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device settings
- Sealable transparent cover
- Push-wire terminal (two terminals per connection)
- Two-module enclosure (36 mm)
- RoHS compliant

**Typical applications**
- Monitoring of automatic switching points between private electricity generation power system in parallel operation with the public low voltage grid
- Applications according to DIN V VDE V 0126-1-1 (VDE V 0126-1-1), C 10/11, EN 50438
- Universally applicable for photovoltaic systems, CHPs (Combined Heat and Power plants), wind power and hydro power plants

**Approvals**
- DIN V VDE V 0126-1-1 (France, Switzerland)
- DIN V VDE V 0126-1-1 and EN 50438 (Czech Republic)
- C 10/11 (Belgium)

**Certificates of non-objection**
- DIN V VDE V 0126-1-1 (France, Switzerland)
- DIN V VDE V 0126-1-1 and EN 50438 (Czech Republic)
- C 10/11 (Belgium)

**Further information**
For further information refer to our product range on www.bender.de.

**Ordering information**

<table>
<thead>
<tr>
<th>Supply voltage ( U_s )</th>
<th>Response value ( U_r )</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>DC</td>
<td>AC</td>
<td>Screw-type terminal</td>
</tr>
<tr>
<td>16…72 V, 15…460 Hz</td>
<td>9,6…94 V</td>
<td>10…500 V</td>
<td>VMD423-D-1</td>
</tr>
<tr>
<td>70…300 V, 15…460 Hz</td>
<td>70…300 V</td>
<td>10…500 V</td>
<td>VMD423-D-2</td>
</tr>
<tr>
<td>( U_b )</td>
<td>( U_r )</td>
<td>70…500 V</td>
<td>VMD423H-D-3</td>
</tr>
</tbody>
</table>

1) Absolute values

**Accessories**

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

- Rated insulation voltage: 400 V
- Rated impulse voltage/pollution degree: 4 kV/t3
- Overvoltage: III
- Protective separation (reinforced insulation) between voltage levels: (A1, A2) - (N, L1, L2, L3) - (11, 12, 14) - (21, 22, 24)

Voltage test according to IEC 61010-1:
- VMD423 and VMD423H: (N, L1, L2, L3) - (A1, A2), (11, 12, 14) - (21, 22, 24) ≤ 3.32 kV
- Voltage test according to IEC 61010-1:
  - (A1, A2) - (N, L1, L2, L3) - (11, 12, 14) - (21, 22, 24) ≤ 2.21 kV

Supply voltage

- VMD423-D-1:
  - Supply voltage U1: AC/DC 16…72 V/DC 96…94 V
  - Frequency range f1: 15…460 Hz

- VMD423-D-2:
  - Supply voltage U2, frequency f2: ≤ 80 ms
  - Power consumption P: 4 VA

- VMD423H-D-3:
  - Supply voltage U3:
    - AC/DC 70…300 V
    - Frequency range f3: 15…460 Hz
    - Power consumption P: ≤ 6 VA

Measuring circuit

- Measuring range (rms value) (L-N) AC: 0…288 V
- Measuring circuit range (rms value) (L-N) AC: 0…500/10…288 V
- Frequency display range: 25…100 Hz

Response values

- Type of distribution system: 3(N)AC/3AC (3(N)AC)*

Resolution of setting

- Time response
  - Start-up delay t1 ≤ 30 ms
  - Response delay t2 ≤ 80 ms
  - Delay on release t2 ≤ 20 s
  - Resolution of setting t, fmax, fmin/2 (8…10 s)

- Operating time t2 ≤ 10 s
- Operating time, frequency fmax ≤ 80 ms
- Response time t2 ≤ 0.1 s
- Recovery time t1 ≤ 300 ms

- Discharging time energy backup on power failure for VMD423H: ≥ 2.5 s
- Charging time energy backup for VMD423H: ≤ 60 s

Technical data

Displays, memory

- Display: LC display, multifunctional, not illuminated
- Display range measured value: AC/DC 0…500 V
- Operating range, voltage at 50/60 Hz: ±1.5 %, ±2 digits
- Operating range, frequency in the range of 40…65 Hz: ±0.1 Hz, ±3 digit
- History memory (HIS) for the first alarm value: data record measured values
- Password: off/on/0…999 (on/126)*
- Fault memory (M) alarm relay: on/off/conv.(OFF)*

Switching elements

- Number: 2 x 1 changeover contacts (K1, K2)
- Operating principle K1/K2: N/O operation n.o/N/C operation n.c
- Underfrequency Hz <, overfrequency Hz >, asymmetry Asy
- Underfrequency Hz <, overfrequency Hz >, alarm when starting SAL, N/C operation n.c.
- K2: Device error Err, underfrequency U, overfrequency U, asymmetry Asy, underfrequency Hz <, overfrequency Hz >, phase sequence PH
- Operating principle: ≤ 80 ms, ≤ 300 ms
- Supply voltage U: AC/DC 70…300 V
- Power consumption P: 4 VA

EMC

- Environment/EMC: IEC 61326-1
- Operating temperature: -25…+55 °C

Classification of climatic conditions acc. to IEC 60721

- Stationary use (IEC 60721-3-3): 3K23 (no condensation, no formation of ice)
- 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: screw-type terminal or push-wire terminal connection

Connection

- Connection properties:
  - rigid: 0.2…4 mm² (AWG 24…12)
  - flexible: 0.2…2.5 mm² (AWG 24…14)
- Two conductors with the same cross section
  - rigid/flexible: 0.2…15 mm² (AWG 24…16)

- Stripping length:
  - Tightening torque, terminal screws: 0.6…0.8 Nm
  - Flexible: 0.8…2.5 mm² (AWG 24…14)
  - Rigid: 0.2…1.5 mm² (AWG 24…12)

- Opening force: 50 N
- Test opening, diameter: 2.1 mm

Other

- Operating mode: continuous operation
- Mounting:
  - Degree of protection, terminals (IEC 60529): IP30
  - Degree of protection, internal components (IEC 60529): IP30
- Enclosure material:
  - Poly carbonate:
  - Screw mounting: 2 x M4 with mounting clip
  - DIN rail mounting acc. to:
    - IEC 60715
  - Flammability class:
    - UL94V-0
  - Document number:
    - D00139 (VMD423)
    - D00140 (VMD423H)
- Weight:
  - ≤ 150 g (VMD423)
  - ≤ 240 g (VMD423H)

(*) = Factory setting
**Dimension diagrams (dimensions in mm)**

**VMD423**

**VMD423H**

**Wiring diagram – VMD423**

1. L1, L2, L3, (N) Connection to the system/load to be monitored
2. A1, A2 Supply voltage Uₚ (see ordering information)
3. 11, 12, 14 Alarm relay “K1”: Configurable for U/U₁/U₂/f/f/Asy/PHS/ERROR

**Wiring diagram – VMD423H**

1. L1, L2, L3, (N) Connection to the system/load to be monitored
2. 11, 12, 14 Alarm relay “K1”: Configurable for U/U₁/U₂/f/f/Asy/PHS/ERROR
3. 21, 22, 24 Alarm relay “K2”: Configurable for U/U₁/U₂/f/f/Asy/PHS/ERROR
4. Fuse as line protection.
6 A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse
LINETRAXX® VMD460-NA
Network and system protection (NS protection) for monitoring the power feed-in of power generation systems

Device features
- Monitoring of different system types: 1AC, 3AC, 3NAC
- Continuous monitoring of the phase voltage and line-to-line voltage
- (Re)connection and monitoring of the conditions
- Reconnection after
  - short interruptions
  - df/dt detection (ROCOF)
  - vector shift detection
- Voltage protection functions $U_<$, $U_<<$, $U_>>$ and $U_>$
- Frequency protection functions $f_<$, $f_<<$, $f_>>$ and $f_>$
- Islanding detection df/dt (ROCOF), vector shift detection
- Unbalance detection
- Monitoring of the tripping circuits and interface switches by means of contact feedback
- Remote trip: remote disconnection via ripple-control receiver
- Test function for checking the tripping circuit, the interface switch and for determining the connection times
- Automatic self test
- Password protection
- Reset device to factory settings
- History memory of the last 300 faults with time stamp (real-time clock)
- Language selection (German, English, Italian)
- Remote configuration and remote maintenance using COM465IP and/or CP9…-I (RS-485)
- Backlit graphic LC display
- Sealable enclosure
- Single-fault tolerance

Typical applications
- Central NS protection (VDE-AR-N 4105)
- Protective disconnection (VDE-AR-N 4110, BDEW)
- Interface Protection (IP) (Engineering Recommendations; EREC G99, G59, G83, G59)
- Protezione di interfaccia (CEI 0-21)
- Automatic disconnection device between a generating plant parallel to the network and the public network
- Universal for generating plants for safe network decoupling

Standard/application guide
- VDE-AR-N 4105:2018-09
- VDE-AR-N 4105:2011-08
- VDE-AR-N 4110:2018-11
- BDEW-Richtlinie 2008 einschl. Ergänzungen bis 01.2013
- C10/11:2012-06
- G98/1-4:2019
- G83/2:2012
- G99/1-4:2019
- G59/3:2013
- G59/2(-1:2011
- UL File No. E173157

Approvals

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage $U_s$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>VMD460-NA-D-2</td>
<td>B93010045</td>
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</tbody>
</table>

Device version with push-wire terminal on request.

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
Technical data

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**

- **Rated voltage**: 400 V
- **Rated impulse voltage/Overvoltage category**: 6 kV/III
- **Pollution degree**: 2
- **Protective separation (reinforced insulation) between (A1, A2) - (L1, L2, L3, N) - (11, 12, 21, 22, 24) (D1, D2, D3, D4, DG1/2, DG3/4, RTG, RT1)- (A1, A2, L1, L2, L3, N)**
- **Voltage test according to IEC 61010-1**: (N, L1, L2, L3) - (A1, A2), (11, 12, 21, 22, 24) 3.32 kV

**Supply voltage**

- **Nominal supply voltage** ($U_S$): AC/DC 100…240 V DC/50/60 Hz
- **Operating range** ($U_S$): AC/DC 75…300 V DC/40…70 Hz
- **Power consumption at AC 230 V**: < 7.5 VA/ < 3.5 W maximum 9 VA/3.5 W
- **Bridging time at $U_S$ = 230 V and dip to 0 V**: 600 ms

**Measuring circuit**

- **Nominal system voltage** ($U_n$): (r.m.s. value) (L-N) AC 0…300 V
- **Nominal system voltage** ($U_n$): (r.m.s. value) (L-L) AC 0…520 V
- **Input impedance (Load) L1, L2, N**: 480 kΩ
- **Input impedance (Load) L3**: 680 kΩ
- **Rated frequency** ($f_n$): ($U_n > 20 V$) 45…65 Hz

**Response values**

- **System type**: 1AC: 230 V, 50 Hz
- **3(N)AC: 400/230 V, 50 Hz**
- **Relative uncertainty, voltage** ($U \leq 280 V$): ± 1 %
- **$U > 280 V$: ± 3 %**
- **Resolution of setting, voltage**: 1 %
- **Nominal frequency**: 50 Hz
- **Relative uncertainty, frequency**: ≤ ±0.1 %
- **Resolution of setting $f$**: 0.05 Hz

**Recording of measured value, switching condition (reconnection and disconnection)**

- **L-N, L-L**: $f_\leq, f_< 45…60$ Hz
- **$f_> 50…65$ Hz

**Recording of measurement value, condition for disconnection**

- **$df/dt$**: 0.05…9.9 Hz/s

**Time response**

- **Delay time for connection $t_{con}$**: 40 ms…60 min
- **Resolution of setting $t_{con}$**
  - < 50 ms: 5 ms
  - 50…200 ms: 10 ms
  - 200 ms…5 s: 50 ms
  - 5…10 s: 0.1 s
  - 10 s…60 s: 1 s
  - 60…300 s: 10 s
  - 300 s…60 min: 1 min
- **Operating time voltage $t_{cos}$**: half a supply period
- **Operating time, frequency $t_{con}$**: ≤ 40 ms
- **Recovery time $t_b$**: 300 ms

**Digital inputs**

- **Monitoring of potential-free contacts or voltage inputs**: closed = low; 0…4 V, $U_{IN} < -5 mA$
  - open = high; > 6…≤ 30 V
- **D1**: feedback signal contact K1
- **D2**: feedback signal contact K2
- **D3**: local control (mode)
- **D4**: external signal (mode) RT1 remote trip
- **DG1/2, DG3/4, RTG**: GND
- **Max. length of the connecting cables of digital inputs**: 3 m

**Displays, memory**

- **Display**: LC display, multi-functional, illuminated
- **Display range, measured value**: AC/DC 0…520 V
- **Operating uncertainty, voltage**: $U \leq 280 V$: ± 1 %
- **$U > 280 V$: ± 3 %
- **Resolution of setting $f$**: 0.05 Hz
- **Recording of measured values**: 1 data record of measured values each
- **Password**: off/on/0…999 (off)*

**Switching elements**

- **Number of changeover contacts**: 2 x 1 (K1, K2)
- **Operating mode**: NC operation/NO operation
- **Electrical endurance in rated operating conditions**: 10,000 cycles

**Contact data acc. to IEC 60947-5-1**

- **Utilisation category**: AC-13, AC-14, DC-12, DC-12, DC-12
- **Rated operational voltage**: 230 V, 230 V, 24 V, 110 V, 220 V
- **Rated operational current**: 4 A**, 5 A, 3 A, 1 A, 0.2 A, 0.1 A
- **Minimum contact rating**: 10 mA/5 V DC

**Environment/EMC**

- **EMC**: DIN EN 60255-26/CEI 0-21
- **Operating temperature**: -25…+55 °C

**Classification of climatic conditions acc. to IEC 60721**

- **Stationary use (IEC 60721-3-3)**: 3K23 (except condensation and formation of ice)
- **Transport (IEC 60721-3-2)**: 2K11 (except condensation and formation of ice)
- **Long-term storage (IEC 60721-3-1)**: 1K22 (except condensation and formation of ice)

**Classification of mechanical conditions acc. to IEC 60721**

- **Stationary use (IEC 60721-3-3)**: 3M11
- **Transport (IEC 60721-3-2)**: 2M2
- **Long-term storage (IEC 60721-3-1)**: 1M22

**Connection**

- **Connection type**: screw-type terminals or push-wire terminals
- **Connection properties**: rigid 0.2…4 mm² (AWG 24…12)
  - flexible 0.2…2.5 mm² (AWG 24…14)
- **Stripping length**: 8…9 mm
- ** Tightening torque**: 0.5…0.6 Nm

**Other**

- **Operating mode**: continuous operation
- **Mounting**: any position
- **Degree of protection, internal components (DIN EN 60529)**: IP30
- **Degree of protection, terminals (DIN EN 60529)**: IP20
- **Enclosure material**: polycarbonate
- **Flammability class**: UL 94 V-0
- **DIN rail mounting acc. to**: IEC 60715
- **Screw mounting**: 2 x M4 with mounting clip
- **Documentation number**: D00001
- **Weight**: ≤ 360 g

*(*) = Factory setting
**Wiring diagram VMD460 (VDE-AR-N 4105:2018 – basic program 4105_2)**

1. **A1, A2** Supply voltage $U_s$ (see ordering details)
2. **L1, L2, L3, N** Power supply connection
3. **K1, K2** Relay connections
4. **DG1/2, D1** Central interface switch with contact monitoring
   - D1: Feedback signal contact K1 (feedback signal contacts optionally NC/NO/off)*
5. **RTG, RT1**
   - RTG: GND
   - RT1: remote trip input (optionally NC/NO/off)*
6. **A, B** Service interface
7. **Ron/off** Activate or deactivate the terminating resistor of the service interface (120 Ω)
8. **DG1/2, D2** Generating unit (in this case PV inverter with an integrated interface switch and contact monitoring)
   - D2: Feedback signal contact K2 (feedback signal contacts optionally NC/NO/off)*

*NO (in non-operating state open)\n**NC (in non-operating state closed)\noff (contact monitoring switched off)
Within the scope of VDE-AR-N 4110, the VMD460-NA can be used as protective disconnection device for the generating unit or as higher-level protective disconnection, the latter, however, only if the Q-U protection function may be dispensed with. According to VDE-AR-N 4110 chapter 10.3.3.4 par. 5, this is possible after consultation with the network operator and under the following conditions:

- Generating plants with limited dynamic network support or
- Generating plants < 1 MVA

Both types of application are possible when the generating plant is connected to the busbar of a substation (MV-busbar) or when the generating plant is connected to the medium-voltage network (MV-network).

---

1. A1, A2  
   Supply voltage $U_s$ (see ordering details)

2. L1, L2, L3, N  
   Power supply connection

3. K1, K2  
   Relay connections

4. DG1/2, D1, D2  
   Contact monitoring coupling switch DG1/2: GND
   D1: Feedback signal contact K1
   D2: Feedback signal contact K2
   (feedback signal contacts optionally NC/NO/off)*

5. RTG, RT1  
   RTG: GND
   RT1: remote trip input (optionally NC/NO/off)*

6. A, B  
   Service interface

---

7. \text{**on/off**}  
   Activate or deactivate the terminating resistor of the service interface (120 Ω)

8. RE  
   Ripple-control receiver

9. K3  
   External relay with an N/C contact and an N/O contact

10. K4  
    External relay with two N/O contacts

11. DG3/4, D3, D4  
    Not used for the standard mentioned before

* NO (in non-operating state open)  
  NC (in non-operating state closed)  
  off (contact monitoring switched off)
1. A1, A2  
   Supply voltage U\textsubscript{s}  
   (see ordering details)

2. L1, L2, L3, N  
   Power supply connection

3. K1, K2  
   Relay connections

4. DG1/2, D1, D2  
   Contact monitoring, coupling switch  
   DG1/2: GND  
   D1: Feedback signal contact K1  
   D2: Feedback signal contact K2  
   (feedback signal contacts optionally NC/NO/off) *

5. DG3/4, D3, D4  
   Digital inputs (external monitoring)  
   DG3/4: GND  
   D3: local control (CEI 0-21 8.6.2.1.1)**  
   D4: external signal (CEI 0-21 8.6.2.1.2)**  
   (optionally NC/NO/off)**

6. RTG, RT1  
   RTG: GND  
   RT1: Remote trip input (optionally NC/NO/off)*

7. A, B  
   Service interface

8. R\text{on/off}  
   Activate or deactivate the terminating resistor of the BMS bus (120 Ω)

* NO (in non-operating state open)  
NC (in non-operating state closed)  
off (contact monitoring switched off)

** In order to evaluate the inputs D3 and D4, the mode can be adjusted correspondingly in the menu (menu: 3. Settings --> 1. General --> 4. Mode)
LINETRAXX® VMD461 with CD440 coupling device
Multifunctional voltage relay for AC, DC, 3(N)AC systems

Device features

• When combined with a CD440 coupling device, DC systems up to 1200 V, 1AC systems up to 690 V, 3AC systems up to 1200 V and 3NAC systems up to 690 V can be monitored
• All functions are represented in ANSI codes
• Monitoring of DC, 1AC, 3(N)AC systems DIN EN 60255-1:2010-9
• Single-fault safety
• Unbalance, phase failure and phase sequence monitoring
• Monitoring of the connected switches and/or disconnectors (configurable: NC/NO/off)
• Islanding detection df/dt (ROCOF)
• Vector shift function
• RS-485 interface (data exchange/parameter setting/software update)
• Test function to determine the switch-off time
• Test button for the trigger circuit
• The last 300 network faults can be recalled with time stamp/real-time clock
• Continuous monitoring of the phase voltage and line-to-line voltage
• Special switch-on conditions after an infringement of a response value
• Language selection (German, English, French)
• Backlight graphic LC display
• Password protection for device setting
• Remote shutdown via ripple control signal receiver
• Sealable enclosure

Standards
The device fulfils the requirements of the following standards:
• DIN EN 60255-127 (IEC 60255-127)
• VDE 0435-3127
• UL File: E173157

Further information
For further information refer to our product range on www.bender.de.

Typical applications

• Monitoring of voltage-sensitive machines and installations
• Switching installations on and off at a certain voltage level
• Protection of three-phase motors against phase failure and phase open-circuit
• Vector shift detection for protection of electrical machines
• Islanding detection ROCOF (rate of change of frequency)
• Transformer protection by recognising asymmetrical load

Ordering information

<table>
<thead>
<tr>
<th>Description</th>
<th>Supply voltage U, Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multifunctional voltage relay</td>
<td>100...240 V</td>
<td>VMD461-D-2 B93010047</td>
</tr>
<tr>
<td>Coupling device</td>
<td>–</td>
<td>CD440    B73010046</td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting</td>
<td>B98060008</td>
</tr>
<tr>
<td>(1 piece per device)</td>
<td></td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Device variants / Supply voltage U, Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition Monitor</td>
<td>with an integrated gateway: Bender system/Ethernet</td>
<td>COM465IP</td>
<td>B950610… 403</td>
</tr>
<tr>
<td>RS-485 repeater</td>
<td>AC/DC 24 V ± 20 %</td>
<td>DI-1PSM</td>
<td>B95012044 – 417</td>
</tr>
</tbody>
</table>
### Technical data

#### Insulation coordination of the device combination VMD461/CD440:

- Rated voltage ≤ 1000 V acc. to IEC 60664-1/IEC 60664-3
- Rated voltage > 1000 V acc. to EN 50178:1998

#### Definitions

- Measuring circuit (IC1) CD440 (L1, L2/DC+, L3, N/DC–)
- Measuring circuit (IC2) VMD461 (L1, L2/DC+, L3, N/DC–)
- Supply circuit (IC5) VMD461 (A1, A2)
- Control circuit (IC4) VMD461 (D1, D2, DG1/2, RTG, RT1)
- Output circuit 1 (IC5) VMD461 (11, 12, 14)
- Output circuit 2 (IC6) VMD461 (21, 22, 24)
- Output circuit 3 (IC7) VMD461 (A, B)

#### Rated voltage

- IC1 DC, 3AC, 1200 V
- 1AC, 3NAC, 690 V
- IC2 400 V
- IC3 250 V
- IC5, IC6 250 V

#### Rated impulse voltage

- Overvoltage category III
- Max. altitude 2000 m
- IC1/IC2…IC6 DC, 3AC, 1250 V
- 1AC, 3NAC, 800 V
- IC2/IC3…IC6 400 V
- IC3/IC4…IC5 400 V
- IC4/IC5…IC6 400 V
- IC5/IC6 400 V

#### Rated insulation voltage

- Pollution degree 3
- DC, 3AC, 3NAC: 690 V
- Overvoltage category III
- Nominal frequency range: DC, 50/60 Hz
- Overload capacity 1.5 x

#### Protective separation (reinforced insulation):

- IC1/IC3…IC6 DC, 3AC, Overvoltage category III, 1250 V
- 1AC, 3NAC: Overvoltage category III, 1000 V
- IC2/IC3…IC6 300 V
- IC3/IC4…IC5 300 V
- IC4/IC5…IC6 300 V
- IC5/IC6 300 V

#### Voltage test (routine test ) acc. to IEC 60255-27/DIN EN 50178:1998

- IC2/IC3…IC6 2.21 kV
- IC3/IC4…IC5 2.21 kV
- IC4/IC5…IC6 2.21 kV
- IC5/IC6 2.21 kV

#### Supply voltage

- Nominal supply voltage Uᵢ
- Tolerance Uᵢ
- ±25 %
- Nominal frequency range Uᵢ
- DC, 50/60 Hz
- Power consumption at AC 230 V < 3.5 W/ < 7.5 VA

#### Measuring circuit

- VMD461 System type DC, 1AC, 3AC, 3NAC
- Nominal voltage Uᵢ
- L–N
- AC 50…260 V
- L–L
- AC 87…450 V
- (DC+/DC–)
- DC 50…450 V

#### Measuring range

- 0…1.15 x Uᵢ
- Overload capacity 1.5 x Uᵢ, max for 5 s
- Response values 1…150 %
- Operating uncertainty Uᵢ
- ≤ ±1 %
- Resolution of setting Uᵢ
- 1 %
- Rated frequency DC, 50/60 Hz
- Frequency range Uᵢ
- DC, 45…65 Hz
- Resolution of setting f
- 0.05 Hz
- Relative uncertainty f
- ≤ ±0.1 %
### Technical data (continued)

#### Switching elements
- **Number of changeover contacts:** 2 x 1 (K1, K2)
- **Operating principle K1, K2:** N/C operation or N/O operation (N/C)*
- **Electrical endurance under rated operating conditions, number of cycles:** 10,000

#### Contact data acc. to IEC 60947-5-1:
- **Utilisation category:** AC-13, AC-14, DC-12, DC-12, DC-12
- **Rated operational voltage:** 230 V, 230 V, 24 V, 110 V, 220 V
- **Rated operational current:** 5 A, 3 A, 1 A, 0.2 A, 0.1 A
- **Minimum contact rating:** 1 mA at AC/DC ≥ 10 V

#### Environment/EMC
- **EMC:** DIN EN 60255-26
- **Operating temperature:** –25…+55 °C

#### Classification of climatic conditions acc. to IEC 60721:
- **Stationary use (IEC 60721-3-3):** 3K23 (except condensation and formation of ice)
- **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 VMD461:** screw-type terminals
- **Connection properties:**
  - Rigid: 0.2…4 mm² (AWG 24…12)
  - Flexible with ferrule: 0.2…2.5 mm² (AWG 24…14)
- **Stripping length:** 8…9 mm
- **Tightening torque:** 0.5…0.6 Nm (5…7 lb-in)

#### Connection CD440
- **Connection:** push-wire terminals
- **Rigid:** 0.2…2.5 mm² (AWG 24…14)
- **Flexible without ferrule:** 0.75…2.5 mm² (AWG 19…14)
- **Flexible with ferrule:** 0.2…1.5 mm² (AWG 24…16)
- **Stripping length:** 10 mm
- **Opening force:** 50 N
- **Test opening, diameter:** 2.1 mm

#### Other
- **Operating mode:** continuous operation
- **Mounting:** any position
- **Degree of protection, internal components (DIN EN 60529):** IP30
- **Degree of protection, terminals (DIN EN 60529):** IP20
- **Enclosure material:** polycarbonate
- **Flammability class:** UL94 V-0
- **DIN rail mounting acc. to:** IEC 60715
- **Screw mounting CD440:** 2 x M4 with mounting clip
- **Screw mounting VMD461:** 2 x M4
- **Software version, measurement technology:** D570 V1.2x
- **Software version, display:** D256 V2.3x
- **Weight:**
  - VMD461: ≤ 360 g
  - CD440: ≤ 125 g

(*) Factory setting

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### Dimension diagram (dimensions in mm)

**VMD461**
- Width: 108 mm
- Height: 93 mm
- Depth: 45 mm
- Dimensions in mm: 47.5
- Dimensions in mm: 74

**CD440**
- Width: 71.7 mm
- Height: 93 mm
- Depth: 45 mm
- Dimensions in mm: 66.9
- Dimensions in mm: 48.5
- Dimensions in mm: 62.9
Multifunctional voltage relay LINETRAXX® VMD461 with CD440 coupling device

Wiring diagram

CD440 optional
LINETRAXX® VMD461 with CD440

Measuring and monitoring relays | voltage relays
Multifunctional voltage relay LINETRAXX® VMD461 with CD440 coupling device

6.2

Connection DC: VMD461 with CD440
Connection AC: VMD461 with CD440 (earthed system)
Connection AC: VMD461 with CD440 (unearthed system)
Connection 3(N)AC: VMD461 with CD440 (earthed system)
Connection 3(N)AC: VMD461 with CD440 (unearthed system)
Possible wiring diagram with 2 circuit breakers
A1, A2 Supply voltage U, (see ordering details)
L1, L2/DC+, L3, N/DC- Power supply connection
11, 12, 14 Connection to alarm relay K1
21, 22, 24 Connection to alarm relay K2
DG1/2, D1, D2 Contact monitoring
DG1/2: GND
D1: Feedback signal contact to alarm relay K1
D2: Feedback signal contact to alarm relay K2
(feedback signal contacts optionally NC/NO/off)*
RTG, RT1 Connection to communication interface BMS bus
RT1: Remote-trip input (optionally NC/NO/off)*
A, B Connection to communication interface BMS bus
Ron/off Activate or deactivate the terminating resistor of the BMS bus (120 Ω)
Q1, Q2 Circuit breakers
* NO (closed in non-operating state)
NC (open in non-operating state)
aus (switched off)
LINETRAXX® CME420
Multi-functional current relay, AC, overcurrent/undercurrent/window discriminator function

Device features
- Undercurrent and overcurrent monitoring in AC systems 0.1…16 A without measuring current transformer
- Indirect current monitoring with standard current transformers x/1 A, x/5 A, x/10 A
- Transformation ratio n allows adaptation to all standard current transformers x/1 A, x/5 A, x/10 A
- Different monitoring functions selectable \( I < I > \) or \( I < I > \)
- Start-up delay, response delay, delay on release
- Adjustable switching hysteresis
- r.m.s. value measurement (AC)
- Digital measured value display via multi-functional LC display
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays (one changeover contact each)
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device setting
- Sealable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)
- RoHS compliant

Typical applications
- Current consumption of motors, such as pumps, elevators, cranes
- Monitoring of lighting circuits, heating circuits, charging stations
- Monitoring of emergency lighting
- Monitoring of screw conveyors, e.g. in sewage plants
- Dust removal in wood working

Approvals

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage ( U_s )</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>DC</td>
<td></td>
</tr>
<tr>
<td>16…72 V, 42…460 Hz</td>
<td>9.6…94 V</td>
<td>CME426-D-1</td>
</tr>
<tr>
<td>70…300 V, 42…460 Hz</td>
<td>70…300 V</td>
<td>CME426-D-2</td>
</tr>
</tbody>
</table>

1) Absolute values

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B90060008</td>
</tr>
</tbody>
</table>
### Technical data

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**
- Rated insulation voltage: 250 V
- Rated impulse voltage/overvoltage category: 4 kV/III
- Pollution degree: 3
- Protective separation (reinforced insulation) between (A1, A2) – (k, l) – (11, 12, 14) – (21, 22, 24)
- Maximum nominal voltage of the system being monitored when the conductor being monitored is directly connected:
  - With protective separation: AC 230 V
  - Without protective separation: AC 400 V

#### Supply voltage

<table>
<thead>
<tr>
<th>Model</th>
<th>Supply voltage $U_s$</th>
<th>Frequency range $U_s$</th>
<th>Power consumption</th>
<th>Measuring circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CME420-D-1</td>
<td>AC 16...72 V/DC 9.6...94 V</td>
<td>42...460 Hz</td>
<td>≤ 4 VA</td>
<td>Measuring range (r.m.s. value, screw-type terminal) AC 0.05...16 A</td>
</tr>
<tr>
<td>CME420-D-2</td>
<td>AC/DC 70...300 V</td>
<td>Frequency range $U_s$ 42...460 Hz</td>
<td>Supply voltage $U_s$ AC/DC 70...300 V</td>
<td>Frequency range $U_s$ 42...460 Hz</td>
</tr>
</tbody>
</table>

#### Response values

- **Undercurrent** $I_{<}$ (alarm $I_2$), direct connection:
  - Push-wire terminal: AC 0.1...12 A (1 A)*
  - Screw-type terminal: AC 0.1...16 A (1 A)*
- **Overcurrent** $I_{>}$ (alarm $I_2$), direct connection:
  - Push-wire terminal: AC 0.1...12 A (1 A)*
  - Screw-type terminal: AC 0.1...16 A (1 A)*
  - or external current transformer: 40 A
  - Rated frequency $f_1$: 42...2000 Hz

#### Others

- **External current transformer**: $x/1 A$, $x/5 A$, $x/10 A$
- **Transformation ratio factor $n$**: 1...2000 (1)*
- **Relative percentage error at 50/60 Hz**: ≤ ±0.5 %, ±2 digits
- **Hysteresis**: 10...40 % (15 %)*

#### Specified time

- **Starting delay**: $0...300$ s (0.5 s)*
- **Response delay** $t_{f1}$: $0...300$ s (1 s)*
- **Response delay** $t_{f2}$: $0...300$ s (0 s)*
- **Delay on release** $t_{f}$: $0...300$ s (1 s)*
- **Operating time** $t_{ae}$: ≤ 70 ms
- **Response time** $t_{an}$: $t_{ae} + t_{f1}/2$
- **Recovery time** $t_{b}$: ≤ 300 ms

#### Displays, memory

- **Display**: LC display, multi-functional, not illuminated
- **Measuring range measured value x transformation ratio factor** AC 0.01...16 A x n
- **Operating error at 50/60 Hz**: ±3 %, ±2 digits
- **Operating error in the range of 42...2000 Hz**: ±5 %, ±2 digits
- **Measured-value memory (HiS) for the first alarm value**: data record measured values
- **Password**: Off/0...999 (Off)*
- **Fault memory (M) alarm relay**: on/off (on)*

#### Switching elements

- **Number**: 2 relays, with one changeover contact each (K1, K2)
- **Operating principle**: N/C operation n.c./N/O operation n.o. (N/C operation n.c.)*
- **Electrical service life under rated operating conditions**: 10,000 switching operations

#### Contact data acc. to IEC 60947-5-1

- **Utilization category**: AC-13, AC-14, DC-12, DC-12, DC-12
- **Rated operational voltage**: 230 V, 230 V, 24 V, 110 V, 220 V
- **Rated operational current**: 5 A, 3 A, 1 A, 0.2 A, 0.1 A
- **Minimum contact load**: 1 mA at AC/DC ≥ 10 V

#### Environment/EMC

- **EMC**: IEC 61326
- **Operating temperature**: -25...+55 °C

#### Classification of climatic conditions acc. to IEC 60721

- **Stationary use (IEC 60721-3-3)**: 3K23 (except condensation and formation of ice)
- **Transportation (IEC 60721-3-2)**: 2K11 (except condensation and formation of ice)
- **Storage (IEC 60721-3-1)**: 1K22 (except condensation and formation of ice)

#### Classification of mechanical conditions acc. to IEC 60721

- **Stationary use (IEC 60721-3-3)**: 3M11
- **Transportation (IEC 60721-3-2)**: 2M4
- **Storage (IEC 60721-3-1)**: 1M12

#### Connection

- **Connection** type: screw-type terminal or push-wire terminal

#### Other

- **Operating mode**: continuous operation
- **Degree of protection DIN EN 60529, internal components**: IP30
- **Degree of protection DIN EN 60529, terminals**: IP20
- **Enclosure material**: polycarbonate
- **DIN rail mounting acc. to IEC 60715**: UL94 V-0
- **Weight**: ≤ 160 g

([)* = factory setting]
**Multi-functional current relay LINETRAXX® CME420**

**Dimension diagram (dimensions in mm)**

- Connection to the system/load being monitored
- Supply voltage $U_s$ (see ordering information)
- Alarm relay “K1”: configurable for $I_<$, $I>$ or $I_{<}/I_{>}$/ERROR/TEST
- Line protection according to IEC 60364-4-43: 6 A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse.
LINETRAXX® CMD420/CMD421
Current monitoring relays for monitoring 3AC currents for overcurrent and undercurrent using measuring current transformers or current monitoring with window discriminator function

**Device features**
- Undercurrent and overcurrent monitoring in AC systems with prealarm and main alarm or current monitoring with window discriminator function
- Current monitoring using current transformers, suitable for standard transformers x/1 A, x/5 A (depending on the device type)
- Transformation ratio n allows adaptation to all standard current transformers x/1 A, x/5 A
- Start-up delay, response delay and delay on release
- Adjustable switching hysteresis
- rms value measurement AC
- Digital measured value display via multi-functional LC display
- LEDs: Power On, Alarm 1, Alarm 2
- Fault memory for the operating value
- Cyclic self monitoring
- Internal test/reset button
- Two separate alarm relays with one changeover contact each
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device setting
- Sealable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)
- RoHS compliant

**Typical applications**
- Current consumption of motors, such as pumps, elevators, cranes
- Monitoring of lighting circuits, heating circuits, charging stations
- Monitoring of emergency lighting
- Monitoring of screw conveyors, e.g. in sewage plants
- Dust removal in wood working

**Approvals**

**Further information**
For further information refer to our product range on www.bender.de.

### Ordering information

<table>
<thead>
<tr>
<th>Suitable for current transformer types</th>
<th>Response value</th>
<th>Supply voltage $U_s$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>AC</td>
<td>DC</td>
<td>AC/DC</td>
</tr>
<tr>
<td>x/1A</td>
<td>0.1...1 A x n</td>
<td>16...72 V, 15...460 Hz</td>
<td>9.6 V...94 V</td>
<td>CMD420-D-1</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>x/5A</td>
<td>0.5...5 A x n</td>
<td>16...72 V, 15...460 Hz</td>
<td>9.6 V...94 V</td>
<td>CMD420-D-2</td>
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<tr>
<td></td>
<td></td>
<td>70...300 V, 15...460 Hz</td>
<td></td>
<td>CMD421-D-1</td>
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<td>70...300 V, 15...460 Hz</td>
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<td>CMD421-D-2</td>
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</tbody>
</table>

1) Absolute values

### Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
Measuring and monitoring relays

**Technical data**

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**

<table>
<thead>
<tr>
<th>AC 250 V</th>
<th>Rated insulation voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated impulse voltage/pollution degree</td>
<td>6 kV/V</td>
</tr>
</tbody>
</table>

**Protective separation**

- (A1, A2) - (k1, l1, k2, l2, k3, l3) - (11, 12, 14)
- (k1, l1, k2, l2, k3, l3) - (A1, A2)

**Rated impulse voltage/pollution degree**

- LINETRAXX® CMD420/CMD421
- AC 250 V
- 3.5 kV/V

**Supply voltage**

**CMD420-D-1, CMD421-D-1:**
- Supply voltage $U_s$
- AC 16…72 V / DC 6…94 V
- Frequency range $f_t$
- 15…460 Hz

**Response values CMD420**

- Undercurrent $I_\text{Lo} < \text{(Alarm 2) n} = 1$
  - AC 0.1…1 A (0.3 A)*
- Overcurrent $I_\text{Hi} > \text{(Alarm 2) n} = 1$
  - AC 0.1…1 A (0.3 A)*

**Response delay**

- 0…300 s (0.5 s)*

**Display, memory**

- LC display, multifunctional, not illuminated

**Number**

- 2 x 1 changeover contacts (K1, K2)

**Operating principle**

- N/C operation (N/O operation)

**Password**

- on/off/…999 (OFF)*

**Fault memory (M) alarm relay**

- on/off/conv (on)*

**Switching elements**

- 2 x 1 changeover contacts (K1, K2)
- Operating principle
  - N/C operation (N/O operation)
- Password
  - on/off/…999 (OFF)*
- Fault memory (M) alarm relay
  - on/off/conv (on)*

**Technical data**

**Classical insulation acc. to IEC 60721**

- Stationary use (IEC 60721-3-3)
  - K12 (except condensation and formation of ice)
  - Transport (IEC 60721-3-2)
  - 2M4
  - Storage (IEC 60721-3-1)
  - 1K22 (except condensation and formation of ice)

**Classification of climatic conditions acc. to IEC 60721**

- Stationary use (IEC 60721-3-3)
- Transport (IEC 60721-3-2)
- Storage (IEC 60721-3-1)

**Connection**

- Connection type
  - screw-type terminal or push-wire terminal
- Connection properties
  - rigid
  - flexible
- Two conductors with the same cross section
  - with ferrules
  - without ferrules
- Stripping length
  - 8 mm
- Tightening torque, terminal screws
  - 0.5…0.6 Nm
- Number: 2 x 1 changeover contacts (K1, K2)

**Other**

- Degree of protection, terminals (IEC 60529)
  - IP20
- Degree of protection, internal components (IEC 60529)
  - IP30
- Degree of protection, terminals (IEC 60529)
  - IP20
- Enclosure material
  - polycarbonate
- Flameability class
  - UL94 V-0
- DIN rail mounting acc. to
  - IEC 60715
- Screw mounting
  - 2 x M4 with mounting clip

**Other**

- Continuous operation
- Mounting
- Degree of protection, internal components (IEC 60529)
  - IP30
- Degree of protection, terminals (IEC 60529)
  - IP20
- Enclosure material
  - polycarbonate
- Flammability class
  - UL94 V-0
- DIN rail mounting acc. to
  - IEC 60715
- Screw mounting
  - 2 x M4 with mounting clip
- Documentation number
  - DOO0103
- Weight
  - ≤ 150 g

**Other**

- Degree of protection, internal components (IEC 60529)
  - IP30
- Degree of protection, terminals (IEC 60529)
  - IP20
- Enclosure material
  - polycarbonate
- Flammability class
  - UL94 V-0
- DIN rail mounting acc. to
  - IEC 60715
- Screw mounting
  - 2 x M4 with mounting clip
- Documentation number
  - DOO0103
- Weight
  - ≤ 150 g

**Other**

- Degree of protection, internal components (IEC 60529)
  - IP30
- Degree of protection, terminals (IEC 60529)
  - IP20
- Enclosure material
  - polycarbonate
- Flammability class
  - UL94 V-0
- DIN rail mounting acc. to
  - IEC 60715
- Screw mounting
  - 2 x M4 with mounting clip
- Documentation number
  - DOO0103
- Weight
  - ≤ 150 g
Dimension diagram (dimensions in mm)

Wiring diagram

1. Connection to the conductors to be monitored; using current transformers
2. A1, A2  Supply voltage Uₖ (see ordering information)
3. 11, 12, 14  Alarm relay “K1”:
configurable for Iₕ, Iₖ or Iₕ/Iₖ/ERROR/TEST
4. 21, 22, 24  Alarm relay “K2”:
configurable for alarm Iₕ, Iₖ or Iₕ/Iₖ/ERROR/TEST
5. Line protection according to IEC 60364-4-43:
6 A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse.
LINETRAXX® CMS460-D
Multi-channel AC, pulsed DC sensitive load current evaluator for AC systems (TN, TT and IT systems)

Device features
- Optional AC or pulsed DC sensitive measurements for each channel
- rms value measurement
- 12 measuring channels per individual device for load current
- Up to 90 evaluators CMS460-D in the system (1080 measuring channels)
- Fast parallel scanning for all channels
- Response ranges 100 mA...125 A (42...2000 Hz)
- Preset function
- Adjustable time delays
- Adjustable frequency behaviour (e.g. fire and plant protection)
- History memory with date and time stamp for 300 data records/channel
- Data logger for 300 data records/channel
- Analysis of the harmonics, THD
- Two alarm relays with one changeover contact each
- N/O or N/C operation and fault memory selectable
- Connection external test and reset button
- Backlit graphical display (7-segment display) and alarm LEDs
- Data exchange via BMS bus
- Password protection for device setting
- RoHS compliant

Typical applications
- Monitoring of loads and installations for load currents in the frequency range of 42...2000 Hz (measuring current transformers CTAC..., WR...S(P), WS..., WF...)
- Monitoring of currents regarded as fire hazards in flammable atmospheres
- EMC monitoring of TN systems for "stray currents" and additional N-PE connections
- Monitoring of N conductors for overload caused by harmonics
- Monitoring of PE and equipotential bonding conductors to ensure they are free of current

Further information
For further information refer to our product range on www.bender.de.

Approvals

Ordering information

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<th>Supply voltage $U_s$</th>
<th>Type</th>
<th>Art. No.</th>
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</thead>
<tbody>
<tr>
<td>DC</td>
<td>AC</td>
<td></td>
</tr>
<tr>
<td>16...94 V</td>
<td>16...72 V, 42...460 Hz</td>
<td>CMS460-D-1</td>
</tr>
<tr>
<td>70...276 V</td>
<td>70...276 V, 42...460 Hz</td>
<td>CMS460-D-2</td>
</tr>
</tbody>
</table>

1) Absolute values

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>XM460 mounting frame, 144 x 82 mm</td>
<td>B990995</td>
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</table>

Suitable system components

<table>
<thead>
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<th>Description</th>
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<th>Type of construction</th>
<th>Type</th>
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<td>Measuring current transformers</td>
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<td>split-core</td>
<td>WS...</td>
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<td>flexible</td>
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<td>Condition Monitor</td>
<td>with integrated gateway: Bender system/Ethernet</td>
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<td>COM465IP</td>
<td>B950610...</td>
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<td></td>
<td>–</td>
<td>CP9...</td>
<td>B9506103...</td>
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<tr>
<td>RS-485 repeater</td>
<td>–</td>
<td>–</td>
<td>DI-1DL</td>
<td>B95012047</td>
<td>398</td>
</tr>
</tbody>
</table>
### Technical data

#### Insulation coordination acc. to IEC 60664-1/IEC 60664-3 for the versions:

**a) CMS460-D1**
- Supply voltage $U_i$: DC 24…75V/AC 24…60 V (AC/DC ±20 %)
- Supply insulation frequency DC 50/60 Hz
- Rated insulation voltage 100 V
- Overvoltage category/pollution degree III/3
- Rated impulse voltage 2.5 kV
- Protective separation (reinforced insulation) between: (A1, A2) - (k1, l…k12, R, T/R, T, A, B)
- Voltage test acc. to IEC 61010-1: 1.344 kV
- Rated insulation voltage 250 V
- Overvoltage category/pollution degree III/3
- Rated impulse voltage 4 kV
- Basic insulation between: (A1, A2), (k1, l…k12, R, T/R, T, A, B) - (C11, C12, C14), (C21, C22, C24), (11, 14) - (21, 24) - (31, 34) - (41, 44), (51, 54), (61, 64), (71, 74), (81, 84), (91, 94), (101, 104), (111, 114), (121, 124)
- Voltage test acc. to IEC 61010-1: 3.536 kV

**b) CMS460-D2**
- Supply voltage $U_i$: AC/DC 100…240 V (-20…+15 %)
- Supply insulation frequency DC 50/60 Hz
- Rated insulation voltage 100 V
- Overvoltage category/pollution degree III/3
- Rated impulse voltage 4 kV
- Protective separation (reinforced insulation) between: (A1, A2), (k1, l…k12, R, T/R, T, A, B) - (C11, C12, C14), (C21, C22, C24), (11, 14) - (21, 24) - (31, 34) - (41, 44), (51, 54), (61, 64), (71, 74), (81, 84), (91, 94), (101, 104), (111, 114), (121, 124)
- Voltage test acc. to IEC 61010-1: 3.536 kV

#### Measuring circuit
- External measuring current transformers CTAC…, WR…, WS…, WF… series (type A)
- Depending on measuring current transformer series (type A)
- Rated frequency 42…2000 Hz (type A)
- Cut-off frequency none, IEC 50, 60 Hz (none)*
- Measuring range 100 mA…125 A (measuring current transformer alarm A) 100 mA…30 A (measuring current transformer Flex)
- Test factor up to 10 A = 4, up to 125 A = 2
- Rated operating current In2 (alarm) 100 mA…125 A (16 A overcurrent) 10…100 % x In2 (preset for alarm 10…100 % x In2) 0...99 % x In2 (preset for alarm 0...99 % x In2)
- Relative uncertainty ±10...20 %
- Hysteresis 2...40 % (20 %)*
- Factor for additional CT 2...10; x 1...10 (x)*
- Number of measuring channels (per device/system) 12/7080

#### Time response
- Start-up delay t(start-up) per device 0...99 s (0 ms)*
- Delay response $t_d$ per channel 0…999 s (200 ms)*
- Delay on release $t_d$ per channel 0…999 s (200 ms)*
- Operating time $t_{op} = t = 4.6 t_{0.5}$ 160 ms
- Operating time $t_{op} = t = 4 x t_{0.5}$ ≤ 30 ms
- Response time $t_{sp}$ per current measurement $t_{sp} = t_{sp} + t_{1/2}$
- Scanning time $t_{scan}$ for all measuring channels (current measurement) ≤ 200 ms
- Recovery time $t_{r}$ 500…1000 ms

#### Displays, memory
- Display range, measuring value < 10 mA…32 A (CT type A) < 10 mA…32 A (measuring current transformer Flex)
- Operating uncertainty ±10 %
- Operating display backlit graphical display
- History memory 300 data records
- Data logger 300 data records per measuring channel
- Language D, GB, F (GB)*
- Fault memory alarm relay on/off (* Factory setting

#### Interface
- Interface/protocol RS-485/BMS
- Baud rate 9.6 kbit/s
- Cable length 0…1200 m
- Recommended cable (shielded, shielded to PE on one side) min. J-YST min. 2x0.8

#### Cable lengths for CTAC…, WR…, WS…, WF… series measuring current transformers
- Single wire ≤ ±0.75 mm
- Single wire twisted ≤ ±0.75 mm
- Shielded cable ≤ ±0.5 mm
- Recommended cable (shielded, shielded to terminal I at one end, must not be earthed) J-YST/Y min. 2x0.8

#### Switching elements
- Number of changeover contacts 2 x 1 changeover contacts
- Operating principle NC or NO (NO operation)*
- Electrical endurance, number of cycles 10,000

#### Contact data acc. to IEC 60947-5-1
- Utilisation category AC-13 AC-14 DC-12 DC-12 DC-12
- Rated operational voltage 230 V 230 V 24 V 110 V 220 V
- Rated operational current (common alarm relay) 5 A 3 A 1 A 0.2 A 0.1 A
- Rated operational current (alarm relay) 2 A 0.5 A 5 A 0.2 A 0.1 A
- Minimum contact rating 1 mA at AC/DC ≥ 10 V

#### Environment/EMC
- EMC IEC 61326-1
- Operating temperature -25 °C

#### Climatic class acc. to IEC 60721
- Stationary use (IEC 60721-3-3) 3K23 (except condensation and formation of ice)
- Transport (IEC 60721-3-2) 2K71 (except condensation and formation of ice)
- Long-term storage (IEC 60721-3-1) 1K22 (except condensation and formation of ice)

#### 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 screw-type terminals
- Connection properties:
  - Rigid/semi-flexible/conductor sizes 0.2…4/0.2…2.5 mm²/AWG 24…12
  - Multi-conductor connection (2 conductors with the same cross section):
  - Rigid/semi-flexible 0.2…1.5/0.2…1.5 mm²
- Stripping length 8…9 mm
- Tightening torque 0.5…0.6 Nm

#### Other
- Operating mode continuous operation
- Mounting display-oriented
- Degree of protection, internal components (IEC 60529) IP30
- Degree of protection, terminals (IEC 60529) IP20
- Enclosure material polycarbonate
- Flammability class UL94V-0
- Screw fixing 2 x M4
- DIN rail mounting acc. to IEC 60715
- Power consumption ≤ 10 VA
- Weight ≤ 360 g
### Wiring diagrams

1. **A1, A2** Connection of supply voltage Us (see ordering information), 6 A fuse recommended.
2. **I, k1…k12** Connection of measuring current transformers CT1…CT12
3. **A, B** RS-485 interface with BMS protocol
4. **R** External reset button “R” (N/O contact)
5. **T, T/R** External test button “T” (N/O contact).
   - The external “T/R” buttons of several devices must not be connected to one another.
6. **C11, C12, C14** Alarm relay “K1”: Alarm 1, common alarm for alarm, prewarning, device error, ext. alarm (adjustable)
7. **C21, C22, C24** Alarm relay “K2”: Alarm 2, common alarm for alarm, prewarning, device error, ext. alarm (adjustable)
8. **Ron/off** Activate or deactivate the BMS bus terminating resistor (120 Ω)

### Connection CTAC…, WR…S(P), WS… series measuring current transformers (pulsed DC sensitive)

### Connection WF… series measuring current transformer (pulsed DC sensitive)
LINETRAXX® GM420
Loop monitoring relay to monitor loop resistances or PE conductor connections

Device features
- Loop monitoring of the PE conductor in AC systems
- Measuring circuit providing a high resistance against extraneous voltages and indication of extraneous voltages
- Adjustable start-up delay, response delay and delay on release
- Adjustable switching hysteresis
- Digital measured value display via multi-functional LC display
- Preset function (automatic setting of basic parameters)
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays with one changeover contact each
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device setting
- Sealable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)
- RoHS compliant

Typical applications
- Loop monitoring of motors
- Loop monitoring of PE conductor connections for wire interruptions in electrical installations
- Monitoring of earthing systems

Approvals

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage $^1$ $U_s$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AC</td>
<td>DC</td>
</tr>
<tr>
<td>16...72 V, 15...460 Hz</td>
<td>9.6...94 V</td>
<td>GM420-D-1</td>
</tr>
<tr>
<td>70...300 V, 15...460 Hz</td>
<td>70...300 V</td>
<td>GM420-D-2</td>
</tr>
</tbody>
</table>

$^1$ Absolute values

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>
### Technical data

#### Insulation coordination acc. to IEC 60664-1/IEC 60664-3

- **Rated insulation voltage**: 400 V
- **Rated impulse voltage/pollution degree**: 4 kV/K

#### Loop monitor LINETRAXX® GM420

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated frequency</td>
<td>50/60 Hz ±2 %, ±1 digit</td>
</tr>
<tr>
<td>Operating uncertainty, loop resistance</td>
<td>1…100 Ω ±5 %, ±1 digit</td>
</tr>
<tr>
<td>Measuring range</td>
<td>0…100 Ω ±20 %, ±1 digit</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>1…40 % (5 %)*</td>
</tr>
<tr>
<td>Response time</td>
<td>≤ 100 ms (0 s)*</td>
</tr>
<tr>
<td>Operating principle</td>
<td>N/C operation or N/O operation</td>
</tr>
<tr>
<td>Operating time</td>
<td>-25…+55 °C</td>
</tr>
<tr>
<td>Classification of climatic conditions acc. to IEC 60721</td>
<td>Stationary use (IEC 60721-3-3) 3K11 (except condensation and formation of ice) Transport (IEC 60721-3-2) 2K12 (except condensation and formation of ice) Long-time storage (IEC 60721-3-1) 1K22 (except condensation and formation of ice)</td>
</tr>
</tbody>
</table>

#### Switching elements

- **Number**: 2 x 1 changeover contacts (K1, K2)
- **Operating principle**: N/C operation or N/O operation
- **Degree of protection, terminals (IEC 60529)**: IP30
- **Degree of protection, internal components (IEC 60529)**: IP30
- **Enclosure material**: polycarbonate
- **Degree of protection class**: UL94 V-0
- **Flammability class**: 90 min
- **Weight**: 150 g

#### Response values

- **Loop resistance > R (Alarm 1)**: 0.1…100 Ω
- **Resolution of setting**: 0.1 Ω
- **Operating time**: ≤ 40 ms

#### Preset function:

- **Loop resistance > R (Alarm 1)**: (|Rn| + 0.5 Ω) x 1.5
- **Relative uncertainty > U (Alarm 1)**: ±30 %, ±1 digit
- **Relative uncertainty > U (Alarm 2)**: ±5 %, ±1 digit
- **Hysteresis > U**: ≤ 20 %, ±1 digit
- **Hysteresis > U**: 1…40 % (5 %)*

#### Time response

- **Response delay (on1/2)**: ≤ 99 s (9.5 s)*
- **Start-up delay t**: 0…99 s (9.5 s)*
- **Delay on release t(d)**: 0…99 s (9.5 s)*

#### Operating temperature

- **Rated operational voltage**: 230 V 230 V 24 V 110 V 220 V
- **Rated operational current**: 5 A 3 A 1 A 0.2 A 0.1 A
- **Minimum contact rating**: 1 mA at AC/DC ≥ 10 V

#### Contact data acc. to IEC 60947-5-1

- **Contact type**: screw-type terminal or push-wire terminal

#### Switching elements

- **Number**: 2 x 1 changeover contacts (K1, K2)
- **Operating principle**: N/C operation or N/O operation

#### Classification of climatic conditions acc. to IEC 60721

- **Stationary use (IEC 60721-3-3)**: 3K11 (except condensation and formation of ice) Transport (IEC 60721-3-2) 2K12 (except condensation and formation of ice) Long-time storage (IEC 60721-3-1) 1K22 (except condensation and formation of ice)
**Dimension diagram (dimensions in mm)**

**Wiring diagram**

1. **A1, A2** Supply voltage \( U_s \) (see ordering details) via fuse
2. **E** Connection of E to the PE conductor
3. **KE** Connection of KE to the loads or the monitoring conductor
4. **11, 12, 14** Alarm relay “K1”:
   - Alarm 1 configurable for \( > R, OL, > U_f, ERROR, TEST \)
5. **21, 22, 24** Alarm relay “K2”:
   - Alarm 2 configurable for \( > R, OL, > U_f, ERROR, TEST \)
6. Line protection by a fuse in accordance with DIN VDE 0100-430/IEC 60364-4-43 (6 A fuse recommended). In case of supply (A1/A2) from an IT system, both lines have to be protected by a fuse.
## Device overview coupling devices

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<td>Application</td>
<td>Extension of the nominal voltage range for ISOMETER’s</td>
<td>Extension of the nominal voltage range for ISOMETER’s</td>
<td>Extension of the nominal voltage range for ISOMETER’s</td>
<td>Extension of the nominal voltage range for ISOMETER’s</td>
<td></td>
</tr>
<tr>
<td>Nominal system voltage Un</td>
<td>AC 0…1150 V, DC 0…1760 V</td>
<td>AC 0…1300 V / AC 0…1650 V</td>
<td>AC 3(N)/AC 0…7200 V</td>
<td>AC 3(N)/AC, DC 0…7.2 kV</td>
<td>AC 3(N)/AC, DC 0…15.5 kV</td>
</tr>
<tr>
<td>Device family</td>
<td>IRDH275BM-7</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>IRA22-D64</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>iso685-D</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>iso685-S</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

### Product details

(Product on [www.bender.de/en](http://www.bender.de/en))

## Device overview measuring current transformers

<table>
<thead>
<tr>
<th>Catalogue page</th>
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<th>362</th>
<th>365</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristics</td>
<td>CT type</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>W0-S20…W5-S210, W10/600</td>
<td>CTAC…</td>
<td>CTUB100-CTBC…</td>
</tr>
</tbody>
</table>

### CT type

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
<th>Inside diameter</th>
<th>Width x height</th>
<th>Strip length</th>
<th>EDS440</th>
<th>EDS441</th>
<th>EDS441-LAB</th>
<th>EDS460/490</th>
<th>EDS461/491</th>
<th>RCM420</th>
<th>RCM4420</th>
<th>RCM4423</th>
<th>RCM5460/490</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>W0-S20</td>
<td>W0-S20</td>
<td>W0-S20</td>
<td>W0-S20</td>
<td>W0-S20</td>
<td>W0-S20</td>
<td>W0-S20</td>
<td>W0-S20</td>
<td>W0-S20</td>
<td>W0-S20</td>
<td>W0-S20</td>
<td>W0-S20</td>
</tr>
</tbody>
</table>

### Device family

(Product on [www.bender.de/en](http://www.bender.de/en))

### Characteristics

(Product on [www.bender.de/en](http://www.bender.de/en))

---

**System components | Device overview**

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**01/2021**
### System components | Device overview

<table>
<thead>
<tr>
<th>WR…(P)</th>
<th>CTBS25</th>
<th>WS…/WS…-8000</th>
<th>WS…S</th>
<th>WF…</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Characteristics

- **CT type**
  - W10/600
  - W0-S20
  - W1-S35
  - W2-S70
  - W3-S105
  - W4-S140
  - W5-S210
  - CTAC20(/01)
  - CTAC35 (/01)
  - CTAC60
  - CTAC120
  - CTAC210
  - CTUB101-CTBC20(P)
  - CTUB101-CTBC35(P)
  - CTUB101-CTBC60(P)
  - CTUB101-CTBC120(P)
  - CTUB101-CTBC210(P)
  - CTUB102-CTBC20(P)
  - CTUB102-CTBC35(P)
  - CTUB102-CTBC60(P)
  - CTUB102-CTBC120(P)
  - CTUB102-CTBC210(P)
  - CTUB104-CTBC20(P)
  - CTUB104-CTBC35(P)
  - CTUB104-CTBC60(P)
  - CTUB104-CTBC120(P)
  - CTUB104-CTBC210(P)
  - WR70x175S(P)
  - WR115x305S(P)
  - WR150x350S(P)
  - WR200x500S(P)
  - CTBS25
  - WS20x30
  - WS50x80
  - WS80x120
  - WS20x30-8000
  - WS50x80-8000
  - WS50x80S
  - WS80x80S
  - WS80x120S
  - WS80x160S
  - WF170
  - WF250
  - WF500
  - WF800
  - WF1200
  - WF1800

### Dimensions (mm)

- **Inside diameter**
  - 10
  - 20
  - 35
  - 70
  - 105
  - 140
  - 210

- **Width x height**
  - 25
  - 20x30
  - 50x80
  - 80x120
  - 20x30
  - 50x80
  - 50x80
  - 80x80
  - 80x120
  - 80x160
  - 170
  - 250
  - 500
  - 800
  - 1200
  - 1800

### Strip length

- –

### Device family

- EDS440
- EDS441
- EDS441-LAB
- EDS460/490
- EDS461/491
- RCM420
- RCMA420
- RCMA423
- RCMS460/490

### Product details

(Products on www.bender.de/en)
### Device overview isolating transformers, transformers for operating theatre lights

<table>
<thead>
<tr>
<th>Catalogue page</th>
<th>Application</th>
<th>Type of distribution system</th>
<th>Input</th>
<th>Output</th>
<th>Frequency range</th>
<th>Power</th>
<th>Design type</th>
</tr>
</thead>
<tbody>
<tr>
<td>380</td>
<td>Design of medical IT systems</td>
<td>single-phase</td>
<td>AC 230 V</td>
<td>AC 230 V</td>
<td>50…60 Hz</td>
<td>3150 VA</td>
<td>vertical</td>
</tr>
<tr>
<td>385</td>
<td>Supply of three-phase loads in group 0, 1 or 2 medical locations</td>
<td>three-phase</td>
<td>3AC 400 V</td>
<td>3NAC 230 V</td>
<td>50…60 Hz</td>
<td>3150 VA</td>
<td>horizontal</td>
</tr>
<tr>
<td>388</td>
<td>Supply of operating theatre luminaires</td>
<td>single-phase</td>
<td>AC 230 V (±5 %, ±10 %)</td>
<td>AC 23…28 V</td>
<td>50…60 Hz</td>
<td>120 VA</td>
<td>encapsulated (protection class B)</td>
</tr>
</tbody>
</table>

### Device overview power supply units

<table>
<thead>
<tr>
<th>Catalogue page</th>
<th>Application</th>
<th>Rated voltage</th>
<th>Rated input voltage $U_{IN}$</th>
<th>Product details</th>
</tr>
</thead>
<tbody>
<tr>
<td>390</td>
<td>for measuring current transformers</td>
<td>DC 24 V</td>
<td>AC 85…264 V, 45…65 Hz</td>
<td>(Products on <a href="http://www.bender.de/en">www.bender.de/en</a>)</td>
</tr>
<tr>
<td>393</td>
<td>for DC 24 V power supply</td>
<td>DC 24 V</td>
<td>DC 95…250 V</td>
<td></td>
</tr>
<tr>
<td>395</td>
<td>for voltage supply</td>
<td>AC 20 V, 50…60 Hz</td>
<td>AC 230 V, 50…60 Hz</td>
<td></td>
</tr>
</tbody>
</table>

### Voltages
- **Input**
  - AC 230 V
  - 3AC 400 V (±5 %, ±10 %)
- **Output**
  - AC 230 V
  - 3NAC 230 V
- **Frequency range**
  - 50…60 Hz
- **Power**
  - 3150 VA
  - 4000 VA
  - 5000 VA
  - 6300 VA
  - 8000 VA
  - 10000 VA
- **Design type**
  - Vertical
  - Horizontal
  - Encapsulated (protection class B)
### Device overview measuring instruments

<table>
<thead>
<tr>
<th>Catalogue page</th>
<th>397</th>
<th>397</th>
<th>397</th>
<th>397</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input current</td>
<td>0…400 μA</td>
<td>0…20 mA</td>
<td>0…400 μA</td>
<td>0…20 mA</td>
</tr>
<tr>
<td>Dimensions (mm)</td>
<td>72 x 72</td>
<td>72 x 72</td>
<td>96 x 96</td>
<td>96 x 96</td>
</tr>
</tbody>
</table>

### Device overview interface converters and repeaters

<table>
<thead>
<tr>
<th>Catalogue page</th>
<th>398</th>
<th>400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Interface repeater BMS bus</td>
<td>Interface converter BMS/USB</td>
</tr>
<tr>
<td>Input</td>
<td>RS-485</td>
<td>RS-485</td>
</tr>
<tr>
<td>Connection</td>
<td>screw-type terminal</td>
<td>screw-type terminal</td>
</tr>
<tr>
<td>Cable length</td>
<td>≤ 1200 m</td>
<td>≤ 1200 m</td>
</tr>
<tr>
<td>Output</td>
<td>RS-485</td>
<td>USB</td>
</tr>
<tr>
<td>Connection</td>
<td>screw-type terminal</td>
<td>USB Type B</td>
</tr>
<tr>
<td>Cable length</td>
<td>≤ 1200 m</td>
<td>≤ 5 m</td>
</tr>
<tr>
<td>Expansion of bus devices</td>
<td>≤ 30</td>
<td>–</td>
</tr>
</tbody>
</table>

### Device overview Relay module

<table>
<thead>
<tr>
<th>Catalogue page</th>
<th>401</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>for extension of EDS44x applications</td>
</tr>
<tr>
<td>Relay number</td>
<td>12 N/O contacts</td>
</tr>
<tr>
<td>Supply voltage $U_s$</td>
<td>via BB bus</td>
</tr>
<tr>
<td>Interface</td>
<td>BB bus</td>
</tr>
<tr>
<td>Connection</td>
<td>push-wire terminal / BBbus PCB</td>
</tr>
<tr>
<td>Relay operation</td>
<td>configurable</td>
</tr>
</tbody>
</table>

---

**Device overview measuring instruments**

---

**Device overview interface converters and repeaters**

---

**Device overview Relay module**
## Device overview condition monitors/gateways

<table>
<thead>
<tr>
<th>Catalogue page</th>
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<th>407</th>
<th>411</th>
<th>415</th>
<th>417</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Application</strong></td>
<td>Condition Monitor/Gateway</td>
<td>Condition Monitor/Gateway</td>
<td>Condition Monitor/Gateway</td>
<td>Condition Monitor/Gateway</td>
<td>Condition Monitor/Gateway</td>
</tr>
<tr>
<td><strong>Protocol input</strong></td>
<td>BMS / BCOM / Modbus RTU/TCP</td>
<td>BMS / BCOM / Modbus RTU/TCP</td>
<td>isoData / Modbus TCP</td>
<td>BMS (extern) / BCOM</td>
<td>BMS (intern) / BCOM / Modbus RTU/TCP</td>
</tr>
<tr>
<td><strong>Protocol output</strong></td>
<td>Ethernet / Modbus RTU/TCP / SNMP</td>
<td>Ethernet / Modbus RTU/TCP / SNMP</td>
<td>Ethernet / Modbus TCP / PROFIBUS DP</td>
<td>Ethernet / Modbus TCP / OPC-UA5</td>
<td>Ethernet / Modbus RTU/TCP / SNMP</td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td>LED</td>
<td>LED</td>
<td>LED</td>
<td>LED</td>
<td>Display in 7&quot; oder 15.6&quot;</td>
</tr>
<tr>
<td><strong>Alarm messages</strong></td>
<td>1, 2)</td>
<td>1, 2)</td>
<td>1, 2)</td>
<td>1, 2)</td>
<td>1, 2, 3)</td>
</tr>
<tr>
<td><strong>Measured values</strong></td>
<td>1, 2)</td>
<td>1, 2)</td>
<td>1, 2)</td>
<td>1, 2)</td>
<td>1, 2, 3)</td>
</tr>
<tr>
<td><strong>Device parameter setting</strong></td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>Alarm list</strong></td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
</tr>
<tr>
<td><strong>History memory</strong></td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
</tr>
<tr>
<td><strong>Diagrams</strong></td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
</tr>
<tr>
<td><strong>Visualisation</strong></td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
</tr>
<tr>
<td><strong>E-mail notification</strong></td>
<td>1, 4)</td>
<td>1, 4)</td>
<td>1, 4)</td>
<td>1, 4)</td>
<td>1, 4)</td>
</tr>
<tr>
<td><strong>Device tests</strong></td>
<td>1, 2)</td>
<td>1, 2)</td>
<td>1, 2)</td>
<td>1, 2)</td>
<td>1, 2)</td>
</tr>
<tr>
<td><strong>PEM… and energy meter support</strong></td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
</tr>
<tr>
<td><strong>SNMP</strong></td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
</tr>
<tr>
<td><strong>Data logger</strong></td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
<td>1)</td>
</tr>
<tr>
<td><strong>BMS</strong></td>
<td>screw-type terminal</td>
<td>screw-type terminal</td>
<td>–</td>
<td>screw-type terminal</td>
<td>screw-type terminal</td>
</tr>
<tr>
<td><strong>Modbus RTU</strong></td>
<td>screw-type terminal</td>
<td>screw-type terminal</td>
<td>–</td>
<td>screw-type terminal</td>
<td>screw-type terminal</td>
</tr>
<tr>
<td><strong>isoData</strong></td>
<td>–</td>
<td>–</td>
<td>screw-type terminal</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td>RJ 45</td>
<td>RJ 45, Sub-D 9-pole</td>
<td>RJ 45</td>
<td>RJ 45</td>
<td>RJ 45</td>
</tr>
<tr>
<td><strong>Supply voltage U&lt;sub&gt;1&lt;/sub&gt;</strong></td>
<td>AC/DC 24…240 V</td>
<td>AC/DC 24…240 V</td>
<td>AC/DC 24…240 V</td>
<td>AC/DC 24…240 V</td>
<td>DC 24 V</td>
</tr>
<tr>
<td><strong>Browser</strong></td>
<td>Internet Explorer, Chrome, Firefox etc.</td>
<td>Internet Explorer, Chrome, Firefox etc.</td>
<td>Internet Explorer, Chrome, Firefox etc.</td>
<td>Internet Explorer, Chrome, Firefox etc.</td>
<td>Internet Explorer, Chrome, Firefox etc.</td>
</tr>
</tbody>
</table>

1) Functions available on the web server – accessible via a personal computer with browser
2) Available via the protocol
3) On the device’s own LC display
4) TLS/SSL Support
5) Special OPC-UA profile stored for railway applications

---

**Product details**

(Product on www.bender.de/en)
## Device overview alarm indicator and test combinations

<table>
<thead>
<tr>
<th>Feature</th>
<th>COMTRAXX® CP9xx</th>
<th>COMTRAXX® MK2430</th>
<th>Visualisation</th>
</tr>
</thead>
<tbody>
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<td>423</td>
<td>426</td>
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<tr>
<td><strong>Message displays</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEDICS® systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RCMS Residual current monitoring system</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EDS insulation fault locator</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Installation type</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flush-mounting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cavity wall mounting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable-duct mounting</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Panel mounting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface mounting</td>
<td></td>
<td></td>
<td>–</td>
</tr>
<tr>
<td><strong>Input/output</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital inputs (potential free)</td>
<td>12</td>
<td>0/12</td>
<td>–</td>
</tr>
<tr>
<td>N/O or N/C operation</td>
<td>selectable</td>
<td>selectable</td>
<td>–</td>
</tr>
<tr>
<td>Relay outputs</td>
<td>1</td>
<td>1</td>
<td>–</td>
</tr>
<tr>
<td>N/O or N/C operation</td>
<td>programmable</td>
<td>programmable</td>
<td>–</td>
</tr>
<tr>
<td>Common alarm</td>
<td>programmable</td>
<td>programmable</td>
<td>–</td>
</tr>
<tr>
<td>System fault alarm</td>
<td>programmable</td>
<td>programmable</td>
<td>–</td>
</tr>
<tr>
<td><strong>Parameter setting/text message</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Languages selectable</td>
<td>25</td>
<td>20</td>
<td>programmable</td>
</tr>
<tr>
<td>Standard display</td>
<td>Graphic LCD (7&quot;, 15.6&quot;, 24&quot;)</td>
<td>4 x 20 characters</td>
<td>–</td>
</tr>
<tr>
<td>Additional text display</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard texts</td>
<td></td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>Freely configurable text messages</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>History memory, maximum number of data records</td>
<td>1000</td>
<td>250</td>
<td>–</td>
</tr>
<tr>
<td>Real-time clock</td>
<td></td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>Parameterisation software</td>
<td>integrated</td>
<td>TMK-Set V 4.xx (USB, BMS)</td>
<td>–</td>
</tr>
<tr>
<td>Messages/alarms, medical gases</td>
<td>acc. to EN475, EN737-3</td>
<td>acc. to EN475, EN737-8</td>
<td>–</td>
</tr>
<tr>
<td><strong>Interface</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS-485 (BMS protocol)</td>
<td></td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>BMS address range</td>
<td>1…150</td>
<td>1…150</td>
<td>–</td>
</tr>
<tr>
<td>Master redundancy, BMS internal</td>
<td></td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>Master redundancy, BMS external</td>
<td></td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>USB</td>
<td></td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>Ethernet (TCP/IP)</td>
<td></td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>Supply voltage $U_s$</td>
<td>DC 24 V/AC 250 V</td>
<td>AC/DC 24 V</td>
<td>–</td>
</tr>
<tr>
<td>Stored energy time in the event of power failure</td>
<td>≥ 15 s</td>
<td>≤ 15 s</td>
<td>–</td>
</tr>
<tr>
<td><strong>Product details</strong></td>
<td></td>
<td></td>
<td>Products on <a href="http://www.bender.de/en">www.bender.de/en</a></td>
</tr>
</tbody>
</table>
## Device overview POWERSCOUT®

<table>
<thead>
<tr>
<th>Functions</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catalogue page</td>
<td>427</td>
</tr>
<tr>
<td>Multi-tenant</td>
<td>Unlimited</td>
</tr>
<tr>
<td>User management</td>
<td>Unlimited</td>
</tr>
<tr>
<td>Logger</td>
<td>Unlimited (all measured values)</td>
</tr>
<tr>
<td>Web front end</td>
<td></td>
</tr>
<tr>
<td>Cloud</td>
<td></td>
</tr>
<tr>
<td>Max. number of devices/data points</td>
<td>Unlimited</td>
</tr>
<tr>
<td>Creation of dashboards</td>
<td></td>
</tr>
<tr>
<td>Event aggregation on the main page</td>
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<td>Configuration of an individual main page</td>
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<td>Reporting</td>
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<td>Export data</td>
<td>csv export</td>
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<td>Import data</td>
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<td>Virtual measuring point calculation</td>
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<td>Graph</td>
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<td>Event statistics</td>
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<td>Alarm state</td>
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<td>Event protocol</td>
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<td>Gauge</td>
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<td>Heat map</td>
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<td>Sankey diagram</td>
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<tr>
<td>Bar graph</td>
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<tr>
<td>Product details</td>
<td>(Products on <a href="http://www.bender.de/en">www.bender.de/en</a>)</td>
</tr>
</tbody>
</table>
AGH150W-4
Coupling device

**Typical applications**
- Extension of the nominal voltage range for the ISOMETER®'s iso685… series to AC 0…1150 V, DC 0…1760 V

**Approvals**

**Further information**
For further information refer to our product range on www.bender.de.

### Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage $U_n$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 0…1150 V, DC 0…1100 V</td>
<td>AGH150W</td>
<td>B915576</td>
</tr>
<tr>
<td>AC 0…1760 V, DC 0…1600 V</td>
<td>AGH150W-4</td>
<td>B98018006</td>
</tr>
</tbody>
</table>

### Technical data

**Insulation coordination acc. to DIN EN 61800-5-1 (VDE 0160-105-1)**

**AGH150W**
- Rated insulation voltage: AC 1000 V
- Voltage test acc. to IEC 60255: 12 kV

**AGH150W-4**
- Rated insulation voltage: AC 1600 V
- Voltage test acc. to IEC 60255: 17 kV

**Voltage test acc. to DIN EN 61800-5-1 (VDE 0160-105-1)**

**AGH150W**
- Voltage impulse test (basic insulation): ≥ AC 8 kV
- AC voltage test (basic insulation): ≥ AC 4.3 kV

**AGH150W-4**
- Voltage impulse test (basic insulation): ≥ AC 11 kV
- AC voltage test (basic insulation): ≥ AC 6.6 kV

**Voltage ranges**

**AGH150W**
- Nominal system voltage $U_n$: AC 0…1150 V, DC 0…1100 V
- Frequency range of $U_n$ (nom): DC 1…460 Hz
- Overvoltage category/rated impulse voltage: CAT III ≥ 8 kV
- Internal DC resistance $R_i$: ≥ 80 kΩ
- Tolerance of internal DC resistance: ±2 kΩ

**AGH150W-4**
- Nominal system voltage $U_n$: AC 0…1150 V, DC 0…1760 V
- Frequency range of $U_n$ (nom): DC 1…460 Hz
- Overvoltage category/rated impulse voltage: CAT III ≥ 11 kV
- Internal DC resistance $R_i$: ≥ 160 kΩ
- Tolerance of internal DC resistance: ±4 kΩ

**Environment**
- Shock resistance IEC 60068-2-27 (device in operation): 15 g/11 ms
- Bumping IEC 60068-2-29 (transport): 40 g/6 ms
- Vibration resistance IEC 60068-2-6 (device in operation): 1 g/10…150 Hz
- Vibration resistance IEC 60068-2-6 (transport): 2 g/10…150 Hz
- Ambient temperature (during operation): -10…+55 °C
- Ambient temperature (during storage): -40…+70 °C
- Climatic class acc. to DIN IEC 60721-3-3: 3K23 (except condensation and formation of ice)

**Connection**
- Connection: flat terminals
- Connection properties:
  - rigid/flexible: 0.2…4/0.2…2.5 mm²

**Other**
- Operating mode: continuous operation
- Mounting: any position
- Degree of protection, internal components (DIN EN 60529): IP30
- Degree of protection, terminals (DIN EN 60529): IP20
- DIN rail mounting acc. to IEC 60715
- Flammability class: UL94 V-0
- Weight: ≤ 900 g

*The tolerance range affects the measured value of the insulation monitoring device used and must be taken into account accordingly.*
Coupling device AGH204S-4

Typical applications
- Extension of the nominal voltage range to AC, 3(N)AC 0…1650 V/0…1300 V, 50…400 Hz for the ISOMETER®'s iso685… series.

Approvals

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage $U_n$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0…1650 V/0…1300 V</td>
<td>AGH204S-4</td>
<td>B914013</td>
</tr>
</tbody>
</table>

Technical data

- Insulation coordination acc. to DIN EN 61800-5-1 (VDE 0160-105-1)
  - Rated insulation voltage AC 1500 V
- Voltage test acc. to DIN EN 61800-5-1 (VDE 0160-105-1)
  - Impulse voltage test (basic insulation) $\geq$ AC 10.4 kV
  - AC voltage test (basic insulation) $\geq$ AC 5 kV
  - Partial discharge test $\geq$ 3 kV
- Voltage ranges
  - Nominal system voltage $U_n$ (including DC components) 0…1300 V
  - Nominal system voltage $U_n$ (AC only) 0…1650 V
  - Nominal frequency $f_n$ 50…400 Hz
  - Overvoltage category/rated impulse voltage III/≥10.4 kV
- Internal DC resistance $R_i$
  - Coupling to AK80 80 kΩ
  - Coupling to AK160 160 kΩ
- Environment
  - Shock resistance IEC 60068-2-27 (device in operation) 15 g/11 ms
  - Bumping IEC 60068-2-29 (transport) 40 g/6 ms
  - Vibration resistance IEC 60068-2-6 (device in operation) 0.5 g/10…150 Hz
  - Vibration resistance IEC 60068-2-6 (transport) 2 g/10…150 Hz
  - Ambient temperature (during operation) -10…+55 °C
  - Ambient temperature for UL applications (during operation) -10…+45 °C
  - Ambient temperature (during storage) -40…+70 °C
  - Climatic class acc. to DIN IEC 60721-33 3K23 (except condensation and formation of ice)
- Connection
  - Connection screw-type terminals
  - Connection properties
    - rigid/flexible 0.2…4 mm²/0.2…2.5 mm²
    - Tightening torque 0.5 Nm
    - Conductor sizes (AWG) 24…12
    - Length of the connecting lead between the ISOMETER® and AGH $\leq$ 0.5 m
- Other
  - Operating mode continuous operation
  - Mounting any position
  - Degree of protection, internal components (DIN EN 60529) IP00
  - Degree of protection, terminals (DIN EN 60529) IP20
  - Type of enclosure X112, free from halogen
  - Screw mounting 2 x M4
  - DIN rail mounting DIN EN 60715/IEC 60715
  - Flammability class UL94 HB
  - Documentation number D00094
  - Weight $\leq$ 1350 g

Dimension diagram (dimensions in mm)

Wiring diagram
**AGH520S**

Coupling device

**Typical applications**

- Extension of the nominal voltage range to (3)AC 0...7200 V, 50...400 Hz for the ISOMETER®’s iso685… series.

**Approvals**

![CE, UK, CA, EAC, UL Listed logos]

**Further information**

For further information refer to our product range on www.bender.de.

---

### Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage $U_n$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(3)AC 0...7200 V</td>
<td>AGH520S</td>
<td>B913033</td>
</tr>
</tbody>
</table>

---

### Technical data

- **Insulation coordination acc. to IEC 61800-5-1**
  - Operating voltage: AC 6.3 kV

- **Voltage test according to IEC 61800-5-1**
  - Overvoltage category/impulse voltage test (basic insulation): III/AC 35 kV
  - AC voltage test (basic insulation): AC 17.5 kV
  - Partial discharge test: 12 kV

- **Voltage ranges**
  - Nominal system voltage $U_n$: AC, (3)AC 0...7.2 kV
  - Nominal system voltage $U_n$ for UL applications: AC, (3)AC 0...6 kV
  - Nominal frequency $f_n$: 50...400 Hz
  - Internal DC resistance $R_i$: $\geq 80$ kΩ
  - Impedance $Z_i$ at 7.2 kV and 50 Hz: $\geq 6$ MΩ

- **Environmental conditions**
  - Classification of mechanical conditions acc. to IEC 60721:
    - Stationary use (IEC 60721-3-3): 3M11
    - Transport (IEC 60721-3-2): 2M4
    - Storage (IEC 60721-3-1): 1M12
  - Ambient temperature (during operation): -10...+55 °C
  - Ambient temperature for UL applications (during operation): -10...+45 °C
  - Ambient temperature (during storage): -20...+70 °C
  - Climatic class acc. to IEC 60721-3-3: 3K23 (except condensation and formation of ice)

- **Connection**
  - Connection terminal 2 (medium voltage): screw-type terminal
  - Connection terminals 3, 4, 5: screw-type terminals
  - Connection properties: rigid/flexible
    - 0.2...4 mm² / 0.2...2.5 mm² (AWG 24...12)
  - Tightening torque: 2.9 Nm

- **General data**
  - Operating mode: continuous operation
  - Position: any position
  - Degree of protection, internal components (DIN EN 60529): IP64
  - Degree of protection, terminals (DIN EN 60529): IP20
  - Type of enclosure: resin-encapsulated block
  - Screw mounting: 4 x M5
  - Flammability class: UL94 HB
  - Documentation number: D00073
  - Weight: $\leq 4500$ g

---

**Dimension diagram**

(Dimensions in mm)

**Wiring diagram**

U, (3)AC 0...7200 V, 50...400 Hz 3 AC terminal 2 to L1

---

**Ordering example**

B913033
AGH675S-7/AGH675S-7MV15
Coupling device

**Typical applications**
- Extension of the nominal voltage range to AC/DC 0…15.5 kV for the ISOMETER® IRDH275BM-7

**Approvals**

**Further information**
For further information refer to our product range on www.bender.de.

### Technical data

#### Insulation coordination acc. to DIN EN 61800-5-1

| AGH675S-7 | AC 7.2 kV |
| AGH675S-7MV15 | AC 15.5 kV |

#### Voltage test according to IEC 61800-5-1

- **Type test:**
  - AGH675S-7
    - AC voltage test (basic insulation) 40 kV
    - Partial discharge test 14 kV
  - AGH675S-7MV15
    - Impulse voltage test (basic insulation) 111 kV
    - AC voltage test (basic insulation) 70 kV
    - Partial discharge test 29 kV

- **Routine test:**
  - AC voltage test 40 kV

#### Voltage ranges

| AGH675S-7 | AC, 3(N)AC, DC 0…7.2 kV |
| AGH675S-7MV15 | AC, 3(N)AC, DC 0…15.5 kV |

#### Environment/EMC
- Operating temperature (normal operation) -10...+60 °C
- Operating temperature (continuous operation with asymmetrical earth fault) -10...+55 °C

#### Classification of climatic conditions acc. to IEC 60721:
- Stationary use (IEC 60721-3-3) 3K22 (except condensation and formation of ice)
- Transport (IEC 60721-3-2) 2K11
- Long-term storage (IEC 60721-3-1) 2K22

#### Classification of mechanical conditions acc. to IEC 60721:
- Stationary use (IEC 60721-3-3) 3M11 (3M12 Y axis)
- Transport (IEC 60721-3-2) 2M4
- Long-term storage (IEC 60721-3-1) 1M12

#### Connection
- Connection terminal 2 (medium voltage) high-voltage cable (encapsulated on the device side)
- Connection, flexible with ring eyelet M4
- Connection type terminals 3, 4, 5 screw-type terminals
- Connection rigid/flexible 0.2...4 mm²/0.2...2.5 mm²
- Flexible connector sleeve 0.25...2.5 mm²

#### Other
- Operating mode continuous operation
- Mounting any position
- Degree of protection, internal components (DIN EN 60529) IP 64
- Degree of protection, terminals (DIN EN 60529) IP 20
- Type of enclosure resin-encapsulated block
- Flammability class UL94 HB
- Documentation number D00095
- Weight ≤ 5100 g

### Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage (U_n)</th>
<th>Cable length</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>0…7.2 kV, 0…460 Hz</td>
<td>500 mm</td>
<td>AGH675S-7-500</td>
<td>B913060</td>
</tr>
<tr>
<td></td>
<td>2000 mm</td>
<td>AGH675S-7-2000</td>
<td>B913061</td>
</tr>
<tr>
<td>0…15.5 kV, 0…460 Hz</td>
<td>500 mm</td>
<td>AGH675S-7-MV15-500</td>
<td>B913058</td>
</tr>
</tbody>
</table>
Both AKs (one from each coupling device) are bridged and coupled with the AK from the IRDH275BM-7.
Typical applications
• Extension of the nominal voltage range to AC, 3(N)AC 0…12 kV, 50…460 Hz for the ISOMETER®’s iso685… series and IR420-D64

Approvals

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage $U_s$</th>
<th>Cable length</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC, 3(N)AC 0...12 kV</td>
<td>2000 mm</td>
<td>AGH676S-4</td>
<td>B913055</td>
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</tbody>
</table>

Technical data

Insulation coordination acc. to IEC 61800-5-1
Rated insulation voltage $AC 12 kV$

Voltage test acc. to IEC 61800-5-1

Type test
Voltage impulse test $\geq AC 75 kV$
AC voltage test $\geq AC 45 kV$
Partial discharge test $\geq 16.5 kV_{eff}$

Routine test
AC voltage test, rate of increase $< 2 kV/s$  $AC 25 kV$

Voltage ranges
Nominal system voltage $U_n$  $AC / 3(N)AC 0...12 kV$
Nominal frequency $f_n$  $50...460 Hz$
Internal DC resistance $R_i$ $\geq 160 k\Omega$
Impedance $Z_i$ at 12 kV and 50 Hz $\geq 12 M\Omega$

Environmental conditions
Shock resistance IEC 60068-2-27 (during operation) 15 g/11 ms
Bumping IEC 60068-2-29 (during transport) 40 g/6 ms
Vibration resistance IEC 60068-2-6 (during operation) 1 g/10...150 Hz
Vibration resistance IEC 60068-2-6 (during transport) 2 g/10...150 Hz
Ambient temperature, during operation $-10...+55^\circ C$
Storage temperature range $-40...+70^\circ C$
Climatic class acc. to IEC 60721-3-3 3K23 (except condensation and formation of ice)
### Dimension diagram (dimensions in mm)

```
<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>320</td>
</tr>
<tr>
<td>Width</td>
<td>220</td>
</tr>
<tr>
<td>Depth</td>
<td>310</td>
</tr>
</tbody>
</table>
```

### Wiring diagram offline (IR420-D64)

```
U_r = 3AC 12 kV

L1  L2  L3

AGH676S-4

K3

AK PE PE

PE

IR420-D64
```

### Wiring diagram online (iso685)

```
U_r = 3AC 12 kV

L1  L2  L3

AGH676S-4

AK PE PE

PE

ISOMETER® iso685
```
### Measuring current transformers

**W0-S20…W5-S210, W10/600**

#### Typical applications
- For residual current monitors (RCM)
- For residual current monitoring systems (RCMS)
- For insulation fault locators with additional EDS in AC and DC systems

#### Standards
W0-S20…W5-S210 series measuring current transformers comply with the device standard:
- IEC 61869-1.

#### Approvals

#### Further information
For further information refer to our product range on www.bender.de.

#### Ordering information

<table>
<thead>
<tr>
<th>Inside diameter</th>
<th>UL</th>
<th>EAC</th>
<th>LR</th>
<th>Type</th>
<th>Art. No.</th>
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<tbody>
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<td>10 mm</td>
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<td><img src="image" alt="UL" /></td>
<td>W10/600</td>
<td>B911761</td>
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<tr>
<td>20 mm</td>
<td>–</td>
<td>–</td>
<td><img src="image" alt="EAC" /></td>
<td>W0-S20</td>
<td>B911787</td>
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<tr>
<td>35 mm</td>
<td><img src="image" alt="UL" /></td>
<td><img src="image" alt="EAC" /></td>
<td><img src="image" alt="LR" /></td>
<td>W1-S35</td>
<td>B911731</td>
</tr>
<tr>
<td>70 mm</td>
<td><img src="image" alt="UL" /></td>
<td><img src="image" alt="EAC" /></td>
<td><img src="image" alt="LR" /></td>
<td>W2-S70</td>
<td>B911732</td>
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<tr>
<td>105 mm</td>
<td><img src="image" alt="UL" /></td>
<td><img src="image" alt="EAC" /></td>
<td><img src="image" alt="LR" /></td>
<td>W3-S105</td>
<td>B911733</td>
</tr>
<tr>
<td>140 mm</td>
<td><img src="image" alt="UL" /></td>
<td><img src="image" alt="EAC" /></td>
<td><img src="image" alt="LR" /></td>
<td>W4-S140</td>
<td>B911734</td>
</tr>
<tr>
<td>210 mm</td>
<td><img src="image" alt="UL" /></td>
<td><img src="image" alt="EAC" /></td>
<td><img src="image" alt="LR" /></td>
<td>W5-S210</td>
<td>B911735</td>
</tr>
</tbody>
</table>
Technical data

Insulation coordination acc. to IEC 60044-1

- Highest system voltage for electrical equipment $U_{m}$: AC 720 V
- Rated impulse withstand voltage $U_{\text{imp}}$: 3 kV

Measuring circuit

- Rated transformation ratio: 600/1
- Rated burden: 180 $\Omega$ (18 $\Omega$ at 100 A)
- Phase displacement: $< 4^\circ$
- Rated primary current: $\leq 10$ A (100 A)
- Rated primary current: $\geq 10$ mA
- Nominal power: 50 mVA
- Rated frequency: 15...600 Hz
- Internal resistance: 5...8 $\Omega$
- Secondary overvoltage protection: with suppressor diode P6KE6V8CP
- Accuracy class: 3
- Rated continuous thermal current: 100 A
- Rated short-time thermal current: 14 kA 1 s
- Rated dynamic current: 35 kA 30 ms

Environment

- Shock resistance IEC 60068-2-27 (device in operation): 15 g/11 ms
- Bumping IEC 60068-2-29 (transport): 40 g/6 ms
- Vibration resistance IEC 60068-2-6 (device in operation): W1-S35...W5-S210 1 g/10...150 Hz, W4-S140, W5-S210 1 g/10...150 Hz/0.075 mm
- Vibration resistance IEC 60068-2-6 (device not in operation): 2 g/10...150 Hz
- Ambient temperature (during operation/during storage): -10...+50 °C/-40...+70 °C
- Climatic class acc. to DIN IEC 60721-3-3: 3K23

Connection

- Connection: screw-type terminals
- Connection: rigid/flexible $0.2...4/0.2...2.5$ mm²
  - flexible with ferrules with/without plastic sleeve $0.25...2.5$ mm²
  - Conductor sizes (AWG): 24...12
- Connection to the evaluator:
  - single wire $\geq 0.75$ mm²
  - single wire, twisted $\geq 0.75$ mm²
  - shielded cable $\geq 0.6$ mm²
  - Shielded cable (shield connected to PE on one side): recommended cable J-Y(St)Y min. 2 x 0.6

Other

- Operating mode: continuous operation
- Mounting: any position
- Degree of protection, internal components (DIN EN 60529): IP40
- Degree of protection, terminals (DIN EN 60529): IP20
- Screw mounting: M5
- Flammability class: UL94 V-0
- Documentation number:
  - D00142 (W(0-5)-S)
  - D00143 (W10)

Dimension diagrams

Type W10/600

Type W0-S20

Type W1-S35...W5-S210

Dimensions (mm) Weight

<table>
<thead>
<tr>
<th>Type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>W10/600</td>
<td>ø 37</td>
<td>ø 10</td>
<td>18</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>85 g</td>
</tr>
<tr>
<td>W9-S20</td>
<td>ø 20.5</td>
<td>36</td>
<td>69</td>
<td>ø 46</td>
<td>25</td>
<td>32</td>
<td>23</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>70 g</td>
</tr>
<tr>
<td>W1-S35</td>
<td>ø 35</td>
<td>44</td>
<td>79</td>
<td>35</td>
<td>100</td>
<td>32.5</td>
<td>46</td>
<td>26.5</td>
<td>48</td>
<td>6.5</td>
<td>250 g</td>
</tr>
<tr>
<td>W2-S70</td>
<td>ø 70</td>
<td>58</td>
<td>110</td>
<td>52</td>
<td>130</td>
<td>32.5</td>
<td>46</td>
<td>32</td>
<td>66</td>
<td>6.5</td>
<td>380 g</td>
</tr>
<tr>
<td>W3-S105</td>
<td>ø 150</td>
<td>74</td>
<td>146</td>
<td>72</td>
<td>170</td>
<td>32.5</td>
<td>46</td>
<td>38</td>
<td>94</td>
<td>6.5</td>
<td>700 g</td>
</tr>
<tr>
<td>W4-S140</td>
<td>ø 140</td>
<td>99.5</td>
<td>197</td>
<td>97.5</td>
<td>220</td>
<td>32.5</td>
<td>46</td>
<td>48.5</td>
<td>123</td>
<td>6.5</td>
<td>1500 g</td>
</tr>
<tr>
<td>W5-S210</td>
<td>ø 210</td>
<td>143</td>
<td>285</td>
<td>150</td>
<td>300</td>
<td>32.5</td>
<td>46</td>
<td>46</td>
<td>69</td>
<td>161</td>
<td>6.5</td>
</tr>
</tbody>
</table>
LINETRAXX® CTAC...

Measuring current transformers

Device features

**Measuring current transformers CTAC...**
- For RCMS460/490 residual current monitoring systems
- For RCM420 residual current monitors
- For EDS440 and EDS460/490 insulation fault locators in AC and DC systems

**Measuring current transformers CTAC.../01**
- For EDS441 and EDS461/EDS491 insulation fault locators

Typical applications

- For residual current monitoring systems of the series RCM or RCMS
- Suitable for use in insulation fault location for IT systems (EDS)

Further information

For further information refer to our product range on www.bender.de.

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Mounting</th>
<th>Inside diameter</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20 mm</td>
<td>CTAC20</td>
<td>B98110005</td>
</tr>
<tr>
<td>Mounting brackets, DIN rail</td>
<td>35 mm</td>
<td>CTAC25</td>
<td>B98110004</td>
</tr>
<tr>
<td></td>
<td>35 mm</td>
<td>CTAC25/01</td>
<td>B98110006</td>
</tr>
<tr>
<td></td>
<td>60 mm</td>
<td>CTAC60</td>
<td>B98110017</td>
</tr>
<tr>
<td></td>
<td>120 mm</td>
<td>CTAC120</td>
<td>B98110019</td>
</tr>
<tr>
<td></td>
<td>210 mm</td>
<td>CTAC210</td>
<td>B98110020</td>
</tr>
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</table>

1) For EDS441 and EDS461/491 insulation fault locators
2) B781100xxMIL variants available on request

Accessories

<table>
<thead>
<tr>
<th>Type designation</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snap-on mounting for CTAC20 and CTAC20/01</td>
<td>B91080111</td>
</tr>
<tr>
<td>Snap-on mounting for CTAC35 and CTAC35/01</td>
<td>B91080112</td>
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Included in scope of delivery

Selection list

<table>
<thead>
<tr>
<th>Type</th>
<th>RCM20</th>
<th>RCMS460</th>
<th>EDS440</th>
<th>EDS460</th>
<th>EDS441</th>
<th>EDS461</th>
<th>EDS440</th>
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<tbody>
<tr>
<td>CTAC20</td>
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<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
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<tr>
<td>CTAC35</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>CTAC60</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>CTAC120</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>CTAC210</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
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<td>–</td>
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<td>–</td>
</tr>
<tr>
<td>CTAC35/01</td>
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<td>–</td>
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## Technical data

### Insulation coordination acc. to IEC 60664-1

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Rated insulation voltage</td>
<td>800 V</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>III</td>
</tr>
<tr>
<td>Rated impulse voltage/pollution degree</td>
<td>8 kV/3</td>
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</table>

### Measuring current transformer circuit

**CTAC…**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated continuous thermal current* $I_{ch}$</td>
<td>125 A</td>
</tr>
<tr>
<td>Frequency range</td>
<td>15 Hz…100 kHz</td>
</tr>
<tr>
<td>Rated short-time thermal current* $I_{th}$</td>
<td>2.4 kA/1 s</td>
</tr>
<tr>
<td>Rated dynamic current* $I_{dyn}$</td>
<td>6.0 kA/40 ms</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTAC20 at $I_{th}$ ≥ 30 mA</td>
<td>63 A</td>
</tr>
<tr>
<td>CTAC20 at $I_{th}$ ≥ 100 mA</td>
<td>80 A</td>
</tr>
<tr>
<td>CTAC35 at $I_{th}$ ≥ 100 mA</td>
<td>125 A</td>
</tr>
<tr>
<td>CTAC35 at $I_{th}$ ≥ 300 mA</td>
<td>160 A</td>
</tr>
<tr>
<td>CTAC60 at $I_{th}$ ≥ 30 mA</td>
<td>200 A</td>
</tr>
<tr>
<td>CTAC60 at $I_{th}$ ≥ 300 mA</td>
<td>400 A</td>
</tr>
<tr>
<td>CTAC120 at $I_{th}$ ≥ 100 mA</td>
<td>400 A</td>
</tr>
<tr>
<td>CTAC210 at $I_{th}$ ≥ 300 mA</td>
<td>630 A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated primary residual current</td>
<td>1 A</td>
</tr>
<tr>
<td>Rated secondary residual current</td>
<td>0.125 mA</td>
</tr>
<tr>
<td>Rated transformation ratio $K_n$</td>
<td>1 A/0.125 mA</td>
</tr>
</tbody>
</table>

### Connection

**Connection**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal type</td>
<td>M5TB 2.5/2-ST-5.0B for B781100xxMIL devices</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>Phoenix Contact</td>
</tr>
<tr>
<td>Connection type</td>
<td>screw type terminal for B781100xxMIL devices</td>
</tr>
<tr>
<td>Push-wire terminal</td>
<td>push-wire terminal</td>
</tr>
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</table>

The connection conditions of the manufacturer apply.

### Corresponding PCB connectors are included in the scope of delivery

**Connection properties**

<table>
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<tr>
<th>Type</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Rigid</td>
<td>0.2…2.5 mm² (AWG 24…12)</td>
</tr>
<tr>
<td>Flexible</td>
<td>0.2…2.5 mm² (AWG 24…12)</td>
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</table>

**Stripping length**

<table>
<thead>
<tr>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>7 mm</td>
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### Connection EDS, RCM(S) measuring current transformers

**Connection EDS, RCM(S) measuring current transformers**

<table>
<thead>
<tr>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0…1 m</td>
</tr>
<tr>
<td>0…10 m</td>
</tr>
<tr>
<td>0…40 m</td>
</tr>
</tbody>
</table>

**Shielded cable**

Recommended: J-V(x)Y min. 2x0.8

**ECS: shield on one side connected to L-conductor, not connected to earth

**ECS: shield on one side connected to PE**

### Environment

**Temperature**

<table>
<thead>
<tr>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>-25…+70 °C</td>
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<tr>
<td>-40…+70 °C</td>
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### Climatic class acc. to IEC 60721

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>B781100xxMIL (for applications with EDS)</td>
<td>3K23</td>
</tr>
<tr>
<td>(except condensation and formation of ice)</td>
<td></td>
</tr>
<tr>
<td>(except condensation and formation of ice)</td>
<td></td>
</tr>
<tr>
<td>Long-time storage (IEC 60721-3-1)</td>
<td>1K22</td>
</tr>
<tr>
<td>(except condensation and formation of ice)</td>
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### Mounting

**Screw Type**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>CTAC20(01), CTAC35(01), CTAC60</td>
<td>DIN EN ISO 7045 - M5x CTAC120, CTAC210</td>
</tr>
<tr>
<td>CTAC60, CTAC120, CTAC210</td>
<td>DIN EN ISO 7045 - M6</td>
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**Washer type**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>CTAC20(01), CTAC35(01), CTAC60</td>
<td>DIN EN ISO 7089/7090 - 5 CTAC120, CTAC210</td>
</tr>
<tr>
<td>CTAC60, CTAC120, CTAC210</td>
<td>DIN EN ISO 7089/7090 - 6</td>
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**Tightening torque**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTAC20(01), CTAC35(01)</td>
<td>0.6 Nm</td>
</tr>
<tr>
<td>CTAC60, CTAC120, CTAC210</td>
<td>1 Nm</td>
</tr>
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</table>

### Other

**Degree of protection, internal components (DIN EN 60529)**

<table>
<thead>
<tr>
<th>Value</th>
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<tbody>
<tr>
<td>IP40</td>
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</table>

**Degree of protection, terminals (IEC 60529)**

<table>
<thead>
<tr>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP20</td>
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</table>

**Flammability class**

<table>
<thead>
<tr>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>UL94 V-0</td>
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**Documentation number**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>D00386</td>
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</table>

**CTAC120 and CTAC210 must be additionally mounted for the 3M12.**

(see Mountings)

### Degree of protection, terminals (IEC 60529)

<table>
<thead>
<tr>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP20</td>
</tr>
</tbody>
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### Mounting

(see Mountings)

### Classification of mechanical conditions IEC 60721

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stationary use (IEC 60721-3-3)</td>
<td>3M11</td>
</tr>
<tr>
<td>8781100xxMIL devices</td>
<td>3M12</td>
</tr>
<tr>
<td>Transport (IEC 60721-3-2)</td>
<td>2M4</td>
</tr>
<tr>
<td>Long-time storage (IEC 60721-3-1)</td>
<td>1M12</td>
</tr>
</tbody>
</table>

### Connection

**Connection type**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTAC20(01), CTAC35(01), CTAC60</td>
<td>DIN EN ISO 7045 - M5x CTAC120, CTAC210</td>
</tr>
<tr>
<td>CTAC60, CTAC120, CTAC210</td>
<td>DIN EN ISO 7045 - M6</td>
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**Washer type**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTAC20(01), CTAC35(01), CTAC60</td>
<td>DIN EN ISO 7089/7090 - 5 CTAC120, CTAC210</td>
</tr>
<tr>
<td>CTAC60, CTAC120, CTAC210</td>
<td>DIN EN ISO 7089/7090 - 6</td>
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</table>

**Tightening torque**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTAC20(01), CTAC35(01)</td>
<td>0.6 Nm</td>
</tr>
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<td>1 Nm</td>
</tr>
</tbody>
</table>

### Other

**Degree of protection, internal components (DIN EN 60529)**

<table>
<thead>
<tr>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>IP40</td>
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</table>

**Degree of protection, terminals (IEC 60529)**

<table>
<thead>
<tr>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP20</td>
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**Flammability class**

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<th>Value</th>
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**Documentation number**

<table>
<thead>
<tr>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>D00386</td>
</tr>
</tbody>
</table>

**CTAC120 and CTAC210 must be additionally mounted for the 3M12.**

(see Mountings)
Measuring current transformers CTAC...
Connection to the respective residual current monitoring system RCMS, residual current monitors RCM or to insulation fault location systems EDS

Measuring current transformers CTAC.../01
Connection to the respective EDS474(E)-12, EDS461, EDS491 and EDS441 insulation fault locator
LINETRAXX® CTUB100 series
AC/DC sensitive measuring current transformer (Type B)

Device features
- Combined test and reset button
- Multicolour LED for operation, fault and status messages
- Exchangeable electronic module without mechanical separation of the primary conductors
- Extension/retrofitting or modification of functionalities in case of changed monitoring requirements
- Insensitive to load currents due to full magnetic shield (CTUB10x-CTBC20P...210P only)
- Monitoring of the connection to the measuring current transformer
- Supply voltage DC ±12 V/DC 24 V
- CTUB10x-CTBC20...210 for residual current monitoring systems of the RCMS460/490 series as well as for RCMA420/423 residual current monitors
- CTUB10x-CTBC20P...210P for residual current monitoring systems of the RCMS460/490 series as well as for RCMA420/423 residual current monitors. Can be used for very high system-related peak load currents.
- CTUB104-CTBC20...210(P) for insulation fault locators of the EDS440 and EDS441LAB series.

Typical applications
- For RCMS460/490 residual current monitoring systems
- For RCMA420/423 residual current monitors
- For insulation fault locators of the EDS440 and EDS441LAB series

Standards
CTUB100 series measuring current transformers comply with the following device standard:
- IEC 62020:2003-11 for CTUB101 and CTUB102 in combination with a residual current monitor/residual current monitoring system (RCMS460/490 or RCMA420/423)
- IEC 61557-9 for CTUB104 in combination with an insulation fault locator (EDS440 or EDS441LAB)

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Suitable for evaluator</th>
<th>Supply voltage</th>
<th>Current transformer diameter</th>
<th>Shielding</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
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<td>DC ±12 V</td>
<td>ø 20</td>
<td>–</td>
<td>CTUB101-CTBC20</td>
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<tr>
<td>RCMA423</td>
<td></td>
<td>ø 20</td>
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<td>CTUB101-CTBC20P</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>ø 35</td>
<td></td>
<td>CTUB101-CTBC35</td>
<td>B78120012</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ø 35</td>
<td></td>
<td>CTUB101-CTBC35P</td>
<td>B78120022</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>CTUB101-CTBC60</td>
<td>B78120014</td>
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<tr>
<td></td>
<td></td>
<td>ø 60</td>
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<td>B78120024</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>–</td>
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<tr>
<td></td>
<td></td>
<td>ø 120</td>
<td></td>
<td>CTUB101-CTBC120P</td>
<td>B78120026</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ø 210</td>
<td>–</td>
<td>CTUB101-CTBC210</td>
<td>B78120018</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ø 210</td>
<td></td>
<td>CTUB101-CTBC210P</td>
<td>B78120028</td>
</tr>
</tbody>
</table>

| RCMS460                | DC 24 V       | ø 20                        | –         | CTUB102-CTBC20 | B78120011 |
| RCMS490                |               | ø 20                        |           | CTUB102-CTBC20P | B78120021 |
|                       |               | ø 35                        |           | CTUB102-CTBC35 | B78120013 |
|                       |               | ø 35                        |           | CTUB102-CTBC35P | B78120023 |
|                       |               | ø 60                        | –         | CTUB102-CTBC60 | B78120015 |
|                       |               | ø 60                        |           | CTUB102-CTBC60P | B78120025 |
|                       |               | ø 120                       | –         | CTUB102-CTBC120 | B78120017 |
|                       |               | ø 120                       |           | CTUB102-CTBC120P | B78120027 |
|                       |               | ø 210                       | –         | CTUB102-CTBC210 | B78120019 |
|                       |               | ø 210                       |           | CTUB102-CTBC210P | B78120029 |

| EDS440                | DC 24 V       | ø 20                        | –         | CTUB104-CTBC20 | B78120033 |
| EDS441LAB             |               | ø 20                        |           | CTUB104-CTBC20P | B78120035 |
|                       |               | ø 35                        |           | CTUB104-CTBC35 | B78120034 |
|                       |               | ø 35                        |           | CTUB104-CTBC35P | B78120035 |

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Supply voltage</th>
<th>Current transformer diameter</th>
<th>Shielding</th>
<th>Type</th>
<th>Art. No.</th>
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<tbody>
<tr>
<td>RCMA420</td>
<td>DC ±12 V</td>
<td>ø 20</td>
<td>–</td>
<td>CTUB101-CTBC20</td>
<td>B78120010</td>
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<tr>
<td>RCMA423</td>
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<td>ø 20</td>
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<td>CTUB101-CTBC20P</td>
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<tr>
<td></td>
<td></td>
<td>ø 35</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>ø 35</td>
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<tr>
<td></td>
<td></td>
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<tr>
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<td>–</td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td>ø 210</td>
<td>–</td>
<td>CTUB101-CTBC210</td>
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<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>ø 35</td>
<td></td>
<td>CTUB102-CTBC35</td>
<td>B78120013</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ø 35</td>
<td></td>
<td>CTUB102-CTBC35P</td>
<td>B78120023</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ø 60</td>
<td>–</td>
<td>CTUB102-CTBC60</td>
<td>B78120015</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ø 60</td>
<td></td>
<td>CTUB102-CTBC60P</td>
<td>B78120025</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ø 120</td>
<td>–</td>
<td>CTUB102-CTBC120</td>
<td>B78120017</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ø 120</td>
<td></td>
<td>CTUB102-CTBC120P</td>
<td>B78120027</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ø 210</td>
<td>–</td>
<td>CTUB102-CTBC210</td>
<td>B78120019</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ø 210</td>
<td></td>
<td>CTUB102-CTBC210P</td>
<td>B78120029</td>
</tr>
<tr>
<td>EDS440</td>
<td>DC 24 V</td>
<td>ø 20</td>
<td>–</td>
<td>CTUB104-CTBC20</td>
<td>B78120033</td>
</tr>
<tr>
<td>EDS441LAB</td>
<td></td>
<td>ø 20</td>
<td></td>
<td>CTUB104-CTBC20P</td>
<td>B78120035</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ø 35</td>
<td></td>
<td>CTUB104-CTBC35</td>
<td>B78120034</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ø 35</td>
<td></td>
<td>CTUB104-CTBC35P</td>
<td>B78120035</td>
</tr>
</tbody>
</table>
### Electronic modules

<table>
<thead>
<tr>
<th>Suitable for evaluator</th>
<th>Supply voltage $U_s$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RMCM420/423</td>
<td>±12 V</td>
<td>DC</td>
<td>CTUB101</td>
</tr>
<tr>
<td>RMS640/490</td>
<td>24 V</td>
<td>CTUB102</td>
<td>B78120051</td>
</tr>
<tr>
<td>ED5440/441LA8</td>
<td>24 V</td>
<td>CTUB104</td>
<td>B78120053</td>
</tr>
</tbody>
</table>

**Ordering details for accessories and spare parts**

<table>
<thead>
<tr>
<th>Description</th>
<th>max. connected current transformers</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage supply</td>
<td>4</td>
<td>STEP-PS/1 AC/24 DC/0.5</td>
<td>B94053110</td>
<td>390</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>STEP-PS/1 AC/24 DC/1.75</td>
<td>B94053111</td>
<td>390</td>
</tr>
<tr>
<td></td>
<td>34</td>
<td>STEP-PS/1 AC/24 DC/4.2</td>
<td>B94053112</td>
<td>390</td>
</tr>
</tbody>
</table>

**Measuring current transformer cores**

<table>
<thead>
<tr>
<th>Internal diameter</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mm</td>
<td>CTBC20</td>
<td>B98120001</td>
</tr>
<tr>
<td></td>
<td>CTBC20P</td>
<td>B98120002</td>
</tr>
<tr>
<td>35 mm</td>
<td>CTBC35</td>
<td>B98120003</td>
</tr>
<tr>
<td></td>
<td>CTBC35P</td>
<td>B98120004</td>
</tr>
<tr>
<td>60 mm</td>
<td>CTBC60</td>
<td>B98120005</td>
</tr>
<tr>
<td></td>
<td>CTBC60P</td>
<td>B98120006</td>
</tr>
<tr>
<td>120 mm</td>
<td>CTBC120</td>
<td>B98120007</td>
</tr>
<tr>
<td></td>
<td>CTBC120P</td>
<td>B98120020</td>
</tr>
<tr>
<td>210 mm</td>
<td>CTBC210</td>
<td>B98120008</td>
</tr>
<tr>
<td></td>
<td>CTBC210P</td>
<td>B98120021</td>
</tr>
</tbody>
</table>

P = full magnetic shield

### Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTUB101</td>
<td>Description</td>
<td>+12 V, GND, -12 V</td>
<td>DC ±12 V</td>
</tr>
<tr>
<td></td>
<td>Supply voltage $U_s$</td>
<td>500 mA</td>
<td>(related to the RMCM423)</td>
</tr>
<tr>
<td></td>
<td>Operating range of $U_s$</td>
<td>2 %</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ripple $U_s$</td>
<td>1 %</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Power consumption</td>
<td>2.5 W</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inrush current</td>
<td>500 mA</td>
<td></td>
</tr>
<tr>
<td>CTUB102, CTUB104</td>
<td>Description</td>
<td>24 V, GND</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply voltage $U_s$</td>
<td>DC 24 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operating range of $U_s$</td>
<td>20 %</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ripple $U_s$</td>
<td>1 %</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Power consumption</td>
<td>5 W</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inrush current</td>
<td>500 mA</td>
<td></td>
</tr>
</tbody>
</table>

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**

**Technical data**

**Measuring circuit**

**Possible response values (to be set on the evaluator)**

<table>
<thead>
<tr>
<th>Measuring range (CTUB104)</th>
<th>Measuring range (CTUB101, CTUB102)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range 1 ($I_{IN} &lt; 0.1 \text{ A}$)</td>
<td>Measuring range 1 ($I_{IN} &lt; 0.1 \text{ A}$)</td>
</tr>
<tr>
<td>Measuring range 2 ($0.1 \text{ A} &lt; I_{IN} &lt; 0.5 \text{ A}$)</td>
<td>Measuring range 2 ($0.1 \text{ A} &lt; I_{IN} &lt; 0.5 \text{ A}$)</td>
</tr>
<tr>
<td>Measuring range 3 ($I_{IN} &gt; 0.5 \text{ A}$)</td>
<td>Measuring range 3 ($I_{IN} &gt; 0.5 \text{ A}$)</td>
</tr>
</tbody>
</table>

**Indication**

- Multicolour LED

Included in the scope of delivery
### Technical data (continued)

#### Output
- **Name**: S1 (L), S2 (L)
- **Scaling**: 400 mV/1 A
- **Max. voltage**: ±10 V
- **Max. connector length**: 10 m
- **Output resistance**: 172 Ω

#### Input
- **Name**: T (for CTUB101 only)
- **Current load**: < 300 mA

#### Environment/EMC
- **EMC** (CTUB101, CTUB102): IEC 62020: 2005-11
- **EMC** (CTUB104): IEC 61326-2-4
- **Operating temperature**: -25…70 °C

#### Classification of climatic conditions acc. to IEC 60721 (except condensation and formation of ice)
- **Stationary use** (IEC 60721-3-3): 3K24
- **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
- Connecting cables are optionally available

#### Terminal block
- **Manufacturer**: Phoenix Contact
- **Type**: DFMC 1.5/4-ST-3.5 BK

#### Connection properties
- **Rigid**: 0.2…1.5 mm² (AWG 24…16)
- **Flexible**: 0.2…1.5 mm²
- **With ferrule**: 0.25…0.75 mm²

#### Mounting CTBC...
- **Screw type**:
  - CTBC20…60(P): DIN EN ISO 7045 - M5
  - CTCB120…210(P): DIN EN ISO 7045 - M6
- **Washer type**:
  - CTBC20…60(P): DIN EN ISO 7089/7090 - 5
  - CTCB120…210(P): DIN EN ISO 7089/7090 - 6
- **Tightening torque**:
  - CTBC20…35 (P): 0.6 Nm
  - CTCB60…210(P): 1 Nm

#### Other
- **Operating mode**: continuous operation
- **Mounting**: any position
- **Degree of protection, internal components (DIN EN 60529)**: IP40
- **Degree of protection, terminals (DIN EN 60529)**: IP20
- **Flammability class**: UL94 V-0
- **Software**: D591
- **Documentation number**: D00362

#### Weight
- **CTUB10…-CTBC20(P)**: ≤ 230 g
- **CTUB10…-CTBC20(P)**: ≤ 290 g
- **CTUB10…-CTBC35(P)**: ≤ 310 g
- **CTUB10…-CTBC35(P)**: ≤ 390 g
- **CTUB10…-CTBC60(P)**: ≤ 530 g
- **CTUB10…-CTBC60(P)**: ≤ 690 g
- **CTUB10…-CTBC120(P)**: ≤ 1460 g
- **CTUB10…-CTBC120(P)**: ≤ 1820 g
- **CTUB10…-CTBC210(P)**: ≤ 4290 g
- **CTUB10…-CTBC210(P)**: ≤ 4940 g

The use of the power supply units listed at “Accessories” is recommended.

The use of a surge protection device is mandatory (not required for CTUB104).

#### Dimension diagrams

### Dimensions (mm)

<table>
<thead>
<tr>
<th>Type</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
<th>f</th>
<th>g</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>CTUB10…-CTBC20(P)</td>
<td>75</td>
<td>83</td>
<td>37</td>
<td>ø 20</td>
<td>46</td>
<td>60.5</td>
</tr>
<tr>
<td>B</td>
<td>CTUB10…-CTBC35(P)</td>
<td>97</td>
<td>130</td>
<td>47</td>
<td>ø 35</td>
<td>46</td>
<td>61</td>
</tr>
<tr>
<td>C</td>
<td>CTUB10…-CTBC60(P)</td>
<td>126</td>
<td>151</td>
<td>57</td>
<td>ø 60</td>
<td>56</td>
<td>78</td>
</tr>
<tr>
<td>D</td>
<td>CTUB10…-CTBC120(P)</td>
<td>188</td>
<td>225</td>
<td>96</td>
<td>ø 120</td>
<td>65</td>
<td>96</td>
</tr>
<tr>
<td>E</td>
<td>CTUB10…-CTBC210(P)</td>
<td>302</td>
<td>339</td>
<td>153</td>
<td>ø 210</td>
<td>67</td>
<td>113</td>
</tr>
</tbody>
</table>

The tolerance is ±0.5 mm.
**System states: LED**

The LED indicates the system state by means of colours and lighting/flashing.

<table>
<thead>
<tr>
<th>System state</th>
<th>LED</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device switched off</td>
<td>off</td>
<td>Device is deenergised</td>
</tr>
<tr>
<td>Normal operating state</td>
<td>lights</td>
<td>The device is supplied with the specified voltage and the measuring current transformer core is connected to the electronic module.</td>
</tr>
<tr>
<td>Device error</td>
<td>off</td>
<td>The device is supplied with the specified voltage but there is no connection to the measuring current transformer core or some other device error has occurred.</td>
</tr>
</tbody>
</table>

**Notes**

- Device switched off: off
- Normal operating state: lights
- Device error: off

---

**Wiring diagram**

![Wiring diagram](image)

---

**Setting measuring range (not required for CTUB104)**

<table>
<thead>
<tr>
<th>#</th>
<th>Potentiometer setting</th>
<th>Response value RCMA/RCMS</th>
<th>Measuring range rms</th>
<th>Measuring range peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>$I_{\Delta N} \leq 0.1\ A$</td>
<td>$0...450\ mA$</td>
<td>$0...900\ mA$</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>$0.1\ A &lt; I_{\Delta N} \leq 0.5\ A$</td>
<td>$0...0.75\ A$</td>
<td>$0...3.5\ A$</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>$I_{\Delta N} &gt; 0.5\ A$</td>
<td>$0...10\ A$</td>
<td>$0...20\ A$</td>
</tr>
</tbody>
</table>

- The use of a type 2 surge protection device (SPD) is mandatory due to possible impulse voltages and in order to comply with normative requirements (not required for CTUB104).
- The surge protection device must be connected upstream of the power supply unit on the supply side.
- The surge protection device 7P.22.8.275.1020 from Finder or an equivalent alternative can be used.

---

**CTUB100 series**

- System components
- Individual components and accessories
- Measuring current transformers
WR70x175S(P)…WR200x500S(P) series
Measuring current transformers

Typical applications
- For RCMS460/490 residual current monitoring systems
- For RCM420 residual current monitors
- For EDS470, EDS460/490 and EDS440 insulation fault locators in AC and DC systems
- The WR…SP measuring current transformers are particularly suitable for use in busbar systems. This series is to be used for load currents ≥ 500 A.

Standards
WR70x175S(P)…WR200x500S(P) measuring current transformers comply with the device standards:
- DIN EN 60044-1
- IEC 61869

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Screening</th>
<th>Internal dimensions</th>
<th>Approvals</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>UL</td>
<td>LR</td>
<td></td>
</tr>
<tr>
<td>without screening</td>
<td>70 x 175 mm</td>
<td></td>
<td>WR70x175S</td>
<td>B911738</td>
</tr>
<tr>
<td></td>
<td>115 x 305 mm</td>
<td></td>
<td>WR115x305S</td>
<td>B911739</td>
</tr>
<tr>
<td></td>
<td>150 x 350 mm</td>
<td></td>
<td>WR150x350S</td>
<td>B911740</td>
</tr>
<tr>
<td></td>
<td>200 x 500 mm</td>
<td></td>
<td>WR200x500S</td>
<td>B911763</td>
</tr>
<tr>
<td>Screening integrated</td>
<td>70 x 175 mm</td>
<td></td>
<td>WR70x175SP</td>
<td>B911790</td>
</tr>
<tr>
<td></td>
<td>115 x 305 mm</td>
<td></td>
<td>WR115x305SP</td>
<td>B911791</td>
</tr>
<tr>
<td></td>
<td>150 x 350 mm</td>
<td></td>
<td>WR150x350SP</td>
<td>B911792</td>
</tr>
<tr>
<td></td>
<td>200 x 500 mm</td>
<td></td>
<td>WR200x500SP</td>
<td>B911793</td>
</tr>
</tbody>
</table>

Approvals
### Technical data

#### Insulation coordination acc. to IEC 61869-2
- Highest system voltage for electrical equipment $U_{m}$: AC 720 V
- Rated impulse withstand voltage $U_{dut}$: 3 kV

#### Measuring circuit
- Rated transformation ratio: 600/1
- Rated burden: 180 Ω
- Rated primary current: $\leq 10$ A (100 A)
- Rated primary current: $\geq 10$ mA
- Nominal power: 50 mW
- Rated frequency: 50…400 Hz
- Internal resistance: $5…8$ Ω

#### Secondary overvoltage protection
- Suppressor diode: P0KE6/08CP

#### Accuracy class
- Rated continuous thermal current: 100 A
- Rated short-time thermal current: 14 kA/1 s
- Rated dynamic current: 35 kA/30 ms

#### Environment
- Shock resistance IEC 60068-2-27 (device in operation): 15 g/11 ms
- Bumping IEC 60068-2-29 (transport): 40 g/6 s
- Vibration resistance IEC 60068-2-6 (device in operation): 1 g/10…150 Hz
- Vibration resistance IEC 60068-2-6 (transport): 2 g/10…150 Hz
- Ambient temperature during operation: $-10…+50$ °C
- Ambient temperature during storage: $-40…+70$ °C
- Climatic class acc. to DIN IEC 60721-3-3: 3K23

#### Connection
- Connection to the evaluator: single wire $\geq 0.75$ mm²
- Single wire, twisted: $\geq 0.75$ mm²
- Shielded cable, shielded on one side connected to PE: recommended: J-Y(St)Y min. 2 x 0.6

#### Other
- Degree of protection, internal components (DIN EN 60529): IP40
- Degree of protection, terminals (DIN EN 60529): IP20
- Screw mounting: M5
- Flammability class: UL94 V-0
- Documentation number: D00144

### Dimension diagrams

#### WR70x175S(P)…WR200x500S(P)

#### Dimensions (mm)

<table>
<thead>
<tr>
<th>Type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR70x175S(P)</td>
<td>70</td>
<td>175</td>
<td>85</td>
<td>165</td>
<td>180</td>
<td>261</td>
<td>2.5</td>
<td>46</td>
<td>22</td>
<td>225</td>
<td>13</td>
<td>7.5</td>
</tr>
<tr>
<td>WR115x305S(P)</td>
<td>115</td>
<td>305</td>
<td>402</td>
<td>225</td>
<td>240</td>
<td>402</td>
<td>2.5</td>
<td>55</td>
<td>25</td>
<td>360</td>
<td>18.5</td>
<td>8</td>
</tr>
<tr>
<td>WR150x350S(P)</td>
<td>150</td>
<td>350</td>
<td>460</td>
<td>272</td>
<td>286</td>
<td>460</td>
<td>2.5</td>
<td>55</td>
<td>28</td>
<td>418</td>
<td>23</td>
<td>8</td>
</tr>
<tr>
<td>WR200x500S(P)</td>
<td>200</td>
<td>500</td>
<td>142.5</td>
<td>285</td>
<td>297</td>
<td>585</td>
<td>567.9</td>
<td>267.9</td>
<td>62</td>
<td>30</td>
<td>ø12</td>
<td>ø5.5</td>
</tr>
</tbody>
</table>

| Weight           | 2900 g | 6300 g | 8250 g | 9000 g |

#### Wiring diagram

- PE, L1, L2, L3, N
- P1 (k)
- P2 (l)
- S1 (k)
- S2 (l)
- RCM, RCMS, EDS
- to the loads
LINETRAXX® CTBS25
Split-core AC/DC sensitive measuring current transformer

Device features
- Split-core measuring current transformer for easy retrofitting without disconnecting the primary conductors
- Suitable for AC/DC sensitive type B residual current measurement
- Can be combined with RCMS460/490 residual current monitoring systems
- Can be combined with EDS440 insulation fault locators
- Supply voltage DC 24 V

Typical applications
- For residual current monitoring systems (RCMS)
- For insulation fault locators (EDS)

Standards
The CTBS25 measuring current transformer complies with the device standard:
- IEC 62020:2003-11 in combination with a residual current monitor/monitoring system (RCMS460/490 or RCMA420/423)
- IEC 61557-9 in combination with an insulation fault locator (EDS440)

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage $U_s$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC 24 V</td>
<td>CTBS25</td>
<td>B98120060</td>
</tr>
</tbody>
</table>

Technical data
Values only apply to closed measuring current transformer.

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

<table>
<thead>
<tr>
<th>Definitions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring circuit (IC1)</td>
<td>Primary conductors routed through the current transformer</td>
</tr>
<tr>
<td>Secondary (IC2)</td>
<td>Terminal block 1 (24 V, GND, S1, S2)</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>300 V</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>III</td>
</tr>
<tr>
<td>Operating altitude</td>
<td>$\leq 2000$ m AMSL</td>
</tr>
<tr>
<td>Rated impulse voltage IC1/IC2</td>
<td>4 kV</td>
</tr>
<tr>
<td>Rated insulation voltage IC1/IC2</td>
<td>300 V</td>
</tr>
<tr>
<td>Pollution degree</td>
<td>2</td>
</tr>
<tr>
<td>Basic insulation between IC1/IC2</td>
<td>300 V</td>
</tr>
</tbody>
</table>

Supply voltage
- Supply voltage $U_s$: DC 24 V
- Operating range of $U_s$: $\pm 5 \%$
- Ripple $U_s$: $\leq 2 \%$
- Inrush current: 10 A for 25 μs
- Power consumption: $\leq 0.25$ W typ. (2.5 W max.)

Measuring circuit
- Measuring current transformer, internal diameter: 25 mm
- Characteristic according to IEC 60208 and IEC/TR 60755
- AC/DC sensitive, type B
- Frequency bandwidth: DC … 100 kHz
- Measuring range $I_{\Delta n}$
  - DC/AC ($\leq 100$ kHz): 10 ... 500 mA
  - Rated current $I_n$: 100 A
- Rated continuous thermal current $I_{\text{rh}}$: 68 A
- Operating uncertainty: $\pm 1 \% \pm 1$ mA
- Cable length between (S1, S2) and (k, l): 10 m

Displays
- Multicolour LED: red, green

Environment/EMC
- Operating temperature: $-25 ... 75 \degree$ 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

Terminal block 1, reverse polarity protection
Required terminals are included in the scope of delivery.
The connection conditions of the manufacturer apply.

Manufacturer
- Phoenix Contact

Type
- PCB plug-in connector - DFMC 0.5/ 5-ST-2.54

Connection properties
- rigid: 0.14...0.5 mm² (AWG 26...20)
- flexible: 0.14...0.5 mm² (AWG 26...20)
- with ferrule: 0.25...0.34 mm² (AWG 24...22)

Other
- Operating mode: continuous operation
- Mounting: any position
- Degree of protection (DIN EN 60529): IP30
- Flammability class: UL94 V-0
- Documentation number: D00388
- Weight: $\leq 165$ g
WS…/WS…-8000 series
Split-core type measuring current transformers

Typical applications

**WS… measuring current transformers**
- For RCMS460/490 residual current monitoring systems
- For RCM420/RCM460 residual current monitors
- For EDS470, EDS460/490 and EDS440 insulation fault locators in AC and DC systems

**WS…-8000 measuring current transformer**
- For EDS473(E)-12, EDS474(E)-12, EDS461 and EDS491 insulation fault locators

Standards

WS… and WS…-8000 measuring current transformers comply with the device standard:
- IEC 61869-1

Further information

For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Mounting</th>
<th>Internal dimensions</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting brackets</td>
<td>20 x 30 mm</td>
<td>WS20x30</td>
<td>B98080601</td>
</tr>
<tr>
<td></td>
<td>50 x 80 mm</td>
<td>WS50x80</td>
<td>B98080603</td>
</tr>
<tr>
<td></td>
<td>80 x 120 mm</td>
<td>WS80x120</td>
<td>B98080606</td>
</tr>
</tbody>
</table>

1 For EDS461/491 and EDS473/474 insulation fault locators

Selection list

<table>
<thead>
<tr>
<th>Type</th>
<th>RCM420</th>
<th>RCMS460 RCM5490</th>
<th>EDS460 EDS5490</th>
<th>EDS461 EDS5491</th>
<th>EDS440</th>
<th>EDS441</th>
<th>EDS441-LAB</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS20x30</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>-</td>
<td>■</td>
<td>-</td>
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<td>WS50x80</td>
<td>■</td>
<td>■</td>
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<td>-</td>
<td>-</td>
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<tr>
<td>WS80x120</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>-</td>
<td>■</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>WS20x30-8000</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>■</td>
<td>-</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>WS50x80-8000</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>■</td>
<td>-</td>
<td>■</td>
<td>■</td>
</tr>
</tbody>
</table>

Mounting Internal dimensions Type Art. No.

| Mounting | 20 x 30 mm | WS20x30 | B98080601 |
| Mounting | 50 x 80 mm | WS50x80 | B98080603 |
| Mounting | 80 x 120 mm | WS80x120 | B98080606 |

For further information refer to our product range on www.bender.de.
**Technical data**

### Insulation coordination acc. to IEC 60664-1/IEC 60664-3

- Rated insulation voltage: 800 V
- Rated impulse voltage/pollution degree: 8 kV/3

### CT circuit WS…

- Rated primary residual current: 10 A
- Rated secondary residual current: 0.0167 A
- Rated transformation ratio $K_n$: 10/0.0167 A
- Nominal power: max. 180 VA
- Frequency range: 42 Hz – 3 kHz
- Rated continuous thermal current $I_\text{cth}$: 40 A
- Rated short-time thermal current $I_\text{sth}$: $60 \times I_\text{cth} = 2.4$ kA/1 s
- Rated dynamic current $I_\text{dyn}$: $2.5 \times I_\text{cth} = 6.0$ kA/40 ms

### CT circuit WS…-8000

- Rated primary residual current: 1 A
- Rated secondary residual current: 0.125 mA
- Rated transformation ratio $K_n$: 1 A/0.125 mA
- Frequency range: 42 Hz – 3 kHz
- Rated continuous thermal current $I_\text{cth}$: 6 A
- Rated short-time thermal current $I_\text{sth}$: $60 \times I_\text{cth} = 0.36$ kA/1 s
- Rated dynamic current $I_\text{dyn}$: $2.5 \times I_\text{cth} = 0.9$ kA/40 ms

### Environmental conditions

- Operating temperature: -25°C...+70°C

### Classification of climatic conditions acc. to IEC 60721

- Stationary use (IEC 60721-3-3): 3K23 (except condensation and formation of ice)
- Transport (IEC 60721-3-2): 2K12 (except condensation and formation of ice)
- Long-time storage (IEC 60721-3-1): 1K22 (except condensation and formation of ice)

### Classification of mechanical conditions IEC 60721

- Stationary use (IEC 60721-3-3): 3M11
- Transport (IEC 60721-3-2): 2M4
- Long-time storage (IEC 60721-3-1): 1M12

### Connection

- Screw-type terminals
- Rigid/flexible/conductor sizes: 0.08...2.5 mm² (AWG 28...12)
- Stripping length: 8...9 mm

### Connection EDS, RCM(S) measuring current transformers

- Single wire $\geq 0.75$ mm²: 0...1 m
- Single wire, twisted $\geq 0.75$ mm²: 0...10 m
- Shielded cable $\geq 0.5$ mm²: 0...40 m
- Shielded cable (shield on one side connected to L-conductor, not connected to earth): recommended: J-Y(ST)Y min. 2x0.8

### Other

- Degree of protection, internal components (DIN EN 60529): IP40
- Degree of protection, terminals (DIN EN 60529): IP20
- Screw mounting: M5 with mounting brackets
- Flammability class: UL94 V-0
- Documentation number: D00077

### Dimension diagram

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>A</td>
</tr>
<tr>
<td>WS20x30</td>
<td>93</td>
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<tr>
<td>WS50x80</td>
<td>125</td>
</tr>
<tr>
<td>WS80x120</td>
<td>155</td>
</tr>
<tr>
<td>WS20x30-8000</td>
<td>93</td>
</tr>
<tr>
<td>WS50x80-8000</td>
<td>125</td>
</tr>
</tbody>
</table>

**WS… series measuring current transformers**

Connection to the respective RCMS series residual current monitoring system, RCM series residual current monitors or to EDS series insulation fault location systems

**WS…-8000 measuring current transformer**

Connection to the respective EDS461 and EDS491 insulation fault locator
WS50x80S…WS80x160S series
Split-core type measuring current transformers

Typical applications
- For residual current monitors (RCM)
- For residual current monitoring systems (RCMS)
- For insulation fault locators with additional EDS in AC and DC systems

Standards
WS… measuring current transformers comply with the device standard:
- IEC 61869-1.

Approvals

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Internal dimensions</th>
<th>Approvals</th>
<th>Type</th>
<th>Art. No.</th>
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<tbody>
<tr>
<td></td>
<td>UL</td>
<td>EAC</td>
<td>LR</td>
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<tr>
<td>50 x 80 mm</td>
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<tr>
<td>80 x 80 mm</td>
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<td></td>
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</tr>
<tr>
<td>80 x 120 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>80 x 160 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Technical data

Insulation coordination acc. to IEC 60044-1

Highest system voltage for electrical equipment $U_m$ = 720 V
Rated impulse withstand voltage $U_{imp}$ = 3 kV

Measuring circuit

Rated transformation ratio 600/1
Rated burden 180 Ω
Rated primary current ≤ 10 A (100 A)
Rated primary current ≥ 10 mA
Nominal power 50 mVA
Rated frequency 50...60 Hz
Rated internal resistance 5...8 Ω
Secondary overvoltage protection with suppressor diode S6KE6V8CP
Accuracy class 5
Rated continuous thermal current 100 A
Rated short-time thermal current 14 kA/1 s
Rated dynamic current 35 kA/30 ms

Environment

Standard IEC 60044-1
Shock resistance IEC 60068-2-27 (device in operation) 15 g/11 ms
Bumping IEC 60068-2-29 (transport) 40 g/11 ms
Vibration resistance IEC 60068-2-6 (device in operation) 1 g/10...150 Hz
Vibration resistance IEC 60068-2-6 (transport) 2 g/10...150 Hz
Ambient temperature (during operation) -10...+50 °C
Storage temperature range -40...+70 °C
Climatic class acc. to DIN IEC 60721-3-3 3K23

Connection

Connection screw-type terminals
Connection rigid/flexible 0.2...4/0.2...2.5 mm²
Connection flexible with ferrules with/without plastic sleeve 0.25...2.5 mm²
Conductor sizes (AWG) 24...12
Connection to the evaluator
single wire ≥ 0.75 mm² 0...1 m
single wire, twisted ≥ 0.75 mm² 0...10 m
shielded cable ≥ 0.6 mm² 0...40 m
Shielded cable (shield on one side connected to PE) recommended: J-Y(St)Y min. 2 x 0.6

Other

Operating mode continuous operation
Mounting any position
Degree of protection, internal components (DIN EN 60529) IP40
Degree of protection, terminals (DIN EN 60529) IP20
Screw mounting M5
Flammability class UL94 V-0
Documentation number D00145
WS50x80S…WS80x160S series measuring current transformers

<table>
<thead>
<tr>
<th>Type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS50x80S</td>
<td>50</td>
<td>80</td>
<td>72</td>
<td>145</td>
<td>57</td>
<td>114</td>
<td>59</td>
<td>45</td>
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<td>WS80x80S</td>
<td>80</td>
<td>80</td>
<td>72</td>
<td>145</td>
<td>72</td>
<td>144</td>
<td>59</td>
<td>45</td>
<td>32</td>
<td>108</td>
<td>6.5</td>
<td>1050 g</td>
</tr>
<tr>
<td>WS80x120S</td>
<td>80</td>
<td>120</td>
<td>92</td>
<td>184</td>
<td>72</td>
<td>144</td>
<td>59</td>
<td>45</td>
<td>32</td>
<td>108</td>
<td>6.5</td>
<td>1250 g</td>
</tr>
<tr>
<td>WS80x160S</td>
<td>80</td>
<td>160</td>
<td>113</td>
<td>225</td>
<td>92</td>
<td>184</td>
<td>59</td>
<td>45</td>
<td>32</td>
<td>120</td>
<td>6.5</td>
<td>2550 g</td>
</tr>
</tbody>
</table>
LINETRAXX® Series WF...
Consisting of an RCC420 signal converter and a W...F measuring current transformer
Flexible WF170, WF250, WF500, WF800, WF1200, WF1800 measuring current transformers

Device features
• Flexible measuring current transformer in different lengths
• Space-saving design, quick installation
• Easy retrofitting into existing installations
• Can be installed without the need to disconnect the conductors
• Connection monitoring WF... measuring current transformers
• For RCMS460/490 series residual current monitoring systems
• For RCM420 series residual current monitors
• Analogue output (U, I) for external measuring devices
• RCC420 with push-wire terminals (two terminals per connection)

Typical applications
• Residual, fault and nominal current monitoring of loads and systems which cannot be switched off
• EMC monitoring of TN-S systems for “stray currents” and additional N-PE connections in the central earthing point (CEP)
• Monitoring of PE and equipotential bonding conductors to ensure they are free of current

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Length A measuring current transformer</th>
<th>Supply voltage $U_{s}$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DC</td>
<td>AC</td>
<td></td>
</tr>
<tr>
<td>170 mm</td>
<td>9.6…94 V</td>
<td>16…72 V, 42…460 Hz</td>
<td>WF170-1</td>
</tr>
<tr>
<td></td>
<td>70…300 V</td>
<td>70…300 V, 42…460 Hz</td>
<td>WF170-2</td>
</tr>
<tr>
<td>250 mm</td>
<td>9.6…94 V</td>
<td>16…72 V, 42…460 Hz</td>
<td>WF250-1</td>
</tr>
<tr>
<td></td>
<td>70…300 V</td>
<td>70…300 V, 42…460 Hz</td>
<td>WF250-2</td>
</tr>
<tr>
<td>500 mm</td>
<td>9.6…94 V</td>
<td>16…72 V, 42…460 Hz</td>
<td>WF500-1</td>
</tr>
<tr>
<td></td>
<td>70…300 V</td>
<td>70…300 V, 42…460 Hz</td>
<td>WF500-2</td>
</tr>
<tr>
<td>800 mm</td>
<td>9.6…94 V</td>
<td>16…72 V, 42…460 Hz</td>
<td>WF800-1</td>
</tr>
<tr>
<td></td>
<td>70…300 V</td>
<td>70…300 V, 42…460 Hz</td>
<td>WF800-2</td>
</tr>
<tr>
<td>1200 mm</td>
<td>9.6…94 V</td>
<td>16…72 V, 42…460 Hz</td>
<td>WF1200-1</td>
</tr>
<tr>
<td></td>
<td>70…300 V</td>
<td>42…460 Hz, 70…300 V</td>
<td>WF1200-2</td>
</tr>
<tr>
<td>1800 mm</td>
<td>9.6…94 V</td>
<td>16…72 V, 42…460 Hz</td>
<td>WF1800-1</td>
</tr>
<tr>
<td></td>
<td>70…300 V</td>
<td>42…460 Hz, 70…300 V</td>
<td>WF1800-2</td>
</tr>
</tbody>
</table>

$^1$ Absolute values

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>XM420 (RCC420)</td>
<td>B9806008</td>
</tr>
</tbody>
</table>
Technical data

Electrical safety
- Standard: RCC420
- Pollution degree: 3
- Rated insulation voltage: 250 V
- Standard: WF…
- Pollution degree: 2
- Rated insulation voltage (CAT III): 1000 Vrms or DC

Supply voltage
- Supply voltage: \( U_s \) see ordering information
- Power consumption: \( \leq 3 \) VA

Measuring circuit
- Measuring range: 100 mA…20 A
- Rated transformation ratio: \( K_n (U - I): 100 \text{ mV} / \text{A}, K_N (k - l): 1.67 \text{ mA} / \text{A} \)
- Rated burden (signal output k, l): 68 \( \Omega \)
- Rated frequency: 42…2000 Hz
- Rated continuous thermal current \( I_{cth} \): 1 kA
- Rated short-time thermal current \( I_{sth} \): 60 kA/1 s
- Rated dynamic current \( I_{dyn} \): 150 kA/40 ms

Environment/EMC
- EMC: IEC 62020
- Operating temperature: -25…+55 °C

Classification of dimitic conditions acc. to IEC 60721
- Stationary use (IEC 60721-3-3): 3K23 (except condensation and formation of ice)
- Transport (IEC 60721-3-2): 2K11 (except condensation and formation of ice)
- Long-time storage (IEC 60721-3-1): 1K22 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721
- Stationary use (IEC 60721-3-3): 3M11
- Transport (IEC 60721-3-2): 2M4
- Long-time storage (IEC 60721-3-1): 1M12

Connection RCC420
- Connection type: push-wire terminal
- Connection properties:
  - rigid
  - flexible without ferrule
- Rating:
  - 0.2…2.5 mm² (AWG 24…14)
  - 0.75…2.5 mm² (AWG 19…14)
  - 0.2…1.5 mm² (AWG 24…16)
- Stripping length: 10 mm
- Test opening, diameter: 2.1 mm
- Connection measuring current transformer WF…F: PS/2 plug
- Cable length WF…: 2 m

Cable lengths RCS4-RCC420...
- Single wire: \( \geq 0.75 \text{ mm}^2 \)
- Single wire, twisted: \( \geq 0.75 \text{ mm}^2 \)
- Shielded cable: \( \geq 0.5 \text{ mm}^2 \)
- Shielded cable (shield to terminal, not connected to earth): recommended: J-Y(St)Y min. 2x0.8

Other
- Operating mode: continuous operation
- Mounting: any position
- Degree of protection, internal components (IEC 60529): IP30
- Degree of protection, terminals (IEC 60529): IP20
- Enclosure material RCC420: polycarbonate
- Screw mounting: 2 x M4 with mounting clip
- DIN rail mounting acc. to IEC 60715
- Flammability class: UL94V-0
- Documentation number: D000072
- Weight: RCC 420 ≤ 160 g
  - WF170 ≤ 160 g
  - WF250 ≤ 180 g
  - WF500 ≤ 200 g
  - WF1200 ≤ 310 g
  - WF500 ≤ 230 g
  - WF800 ≤ 310 g
  - WF1800 ≤ 430 g
- Note: The measuring current transformer is adapted to the associated signal converter RCC420.

Dimension diagrams (dimensions in mm)

XM420 (RCC420)

WF… measuring current transformers
- A = For details about the length of the measuring current transformer refer to ordering information.

Dimension diagrams (dimensions in mm)

Locking connector measuring current transformer WF500…WF1800
- Keep the locking connector clean

Locking connector WF170…WF250
Connection to the respective RCMS460/490 residual monitoring system or to an RCM420 residual current monitor.

1. **Power On LED "ON":** lights up when voltage is available and when the device is in operation
2. **Alarm LED "ERR":** Lights in the event of a short circuit and interruption of the WF...

**Additional Notes:**
- When using software version D233 V 2.21 or an earlier version, switch off CT monitoring.
- When using software version D233 V 2.31 or higher, set the CT type to "flex".
Isolating transformer ES710
Single-phase isolating transformers for the design of medical IT systems

Device features
- Built-in temperature sensors acc. to DIN 44081 (120 °C)
- Screen winding with brought-out insulated connection terminal
- Insulated mounting angles
- Degree of protection, IP00 (open design)
- Degree of protection, IP23 (with enclosure)
- Protection class I
- Protection class II (option: encapsulated version)
- Reinforced insulation
- Classification of insulation: ta40/B
- Connections: screw terminals
- Noise level < 35 dB (A) (no-load and nominal load)
- Vector group: II0
- Inrush current \( I_E \) GL version < \( 8 \times I_n \)

Standards
ES710 isolating transformers comply with the device standards and the regulations for installation:
- DIN EN 61558-1 (VDE 570-1)
- IEC 61558-1
- DIN VDE 0100-710 (VDE 0570-2-15)
- IEC 61558-2-15
- IEC 60364-7-710

Further information
For further information refer to our product range on www.bender.de.
### Technical data

<table>
<thead>
<tr>
<th>Type</th>
<th>ES710/3150</th>
<th>ES710/4000</th>
<th>ES710/5000</th>
<th>ES710/6300</th>
<th>ES710/8000</th>
<th>ES710/10000</th>
</tr>
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<tbody>
<tr>
<td>Power/voltages/currents</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Rated power</td>
<td>3150 VA</td>
<td>4000 VA</td>
<td>5000 VA</td>
<td>6300 VA</td>
<td>8000 VA</td>
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<tr>
<td>Rated frequency</td>
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<td>AC 230 V</td>
<td>AC 230 V</td>
<td>AC 230 V</td>
<td>AC 230 V</td>
<td>AC 230 V</td>
</tr>
<tr>
<td>Rated input current</td>
<td>14.2 A</td>
<td>18 A</td>
<td>22.5 A</td>
<td>28.5 A</td>
<td>36 A</td>
<td>45.3 A</td>
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<tr>
<td>Rated output current</td>
<td>13.7 A</td>
<td>17.4 A</td>
<td>21.7 A</td>
<td>27.4 A</td>
<td>34.7 A</td>
<td>43.5 A</td>
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<tr>
<td>Inrush current</td>
<td>&lt; 12 x $I_n$</td>
<td>&lt; 12 x $I_n$</td>
<td>&lt; 12 x $I_n$</td>
<td>&lt; 12 x $I_n$</td>
<td>&lt; 12 x $I_n$</td>
<td>&lt; 12 x $I_n$</td>
</tr>
<tr>
<td>Leakage current</td>
<td>≤ 0.5 mA</td>
<td>≤ 0.5 mA</td>
<td>≤ 0.5 mA</td>
<td>≤ 0.5 mA</td>
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<tr>
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<td>≤ 43.5 A</td>
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### Environmental conditions

- **Ambient temperature**: ≤ 40 °C
- **Full-load temperature rise**: ≤ 69 °C
- **Noise level (under no-load conditions and nominal load)**: ≤ 35 dB(A)

### Other

- **Insulation classification**: $t_a 40/B$
- **Degree of protection**: IP00
- **Core U/I**: 180/93
- **Core U/I GL version**: 180/93
- **Recommended use when used in accordance with DIN VDE 0100-710**: 25 A gl/gG/6/33 A gl/g6/63 A gl/g6/6/3 A gl/g6/6
- **Recommended use when used in accordance with DIN VDE 0100-710 GL version**: 25 A gl/g6/6/33 A gl/g6/6/3 A gl/g6/6
- **Induction**: 0.86 T
- **Core $R_{primary}$**: ±5 %
- **Efficiency**: 95 %
- **Document number**: D00109

### Loss at 20...22 °C ambient temperature

- **Fe loss (iron loss)**: < 55 W
- **Fe loss (iron loss) GL version**: < 18 W
- **Cu loss (copper loss)**: < 90 W
- **Cu loss (copper loss) GL version**: < 90 W

### Heat dissipation loss at 40 °C ambient temperature and 100 % continuous load

- **Heat dissipation loss**: < 165 W
- **Heat dissipation loss GL version**: < 125 W

*Option: completely encapsulated version

**Green Line transformer** (energy efficient version) - High degree of energy saving over the life time (16 years AfA) (German AfA table for deprecation of wear and tear)

This general illustration is based on calculations of the transformer’s energy consumption while energy costs remained constant at 13.4 ct/kWh (source: first energy) for 16 years. The wide variety of bandwidths result from the different transformer capacities.

- **Afa** = Deprecation of wear and tear
- **GL version** = Green Line

* A higher purchase price of approx. 15-20%

**Efficiency** = Efficiency GL = Green Line

**Energy efficient version GL = Green Line**
Dimension diagrams

**Standard**
- Dimension B is the depth incl. terminals

**SK2 series**

**S series**
- Dimension E is the depth incl. terminals

**K series**

**LG series**

**SN-GL series**

**Enclosure ESDS0107-1**

**Enclosure ESDS710**
### Ordering information enclosure

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### Ordering information

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#### Ordering information enclosure

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#### Dimensions (mm) | Weight (kg) | Core W/I | Type | Art. No. |
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**Nameplate**

ES: single-phase isolating transformer  
DS: three-phase isolating transformer  
Nominal power  
Type series without = standard  
K = terminals on top  
LG = horizontal position  
SK2 = encapsulation according to protection class II  
S = terminals on top side end  
S-GL = terminals front side (energy efficient)  
SN-GL = terminals front side, low type of construction (energy efficient)

**Wiring diagram**

![Wiring diagram](image)

**Terminal diagram**

**Standard, K series, LG series**

S series, S-GL series, SN-GL series

**SK2 series**

**Connection properties**

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<th>Screen winding flexible/rigid</th>
<th>Control terminals flexible/rigid</th>
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Isolating transformers DS0107
Three-phase isolating transformers for the supply of three-phase loads in medical locations

### Device features
- Built-in temperature sensors acc. to DIN 44081 (120 °C)
- Screen winding with brought-out insulated connection terminal
- Insulated mounting angles
- Degree of protection, IP00 (open design)
- Degree of protection, IP23 (with enclosure)
- Protection class I
- Protection class II (option: encapsulated version)
- Reinforced insulation
- Classification of insulation ta40/B
- Connections: screw terminals
- Noise level < 35 dB (A) (no-load and nominal load)
- Vector group: Yyn O

### Standards
DS0107 isolating transformers comply with the device standards and the regulations for installation:
- DIN EN 61558-1 (VDE 570-1)
- IEC 61558-1
- DIN VDE 0100-710 (VDE 0100-710)
- DIN EN 61558-2-15 (VDE 0570-2-15)
- IEC 61558-2-15
- IEC 60364-7-710

**Note:**
- According to DIN VDE 0100-710 (VDE 0100-710), para. 7.10.1.6.2, single-phase transformers shall be used for the erection of medical IT systems.
- The transformers of the DS0107 series are not suitable for the erection and installation of medical IT systems.

### Technical data

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<tr>
<th>Type</th>
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**Power/voltages/currents**
- Rated power 2000 VA, 3150 VA, 4000 VA, 5000 VA, 6300 VA, 8000 VA, 10000 VA
- Rated frequency 50…60 Hz
- Rated input voltage 3AC 400 V
- Rated input current 1 A, 4.9 A, 6.1 A, 7.7 A, 9.8 A, 12.2 A, 15.6 A
- Rated output voltage 3NAC 230 V
- Rated output current 5 A, 7.9 A, 10 A, 12.6 A, 15.8 A, 20.7 A, 25.2 A

**Inrush current** \(i_I \leq 12 \times \sqrt{\frac{1}{6}}\) \(i_I \leq 12 \times \sqrt{\frac{1}{6}}\) \(i_I \leq 12 \times \sqrt{\frac{1}{6}}\) \(i_I \leq 12 \times \sqrt{\frac{1}{6}}\) \(i_I \leq 12 \times \sqrt{\frac{1}{6}}\) \(i_I \leq 12 \times \sqrt{\frac{1}{6}}\) \(i_I \leq 12 \times \sqrt{\frac{1}{6}}\)

**Leakage current** \(i_l \leq 0.5 \text{ mA}\) \(i_l \leq 0.5 \text{ mA}\) \(i_l \leq 0.5 \text{ mA}\) \(i_l \leq 0.5 \text{ mA}\) \(i_l \leq 0.5 \text{ mA}\) \(i_l \leq 0.5 \text{ mA}\) \(i_l \leq 0.5 \text{ mA}\)

**No-load input current** \(i_0 \leq 3 \%\) \(i_0 \leq 3 \%\) \(i_0 \leq 3 \%\) \(i_0 \leq 3 \%\) \(i_0 \leq 3 \%\) \(i_0 \leq 3 \%\) \(i_0 \leq 3 \%\)

**No-load output voltage** \(u_0 \leq 232 \text{ V}\) \(u_0 \leq 235 \text{ V}\) \(u_0 \leq 234 \text{ V}\) \(u_0 \leq 236 \text{ V}\) \(u_0 \leq 236 \text{ V}\) \(u_0 \leq 235 \text{ V}\) \(u_0 \leq 235 \text{ V}\)

**Short-circuit voltage** \(u_q \leq 2.9 \%\) \(u_q \leq 2.9 \%\) \(u_q \leq 2.8 \%\) \(u_q \leq 3 \%\) \(u_q \leq 2.8 \%\) \(u_q \leq 2.8 \%\) \(u_q \leq 2.5 \%\)

**Environmental conditions**
- Ambient temperature \(\leq 40 \text{ °C}\) \(\leq 40 \text{ °C}\) \(\leq 40 \text{ °C}\) \(\leq 40 \text{ °C}\) \(\leq 40 \text{ °C}\) \(\leq 40 \text{ °C}\) \(\leq 40 \text{ °C}\)
- No-load temperature rise \(\leq 25 \text{ °C}\) \(\leq 21 \text{ °C}\) \(\leq 24 \text{ °C}\) \(\leq 28 \text{ °C}\) \(\leq 24 \text{ °C}\) \(\leq 27 \text{ °C}\) \(\leq 32 \text{ °C}\)
- Full-load temperature rise \(\leq 50 \text{ °C}\) \(\leq 50 \text{ °C}\) \(\leq 53 \text{ °C}\) \(\leq 67 \text{ °C}\) \(\leq 60 \text{ °C}\) \(\leq 72 \text{ °C}\) \(\leq 75 \text{ °C}\)
- Noise level (no load and full load) \(\leq 35 \text{ dB(A)}\) \(\leq 35 \text{ dB(A)}\) \(\leq 35 \text{ dB(A)}\) \(\leq 35 \text{ dB(A)}\) \(\leq 35 \text{ dB(A)}\) \(\leq 35 \text{ dB(A)}\) \(\leq 35 \text{ dB(A)}\)

**Other**
- Recommended fuse when used in accordance with DIN VDE 0100-710 10 A gl/gG, 16 A gl/gG, 20 A gl/gG, 20 A gl/gG, 25 A gl/gG, 35 A gl/gG, 35 A gl/gG
- Induction 1.0 T, 0.8 T, 0.6 T, 0.6 T, 0.8 T, 0.8 T, 0.82 T
- Frequency 50 Hz, 60 Hz, 60 Hz, 60 Hz, 60 Hz, 60 Hz, 60 Hz
- Efficiency 95 %, 96 %, 95 %, 95 %, 96 %, 96 %, 96 %

Documentation number: D00105

* Option: completely encapsulated version

For further information refer to our product range on www.bender.de.
### Ordering information

#### Dimensions (mm) vs Weight (kg)

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<td>DS107/4000SK2</td>
<td>B924123</td>
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<tr>
<td>420 200 450 490</td>
<td>31</td>
<td>86</td>
<td>DS107/5000SK2</td>
<td>B924124</td>
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<tr>
<td>420 220 450 490</td>
<td>48</td>
<td>107</td>
<td>DS107/6300SK2</td>
<td>B924125</td>
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<td>420 230 450 490</td>
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<td>130</td>
<td>DS107/8000SK2</td>
<td>B924126</td>
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<tr>
<td>420 230 450 450</td>
<td>59</td>
<td>155</td>
<td>DS107/10000SK2</td>
<td>B924678</td>
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### Ordering information enclosure

#### Dimensions (mm) vs Suitability for following device types

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
<th>Suitable for following device types</th>
<th>Weight (kg)</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>430 380 490 385</td>
<td>D0107/2000 bis D0107/5000</td>
<td>16</td>
<td>ESD0107-1</td>
<td>B924673</td>
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<tr>
<td>600 420 490 555</td>
<td>D0107/6300 bis D0107/10000</td>
<td>23</td>
<td>ESD0107-2</td>
<td>B924674</td>
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</table>
Isolating transformers DS0107

Nameplate

Wiring diagram

Terminal diagram

Connection properties

<table>
<thead>
<tr>
<th>Type</th>
<th>Input terminals flexible/rigid</th>
<th>Screen winding flexible/rigid</th>
<th>Control terminals flexible/rigid</th>
<th>Output terminals flexible/rigid</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS0107/2000</td>
<td>10/16 mm²</td>
<td>10/16 mm²</td>
<td>2.5/4 mm²</td>
<td>10/16 mm²</td>
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<tr>
<td>DS0107/3150</td>
<td>10/16 mm²</td>
<td>10/16 mm²</td>
<td>2.5/4 mm²</td>
<td>10/16 mm²</td>
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<tr>
<td>DS0107/4000</td>
<td>10/16 mm²</td>
<td>10/16 mm²</td>
<td>2.5/4 mm²</td>
<td>10/16 mm²</td>
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<td>DS0107/5000</td>
<td>10/16 mm²</td>
<td>10/16 mm²</td>
<td>2.5/4 mm²</td>
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<tr>
<td>DS0107/6300</td>
<td>10/16 mm²</td>
<td>10/16 mm²</td>
<td>2.5/4 mm²</td>
<td>16/25 mm²</td>
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<tr>
<td>DS0107/8000</td>
<td>10/16 mm²</td>
<td>10/16 mm²</td>
<td>2.5/4 mm²</td>
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<tr>
<td>DS0107/10000</td>
<td>16/25 mm²</td>
<td>16/25 mm²</td>
<td>2.5/4 mm²</td>
<td>16/25 mm²</td>
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</tbody>
</table>
ESL0107 transformers for operating theatre lights
Single-phase isolating transformers for the supply of operating theatre lights

Device features
- Screen winding lead out for external connection
- Insulated mounting angles
- Degree of protection, IP00 (open design)
- Reinforced insulation
- Classification of insulation ta 40/E
- Connections: screw terminals
- Vector group: IIO

Standards
ESL0107 isolating transformers comply with the device standards and the regulations for installation:
- DIN EN 61558-1 (VDE 0570-1)
- IEC 61558-1
- DIN EN 61558-2-6 (VDE 0570-2-6)
- IEC 61558-2-6

Further information
For further information refer to our product range on www.bender.de.

Typical applications
- For the supply of operating theatre lights in group 2 medical locations

Approvals

Technical data

<table>
<thead>
<tr>
<th>Type</th>
<th>ESL0107/120</th>
<th>ESL0107/160</th>
<th>ESL0107/280</th>
<th>ESL0107/400</th>
<th>ESL0107/630</th>
<th>ESL0107/1000</th>
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<tbody>
<tr>
<td>Insulation classification</td>
<td>40 E</td>
<td>40 E</td>
<td>40 E</td>
<td>40 E</td>
<td>40 E</td>
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<td>Degree of protection/protection class</td>
<td>IP00/I</td>
<td>IP00/I</td>
<td>IP00/I</td>
<td>IP00/I</td>
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<td>Power/voltages/currents</td>
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<tr>
<td>Rated power</td>
<td>120 VA</td>
<td>160 VA</td>
<td>280 VA</td>
<td>400 VA</td>
<td>630 VA</td>
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<td>Rated frequency</td>
<td>50…60 Hz</td>
<td>50…60 Hz</td>
<td>50…60 Hz</td>
<td>50…60 Hz</td>
<td>50…60 Hz</td>
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<td>Rated input voltage</td>
<td>230 V</td>
<td>230 V</td>
<td>230 V</td>
<td>230 V</td>
<td>230 V</td>
<td>230 V</td>
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<tr>
<td>Rated input current</td>
<td>0.6 A</td>
<td>0.8 A</td>
<td>1.4 A</td>
<td>1.9 A</td>
<td>3 A</td>
<td>4.6 A</td>
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<tr>
<td>Rated output current</td>
<td>4.3 A</td>
<td>5.7 A</td>
<td>10 A</td>
<td>14.3 A</td>
<td>22.5 A</td>
<td>35.7 A</td>
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<td>Inrush current</td>
<td>&lt; 15 x (i_n)</td>
<td>&lt; 15 x (i_n)</td>
<td>&lt; 15 x (i_n)</td>
<td>&lt; 15 x (i_n)</td>
<td>&lt; 15 x (i_n)</td>
<td>&lt; 15 x (i_n)</td>
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<tr>
<td>Leakage current</td>
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<td>≤ 5 µA</td>
<td>≤ 5 µA</td>
<td>≤ 5 µA</td>
<td>≤ 5 µA</td>
<td>≤ 5 µA</td>
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<tr>
<td>No-load input current</td>
<td>≤ 95 mA</td>
<td>≤ 120 mA</td>
<td>≤ 140 mA</td>
<td>≤ 237 mA</td>
<td>≤ 270 mA</td>
<td>≤ 320 mA</td>
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<tr>
<td>No-load output voltage</td>
<td>≤ 31.7 V</td>
<td>≤ 30.7 V</td>
<td>≤ 30.6 V</td>
<td>≤ 29.7 V</td>
<td>≤ 30 V</td>
<td>≤ 30 V</td>
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<tr>
<td>Short-circuit voltage</td>
<td>≤ 11 %</td>
<td>≤ 8.8 %</td>
<td>≤ 7.9 %</td>
<td>≤ 5.3 %</td>
<td>≤ 5 %</td>
<td>≤ 4.3 %</td>
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Environmental conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>ESL0107/120</th>
<th>ESL0107/160</th>
<th>ESL0107/280</th>
<th>ESL0107/400</th>
<th>ESL0107/630</th>
<th>ESL0107/1000</th>
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<tbody>
<tr>
<td>Ambient temperature</td>
<td>40 °C</td>
<td>40 °C</td>
<td>40 °C</td>
<td>40 °C</td>
<td>40 °C</td>
<td>40 °C</td>
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<tr>
<td>No-load temperature rise</td>
<td>≤ 17 °C</td>
<td>≤ 20 °C</td>
<td>≤ 18 °C</td>
<td>≤ 26 °C</td>
<td>≤ 23 °C</td>
<td>≤ 26 °C</td>
</tr>
<tr>
<td>No-load temperature rise</td>
<td>≤ 66 °C</td>
<td>≤ 64 °C</td>
<td>≤ 71 °C</td>
<td>≤ 62 °C</td>
<td>≤ 64 °C</td>
<td>≤ 65 °C</td>
</tr>
<tr>
<td>Noise level (no load and full load)</td>
<td>≤ 35 dB(A)</td>
<td>≤ 35 dB(A)</td>
<td>≤ 35 dB(A)</td>
<td>≤ 35 dB(A)</td>
<td>≤ 35 dB(A)</td>
<td>≤ 35 dB(A)</td>
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Other

Recommended fuse when used in accordance with DIN VDE 0100-710

<table>
<thead>
<tr>
<th>Type</th>
<th>6 A gl/g6</th>
<th>6 A gl/g6</th>
<th>6 A gl/g6</th>
<th>10 A gl/g6</th>
<th>16 A gl/g6</th>
<th>16 A gl/g6</th>
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<tbody>
<tr>
<td>Induction</td>
<td>1.23 T</td>
<td>1.17 T</td>
<td>1.14 T</td>
<td>1.14 T</td>
<td>1.06 T</td>
<td>1 T</td>
</tr>
<tr>
<td>Primary</td>
<td>15.3 Ω</td>
<td>8.9 Ω</td>
<td>4.7 Ω</td>
<td>2 Ω</td>
<td>1.2 Ω</td>
<td>0.6 Ω</td>
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<tr>
<td>Secondary</td>
<td>0.32 Ω</td>
<td>0.2 Ω</td>
<td>0.095 Ω</td>
<td>0.05 Ω</td>
<td>0.028 Ω</td>
<td>0.016 Ω</td>
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<tr>
<td>FE loss (iron loss)</td>
<td>5.3 W</td>
<td>6.3 W</td>
<td>9 W</td>
<td>15 W</td>
<td>18 W</td>
<td>26 W</td>
</tr>
<tr>
<td>Cu loss (copper loss)</td>
<td>15.8 W</td>
<td>16 W</td>
<td>25 W</td>
<td>23 W</td>
<td>33 W</td>
<td>44 W</td>
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<tr>
<td>Efficiency</td>
<td>85 %</td>
<td>88 %</td>
<td>89 %</td>
<td>91 %</td>
<td>92 %</td>
<td>94 %</td>
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Documentation number: D00110

Further information
For further information refer to our product range on www.bender.de.
## Ordering information

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
<th>Cu weight (kg)</th>
<th>Weight (kg)</th>
<th>Type</th>
<th>Art. No.</th>
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<tbody>
<tr>
<td>A   B   C   D   E   F   G</td>
<td>96   96   105   84   82   65   5.5</td>
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<td>ESL0107/120 B924632</td>
</tr>
<tr>
<td>96   106   105   84   92   75   5.5</td>
<td>0.8</td>
<td>2.8</td>
<td>ESL0107/160 B924633</td>
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<tr>
<td>120   102   125   90   92   74   5.5</td>
<td>1</td>
<td>4</td>
<td>ESL0107/280 B924634</td>
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<tr>
<td>120   134   125   90   128   110   5.5</td>
<td>1.6</td>
<td>6.7</td>
<td>ESL0107/400 B924637</td>
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<td>150   135   150   122   130   108   6.5</td>
<td>3</td>
<td>10.2</td>
<td>ESL0107/630 B924638</td>
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<tr>
<td>174   145   175   135   150   120   6.5</td>
<td>5.8</td>
<td>16.5</td>
<td>ESL0107/1000 B924639</td>
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## Ordering information enclosure

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
<th>Weight (kg)</th>
<th>Type</th>
<th>Art. No.</th>
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</thead>
<tbody>
<tr>
<td>A   B   C   D   E   F   G   H   I</td>
<td>240   280   220   220   300   320   M6   ø 29   ø 21</td>
<td>3.5</td>
<td>ESL0107-0 B924204</td>
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</table>

## Terminal diagram

<table>
<thead>
<tr>
<th>Connection properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
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<tr>
<td>ESL0107/120</td>
</tr>
<tr>
<td>ESL0107/160</td>
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<tr>
<td>ESL0107/280</td>
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<td>ESL0107/400</td>
</tr>
<tr>
<td>ESL0107/630</td>
</tr>
<tr>
<td>ESL0107/1000</td>
</tr>
</tbody>
</table>

## Wiring diagram
**STEP-PS**

For supply of Bender devices with a supply voltage of DC 24 V

---

### Device features

- Easy DIN rail and wall mounting
- Maximum energy efficiency thanks to low idling losses
- Fast commissioning with LED function monitoring
- High operational reliability thanks to long power failure buffering under full load and high MTBF (> 500,000 h)
- Can be used worldwide in all industrial sectors due to a wide-range input and an international approval package
- Wide temperature range from -25 °C to +70 °C
- Can be connected in parallel to increase power

---

### Typical applications

- For supply of Bender devices with a supply voltage of DC 24 V
- The compact design makes them especially suitable for installation distributors and flat control panels

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### Further information

For further information refer to our product range on [www.bender.de](http://www.bender.de).

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### Approvals

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### Ordering information

<table>
<thead>
<tr>
<th>Rated input voltage $U_{IN}$</th>
<th>Rated voltage</th>
<th>Type</th>
<th>Art. No.</th>
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<tbody>
<tr>
<td>AC</td>
<td>DC</td>
<td>DC</td>
<td>STEP-PS/1 AC/24 DC/0.5</td>
</tr>
<tr>
<td>85 …264 V, 45…65 Hz</td>
<td>95…250 V</td>
<td>24V</td>
<td>STEP-PS/1 AC/24 DC/1.75</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>STEP-PS/1 AC/24 DC/4.2</td>
</tr>
</tbody>
</table>
Technical data

Input data

Nominal input voltage range AC 100…240 V
AC input voltage range AC 65…264 V
DC input voltage range DC 95 V…230 V
AC frequency range 45…65 Hz
DC frequency range 0 Hz

STEP-PS/1AC/24DC/0.5 (12 W)

Current consumption approx. 0.28 A (AC 120 V)
approx. 0.13 A (AC 230 V)
Inrush current limitation < 15 A (typical)
< 0.1 A (AC 120 V)
Power failure buffering > 15 ms (AC 120 V)
> 90 ms (AC 230 V)
Typical turn-on time < 0.5 s
Input fuse, integrated 1.25 A (slow acting, internal)

STEP-PS/1AC/24DC/1.75 (40 W)

Current consumption approx. 0.6 A (AC 120 V)
approx. 0.3 A (AC 230 V)
Inrush current limitation < 15 A (typical)
< 0.6 A (AC 120 V)
Power failure buffering > 25 ms (AC 120 V)
> 150 ms (AC 230 V)
Typical turn-on time < 0.5 s
Input fuse, integrated 3.15 A (slow acting, internal)
Recommended back-up fuse for line protection 6 A
10 A
16 A (characteristic B)

STEP-PS/1AC/24DC/4.2 (100 W)

Current consumption approx. 1.3 A (AC 120 V)
approx. 0.8 A (AC 230 V)
Inrush current limitation < 15 A (typical)
< 1 A (AC 120 V)
Power failure buffering > 20 ms (AC 120 V)
> 100 ms (AC 230 V)
Typical turn-on time < 0.5 s
Input fuse, integrated 4 A (slow acting, internal)
Recommended back-up fuse for line protection 6 A
10 A
16 A (characteristic B)

Output data

Nominal output voltage DC 24 V ±1 %

STEP-PS/1AC/24DC/0.5 (12 W)

Output current 0.5 A (25…+55 °C)
0.55 A (25…40 °C permanent)
Control deviation < 1 % (change in load, static 10…90 %)
< 2 % (change in load, dynamic 10…90 %)
< 0.1 % (change in input voltage ±10 %)
Efficiency > 84 % (for AC 230 V and nominal values)
Residual ripple < 25 mV (with nominal values)
Peak switching voltages < 25 mV (with nominal values)
Connection in parallel yes, for increased power
Connection in series yes
Protection against internal overvoltages yes, limited to approx. DC 35 V
Resistance to reverse feed ≤ DC 35 V

STEP-PS/1AC/24DC/1.75 (40 W)

Setting range of the output voltage DC 22.5 V…29.5 V (> 24 V constant power)
Output current 4.2 A (25…+55 °C)
3.75 A (maximum output current)
Derating above +55 °C 2.5 % per kelvin
Control deviation < 1 % (change in load, static 10…90 %)
< 2 % (change in load, dynamic 10…90 %)
< 0.1 % (change in input voltage ±10 %)
Maximum power loss nominal load 5 W
Maximum power dissipation idling 0.7 W
Efficiency > 89 % (for AC 230 V and nominal values)
Ascent time > 0.5 s (U2 = 10…90 %)
Residual ripple < 35 mV (with nominal values)
Switching transients < 35 mV (with nominal values)
Connection in parallel yes, for increased power
Connection in series yes
Overvoltage protection against internal overvoltages yes, limited to approx. DC 35 V
Resistance to reverse feed ≤ DC 35 V

STEP-PS/1AC/24DC/4.2 (100 W)

Setting range of the output voltage DC 22.5 V…29.5 V (> 24 V constant power)
Output current 4.2 A (25…+55 °C)
3.75 A (maximum output current)
Derating above +55 °C 2.5 % per kelvin
Control deviation < 1 % (change in load, static 10…90 %)
< 2 % (change in load, dynamic 10…90 %)
< 0.1 % (change in input voltage ±10 %)
Maximum power loss nominal load 13.2 W
Maximum power dissipation idling 0.7 W
Efficiency > 89 % (for AC 230 V and nominal values)
Ascent time > 0.5 s (U2 = 10…90 %)
Residual ripple < 25 mV (with nominal values)
Peak switching voltages < 25 mV (with nominal values)
Connection in parallel yes, for increased power
Connection in series yes
Overvoltage protection against internal overvoltages yes, limited to approx. DC 35 V
Resistance to reverse feed ≤ DC 35 V

Power consumption

STEP-PS/1AC/24DC/0.5 (12 W)

Maximum power dissipation idling < 0.3 W
Maximum power loss nominal load < 2.2 W

STEP-PS/1AC/24DC/1.75 (40 W)

Maximum power dissipation idling 5 W
Maximum power loss nominal load 0.7 W

STEP-PS/1AC/24DC/4.2 (100 W)

Maximum power dissipation idling 13.2 W
Maximum power loss nominal load 0.7 W

LED status indicator

Status display "DC OK" LED green/UOUT > 21.5 V: LED lights up
< 21.5 V: LED off

Environmental conditions

Ambient temperature (operation) -25…70 °C (> 55 °C derating)
Ambient temperature (storage/transport) -40…+85 °C
Max. perm. humidity (operation) ≤ 95 % at 25 °C, no condensation
Vibration (operation) < 15 Hz, amplitude ±2.5 mm acc. to IEC 60660-2-6
Pollution degree acc. to EN 50178 3
Classification of climatic conditions 3K22 acc. to EN 60721

Connection

Connection type screw connection
Connection properties
Rigid/flexible
Conductor sizes (AWG)
Tightening torque
Stripping length

Other

Insulation voltage input/output AC 4 kV (type test)
AC 2 kV (routine test)
Insulation voltage input/PE AC 3.5 kV (type test)
AC 2 kV (routine test)
Insulation voltage output/PE DC 500 V (routine test)
Degree of protection IP20

Protection class II

Degree of protection IP20

Enclosure material polycarbonate
Foot latch material plastic POM
Dimensions W/H/D (state of delivery) 400 g
18/90/61 mm
54/90/61 mm
90/90/61 mm

Shock 30 g in all directions, acc. to IEC 60068-2-2
Pollution degree acc. to EN 50178
Classification of climatic conditions

Power consumption

STEP-PS/1AC/24DC/0.5 (12 W)

Maximum power dissipation idling < 0.3 W
Maximum power loss nominal load < 2.2 W

STEP-PS/1AC/24DC/1.75 (40 W)

Maximum power dissipation idling 5 W
Maximum power loss nominal load 0.7 W

STEP-PS/1AC/24DC/4.2 (100 W)

Maximum power dissipation idling 13.2 W
Maximum power loss nominal load 0.7 W

LED status indicator

Status display "DC OK" LED green/UOUT > 21.5 V: LED lights up
< 21.5 V: LED off

Environmental conditions

Ambient temperature (operation) -25…70 °C (> 55 °C derating)
Ambient temperature (storage/transport) -40…+85 °C
Max. perm. humidity (operation) ≤ 95 % at 25 °C, no condensation
Vibration (operation) < 15 Hz, amplitude ±2.5 mm acc. to IEC 60660-2-6
Pollution degree acc. to EN 50178 3
Classification of climatic conditions 3K22 acc. to EN 60721

Connection

Connection type screw connection
Connection properties
Rigid/flexible
Conductor sizes (AWG)
Tightening torque
Stripping length

Other

Insulation voltage input/output AC 4 kV (type test)
AC 2 kV (routine test)
Insulation voltage input/PE AC 3.5 kV (type test)
AC 2 kV (routine test)
Insulation voltage output/PE DC 500 V (routine test)
Degree of protection IP20

Protection class II

Degree of protection IP20

Enclosure material polycarbonate
Foot latch material plastic POM
Dimensions W/H/D (state of delivery) 400 g
18/90/61 mm
54/90/61 mm
90/90/61 mm

Shock 30 g in all directions, acc. to IEC 60068-2-2
Pollution degree acc. to EN 50178
Classification of climatic conditions

System components | Individual components and accessories | Power supply unit
Power supply unit STEP-PS
## Technische Daten (Fortsetzung)

### Standards

<table>
<thead>
<tr>
<th>Komponenten</th>
<th>Bezeichnung</th>
<th>Norm</th>
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<tbody>
<tr>
<td>Systemkomponenten</td>
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<tr>
<td>Einzelkomponenten und Zubehör</td>
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<td>IEC 61538-2-17</td>
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<td>Elektrische Anlagen mit Informationstechnologie</td>
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<td>EN 50170/VDE 0160 (PELV)</td>
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<td>Schutz gegen elektromagnetische Störimpulse</td>
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<td>DIN VDE 0106-101</td>
</tr>
<tr>
<td>Schutz gegen elektromagnetische Störimpulse, grundlegende Anforderungen für die elektrische Ausrüstung</td>
<td></td>
<td>EN 61000-3-2</td>
</tr>
<tr>
<td>Absicherung für den Nennspannungsbereich 1</td>
<td></td>
<td>DIN VDE 0106-101</td>
</tr>
<tr>
<td>Absicherung für den Nennspannungsbereich 2</td>
<td></td>
<td>DIN VDE 0106-101</td>
</tr>
<tr>
<td>Limite für harmonische Stromemissionen</td>
<td></td>
<td>EN 61000-3-2</td>
</tr>
</tbody>
</table>

### Approvals and certifications

**STEP-PS/1AC/24DC/0.5 (12 W)**

<table>
<thead>
<tr>
<th>Approvals and certifications</th>
<th>UL approvals</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL/C-UL Listed</td>
<td>UL C-UL Recognized</td>
</tr>
<tr>
<td>UL 508</td>
<td>UL 60950</td>
</tr>
<tr>
<td>UL/C-UL Listed</td>
<td>NEC Class 2 as per UL 1310</td>
</tr>
<tr>
<td>ANSI/ISA-12.12.01</td>
<td>Germanischer Lloyd</td>
</tr>
</tbody>
</table>

**STEP-PS/1AC/24DC/1.75 (40 W)**

<table>
<thead>
<tr>
<th>Approvals and certifications</th>
<th>UL approvals</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL/C-UL Listed</td>
<td>UL C-UL Listed</td>
</tr>
<tr>
<td>UL 508</td>
<td>UL 60950</td>
</tr>
<tr>
<td>UL/C-UL Listed</td>
<td>NEC Class 2 as per UL 1310</td>
</tr>
<tr>
<td>Germanischer Lloyd</td>
<td>Germanischer Lloyd</td>
</tr>
</tbody>
</table>

**STEP-PS/1AC/24DC/4.2 (100 W)**

<table>
<thead>
<tr>
<th>Approvals and certifications</th>
<th>UL approvals</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL/C-UL Listed</td>
<td>UL C-UL Listed</td>
</tr>
<tr>
<td>UL 508</td>
<td>UL 60950</td>
</tr>
<tr>
<td>Germanischer Lloyd</td>
<td>Germanischer Lloyd</td>
</tr>
</tbody>
</table>

### Dimension diagram (dimensions in mm)

**STEP-PS/1AC/24DC/0.5 (12 W)**

- Dimension: 58 x 44 x 18 mm
- Connection: L N PE

**STEP-PS/1AC/24DC/1.75 (40 W)**

- Dimension: 54 x 44 x 90 mm
- Connection: L N PEN

**STEP-PS/1AC/24DC/4.2 (100 W)**

- Dimension: 61 x 60 x 90 mm
- Connection: L N

### Connection to different systems

- **TN-S**: L N PE
- **TN-C**: L N PEN
- **TT**: L N
- **IT**: L1 L2 L3
AN410
Power supply unit for DC 24 V supply

Device features
- Primary-pulsed power supply unit for the power supply of Bender devices with a supply voltage of DC 24 V and a power consumption of max. 10 VA
- Power supply for max. 3 MK2430 alarm indicator and test combinations
- Protected against idle running, overload and continuous short circuits

Standards
The AN410 series complies with the requirements of the device standard:
- EN 61204

Further information
For further information refer to our product range on www.bender.de.

Typical applications
- To supply Bender devices with DC 24 V and maximum 10 VA power consumption

Approvals
- Approval relating to the rated input voltage $U_{IN}$

Ordering information

<table>
<thead>
<tr>
<th>Rated input voltage $U_{IN}$</th>
<th>Rated output voltage</th>
<th>ABB type</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 90...264 V, 47...63 Hz</td>
<td>DC 24 V</td>
<td>CP-D 24/0.42/Art. No. 15VR 427 041 R0000</td>
<td>AN410</td>
<td>B924209</td>
</tr>
<tr>
<td></td>
<td>DC 120...370 V</td>
<td>CP-D RU/Art. No. 15VR 427 049 R0000</td>
<td>AN420-R</td>
<td>B95100250</td>
</tr>
<tr>
<td>DC 9...35 V</td>
<td>DC 9...35 V</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Technical data
Insulation coordination acc. to IEC 60664-1
Rated impulse voltage/pollution degree 3 kV/2
Rated insulation voltage $U_{i}$ input circuit/output circuit 3 kV
Input circuits
Rated input voltage $U_{IN}$ see ordering information
Power consumption $\leq 3$ W
Inrush current $\leq 30$ A, $\leq 3$ ms
Stored energy time in the event of power system failure $\geq 30$ ms
Typical current/power consumption
- at AC 110 V: 184 mA/11.62 W
- at AC 230 V: 120.6 mA/12 W
Primary fuse (internal device protection, not accessible) 1 A time-lag/AC 250 V

Output circuit
Rated output voltage DC 24 V ($\geq 1$ %)
Rated output current 420 mA
Derating of the output current 60 °C < $T_{J} \leq 70$ °C 2.5 %/K
Parallel connection option with redundancy unit AN420-R
Protection against short circuits/no-load continuous protection against short circuits/no-load

Environment/EMC
EMC immunity acc. to EN 61000-6-2
EMC emission acc. to EN 61000-6-3
Ambient temperature (during operation/during storage) -25...+70 °C/-25...+85 °C
Classification of mechanical conditions acc. to IEC/EN 60668-2

Connection
Connection screw-type terminals
Connection rigid, flexible (with or without ferrule)/conductor sizes 0.2...2 mm² (AWG 24...14)
Stripping length 6 mm (0.24 inches)
Tightening torque 0.36...0.56 Nm

Standards, approvals and certifications
- UL 508, CAN/CSA C22.2 No. 14 *)
- UL 1310, CAN/CSA C22.2 No. 223 (Class 2 Power Supply) *)
- UL 60950 *)
- CCC *)

Mark
- CE

Other
Status indicators 2 LEDs: output voltage present, output voltage low
Operating mode continuous operation
Mounting vertically (terminals +/- at the top)
Degree of protection, internal components DIN EN 60529 (VDE 0470-1) IP30
Degree of protection, terminals (DIN EN 60529 (VDE 0470-1)) IP20
Protection class II
Minimum distance to adjacent devices vertically/horizontally 25/25 mm
Enclosure dimensions ($W \times H \times D$) 18 x 91 x 57.5 mm (0.71 x 3.58 x 2.26 inches)
DIN rail mounting acc. to IEC 60715
Protective extra low voltage SELV (EN 60950-1)
Documentation number D00999
Weight $\leq 70$ g

*) Approval relating to the rated input voltage $U_{IN}$
### Wiring diagram

L, N: input voltage
+, -: output voltage

### Option for redundant power supply

Input voltage 1

Input voltage 2

Output voltage
AN450
Power supply unit

Device features
- Power supply unit for the supply of Bender devices with AC 20 V and a power consumption of maximum 9 VA
- Supply of 3 MK2430 alarm indicator and test combinations (for example)
- Protected secondary circuit

Standards
The AN450 series complies with the requirements of the device standards:
- DIN EN 61558-1 (VDE 0570-1)
- IEC 61558-1

Further information
For further information refer to our product range on www.bender.de.

Typical applications
- Supply of Bender devices with AC 20 V and a power consumption of maximum 9 VA

Ordering information

<table>
<thead>
<tr>
<th>Output voltage</th>
<th>Supply voltage $U_s$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>230 V, 50…60 Hz</td>
<td>AN450</td>
<td>B924201</td>
</tr>
<tr>
<td></td>
<td>127 V, 50…60 Hz</td>
<td>AN450-133</td>
<td>B924203</td>
</tr>
</tbody>
</table>

Technical data
Insulation coordination acc. to IEC 60664-1
- Rated voltage AC 250 V
- Overvoltage category/pollution degree III/2
- Rated impulse voltage 4 kV
- Altitude $\leq 2000$ m NN

Voltage ranges
- Nominal voltage see ordering details
- Frequency range see ordering details
- Operating range of rated voltage 0.85…1.1
- Output voltage AC 20 V, 50…60 Hz
- Rated output Power $\leq 9$ VA
- Internal secondary protection PTC resistor

Enviroment/EMC
- EMC immunity acc. to EN 61000-6-2
- EMC emission acc. to EN 61000-6-4

Classification of climatic conditions acc. to IEC 60721
- Stationary use 3K23 (except condensation, water and formation of ice)
- Transport 2K11
- Storage 1K21
- Operating temperature $-10…+55$ °C

Classification of mechanical conditions acc. to IEC 60721
- Stationary use 3M11
- Transport 2M4
- Storage 1M12

Connection
- Connection screw terminals
- Connection properties:
  - rigid/flexible/Conductor sizes: 0.2…4/0.2…2.5 mm²/AWG 24-12
  - Stripping length: 8 mm
  - Tightening torque, terminal screws: 0.5 Nm

Other
- Operating mode continuous operation
- Mounting any position
- Protection class internal components/terminals (DIN EN 60529) IP30/IP20
- DIN rail mounting acc. to DIN EN 60715/IEC 60715
- Flammability class UL94V-0
- Standards IEC 61558-2-6
- Weight $\leq 400$ g
**Dimension diagram** (dimensions in mm)

![Dimension diagram](image)

**Wiring diagram**

![Wiring diagram](image)

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A1, A2 supply voltage $U_s$, F = short circuit protection</td>
</tr>
<tr>
<td>2</td>
<td>Power supply unit AN450</td>
</tr>
<tr>
<td>3</td>
<td>U2, V2 output voltage</td>
</tr>
<tr>
<td>4</td>
<td>Alarm indicator and test combination</td>
</tr>
</tbody>
</table>
**Device features**
- Dimensions: 72 x 72 mm (7204/7220) or 96 x 96 mm (9604/9620)
- Version S for increased shock and vibration resistance
- Scale background: white, imprint: black

**Further information**
For further information refer to our product range on www.bender.de.

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**Typical applications**
- The analogue measuring instruments of the 96…/72… series for indication of measured values from Bender devices utilising an appropriate output

---

**Approvals**

---

**Ordering information**

<table>
<thead>
<tr>
<th>Suitable ISOMETER*</th>
<th>Input current</th>
<th>Dimensions</th>
<th>Scale centre point (SKMP)</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>iso685…</td>
<td>0…400 µA</td>
<td>72 x 72 mm</td>
<td>120 kΩ</td>
<td>7204-1421</td>
<td>B986763</td>
</tr>
<tr>
<td></td>
<td>96 x 96 mm</td>
<td>120 kΩ</td>
<td></td>
<td>7204S-1421</td>
<td>B986764</td>
</tr>
<tr>
<td></td>
<td>0…20 mA</td>
<td>120 kΩ</td>
<td></td>
<td>9604-1421</td>
<td>B986764</td>
</tr>
<tr>
<td></td>
<td>96 x 96 mm</td>
<td>120 kΩ</td>
<td></td>
<td>9604S-1421</td>
<td>B986764</td>
</tr>
<tr>
<td></td>
<td>0…400 µA</td>
<td>1,2 MΩ</td>
<td></td>
<td>9620-1421</td>
<td>B986841</td>
</tr>
<tr>
<td></td>
<td>96 x 96 mm</td>
<td>1,2 MΩ</td>
<td></td>
<td>9620S-1421</td>
<td>B986842</td>
</tr>
<tr>
<td></td>
<td>0…20 mA</td>
<td>120 kΩ</td>
<td></td>
<td>7220-1421</td>
<td>B986844</td>
</tr>
<tr>
<td></td>
<td>72 x 72 mm</td>
<td>120 kΩ</td>
<td></td>
<td>7220S-1421</td>
<td>B986844</td>
</tr>
</tbody>
</table>

---

**Technical data**

- Test voltage: 3 kV
- Accuracy class acc. to DIN 43780: 1.5
- Normal position: vertical +5°
- Temperature range: -25°…+40 °C
- Protection class acc. to DIN 40050: IP52
- Enclosure: IP52
- Terminals: IP00
- Terminals with contact protection: IP00
- Documentation number: D00992

---

**Dimension diagram (dimensions in mm)**

**7204/7220**
- Cut-out dimensions: 68 x 68 mm
- Min. installation depth: 62.5 mm

**9604/9620**
- Cut-out dimensions: 92 x 92 mm
- Min. installation depth: 62.5 mm
DI-1DL
RS-485 interface repeater for RS-485 bus extension

**Device features**
- Plastic enclosure for DIN rail mounting
- Dynamic baud rate setting
- Galvanic separation between the input and output circuit and the power supply – overvoltage protection
- Supply voltage AC 85…260 V, 50…60 Hz
- Automatic baud rate changeover – can therefore be used for the internal BMS bus without limitations

**Approvals**

**Technical data**

<table>
<thead>
<tr>
<th>Supply voltage $U_s$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>DI-1DL</td>
<td>B95012047</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environment</th>
<th>Connection</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>0…+70 °C</td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>0.1 A/7 W</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Supply voltage</th>
<th>Power consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 85…260 V, 50…60 Hz</td>
<td>0.1 A/7 W</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interfaces</th>
<th>Interfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMS</td>
<td>2 x RS-485/BMS</td>
</tr>
<tr>
<td>Baud rate</td>
<td>dynamic</td>
</tr>
<tr>
<td>Cable length</td>
<td>≤ 1200 m</td>
</tr>
<tr>
<td>Cable (twisted in pairs, one end of shield connected to PE)</td>
<td>recommended: J-Y(St)Y min. 2x0.8</td>
</tr>
<tr>
<td>Data direction switching</td>
<td>automatic</td>
</tr>
<tr>
<td>Cascading option</td>
<td>yes</td>
</tr>
<tr>
<td>Number of bus devices: cascading allows a virtually unrestricted number of connections</td>
<td>31 additional bus devices per repeater,</td>
</tr>
<tr>
<td>Terminating resistor and bus bias voltage can be activated by a switch</td>
<td></td>
</tr>
<tr>
<td>Device address, BMS bus</td>
<td>–</td>
</tr>
<tr>
<td>Alarm LEDs</td>
<td>activity indication: direction and faults (green) internal operating voltage (red)</td>
</tr>
</tbody>
</table>

**Further information**
For further information refer to our product range on www.bender.de.

**Ordering information**

<table>
<thead>
<tr>
<th>Technical data</th>
<th>Dimension diagram (dimensions in mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td></td>
</tr>
<tr>
<td>Interfaces</td>
<td></td>
</tr>
<tr>
<td>Environment</td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

* depending on used transceivers
When used in the BMS bus, the rotary switch is to be set to position 4 for baud rate/interference suppression. The rotary switch is located at the bottom of the device.

Two DIP switches are available per bus segment to terminate the bus and to generate the required bias voltage. Both DIP switches must be switched on for activation.

The termination is carried out as shown in the following example of a BMS bus system:

### Settings

<table>
<thead>
<tr>
<th>Bus 1: Terminating resistor and bias voltage generation deactivated via switch on device (DIP switch 1, 2: OFF)</th>
<th>Bus 2: Terminating resistor and bias voltage generation activated via switch on device (DIP switch 3, 4: ON)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Master</td>
<td>Terminating resistor activated via switch on device (ON)* or external terminating resistor between terminals A and B</td>
</tr>
<tr>
<td>B Slave</td>
<td>Terminating resistor deactivated via switch on device (OFF)*</td>
</tr>
<tr>
<td>C RS-485 interface repeater DI-1DL</td>
<td>Bus 1: Terminating resistor and bias voltage generation deactivated via switch on device (DIP switch 1, 2: OFF)</td>
</tr>
<tr>
<td>D RS-485 interface repeater DI-1DL</td>
<td>Bus 2: Terminating resistor and bias voltage generation activated via switch on device (DIP switch 3, 4: ON)*</td>
</tr>
<tr>
<td>E Slave</td>
<td>Terminating resistor activated via switch on device (ON) or external terminating resistor between terminals A and B</td>
</tr>
</tbody>
</table>

* The bias voltage generation is generally activated for the BMS bus master (via software) and deactivated for the BMS slaves.
DI-2USB
Interface converter USB to RS-485

Device features
- Plastic enclosure
- Galvanic separation between the input and output circuit
- Power supply via USB port
- USB cable and driver CD included in the scope of delivery

Typical applications
- Conversion of USB interface into RS-485 interface
- Parameterisation of alarm indicator and operator panels (MK2430) via RS-485 interface by means of software
- Parameterisation of Modbus RTU devices via RS-485 interface by means of software

Approvals

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>from USB port, no additional power supply required</td>
<td>DI-2USB</td>
<td>B95012045</td>
</tr>
</tbody>
</table>

Technical data

Insulation coordination acc. to IEC 60664-1
- Rated voltage
- Rated impulse voltage/pollution degree: 3 kV/3

Supply voltage
- Supply voltage $U_s$: see ordering details
- Power consumption: 95 mA

Interfaces
- RS-485
  - Interface/protocol: 1 x RS-485/-
  - Baud rate: 9.6…115.2 kbit/s
  - Cable length: ≤ 1200 m
  - Cable (twisted in pairs, one end of shield connected to PE) recommended: J-Y(St)Y min. 2x0.8
  - Mode: –
  - Connection: A, B
  - Integrated terminating resistors, selectable via jumper, factory setting: terminating resistors included
  - Device address: –

USB
- Serial interface: 1 x USB
- Alarm LEDs: ON (yellow), R x Data (green), T x Data (red)

Environment/EMC
- EMC immunity/EMC emission: EN 61000-6-2/EN 61000-6-4
- Operating temperature: -10…+55 °C

Classification of climatic conditions acc. to IEC 60721
- Stationary use: 3K23
- Transport: 2K11
- Long-term storage: 1K22

Classification of mechanical conditions acc. to IEC 60721
- Stationary use: 3M11
- Transport: 2M4
- Long-term storage: 1M12

Connection
- Connection: screw-type terminals/USB plug type B
- Connection properties
  - rigid/flexible/conductor sizes: 0.5…2.5 mm² (AWG 22…12)

Other
- Operating mode: continuous operation
- Mounting: any position
- Screw mounting: 2 x M3
- DIN rail mounting acc. to: IEC 60715
- Operating manual: manual of third-party manufacturer
- Documentation number: D00103
- Weight: ≤ 25 g

Dimension diagram

Wiring diagram

DI-2USB to connect a personal computer utilising a USB interface to a BMS network.

Note: Consider BMS bus termination
IOM441-S / IOM441W-S
Relay module

Device features
- Extension of Bender devices by 12 relays
- N/O and N/C selectable

Further information
For further information refer to our product range on www.bender.de.

Typical applications
- Extension of the measuring channels during insulation fault location by potential-free contacts

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage $U_s$</th>
<th>Option “W”</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC 24 V</td>
<td>-</td>
<td>IOM441-S</td>
<td>B95012057</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>IOM441W-S</td>
<td>B95012057W</td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plug Kit Pushin ¹</td>
<td>B95012902</td>
</tr>
</tbody>
</table>

¹ included in the scope of delivery

Technical data

Insulation coordination according to IEC 60664-1
Definitions:
- Supply circuit
- Output circuits
- BB bus
- relay contacts [(13, 14), (23, 24), (33, 34), (43, 44), (53, 54), (63, 64), (73, 74), (83, 84), (93, 94), (103, 104), (113, 114), (123, 124)]
- Protective separation (reinforced insulation) between (BB bus) — (relay contacts)

<table>
<thead>
<tr>
<th>Supply voltage $U_s$</th>
<th>DC 24 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolerance of $U_s$</td>
<td>5 %</td>
</tr>
<tr>
<td>Power consumption</td>
<td>&lt; 1.7 W</td>
</tr>
</tbody>
</table>

LEDs
ON (operation LED) green

Switching elements
- 12 N/O contacts
- Rated operational voltage AC 250 V/DC 30 V
- Rated operational current 5 A
- Minimum contact rating 1 mA at ≥ DC 5 V

Environment/EMC
- EMC IEC 61326-2-4

Ambient temperatures:
- Operating temperature -25...+55 °C
- Transport -40...+85 °C
- Storage -25...+70 °C

Classification of climatic conditions acc. to IEC 60721:
- Stationary use (IEC 60721-3-3) 3K23 (no condensation, no formation of ice)
- 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) 2N4
- Long-term storage (IEC 60721-3-1) 1M12
- Area of application ≤ 2000 m AMSL
Technical data (continued)

Connection
- Connection type: pluggable push-wire terminal
- Conductor sizes: AWG 24-12
- Stripping length: 10 mm
- Rigid/flexible: 0.2...2.5 mm²
- Flexible with ferrule, with/without plastic sleeve: 0.25...2.5 mm²
- Multiple conductor, flexible with TWIN ferrule with plastic sleeve: 0.5...1.5 mm²

Other
- Operating mode: continuous operation
- Degree of protection internal components: IP40
- Degree of protection terminals: IP20
- DIN rail mounting acc. to: IEC 60715
- Screw fixing: 2 x M4 with mounting clip
- Enclosure material: polycarbonate
- Flammability class: UL 94V-0
- Dimensions (W x H x D): 72 x 93 x 63
- Documentation number: D00300
- Weight: approx. 180 g

Device version “W”
- Devices with the suffix “W” feature increased shock and vibration resistance.
- The electronics is covered with a special varnish to provide increased protection against mechanical stress and moisture.

Ambient temperatures:
- Operating temperature: -40...+70 °C
- Transport: -40...+85 °C
- Long-term storage: -25...+70 °C

Classification of climatic conditions acc. to IEC 60721:
- Stationary use (IEC 60721-3-3) 3K23 (condensation and formation of ice possible)
- Classification of mechanical conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3) 3K12

* = Factory settings

Dimension diagram (dimensions in mm)

Wiring diagram

1. Basic device
2. IOM441-S
3. Relay outputs
**COMTRAXX® COM465IP**

Condition Monitor with integrated gateway for the connection of Bender devices to Ethernet TCP/IP networks

### Device features

- Condition monitor for Bender systems
- Integrated modular gateway between Bender systems and TCP/IP enables remote access via LAN, WAN or Internet
- Range of functions adjustable through function modules
- Ethernet (10/100 MBit/s) for remote access via LAN, WAN or Internet
- Support of devices that are connected to the internal or external BMS bus, via BCOM, via Modbus RTU or Modbus TCP
- Individual visualisation can be generated, which is displayed via the web browser

### Range of functions (V4.3.0 and higher)

**Basic device (without function modules)**

- Condition monitor with web interface
- Interfaces for the integration of devices
  - Internal BMS bus (max. 150 devices) and external* BMS bus (max. 99 * 150 devices)
  - BCOM (max. 255 devices)
  - Modbus RTU and Modbus TCP (max. 247 devices each)
- Remote display of the latest measured values, status/alarm messages and parameters*
- Gateway to Modbus TCP: Reading the latest measured values, status/alarm messages from addresses 1…10 of each interface via Modbus TCP
- Gateway to Modbus RTU: Reading the latest measured values, status/alarm messages from addresses 1…10 of the internal BMS interface via Modbus RTU
- Ethernet interface with 10/100 MBit/s for remote access via LAN, WAN or Internet
- Setting of internal device parameters and parameters of devices connected via Modbus RTU and Modbus TCP **
- Time synchronisation for all assigned devices
- History memory (20,000 entries)
- Data loggers, freely configurable (30 * 10,000 entries)
- 50 data points from third-party devices (via Modbus RTU or Modbus TCP) can be integrated into the system
- A virtual device with 16 channels can be created

* Parameters can be set via web application and externally (via BMS/ICOM/BCOM), but not via Modbus. The parameters of assigned devices can only be read; Function module C is necessary for modification of settings!

** Function module A

- Assignment of individual texts for devices, channels (measuring points) and alarms.
- Device failure monitoring.
- E-mail notification to different users in case of alarms or system errors.
- Device documentation of any device in the system can be generated.* * It contains all parameters and measured values belonging to the device, as well as device information such as serial number and software version.
- System documentation can be created. It documents all devices in the system at once.

* Creating device documentation of BMS bus devices is only possible if the gateway is connected to the internal BMS bus.

** Function module B

- Support of external applications (e.g. visualisation programs or PLCs) by means of the Modbus TCP and Modbus RTU protocol.
- Reading the latest measured values, status and alarms messages from all assigned devices. Uniform access to all assigned devices via Modbus TCP over integrated server.
- Control commands: From an external application (e.g. visualisation software or PLC), commands can be sent to devices via Modbus TCP or Modbus RTU.
- Access to alarms and measured values via SNMP protocol (V1, V2c or V3). SNMP traps are supported.

** Function module C

- Fast and easy parameter setting of all devices* assigned to the gateway via web browser.
- Device backups of all devices in the system can be created and restored.

* Parameter setting of BMS bus devices is only possible when the gateway is connected to the internal BMS bus.

### Typical applications

- Optimum display and visualisation of device and system states in the web browser
- Monitoring and analysis of compatible Bender products and third-party devices
- Specific system overview through individual system description
- Selective notification to various users in the event of alarms
- Use of professional visualisation programs by converting to Modbus TCP or Modbus RTU protocol
- Clear setting of device parameters. Storing, documenting and restoring parameters is possible
- Commissioning and diagnosis of Bender systems
- Remote diagnosis, remote maintenance

### Approvals

![CE](ce.png)

![UK](uk.png)

![CA](ca.png)

![ERC](erc.png)

![UL Listed](ul.png)

![Japan Listed](ja.png)

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7.2

System components | Communication systems | Condition Monitor/Gateway

Condition Monitor with integrated gateway COMTRAXX® COM465IP
### Function module D
Quick and easy-to-create visualisation of the system. Integrated editor provides access to a variety of widgets and functions.
- Display on up to 50 overview pages, where e.g. room plans can be stored. Navigation within these overview pages is possible.
- Access to all measured values that are available in the system.
- Buttons and sliders can be used to send BMS test and reset commands, as well as to control external devices via Modbus TCP.

### Function module E
- 100 virtual devices with 16 channels each can be created.

### Function module F
- 1,600 data points from third-party devices (via Modbus RTU or Modbus TCP) can be integrated into the system.

### Ordering information

<table>
<thead>
<tr>
<th>Supply voltage/frequency range $U_s$</th>
<th>Power consumption</th>
<th>Application</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC</td>
<td>$\leq 6.5$ VA/$\leq 4$ W</td>
<td>Condition monitor with integrated gateway: Bender system/Ethernet</td>
<td>COM465IP-230V</td>
<td>B95061065</td>
</tr>
</tbody>
</table>

### Function modules

<table>
<thead>
<tr>
<th>Application</th>
<th>Function module (software licence)</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual text messages for all devices/ channels, device failure monitoring, e-mail in the event of an alarm, device documentation</td>
<td>Function module A</td>
<td>B75061011</td>
</tr>
<tr>
<td>Modbus TCP server provides all data, SNMP server with trap function</td>
<td>Function module B</td>
<td>B75061012</td>
</tr>
<tr>
<td>Parameter setting of all integrated devices, device backups</td>
<td>Function module C</td>
<td>B75061013</td>
</tr>
<tr>
<td>Visualisation application</td>
<td>Function module D</td>
<td>B75061014</td>
</tr>
<tr>
<td>Virtual devices</td>
<td>Function module E</td>
<td>B75061015</td>
</tr>
<tr>
<td>Integration of third-party devices</td>
<td>Function module F</td>
<td>B75061016</td>
</tr>
</tbody>
</table>

### Examples:
- To write parameters via Modbus, function modules B and C are required.
- To read parameters via Modbus, function module B is required.
- Function modules A and D are required to be able to use a visualisation in combination with the individual texts.

### Further information
For further information refer to our product range on www.bender.de.
Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3
Rated voltage  AC 250 V
Rated impulse voltage/overvoltage category 4 kV/III
Protection degree 3

Supply voltage
Supply voltage U, see ordering information
Frequency range f, see ordering information
Power consumption see ordering information

Modbus RTU
Interface/protocol RS-485/Modbus RTU
Operating mode master/slave (master) *
Baud rate 9.6…57.6 kBit/s
Cable length ≤ 1,200 m
Connection CAT6/CAT7 min. AWG23 twisted pair, J-Y(ST)Y min. 2x0,8

SNMP
Version 1, 2c, 3
Supported devices queries to all devices (channels) possible
Trap support yes

Used ports
53 DNS (UDP/TCP)
67, 68 DHCP (UDP)
80 HTTP (TCP)
123 SNMP (UDP)
161 TRAP (UDP)
162 SNMP TRAP (UDP)
443 HTTPS (TCP)
502 MODBUS (TCP)
4890 OPC-UA (TCP)
5535 MDNS (UDP)
48862 BCOM (UDP)

Environment/EMC
EMC EN 61326-1

Ambient temperatures
Operating temperature -25…+55 °C
Transport -40…+85 °C
Long-term storage -25…+70 °C

Classification of climatic conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) 3K23 (except condensation and formation of ice)
Transport (IEC 60721-3-2) 2K11
Long-term storage (IEC 60721-3-1) 1K22

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 pluggable push-wire terminals

Push-wire terminals
Conductor sizes AWG 24-12
Stripping length 10 mm
rigid/flexible 0.2…1.5 mm²
Flexible with ferrule, with/without plastic sleeve 0.25…2.5 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve 0.5…3.5 mm²

Other
Operating mode continuous operation
Mounting front-oriented, cooling slots must be ventilated vertically
Degree of protection, internal components (IEC 60529) IP30
Degree of protection, terminals (IEC 60529) IP67

System components | Communication systems | Condition Monitor/Gateway
Condition Monitor with integrated gateway COMTRAXX® COM465IP

Dimensions (W x H x D) 107.5 x 93 x 62.9 mm
Weight ≤ 240 g

(*) = factory settings

7.2
### Dimension diagram (dimensions in mm)

![Dimension Diagram]

### Operating controls and connections

<table>
<thead>
<tr>
<th>Number</th>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ON</td>
<td>Flashes during start-up. The LED lights permanently as soon as the device is ready for operation.</td>
</tr>
<tr>
<td>2</td>
<td>ETHERNET/IP ISODATA 1 ISODATA 2</td>
<td>LEDs show activities on the different interfaces</td>
</tr>
<tr>
<td>3</td>
<td>A1/+, A2/-</td>
<td>Supply voltage: see nameplate and ordering information</td>
</tr>
<tr>
<td>4</td>
<td>X1</td>
<td>Interface Modbus RTU</td>
</tr>
<tr>
<td>5</td>
<td>X1</td>
<td>BMS bus (Bender measuring device interface)</td>
</tr>
<tr>
<td>6</td>
<td>X2</td>
<td>Ethernet port (RJ45) for connection to the PC network as well as BCOM</td>
</tr>
<tr>
<td>7</td>
<td>RMB on/off</td>
<td>Terminating resistor Modbus RTU switch</td>
</tr>
<tr>
<td>8</td>
<td>RBMS on/off</td>
<td>Terminating resistor BMS bus switch</td>
</tr>
<tr>
<td>9</td>
<td>X3</td>
<td>Micro USB interface (currently without function)</td>
</tr>
<tr>
<td>10</td>
<td>X4</td>
<td>Mini HDMI interface (currently without function)</td>
</tr>
</tbody>
</table>

For UL applications, the following has to be observed:
- Maximum ambient temperature: 55 °C
- Use 60/75-°C copper wires only
COMTRAXX® COM465DP
Condition Monitor with integrated gateway for the connection of Bender devices to PROFIBUS DP and Ethernet TCP/IP networks

Device features
- Condition monitor for Bender systems
- Integrated modular gateway between Bender systems and TCP/IP enables remote access via LAN, WAN or Internet
- Range of functions adjustable through function modules
- Ethernet (10/100 MBit/s) for remote access via LAN, WAN or Internet
- Support of devices that are connected to the internal or external BMS bus, via BCOM, via Modbus RTU or Modbus TCP
- Integrated gateway between Bender system and PROFIBUS DP
- Individual visualisation can be generated, which is displayed via the web browser

Typical applications
- Optimum display and visualisation of device and system states in the web browser
- Monitoring and analysis of compatible Bender products and third-party devices
- Specific system description through individual system description
- Selective notification to various users in the event of alarms
- Use of professional visualisation programs by converting to Modbus TCP, Modbus RTU protocol or PROFIBUS DP
- Clear setting of device parameters. Storing, documenting and restoring parameters is possible
- Commissioning and diagnosis of Bender systems
- Remote diagnosis, remote maintenance

Approvals

Function module A
- Assignment of individual texts for devices, channels (measuring points) and alarms.
- Device failure monitoring.
- E-mail notification to different users in case of alarms or system errors.
- Device documentation of any device in the system can be generated*. It contains all parameters and measured values belonging to the device, as well as device information such as serial number and software version.
- System documentation can be created. It documents all devices in the system at once.
* ) Indicating parameters of BMS bus devices is only possible when the gateway is connected to the internal BMS bus.

Function module B
- Support of external applications (e.g. visualisation programs or PLCs) by means of the Modbus TCP and Modbus RTU protocol.
- Reading the latest measured values, status and alarm messages from all assigned devices. Uniform access to all assigned devices via Modbus TCP over integrated server.
- Control commands: From an external application (e.g. visualisation software or PLC), commands can be sent to devices via Modbus TCP or Modbus RTU.
- Access to alarms and measured values via SNMP protocol (V1, V2c or V3). SNMP traps are supported.

Function module C
- Fast and easy parameter setting of all devices* assigned to the gateway via web browser.
- Backups of all devices in the system can be created and restored.
* ) Parameter setting of BMS bus devices is only possible if the gateway is connected to the internal BMS bus.
**Function module D**
Quick and easy-to-create visualisation of the system. Integrated editor provides access to a variety of widgets and functions.
- Display on up to 50 overview pages, where e.g. room plans can be stored. Navigation within these overview pages is possible.
- Access to all measured values that are available in the system.
- Buttons and sliders can be used to send BMS test and reset commands, as well as to control external devices via Modbus TCP.

**Function module E**
- 100 virtual devices with 16 channels each can be created.

**Function module F**
- 1,600 data points from third-party devices (via Modbus RTU or Modbus TCP) can be integrated into the system.

---

**Ordering information**

<table>
<thead>
<tr>
<th>Supply voltage/frequency range $U_s$</th>
<th>Power consumption</th>
<th>Application</th>
<th>Type</th>
<th>Art. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC</td>
<td>$\leq 6.5 \text{VA}/ \leq 4 \text{W}$</td>
<td>Condition Monitor with integrated gateway: Bender system/PROFIBUS DP/Ethernet</td>
<td>COM465DP-230 V</td>
<td>B95061060</td>
</tr>
</tbody>
</table>

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**Function modules**

<table>
<thead>
<tr>
<th>Application</th>
<th>Function module (software licence)</th>
<th>Art. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual text messages for all devices/ channels, device failure monitoring, e-mail in the event of an alarm</td>
<td>Function module A</td>
<td>B75061011</td>
</tr>
<tr>
<td>Modbus TCP server for max. 98 * 139 BMS nodes as well as BCOM and universal measuring devices, SNMP server</td>
<td>Function module B</td>
<td>B75061012</td>
</tr>
<tr>
<td>Parameter setting of BMS devices as well as BCOM and universal measuring devices</td>
<td>Function module C</td>
<td>B75061013</td>
</tr>
<tr>
<td>Visualisation of Bender systems, System visualisation</td>
<td>Function module D</td>
<td>B75061014</td>
</tr>
<tr>
<td>Virtual devices</td>
<td>Function module E</td>
<td>B75061015</td>
</tr>
<tr>
<td>Integration of third-party devices</td>
<td>Function module F</td>
<td>B75061016</td>
</tr>
</tbody>
</table>

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**Examples:**
- To write parameters via Modbus, function modules B and C are required.
- To read parameters via Modbus, function module B is required.
- For parameterisation via PROFIBUS, the function module C is required.

---

Further information
For further information refer to our product range on www.bender.de.
Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Ratings:
- Rated voltage: 250 V
- Rated impulse voltage/overvoltage category: 4 kV/III
- Pollution degree: 3

Supply voltage:
- Supply voltage Ua:
  - Frequency range Ua:
  - Power consumption:

Indications:
- LED's:
  - ON: PROBUS
  - Ethernet (terminal X2): lights during network connection, flashes during data transfer

Memory:
- Number of data points for "third-party devices" to Modbus TCP and Modbus RTU: 50
- Number of data loggers: 30
- Number of history memory entries: 20,000

Visualisation:
- Number of pages: 50
- Background image size: max. 3 MB

Interfaces:

**Ethernet**
- Port: RJ45
- Data rate: 10/100 MBit/s, autodetect
- HTTP Modbus: HTTP/HTTPS (HTTP)*
- DHCP:
  - on/off (on) 5…60 s (30 s)*
- Auto (DHCP) 9.6/19.2/93.75/187.5/500 kBit/s, 1.5 MBit/s
- IP address: nnn.nnn.nnn.nnn (192.168.0.254)*, can always be reached over: 169.254.0.1
- Net mask: nnn.nnn.nnn.nnn (255.255.0.0)*
- Protocols (depending on function module selected):
  - TCP/IP, Modbus TCP, Modbus RTU, DHCP, SMTP, NTP

**BMS bus (internal/external)**
- Interface/protocol: RS-485/BMS internal or BMS external (BMS internal)*
- Baud rate BMS:
  - internal: 9.6 kBit/s
  - external: 19.2, 38.4, 57.6 kBit/s
- Cable length:
  - ≤ 1,200 m
- Cable:
  - Shield on one side connected to PI: GATE4/GAT7 min. AWG23
  - recommended:
    - twisted pair, J15Y/Y mini. 2x0.8
- Connection:
  - X1 (ABMS, BBMS)
- Connection type:
  - refer to connection "push-wire terminal X1"
- Terminating resistor:
  - 120 Ω (0.25 W), can be connected internally
- Device address, internal/external BMS bus:
  - 1…150 (1)*, 12…99

**BCOM**
- Interface/protocol: Ethernet/BCOM
- BCOM system name: (SYSTEM)
- BCOM subsystem address:
  - 1…255 (1)*
- BCOM device address:
  - 0…255 (0)*

**Modbus TCP**
- Interface/protocol: Ethernet/Modbus TCP
- Operating mode:
  - for Bender Modbus TCP devices and "third-party devices"
  - server for access to the process image and for Modbus control commands
- Parallel data access from different clients:
  - max. 25

**Modbus RTU**
- Interface/protocol: RS-485/Modbus RTU
- Operating mode:
  - master/slave (master)*
  - Baud rate:
  - 9.6…57.6 kBit/s
- Cable length:
  - ≤ 1,200 m
- Cable:
  - Shield on one side connected to PE:
    - GATE4/GAT7 min. AWG23
  - recommended:
    - twisted pair, J15Y/Y mini. 2x0.8
- Connection:
  - X1 (ABMS, BBMS)
- Connection type:
  - refer to connection "push-wire terminal X1"
- Terminating resistor:
  - 120 Ω (0.25 W), can be connected internally
- Supported Modbus RTU slave addresses:
  - 2…247

**SNMP**
- Versions: 1, 2c, 3
- Supported devices:
  - queries to all devices (channels) possible
  - Trap support:
- PROFBUS DP
- Interface/protocol:
  - RS-485 galvanically separated/PROFBUS DP
- Operating mode:
  - slave
  - Baud rate:
    - automatic baud rate detection: 9.6 kBit/s…1.5 MBit/s
    - 9.6/19.2/38.4/76.8/153.6 kBit/s, 1.5 MBit/s
- Connection:
  - 9-pole sub D
  - 1…125 (1)*

**Used ports**
- Port:
  - 55: DNS (UDP/TCP)
  - 67, 68: DHCP (UDP/TCP)
  - 80: HTTP (TCP)
  - 123: NTP (UDP)
  - 161: SNMP (UDP)
  - 162: SNMP TRAPs (UDP)
  - 443: HTTPS (TCP)
  - 502: MODBUS TCP
  - 4800: OPCIUA (TCP)
  - 5553: MDNS (UDP)
  - 48862: BCOM (UDP)

**Environment/EMC**
- EMC:
  - EN 61326-1

**Ambient temperatures**
- Operating temperature:
  - -25…+55 °C
- Transport:
  - -40…+85 °C
- Long-term storage:
  - -25…+70 °C

**Classification of climatic conditions acc. to IEC 60721**
- Stationary use (IEC 60721-3-3):
  - 3K23 (except condensation and formation of ice)
- Transport (IEC 60721-3-2):
  - 2K11
- Long-term storage (IEC 60721-3-1):
  - 1K22

**Connection**
- Connection type:
  - pluggable push-wire terminals
  - TCP/IP, Modbus TCP, Modbus RTU, DHCP, SMTP, NTP

**Push-wire terminals**
- Conductor sizes:
  - AWG 4-12
- Stripping length:
  - rigid/flexible: 10 mm
  - flexible with ferrule, with/without plastic sleeve: 0.25…2.5 mm²
  - Multiple conductor, flexible with TWIN ferrule with plastic sleeve: 0.5…1.5 mm²

**Push-wire terminal X1**
- Conductor sizes:
  - AWG 4-16
- Stripping length:
  - rigid/flexible: 10 mm
  - flexible with ferrule without plastic sleeve: 0.25…1.5 mm²
  - flexible with ferrule with plastic sleeve: 0.25…0.75 mm²

**Other**
- Operating mode:
  - continuous operation
- Mounting:
  - front-oriented, cooling slots must be ventilated vertically
- Degree of protection, internal components (IEC 60529):
  - IP 20
  - Degree of protection, terminals (IEC 60529):
  - IP 20
- Weight:
  - ≤ 240 g
Operating controls and connections

1. ON  - Flashes during start-up. The LED lights permanently as soon as the device is ready for operation.
2. ETHERNET/IP, MODBUS RTU, BMS  - LEDs show activities on the different interfaces
3. A1/+ , A2/-  - Supply voltage: see nameplate and ordering information
4. PROFIBUS DP  - Connection PROFIBUS DP
5. X1  - Interface Modbus RTU
6. X1  - BMS bus (Bender measuring device interface)
7. X2  - Ethernet port (RJ45) for connection to the PC network as well as BCOM
8. RMB on/off  - Terminating resistor Modbus RTU switch
9. RBMS on/off  - Terminating resistor BMS bus switch
10. X3  - Micro USB interface (currently without function)
11. X4  - Mini HDMI interface (currently without function)

For UL applications, the following must be observed:
- Maximum ambient temperature: 55 °C
- Only 60/75 °C copper wires must be used
Condition Monitor with an integrated gateway for the connection of Bender isoData devices to Ethernet TCP/IP networks

**Device features**
- Condition Monitor for Bender systems
- Integrated modular gateway between Bender systems and TCP/IP enables remote access via LAN, WAN or the Internet
- Range of functions adjustable through function modules
- Ethernet (10/100 Mbit/s) for remote access via LAN, WAN or the Internet
- Integration of devices that are connected via IsoData or BCOM
- OPC UA interface for data transmission

**Range of functions**

**Basic device (without function modules)**
- Condition Monitor with a web interface for use with Bender isoData and BCOM as well as universal measuring devices.
- Support for devices that are connected:
  - via IsoData (1 device per interface),
  - via the BCOM interface (see the BCOM operating manual),
  - via Modbus TCP (max. 247 devices).
- Remote display of present measured values, operating status and alarm messages.
- Gateway to Modbus TCP: Reading the latest subsystem measured values, operating status and alarm messages from addresses 1…10 via Modbus TCP.
- Ethernet interface with 10/100 Mbit/s for remote access via LAN, WAN or the Internet.
- Setting for internal parameters and for configuration of Bender universal measuring devices and energy meters.*
- Time synchronisation for all assigned devices.
- History memory (1,000 entries).
- Data loggers, freely configurable (30 * 10,000 entries).
- 50 data points from third-party devices (via Modbus TCP) can be integrated into the system.
- A virtual device with 16 channels can be created.

*) Individual parameters can be set via a web-based application and externally (via BCOM), but not via Modbus. The parameters of assigned devices can only be read; in order to change settings, function module C is required.

No reports can be generated – also not for your own device.

**Function module A**
- Assigning individual texts for devices, channels (measuring points) and alarms
- Device failure monitoring
- E-mail notification in the event of alarms or system faults to different users
- Configuration of e-mail notifications
- Device documentation can be created by any device in the system. Present measured values, settings and software statuses are stored.
- System documentation can be created. It documents all devices in the system at once.

**Function module B**
- Supports external applications (e.g. visualisation programs or PLCs) by means of the Modbus TCP protocol.
- Reading the latest measured values, operating status and alarms messages from all assigned devices. Uniform access to all assigned devices by means of Modbus TCP via an integrated server.
- Control commands: From an external application (e.g. visualisation software or PLC), commands can be sent to devices by means of Modbus TCP.
- Access to alarms and measurement values via SNMP protocol (V1, V2c or V3).

**Function module C**
- Quick and easy parameterisation of all devices* assigned to the gateway via web browser.
- Backups can be generated and restored from all devices in the system.

*) Only BCOM devices can be parameterised. IsoData devices cannot be parameterised.

**Function module D**
- Fast, simple visualisation without programming. Device statuses, alarms or readings can be arranged and displayed (e.g. a spatial plan) in front of a background image.
- Display of an overview covering several pages. Jump to another view page and return to the overview page.
- Graphical display of the data loggers with scaling of the time axis.

*) Currently, the Silverlight web interface is still necessary for this function.
### Function module E
- 100 virtual devices with 16 channels each can be created.

### Function module F
- 1,600 data points from third-party devices (via Modbus TCP) can be integrated into the system.

### Ordering information

<table>
<thead>
<tr>
<th>Supply voltage/Frequency range ( U_s )</th>
<th>Power consumption</th>
<th>Application</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC</td>
<td>( \leq 6.5 \text{VA} \leq 4 \text{W} )</td>
<td>Condition Monitor with an integrated gateway: Bender system/Ethernet</td>
<td>COM465ID-230 V</td>
<td>B95061070</td>
</tr>
</tbody>
</table>

### Function modules

<table>
<thead>
<tr>
<th>Application</th>
<th>Function module</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual texts for devices/channels, device failure monitoring, e-mail in case of an alarm</td>
<td>Function module A</td>
<td>B75061011</td>
</tr>
<tr>
<td>Modbus TCP server for max. 98 * 139 BMS nodes as well as BCOM and universal measuring devices, SNMP server</td>
<td>Function module B</td>
<td>B75061012</td>
</tr>
<tr>
<td>Parameter setting of BMS devices as well as BCOM and universal measuring devices</td>
<td>Function module C</td>
<td>B75061013</td>
</tr>
<tr>
<td>Visualisation of Bender systems, System visualisation</td>
<td>Function module D</td>
<td>B75061014</td>
</tr>
<tr>
<td>Virtual devices</td>
<td>Function module E</td>
<td>B75061015</td>
</tr>
<tr>
<td>Integrating third-party devices</td>
<td>Function module F</td>
<td>B75061016</td>
</tr>
</tbody>
</table>

### Examples:
- To write parameters via Modbus, the function modules B and C are required.
- To read parameters via Modbus, the function module B is required.

Further information
For further information refer to our product range on www.bender.de.
### Technical data

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>AC 250 V</td>
</tr>
<tr>
<td>Rated impulse voltage/Overvoltage category</td>
<td>4 kV/III</td>
</tr>
<tr>
<td>Pollution degree</td>
<td>3</td>
</tr>
<tr>
<td>Protective separation (reinforced insulation) between (A1/+, A2/-)</td>
<td>(AMB, BMB), (ABMS, BBMS), (X2)</td>
</tr>
</tbody>
</table>

**Supply voltage**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage U₁</td>
<td>see ordering details</td>
</tr>
<tr>
<td>Frequency range U₄</td>
<td>see ordering details</td>
</tr>
<tr>
<td>Power consumption</td>
<td>see ordering details</td>
</tr>
</tbody>
</table>

**Indication**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEDs:</td>
<td></td>
</tr>
<tr>
<td>ON</td>
<td>operation indicator</td>
</tr>
<tr>
<td>ETHERNET IP</td>
<td>data traffic Ethernet</td>
</tr>
<tr>
<td>ISODATA1</td>
<td>data traffic ISODATA1</td>
</tr>
<tr>
<td>ISODATA2</td>
<td>data traffic ISODATA2</td>
</tr>
<tr>
<td>Ethernet (X2 terminal)</td>
<td>lights during network connection, flashes during data transmission</td>
</tr>
</tbody>
</table>

**Internal memory**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-mail configuration (function module A only) and device failure monitoring</td>
<td>max. 250 entries</td>
</tr>
<tr>
<td>Individual texts (function module A only)</td>
<td>unlimited number of texts with 100 characters each</td>
</tr>
<tr>
<td>Number of data points for “third-party devices” on Modbus TCP and Modbus RTU</td>
<td>50</td>
</tr>
<tr>
<td>Data loggers</td>
<td>39</td>
</tr>
<tr>
<td>Number of data points per data logger</td>
<td>10,000</td>
</tr>
<tr>
<td>Number of history memory entries</td>
<td>1,000</td>
</tr>
</tbody>
</table>

**Visualisation**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of pages</td>
<td>20</td>
</tr>
<tr>
<td>Size of the background image</td>
<td>50 kByte (scaled down if larger)</td>
</tr>
<tr>
<td>Data points (per page)</td>
<td>50 devices or channels, 150 text elements</td>
</tr>
</tbody>
</table>

**Interfaces**

**Ethernet**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port</td>
<td>RJ45</td>
</tr>
<tr>
<td>Data rate</td>
<td>10/100 Mbit/s, autodetect</td>
</tr>
<tr>
<td>DHCP</td>
<td>on/off (on)*</td>
</tr>
<tr>
<td>IP address</td>
<td>nnn.nnn.nnn.nnn, can always be reached over: 192.168.0.254, (169.254.0.1)*</td>
</tr>
<tr>
<td>Netmask</td>
<td>nnn.nnn.nnn.nnn (255.255.0.0)*</td>
</tr>
</tbody>
</table>

**Protocols (depending on function module selected)**

- TCP/IP, Modbus TCP, Modbus RTU, DHCP, SMTP, NTP, OPC UA
- BCOM

**SNMP**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Versions</td>
<td>1, 2c, 3</td>
</tr>
</tbody>
</table>

**Devices supported**

Queries to all devices (channels) possible (no trap functionality)

**ISODATA**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface/protocol</td>
<td>RS-485/ISODATA</td>
</tr>
<tr>
<td>Operating mode</td>
<td>master</td>
</tr>
<tr>
<td>Baud rate ISODATA</td>
<td>9.6 kbit/s</td>
</tr>
<tr>
<td>Cable length</td>
<td>≤ 1200 m</td>
</tr>
<tr>
<td>Cable: twisted pair, shielded, one end of shield connected to PE recommended: J-Y3(Y) min. 2x0.8</td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>X1 (A-101, B-101, A-102, B-102)</td>
</tr>
</tbody>
</table>

**Connection type**

ref to connection “push-wire terminal X1”

**Terminating resistor**

120 Ω (0.25 W), can be connected internally

**Device address**

ISODATA1 (21), ISODATA2 (3)

**BCom**

<table>
<thead>
<tr>
<th>Interface/protocol</th>
<th>Ethernet/BCOM</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCOM subsystem address</td>
<td>1…99 (1)*</td>
</tr>
<tr>
<td>BCOM device address</td>
<td>1…99 (2)*</td>
</tr>
</tbody>
</table>

**Modbus TCP**

<table>
<thead>
<tr>
<th>Interface/protocol</th>
<th>Ethernet/Modbus TCP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating mode</td>
<td>server for access to the process image and for Modbus control commands</td>
</tr>
</tbody>
</table>

**Parallel data access by different clients**

max. 8

**Classification of climatic conditions acc. to IEC 60721**

| Stationary use (IEC 60721-3)      | 3K23 (except condensation and formation of ice) |
| Transport (IEC 60721-3)           | 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                   | pluggable push-wire terminals |

**Push-wire terminals**

**Conductor sizes**

AWG 24-12

**Stripping length**

10 mm

**rgid/flexible**

0.2…2.5 mm²

**Flexible with ferrule, with/without plastic sleeve**

0.25…2.5 mm²

**Multiple conductor, flexible with TWIN ferrule with plastic sleeve**

0.5…1.5 mm²

**Push-wire terminal X1**

<table>
<thead>
<tr>
<th>Conductor sizes</th>
<th>AWG 24-16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stripping length</td>
<td>10 mm</td>
</tr>
</tbody>
</table>

**rgid/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

**Other**

<table>
<thead>
<tr>
<th>Operating mode</th>
<th>continuous operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting</td>
<td>front-oriented, cooling slots must be ventilated vertically</td>
</tr>
<tr>
<td>Degree of protection, internal components (IEC 60529)</td>
<td>IP30</td>
</tr>
<tr>
<td>Degree of protection, terminals (IEC 60529)</td>
<td>IP20</td>
</tr>
<tr>
<td>DIN rail mounting acc. to IEC 60715</td>
<td></td>
</tr>
<tr>
<td>Screw fixing</td>
<td>2 x M4</td>
</tr>
<tr>
<td>Enclosure type</td>
<td>J460</td>
</tr>
<tr>
<td>Enclosure material</td>
<td>polycarbonate</td>
</tr>
<tr>
<td>Flammability class</td>
<td>UL94V-0</td>
</tr>
<tr>
<td>Dimensions (W x H x D)</td>
<td>107.5 x 93 x 62.9 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>≤ 240 g</td>
</tr>
</tbody>
</table>

(*) = Factory settings
Condition Monitor with integrated gateway COMTRAXX® COM465ID

Operating controls and connections

1 ON
   The LED flashes during start-up. The LED lights permanently as soon as the device is ready for operation.

2 ETHERNET/IP ISODATA 1 ISODATA 2
   LEDs show activities on the different interfaces

3 A1/+, A2/- Voltage supply: see nameplate and ordering details

4 X1 IsoData 1 interface 1
5 X1 IsoData 1 interface 2
6 X2 Ethernet port (RJ45) for connection to the PC network as well as BCOM
7 MB on/off IsoData 1 terminating resistor switch
8 BMS on/off IsoData 2 terminating resistor switch
COMTRAXX® COM463BC
Gateway for data exchange between the interfaces BCOM and external BMS

**Device features**
- Gateway for data exchange between the interfaces BCOM and external BMS
- Ethernet (10/100 Mbit/s) for remote access via LAN, WAN or the Internet
- Configurable data exchange between BCOM and external BMS

**Typical applications**
- Information exchange between BCOM and external BMS systems
- Configuration of the information to be transferred from one system to the other
- Several external BMS systems can be displayed together with BCOM systems in one overview
- Selective notification to different users in case of alarms
- Remote diagnosis, remote maintenance

**Further information**
For further information refer to our product range on www.bender.de.

**Technical data**
Insulation coordination acc. to IEC 60664-1/IEC 60664-3
Rated insulation voltage 250 V
Rated impulse voltage/Overvoltage category 4 kV/III
Pollution degree 3
Protective separation (reinforced insulation) between
(A1+, A2/-) – [(AMB, BMB), (ABMS, BBMS), (X2), (X3, X4)]

**Ordering information**

<table>
<thead>
<tr>
<th>Supply voltage/Frequency range U_s</th>
<th>Power consumption</th>
<th>Application</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC</td>
<td></td>
<td>Gateway for the connection of systems with BCOM and external BMS</td>
<td>COM463BC-230 V</td>
<td>895061051</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Supply voltage U_s</th>
<th>Power consumption</th>
<th>Application</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>24…240 V, 50…60 Hz</td>
<td>≤ 6.5 VA/≤ 4 W</td>
<td>Gateway for the connection of systems with BCOM and external BMS</td>
<td>COM463BC-230 V</td>
<td>895061051</td>
</tr>
</tbody>
</table>

**Approvals**

**Ordering information**

<table>
<thead>
<tr>
<th>Supply voltage/Frequency range U_s</th>
<th>Power consumption</th>
<th>Application</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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<th>Power consumption</th>
<th>Application</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
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<td>≤ 6.5 VA/≤ 4 W</td>
<td>Gateway for the connection of systems with BCOM and external BMS</td>
<td>COM463BC-230 V</td>
<td>895061051</td>
</tr>
</tbody>
</table>

**Interfaces**

**Ethernet**
- Port RJ45
- Data rate 10/100 MBit/s, autodetect
- DHCP on/off (on)*
- IP address nnn.nnn.nnn.nnn, can always be reached over: 192.168.0.254, (169.254.0.1)*
- IP address nnn.nnn.nnn.nnn (192.168.0.254)*
- IP address static 169.254.0.1
- Netmask nnn.nnn.nnn.nnn (255.255.255.0)*
- Protocols TCP/IP, DHCP, SMTP, NTP

**BMS bus (external)**
Interface/protocol RS-485/external BMS (external BMS)*
Operating mode master/slave (master)*
Baud rate BMS external 19.2; 38.4; 57.6 kBit/s
Cable length ≤1,200 m
Connection X1 (ABMS, BBMS)
Connection type refer to connection "push-wire terminal X1"
Terminating resistor 120 Ω (0.25 W), can be connected internally
Device address, external BMS bus 2…99 (2)*

**BCOM**
Interface/protocol Ethernet/BCOM
BCOM subsystem address 1…255 (1)*
BCOM device address 0…255 (0)*
Technical data

Environment/EMC

EMC

EN 61326-1

Ambient temperatures

Operation

-25…+55 °C

Transport

-40…+65 °C

Long-term storage

-25…+70 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3) 3K24 (except condensation and formation of ice)

Transport (IEC 60721-3-3) 2K11

Long-term storage (IEC 60721-3-3) 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

pluggable push-wire terminals

Push-wire terminals

Conductor sizes

AWG 24-12

Stripping length

10 mm

rigid/flexible

0.2…2.5 mm²

flexible with ferrule, with/without plastic sleeve

0.25…2.5 mm²

Multiple conductor, flexible with TWIN ferrule with plastic sleeve

0.5…1.5 mm²

Push-wire terminal X1

Conductor sizes

AWG 24-16

Stripping length

10 mm

rigid/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

Other

Operating mode

continuous operation

Mounting

front-oriented, cooling slots must be ventilated vertically

Degree of protection, internal components (IEC 60529)

IP30

Degree of protection, terminals (IEC 60529)

IP20

Quick DIN rail mounting acc. to

IEC 60715

Screw fixing

2 x M4

Enclosure type

J460

Enclosure material

polycarbonate

Flammability class

UL94V-0

Dimensions (W x H x D)

107.5 x 93 x 62.9 mm

Documentation number

D00427

Weight

≤ 240 g

(1)* = factory settings

Dimension diagram (dimensions in mm)

Operating controls and connections

1 ON

“ON” LED: Flashes during start-up.
The LED lights permanently as soon as the device is ready for operation.

2 BCOM, BMS

LEDs show activities on the different interfaces

Supply voltage: see nameplate and ordering information

3 A1/+, A2/-

4 X1

BMS bus (Bender measuring device interface)

5 X2

Ethernet port (RJ45) for connection to the PC network as well as to BCOM

6 BMS on/off

Terminating resistor BMS bus switch
COMTRAXX® CP9…-I
Alarm indicator and operator panel for medical locations and other areas

Device features
- Display size 7” and 15.6” with tempered and anti-reflective glass
- Easy to clean and disinfect, degree of protection IP54
- Screwless mounted front plate
- Condition monitor for Bender systems
- Integrated modular gateway between Bender systems and TCP/IP
- Remote access via LAN, WAN or Internet
- Support of devices that are connected to the internal BMS bus, via BCOM, Modbus RTU or Modbus TCP
- Individual visualisation can be generated, which can be viewed via the web browser or on the display
- Silent due to operation without fan
- High-quality representation with excellent contrast, high resolution and a wide viewing angle
- Possibility of graphical integration of building plans or status display in photo quality
- Visual and acoustic notification in the event of an alarm

Typical applications
- Monitoring and parameter setting of all Bender products that support communication
- Mounting in the control cabinet door so that all information is immediately visible
- Commissioning and diagnosis of Bender systems
- Remote diagnosis and remote maintenance
- Control stations in all areas
- Monitoring and analysis of data centres

Further information
For further information refer to our product range on www.bender.de.

Approvals
![CE, UL Listed]
only CP907-I

Ordering information

Complete devices

<table>
<thead>
<tr>
<th>Type</th>
<th>Display size</th>
<th>Supply</th>
<th>Device dimensions (W x H x D)</th>
<th>Weight</th>
<th>Enclosure</th>
<th>Display unit</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP907-I</td>
<td>7” (17.6 cm)</td>
<td>DC 24 V, &lt; 15 W</td>
<td>226 x 144 x 78 mm</td>
<td>1.1 kg</td>
<td>Flush-mounting enclosure</td>
<td>Glass, tempered, white</td>
<td>B95061031</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>226 x 144 x 65 mm</td>
<td>1.0 kg</td>
<td>Control cabinet door mounting</td>
<td>Glass, tempered, white</td>
<td>B95061032</td>
</tr>
<tr>
<td>CP915-I</td>
<td>15.6” (38.6 cm)</td>
<td>AC 100…240 V, &lt; 30 W</td>
<td>505 x 350 x 92 mm</td>
<td>6.1 kg</td>
<td>Flush-mounting enclosure</td>
<td>Glass, tempered, white</td>
<td>B95061033</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Glass, tempered, grey</td>
<td>only CP907-I</td>
<td>B95061034</td>
</tr>
</tbody>
</table>

Scope of delivery: Display unit, control cabinet door mounting or flush-mounting enclosure incl. mounting plate with electronics, CP9xx connecting cable and plug kit.

Components separately

<table>
<thead>
<tr>
<th>Device series</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP907-I</td>
<td>Flush-mounting enclosure</td>
<td>B95100140</td>
</tr>
<tr>
<td></td>
<td>Display unit white</td>
<td>B95061090</td>
</tr>
<tr>
<td></td>
<td>Display unit grey</td>
<td>B95061110</td>
</tr>
<tr>
<td></td>
<td>Flush-mounting enclosure incl. mounting plate with electronics</td>
<td>B95061092</td>
</tr>
<tr>
<td>CP915-I</td>
<td>Display unit white</td>
<td>B95061090</td>
</tr>
<tr>
<td></td>
<td>Display unit grey</td>
<td>B95061110</td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP9xx-i replacement plug kit</td>
<td>B95061910</td>
</tr>
<tr>
<td>CP9xx-i suction lifter 1)</td>
<td>B95061911</td>
</tr>
</tbody>
</table>

1) The suction lifter is required to remove the display.
### Technical data

#### Insulation coordination CP907-I acc. to IEC 60664-1
- Rated voltage: 50 V
- Overvoltage category: III
- Pollution degree: 2
- Rated impulse voltage: 800 V

#### Insulation coordination CP915-I acc. to IEC 60664-1
- Rated voltage: AC 250 V
- Overvoltage category: III
- Pollution degree: 2
- Rated impulse voltage: 4 kV

#### Supply CP907-I via plug-in terminal (A1/+;A2/-)
- Nominal voltage CP907-I: DC 24 V SELV/PELV
- Nominal voltage tolerance: ±20 %
- Typical power consumption at DC 24 V: < 15 W
- Maximum cable length when supplied via B95061210 (24-V DC power supply unit 1.75 A): 0.28 mm²: 75 m; 0.5 mm²: 130 m; 0.75 mm²: 200 m; 1.5 mm²: 400 m; 2.5 mm²: 650 m

#### Supply CP907-I via PoE
- PoE standard: IEEE 802.3at
- Nominal voltage: DC 48 V SELV/PELV
- Nominal voltage tolerance: -25...+15 %
- Typical power consumption for PoE: < 15 W
- Maximum cable length when supplied via AWG 26/7; 0.14 mm²: 100 m

#### Supply CP915-I via terminal block (L1; N)
- Nominal voltage CP915-I via external power supply unit: AC 100...240 V
- Nominal voltage tolerance: -15...+10 %
- Frequency range: 50...60 Hz
- Typical power consumption at AC 230 V: < 30 W
- Connection: terminal block (L1; N)

#### Stored energy time in the event of voltage failure
- Time, date: min. 3 days

#### Displays, memory
- Display CP907-I: 7" TFT touch display
- Display CP915-I: 15.6" TFT touch display
- E-mail configuration and device failure monitoring
- E-mail notification
- Individual texts: unlimited number of texts with 100 characters each
- Number of data points for ‘third-party devices’ to Modbus TCP and Modbus RTU: 1 600
- Number of data loggers: 30
- Number of data points per data logger: 10 000
- Number of history memory entries: 20 000

#### Visualisation
- Number of pages: 50
- Background image size: max. 3 MB

#### Interfaces
- Ethernet: RJ45
- Data rate: 10/100 Mbit/s, autodetect
- HTTP mode: HTTP/HTTPS (HTTP)*
- DHCP: on/off (DHCP) 5...60 s (30 s)*
- IP address: nnn.nnn.nnn.nnn (192.168.0.254)*, can always be reached via: 169.254.0.1
- Net mask: nnn.nnn.nnn.nnn (255.255.0.0)*
- Protocols: TCP/IP, Modbus TCP, Modbus RTU, DHCP, SNMP, SMTP, NTP

#### BMS bus (internal)
- Interface/protocol: RS-485/BAAS internal
- Operating mode: master/slave (master)*
- Baud rate: 9.6 Kbit/s
- Cable length: < 1200 m
- Cable: shielded, twisted pair, J-Y(St)Y min. 2x0.2

#### Modbus TCP
- Interface/protocol: Ethernet/Modbus TCP
- Operating mode client for Bender Modbus TCP devices and “third-party devices”
- Operating mode server for access to process image and for Modbus control commands
- Parallel data access for different clients: max. 25

#### Modbus RTU
- Interface/protocol: RS-485/Modbus RTU
- Operating mode: master/slave (master)*
- Baud rate: 9.6...57.6 Kbit/s
- Cable length: < 1200 m
- Cable: shielded, twisted pair, J-Y(St)Y min. 2x0.2

#### SNMP
- Versions: 1, 2c, 3
- Supported devices: query of all devices (channels) possible
- Trap support: yes

#### USB
- Number: 2
- Operating mode: USB 2.0 host (5 V, 500 mA)*
- Data rate: 480 Mbit/s
- Connection type: USB 2.0 Standard-A

#### Used ports
- 67, 68 DHCP (UDP)
- 53 DNS (UDP/TCP)
- 502 MODBUS (TCP)
- 80 HTTP (TCP)
- 67, 68, 123, 161, 443, 502, 48862 BCOM (UDP/TCP)

#### Digital inputs (1-12)
- Number: 12
- Galvanic separation: yes
- Operating mode: selectable for each input: active-high or active-low
- Factory setting: active-high
- Voltage range (high): AC/DC 0...2 V
- Voltage range (low): AC/DC 10...30 V
- Max. current per channel (at AC/DC 30 V): 8 mA
- Connection push-in terminal: (1-1) [2-2] [3-3] ... (12-12)
- Maximum cable length: < 1000 m

#### Switching elements
- Number: 1 relay
- Operating mode: N/C operation or N/O operation
- Function: programmable
- Electrical endurance under rated operating conditions, number of cycles: 10,000

#### Contact data acc. to IEC 60947-5-1:
- Utilisation category: AC-13, AC-14, DC-12
- Rated operational voltage: 24 V
- Rated operational current: 2 A
- Minimum contact load (relay manufacturer’s reference): 10 µA / 10 mV DC
- Connection: plug-in terminal (11;12;14)

#### Buzzer
- Buzzer message: can be acknowledged, adoption of characteristics of new value
- Buzzer interval: configurable
- Buzzer frequency: configurable
- Buzzer repetition: configurable

#### Audio (for CP915-I only)
- Line IN: STEREO signal input via 3.5 mm jack plug
- Line OUT: Output to a STEREO playback device via 3.5 mm jack plug
Technical data (continued)

Device connections

Terminal block (L1; N; PE) (for CP915-I only)
- Conductor sizes: AWG 20-12
- Stripping length: 10…11 mm
- Rigid/flexible: 0.2…2.5 mm²
- Flexible with ferrule with/without plastic sleeve: 0.25…2.5 mm²
- Multiple conductor, flexible with TWIN ferrule with plastic sleeve: 0.25…1.5 mm²

Plug-in terminal (A1+/A2; A12) (11;12;14)
- Conductor sizes: AWG 24-12
- Stripping length: 10 mm
- Rigid/flexible: 0.2…1.5 mm²
- Flexible with ferrule, with/without plastic sleeve: 0.25…1.5 mm²
- Flexible with ferrule with/without plastic sleeve: 0.25…0.75 mm²

For UL applications (CP907-I only)
- Use copper lines only.
- Minimum temperature range of the cable to be connected to the plug-in terminals: 75 °C
- Minimum temperature range of the cable to be connected to the PoE plug: 80 °C

Environment/EMC
- EMC: IEC 61326-1
- Operating temperature CP907-I: -10…+55 °C
- Operating temperature CP907-I for UL applications: -10…+50 °C
- Operating temperature CP915-I: -5…+40 °C
- Operating altitude: ≤ 2000 m AMSL
- Rel. humidity: ≤ 98 %

Classification of climatic conditions acc. to IEC 60721:
- Stationary use (IEC 60721-3-3): 3K23 (except condensation and formation of ice)
- 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
- Stationary use (IEC 60721-3-3): 3M10
- Transport (IEC 60721-3-2): 2M4
- Long-term storage (IEC 60721-3-1): 1M12

Other
- Operating mode: continuous operation
- Mounting: display-oriented
- Degree of protection, front: IP54
- Degree of protection, front, for UL applications: IP50
- Degree of protection, enclosure: IP20
- Flammability class: UL 94V-0
- Device dimensions:
  - CP907-I (W x H x D): 226 x 144 x 176 (7”)
  - CP915-I (W x H x D): 505 x 350 x 95 mm
- Documentation number: D00418
- Weight:
  - CP907-I: approx. 1.1 kg
  - CP915-I: approx. 6.1 kg

(*) = factory settings

Dimensions

External dimensions

<table>
<thead>
<tr>
<th>Type</th>
<th>Dimensions (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a</td>
</tr>
<tr>
<td>CP907-I</td>
<td>226</td>
</tr>
<tr>
<td>CP915-I</td>
<td>505</td>
</tr>
</tbody>
</table>

Glass thickness 3 mm

Installation dimensions – panel cut-out

<table>
<thead>
<tr>
<th>Type</th>
<th>Enclosure</th>
<th>Dimensions (mm)</th>
<th>Required installation depth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>a</td>
<td>b</td>
</tr>
<tr>
<td>CP907-I</td>
<td>Flush-mounting enclosure</td>
<td>212</td>
<td>124</td>
</tr>
<tr>
<td></td>
<td>Control cabinet door mounting</td>
<td>213</td>
<td>123</td>
</tr>
<tr>
<td>CP915-I</td>
<td>Flush-mounting enclosure</td>
<td>461</td>
<td>306</td>
</tr>
</tbody>
</table>
# COMTRAXX® CP9xx

## Alarm indicator and operator panel for medical locations and other areas

### Device features
- Display size 7", 15" and 24" with tempered and anti-reflective glass
- Easy to clean and to disinfect, degree of protection IP54
- Screwless mounted front plate
- User-friendly touch-sensitive monitoring system for medical locations and other applications
- Particularly simple operation
- Additional information for medical and technical personnel
- Visual and acoustic notification in the event of an alarm
- Clear menu structure with self-explanatory interactive images
- Clearly marked safety functions
- Silent due to operation without fan
- High-quality representation with excellent contrast, high resolution and a wide viewing angle
- Possibility of graphical integration of building plans or status display in photo quality
- Easy integration of external subsections like charging stations for operating theatre table controls and intercom systems with front foil
- Simple conversion and expansion with minimal service interruptions

### Typical applications
- Monitoring, operation and display of:
  - Medical Isolated Power Systems (IPS)
  - Supply systems for medical gases
  - Ventilation and air-conditioning systems
  - Room lighting
  - Operating theatre lights
  - Special power supply systems (BSV (battery-based safety power supply) or UPS (uninterruptible power supply))
  - Further systems from different manufacturers.

### Approvals

[CE, UL, UKCA Listed]

### Ordering information

#### Complete devices

<table>
<thead>
<tr>
<th>Type</th>
<th>Display size</th>
<th>Supply</th>
<th>Device dimensions (W x H x D)</th>
<th>Weight</th>
<th>Display unit</th>
<th>Art. No.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CP907</td>
<td>7&quot; (17.6 cm)</td>
<td>DC 24 V, &lt; 15 W</td>
<td>226 x 144 x 78 mm</td>
<td>1.1 kg</td>
<td>Glass, tempered, white</td>
<td>B95061080</td>
<td></td>
</tr>
<tr>
<td>CP915</td>
<td>15.6&quot; (38.6 cm)</td>
<td>AC 100…240 V, &lt; 30 W</td>
<td>505 x 350 x 92 mm</td>
<td>6.1 kg</td>
<td>Glass, tempered, white</td>
<td>B95061081</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Glass, tempered, gray</td>
<td>B95061085</td>
<td></td>
</tr>
<tr>
<td>CP924</td>
<td>24&quot; (54.5 cm)</td>
<td>AC 100…240 V, &lt; 55 W</td>
<td>654 x 441 x 100 mm</td>
<td>9.1 kg</td>
<td>Glass, tempered, white</td>
<td>B95061083</td>
<td></td>
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<tr>
<td></td>
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<td></td>
<td>Glass, tempered, gray</td>
<td>B95061084</td>
<td></td>
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</tbody>
</table>

1) In the offer phase the Art. No. may differ

Scope of delivery: display unit, flush-mounting enclosure incl. mounting plate with electronics, CP9xx connecting cable and plug connector kit.

#### Components separately

<table>
<thead>
<tr>
<th>Device series</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP907</td>
<td>Flush-mounting enclosure</td>
<td>B95100140</td>
</tr>
<tr>
<td></td>
<td>Display unit white</td>
<td>B95061090</td>
</tr>
<tr>
<td>CP915</td>
<td>Display unit gray</td>
<td>B95061110</td>
</tr>
<tr>
<td></td>
<td>Flush-mounting enclosure incl.</td>
<td>B95061092</td>
</tr>
<tr>
<td></td>
<td>mounting plate with electronics</td>
<td></td>
</tr>
<tr>
<td>CP924</td>
<td>Display unit white</td>
<td>B95061097</td>
</tr>
<tr>
<td></td>
<td>Display unit gray</td>
<td>B95061111</td>
</tr>
<tr>
<td></td>
<td>Flush-mounting enclosure incl.</td>
<td>B95061099</td>
</tr>
<tr>
<td></td>
<td>mounting plate with electronics</td>
<td></td>
</tr>
</tbody>
</table>

#### Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP9xx replacement plug connector kit</td>
<td>B95061910</td>
</tr>
<tr>
<td>CP9xx suction lifter</td>
<td>B95061911</td>
</tr>
</tbody>
</table>

1) The suction lifter is needed to remove the display.

1) In the offer phase the Art. No. may differ
**Technical data**

### Insulation coordination CP907 acc. to IEC 60664-1
- **Rated voltage**: 50 V
- **Insulation coordination**: CP907 acc. to IEC 60664-1
- **Overvoltage category**: III
- **Pollution degree**: 2
- **Rated insulation voltage**: AC 250 V
- **Insulation coordination**: CP915 acc. to IEC 60664-1
- **Pollution degree**: 2

### Supply CP907 via plug in terminal (A1+/A2/-)
- **Nominal voltage**: CP907 DC 24 V SELV/PELV
- **Nominal voltage tolerance**: ±20 %
- **Typical power consumption at DC 24 V**: < 15 W
- **Connection**: plug-in terminal (A1+/A2/-)
- **Maximum cable length when supplied via B95058120 (DC 24 V power supply unit 1.75 A)**:
  - 0.28 mm²: 75 m
  - 0.5 mm²: 130 m
  - 0.75 mm²: 200 m
  - 1.5 mm²: 400 m
  - 2.5 mm²: 650 m

### Supply via PoE
- **Nominal voltage**: DC 48 V SELV/PELV
- **Nominal voltage tolerance**: -25...±15 %
- **Typical power consumption for PoE**: < 15 W
- **Maximum cable length when supplied via AWG 26/7; 0.14 mm²**: 100 m

### Supply CP915/CP924 via terminal block (L1; N)
- **Nominal voltage**: CP915 via external power supply unit AC 100...240 V
- **Nominal voltage tolerance**: -15...±10 %
- **Frequency range**: 50...60 Hz
- **Typical power consumption at AC 230 V**: < 30 W (CP915) / < 55 W (CP924)
- **Connection**: terminal block (L1; N)

### Stored energy time in the event of voltage failure
- **Time, date**: min. 3 days
- **Restart after voltage interruption**: min. 15 seconds

### Displays, Memory
- **Display CP907**: 7” TFT touch display
- **Display CP915**: 15.6” TFT touch display
- **Display CP924**: 24” TFT touch display
- **E-mail configuration and device failure monitoring**: max. 250 entries
- **Individual texts**: 1200 texts with 100 characters each
- **Displayable devices**: 247
- **Number of data points for “third-party devices” to Modbus TCP and Modbus RTU**: 50
- **Number of data loggers**: 30
- **Number of data points per data logger**: 10,000
- **Number of entries in the history memory**: 1,000

### Visualisation
- **Number of pages**: 20
- **Background image size**: max. 3 MB/image; max. 50 MB total memory

### Interfaces
- **Ethernet**
  - **Connection**: RJ45
  - **Data rate**: 10/100 Mbit/s, autodetect
  - **DHCP**: on/off (off)
  - **IP address**: nnn.nnn.nnn.nnn (192.168.0.254)*, can always be reached via: 169.254.0.1
  - **Net mask**: nnn.nnn.nnn.nnn (255.255.0.0)*
  - **Protocols (depending on function module selected)**: TCP/IP, Modbus RTU, DHCP, SMTP, NTP
- **B.COM**
  - **Interface/protocol**: Ethernet/B.COM
  - **B.COM system name**: (SYSTEM)*
  - **B.COM subsystem address**: 1...255 (1)*
  - **B.COM device address**: 1...255 (1)*

### Other project-specific versions with foil surface or with additional internal components available on request:
- Charging tray for operating theatre table remote controls
- Intercom systems
- Operating theatre light controls
- Programmable backlight keypads
- Digital/Analogue inputs/outputs for installation in panel enclosures or control cabinets
- Data coupling to third-party systems
- Project-specific built-in enclosures
- Integration of third-party systems
- Antibacterial or highly transparent foil
- Exchange of existing control panels (Retrofit) etc.

### System components | Communication systems | Alarm indicator and operator panel

**Alarm indicator and operator panel COMTRAXX® CP9xx**

**USB**
- **Number**: 2
- **Operating mode**: USB-2.0-Host (5 V, 500 mA)
- **Data rate**: 480 Mbit/s
- **Connection type**: USB 2 Standard-A

**Modbus TCP**
- **Interface/protocol**: Ethernet/Modbus TCP
- **Operating mode**: Client for PEM and “third-party devices” assigned
- **Operating mode**: Server for access to process image and for Modbus control commands

**SNMP**
- **Versions**: 1, 2c, 3
- **Devices supported**: Queries to all devices (channels) possible (no trap functionality)

**BMS bus**
- **Interface/protocol**: RS-485/MBUS internal
- **Operating mode**: master/slave (master)*
- **Baud rate**: 9.6 kbit/s
- **Cable length**: < 1200 m
- **Connection**: “ABMS”, “BBMS” (see plug-in terminal)
- **Terminating resistor**: 120 Ω (0.25 W), can be switched on internally (see plug-in terminal)
- **Device address**: 1...99 (1)*

**Modbus RTU**
- **Interface/protocol**: RS-485/Modbus RTU
- **Operating mode**: master
- **Baud rate**: 9.6 to 9.6 kbit/s
- **Cable length**: < 1200 m
- **Connection**: “AMB”, “BBM” (see plug-in terminal)
- **Terminating resistor**: 120 Ω (0.25 W), can be switched on internally (see plug-in terminal)
- **Supported Modbus RTU slave addresses**: 2...247

**Digital inputs (1-12)**
- **Number**: 12
- **Galinian separation**: yes
- **Operation mode**: selectable for each input: active-high or active-low
- **Factory setting**: active-high
- **Voltage range (high)**: AC/DC 24 V
- **Voltage range (low)**: AC/DC 0...2 V
- **Connection**: plug-in terminal: (1;2;3;4;5;6;7;8;9;10;11;12)
- **Maximum cable length**: < 1200 m

**Switching elements**
- **Operating mode**: N/C operation / N/O operation
- **Function**: programmable
- **Electrical endurance under rated operating conditions, number of cycles**: 10,000

**Contact data acc. to IEC 60947-5-1:**
- **Utilisation category**: AC-13 AC-14 DC-12
- **Rated operational voltage**: 24 V
- **Rated operational current**: 2 A
- **Minimum contact rating**: 1 mA at AC/DC > 30 V
- **Connection**: plug-in terminal: (11;12;14)

**Buzzer**
- **Buzzer message**: can be acknowledged, adoption of characteristics of new value
- **Buzzer frequency**: configurable
- **Buzzer repletion**: configurable

**Audio (for CP015 and CP924 only)**
- **Line IN**: STEREO signal input via 3.5 mm jack plug
- **Line OUT**: Output to a STEREO playback device via 3.5 mm jack plug
### Technical data (continued)

#### Device connections

**Terminal block (L; N; PE) (for CP015 and CP924 only)**
- Conductor sizes: AWG 20-12
- Stripping length: 10…11 mm
- Flexible with ferrule with/without plastic sleeve: 0.5…4 mm²
- Multiple conductor, flexible with TWIN ferrule with plastic sleeve: 0.5…4 mm²

**Plug-in terminal (A1/1…A2/2) (11;12;14)**
- Conductor sizes: AWG 24-12
- Stripping length: 10 mm
- Flexible with ferrule with/without plastic sleeve: 0.25…2.5 mm²
- Multiple conductor, flexible with TWIN ferrule with plastic sleeve: 0.5…1.5 mm²

**Plug-in terminal (11;12;13…112;112) (AMB;BMB;SMB;ABMS;BBMS;SBMS)**
- Conductor sizes: AWG 24-16
- Stripping length: 10 mm
- Flexible with ferrule with/without plastic sleeve: 0.25…1.5 mm²
- Flexible with ferrule with plastic sleeve: 0.25…0.75 mm²

**For UL-applications (only CP907)**
- Use copper conductors only.
- Minimum temperature rating of the cable to be connected to the field wiring terminals: 75 °C
- Minimum temperature rating of the cable to be connected to the PoE-Connector: 80 °C

#### Environment/EMC

**EMC**
- IEC 61326-1

**Operating temperature CP907**
- -10…+55 °C

**Operating temperature CP907 for UL-applications**
- -10…+50 °C

**Operating temperature CP915 and CP924**
- -5…+40 °C

**Range of use**
- ≤ 2000 m AMSL

**Humidity**
- ≤ 98%

**Classification of climatic conditions acc. to IEC 60721:**
- Stationary use (IEC 60721-3-3) 3K23 (except condensation and formation of ice)
- 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) CP907 3M11
- Stationary use (IEC 60721-3-3) CP915 and CP924 3M10
- Transport (IEC 60721-3-2) 2M4
- Long-term storage (IEC 60721-3-1) 1M12

#### Other

**Operating mode**
- Continuous operation

**Mounting**
- Display-oriented

**Degree of protection, front**
- IP54

**Degree of protection, enclosure**
- IP20

**Flammability class**
- UL 94V-0

**Dimensions**

<table>
<thead>
<tr>
<th>Type</th>
<th>Dimensions (mm)</th>
<th>Required installation depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP907</td>
<td>a: 226 b: 144 c: 176 (”)</td>
<td>a: 212 b: 124</td>
</tr>
<tr>
<td>CP915</td>
<td>a: 505 b: 350 c: 386 (15,6”)</td>
<td>a: 461 b: 306</td>
</tr>
<tr>
<td>CP924</td>
<td>a: 654 b: 441 c: 545 (24”)</td>
<td>a: 610 b: 398</td>
</tr>
</tbody>
</table>

**Weight**
- CP907: approx. 1.1 kg
- CP915: approx. 6.1 kg
- CP924: approx. 9.1 kg

### Dimensions

#### External dimensions

**Installation dimensions – panel cut-out**

<table>
<thead>
<tr>
<th>Type</th>
<th>Dimensions (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP907</td>
<td>a: 226 b: 144 c: 176 (”)</td>
</tr>
<tr>
<td>CP915</td>
<td>a: 505 b: 350 c: 386 (15,6”)</td>
</tr>
<tr>
<td>CP924</td>
<td>a: 654 b: 441 c: 545 (24”)</td>
</tr>
</tbody>
</table>

**Glass thickness 3 mm**
COMTRAXX® MK2430

Alarm indicator and test combination with LCD

Device features

- Display of operating status, warning and alarm messages in accordance with DIN VDE 0100-710, IEC 60364-7-710 and other standards
- Backlit clear LC text display (4 x 20 characters)
- Predefined standard texts in 20 languages
- 200 freely programmable message texts
- Bus technology for easy installation and reduced fire load
- Acoustic alarm with mute function
- Parameter setting via menu (German/English)
- Suitable for flush and surface mounting
- Easy commissioning due to predefined message texts
- MK2418 can easily be exchanged for MK2430/MK2007

Typical applications

- Visual and acoustic signalling of operating status and alarm messages
- Display of measured values and setting of limit values for monitoring purposes from BMS-capable Bender monitoring systems

Standards

The MK2430 alarm indicator and test combination meets the requirements for installation:

- DIN VDE 0100-710 (VDE 0100 Part 710)
- IEC 60364-7-710

Further information

For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Endorsement</th>
<th>Enclosure included in the scope of delivery</th>
<th>Digital inputs/relay output</th>
<th>factory-programmed</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flush-mounting</td>
<td>-</td>
<td>12/1</td>
<td>-</td>
<td>MK2430-11</td>
<td>B95100001</td>
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<tr>
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<td>-</td>
<td>MK2430C-11</td>
<td>B95100003C</td>
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<td>-</td>
<td>MK2430-12</td>
<td>B95100002</td>
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<td></td>
<td>-</td>
<td>MK2430C-12</td>
<td>B95100004C</td>
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<tr>
<td>Flush-mounting, horizontal mounting</td>
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<td>-</td>
<td>MK2430H-12</td>
<td>B95100024</td>
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<td>MK2430CA-11</td>
<td>B95100007C</td>
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<tr>
<td>Surface-mounting</td>
<td>-</td>
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<td>MK2430A-12</td>
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<td>-</td>
<td>MK2430CA-12</td>
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Accessories

<table>
<thead>
<tr>
<th>Type designation</th>
<th>Art. No.</th>
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</thead>
<tbody>
<tr>
<td>Parameterisation software TMK-SET</td>
<td>as Internet download</td>
</tr>
<tr>
<td>MK2430-mounting kit, complete</td>
<td>B95101000</td>
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<tr>
<td>Flush-mounting enclosure</td>
<td>B923710</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply unit</td>
<td>AN410</td>
<td>B924209</td>
<td>393</td>
</tr>
<tr>
<td></td>
<td>AN450</td>
<td>B924201</td>
<td>395</td>
</tr>
</tbody>
</table>
## Technical data

### Insulation coordination acc. to IEC 60664-1

- Rated insulation voltage: AC 250 V
- Rated impulse withstand voltage/pollution degree: 4 kV

### Supply voltage

- Supply voltage: AC/DC 24 V
- Frequency range: 0/40...60 Hz
- Operating range: AC 18...28/DC 18...30 V
- Power consumption: ≤ 3 VA
- Voltage failure without reset: ≤ 15 s

### Displays and LEDs

- Display: characters, four lines, 4 x 20 characters
- Standard message texts: in 20 languages
- Alarm addresses: configurable
- Programmable text messages: 200
- History memory (messages): 250
- Standard text message: 3 x 20 characters
- Additional text message (press button to access): 3 x 20 characters
- Alarm LEDs (three different colours): NORMAL (green), WARNING (yellow), ALARM (red)
- Menu texts: German/English

### Buzzer

- Buzzer message: can be acknowledged, adoption of characteristics of new value
- Buzzer interval: configurable
- Buzzer frequency: configurable
- Buzzer repetition: configurable

### Inputs (MK2430...-11 only)

- Digital inputs: 12 (IN1...IN12)
- Galvanic separation: yes
- Activation of the digital inputs: via potential-free contacts/extraneous voltage
- Operating principle: N/O or N/C operation individually selectable for each input
- Factory setting: N/O operation
- Voltage range (high): AC/DC 10...30 V
- Voltage range (low): AC/DC 0...2 V
- Recommended cable: J-Y(St)Y min. 2 x 0.8

### Interfaces

- Interfaces: RS-485 and USB (V2.0/V1.1)

### Technical data for the RS-485 interface:

- Protocol: BMS
- Baud rate: 9.6 kbit/s
- Cable length: ≤ 1200 m
- Cable (twisted in pairs, one end of shield connected to PE): recommended: J-Y(St)Y min. 2 x 0.8
- Terminating resistor: 120 Ω (0.25 W) connectable via DIP switch
- Device address, BMS bus: 1...150
- Factory setting device address: 1 (master)

### Programming

- Interfaces: RS-485 or USB (V2.0/V1.1), USB cable: Type A plug on type B plug
- Software: TMK-SET V 4.0 or higher
- Factory setting password: activated

### Max. cable length in case of power supply of 1/2/3 MK24... from one AN410

<table>
<thead>
<tr>
<th>Cable size (mm²)</th>
<th>Max. cable length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5 mm²</td>
<td>1300/560/20 m</td>
</tr>
<tr>
<td>1.5 mm²</td>
<td>800/210/10 m</td>
</tr>
<tr>
<td>0.75 mm²</td>
<td>400/100/– m</td>
</tr>
<tr>
<td>0.5 mm²</td>
<td>250/70/– m</td>
</tr>
<tr>
<td>0.28 mm²</td>
<td>160/40/– m</td>
</tr>
</tbody>
</table>

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</tr>
<tr>
<td>2.5 mm²</td>
<td>1300/560/20 m</td>
</tr>
</tbody>
</table>

### Contact details acc. to IEC 60947-5-1

- Rated operational voltage: 24 V
- Rated operational current: 5 A
- Minimum contact rating: 1 mA at AC/DC > 10 V

### Environment/EMC

- EMC immunity: DIN EN 61000-6-2
- EMC emission: DIN EN 61000-6-3
- Operating temperature: -5...+55 °C

### Classification of climatic conditions acc. to IEC 60721:

- Stationary use: 3K23
- Transport: 2K11
- Long-term storage: 1K22

### Classification of mechanical conditions acc. to IEC 60721:

- Stationary use: 3M11
- Transport: 2M8
- Long-term storage: 1M12

### Connection

- Connection: pluggable screw terminals

### Connection properties (supply voltage, BMS bus):

- Connection of single conductors:
  - rigid/flexible/conductor sizes:
    - 0.2...2.5/0.2...2.5 mm² (AWG 24...12)
    - 0.25...2.5/0.25...2.5 mm²
  - Multi-conductor connection (2 conductors of the same cross section):
    - rigid/flexible: 0.2...1/0.2...1 mm²
    - flexible with TWIN ferrules with plastic sleeve: 0.5...1.5 mm²
    - flexible with TWIN ferrules with plastic sleeve: 0.5...1.5 mm²

- Connection properties (inputs):
  - Connection of single conductors:
    - rigid/flexible/conductor sizes:
      - 0.08...1.5/0.08...1.5 mm² (AWG 28...16)
      - 0.25...1.5/0.25...1.5 mm²
    - Multi-conductor connection (2 conductors of the same cross section):
      - rigid/flexible: 0.08...0.8/0.08...0.8 mm²
      - flexible with TWIN ferrules without plastic sleeve: 0.25...0.34 mm²
      - flexible with TWIN ferrules with plastic sleeve: 0.5 mm²

### Other

- Operating mode: continuous operation
- Mounting: display-oriented
- Degree of protection (DIN EN 60529):
  - IP50 (surface-mounting type: IP54)
  - IP20
- Flammability class: UL94-V0
- Documentation number: D00129
- Weight: flush mounting ≤ 210 g, surface mounting ≤ 400 g

### System components

- Communication systems
- Alarm indicator and test combination

### Alarm indicator and test combination COMTRAXX® MK2430

- Front plate: RAL 7035 (light grey)
- Front foil: RAL 7035 (light grey); RAL 7040 (basalt grey)
- Colours:
  - RAL 5005 (ultramarine blue)
  - RAL 7015 (light grey)
1. Terminating resistor BMS bus (120 Ω)
2. Connection BMS bus
3. Power supply unit incorporated in the MEDICS® module, sufficient for supplying power to maximum three MK2430
4. Cable between MEDICS® module and MK2430
   When the MK2430 is supplied by the AN410 or AN450 power supply unit in the MEDICS® modules, the permissible cable lengths and cable cross sections have to be considered.
5. Digital inputs
   The digital inputs may be controlled either via potential-free contacts or via voltage signals. If you are using potential-free contacts, the voltage can be drawn from the AN410 or AN450 (3). When the inputs are activated via an external voltage, the common 0(-) is connected to terminal 0 and the 1(+)-signal is connected to the respective input IN1…IN12. In this case, the connections between the terminals 0 and V2 and the common connections and U2 are not required.
6. USB connection for programming purposes
Visualisation

Device features

- Graphical representation on a screen showing the design and status of Bender systems, e.g. in the form of an outline view or a circuit diagram
- Localising and identifying faults easier and faster
- Display of operating messages, alarm messages and currently measured values
- Displaying and analysing historical data
- Viewing and operating from remote computers
- Display and operation via the gateway COM465IP option D by means of a browser and a personal computer in the network.
- Individually programmed visualisation on a touch panel PC or a PC

Our service range:

Bender offers you the following solution package:
- Bender gateway to connect your Bender system to a computer
- Touch panel computer and/or computer with monitor for displaying the visualisation solution
- Customer-specific programming of the visualisation solution using a high-performance software
- On-site setting and testing of the visualisation

Your advantages:

- Continuous overview of the system at any place
- Faults can be detected easily and hence remedied faster
- Correlations can be recognised and faults can be avoided in the future

Further information

For further information refer to our product range on www.bender.de.
PowerScout®
Recognising connections – optimising maintenance

Device features
- Transmission of measured values every minute
- Resolution of the data as a function of the velocity of the bus system
- 16 visible dashboards
- 256 public dashboards
- Commissioning wizards
  - Residual current
  - Stray currents
  - Neutral conductor
  - Central earthing point
- Dashboard management
- Tree views management
- Report management
- Automated sending of reports
- Integration via CP9xx(-I), COM465IP and COM465DP
- Integration of third-party devices
- A web-based application for all types of devices
- Languages
  - English
  - German
- User management
- Supported browsers
  - Chrome
  - Firefox
  - Internet Explorer

Typical applications
- Commissioning wizards
  The wizards support the user in generating dashboards and reports. With just a few steps, meaningful dashboards related to a specific subject of electrical safety can be generated.
- Residual current
  The commissioning wizard supports you in creating a dashboard that allows evaluating the level of the residual current at a glance. The ratio of residual current and load current is calculated.
- Stray currents
  The wizard for stray currents indicates the system parts where excessive stray currents exist.
- Central earthing point
  The central earthing point wizard generates a meaningful visualisation for the user by querying the current at the CEP and the corresponding phase current.
- Neutral conductor
  The excessive load on the neutral conductor challenges many system operators. The commissioning wizard evaluates the neutral currents and indicates whether they are too high.

Further information
For further information refer to our product range on www.bender.de.
## Overview price model

<table>
<thead>
<tr>
<th>Model</th>
<th>Collectors (gateways)</th>
<th>User</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hosted</td>
<td>up to 2</td>
<td>10</td>
<td>POWERSCOUT 2</td>
<td>B95061500</td>
</tr>
<tr>
<td></td>
<td>up to 5</td>
<td>20</td>
<td>POWERSCOUT 5</td>
<td>B95061501</td>
</tr>
<tr>
<td></td>
<td>up to 10</td>
<td>40</td>
<td>POWERSCOUT 10</td>
<td>B95061502</td>
</tr>
<tr>
<td></td>
<td>&gt; 10</td>
<td>&gt; 40</td>
<td>POWERSCOUT project</td>
<td>B95061503</td>
</tr>
</tbody>
</table>

If you choose the Hosted model, we will operate POWERSCOUT for you in a German data centre. We take care of updates and maintenance for you.

## System architecture
Insulation monitoring devices
ISOMETER®

Equipment for insulation fault location
ISOSCAN®

Residual current monitoring systems
LINETRAXX®

Neutral Grounding Resistor Monitor (NGR)
LINETRAXX®

Charge Controller

Power Quality and Energy Measurement
LINETRAXX®

Measuring and monitoring relays
LINETRAXX®

System components
- Coupling devices
- Power supply units
- COMTRAXX® Gateways
- Interface converters
- COMTRAXX® Alarm indicator and test combinations
- Interface repeaters
- COMTRAXX® condition monitors
- Visualisation

Switching equipment
ATICS® transfer switching and monitoring devices

Test systems
UNIMET® Safety analyser

Annex
- Technical terms
- Alphabetical list of devices
- Service
### ATICS®, the worldwide safest and most compact all-in-one changeover and monitoring device for safety-relevant and medical locations

<table>
<thead>
<tr>
<th><strong>Safe</strong></th>
<th><strong>Easy-to-use</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Functional safety SIL2 according to IEC 61508</strong></td>
<td><strong>Easy to operate and perfect overview</strong> due to clear menu structure and user guidance</td>
</tr>
<tr>
<td>guarantees protection against malfunction hazards</td>
<td><strong>Correct information at the correct time</strong> due to clear messages via an illuminated graphic display and via bus</td>
</tr>
<tr>
<td><strong>Continuous self monitoring</strong> of electronic system and circuit paths with automatic notification</td>
<td><strong>Safe manual changeover during service</strong> due to integrated manual/automatic mode with mechanical restart interlock</td>
</tr>
<tr>
<td><strong>Preventive safety</strong> by automatic reminders for prescribed tests</td>
<td><strong>Complete documentation of events</strong></td>
</tr>
<tr>
<td><strong>Maximum reliability during changeover</strong></td>
<td>- Changeover procedures</td>
</tr>
<tr>
<td>- Patented changeover system with mechanical and electrical interlock</td>
<td>- Testing</td>
</tr>
<tr>
<td>- Weld-free switching contacts with circuit breaker mechanism</td>
<td>- Parameter changes</td>
</tr>
<tr>
<td>- Insensitive to voltage fluctuations or shocks, for example, due to stable operating position and constant contact pressure</td>
<td><strong>External functional test or replacement without service interruption</strong> by optional bypass switch</td>
</tr>
<tr>
<td>- Monitoring for short circuits</td>
<td><strong>Compact</strong></td>
</tr>
<tr>
<td><strong>Compact design</strong> of electronic system and switching elements in one enclosure</td>
<td><strong>Efficient</strong></td>
</tr>
<tr>
<td><strong>Changeover, IT system monitoring and locating current injector</strong> in one device</td>
<td><strong>Small space required</strong></td>
</tr>
<tr>
<td><strong>Simple wiring</strong> due to integrated design</td>
<td><strong>Tests according to the regulations without interruption of the power supply</strong></td>
</tr>
<tr>
<td><strong>Completely pluggable</strong></td>
<td><strong>Easy integration into existing installations</strong></td>
</tr>
</tbody>
</table>
# Device overview ATICS® switchover and monitoring devices

<table>
<thead>
<tr>
<th>Catalogue page</th>
<th>432</th>
<th>436</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Application</strong></td>
<td>Unearthed safety power supplies</td>
<td>Safety power supplies</td>
</tr>
<tr>
<td><strong>Rated insulation voltage</strong></td>
<td>2-pole: 250 V</td>
<td>2-pole: 250 V</td>
</tr>
<tr>
<td></td>
<td>4-pole: 400 V</td>
<td>4-pole: 400 V</td>
</tr>
<tr>
<td><strong>Nominal system voltage $U_{\text{n}}$</strong></td>
<td>AC 230 V (AC 160…276 V)</td>
<td>2-pole: AC 230 V</td>
</tr>
<tr>
<td></td>
<td>4-pole: 3N AC 400/230 V</td>
<td>4-pole: 3N AC 400/230 V</td>
</tr>
<tr>
<td><strong>Frequency range</strong></td>
<td>48…62 Hz</td>
<td>48…62 Hz</td>
</tr>
<tr>
<td><strong>Insulation monitoring Measuring range</strong></td>
<td>10 kΩ…1 MΩ</td>
<td>–</td>
</tr>
<tr>
<td><strong>Insulation monitoring Response value $R_{\text{an}}$</strong></td>
<td>50…500 kΩ</td>
<td>–</td>
</tr>
<tr>
<td><strong>Digital inputs/relays</strong></td>
<td>1/1</td>
<td>4/4</td>
</tr>
<tr>
<td><strong>Interface/protocol</strong></td>
<td>RS-485/BMS</td>
<td>RS-485/BMS</td>
</tr>
<tr>
<td><strong>Pluggable screw terminals</strong></td>
<td>–</td>
<td>(up to 125 A)</td>
</tr>
<tr>
<td><strong>Screw terminals</strong></td>
<td>–</td>
<td>(160 A)</td>
</tr>
<tr>
<td><strong>DIN rail</strong></td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>Screw mounting</strong></td>
<td>4 x M5</td>
<td>6 x M5</td>
</tr>
</tbody>
</table>

Product details (Products on www.bender.de/en)
ATICS®-…-ISO
Automatic transfer switching devices with monitoring function for unearthed safety power supplies

Device features

Perfectly suitable for space-saving installation/retrofitting
- Compact device for easy setup of safety power supplies with functional safety in accordance with DIN EN 61508 (SIL 2) e.g. for group 2 medical locations in compliance with DIN VDE 0100-710 (VDE 0100-710)/IEC 60364-7-710
- Increased safety and availability by integrating changeover and IT system monitoring in one compact device
- All-in-one: Integration of switch disconnector, control and monitoring electronics for unearthed safety power supplies
- Solutions for any application

Safe operation
- Robust switch disconnector contacts
- Mechanical locking
- Manual operation directly on the device
- Functional safety SIL 2
- Certification by TÜV SÜD in accordance with EN 61508 (VDE 0803) SIL 2 and DIN VDE 0100-710 (VDE 0100-710)

Uninterrupted maintenance
- Plug connectors and optional bypass switch
- Excellent communication and parameterisation options

Standards
The transfer switching device conforms to the following standards:
- DIN VDE 0100-710 (VDE 0100-710)*
- DIN VDE 0100-718 (VDE 0100-718)
- ÖVE/ÖNORM E 8007
- IEC 60364-7-710*
- DIN EN 61508-1 (VDE 0803)-1*
- IEC 61508-1 (2010-04) Ed. 2.0*
- DIN EN 61508-2 (VDE 0803)-2*
- IEC 61508-2 (2010-04) Ed. 2.0*
- DIN EN 61508-3 (VDE 0803)-3*
- IEC 61508-3 (2010-04) Ed. 2.0*
- DIN EN 60947-6-1 (VDE 0660-114)
- IEC 60947-6-1 (2013-12) Ed. 2.1
- DIN EN 61557-8 (VDE 0413-8)

Standard-compliant isolating transformer monitoring according to:
- DIN EN 61558-1 (VDE 0570-1)
- DIN EN 61558-1/A1 (VDE 0570-1/A1)

The standards marked with * were part of the test conducted by TÜV Süd.

Further information
For further information refer to our product range on www.bender.de.

Typical applications
- Design of safety power supplies in group 2 medical locations, e.g.
  - intensive care unit
  - operating theatres
- Retrofit

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Rated operational voltage $U_e$</th>
<th>Nominal system voltage $U_n$</th>
<th>Rated operational current $I_e$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>AC</td>
<td>AC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>230 V</td>
<td></td>
<td>63 A</td>
<td>ATICS-2-63A-ISO</td>
<td>B92057202</td>
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<tr>
<td>230 V</td>
<td></td>
<td>80 A</td>
<td>ATICS-2-80A-ISO</td>
<td>B92057203</td>
</tr>
<tr>
<td>400 V</td>
<td></td>
<td>63 A</td>
<td>ATICS-2-63A-ISO-400</td>
<td>B92057204</td>
</tr>
<tr>
<td>230 V</td>
<td></td>
<td>80 A</td>
<td>ATICS-2-80A-ISO-400</td>
<td>B92057205</td>
</tr>
<tr>
<td>230 V</td>
<td></td>
<td>63 A</td>
<td>ATICS-2-63A-ISO-ES</td>
<td>B92057206</td>
</tr>
<tr>
<td>230 V</td>
<td></td>
<td>80 A</td>
<td>ATICS-2-80A-ISO-ES</td>
<td>B92057207</td>
</tr>
</tbody>
</table>
### Technical data

#### Insulation coordination acc. to IEC 60664-1/IEC 60664-3
- **Overvoltage category**: III
- **Pollution degree outside, inside**: 2
- **Rated insulation voltage**: 250 V
- **Protective separation between**: line 1, 2, 3 – digital inputs; line 1, 2, 3 – relay outputs
- **Voltage test according to IEC 61010-1 (basic insulation/protective separation)**: 2.21 kV/3.54 kV

#### Supply voltage
- **Rated operational voltage** $U_n$: 50…60 Hz, 230 V

#### Voltage monitoring/changeover
- **Frequency range $f_n$**: 48…62 Hz
- **Crest factor**: ≤ 1.2
- **Number of switching cycles (mechanical)**: > 8000
- **Voltage monitoring/changeover**: refer to the manual, table "Utilisation category acc. to DIN EN 60947"

#### Current monitoring (output current)
- **Measuring range $I_n$ (TRMS)**: STW2, STW3, SWL-100 A
- **Measuring range IL (TRMS)**: STW3: 0…150 A, STW4: 0…250 A
- **Operation uncertainty**: ≤ 1 %

#### IT system monitoring
- **Nominal system voltage (operating range)**: 80…275 V
- **Measuring range**: 10 kΩ…2 MΩ
- **Relative uncertainty**: ±5 %

#### Load current monitoring (IT system transformer)
- **Measuring current transformers**: STW2, STW3, SWL-100 A
- **Measuring range IL (TRMS)**: 10…110 % of the response value
- **Crest factor**: ≤ 2
- **Release value**: 1.6 kΩ
- **Response time CT connection monitoring**: ≤ 2 s
- **Response time for loss of earth connection as well as loss of network connection**: 1…10 s
- **Automatic self test**: every hour

#### Temperature monitoring (IT system transformer)
- **Response value**: 4 kΩ
- **Relative uncertainty**: ±10 %
- **Release value**: 1.6 kΩ
- **Response time (temperature or open-circuit temperature sensor)**: ≤ 2 s
- **PTC resistors acc. to DIN 44081**: max. 6 in series

#### Insulation fault location
- **Current $I_n$**: < 1 mA
- **Test cycle/pause**: 2/4 s

### Accessories

#### Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bypass switch kit</td>
<td>ATICS®-BP-2-63A-SET</td>
<td>B92057252</td>
<td>159</td>
</tr>
<tr>
<td>ATICS®-BP-2-80A-SET</td>
<td>B92057253</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy storage for ATICS®</td>
<td>ATICS-ES*</td>
<td>B92057255</td>
<td></td>
</tr>
</tbody>
</table>

*ATICS-ES may only be used in combination with the following ATICS® transfer switching devices: B92057206, B92057207.*
Technical data (continued)

**Input**
- Digital inputs: 1
- Galvanic separation: yes
- Control: via potential-free contacts
- Mode of operation: active at 0 V (low) or 24 V (high), adjustable
- Voltage range high/low: AC/DC 10…30 V/AC/DC 0…6.5 V
- Adjustable function: switching back interlocking function, manual/automatic mode, bypass operation, function test, changeover of the preferred line, alarm input for operating theatre lights, alarm input for other devices

**Output**
- Switching element: 1 potential-free changeover contact
- Mode of operation: adjustable
- Adjustable function: refer to the manual, settings menu 5: “Relay”
- Electrical endurance under rated operating conditions, number of cycles: 10 000

**Contact data according to IEC 61810**
- Rated operational current AC (resistive load, cos φ=1): 5 A/AC 250 V
- Rated operational current DC: 5 A/DC 30 V
- Overvoltage category: III
- Minimum contact rating: 10 mA at DC > 5 V

**BMS interface**
- Interface/protocol: RS-485/BMS
- Baud rate: 9.6 kbit/s
- Cable length: ≤ 1200 m
- Cable (twisted pairs, shielded, shield connected to PE on one side) recommended: 1-Y(St)Y min. n x 2 x 0.8
- Terminating resistor: 120 Ω (0.25 W)
- Device address, BMS bus: 2…90

**Environment/EMC**
- EMC: EN 61326 (see CE declaration)
- Classification of climatic conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3K23 (except condensation and formation of ice)
  - Transport (IEC 60721-3-2): 2K11
  - Long-term storage (IEC 60721-3-1): 1K22
  - Operating temperature: -25…+55 °C
- Classification of mechanical conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3MT1
  - Transport (IEC 60721-3-2): 2M4
  - Long-term storage (IEC 60721-3-1): 1M12

**Terminals**
- Power section
  - Connection directly on ATICS®, for plug connections: screw-type terminals
  - Rigid (flexible)/conductor sizes: 10…70 mm² (6…50 mm²)/8 (10)…0 AWG
  - Stripping length: 15 mm
  - Tightening torque (hexagon socket 4 mm): 5 Nm
  - Connection type: pluggable screw-type terminals
  - Conductor cross section, rigid min/max: 1.5/35 mm²
  - Conductor cross section, flexible min/max: 1.5 mm²/25 mm²
  - Conductor cross section AWG/min/max: 20/2
- Stripping length (do not use ferrules): 20 mm
- Tightening torque (Torx® screwdriver T20 or slotted screwdriver 6.5 x 1.2 mm):
  - 2.5 Nm (≤ 25 mm²)
  - 4.5 Nm (> 25 mm²)
- Torque setting for manual operation (Allen 5 mm):
  - approx. 6 Nm

**Electronics**
- Connection: screw-type terminals
- Rigid/flexible/conductor sizes: 0.14…1.5 mm²/28…16 AWG
- Stripping length: 7 mm
- Tightening torque (slotted screws, screwdriver 2.5 x 0.4 mm):
  - 0.22…0.25 Nm

**Other**
- Operating mode: continuous operation
- Mounting: display-oriented
- Operating altitude up to a maximum of: 2000 m AMSL
- Protection class:
  - IP40
  - Flammability class: UL94V-0
- DIN rail mounting: acc. to IEC 60715
- Screw mounting: 4 x MS
- Dimensions incl. terminals (W x H x D): 234 x 270 x 73
- Documentation number: D00046
- Weight: approx. 3400 g

**Dimension diagram (dimensions in mm)**
### Application example operating theatre

- **ATICS®-2-63A-ISO**: Changeover between the preferred and the redundant line while monitoring the medical IT system with transformer load and temperature monitoring.
- **IR426-D47**: Monitoring of the operating theatre light IT system (optional).
- **MK2430/CP9xx**: Alarm at at least two points with independent power supplies for functional safety.
- **ATIC®-ES**: Energy storage (B92057206, B92057207 only).

### Example intensive care unit

- **ATICS®-2-63A-ISO**: Changeover between the preferred and the redundant line while monitoring the medical IT system with transformer load and temperature monitoring.
- **EDS151**: Insulation fault locator or fast insulation fault localisation (recommended).
- **ATIC®-BP**: Bypass switch for uninterrupted test/maintenance (recommended).
- **MK**: Alarm at at least two points with independent power supplies for functional safety.
- **ATIC®-ES**: Energy storage (B92057206, B92057207 only).
Device features

Perfectly suitable for space-saving installation/retrofitting
• Compact device for designing safety power supplies with functional safety more easily, in accordance with DIN VDE 61508 (SIL 2), in computing centres, industry, or in group 2 medical locations in accordance with DIN VDE 0100-710 (VDE 0100-710)/IEC 60364-7-710
• All-in-one: Integration of switch disconnector and control electronics
• Compact design
• Solutions for any application

Typical applications
• Design of safety power supplies, e.g. for
  – main distribution boards
  – computing centres
  – industry
• Retrofit

Convenient installation and commissioning
• Saves time and money

Safe operation
• Switch disconnector contacts of robust design
• Mechanical locking
• Manual operation directly on the device
• Functional safety SIL 2
• Certification by TÜV SÜD

Uninterrupted maintenance
• Plug connectors and optional bypass switch
• Excellent communication and parameterisation options

Standards
The transfer switching device conforms to the following standards:
• DIN VDE 0100-710 (VDE 0100 Part 710)*
• DIN VDE 0100-718 (VDE 0100-718)
• ÖVE/ÖNORM E 8007
• IEC 60364-7-710*
• DIN EN 61508-1 (VDE 0803-1)*
• IEC 61508-2 (2010-04 Ed. 2.0)*
• DIN EN 61508-2 (VDE 0803-2)*
• IEC 61508-2 (2010-04 Ed. 2.0)*
• DIN EN 61508-3 (VDE 0803-3)*
• IEC 61508-3 (2010-04 Ed. 2.0)*
• DIN EN 60947-6-1 (VDE 0660-114)
• IEC 60947-6-1 (2013-12) Ed. 2.1

Standard-compliant isolating transformer monitoring according to:
• DIN EN 61558-1 (VDE 0570-1)
• DIN EN 61558-1/A1 (VDE 0570-1/A1)

Further information
For further information refer to our product range on www.bender.de.

Ordering information ATICS®...-DIO 2-pole

<table>
<thead>
<tr>
<th>Version</th>
<th>Rated operational current /e</th>
<th>Scope of delivery</th>
<th>Type</th>
<th>Art. No.</th>
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Ordering information ATICS®...-DIO 4-pole

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<tr>
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</table>
Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

- Overvoltage category: III
- Pollution degree outside, inside: 2
- Rated insulation voltage ATICS-2-DIO/ATICS-4-DIO: 250 V/400 V
- Protective separation: Line 1 — Line 2: 2, 3 – RS-485
- Voltage test according to IEC 61010-1 (basic insulation/protective separation): 2.21 kV/3.54 kV
- Supply voltage: AC 50…60 Hz, 230 V

Supply voltage

- Rated operational voltage Ue
- Current during the changeover process: 17 A (< 30 ms)

Power section/switching elements

- Nominal system voltage Un (operating range) ATICS-2-DIO/ATICS-4-DIO: AC 230 V/3NAC 400 V
- Frequency range f
- Crest factor:
- Number of switching cycles (mechanical):
- Short-circuit current isl and fus:

Voltage monitoring/changeover

- Frequency range f
- Undervoltage response value (Alarm 1):
- Overvoltage response value (Alarm 2):
- Response delay t
- Delay on release t
- Hysteresis:
- Frequency measurement:
- Display range measured value ATICS-2-DIO:
- Display range measured value ATICS-4-DIO:
- Operating uncertainty:

Current monitoring (output current)

- Measuring current transformers:
- Measuring range In (TRMS):
- Response value for short-circuit detection ATICS-DIO:
- Crest factor:
- Hysteresis for short-circuit alarm:

Cable length:

- Single wire ≥ 0.75 mm²:
- Single wire, twisted ≥ 0.75 mm²:
- Shielded cable:
- Cable: twisted pairs, shielded, shield connected to PE on one side:

Displays and data memory

- Display: graphic display
- Languages: DE, EN, FR
- Alarm LEDs:
- Line 1, line 2, alarm, com
- History memory:
- 500 data records
- Data logger:
- 500 data records/channel
- Config. logger:
- 300 data records
- Test data logger:
- 100 data records
- Service logger:
- 100 data records

Input

- Digital inputs:
- Galvanic separation:
- Control:
- Mode of operation:
- Voltage range high/low:
- Adjustable function:

Relay output 1

- Switching element 1:
- Mode of operation adjustable:
- Adjustable function:
- Electrical endurance under rated operating conditions, number of cycles:

Contact data according to IEC 61810

- Rated operational current AC (resistive load, cos φ = 1):
- Rated operational current DC:
- Overvoltage category:
- Minimum contact rating:

Relay outputs 2...4

- 1 potential-free N/O contact
- Mode of operation adjustable:
- Adjustable function:

Technical data

- Automatic transfer switching devices ATICS®...
- Automatic transfer and monitoring devices
- DIN rail mounting acc. to IEC 60715
- Transport (IEC 60721-3-2):
- Stationary use (IEC 60721-3-3):
- Classification of climatic conditions acc. to IEC 60721:
- EMC:
- Environment/EMC:
- Classification of climatic conditions acc. to IEC 60721:
- EMC:
- Classification of mechanical conditions acc. to IEC 60721:
- EMC:

Terminals

- Power section:
- Connection type:
- Conductor cross section, max.:
- Conductor cross section, min.:
- Stripping length:
- Torque setting for manual operation (Allen 5 mm):

Electronics

- Connection:
- screw terminals
- screw terminals
- Connection type:
- Conductor cross section, max.:
- Conductor cross section, min.:
- Stripping length:
- Torque setting for manual operation (Allen 5 mm):

Other

- Operating mode:
- Mounting:
- Use at altitudes:
- Protection class:
- Protection class LCD under foil (DIN EN 60529):
- Enclosure material:
- Flammability class:
- DIN rail mounting:
- Screw mounting:
- Dimensions incl. terminals (W x H x D):
- Documentation number:
- Weight:

- ATICS-2-DIO:
- ATICS-4-DIO:
Example application data centre
- ATICS®-…-DIO: Changeover between the preferred and the redundant line
- MK2430/CP9xx: Alarm at least two points for functional safety
Safety Analyser

For over 30 years, the “Bender Tester” has been a wellknown term for quality and long service life in the area of fully automated electrical safety testers. “UNIMET®” became the brand name.

UNIMET® – compact design – “Made in Germany”, the user-friendly one among the safety analysers.
### Device overview UNIMET® test systems

<table>
<thead>
<tr>
<th></th>
<th>UNIMET® 300ST</th>
<th>UNIMET® 400ST</th>
<th>UNIMET® 610ST</th>
<th>UNIMET® 810ST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catalogue page</td>
<td>442</td>
<td>445</td>
<td>449</td>
<td>452</td>
</tr>
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</table>

#### Application
- **Electrical equipment**
- **Electric hospital and care beds**
- **Medical electrical equipment**
- **Electrical machines**

#### Voltages
- **Supply voltage $U_s$**
  - AC 230 V
  - AC 230 V
  - AC 230 V
  - AC 100...120 V, AC 220...240 V
- **Voltage measurement**
  - AC 90...264 V
  - AC 90...264 V
  - AC 90...264 V
  - AC 90...264 V
- **Load current measurement**
  - 0.01...16 A
  - 0.01...16 A
  - 0.01...16 A
  - 0.01...16 A

#### Test sequence
- **manual**
- **semi-automatic**
- **automatic**

#### Data exchange
- UNIData300
- UNIData300/400
- UNIMET® 610ST Control Center
- UNIMET® 810ST Control Center

#### Product details
(Products on www.bender.de/en)

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1 Medical electrical equipment without patient connections
UNIMET® 300ST
Test system for electrical equipment and electric hospital and care beds

Device features
- Easy operation and handling
- Automatic and manual test procedure
- Data input via keyboard or barcode scanner
- Visual inspection, functional testing and electrical testing
- 600 data records can be stored
- Data exchange and storage via UNIData 300
- Compatible with common application programs such as visual FM, MT Data and Fundamed

Typical applications
- Safe tests of electrical equipment, hospital and healthcare beds as well as medical electrical equipment without patient connections.

Standards
The UNIMET® 300ST series tests are carried out in accordance with the requirements of the device standards:
- IEC 62353
- DIN EN 62353 (VDE 0751-1)
- ÖVE/ÖNORM EN 62353
- DIN VDE 0701-0702
- ÖVE EB701-1

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
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<th>Supply voltage $U_s$</th>
<th>Version</th>
<th>Type</th>
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<td>230 V</td>
<td>CH</td>
<td>UNIMET®300ST</td>
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Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Variant</th>
<th>Type</th>
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<td>Adapter</td>
<td>German Schuko</td>
<td>VK701-6</td>
<td>B96020067</td>
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<td>Non-heating appliances</td>
<td>VK701-7</td>
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<td>Interface cable</td>
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<td>Testprobe</td>
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<td>Test terminal</td>
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<td>Testterminal</td>
<td>B928741</td>
<td>–</td>
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<tr>
<td>Barcode scanner</td>
<td>–</td>
<td>PS/2</td>
<td>B96020082</td>
<td>–</td>
</tr>
<tr>
<td>Converter</td>
<td>–</td>
<td>USB1.1RS-232converter</td>
<td>B96020086</td>
<td>–</td>
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<td>Flex keyboard</td>
<td>–</td>
<td>Flexkeyboard</td>
<td>B96020093</td>
<td>–</td>
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<td>Three-phase adapter</td>
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<td>D532A</td>
<td>B96020098</td>
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<td></td>
<td>D532DCT</td>
<td>B96020100</td>
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</tbody>
</table>
Technical data

Supply voltage AC 230 V ±10 %
Frequency range 45…65 Hz
Power consumption max. 50 VA
Maximum load current 16 A
Max. connectable load at 230 V 3700 VA
Protection class II
Ambient temperature 0…50 °C
Storage temperature -10…+70 °C
Degree of protection IP20

Testing of PE resistance
Test voltage approx. 5 V, system frequency > 2 A
Measuring range 0.001…29.999 Ω
Measuring accuracy 0.001…1.0 Ω: ±2.5 % of MV ±2 digits
1.001…29.999 Ω: ±5 % of MV ±2 digits

Leakage current, differential measurement method
Measuring range 0.001…19.999 mA
Measuring accuracy ±5 % of MV ±5 digits

Leakage current, direct measurement
Measuring range 0.001…19.999 mA
Measuring accuracy ±5 % of MV ±5 digits

Equipment leakage current - Alternative method
Measuring range 0.001…19.999 mA
Measuring accuracy 0.001…9,999 mA: ±5 % of MV ±2 digits
10,000…19,999 mA: ±7 % of MV ±2 digits
Test voltage (Equipment leakage current measurement – alternative method) approx. system voltage, system frequency
Test current max. 3.5 mA

Insulation resistance
Test voltage approx. DC 500 V
Max. test current 2.5 mA
Measuring range 0.01…199.99 MΩ
Measuring accuracy 0.01…99.99 MΩ: ±5 % of MV ±2 digits
100.00…199.99 MΩ: ±10 % of MV ±2 digits

Load current measurement
Measuring range 0.01 A to 16 A
Measuring accuracy ±2.5 % of MV ±3 digits

Voltage measurement
Measuring range 90…264 V
Measuring accuracy ±2.5 % of MV ±2 digits

Apparent power
Measuring range 5…3700 VA
Measuring accuracy ±5 % of MV ±5 digits

Other
Dimensions (without bag) ca. 168 x 272 x 124 mm (W x D x H)
Weight (without accessories or bag) approx. 2.2 kg
Calibration interval 36 months
Documentation number D00135

Dimension diagram (dimensions in mm)
### Function buttons

- Backlit LCD for displaying the user menu and the measurement results. Four lines of 20 characters each.

### Sockets

- Violet: Connection for test probe for testing exposed parts of the device under test.
- Yellow (E): for a second test lead when the low-resistance continuity of the PE conductor is to be measured between two points (e.g., on single-phase, permanently connected devices or extension cables).

### Test socket

This is where the DUT’s power supply cable is plugged in.

### Durable plastic enclosure

With pushbuttons for safe storage in the carrying bag.

### Power switch with thermo-magnetic circuit breaker

### Interfaces

- 9-pole RS-232 interface, galvanically isolated, for connection to a personal computer
- Centronics interface for connection to a printer
- PS/2 port for connection to an external standard keyboard and a barcode reading wand or scanner.

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### Wiring diagrams

#### Connection of hospital and care beds and electrical equipment with plug-in connector.

#### For connecting single-phase permanently installed equipment to the test system

- Disconnect the device
- Disconnect the connection to the supply voltage

#### Testing of extension cables

- Connection of connecting and extension cords

#### Testing of extension cables

- Connection of connecting and extension cords
UNIMET® 400ST
Test system for medical electrical equipment, electrical hospital and care beds and electrical equipment

Device features
- Easy operation and handling
- Automatic and manual test procedure
- Data input via keyboard or barcode scanner
- Visual inspection, functional testing and electrical testing
- 4mm socket for testing applied parts
- 600 data records can be stored
- Data exchange and storage via UNIData 300/400
- Compatible with common application programs such as visual FM, MT Data and Fundamed

Typical applications
- Safe testing of medical electrical equipment with patient connections, hospital and care beds and electrical equipment.

Standards
The UNIMET® 400ST series carries out tests in accordance with the requirements of the device standards:
- IEC 62353
- DIN EN 62353 (VDE 0751-1)
- ÖVE/ÖNORM EN 62353
- DIN VDE 0701-0702
- ÖVE E8701-1

Approvals

Further information
For further information refer to our product range on www.bender.de.

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<td>Standard UNIMET® 400ST</td>
<td>B96024000</td>
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<td>CH</td>
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Suitable system components

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<td>DS32DCT</td>
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Technical data

Supply voltage AC 230 V ±10 %)
Frequency range 45…65 Hz
Power consumption max. 50 VA
Maximum load current 16 A
Max. connectable load at 230 V 3700 VA
Protection class II
Ambient temperature 0…50 °C
Storage temperature -10…+70 °C
Degree of protection IP20

Testing of PE resistance

Test voltage approx. 5 V, system frequency
Short-circuit current > 2 A
Measuring range 0.001…29.999 Ω
Measuring accuracy 0.001…1.0 Ω: ±2.5 % of MV ±2 digits
1.001…29.999 Ω: ±5 % of MV ±2 digits

Leakage current, differential measuring method

Measuring range 0.02 mA…19.99 mA
Measuring accuracy ±5 % of MV ±5 digits

Leakage current, direct measurement

Measuring range 0.001…19.999 mA
Measuring accuracy 0.001…19.999 mA: ±5 % of MV ±2 digits

Equipment leakage current -alternative method

Measuring range 0.001…19.999 mA
Measuring accuracy 0.001…9.999 mA: ±5 % of MV ±2 digits
10,000…19,999 mA: ±7 % of MV ±2 digits
Test voltage (Equipment leakage current measurement – alternative method) approx. system voltage, system frequency
Test current max. 3.5 mA

Insulation resistance

Test voltage approx. DC 500 V
Max. test current 2.5 mA
Measuring range 0.01…199.99 MΩ
Measuring accuracy 0.01…99.99 MΩ: ±5 % of MV ±2 digits
100.00…199.99 MΩ: ±10 % of MV ±2 digits

Load current measurement

Measuring range 0.01…16 A
Measuring accuracy ±2.5 % of MV, ±3 digits

Voltage measurement

Measuring range 90…264 V
Measuring accuracy ±2.5 % of MV, ±2 digits
Apparent power
Measuring range 5…3700 VA
Measuring accuracy ±5 % of MV, ±5 digits

Other

Dimensions (without bag) ca. 168 x 272 x 124 mm (W x D x H)
Weight (without accessories or bag) approx. 2.2 kg
Calibration interval 36 months
Documentation number D00136

of MV = of measured value

Dimension diagram (dimensions in mm)
Displays and controls

1. Function buttons
2. Backlit LCD for displaying the user menu and the measurement results. Four lines of 20 characters each.
3. Permanently attached power cable for connection to the supply voltage.
4. Sockets
   - black (AP): for testing applied parts
   - violet: Connection for test probe for testing exposed parts of the device under test.
   - yellow (E): for a second test lead when the low-resistance continuity of the PE conductor is to be measured between two points (e.g., on single-phase, permanently connected devices or extension cables).

5. Test socket: This is where the DUT’s power supply cable is plugged in
6. Durable plastic enclosure, with pushbuttons for safe storage in the carrying bag.
7. Power switch with thermo-magnetic circuit breaker
8. Interfaces
   - 9-pole RS-232 interface, galvanically isolated, for connection to a personal computer
   - Centronics interface for connection to a printer
   - PS/2 port for connection to an external standard keyboard and a barcode reading wand or scanner.

Wiring diagrams

Connection of hospital and care beds and electrical equipment with plug-in connector.

For connecting single-phase permanently installed equipment to the test system
- Disconnect the device
- Disconnect the connection to the supply voltage
UNIMET® 400ST test system

Testing of extension cables
– Connection of connecting and extension cords

Connection of medical electrical equipment with plug-in connector
UNIMET® 610ST
Test system for electrical equipment and machines

Device features
- The Windows user interface provides an easy-to-use solution
- Data exchange and storage via Control Center
- Automatic, semi-automatic or manual test sequences
- Data input via touch screen, keyboard or barcode scanner
- Visual inspection, electrical safety and functional test user-definable
- Test sequences user-definable
- Data storage > 10,000 data records
- Filter function for fast data selection
- Management of test dates
- Multitenancy
- Catalogue systems
- Test probe with two switching contacts – for semi-automatic testing of parts not connected to PE
- Compatible with all common application programs

Areas of application
- Electrical equipment
  "Inspection after repair, modification of electrical appliances – Periodic inspection on electrical appliances" acc. to DIN VDE 0701-0702 (VDE 0701-0702);
- DIN EN 60204-1/VDE 0113
  Safety of machinery - Electrical equipment of machines - Part 1: General requirements

Certifications

Standards
The UNIMET® 610ST series tests according to the device standards:
- DIN VDE 0701-0702
- DIN VDE 0113/ EN 60204-1
- ÖVE/ÖNORM E 8701-1

Further information
For further information, refer to our product area at www.bender.de.

Ordering details

<table>
<thead>
<tr>
<th>Nominal voltage range</th>
<th>Maximum output current</th>
<th>Version</th>
<th>Type</th>
<th>Art. No.</th>
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<tbody>
<tr>
<td>AC</td>
<td>16 A</td>
<td>Standard (DE/DE)</td>
<td>UNIMET® 610ST</td>
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Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Variant</th>
<th>Type</th>
<th>Art. No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adapter</td>
<td>Schuko</td>
<td>VK701-6</td>
<td>B96020067</td>
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<tr>
<td></td>
<td>Non-heating devices</td>
<td>VK701-7</td>
<td>B96020066</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Adapter kit 16 A for DS32A</td>
<td>VK701-8</td>
<td>B96020097</td>
<td>459</td>
</tr>
<tr>
<td>Cable</td>
<td>For connecting the test system to a PC, 9-pin, female-female (null-modem cable)</td>
<td>RS-232/RS-232 interface cable</td>
<td>B96012012</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Measuring lead, 150 cm, 4-mm connector</td>
<td>Cable 150 cm</td>
<td>B928703</td>
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<tr>
<td>Test probe</td>
<td>TP800 active test probe (with switch)</td>
<td>TP800</td>
<td>B96020080</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Measuring lead, 3 m, with black test probe</td>
<td>–</td>
<td>B928748</td>
<td>–</td>
</tr>
<tr>
<td>Test terminal</td>
<td>Black</td>
<td>–</td>
<td>B928741</td>
<td>–</td>
</tr>
<tr>
<td>Touchscreen pen</td>
<td>–</td>
<td>Stylus pen</td>
<td>B928749</td>
<td>–</td>
</tr>
<tr>
<td>Barcode scanner</td>
<td>for UNIMET® 610ST (PS/2 port)</td>
<td>–</td>
<td>B96020082</td>
<td>–</td>
</tr>
<tr>
<td>Flex keyboard</td>
<td>for UNIMET® 610ST (USB port)</td>
<td>–</td>
<td>B96020093</td>
<td>–</td>
</tr>
<tr>
<td>Test kit</td>
<td>various adapters for connecting medical electrical equipment to test systems</td>
<td>PK3</td>
<td>B96020004</td>
<td>–</td>
</tr>
<tr>
<td>Three-phase adapter</td>
<td>for testing three-phase devices during operation</td>
<td>DS32A</td>
<td>B96020098</td>
<td>457</td>
</tr>
</tbody>
</table>
Technical data

Nominal voltage range  AC 100…120 V/±10 %, AC 220…240 V/±10 %
Frequency range  48…62 Hz
Power consumption  max. 100 VA
Maximum output current  see ordering details
Protection class  II

Testing of PE resistance
Measuring range  0.001…29.999 Ω
Measuring current  max. AC 8 A
Measuring voltage  max. AC 8 V
Intrinsic uncertainty  0.001…1.000 Ω: ±2.5 % of MV ±5 digits
1.001…29.999 Ω: ±5 % of MV ±5 digits
Operating uncertainty  0.001…1.000 Ω: ±5 % of MV ±10 digits
1.001…29.999 Ω: ±7.5 % of MV ±10 digits

Insulation resistance
Measuring range  0.01…199.99 MΩ
Measuring voltage  max. DC 550 V
Measuring current  max. 2.5 mA
Intrinsic uncertainty  0.01…99.99 MΩ: ±5 % of MV ±2 digits
100.00…199.99 MΩ: ±10 % of MV ±2 digits
Operating uncertainty  0.01…99.99 MΩ: ±7.5 % of MV ±4 digits
100.00…199.99 MΩ: ±10 % of MV ±4 digits

Equipment leakage current - alternative method
Measuring range  0.001…19.999 mA
Measuring voltage  max. AC 250 V
Measuring current  max. 3 mA
Intrinsic uncertainty  ±5 % of MV ±5 digits
Operating uncertainty  ±7.5 % of MV ±10 digits

Leakage current, residual current measuring method
Measuring range  0.02…19.999 mA
Intrinsic uncertainty  ±5 % of MV ±2 digits
Operating uncertainty  ±7.5 % of MV ±4 digits
Frequency response  40…100 kHz ±3 dB

Leakage current, direct measurement
Measuring range  0.001…19.999 mA
Intrinsic uncertainty  ±5 % of MV ±2 digits
Operating uncertainty  ±7.5 % of MV ±4 digits
Frequency response  up to 100 kHz ±3 dB

Voltage measurement
Measuring range  AC 90…264 V
Frequency range  48…62 Hz
Intrinsic uncertainty  ±2.5 % of MV ±3 digits

Load current measurement
Measuring range  0.005…16 A
Frequency range  48…62 Hz
Intrinsic uncertainty  ±2.5 % of MV ±3 digits

Apparent power
Measuring range  5…3600 VA
Frequency range  48…62 Hz
Intrinsic uncertainty  ±5 % of MV ±3 digits

Environment/EMC
EMC   IEC 61326-1
Ambient temperature  0…+40 °C
Storage temperature  -10…+70 °C
Relative humidity (up to 31 °C) max. 80 %
Relative humidity (> 31…40 °C) decreasing linearly, max. 50 %
condensation must be avoided
Height AMSL max. 2000 m

Other
Degree of protection  enclosure: IP40, connections: IP20
in acc. with DIN VDE 0470 Part 1/EN 60529
Dimensions (without bag) approx. 390x277x126 mm (W x D x H)
Weight (without accessories or bag) approx. 3.5 kg
Calibration interval 36 months
Documentation number D00380

of MV = of measured value
1. Touch screen for operation and display. For this purpose, a stylus is included in the scope of delivery.
2. Durable plastic enclosure, with push buttons for safe storage in the carrier bag.
3. 10 sockets (1…10) for the connection of VK adapters to test extension lines.
4. Measuring terminals
   - [B] (violet) for the connection of the single-pole test probe supplied with the product.
   - [A] for active test probe TP800 with push button (optional).
   - Socket [C] for equipotential bonding (e.g. connection for single-pole line extension with clip for the testing of permanently installed equipment).
   - Socket [D] for functional earth
5. Test socket: This is where the DUT’s power supply cable is plugged in.
6. Connection to the supply voltage and power switch with thermomagnetic circuit breaker.
7. Without function.
8. Interfaces:
   - PS/2 port for external keyboard
   - RS-485 serial interface for Bender Service
   - RS-232 interface, 9-pin, electrically isolated, for connection to a PC
   - USB interface for connection to a printer, a USB stick, an external keyboard or a barcode scanner (2 x host) and a PC (1 x device, for Bender Service only)
   - Ethernet network connection (optional)

---

Operating elements

![Operating elements diagram]

Wiring diagram

![Wiring diagram]
UNIMET® 810ST
Test system for medical electrical equipment

Device features
• Easy operation by Windows user interface
• Data exchange and storage via Control Center
• Automatic, semi-automatic or manual test sequence
• Data input via touch screen, keyboard or barcode scanner
• Visual inspection, electrical tests, functional tests, user-definable
• Test sequences user-definable
• Data memory > 10,000 data records
• Filter function for fast data selection
• Management of test dates
• Multitenancy
• Catalogue systems
• Test probe with two switching contacts – for semi-automatic testing of conductive parts not connected to PE
• Compatible with common application programs such as visual FM, MT Data and Fundamed

Standards
The UNIMET® 810ST series carries out tests in accordance with the requirements of the device standards:
• IEC 60601-1
• IEC 62353
• DIN EN 62353 (VDE 0751-1)
• IEC 61010-1
• ÖVE/ÖNORM EN 62353
• DIN VDE 0701-0702
• ÖVE E8701-1

Further information
For further information refer to our product range on www.bender.de.

Ordering information

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<thead>
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<th>Version</th>
<th>Type</th>
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<td>100…120 V and</td>
<td>16 A</td>
<td>Standard (DE/DE)</td>
<td>UNIMET®810ST</td>
<td>B96028020</td>
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<td>220…240 V</td>
<td>GB/GB</td>
<td>UNIMET®810ST</td>
<td>B96028024</td>
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<td>13 A</td>
<td>B/B</td>
<td>UNIMET®810ST</td>
<td>B96028027</td>
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<td>10 A</td>
<td>Us/Us</td>
<td>UNIMET®810ST</td>
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Suitable system components

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<th>Type</th>
<th>Art No.</th>
<th>Page</th>
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<tr>
<td>Adapter</td>
<td>German Schuko</td>
<td>VK701-6</td>
<td>B96020067</td>
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<td>Non-heating appliances</td>
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<td>VK701-7</td>
<td>B96020066</td>
<td>–</td>
</tr>
<tr>
<td>Adapter kit 16 A for DS32A</td>
<td></td>
<td>VK701-8</td>
<td>B96020097</td>
<td>459</td>
</tr>
<tr>
<td>Cable</td>
<td>for connecting the test system with a PC, 5-pole, female-female (Null modem cable)</td>
<td>RS-232/RS-232interfacecable</td>
<td>B96012012</td>
<td>–</td>
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<tr>
<td>Measuring lead, 150 cm, 4 mm connector</td>
<td>Cable150cm</td>
<td>B928703</td>
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<td>Test probe active (with switch)</td>
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<td>TP800</td>
<td>B96020080</td>
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<tr>
<td>3 m measuring lead with black test probe</td>
<td>–</td>
<td>B928748</td>
<td>–</td>
<td></td>
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<tr>
<td>Test terminal black</td>
<td>–</td>
<td>B928741</td>
<td>–</td>
<td></td>
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<tr>
<td>Touchscreen pen – Styluspen</td>
<td>–</td>
<td>B928749</td>
<td>–</td>
<td></td>
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<tr>
<td>Barcode scanner for the UNIMET® 810ST (PS/2 connection)</td>
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<td>B96020082</td>
<td>–</td>
<td></td>
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<tr>
<td>Flex keyboard for the UNIMET® 810ST (USB connection)</td>
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<td>B96020093</td>
<td>–</td>
<td></td>
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<td>Test kit various adapters for connecting medical electrical equipment to test systems</td>
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<td>PK3</td>
<td>B9602004</td>
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<td>Test box for testing test systems</td>
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<td>TB3</td>
<td>B96020025</td>
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<td>Three-phase adapter for testing three-phase devices during operation</td>
<td></td>
<td>DS32A</td>
<td>B96020098</td>
<td>457</td>
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<tr>
<td>External power source 25 A for standard-compliant protective earth resistance measurements (only in conjunction with UNIMET® 810ST)</td>
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<td>EPS800</td>
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### Technical data

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<th>Specification</th>
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<td><strong>Nominal voltage range</strong></td>
<td>AC 100…120 V ±10 %, AC 220…240 V ±10 %</td>
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<tr>
<td><strong>Frequency range</strong></td>
<td>48…62 Hz</td>
</tr>
<tr>
<td><strong>Power consumption</strong></td>
<td>max. 100 VA</td>
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<tr>
<td><strong>Maximum output current</strong></td>
<td>see ordering information</td>
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<td><strong>Protection class</strong></td>
<td>SKII</td>
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#### Testing of PE resistance

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<th>Specification</th>
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<td><strong>Measuring range</strong></td>
<td>0.001…29.999 Ω</td>
</tr>
<tr>
<td><strong>Measuring current</strong></td>
<td>max. AC 8 A</td>
</tr>
<tr>
<td><strong>Measuring voltage</strong></td>
<td>max. AC 8 V</td>
</tr>
<tr>
<td><strong>Intrinsic uncertainty</strong></td>
<td>0.001…1.000 Ω ±2.5 % v. M. ±5 digits</td>
</tr>
<tr>
<td></td>
<td>1.001…29.999 Ω ±5 % v. M. ±5 digits</td>
</tr>
<tr>
<td><strong>Operating uncertainty</strong></td>
<td>0.001…1.000 Ω ±5 % v. M. ±10 digits</td>
</tr>
<tr>
<td></td>
<td>1.001…29.999 Ω ±7.5 % v. M. ±10 digits</td>
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#### Insulation resistance

<table>
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<th>Specification</th>
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<td><strong>Measuring range</strong></td>
<td>0.01…199.99 MΩ</td>
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<tr>
<td><strong>Measuring voltage</strong></td>
<td>max. DC 550 V</td>
</tr>
<tr>
<td><strong>Intrinsic uncertainty</strong></td>
<td>0.01…99.99 MΩ ±5 % v. M. ±2 digits</td>
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<td>100.00…199.99 MΩ ±10 % v. M. ±2 digits</td>
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<tr>
<td><strong>Operating uncertainty</strong></td>
<td>0.01…99.99 MΩ ±7.5 % v. M. ±4 digits</td>
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<tr>
<td></td>
<td>100.00…199.99 MΩ ±10 % v. M. ±4 digits</td>
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#### Equipment leakage current -alternative method

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<td><strong>Measuring voltage</strong></td>
<td>max. AC 250 V</td>
</tr>
<tr>
<td><strong>Intrinsic uncertainty</strong></td>
<td>±5 % v. M. ±5 digits</td>
</tr>
<tr>
<td><strong>Operating uncertainty</strong></td>
<td>±7.5 % v. M. ±10 digits</td>
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#### Leakage current, differential measurement method

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<td><strong>Measuring range</strong></td>
<td>0.02…19.99 mA</td>
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<tr>
<td><strong>Intrinsic uncertainty</strong></td>
<td>±5 % v. M. ±2 digits</td>
</tr>
<tr>
<td><strong>Operating uncertainty</strong></td>
<td>±7.5 % v. M. ±4 digits</td>
</tr>
<tr>
<td><strong>Frequency response</strong></td>
<td>40…100 kHz ±3 dB</td>
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</tbody>
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#### Leakage current, direct measurement

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<td><strong>Measuring range</strong></td>
<td>0.001…19.999 mA</td>
</tr>
<tr>
<td><strong>Intrinsic uncertainty</strong></td>
<td>±5 % v. M. ±2 digits</td>
</tr>
<tr>
<td><strong>Operating uncertainty</strong></td>
<td>±7.5 % v. M. ±4 digits</td>
</tr>
<tr>
<td><strong>Frequency response</strong></td>
<td>up to 100 kHz ±3 dB</td>
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#### Voltage measurement

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<tbody>
<tr>
<td><strong>Measuring range</strong></td>
<td>AC 90…264 V</td>
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<tr>
<td><strong>Frequency range</strong></td>
<td>48…62 Hz</td>
</tr>
<tr>
<td><strong>Intrinsic uncertainty</strong></td>
<td>±2.5 % v. M. ±3 digits</td>
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#### Load current measurement

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<tr>
<td><strong>Measuring range</strong></td>
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<tr>
<td><strong>Frequency range</strong></td>
<td>48…62 Hz</td>
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<tr>
<td><strong>Intrinsic uncertainty</strong></td>
<td>±2.5 % v. M. ±3 digits</td>
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#### Apparent power

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<td>5…3600 VA</td>
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<tr>
<td><strong>Frequency range</strong></td>
<td>48…62 Hz</td>
</tr>
<tr>
<td><strong>Intrinsic uncertainty</strong></td>
<td>±5 % v. M. ±3 digits</td>
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#### Environment/EMC

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<tr>
<td><strong>EMC</strong></td>
<td>IEC 61326-1</td>
</tr>
<tr>
<td><strong>Ambient temperature</strong></td>
<td>0…+40 °C</td>
</tr>
<tr>
<td><strong>Storage temperature</strong></td>
<td>-10…+70 °C</td>
</tr>
<tr>
<td><strong>Relative humidity (up to 31 °C)</strong></td>
<td>max. 80 %</td>
</tr>
<tr>
<td><strong>Relative humidity (&gt; 31…40 °C)</strong></td>
<td>decreasing linearly, max. 50 %</td>
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<tr>
<td><strong>Height above sea level</strong></td>
<td>max. 2000 m</td>
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<tr>
<td><strong>Degree of protection, enclosure:</strong></td>
<td>IP40, connections: IP20</td>
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</table>

#### Other

<table>
<thead>
<tr>
<th>Measure</th>
<th>Specification</th>
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<tbody>
<tr>
<td><strong>Dimensions (without bag)</strong></td>
<td>approx. 300x277x126 mm (W x D x H)</td>
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<tr>
<td><strong>Weight (without accessories or bag)</strong></td>
<td>approx. 3.5 kg</td>
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<tr>
<td><strong>Calibration interval</strong></td>
<td>36 months</td>
</tr>
<tr>
<td><strong>Documentation number</strong></td>
<td>D00008</td>
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</table>

### Dimension diagram

[Dimension diagram with dimensions in mm]
1 Touchscreen for operator control and indication. For this purpose, a stylus is included in the scope of supply.
2 Durable plastic enclosure, with pushbuttons for safe storage in the carrying bag.
3 10 sockets (1...10) for the connection of patient electrodes.
4 Measuring terminals
   - [B] (violet) for the connection of the single-pole test probe supplied with the product.
   - [A] for active test probe TP800 with pushbutton (option).
   - Socket [C] for equipotential bonding (e.g. connection for single-pole line extension with clip for the testing of permanently installed equipment).
   - socket [D] for functional earth
5 Test socket: This is where the DUT’s power supply cable is plugged in.
6 Connection to the supply voltage and power switch with thermomagnetic circuit breaker.
7 Connection for the external 25 A power source EPS800.

Note: The plug clicks into place and is secured against being pulled out accidentally. The plug can only be removed after pushing the movable grip back.

Interfaces:
   - PS/2 connection for external keyboard
   - RS-485 serial interface for Bender Service
   - 9-pole RS-232 interface, galvanically isolated, for connection to a personal computer
   - USB interface for connection to a printer, a USB stick, an external keyboard or a barcode scanner (2 x host) and a PC (1 x device, for Bender Service only)
   - Ethernet network connection (optional)

Displays and controls
**EPS800**

External power source 25 A for UNIMET® 800/810ST

---

### Device features
- To be used in conjunction with the appropriate UNIMET® 800/810ST

### Standards
The EPS800 series carries out tests in compliance with the device standard:
- IEC 60601-1
- IEC 61010-1

### Typical applications
- External 25 A power source for standard-compliant protective earth resistance measurement acc. to IEC 60601-1 and IEC 61010-1

### Further information
For further information refer to our product range on www.bender.de.

### Approvals

---

### Ordering information

<table>
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<th>Version</th>
<th>for UNIMET®</th>
<th>Type</th>
<th>Art. No.</th>
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<td>810ST</td>
<td>EPS800</td>
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<td>B96028050</td>
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<td>US</td>
<td>B96028018</td>
<td>B96028028</td>
<td>B96028058</td>
</tr>
</tbody>
</table>

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### Technical data

- **Nominal voltage**: AC 207...253 V, 48...62 Hz
- **Power consumption**: 400 VA
- **Measuring current**: AC 25 A ±10 % (0...0.3 Ω)
- **Output power**: 230 VA
- **Operating mode**: continuous operation
- **Protection class**: II
- **Mic-fuse**: 5 x 20 mm, fast 5 A/250 V

**Other**

- **EMC**: IEC 61326-1
- **Ambient temperature**: -10...+70 °C
- **Storage temperature**: 0...+40 °C
- **Relative humidity (up to 31 °C)**: max. 80 %
- **Relative humidity (> 31...40 °C)**: decreasing linearly, max. 50 %
- **Height above sea level**: max. 2000 m
- **Degree of protection**: IP20
- **Dimensions**: ca. 244 x 164 x 120 mm (W x D x H)
- **Documentation number**: D00146
- **Weight**: ≤ 4 kg

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### Dimension diagram (dimensions in mm)

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1. Insert the control cable of the EPS800 into the “EPS800” connector socket on the rear of the UNIMET® 800ST/810ST.
   Note: The plug clicks into place and is secured against being pulled out accidentally. The plug can only be removed after sliding back the movable handle piece.

2. Connect the supply line of the EPS800 to the power socket.

3. Connect the supply line of the UNIMET® 800ST/810ST to the power socket.

4. Switch on the power switch of the UNIMET® 800ST/810ST.

5. Switch on the power switch of the EPS800. The sound of the internal ventilator can be heard.

6. Connect the DUT. Determine the test sequence according to the classification.
DS32A
3AC three-phase adapter with differential current measurement

Device features
• To be used in conjunction with an UNIMET test system

Standards
The DS32A series carries out tests in compliance with the device standard:
• DIN VDE 0701-0702
• DIN EN 62353

Typical applications
• Three-phase adapter for testing medical electrical three-phase devices during operation

Further information
For further information refer to our product range on www.bender.de.

Ordering information

<table>
<thead>
<tr>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS32A</td>
<td>B96020098</td>
</tr>
<tr>
<td>DS32A (CH/CH)</td>
<td>B96020110</td>
</tr>
</tbody>
</table>

Technical data

Electrical safety
- Protection class: I acc. to IEC 61010-1/EN 601010-1/VDE 0411-1
- Pollution degree: 2
- Measurement category: CAT II
- Test voltage: 1.69 kV
- Current carrying capacity: 32 A/6 h three-phase current
- EMC: EN 61326-1

Differential current
- Measuring range: AC 0.02…20 mA
- Intrinsic uncertainty: 5 % v. M. ±50 μA

Supply voltage
- Supply voltage \( U_s \): 3AC 400 V ±10 %
- Frequency range \( U_s \): 50…60 Hz
- Power consumption: approx. 18 VA
- Load current max.: 32 A

Environmental conditions
- Storage temperature: -10…+70 °C
- Operating temperature: 0…+50 °C
- Degree of protection: IP20
- Dimensions: 405 x 210 x 200 mm (width x height x depth)
- Weight: 8.9 kg
- Height above sea level: max. 2000 m
- Operating mode: not suitable for continuous operation
- Documentation number: D00147

Dimension diagram (dimensions in mm)
Wiring diagram

System connection
CEE 32A

DS32A
Three-phase adapter

Connection to
the test socket UNIMET®

Power supply
UNIMET®

Test probe

Device under test 3AC
(max. 32A)
**VK701-8**

Adapter kit 16 A for DS32A

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**Device features**

- To be used in conjunction with the three-phase adapter DS32A

**Further information**

For further information refer to our product range on www.bender.de.

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**Typical applications**

- for the measurement of 16-A-three-phase devices in conjunction with the three-phase adapter DS32A

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**Approvals**

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**Ordering information**

<table>
<thead>
<tr>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>VK701-8</td>
<td>B96020097</td>
</tr>
</tbody>
</table>

**Technical data**

- **Nominal voltage**
  - Nominal voltage 3AC 400 V
  - Max. current 16 A

- **Documentation number** D00172

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**Wiring diagram**

[Diagram showing the connection of the VK701-8 adapter kit with a three-phase adapter DS32A, UNIMET® devices, and test probe connections.]
**TB3**

**Test box**

### Device features
- Test box for UNIMET® 800/810ST
- Time and cost saving through simple handling
- Simulation of a standardised DUT
- 10 patient sockets for individual calibration
- Magnetic adhesive stripes allow simple fixing to the safety tester

### Typical applications
- Testing the measured values of safety testers
- Comprehensive system self test

### Further information
For further information refer to our product range on www.bender.de.

### Ordering information

<table>
<thead>
<tr>
<th>Version</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard (German)</td>
<td>TB3 test box</td>
<td>89602002S</td>
</tr>
</tbody>
</table>

### Technical data
**Insulation coordination acc. to IEC 60664-1**
- Rated insulation voltage: AC 250 V
- Rated impulse voltage/pollution degree: 4 kV/3

**Voltage ranges**
- Nominal system voltage $U_n$: 100…240 V
- Rated frequency $f_n$: AC 48…62 Hz
- Output voltage $U_{12}$: 7.39 V (±2.5 %)
- Max. power consumption: 35 VA at 50 Hz, 230 V

**Evaluation of tolerance values**
- Precalculation: 110 %
- Tolerance: 10 %
- Built-in resistors
  - R-MD (safety tester): 1 kΩ
  - R-PE: 0.233 kΩ
  - R3: 25 kΩ
  - R4: 100 kΩ
  - R5: 1 MΩ
  - R6: 100 MΩ
  - R7: 1 kΩ
  - R8: 100 kΩ
  - R9: 130 kΩ

**Other**
- Ambient temperature (during operation): 0…+50 °C
- Ambient temperature (during storage): -10…+70 °C
- Operating mode: continuous operation
- Mounting: any position
- Protection class: Class I
- Dimensions in mm (H x W x D): 148 x 160 x 76
- Weight: ≤ 900 g
- 24-month calibration interval
- Documentation number: D00149

### Dimension diagram (dimensions in mm)

![Dimension Diagram](image-url)
1. Mains plug: only to be used for the test socket of the safety tester
2. Socket for the connection of the test probe
3. Carrying handle
4. Enclosure, magnetic adhesive stripes allow simple fixing to the safety tester μP601
5. LED lights when voltage is applied at the mains plug
6. Sockets for the patient connections 1 and 2 of the safety tester

7. The sockets 1 and 2 at the side of the test box TB3 are internally connected to the sockets on the front. The sockets 3…10 can be used to test the patient connections 3…10 at the safety tester (patient auxiliary current measurement). The measured values differ from the values documented in the table “tolerance values”.

<table>
<thead>
<tr>
<th>Socket</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
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<tr>
<td>5</td>
<td>5</td>
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<tr>
<td>6</td>
<td>6</td>
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<tr>
<td>7</td>
<td>7</td>
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<tr>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

Sockets on the side

8. Jumpers allow simulation of different test situations

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Connections

1. Jumpers. Insert the jumpers in such a way that the following sockets are connected:

<table>
<thead>
<tr>
<th>μP601</th>
<th>UNIMET® 810ST</th>
</tr>
</thead>
<tbody>
<tr>
<td>a-b</td>
<td>a-b</td>
</tr>
<tr>
<td>d-e</td>
<td>d-f</td>
</tr>
<tr>
<td>h-i</td>
<td>h-i</td>
</tr>
</tbody>
</table>

2. Connect the patient sockets 1 and 2 of the safety tester (at UNIMET® 810ST socket 2 only) to the respective socket of the test box TB3.

3. Insert the mains plug of TB3 into the test socket of the safety tester, as illustrated. Please observe the plug-in direction.

   - at UNIMET® 810ST, insert the supply cable from the top

In case of wrong plug-in direction test results will become unusable.

4. Contact the test probe of the safety tester with the socket PE of TB3

5. UNIMET® 800/810ST test system
### Technical terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm state</td>
<td>Indicates that the residual current in the installation monitored has exceeded the preset level of the RCM.</td>
</tr>
<tr>
<td>Direct contact</td>
<td>Electric contact of persons or animals with live parts.</td>
</tr>
<tr>
<td>Earth</td>
<td>Part of the Earth which is in electric contact with an earth electrode and the electric potential of which is not necessarily equal to zero.</td>
</tr>
<tr>
<td>Earth electrode</td>
<td>Conductive part, which may be embedded in a specific conductive medium, e.g. concrete or coke, in electric contact with the Earth.</td>
</tr>
<tr>
<td>Earth fault</td>
<td>Occurrence of an accidental conductive path between a live conductor and the Earth.</td>
</tr>
<tr>
<td>Earth fault current</td>
<td>Current flowing to earth due to an insulation fault.</td>
</tr>
<tr>
<td>Earth leakage current</td>
<td>Current flowing from the live parts of the installation to earth in the absence of an insulation fault.</td>
</tr>
<tr>
<td>Effect of the supply voltage</td>
<td>Effect influencing the functioning of measuring equipment and, consequently, the measured value produced by it.</td>
</tr>
<tr>
<td>Effects of the distribution system voltage</td>
<td>Effect influencing the operation and, consequently, the measured value produced by it.</td>
</tr>
<tr>
<td>Electric shock</td>
<td>Physiological effect resulting from an electric current through a human or animal body.</td>
</tr>
<tr>
<td>Equipment for insulation fault location</td>
<td>Device or combination of devices used for insulation fault location in IT systems. The insulation fault location system is used in addition to an insulation monitoring device. It injects a locating current between the electrical system and earth and locates insulation faults.</td>
</tr>
<tr>
<td>Equipotential bonding</td>
<td>Provision of electrical connections between conductive parts, intended to achieve equipotentiality.</td>
</tr>
<tr>
<td>Exposed-conductive part</td>
<td>Conductive part of equipment which can be touched and which is not normally live, but which can become live when basic insulation fails.</td>
</tr>
<tr>
<td>Extraneous conductive part</td>
<td>Conductive part not forming part of the electrical installation and liable to introduce an electric potential, generally the electric potential of a local earth.</td>
</tr>
<tr>
<td>Extraneous DC voltage $U_{f}$</td>
<td>DC voltage occurring in AC systems between the AC conductors and earth (derived from DC parts).</td>
</tr>
<tr>
<td>Extraneous voltage</td>
<td>Voltage to which the measuring equipment can be subjected by external influences. This is not required for the operation of the measuring equipment, but can interfere with its operation.</td>
</tr>
<tr>
<td>Fault current $I_{f}$</td>
<td>Current which flows across a given point of fault resulting from an insulation fault.</td>
</tr>
<tr>
<td>Fault voltage $(U_f)$</td>
<td>Voltage appearing under fault conditions between exposed conductive and/or extraneous conductive parts and earth.</td>
</tr>
<tr>
<td>Fiducial value</td>
<td>A clearly specified value to which reference is made in order to define the fiducial error.</td>
</tr>
<tr>
<td>Indirect contact</td>
<td>Electric contact of persons or animals with exposed-conductive parts which have become live under fault conditions.</td>
</tr>
<tr>
<td>Influence quantity</td>
<td>A quantity which is not the subject of the measurement, but which influences the value of the measured quantity, or the indication of measuring equipment.</td>
</tr>
<tr>
<td>Insulation fault</td>
<td>A defect in the insulation of an equipment which can result either in an abnormal current through this insulation or in a disruptive discharge.</td>
</tr>
<tr>
<td>Insulation fault locator</td>
<td>Device or part of device for the location of the insulation fault.</td>
</tr>
<tr>
<td>Insulation monitoring device</td>
<td>Equipment which permanently monitors and indicates the insulation resistance of an electrical installation or a section of it in unearthed IT AC systems. The equipment is intended to signal a drop in insulation resistance below a minimum limit, so that the cause of the reduction can be found before a second fault occurs resulting in an unwanted disconnection of the electrical installation.</td>
</tr>
<tr>
<td>Insulation resistance $R_f$</td>
<td>Resistance in the system being monitored, including the resistance of all the connected appliances to earth.</td>
</tr>
<tr>
<td><strong>Term</strong></td>
<td><strong>Definition</strong></td>
</tr>
<tr>
<td>----------</td>
<td>---------------</td>
</tr>
<tr>
<td>Internal DC resistance $R_i$</td>
<td>Resistance of the insulation monitoring device between the terminals to the system being monitored and earth.</td>
</tr>
<tr>
<td>Internal impedance $Z_i$</td>
<td>Total impedance of the insulation monitoring device between the terminals to the system being monitored and earth, measured at the nominal frequency.</td>
</tr>
<tr>
<td>ISOMETER®</td>
<td>Registered trademark of Bender GmbH &amp; Co. KG, Grünberg. An ISOMETER® actively measures the insulation resistance in IT systems with a measuring voltage which is superimposed between the system and the PE conductor.</td>
</tr>
<tr>
<td>Leakage current</td>
<td>Electric current in an unwanted conductive path under normal operating conditions.</td>
</tr>
<tr>
<td>Live part</td>
<td>Conductor or conductive part intended to be energised in normal operation, including a neutral conductor, but by convention not a PEN conductor or PEM conductor or PEL conductor.</td>
</tr>
<tr>
<td>Locating current $I_L$</td>
<td>r.m.s. value of the current that is injected by the locating current injector during the location process. The locating current can be generated by an independent locating voltage source, or an independent locating current source, or it can be driven directly from the system to be monitored.</td>
</tr>
<tr>
<td>Locating voltage $U_L$</td>
<td>r.m.s. value of the voltage present at the measuring terminals of the locating current injector during the measurement when the device has an independent locating voltage or current source.</td>
</tr>
<tr>
<td>Measuring current $I_m$</td>
<td>Maximum current that can flow between the system and earth, limited by the internal resistance from the measuring voltage source of the insulation monitoring device.</td>
</tr>
<tr>
<td>Measuring voltage $U_m$</td>
<td>Voltage present at the measuring terminals during the measurement.</td>
</tr>
<tr>
<td>Nominal current $I_n$</td>
<td>Current of the measuring equipment under nominal conditions.</td>
</tr>
<tr>
<td>Nominal frequency ($f_n$)</td>
<td>Frequency for which the measuring equipment is intended to be used and designed.</td>
</tr>
<tr>
<td>Nominal voltage of the distribution system ($U_n$)</td>
<td>Voltage by which a distribution system or equipment is designated and to which certain operating characteristics are referred.</td>
</tr>
<tr>
<td>Nominal voltage of the measuring equipment ($U_{me}$)</td>
<td>Voltage for which the measuring equipment is intended to be used and the value of which is marked on the equipment.</td>
</tr>
<tr>
<td>Nominal voltage range</td>
<td>Voltage range for which the measuring and monitoring equipment is intended to be used and for which it has been designed.</td>
</tr>
<tr>
<td>Open-circuit voltage ($U_o$)</td>
<td>Voltage present across unloaded terminals on the measuring equipment.</td>
</tr>
<tr>
<td>Operating voltage in a system</td>
<td>The value of the voltage under normal conditions at a given, specific point of the system.</td>
</tr>
<tr>
<td>Origin (of the electrical installation)</td>
<td>Point at which electric energy is delivered to the electrical installation.</td>
</tr>
<tr>
<td>Output voltage ($U_a$)</td>
<td>Voltage across the measuring equipment terminals where this equipment does or can output electric power.</td>
</tr>
<tr>
<td>Performance characteristic</td>
<td>One of the quantities (described by values, tolerances, ranges) assigned to an equipment in order to define its performance.</td>
</tr>
<tr>
<td>Protective conductor PE</td>
<td>Conductor provided for purposes of safety for example protection against electric shock.</td>
</tr>
<tr>
<td>Pulsating direct current</td>
<td>Current of pulsating waveform which assumes, in each period of the rated power frequency, the value 0 or the value not exceeding 0.006 A d.c. during one single interval of time, expressed in angular measure, of at least 150°.</td>
</tr>
<tr>
<td>Rated contact voltage</td>
<td>Voltage for which a relay contact is rated to open and close under specified conditions.</td>
</tr>
<tr>
<td>Rated operating conditions</td>
<td>A set of specified measuring ranges for performance characteristics and specified operating ranges for influence quantities, within which the variations of operating errors of an instrument are specified and determined.</td>
</tr>
<tr>
<td>Rated residual operating current $I_{\Delta n}$</td>
<td>The value of the residual operating current, assigned to the RCM by the manufacturer, at which the RCM shall operate under specified conditions.</td>
</tr>
<tr>
<td>RCM directionally discriminating</td>
<td>RCM used in IT systems, capable of directionally discriminating between supply side and load side residual currents.</td>
</tr>
<tr>
<td>RCM type A</td>
<td>RCM for which actuation is ensured for residual sinusoidal alternating currents and residual pulsating direct currents, whether suddenly applied or slowly rising.</td>
</tr>
<tr>
<td><strong>Technical terms</strong></td>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>---------------------</td>
<td>----------------</td>
</tr>
<tr>
<td><strong>RCM type B</strong></td>
<td>RCM for which actuation is ensured for residual sinusoidal alternating currents, residual pulsating direct currents or smooth residual direct currents, whether suddenly applied or slowly rising.</td>
</tr>
<tr>
<td><strong>Residual current ( I_D )</strong></td>
<td>Algebraic sum of the values of the electric currents in all live conductors, at the same time at a given point of an electric circuit in an electrical installation.</td>
</tr>
<tr>
<td><strong>Residual current monitor</strong></td>
<td>Device or association of devices which monitors the residual current in an electrical installation, and which activates an alarm when the residual current exceeds the operating value of the device.</td>
</tr>
<tr>
<td><strong>Residual current monitoring system</strong></td>
<td>Usually consists of the residual current monitor and measuring current transformers. The system localises occurring residual currents and indicates the location of the fault.</td>
</tr>
<tr>
<td><strong>Residual operating current</strong></td>
<td>Value of the residual current which causes the RCM to operate under specified conditions.</td>
</tr>
<tr>
<td><strong>Response sensitivity</strong></td>
<td>Value of the evaluating current or insulation resistance at which the evaluator responds under specified conditions.</td>
</tr>
<tr>
<td><strong>Response time ( t_{an} )</strong></td>
<td>Time required by an insulation monitoring device to respond under specified conditions.</td>
</tr>
<tr>
<td><strong>Response value ( R_{an} )</strong></td>
<td>Value of the insulation resistance at which the device responds under specified conditions.</td>
</tr>
<tr>
<td><strong>Short circuit to exposed-conductive part</strong></td>
<td>A conductive connection caused by a fault between the exposed-conductive part and the live parts of electrical equipment.</td>
</tr>
<tr>
<td><strong>Short circuit current ( I_k )</strong></td>
<td>Current flowing across the short-circuited terminals of the measuring equipment.</td>
</tr>
<tr>
<td><strong>Solid short circuit, short circuit to exposed-conductive parts, short circuit to earth</strong></td>
<td>A solid short circuit, short circuit to exposed-conductive parts or short-circuit to earth exists if the impedance of the conductive connection at the point of fault is almost zero.</td>
</tr>
<tr>
<td><strong>Specified operating range</strong></td>
<td>Range of values of a single influence quantity which forms a part of the rated operating conditions.</td>
</tr>
<tr>
<td><strong>Specified response value ( R_{an} )</strong></td>
<td>Value of the insulation resistance, permanently set or adjustable, on the device and monitored if the insulation resistance falls below this limit.</td>
</tr>
<tr>
<td><strong>Supply voltage ( U_s )</strong></td>
<td>Voltage at a point where the measuring equipment does or can accept electric energy as a supply.</td>
</tr>
<tr>
<td><strong>System leakage capacitance ( C_e )</strong></td>
<td>Total capacitance to earth of the system to be monitored, including any connected appliances, up to which value the insulation monitoring device can work as specified.</td>
</tr>
<tr>
<td><strong>Total earthing resistance ( R_A )</strong></td>
<td>The resistance between the main earthing terminal and the earth.</td>
</tr>
<tr>
<td><strong>Touch voltage ( U_t )</strong></td>
<td>Maximum value of the touch voltage which is permitted to be maintained indefinitely in specified conditions of external influences and is usually equal to AC 50 V, r.m.s. or 120 V ripple free DC.</td>
</tr>
<tr>
<td><strong>Touch voltage ( U_t )</strong></td>
<td>Voltage between conductive parts when touched simultaneously by a person or an animal.</td>
</tr>
<tr>
<td><strong>True value</strong></td>
<td>The value which characterises a quantity perfectly defined, under the conditions which exist when the quantity is considered.</td>
</tr>
<tr>
<td><strong>Variation</strong></td>
<td>The difference between the indicated values for the same value of the measured quantity of an indicating or recording instrument, of the (conventional) true value of a supply instrument, when a single influence quantity assumes successively two different values.</td>
</tr>
</tbody>
</table>
| **Voltage against earth \( U_o \)** | a) In distribution systems with an earthed neutral point, the voltage between a phase conductor and the earthed neutral point.  
   b) In all other distribution systems, the voltage present between the remaining phase conductors and earth when one of the phase conductors is shorted to earth. |
<table>
<thead>
<tr>
<th>Short form</th>
<th>German term</th>
<th>English term</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRCD</td>
<td>Gerät oder Anordnung von Geräten, das/die eine Strommesseinrichtung und eine Auswerteeinheit zur Erkennung und Bewertung sowie zur Ansteuerung des Kontaktöffnens einer Abschaltvorrichtung enthält.</td>
<td>device or an association of devices comprising a current sensing means and a processing device designed to detect and to evaluate the residual current and to control the opening of the contacts of a current breaking device</td>
</tr>
<tr>
<td>PRCD</td>
<td>ortsveränderliche FI-bzw. DI-Schutzeinrichtung (auch OVS)</td>
<td>portable residual current protective device</td>
</tr>
<tr>
<td>PRCD-S</td>
<td>OVS mit erweitertem Schutzumfang und Sicherstellung der bestimmungsgemäßen Nutzbarkeit des Schutzleiters</td>
<td>portable residual current protective device-safety</td>
</tr>
<tr>
<td>RCBO</td>
<td>FI-bzw. DI-Schutzeinrichtung mit eingebautem Überstromauslöser (FI/LS-bzw. DI/LS-Schalter)</td>
<td>residual-current-operated circuit breakers with integrated overcurrent protection</td>
</tr>
<tr>
<td>RCCB</td>
<td>FI-bzw. DI-Schutzeinrichtung ohne eingebauten Überstromschutz</td>
<td>residual-current-operated circuit breakers without integrated overcurrent protection</td>
</tr>
<tr>
<td>RCD (generic term)</td>
<td>Fehlerstrom-Schutzeinrichtung (RCD ohne Hilfsspannung, spannungsunabhängig) bzw. Differenzstrom-Schutzeinrichtung (RCD mit Hilfsspannung, spannungsabhängig)</td>
<td>residual current protective device</td>
</tr>
<tr>
<td>RCM</td>
<td>Differenzstrom-Überwachungsgerät</td>
<td>residual current monitors</td>
</tr>
<tr>
<td>SRCD</td>
<td>ortsfeste FI-bzw-DI-Schutzeinrichtung in Steckdoseenausführung</td>
<td>fixed socket-outlets residual current protective device</td>
</tr>
</tbody>
</table>
## Alphabetical list of devices

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Catalogue page</th>
</tr>
</thead>
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<tr>
<td>7204</td>
<td>MEASURING INSTRUMENT</td>
<td>397</td>
</tr>
<tr>
<td>7220</td>
<td></td>
<td>397</td>
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<tr>
<td>9604</td>
<td></td>
<td>397</td>
</tr>
<tr>
<td>9620</td>
<td></td>
<td>397</td>
</tr>
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Support during all stages
Comprehensive service for your installation: remote, by phone, on site

Competent service for maximum safety and high availability of your installation

From planning to modernisation – Our extensive know-how is at your disposal during all project phases.

Furthermore, with our first-class service we guarantee maximum safety for your electrical installations.
We offer services ranging from support over telephone to repairs and on-site service – with modern measuring devices and competent employees.

Secure yourself:
- High availability of your installation thanks to fast reaction to fault messages
- Increased profitability of your capital expenditure (CapEx) via optimised maintenance processes
- Targeted operating expenditure (OpEx) due to less downtimes and shorter service visits
- Support for your prospective system monitoring and regular tests of your system/power quality/monitoring devices
- Automatic control, analysis, correction, new settings/updates
- Competent assistance with setting changes and updates

Bender Remote Assist
Bender Remote Assist offers you support via remote access, high-quality service and advice for your challenging task consisting in ensuring consistent high safety in your systems.

Many service visits, fault clearance but also analyses and controls can be carried out remotely – without the expenses of time and money that an on-site visit of a technician implies.

This fast, efficient help and advice by our expert network allows the highest possible availability of your system.