Insulation monitoring devices
ISOMETER®

Equipment for insulation fault location
ISOSCAN®

Power Quality and Energy Measurement
LINETRAXX®

Measuring and monitoring relays
LINETRAXX®

Residual current monitoring systems
LINETRAXX®

System components
- Coupling devices
- Measuring current transformers
- Transformers
- Measuring transducers
- 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
Standards and guidelines applied
Alphabetical list of devices
Technical terms
Service
The Power in Electrical Safety
In the past 70 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. As a global market and technology leader we underline this by our quality promise 5foryou.

With over 700 employees we are globally present in over 70 countries.

Since January 2012 we provide a five-year warranty for “5forU”-relevant devices registered not later than 24 months after the date of purchase.
Monitoring and analysis made easy

More information on powerscout.bender.de
Simple setup
Long-term analysis
Visualisations
Automated reports
Across locations
Central testing and monitoring of the electrical installation and equipment (DGUV Vorschrift 3 (German Social Accident Insurance Regulation 3))
No local software installation required
Insulation monitoring devices
ISO METER®

Equipment for insulation fault location
ISO SCAN®

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- Standards and guidelines applied
- Technical terms
- Alphabetical list of devices
- Service
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<th>ISOMETER® iso685-…-P</th>
<th>ISOMETER® isoNAV685-D</th>
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<td>Locating current injector for insulation fault location</td>
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<th>Suitable system components</th>
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<td>AGH150W-4</td>
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<td>AGH2045-4</td>
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<td>AGH5205</td>
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<td>AGH5755-7</td>
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<td>AGH6765-4</td>
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<tr>
<td>ISOMETER® isoRW685W-D</td>
<td>ISOMETER® IRDH275</td>
<td>ISOMETER® IRDH275BM-7</td>
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<td>------------------------</td>
<td>------------------</td>
<td>------------------------</td>
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<td>Railway</td>
<td>AC, DC or AC/DC medium voltage systems</td>
<td>Equipment for insulation fault location</td>
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<tr>
<td>AC, 3(N)AC 0...690 V, DC 0...1000 V</td>
<td>AC, 3(N)AC 0...690 V DC 0...565 V</td>
<td>AC, 3(N)AC, DC 0...15,5 kV (absolute)</td>
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<td>+ 15 %</td>
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**Suitable system components**

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<th>ISOMETER® IR420-D4</th>
<th>ISOMETER® IR125Y-4</th>
<th>ISOMETER® IR42S</th>
<th>ISOMETER® IR470LY</th>
<th>ISOMETER® IR470LY2-4061</th>
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<table>
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<th>Control circuits</th>
<th>Auxiliary circuits</th>
<th>Main circuits</th>
<th>3(N)AC</th>
<th>AC</th>
<th>AC/DC</th>
<th>DC</th>
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</thead>
</table>

### Nominal system voltage $U_n$

<table>
<thead>
<tr>
<th>AC 0…250 V</th>
<th>AC 19.2…230 V, DC 19.2…250 V</th>
<th>AC/DC 0…250 V</th>
<th>AC, 3(N)AC 0…690 V</th>
<th>AC, 3(N)AC 0…690 V</th>
</tr>
</thead>
</table>

### Tolerance of $U_n$

| + 20 % | + 15 % | + 20 % | + 15 % | + 15 % |

### System leakage capacitance $C_e \mu F$

| ≤ 20 | ≤ 10 | ≤ 20 | ≤ 20 | ≤ 20 |

### Response value $R_{an} \Omega$

| 1…200 | 10…200 | 1…200 | 1…200 | 10…300 35…500 |

### Coupled systems

### Locating current injector for insulation fault location

### Installation

<table>
<thead>
<tr>
<th>DIN rail</th>
<th>Screw mounting</th>
<th>Panel mounting/ wall Fastening</th>
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</thead>
</table>

### Interfaces

| Web server | Modbus | BCOM | BS | BMS |

### Suitable system components

<table>
<thead>
<tr>
<th>Type</th>
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<tr>
<td>AGH150W-4</td>
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<tr>
<td>AGH204S-4</td>
<td>283</td>
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<tr>
<td>AGH5205</td>
<td>284</td>
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<tr>
<td>AGH575S-7</td>
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<tr>
<td>AGH676S-4</td>
<td>287</td>
</tr>
</tbody>
</table>

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2016/2017 Insulation monitoring devices | Device overview

*BENDER*
### ISOMETER® iso685P

- **Models:** ISOMETER® IR1575
- **Specifications:**
  - 

### ISOMETER® IR427

- **Models:** ISOMETER® isoMED427P
- **Specifications:**
  - 

### ISOMETER® isoLR275

- **Models:** ISOMETER® IR470LY
- **Specifications:**
  - 

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<th>86</th>
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<th>104</th>
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<td>Medical locations</td>
<td>Installations with a low level of insulation</td>
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</tr>
<tr>
<td>AC 0...1000 V, DC 0...1500 V</td>
<td>AC 3(N) AC 0...400 V DC 0...400 V</td>
<td>AC 70...330 V</td>
<td>AC 70...230 V</td>
<td>via AGH-LR 3(N) AC 0...690 V DC 0...1000 V</td>
</tr>
<tr>
<td>+ 6 %</td>
<td>+ 20 %</td>
<td>+ 15 %</td>
<td>+ 15 %</td>
<td>+ 15 % ± 10 %</td>
</tr>
<tr>
<td>≤ 500</td>
<td>≤ 60</td>
<td>≤ 5</td>
<td>≤ 5</td>
<td>≤ 500</td>
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<tr>
<td>200...1000</td>
<td>2...1000</td>
<td>50...500</td>
<td>50...500 kΩ</td>
<td>0.2...100</td>
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### Suitable system components

- | | | | |
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**Interfaces:**
- Web server
- Modbus
- BCOM
- BS
- BMS

**Type P:** Suitable system components

- FP200
- 64

**Coupling devices**

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- AGH204S-4 283
- AGH520S 284
- AGH675S-7 285
- AGH676S-4 287
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<td>Photovoltaic</td>
<td>Photovoltaic</td>
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<td>Disconnected loads</td>
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<tr>
<td>Control circuits</td>
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<td>Auxiliary circuits</td>
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<td>Main circuits</td>
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<td><strong>Voltage system</strong></td>
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<tr>
<td>3(N)AC</td>
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<tr>
<td>AC</td>
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<td>AC/DC</td>
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<td>DC</td>
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<tr>
<td><strong>Nominal system voltage (U_n)</strong></td>
<td>via AGH-PV</td>
<td>DC (0...1000) V</td>
<td>DC (0...1000), AC (0...690) V, (15...460) Hz</td>
<td>DC (0...250) V</td>
<td>offline</td>
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<tr>
<td><strong>Tolerance of (U_n)</strong></td>
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<td>+ 15 %</td>
<td>+ 6 %</td>
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<td>(\leq 10)</td>
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<td>(10...1000)</td>
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<td><strong>Coupled systems</strong></td>
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<td>Locating current injector for insulation fault location</td>
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<td>(only isoPV1685PFR)</td>
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### ISOMETER® Devices Overview

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### Special Applications

- Photovoltaic
- Disconnected loads
- Mobile generators
- Electric mobility
- Railway

### Nominal System Voltage

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<tr>
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<td>Offline</td>
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### Tolerance of Uₙ

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<td>+ 6 %</td>
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<td>+ 20 %</td>
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<tr>
<td>+ 0 %</td>
<td>+ 15 %</td>
</tr>
</tbody>
</table>

### System Leakage Capacitance

<table>
<thead>
<tr>
<th>Circuit Type</th>
<th>Cₑ µF</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 2000</td>
<td>≤ 500</td>
</tr>
<tr>
<td>≤ 10</td>
<td>≤ 10</td>
</tr>
<tr>
<td>≤ 5</td>
<td>≤ 1</td>
</tr>
<tr>
<td>≤ 1</td>
<td>≤ 300</td>
</tr>
</tbody>
</table>

### Response Value

<table>
<thead>
<tr>
<th>Circuit Type</th>
<th>Rₖ Ω</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2…100</td>
<td>1…990</td>
</tr>
<tr>
<td>10…1000</td>
<td>500…5000</td>
</tr>
<tr>
<td>100…10000</td>
<td>1…200</td>
</tr>
<tr>
<td>46/23</td>
<td>100…10000</td>
</tr>
<tr>
<td>10…990</td>
<td>30 kΩ…1 MΩ</td>
</tr>
<tr>
<td>40 kΩ…2 MΩ</td>
<td>1…990</td>
</tr>
</tbody>
</table>

### Coupling Devices

- AGH150W-4
- AGH204S-4
- AGH520S
- AGH675S-7
- AGH676S-4

### Interfaces

- Web server
- Modbus
- RTU

### Suitable System Components

- FP200 64
- BCOM BS
- BMS

### Installation

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

### Locating Current Injector

- for insulation fault location (only isoPV1685PFR)
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)

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

Standards
The ISOMETER® of the IR420 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

<table>
<thead>
<tr>
<th>Supply voltage Uᵦ</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 16…72 V, 42…460 Hz</td>
<td>IR420-D4-1</td>
<td>B 7101 6409</td>
</tr>
<tr>
<td>DC 9.6…94 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC 70…300 V, 42…460 Hz</td>
<td>IR420-D4-2</td>
<td>B 7101 6405</td>
</tr>
<tr>
<td>DC 70…300 V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Device version with screw terminals on request.
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>
Insulation monitoring device ISOMETER® IR420-D4

**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**

- Supply voltage $U_s$: see ordering information
- Power consumption: ≤ 4 W

**IT system being monitored**

- Nominal system voltage $U_n$: AC 0...300 V
- Nominal frequency $f_n$: 42...460 Hz

**Response values**

- Response value $R_{11}$ (Alarm 1): 1...200 kΩ
- Response value $R_{22}$ (Alarm 2): 1...200 kΩ
- Preset mode: $U_n < 72$ V $R_{11}$ (Alarm 1) = 20 kΩ/$R_{12}$ (Alarm 2) = 10 kΩ
- $U_n > 72$ V $R_{11}$ (Alarm 1) = 46 kΩ/$R_{12}$ (Alarm 2) = 23 kΩ
- Relative uncertainty: ±0.5 kΩ/±15 %
- Hysteresis: ±1 kΩ/±25 %

**Time response**

- Response time $t_{R}$ at $R_0 = 0.5 \times R_{10}$ and $C_t = 1 \mu F$: ≤ 1 s
- Start-up delay (start time) $t_s$: 0...10 s @ $0^\circ$C
- Response delay $t_{R}$: 0...99 s @ $0^\circ$C

**Measuring circuit**

- Measuring voltage $U_{M}$: 12 V
- Measuring current $I_{M}$ (at $R_0 = 0$ Ω): ≤ 200 μA
- Internal DC resistance $R_i$: ≥ 62 kΩ
- Impedance $Z$ at 50 Hz: ≥ 60 kΩ
- Permissible extraneous DC voltage $U_{E}$: ≤ DC 300 V
- Permissible system leakage capacitance $C_t$: ≤ 20 μF

**Displays, memory**

- Display: LC display, multi-functional, non-illuminated
- Display range, measured value: 1 kΩ...1 MΩ
- Operating uncertainty: ±0.5 kΩ/±15 %
- Percentage operating error: ±15 %
- Password: off/0...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
  - Utilisation category: AC-13, AC-14, 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 61228-2-4
- Operating temperature: -25...+55 °C

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

- Stationary use (IEC 60721-3-3)
  - K3S (except condensation and formation of ice)
- Transport (IEC 60721-3-2)
  - K2 (except condensation and formation of ice)
- Long-time storage (IEC 60721-3-1)
  - IK4 (except condensation and formation of ice)

**Classification of mechanical conditions IEC 60721**

- Stationary use (IEC 60721-3-3)
  - Class 0
- Transport (IEC 60721-3-2)
  - Class 2
- Long-time storage (IEC 60721-3-1)
  - Class 1

**Connection**

- Connection type: push-wire terminal
- Connection properties: rigid
  - Flexible without ferrule
    - 0.2...1.5 mm² (AWG 24...16)
  - 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: 2 x M4 with mounting clip
- Documentation number: D00037
- Weight: ≤ 150 g

( )* = factory setting

**Dimension diagram** (dimensions in mm)
## Displays and controls

| 1 | LED power “ON”, (flashes in case of interruption of the connecting leads E/KE or L1/L2). |
| 2 | Alarm LED “AL1”, lights when the value falls below the set response value Alarm 1 and flashes in case of interruption of the connecting leads E/KE or L1/L2. |
| 3 | Alarm LED “AL2”, lights when the value falls below the set response value Alarm 2 and flashes in case of interruption of the connecting leads E/KE or L1/L2. |

### Wiring diagram

1. Supply voltage $U_s$ (see ordering details) via fuse
2. Separate connection of E, KE to PE
3. Connection of the AC system to be monitored: AC: connect terminals L1, L2 to conductor L1, L2.
4. Alarm relay “K1”: Alarm 1
5. Alarm relay “K2”: Alarm 2
6. Combined test and reset button “T/R”: short-time pressing (< 1.5 s) = RESET, long-time pressing (> 1.5 s) = TEST
7. 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.

### LC display

- Test button “T”: to call up the self test.
- Arrow up button: parameter change, to move up in the menu
- Reset button “R”: to delete stored insulation fault alarms
- Arrow down button: parameter change, to move down in the menu
- Menu button “MENU”: to call up the menu system.
- Enter button: Confirms parameter changes
ISOMETER® IR125Y-4
Insulation monitoring device for unearthed AC and DC systems

Device features
• Insulation monitoring for AC and DC systems (IT systems)
• Response values, adjustable 10…200 kΩ
• LEDs: Power On LED, alarm LED to signal insulation faults
• Internal combined test and reset button
• Connection external reset button
• Alarm relay with one potential-free changeover contact
• N/C operation
• Fault memory behaviour, selectable

Typical applications
• AC and DC control and auxiliary circuits in accordance with DIN EN 60204-1, "Electrical equipment of machines"; IEC 60204-1, EN 60204-1
• DC auxiliary circuits in accordance with DIN VDE 0100-725
• Simple battery systems

Standards
The ISOMETER® of the IR125Y-4 series complies with the requirements of the standards: DIN EN 61557-8 (VDE 0413-8), EN 61557-8, IEC 61557-8, ASTM F1669M-96 (2007)

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 19.2…265 V</td>
<td>DC 19.2…308 V</td>
<td>IR125Y-4</td>
</tr>
</tbody>
</table>

1) Absolute values

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting plate</td>
<td>B 990 056</td>
</tr>
</tbody>
</table>

Response values/measuring circuits

<table>
<thead>
<tr>
<th>Type</th>
<th>Response value $R_{in}$</th>
<th>Response time $t_{on}$</th>
<th>System leakage capacitance $C_e$</th>
</tr>
</thead>
<tbody>
<tr>
<td>IR125Y-4…</td>
<td>10…200 kΩ</td>
<td>$\leq 6$ s</td>
<td>$\leq 10$ µF</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>Measuring voltage $U_m$</th>
<th>Measuring current $I_m$</th>
<th>Internal DC resistance $R_i$</th>
</tr>
</thead>
<tbody>
<tr>
<td>IR125Y-4…</td>
<td>13 V</td>
<td>$\leq 0.12$ mA</td>
<td>112 kΩ</td>
</tr>
</tbody>
</table>
**Technical data**

<table>
<thead>
<tr>
<th>Insulation coordination acc. to IEC 60664-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage</td>
</tr>
<tr>
<td>Rated impulse withstand voltage/pollution degree</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Voltage ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal system voltage $U_n$</td>
</tr>
<tr>
<td>Supply voltage $U_S$</td>
</tr>
<tr>
<td>Power consumption</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Response values</th>
</tr>
</thead>
<tbody>
<tr>
<td>see table &quot;Response values/measuring circuit&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measuring circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>see table &quot;Response values/measuring circuit&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test button</td>
</tr>
<tr>
<td>Reset button</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Switching elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of switching elements</td>
</tr>
<tr>
<td>Operating principle</td>
</tr>
<tr>
<td>Electrical endurance, number of cycles</td>
</tr>
<tr>
<td>Contact class</td>
</tr>
<tr>
<td>Rated contact voltage</td>
</tr>
<tr>
<td>Making capacity</td>
</tr>
<tr>
<td>Breaking capacity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shock resistance IEC 60068-2-27 (device in operation)</td>
</tr>
<tr>
<td>Bumping IEC 60068-2-29 (transport)</td>
</tr>
<tr>
<td>Vibration resistance IEC 60068-2-6 (device in operation)</td>
</tr>
<tr>
<td>Vibration resistance IEC 60068-2-6 (transport)</td>
</tr>
<tr>
<td>Ambient temperature (during operation/transport)</td>
</tr>
<tr>
<td>Classification of climatic conditions acc. to DIN IEC 60721-3-3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection type</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating mode</td>
</tr>
<tr>
<td>Mounting any position</td>
</tr>
<tr>
<td>Degree of protection, internal components (DIN EN 60529)</td>
</tr>
<tr>
<td>Degree of protection, terminals (DIN EN 60529)</td>
</tr>
<tr>
<td>Screw mounting with mounting plate</td>
</tr>
<tr>
<td>DIN rail mounting acc. to</td>
</tr>
<tr>
<td>Flammability class</td>
</tr>
<tr>
<td>Documentation number</td>
</tr>
<tr>
<td>Weight</td>
</tr>
</tbody>
</table>

**Dimension diagram (dimensions in mm)**

**Wiring diagram**

1. Supply voltage $U_S$ (see ordering details) via fuse
2. Power On LED "ON"
3. LED "ALARM"
4. Combined test and reset button "TEST/RESET", short-time pressing (< 1 s) = RESET; long-time pressing (> 1 s) = TEST
5. Adjustable response value 10…200 kΩ
6. "R1/R2" bridged: Fault memory active
7. Alarm relay in N/C operation
8. Alarm
9. No alarm
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® of the IR425 complies with the requirements of the device standards:

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

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 1) U₅</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 16…72 V, 15…460 Hz</td>
<td>IR425-D4-1</td>
<td>B 7103 6403</td>
</tr>
<tr>
<td>DC 9.6…94 V</td>
<td>IR425-D4W-1</td>
<td>B 7103 6403W</td>
</tr>
<tr>
<td>AC 70…300 V, 15…460 Hz</td>
<td>IR425-D4-2</td>
<td>B 7103 6402</td>
</tr>
<tr>
<td>DC 70…300 V</td>
<td>IR425-D4W-2</td>
<td>B 7103 6402W</td>
</tr>
</tbody>
</table>

Device version with screw terminals on request.
1) Absolute values

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting</td>
<td>B 9806 0008</td>
</tr>
</tbody>
</table>

1) Absolute values
Technical data

Insulation monitoring device ISOMETER® IR425

Rated insulation voltage 250 V
Rated impulse voltage/pollution degree 4 kV/3

Voltage test acc. to IEC 61010-1 2,2 kV

Supply power
Supply voltage Uₜ see ordering information
Power consumption ≤ 4 VA

IT system being monitored
Nominal system voltage Uₙ AC/DC 0…300 V
Nominal frequency fₙ DC 15…460 Hz

Response values
Response value Rₑₑₑ (Alarm 1) 1…200 kΩ
Response value Rₑₑₑ (Alarm 2) 1…200 kΩ

Preset mode
Uₙ ≤ 72 V Rₑₑₑ (Alarm 1) = 20 kΩ/Rₑₑₑ (Alarm 2) = 10 kΩ
Uₙ > 72 V Rₑₑₑ (Alarm 1) = 46 kΩ/Rₑₑₑ (Alarm 2) = 23 kΩ

Relative uncertainty 1…5 kΩ/5…200 kΩ
Relative uncertainty 1…200 kΩ/…1 MΩ

Hysteresis
Time response
Response time tₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑₑἐxBB

Measuring circuit
Measuring voltage Uₑₑₑ ≤ 12 V
Measuring current Iₑₑₑ (at Rₑₑₑ = 0 Ω) ≤ 200 μA
Internal DC resistance Rₑ ≤ 62 kΩ
Impedance Zₑ at 50 Hz ≥ 60 kΩ

Permissible system leakage capacitance ≤ 20 μF

Displays, memory
Display range, measured value
1 kΩ…1 MCΩ
Operating uncertainty 1…5 kΩ/5 kΩ…1 MCΩ
Password
off/0…999 (on/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/I/O operation (N/O operation)*
Electrical endurance, number of cycles 10,000

Connection 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 ≥ 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) 3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2) 2K5 (except condensation and formation of ice)
Long-time storage (IEC 60721-3-1) 1K4 (except condensation and formation of ice)
Classification of mechanical conditions IEC 60721
Stationary use (IEC 60721-3-3) 3M4
Transport (IEC 60721-3-2) 2M2
Long-time storage (IEC 60721-3-1) 1M3

Option “W”
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) 2K5 (except condensation and formation of ice)
Long-time storage (IEC 60721-3-1) 1K4 (except condensation and formation of ice)
Classification of mechanical conditions IEC 60721
Stationary use (IEC 60721-3-3) 3M7
Transport (IEC 60721-3-2) 2M2
Long-time storage (IEC 60721-3-1) 1M3

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 D00039
Weight ≤ 150 g

(*) = factory setting

Dimension diagram (dimensions in mm)

---

2016/2017
## Displays and Controls

**LED power “ON”,** (flashes in case of interruption of the connecting leads E/KE or L1/L2).

**2** Alarm LED “AL1”, lights when the value falls below the set response value Alarm 1 and flashes in case of interruption of the connecting leads E/KE or L1/L2.

**3** Alarm LED “AL2”, lights when the value falls below the set response value Alarm 2 and flashes in case of interruption of the connecting leads E/KE or L1/L2.

**4** LC display

**5** Test button “T”: to call up the self test. Arrow up button: parameter change, to move up in the menu

**6** Reset button “R”: to delete stored insulation fault alarms Arrow down button: parameter change, to move down in the menu

**7** Menu button “MENU”: to call up the menu system. Enter button: Confirms parameter changes

### Wiring Diagram

**1** Supply voltage $U_S$ (see ordering details) via fuse

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

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

**4** Alarm relay “K1”: Alarm 1

**5** Alarm relay “K2”: Alarm 2

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

**7** 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® IR470LY...
Insulation monitoring device for unearthed AC and 3(N)AC systems (IT systems)

Device features
- Insulation monitoring for AC, 3(N)AC systems 0…793 V (IT systems)
- Nominal voltage extendable via coupling device
- Response values, adjustable 1…200 kΩ
- Connection monitoring system/earth
- Power ON LED, Alarm LED for signalling AC, L+, L-insulation faults
- LED bar graph indicator for signalling AC, L+, L-insulation faults
- Connection for external kΩ indication
- Combined test and reset button
- Connection external test/reset button
- Alarm relay with two potential-free changeover contacts
- Selectable N/O or N/C operation
- Fault memory behaviour, selectable

Standards
The ISOMETER® of the IR470LY series complies with the requirements of the device standards:

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

Typical applications
- AC, 3(N)AC main circuits (without directly connected rectifiers), such as motors, pumps, rolling mills without variable-speed drives, air cooling and air conditioning systems, lighting systems, heating systems, mobile generators, building services, domestic electrical installation practice, etc.

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>230 V</td>
<td>–</td>
<td>IR470LY-40 B 9104 8007</td>
</tr>
<tr>
<td>24 V</td>
<td>–</td>
<td>IR470LY-4011 B 9104 8012</td>
</tr>
<tr>
<td>42 V</td>
<td>–</td>
<td>IR470LY-4012 B 9104 8002</td>
</tr>
<tr>
<td>90…132 V1)</td>
<td>–</td>
<td>IR470LY-4013 B 9104 8011</td>
</tr>
<tr>
<td>400 V</td>
<td>–</td>
<td>IR470LY-4015 B 9104 8008</td>
</tr>
<tr>
<td>500 V</td>
<td>–</td>
<td>IR470LY-4016 B 9104 8018</td>
</tr>
<tr>
<td>690 V</td>
<td>–</td>
<td>IR470LY-4017 B 9104 8017</td>
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<tr>
<td>440 V</td>
<td>–</td>
<td>IR470LY-4018 B 9104 8024</td>
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<tr>
<td>–</td>
<td>9.6…84 V1)</td>
<td>IR470LY-4021 B 9104 8006</td>
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<tr>
<td>–</td>
<td>77…286 V1)</td>
<td>IR470LY-4023 B 9104 8026</td>
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</tbody>
</table>

Other supply voltages on request
1) Absolute values

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>External kΩ measuring instruments</td>
<td>7204-1421</td>
<td>328</td>
</tr>
<tr>
<td></td>
<td>9604-1421</td>
<td>328</td>
</tr>
<tr>
<td>Coupling devices</td>
<td>AGH204S-4</td>
<td>283</td>
</tr>
<tr>
<td></td>
<td>AGHS205</td>
<td>284</td>
</tr>
</tbody>
</table>
**Technical data**

### Insulation coordination acc. to IEC 60664-1

- **Rated insulation voltage**: AC 630 V
- **Rated impulse voltage/pollution degree**: 6 kV/3

### Voltage ranges

- **Nominal system voltage** $U_n$: AC 3N/AC 0…793 V
- **Nominal frequency** $f_n$: 40…460 Hz
- **Supply voltage** $U_s$: see ordering information
- **Operating range of $U_s$**: 0.8…1.15 x $U_s$
- **Frequency range** $f_s$: 50…460 Hz
- **Power consumption** $P$: ≤ 3 W

#### Response values

- **Response value $R_{an1}$ (Alarm 1)**: 1…200 kΩ
- **Response time $t_{an}$**: 1 s at $R_F = 0.5 x R_{an}$ and $C_e = 1 \mu F$
- **1…200 kΩ range**: ≤ 3 s
- **1…10 kΩ range**: ≤ 5 s

### Measuring circuit

- **Measuring voltage** $U_m$: ≤ 40 V
- **Measuring current** $I_m$ (at $R = 0$ Ω): ≤ 200 µA
- **Internal DC resistance** $R_i$: ≥ 200 kΩ
- **Impedance $Z_i$ at 50 Hz**: ≥ 180 kΩ
- **Permissible extraneous DC voltage** $U_{fg}$: ≤ 800 V
- **Permissible system leakage capacitance** $C_e$: ≤ 20 µF

### Outputs

- **Test/reset button**: internal/external
- **Current output for measuring instrument (scale centre point = 120 kΩ)**: 0…400 µA
- **Load**: ≤ 25 kΩ

### Switching elements

- **2 changeover contacts**: N/O operation/N/C operation

### Operating principle

- **N/O operation**: IEC 60555-20
- **N/C operation**: IEC 60555-20

### 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/during storage)**: -10…+55 °C/-40…+70 °C
- **Classification of climatic conditions acc. to DIN IEC 60721-3-3**: 3K5

### Connection

- **Connection type**: modular terminals
- **Connection properties**: rigid/flexible
  - 0.2…4 mm²/0.2…2.5 mm²

### Other

- **Degree of protection, internal components (DIN EN 60529)**: IP30
- **Degree of protection, terminals (DIN EN 60529)**: IP20
- **DIN rail mounting acc. to IEC 60715**: IP20
- **Degree of protection, internal components (DIN EN 60529)**: IP30
- **Degree of protection, terminals (DIN EN 60529)**: IP20
- **Screw mounting**: 2 x M4
- **Weight**: ≤ 360 g

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**Dimension diagram** (dimensions in mm)
Combined test/reset button “TEST/RESET”; short-time pressing (< 1 s) = RESET, long-time pressing (> 1 s) = TEST

1. LED Power on “ON”
2. Alarm LEDs “+ALARM -”, yellow, light when the value falls below the set response value and flash in case of interruption of the connecting leads KE/KE or L1/L2
3. LED bar graph indicator
4. Operating principle of the alarm relays and setting range \( R_{\text{ALARM}} \)
   - N/O operation \( \times 10 \) kΩ
   - N/C operation \( \times 1 \) kΩ

Changing the setting range from \( \times 1 \) kΩ to \( \times 10 \) kΩ automatically changes the indication of the kΩ values on the LED bar graph indicator: Setting range \( \times 1 \) kΩ: Meter scale point \( \times 1 \) kΩ.
Setting range \( \times 10 \) kΩ: Meter scale point has to be multiplied by \( 10 \) kΩ.

Potentiometer to set the response value \( R_{\text{ALARM}} \)

1. Alarm relay – N/O operation (basic setting)
2. Alarm relay – N/C operation
3. External kΩ indicating instrument
4. External reset button “LT1, LT2” or bridge for fault memory
5. External test button “PT”
6. \( U_s \) see ordering information, 6 A fuse recommended

Wiring diagram – front plate

1. \( U_n \) 3NAC system
2. \( U_n \) 3AC system
3. \( U_n \) AC system
4. \( U_n \) with coupling devices: AGH204S-4 = 0…1300 V resp. 0…1650 V, AGH520S = 0…7200 V, here: coupling device AGH204S-4 connected to \( U_n \) 3AC system

Wiring diagram – system connection
**ISOMETER® IR470LY2-4061**

Insulation monitoring device for unearthed AC and 3(N)AC systems (IT systems)

- **Device features**
  - Insulation monitoring for AC, 3(N)AC systems 0…793 V (IT systems)
  - Nominal voltage extendable via coupling device
  - Two separately adjustable response values 10…100 kΩ/35…500 kΩ
  - Connection monitoring system/earth
  - LEDs: Power ON LED, LED to signal AC insulation faults
  - LED bar graph indicator for the indication of the insulation resistance
  - Connection for external kΩ indication
  - Combined test and reset button
  - Two separate alarm relays with one potential-free changeover contact each
  - N/O or N/C operation, selectable
  - Fault memory behaviour, selectable

- **Standards**
The ISOMETER® of the IR470LY2-4061 series complies with the requirements of the device standards:

- **Typical applications**
  - AC, 3(N)AC main circuits (without directly connected rectifiers), such as motors, pumps, rolling mills without variable-speed drives, air cooling and air conditioning systems, lighting systems, heating systems, mobile generators, building services, domestic electrical installation practice, etc.

**Approvals**

- CE
- EAC
- Lloyd's Register
- GL

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

**Ordering information**

<table>
<thead>
<tr>
<th>Supply voltage U&lt;sub&gt;S&lt;/sub&gt;</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 230 V</td>
<td>IR470LY2-4061</td>
<td>B 9104 8052</td>
</tr>
</tbody>
</table>

Other supply voltages on request

**Suitable system components**

<table>
<thead>
<tr>
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<th>Page</th>
</tr>
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<td>328</td>
</tr>
<tr>
<td>Coupling devices</td>
<td>AGH204S-4, AGH5205</td>
<td>283, 284</td>
</tr>
</tbody>
</table>
## Technical data

### Insulation coordination acc. to IEC 60664-1

- **Rated insulation voltage**: AC 630 V
- **Rated impulse voltage/pollution degree**: 6 kV/3

### Voltage ranges

<table>
<thead>
<tr>
<th>Nominal system voltage $U_n$</th>
<th>AC, 3(N)AC 0...793 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal frequency $f_n$</td>
<td>40...460 Hz</td>
</tr>
<tr>
<td>Supply voltage $U_s$</td>
<td>see ordering information</td>
</tr>
<tr>
<td>Operating range of $U_s$</td>
<td>0.85...1.15 x $U_n$</td>
</tr>
<tr>
<td>Frequency range $U_s$</td>
<td>50...460 Hz</td>
</tr>
<tr>
<td>Power consumption</td>
<td>≤ 3 VA</td>
</tr>
</tbody>
</table>

### Response values

<table>
<thead>
<tr>
<th>Response value $R_{an1}$ (Alarm 1)</th>
<th>10...100 kΩ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response value $R_{an2}$ (Alarm 2)</td>
<td>35...500 kΩ</td>
</tr>
<tr>
<td>Response time $t_{an}$ ≥ 0.5 x $R_{an}$ and $C_e$ = 1 µF</td>
<td>≤ 1 s</td>
</tr>
</tbody>
</table>

### Measuring circuit

<table>
<thead>
<tr>
<th>Measuring voltage $U_m$</th>
<th>≤ 40 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring current $I_m$ (at $R = 0$ Ω)</td>
<td>≤ 200 µA</td>
</tr>
<tr>
<td>Impedance $Z_{i}$ at 50 Hz</td>
<td>≥ 100 kΩ</td>
</tr>
<tr>
<td>Permissible extraneous DC voltage $U_{by}$</td>
<td>≤ 800 V</td>
</tr>
<tr>
<td>Permissible system leakage capacitance</td>
<td>≤ 20 µF</td>
</tr>
</tbody>
</table>

### Outputs

<table>
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<th>internal/external</th>
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<tbody>
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<td>Current output for measuring instrument (scale centre point = 120 kΩ)</td>
<td>0...400 µA</td>
</tr>
<tr>
<td>Load</td>
<td>≤ 25 kΩ</td>
</tr>
</tbody>
</table>

### Switching elements

- **Number of switching elements**: 2 x 1 changeover contact
- **Operating principle**: N/O operation/N/C operation
- **Factory setting**: N/O operation
- **Electrical endurance, number of cycles**: 12,000
- **Contact class**: 1B in accordance with DIN IEC 60255-6-20
- **Rated contact voltage**: AC 230 V/DC 300 V
- **Making capacity**: AC/DC 5 A
- **Breaking capacity**: 2 A, AC 230 V, cos phi = 0.4 – 0.2 A, DC 220 V, L/R = 0.04 s
- **Contact rating at DC 24 V**: ≥ 2 mA (50 mW)

### 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
- **Classification of climatic conditions acc. to DIN IEC 60721-3-3**: 3K5

### Connection

- **Connection type**: modular terminals
- **Connection properties**: rigid/flexible 0.2...4 mm²/0.2...2.5 mm²

### Other

- **Operating mode**: continuous operation
- **Degree of protection, internal components (DIN EN 60529)**: IP40
- **Degree of protection, terminals (DIN EN 60529)**: IP30
- **Screw mounting**: 2 x M4
- **DIN rail mounting acc. to**: IEC 60715
- **Flammability class**: UL94 V-0
- **Documentation number**: D00120
- **Weight**: ≤ 360 g

---

### Dimension diagram (dimensions in mm)

[Dimensions diagram image]

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**ISOMETER® IR470LY2-4061**

**Insulation monitoring devices | Main circuits**

**2016/2017**

**Insulation monitoring device ISOMETER® IR470LY2-4061**
1 Combined test and reset button “TEST RESET”, short-time pressing (< 1 s) = RESET, long-time pressing (> 2 s) = TEST
2 Power On LED “ON”
3 Alarm LEDs "1 ALARM 2", yellow; light when the value falls below the set response value and flash in case of interruption of the connecting leads U/E or L1/L2
4 kΩ LED bar graph indicator
5 Operating principle of the alarm relay Fault memory
   5.1 N/O operation
   5.2 N/C operation
   5.3 without fault memory
   5.4 with fault memory
6 Potentiometer to set the response value R_ALARM1
7 Potentiometer to set the response value R_ALARM2
8 Alarm relay 1: N/O operation
9 Alarm relay 1: N/C operation
10 Alarm relay 2: N/O operation
11 Alarm relay 2: N/C operation
12 External test button "PT"
13 External reset button “LT1, LT2” or bridge for fault memory
14 Us see ordering information, 6 A fuse recommended
15 External kΩ indicating instrument

Wiring diagram – front plate

1 3NAC system
2 3AC system
3 AC system
4 AC system AC 0…7200 V with coupling device AGHS20S
**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 of IT systems up to AC 1000 V/DC 1500 V
- Measuring low-resistance insulation faults
- Separately configurable response values $R_{\text{Alm1}}$ (Alarm 1) and $R_{\text{Alm2}}$ (Alarm 2) (200 $\Omega$…1 M$\Omega$ for both values) for prewarning and alarm
- Automatic adaptation to high system leakage capacitances, selectable within the indicated range
- Monitoring the connection to DC systems for pole reversal
- Integrated locating current injector up to 50 mA for insulation fault location
- Device self test with automatic alarm message in the event of a fault
- Alarm relays separately adjustable for insulation faults and device errors
- RS-485 interface (BMS bus), e.g. to control insulation fault location
- $\mu$SD card containing 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

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**Approvals**

The ISOMETER® of the iso1685P series complies with the requirements of the device 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**

<table>
<thead>
<tr>
<th>Response value range</th>
<th>Supply voltage</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 $\Omega$…1 M$\Omega$</td>
<td>18…30 V</td>
<td>iso1685P-425</td>
<td>B 9106 5801</td>
</tr>
</tbody>
</table>
Insulation monitoring devices | Main circuits

Insulation monitoring device ISOMETER® iso1685P

* = factory setting

<table>
<thead>
<tr>
<th>Technical data</th>
</tr>
</thead>
</table>

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

- **Nominal system voltage** $U_n$: AC 0…1000 V/DC 0…1500 V
- **Frequency** $f_n$: 0.1…400 Hz
- **Internal DC resistance** $R$: $\leq 7$ kΩ
- **Impedance** $Z$: $\geq 70$ kΩ
- **Permissible extraneous DC voltage** $U_{fg}$: $\leq DC 1500$ V
- **Permissible system leakage capacitance** $C_L$: $\leq 500$ μF (150 μF)*

### Measurement circuit for insulation monitoring

- **Response voltage** $R_{\text{res}}$ (Alarm 1): $200$ Ω…1 MΩ (10 kΩ)*
- **Upper measurement range limit** with the setting $C_{ \text{max} } = 500$ μF: $200$ kΩ
- **Response time** $t_{\text{an}}$: see table

### Measuring circuit for insulation fault location (EDS)

- **Measuring current** $I_{\text{m}}$ (at $f = 0$ kΩ): $\leq 50$ mA
- **Test pulse/break**: 2/4 s

### Displays, memory

- **Alarm LEDs for alarms and operating states**: 2 x green, 3 x yellow
- **μSD card for history memory and log files**: $\leq 32$ GB

### Inputs

- **Digital inputs**: DigIn1/DigIn2:
  - **High level**: 10…30 V
  - **Low level**: 0…0.5 V

### Serial interfaces

- **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 enabled (term. RS-485): $120$ Ω (0.5 W)
- **Device address**, BMS bus: 2…33 (2)*

### Switching elements

- **Switching components**: 3 changeover contacts: K1 (Insulation fault Alarm 1), K2 (Insulation fault Alarm 2), K3 (device error)
- **Operating principle K1, K2**: N/C operation n.c., N/O operation n.o. (N/C operation n.c.)*
- **Operating principle K3**: N/C operation n.c., fixed setting

### 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 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 $\geq 10$ V

### Connection (except power supply connection)

- **Connection type**: pluggable push-wire terminals

- **Connection properties**
  - rigid/flexible: $0.2…2.5/0.2…2.5$ mm²
  - flexible with ferrules without/with plastic sleeve: $0.25…2.5$ mm²
  - Conductor sizes (AWG): 24…12

### Connection of the system coupling

- **Connection type**: pluggable push-wire terminals

- **Connection properties**
  - rigid/flexible: $0.2…10/0.2…6$ mm²
  - flexible with ferrules without/with plastic sleeve: $0.25…6/0.25…4$ mm²
  - Conductor sizes (AWG): 24…8

### Environment/EMC

- **Classification of climatic conditions acc. to IEC 60721**:
  - Without solar radiation, precipitation, water, icing. Condensation possible temporarily:
    - Stationary use (IEC 60721-3-3): 3K5
    - Transport (IEC 60721-3-2): 2K3
    - Long-term storage (IEC 60721-3-1): 1K4
  - Classification of mechanical conditions acc. to IEC 60721:
    - Stationary use for iso1685SP (IEC 60721-3-3): 3M4
    - Stationary use for iso1685SPW (IEC 60721-3-3): 3M7
    - Transport (IEC 60721-3-2): 2M2
    - Long-term storage (IEC 60721-3-1): 1M3

### Deviation from the classification of climatic conditions:

- **Ambient temperature (drying operation)**: $-40…+70$ °C
- **Ambient temperature (transport)**: $-40…+80$ °C
- **Ambient temperature (long-term storage)**: $-25…+80$ °C
- **Relative humidity**: 10…100 %
- **Air pressure**: 700…1060 hPa (max. height 4000 m)

### Other

- **Operating mode**: continuous operation
- **Position of normal use**: vertical, power system connection at the top
- **PCB fixing**: lens head screw DIN7985TX
- **Tightening torque**: 1.0…1.5 Nm
- **Degree of protection, internal components**: IP30
- **Degree of protection, terminals**: IP30
- **Documentation number**: D00003
- **Weight**: 650 g
1. Currently has no function, digital input
2. Currently has no function, digital input
3. Connection to BMS bus, RS-485, S = shield (connected to PE on one side), can be terminated with S700
4. Alarm relay K3 for internal device errors
5. Alarm relay K2 for insulation fault Alarm 2

6. Alarm relay K1 for insulation fault Alarm 1
7. Separate connections of E and KE to PE
8. Connection to $U_s = DC 24 V$ via fuses, je 6 A
9. Connection to the IT system to be monitored
10. Connection to the IT system to be monitored
ISOMETER® iso685-...
Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems)

Device features
- Insulation monitoring for unearthed systems AC, 3(N)AC 0…690 V, DC 0…1000 V
- Nominal system voltage expandable via coupling devices
- Two separately adjustable response values 1 kΩ…10 MΩ
- Combination of AMPPLUS and other profile-specific measurement methods
- Continuous measurement of capacitance, voltage and system frequency
- Predefined measurement profiles to meet different requirements
- Automatic adaptation to the system leakage capacitance
- INFO button to display device and network settings
- Self-monitoring with automatic alarm message
- 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
- Permanent coupling monitoring of the measuring lines
- Freely configurable digital and analogue inputs and outputs
- Two separate alarm relays with potential-free contact
- N/O or N/C operation selectable
- High-resolution graphic LC display
- IsoGraph function for time-related representation of the insulation resistance
- Remote setting of certain parameters via Internet (web server/option; COMTRAXX® Gateway)
- Worldwide remote diagnosis via Internet
- Modbus TCP, web server and BCOM
- Multilingual

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.

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 including switched-mode power supplies
- IT systems with high leakage capacitances

Standards
The ISOMETER® iso685-D-B series corresponds to the device standard: DIN EN 61557-8

Further information
For further information refer to our product range on www.bender.de.
### Insulation monitoring devices | Main circuits

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A set of screw terminals</td>
<td>B 9106 7901</td>
</tr>
<tr>
<td>A set of push-wire terminals</td>
<td>B 9106 7902</td>
</tr>
<tr>
<td>Enclosure accessories (terminal cover, 2 mounting clips)</td>
<td>B 9106 7903</td>
</tr>
<tr>
<td>Front cover 144x72 transparent (for IP65)</td>
<td>B 9060 0005</td>
</tr>
</tbody>
</table>

**11) included in the scope of delivery**

### 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 (OV): 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.

**Pollution degree for accessible parts on the outside of the device housing:**
- (Ue < 690 V): 3;
- (Ue > 690 V < 1000 V): 2.

**Protective separation (reinforced insulation) between:**
- IC1/(IC2-5): OVC III, 1000 V;
- IC2/(IC3-5): OVC III, 300 V;
- IC3/(IC4-5): OVC III, 300 V;
- IC4/IC5: OVC III, 300 V.

**Voltage test (routine test) according to IEC 61010-1:**
- IC2/(IC3-5): AC 2.2 kV;
- IC3/(IC4-5): AC 2.2 kV;
- IC4/IC5: AC 2.2 kV.

**Supply voltage range Ue:**
- AC/DC 24...240 V.

### IT system being monitored

**Nominal system voltage range Ue:**
- AC 0...690 V;
- DC 0...1000 V

**Tolerance of Ue:**
- AC/DC ± 15 %

**Frequency range of Ue:**
- DC 1...460 Hz

**Max. AC voltage Umax**
- In the frequency range fmax = 1...10 Hz:
  - Umax = 110 V/Hz + fmax

**Response values**
- Response value Ran (alarm 1): 1 kΩ; 10 kΩ (40 kΩ)
- Response value Ran2 (alarm 2): 1 kΩ; 10 kΩ (10 kΩ)

**Relative uncertainty**
- (acc. to IEC 61557-8): profile dependent, ±15 %, at least ±1 kΩ;
- Hysteresis: 25 %, at least 1 kΩ

**Time response**
- Response time tRan at tmax = 0.5 x tRan (Ran = 10 kΩ) and CR1 = 1 μF according to IEC 61557-8:
  - Profile dependent, typ. 4 s (see diagrams in manual)
  - Start-up delay tFstart-up:
    - 0...120 s (0 s)*

**Measuring circuit**
- Measuring voltage U1:
  - Profile dependent, ±10 V, ±50 V
- Measuring current I1:
  - ≤ 403 μA
- Internal resistance R1:
  - ≥ 124 kΩ

**Permissible extraneous DC voltage Uex**
- ≤ 1200 V

**Permissible system leakage capacitance CR**
- Profile dependent, 0...1000 μF

**Measuring ranges**
- Measuring range f1:
  - 10...460 Hz
- Tolerance measurement of f1:
  - ±1 % ±0.1 Hz
- Voltage range measurement of f1:
  - AC 25...690 V
- Measuring range U2:
  - AC 25...690 V
- DC 25...1000 V
- Voltage range measurement of U2:
  - AC/DC > 10 V
- Tolerance measurement of U2:
  - ±5 % ±5 V
- Measuring range CR:
  - 0...1000 μF
- Tolerance measurement of CR:
  - ±10 % ±10 μF
- Frequency range measurement of CR:
  - DC 30...460 Hz
- Min. insulation resistance measurement of CR:
  - Depending on the profile and coupling mode, typ. > 10 kΩ

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1) Increased shock and vibration resistance 3K5 and 3M7.

2) Tolerance measurement of C

3) Tolerance measurement of U

---

**Ordering information**

<table>
<thead>
<tr>
<th>Nominal system voltage range Ue</th>
<th>Supply voltage Ue</th>
<th>Display</th>
<th>Option “W”</th>
<th>Type</th>
<th>Art. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC 0...690 V</td>
<td>AC/DC 24...240 V</td>
<td>-</td>
<td>-</td>
<td>iso685-D</td>
<td>B 9106 7010</td>
</tr>
</tbody>
</table>

**Accessories**

<table>
<thead>
<tr>
<th>Description</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Front cover 144x72 transparent (for IP65)</td>
<td>B 9060 0005</td>
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</table>

**Suitable measuring instruments on request!**

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<th>Option “W”</th>
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<td>-</td>
<td>-</td>
<td>iso685-D</td>
<td>B 9106 7010</td>
</tr>
</tbody>
</table>

---

**Device version without display:**
- iso685-S
- iso685-D

**Display for front panel mounting:**
- FP200 64

**Coupling devices:**
- AGH150W-4 282
- AGH204S-4 283
- AGH520S 284
- AGH767S-4 287
## Technical data (continued)

### Display
- **Indication**: graphic display 127 x 127 pixels, 40 x 40 mm
- **Display range measured value**: 0.1 kΩ to 20 MΩ

### LEDs
- **ON (operation LED)**: green
- **SERVICE**: off, test, reset, deactivate device, start initial measurement
- **ALARM 1**: yellow
- **ALARM 2**: yellow

### Digital inputs
- **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
- **Cable length X1**: ≤ 1 m

### Digital outputs
- **Number**: 2
- **Operating mode, adjustable**: active, passive
- **Functions**: 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
- **Voltage**: passive DC 0...32 V, active DC 0/19...32 V
- **Max. current internal sum X1**: max. 200 mA
- **Max. current per channel**: max. 1 A
- **Cable length X1**: ≤ 1 m

### Analogue output
- **Number**: 1
- **Operating mode**: linear, midscale point 28 kΩ/120 kΩ
- **Functions**: insulation value, insulation, DC offset
- **Current**: 0...20 mA (< 600 Ω), 0.5...0.6 Nm (5...7 lb-in)
- **Conductor sizes**: AWG 24-12
- **Striping length**: ≤ 10 A
- **Conductor sizes**: AWG 24-12
- **Striping length**: 10 mm
- **r/g**: flexible with ferrules, with/without plastic sleeve
- **Multiple conductor, rigid**: 0.25...1 mm²
- **Multiple conductor, flexible**: 0.25...1 mm²
- **Multiple conductor, flexible with TWIN ferrule with plastic sleeve**: 0.5...1.5 mm²

### Environment/EMC
- **EMC**: IEC 61326-2-4
- **Ambient temperatures**: -25...+55 °C
- **Transport**: -40...+70 °C
- **Long-term storage**: -40...+70 °C
- **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
- **Long-term storage (IEC 60721-3-1)**: 1K4

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

#### Screw-type terminals:
- **Nominal current**: ≤ 10 A
- **Conductor sizes**: AWG 24-16
- **Striping length**: 10 mm
- **r/g**: flexible with ferrules, with/without plastic sleeve
- **Multiple conductor, rigid**: 0.25...1 mm²
- **Multiple conductor, flexible**: 0.25...1 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
- **Striping length**: 10 mm
- **r/g**: flexible with ferrule without plastic sleeve
- **Multiple conductor, flexible with TWIN ferrule with plastic sleeve**: 0.5...1.5 mm²

#### Push-wire terminals X2:
- **Nominal current**: ≤ 10 A
- **Conductor sizes**: AWG 24-12
- **Striping length**: 10 mm
- **r/g**: flexible with ferrule without plastic sleeve
- **Multiple conductor, flexible with TWIN ferrule with plastic sleeve**: 0.5...1.5 mm²

### Other
- **Degree of protection internal components**: IP20
- **Degree of protection terminals**: IP65
- **Enclosure material**: polycarbonate
- **Ferrule material**: nylon (K-V)
- **Weight**: ≤ 390 g
- **Dimensions (W x H x D)**: 108 x 93 x 110 mm
- **Document number**: D00025
- **Area of application**: ≤ 300 m NN

### Option “W” data different from the standard version
- **Ambient temperatures**: Operating temperature: -25...+55 °C
- **Transport**: -40...+70 °C
- **Long-term storage**: -40...+70 °C
- **Classification of climatic conditions acc. to IEC 60721**: Stationary use (IEC 60721-3-3) 3K5 (condensation and formation of ice possible)
- **Classification of mechanical conditions acc. to IEC 60721**: Stationary use (IEC 60721-3-3) 3M7
**Dimension diagram** (dimensions in mm)

Connection to FP200

Displays and controls

1. “∧” button: up, increase value
2. “RESET” button: reset messages
3. “<” button: back, select parameter
4. “DATA” button: display data values
5. “∨” button: down, decrease value
6. “MENU” button: start device menu
7. “ESC” button: abort, return to the previous menu level
8. “TEST” button: carry out self test
9. “>” button: forward, select parameter
10. “INFO” button: display information
11. “OK” button: OK, confirm
12. LED “ON”: Operation
13. LED indication “SERVICE, ALARM 1, ALARM 2”
14. LC display
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 ≤ 690 V 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.
ISOMETER® iso685-…-B
Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems)

Device features

- Insulation monitoring for unearthed systems AC, 3(N)AC 0…690 V, DC 0…1000 V
- Two separately adjustable response values 1 kΩ…10 MΩ
- Combination of AMP plus and other profile-specific measurement methods
- Continuous measurement of capacitance, voltage and system frequency
- Predefined measurement profiles to meet different requirements
- Automatic adaptation to the system leakage capacitance
- INFO button to display devices and network settings
- Self-monitoring with automatic alarm message
- 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
- Permanent coupling monitoring of the measuring lines
- Freely configurable digital and analogue inputs and outputs
- High-resolution graphic LC display
- IsoGraph function for time-related representation of the insulation resistance
- Remote setting and diagnosis via Internet (web server/option; COMTRAXX® Gateway)
- Modbus TCP, web server and BCOM
- Internal system isolating switch for use in coupled systems (ISOnet)
- Multilingual

Device variants

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

- iso685-S-B
  The device version iso685-S-B 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® iso685 series corresponds to the device standard: DIN EN 61557-8

Further information

For further information refer to our product range on www.bender.de.
Tolerance of IC2/(IC3-5) Voltage test (routine test) according to IEC 61010-1:

<table>
<thead>
<tr>
<th>Supply voltage IC4/IC5</th>
<th>IC3/(IC4-5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24…240 V</td>
<td>24…240 V</td>
</tr>
</tbody>
</table>

Supply voltage range

<table>
<thead>
<tr>
<th>AC</th>
<th>DC</th>
<th>AC</th>
<th>DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>0…690 V</td>
<td>1…460 Hz</td>
<td>0…1000 V</td>
<td></td>
</tr>
</tbody>
</table>

Supply voltage

<table>
<thead>
<tr>
<th>AC</th>
<th>DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>24…240 V</td>
<td>250 V</td>
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Overvoltage category (OVC)

<table>
<thead>
<tr>
<th>OVC</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
</tr>
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</table>

Rated impulse voltage:

<table>
<thead>
<tr>
<th>OVC</th>
<th>C1/(IC2-5)</th>
<th>C2/(IC3-5)</th>
<th>C3/(IC4-5)</th>
<th>C4/IC5</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>8 kV</td>
<td>4 kV</td>
<td>4 kV</td>
<td>4 kV</td>
</tr>
</tbody>
</table>

Rated insulation voltage:

<table>
<thead>
<tr>
<th>C1/(IC2-5)</th>
<th>C2/(IC3-5)</th>
<th>C3/(IC4-5)</th>
<th>C4/IC5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 V</td>
<td>250 V</td>
<td>250 V</td>
<td>250 V</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Pollution degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Pollution degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
</tr>
</tbody>
</table>

Protective separation (reinforced insulation) between:

<table>
<thead>
<tr>
<th>C1/(IC2-5)</th>
<th>C2/(IC3-5)</th>
<th>C3/(IC4-5)</th>
<th>C4/IC5</th>
</tr>
</thead>
<tbody>
<tr>
<td>OVC, III</td>
<td>1000 V</td>
<td>250 V</td>
<td>250 V</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>C1/(IC2-5)</th>
<th>C2/(IC3-5)</th>
<th>C3/(IC4-5)</th>
<th>C4/IC5</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 2.2 kV</td>
<td>AC 2.2 kV</td>
<td>AC 2.2 kV</td>
<td>AC 2.2 kV</td>
</tr>
</tbody>
</table>

Supply voltage

<table>
<thead>
<tr>
<th>Supply voltage range U1</th>
<th>Tolerance of U1</th>
<th>Maximum permissible input current of U1</th>
<th>Frequency range of U1</th>
<th>Power consumption, typically 50 Hz (400 Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC 24…240 V</td>
<td>-20…+15 %</td>
<td>≤ 650 mA</td>
<td>DC 50…400 Hz</td>
<td>≤ 12 W/21 VA (≤ 12 W/45 VA)</td>
</tr>
</tbody>
</table>

IT system being monitored

<table>
<thead>
<tr>
<th>Nominal system voltage range U1</th>
<th>Tolerance of U1</th>
<th>Frequency range of U1</th>
<th>Max. AC voltage U~ – in the frequency range f1 = 1…10 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 0…690 V</td>
<td>AC/DC +15 %</td>
<td>DC 0…1000 V</td>
<td>U~ max = 110 V/Hz * f1</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. no./page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device version without display</td>
<td>iso685-S-B</td>
<td>B 9106 7120</td>
</tr>
<tr>
<td>Display for front panel mounting</td>
<td>FP200W</td>
<td>64</td>
</tr>
</tbody>
</table>

Suitable measuring instruments on request!

### Technical data

**Insulation monitoring device ISOMETER® iso685-…-B**

- **Insulation monitoring device ISOMETER® iso685-…-B**
- **Display range measured value**: 0.1 kΩ...20 MΩ

**Ordering information**

<table>
<thead>
<tr>
<th>Nominal system voltage range U1</th>
<th>Supply voltage U5</th>
<th>Display</th>
<th>Option &quot;W&quot;</th>
<th>Type</th>
<th>Art. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>DC</td>
<td>AC</td>
<td>DC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0…690 V</td>
<td>1…460 Hz</td>
<td>24…240 V</td>
<td>250…400 Hz</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Accessories**

- **A set of screw terminals**: B 9106 7902
- **A set of push-wire terminals**: B 9106 7901
- **Enclosure accessories (terminal cover, 2 mounting clips)**: B 9106 7903
- **Front cover 144x72 transparent (for IP65)**: B 9806 0005

1) Increased shock and vibration resistance 3K5 and 3M7.

**Display**

<table>
<thead>
<tr>
<th>Display code</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;W&quot;</td>
<td>Off, test, reset, deactivate device, start initial measurement</td>
</tr>
</tbody>
</table>

**Start-up delay**

<table>
<thead>
<tr>
<th>T1</th>
</tr>
</thead>
<tbody>
<tr>
<td>start-up</td>
</tr>
</tbody>
</table>

**Time response**

<table>
<thead>
<tr>
<th>Time response</th>
</tr>
</thead>
<tbody>
<tr>
<td>typ. 0…120 s</td>
</tr>
</tbody>
</table>

**Response values**

- **Response value R1 (alarm 1)**: 1 kΩ…10 MΩ
- **Response value R2 (alarm 2)**: 1 kΩ…10 MΩ

**Relative uncertainty (acc. to IEC 61557-8)**

- **Requirement dependent, ±15 %**, at least ±1 kΩ

**Hysteresis**

- **Requirement dependent, ±15 %, at least ±1 kΩ**

**Measuring circuit**

- **Measuring voltage U1**
- **Tolerance measurement of U1**
- **Measuring current I1**
- **Tolerance measurement of I1**
- **Internal resistance R1**, typ. 124 kΩ
- **Permissible extraneous DC voltage U0**
- **Permissible system leakage capacitance C0**

**Measuring ranges**

- **Measuring range f0**
- **Tolerance measurement of f0**
- **Voltage range measurement of f0**
- **Measuring range U0**
- **Tolerance measurement of U0**
- **Measuring range C0**
- **Tolerance measurement of C0**

**Response values**

- 10…460 Hz
- ±1 % ±5 V
- ±5 % ±5 V
- ±10 % ±10 μF
- ±10 % ±10 μF
- ±10 % ±10 μF
- ±10 % ±10 μF
- ±10 % ±10 μF

**Supply voltage range U1**

<table>
<thead>
<tr>
<th>Supply voltage range U5</th>
<th>Tolerance of U5</th>
<th>Maximum permissible input current of U5</th>
<th>Frequency range of U5</th>
<th>Power consumption, typically 50 Hz (400 Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC 24…240 V</td>
<td>-20…+15 %</td>
<td>≤ 650 mA</td>
<td>DC 50…400 Hz</td>
<td>≤ 12 W/21 VA (≤ 12 W/45 VA)</td>
</tr>
</tbody>
</table>

**IT system being monitored**

<table>
<thead>
<tr>
<th>Nominal system voltage range U1</th>
<th>Tolerance of U1</th>
<th>Frequency range of U1</th>
<th>Max. AC voltage U~ – in the frequency range f1 = 1…10 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 0…690 V</td>
<td>AC/DC +15 %</td>
<td>DC 0…1000 V</td>
<td>U~ max = 110 V/Hz * f1</td>
</tr>
</tbody>
</table>

**Digital inputs**

<table>
<thead>
<tr>
<th>Number</th>
<th>Operating mode, adjustable</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>active high, active low</td>
<td>off, test, reset, deactivate device, start initial measurement</td>
</tr>
</tbody>
</table>

**Voltage**

- **Low DC**: 3…5 V, High DC 11…32 V

**Cable length X1**

<table>
<thead>
<tr>
<th>Cable length X1</th>
<th>≤ 1 m</th>
</tr>
</thead>
</table>
## Technical data (continued)

### Digital outputs

<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...32 V</td>
</tr>
<tr>
<td>Max. current internal</td>
<td>X1</td>
</tr>
<tr>
<td>Max. current external per channel</td>
<td>X1</td>
</tr>
</tbody>
</table>

### Analogue output

<table>
<thead>
<tr>
<th>Number</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating mode</td>
<td>linear, midrange point 28 kΩ/120 kΩ</td>
</tr>
<tr>
<td>Functions</td>
<td>insulation value, DC offset</td>
</tr>
<tr>
<td>Current</td>
<td>0...20 mA (&lt; 600 Ω), 4...20 mA (&lt; 600 Ω), 0...400 μA (&lt; 4 kΩ)</td>
</tr>
<tr>
<td>Voltage</td>
<td>0...10 V (&gt;1 kΩ), 2...10 V (&gt;1 kΩ)</td>
</tr>
<tr>
<td>Tolerance</td>
<td>±20 %</td>
</tr>
</tbody>
</table>

### Interfaces

#### Field bus:

| Data rate | 10/100 Mbit/s, autodetect |
| Max. amount Modbus requests | < 1000/s |
| Cable length | ≤ 100 m |
| IP address | DHCP/manual 192.168.0.5 |
| Network mask | 255.255.255.0 |
| BCD address | system-1-0 |
| Function | communication interface |

#### ISOnet

| Number ISOnet devices | ≤ 5 |
| Sensor bus: | |
| Interface/protocol | web server/Modbus TCP/BCOM |
| Data rate | 9.6 kbaud/s |
| Cable length | ≤ 1200 m |
| Cable: twisted pair, one end of shield connected to PE | recommended: 1-Y(Ø4)Y min. 2xØ8 |
| Terminating resistor at the beginning and at the end of the transmission path | 120 Ω, can be connected internally |

#### Switching elements

| Number of switching elements | 2 changeover contacts |
| Operating mode | N/C operation/N/O operation |
| Contact 11-12-14 | 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 |
| Contact 21-22-24 | 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 |

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

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

| Utilisation category | AC-13/A-C14/DC12/DC12-DC12 |
| 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 | ≤ 2000 m NN |
| Rated insulation voltage | 250 V |
| Rated insulation voltage | ≤ 3000 m NN |
| Minimum contact rating | 1 mA at AC/DC > 10 V |

### Environment/EMC

| EMC | IEC 61326-2-4 |
| Environmental conditions: | |
| Operating temperature | -25...+55 °C |
| Transport | -40...+70 °C |
| Long-term storage | -40...+70 °C |

### Option “W” data different from the standard version

#### 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) | SKS (except condensation and formation of ice) |
| Transport (IEC 60721-3-3) | 2K3 |
| Long-term storage (IEC 60721-3-1) | 1K4 |

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

| Stationary use (IEC 60721-3-3) | 3M4 |
| Transport (IEC 60721-3-3) | 2M2 |
| Long-term storage (IEC 60721-3-1) | 1M3 |

#### Area of application

| ≤ 3000 m NN |
Insulation monitoring devices | Main circuits

**ISOMETER® iso685-...-B**

**Connection to FP200**

**Displays and controls**

1. "A" button: up, increase value
2. "RESET" button: reset messages
3. "<" button: back, select parameter
4. "DATA" button: display data values
5. "V" button: down, decrease value
6. "MENU" button: start device menu
7. "ESC" button: abort, return to the previous menu level
8. "TEST" button: carry out self test
9. "INFO" button: display information
10. "OK" button: OK, confirm
11. LED "ON": Operation
12. LED indication "SERVICE, ALARM 1, ALARM 2"
13. LC display
**Insulation monitoring devices | Main circuits**

**Insulation monitoring device ISOMETER® iso685-...-B**

**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>

**Digital outputs**

- Passive
- Active

**Digital inputs**

- High-Active
- Low-Active

**Analogue output**

- Current output
- Voltage output

**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/+ and 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.
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**
- 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 AMP™ and other profile-dependent 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 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 of certain parameters via the Internet (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.
- 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

**Device variants**
- iso685-D-P
  The device version 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 iso685-S-P variant itself does not feature a display and can only be used in combination with an FP200. The iso685-S-P is thereby operated indirectly via the FP200.
- Option “W”
  Device variants with Option “W” are available for extreme climatic and mechanical conditions.

**Standards**
Die ISOMETER® iso685-…-P series meets the device standards:

**Approvals**
UL in preparation
Lloyds Register in preparation

**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 including switch mode power supplies
- IT systems with high leakage capacitances
- Installations with insulation fault location

**Further information**
For further information refer to our product range on www.bender.de.
### 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, K2), (E1, ET3, X, X4)

**Rated voltage:**
- 1000 V

**Overvoltage category (OV)C**
- III

**Rated impulse voltage:**
- IC1(2-5) 8 kV
- IC2(3-5) 4 kV
- IC3(4-5) 4 kV
- IC4/IC5 4 kV

**Rated insulation voltage:**
- IC1(2-5) 1000 V
- IC2(3-5) 250 V
- IC3(4-5) 250 V
- IC4/IC5 250 V

**Pollution degree for accessible parts on the outside of the device housing:**
- U1 < 690 V
- U1 > 690 < 1000 V

**Protective separation (reinforced insulation) between:**
- IC1(2-5) OVC III, 1000 V
- IC2(3-5) OVC III, 100 V
- IC3(4-5) OVC III, 100 V
- IC4/IC5 OVC III, 100 V

**Voltage test (routine test) according to IEC 61010-1:**
- IC2(3-5) AC 2,2 kV
- IC3(4-5) AC 2,2 kV
- IC4/IC5 AC 2,2 kV

**Supply voltage**
- Supply voltage range U1
- Tolerance of U1
- Maximum permissible input current of U1
- Frequency range of U1
- Tolerance of the frequency range of U1
- Power consumption
- Tolerance of U2
- Frequency range of U2
- Max. AC voltage U in the frequency range

**IT system being monitored**
- Nominal system voltage range U2
- Tolerance of U2
- Frequency range of U2

### Ordering information

**Nominal system voltage range U1**

<table>
<thead>
<tr>
<th>AC</th>
<th>DC</th>
<th>AC</th>
<th>DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>0…690 V</td>
<td>0…1000 V</td>
<td>24…240 V, 50…400 Hz</td>
<td>24…240 V</td>
</tr>
</tbody>
</table>

**Supply voltage U2**

<table>
<thead>
<tr>
<th>AC</th>
<th>DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>0…690 V</td>
<td>0…1000 V</td>
</tr>
</tbody>
</table>

**Display Options**

<table>
<thead>
<tr>
<th>Display</th>
<th>Option &quot;W&quot;</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>-iso685-D-P</td>
<td>1) B9106 7030</td>
<td></td>
</tr>
<tr>
<td>Display</td>
<td>-iso685W-D-P</td>
<td>1) B9106 7030</td>
<td></td>
</tr>
<tr>
<td>Display</td>
<td>-iso685-S-P +FP200</td>
<td>1) B9106 7230</td>
<td></td>
</tr>
<tr>
<td>Display</td>
<td>-iso685W-S-P +FP200W</td>
<td>1) B9106 7230</td>
<td></td>
</tr>
</tbody>
</table>

**Accessories**

- A set of screw-type terminals 1)
- A set of push-wire terminals
- Enclosure accessories (terminal cover, 2 mounting clips) 1)
- Front cover 144x72 transparent (for IP65)

**Suitable system components**

- Device version without display
- Display for front panel mounting

**Response values**

| Response value Rmax 1 | Relative uncertainty
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 kΩ…10 MΩ 2</td>
<td>profile dependent</td>
</tr>
<tr>
<td>1 kΩ…10 MΩ 2</td>
<td>profile dependent</td>
</tr>
<tr>
<td>±15 %, at least ±1 kΩ</td>
<td>profile dependent</td>
</tr>
<tr>
<td>±25 %, at least 1 kΩ</td>
<td>profile dependent</td>
</tr>
</tbody>
</table>

**Response time**

| Response time τon at R1 = 0.5 x Rmax (Rmax = 10 kΩ) and C2 = 1 μF | profile dependent, typ. 4 s (see diagrams in manual) |
| Response time -dc offset alarm at Ce = 1 μF | profile dependent, typ. 2 s (see diagrams in manual) |
| Start-up delay τstart-up | 0…120 s |

**Measuring circuit**

- Measuring voltage Uin
- Measuring current Im
- Relative uncertainty
- Internal resistance Rn
- Permissible extraneous DC voltage Ue
- Permissible system leakage capacitance Ce

**Measuring circuit for insulation fault location (EDS):**

- Locating current IL
- Frequency range measurement of
- Measuring voltage
- Measuring current
- Measuring range
- Measuring range
- Measuring range
- Measuring range
- Min. insulation resistance measurement of

**Suitable measuring instruments on request!**

### Suitable measuring instruments on request!

**Description** | **Type** | **Art./page** |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Device version without display</td>
<td>iso685-S-P</td>
<td>B9106 7130</td>
</tr>
<tr>
<td>Display for front panel mounting</td>
<td>FP200</td>
<td>64</td>
</tr>
</tbody>
</table>

**Responses**

| Response an1 (alarm 1) | 1 kΩ…10 MΩ |
| Response an2 (alarm 2) | 1 kΩ…10 MΩ |

**Response time**

| Response time τon at R1 = 0.5 x Rmax (Rmax = 10 kΩ) and C2 = 1 μF |
| Response time -dc offset alarm at Ce = 1 μF |

| Start-up delay τstart-up | 0…120 s |

**Measuring ranges**

| Measuring range IL | 10…460 Hz |
| Tolerance measurement of | ±1 % ±0.1 Hz |
| Voltage range measurement of IL | AC 25…690 V |
| Measuring range IL | AC 25…690 V |
| Tolerance measurement of IL | DC 25…1000 V |
| Voltage range measurement of IL | AC/DC > 10 V |
| Tolerance measurement of IL | ±5 % ±5 V |
| Measuring range Ce | 0…7000 μF |
| Tolerance measurement of Ce | ±10 % ±10 μF |
| Frequency range measurement of Ce | DC 30…460 Hz |

**Suitable measuring instruments on request!**

**Display**

| Indication | Graphic display 127 x 127 pixels, 40 x 40 mm |
| Display range measured value | 0.1 kΩ…20 MΩ |

**LEDs**

| ON (operation LED) | green |
| SERVICE | yellow |
| ALARM 1 | yellow |
| ALARM 2 | yellow |
### Technical data (continued)

#### Digital inputs

<table>
<thead>
<tr>
<th>Number</th>
<th>Operating mode, adjustable</th>
<th>Functions</th>
<th>Voltage</th>
<th>Cable length X1</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>active, high, active low</td>
<td>off, test, reset, deactivate device, start initial measurement, insulation fault location</td>
<td>Low DC -3…5 V, High DC 11…32 V</td>
<td>≤ 1 m</td>
</tr>
</tbody>
</table>

#### Digital outputs

<table>
<thead>
<tr>
<th>Number</th>
<th>Operating mode, adjustable</th>
<th>Functions</th>
<th>Voltage</th>
<th>Max. current internal sum X1</th>
<th>Max. current external per channel</th>
<th>Cable length X1</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>active, passive</td>
<td>off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm, symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm, common alarm EDS</td>
<td>passive DC 0…32 V, active DC 0/19.2…32 V</td>
<td>max. 200 mA</td>
<td>max. 1 A</td>
<td>≤ 1 m</td>
</tr>
</tbody>
</table>

#### Analogue output

<table>
<thead>
<tr>
<th>Number</th>
<th>Operating mode</th>
<th>Functions</th>
<th>Current, voltage</th>
<th>Cable length</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>linear, midscale point 28 kΩ/120 kΩ</td>
<td>insulation value, DC offset</td>
<td>0…20 mA (&lt;600 Ω), 4…20 mA (&lt;600 Ω), 0…400 μA (&lt;4 kΩ), 0…10 V (&lt;1 kΩ), 2…10 V (&lt;1 kΩ)</td>
<td>≤ 100 m</td>
<td>±20 %</td>
</tr>
</tbody>
</table>

#### 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: system-1-0
- Function: communication interface

**ISOnet:**
- Number ISOnet devices: ≤ 20

**Sensor bus:**
- Interface/protocol: RS-485/BS
- Data rate: 9.6 kbaud/s
- Cable length: ≤ 1200 m
- Cable: twisted pair, one end of divider connected to PE recommended: J-Y/SY/Y min. 2x0.8

#### 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

<table>
<thead>
<tr>
<th>Number of switching elements</th>
<th>Operating mode</th>
<th>Contact 11-12-14</th>
<th>Contact 21-22-24</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>N/C operation/N/O operation</td>
<td>off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm, symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm, common alarm EDS</td>
<td>off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm, symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm, common alarm EDS</td>
</tr>
</tbody>
</table>

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

#### Contact data acc. to IEC 60947-5-1:
- Contact 11-12-14
- Contact 21-22-24

#### Utilisation category
<table>
<thead>
<tr>
<th>AC-13/AC-14/DC-12/DC-12/DC-12</th>
</tr>
</thead>
</table>

#### Rated operational current
- 5 A/3 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 61136-2-4:3

#### Ambient temperatures:
- Operating temperature: -25…+55 °C
- Transport: −40…+70 °C
- Long-term storage: −40…+70 °C

#### 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
- Long-term storage (IEC 60721-3-1) | 1K4
- Classification of mechanical conditions acc. to IEC 60721:
- Stationary use (IEC 60721-3-3) | 3M4
- Transport (IEC 60721-3-2) | 2M2
- Long-term storage (IEC 60721-3-1) | 1M3

**Area of application:** ≤ 3000 m NN

#### Connection

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

#### Screw-type terminals:

**Nominal current:** ≤ 10 A

**Conductor sizes:**
- AWG 24-12
- Stripping length: 7 mm
- 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 TW1 ferrule with plastic sleeve: 0.25…1.5 mm²

**Push-wire terminals:**

**Nominal current:** ≤ 10 A

**Conductor sizes:**
- AWG 24-12
- Stripping length: 10 mm
- Flexible with ferrules, with/without plastic sleeve: 0.25…2.5 mm²
- Multiple conductor, flexible with TW1 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 with ferrule without plastic sleeve: 0.25…1.5 mm²
- Flexible with TW1 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
- Flammability class: V-0
- Enclosure material: polycarbonate
- Dimensions (W x H x D): 108 x 93 x 110 mm
- Document number: D00170
- Weight: ≤ 510 g

#### Option “W” data different from the standard version

- 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 60721-3-1) | 3K5 (condensation and formation of ice possible) | Transport (IEC 60721-3-2) | 2K3
  - Long-term storage (IEC 60721-3-1) | 1K4
  - Classification of mechanical conditions acc. to IEC 60721:
    - Stationary use (IEC 60721-3-3) | 3M4
    - Transport (IEC 60721-3-2) | 2M2
    - Long-term storage (IEC 60721-3-1) | 1M3

- 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.
- 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.
Connection to FP200

Displays and controls

1. “EDS” button: starts the insulation fault location permanently manually or stops the insulation fault location immediately.
   “^” button: up, increase value
2. “RESET” button: reset messages
   “<” button: back, select parameter
3. “DATA” button: display data values
   “V” button: down, decrease value
4. “MENU” button: start device menu
   “ESC” button: abort, return to the previous menu level
5. “TEST” button: carry out self test
6. “>” button: forward, select parameter
7. “INFO” button: display information
   “OK” button: OK, confirm
8. LED indication “ON”: Operation
9. LED indication “PGH ON, SERVICE, ALARM 1, ALARM 2”
10. LC display
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 $\leq 690$ 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.
(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>

### Digital outputs
- Passive
- Active

### Digital inputs
- High-Active
- Low-Active

### Analogue output
- Current output
- Voltage output

---

Example of wiring diagram:Provide line protection!

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.
Connection example ISOMETER® with insulation fault locators

System setup

ISOMETER® iso685-D-P

Ethernet

BS

EDS44...-L

EDS44...-L

EDS195P

COM465

Router

Browser
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 AMP® 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
- 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: COMTRAX® gateway)
- Worldwide remote diagnosis via the Internet
- BCOM, Modbus TCP and web server

Standards
The ISOMETER® isoNAV685-D series corresponds to the device standard: DIN EN 61557-8 (VDE 0413-8)

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

Typical applications
- AC/DC main circuits with directly connected DC components, such as rectifiers, converters, variable-speed drives
- Systems including switch mode power supplies
- Systems including frequency inverters

Approvals
UL in preparation
Lloyds Register in preparation

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 AC DC</td>
<td>0…690 V; 60 Hz</td>
<td>100…240 V; 47…460 Hz</td>
<td>24 V, 100…240 V</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(^1)</td>
<td>B 9106 7901</td>
</tr>
<tr>
<td>A set of push-wire terminals</td>
<td>B 9106 7902</td>
</tr>
<tr>
<td>Enclosure accessories (terminal cover, 2 mounting clips)(^1)</td>
<td>B 9106 7903</td>
</tr>
<tr>
<td>Front cover 144x72 transparent (for IP65)</td>
<td>B 9806 0005</td>
</tr>
</tbody>
</table>

\(^1\) included in the scope of delivery
Suitable measuring instruments on request!
Technical data

Insulation coordination
Rated insulation voltage (IEC 60664-1) 1000 V
Rated impulse voltage (IEC 60664-1) 8 kV
Overvoltage category III
Pollution degree (UI) ≤ 600 V 3
Pollution degree (UI) ≤ 1000 V 2
Protective separation (reinforced insulation) between (A1, A2) - (11, 12, 14) - (21, 22, 24) - (L1+/L2, L2/L3-), (E, KE), (X1, ETH)
Voltage test, routine test (IEC 61010-1) 4.3 kV

Supply voltage
Supply via A1+/-, A2-/:
Supply voltage range UD AC/DC 100…240 V
Tolerance of UD AC 15% +/− 10% DC 15% +/− 15% Frequency range of UD DC 47…60 Hz
Power consumption, typically 50 Hz (460 Hz) 5.7 W/20 VA (7.9 W/45.5 VA)

Supply via X1:
Supply voltage UX DC 24 V
Tolerance of UX DC 20% +/− 25%

IT system being monitored
Nominal system voltage range UD AC 0…690 V
Tolerance of UD AC 15% Frequency of UD 60 Hz

Response values
Response value Rw alarm (Alarm 1) 1 kΩ ± 10% (5 kΩ)*
Response value DC offset voltage (Alarm 2) (UXDC) 20 V…1 kV (150 V)*
Relative uncertainty (acc. to IEC 61557-8) profile-dependent ±15% min. ±1 kΩ
Hysteresis 25%, min. 1 kΩ

Time response
Response time tstart-up at DC offset voltage > 1.1xUXDC and alarm 1 max. 150 ms
Response time tstart-up at UH 0.5 x Rw (Rin = 10 kΩ) and Cx = 1 μF acc. to IEC 61557-8 profile-dependent, typ. 4 s (see diagrams)

Measuring circuit
Measuring voltage UN ±50 V
Measuring current IN ≤ 403 μA
Internal resistance Rf ≥ 124 kΩ
Permissible stray DC voltage USC ≤ 1200 V
Permissible system leakage capacitance Cx profile-dependent, 0…150 μF

Measuring ranges
Measuring range E0 10…690 V
Tolerance measurement of E0 ±1% ±8 V
Voltage range measurement of E0 AC 10…690 V
Measuring range UX (without external coupling device) AC 25…690 V
Voltage range measurement of UX AC/DC > 10 V
Tolerance measurement of UX ±5% ±2.5 V
Measuring range Cx 0…10000 μF
Tolerance measurement of Cx ±10% ±10 μF
Min. insulation resistance measurement of Cx depending on profile and coupling mode, typ. > 10 kΩ

Display
Indication** graphic display 127 x 127 pixel, 40 x 40 mm
Display range measured value 0.1 kΩ…20 MΩ

LEDs
ON (operation LED) green
SERVICE yellow
ALARM 1 (ins. alarm 1) yellow
ALARM 2 (insulation fault +DC offset voltage) yellow

Digital inputs
Number 3
Operating mode, adjustable active, passive
Functions none, test, deactivate start, initial measurement (X1.1: reset, X1.3: deactivate device)*
Voltage low DC -3.5 V, High DC 11…32 V

Digital outputs
Number 2
Operating mode, adjustable active, passive
Functions none, ins. alarm 1, insulation fault + DC offset voltage, connection fault, device fault, common alarm, measurement ended, device inactive (X1.1: insulation fault + DC offset voltage)*
Voltage passive DC 0…33 V, active DC 0/19.2…32 V
Max. current internal total X1 max. 200 mA
Max. current external per channel max. 1 A

Analogue output
Number 1
Operating mode linear, mid-scale 28 kΩ/120 kΩ
Functions insulation value, DC offset current
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 ±20%

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 system-1-0
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, ins. alarm 1, insulation fault + DC offset voltage, connection fault, device fault, common alarm, measurement ended, device inactive (function 1: ins. alarm 1)*
Contact 21-22-24 none, ins. alarm 1, insulation fault + DC offset voltage, connection fault, device fault, common alarm, measurement ended, device inactive (function 1: insulation fault + DC offset voltage)*

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 5 A / 3 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 61326-2-1)
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)
Transport (IEC 60721-3-2)
Long-term storage (IEC 60721-3-1)
Area of application ≤ 3000 m NN
Connection

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

Screw-type terminal:
- Nominal current: ≤ 10 A
- Tightening torque: 0.5…0.6 Nm (5…7 lb-in)
- Conductor sizes: AWG 24-12
- Stripping length: 3 mm
- Flexible with ferrule with/without plastic sleeve: 0.2…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
- Flexible with ferrule with/without plastic sleeve: 0.2…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 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
- Quick DIN rail mounting acc. to IEC 60715
- Screw fixing: 3 x M4 with mounting clip
- Enclosure material: polycarbonate
- Flammability class: V-0
- Dimensions (W x H x D): 108 x 93 x 110 mm
- Documentation number: D00215
- Weight: < 390 g

Other indicators:
- (1) = factory setting
- (2) = indication limited outside the temperature range -25…+55 °C

Notes:
1) Fast tripping only works in IT networks with a mains frequency of 60 Hz.
2) 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.

Displays and controls

1. “A” button: up, increase value
2. “RESET” button: reset messages
3. “<” button: back, select parameter
4. “DATA” button: display data values
5. “V” button: down, decrease value
6. “MENU” button: start device menu
7. “ESC” button: abort, return to the previous menu level
8. “TEST” button: carry out self test
9. “>” button: forward, select parameter
10. “INFO” button: display information
11. “OK” button: OK, confirm
12. LED “ON”: Operation
13. LED indication “SERVICE, ALARM 1, ALARM 2”
14. LC display
1 Connection to a 3(N)AC system
2 Supply voltage $U_s$ (see nameplate) via 6 A fuse
3 Connection to the IT system to be monitored (L1/+, L2, L3/-)
4 Separate connection of KE, E to PE
5 (K1) Alarm relay 1, available changeover contacts
6 (K2) Alarm relay 2, available changeover contacts
7 Switchable resistor $R$ for RS-485 bus termination
8 Ethernet interface
9 Digital interface
10 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 ≤ 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/+ to 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 otherwise 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
- 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
UL in preparation
Lloyds Register in preparation

Standards
The ISOMETER® isoNAV685-D-B series corresponds to the device standard: DIN EN 61557-8 (VDE 0413-8)

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 $U_s$ (AC, DC)</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>offline</td>
<td>100…240 V, 47…460 Hz</td>
<td>24 V, 100…240 V</td>
<td>isoNAV685-D-B</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>B 9106 7901</td>
</tr>
<tr>
<td>A set of push-wire terminals</td>
<td>B 9106 7902</td>
</tr>
<tr>
<td>Enclosure accessories (terminal cover, 2 mounting clips)</td>
<td>B 9106 7903</td>
</tr>
<tr>
<td>Front cover 144x72 transparent (for IP65)</td>
<td>B 9806 0005</td>
</tr>
</tbody>
</table>

1) included in the scope of delivery
Technical data

### Insulation coordination
- Rated insulation voltage (IEC 60664-1): 1000 V
- Rated impulse voltage (IEC 60664-1): 8 kV
- Overvoltage category: III
- Pollution degree: I
- Protection category: 2
- Protective separation (reinforced insulation) between (A1, A2) - (11, 12, 14) - (21, 22, 24) - (11/+, L2, L3/-), (E, KE), (X1, ETH)
- Voltage test, routine test (IEC 61010-1): 4.3 kV

### Supply voltage
- Supply via X1/+, A2/–:
  - Supply voltage range $U_{X1}$: AC/DC 100…240 V
  - Tolerance of $U_{X1}$: AC -15…+10 %
  - DC -15…+15 %
  - Frequency range of $U_{X1}$: DC, 47…660 Hz
- Power consumption, typically 50 Hz (460 Hz): 5.7 W/20 VA (7.9 W/45.5 VA)

### Supplies
- Supply voltage $U_{X1}$: DC 24 V
- Tolerance of $U_{X1}$: DC -20…+25 %

### IT system being monitored
- Nominal system voltage range $U_{X1}$: offline
- Circuit capacity internal system isolating switch: AC 0…690 V
- DC 0…1000 V

### Response values
- Response value $R_m$: 10 kΩ…1 MΩ (50 kΩ)²
- Relative uncertainty (acc. to IEC 61557-8): ± 15 %, min. ± 1 kΩ
- Hysteresis: 25 %, min. 1 kΩ

### Time response
- Response time $t_{r, m}$: 30 s
- Start-up delay $t_{start}$: 0…120 s (30 s)²

### Measuring circuit
- Measuring voltage $U_m$: ± 5 V
- Measuring current $I_m$: ≤ 13.4 μA
- Internal resistance $R_i$: ≤ 372 kΩ
- Permissible extraneous DC voltage $U_{ex}$: ≤ 1200 V
- Permissible system leakage capacitance $C_e$: 150 μF

### Display
- Indication**: graphic display 127 x 127 pixel, 40 x 40 mm
- Display range measured value: 0.1 kΩ…20 MΩ

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

### Digital inputs
- Number: 3
- Operating mode, adjustable: active high, active low
- Functions: none, test, reset, deactivate device
- Voltage: Low DC -5…5 V, High DC 11…32 V

### Digital outputs
- Number: 2
- Operating mode, adjustable: active, passive
- Functions: none, Alarm L1, Alarm L2, Alarm L3, connection fault; device fault, device inactive
- Voltage: passive DC 0…32 V, active DC 0/19…32 V
- Max. current internal total X1: max. 200 mA
- Max. current external per channel: max. 1 A

### Interfaces
- Field bus:
  - Interface/protocol: web server/Modbus TCP/Modbus
  - 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: server, system 0-1

### Switching elements
- Number of switching elements: 2 changeover contacts
- Operating mode: N/C operation*/*N/O operation
- Contact 11-12-14: none, Alarm L1, Alarm L2, Alarm L3, connection fault, device fault, device inactive
- Contact 21-22-24: none, Alarm L1, Alarm L2, Alarm L3, connection fault, device fault, device inactive
- 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
  - Rated operational current: 5 A / 3 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
- Ambient temperatures:
  - Operating temperature: -25…+55 °C
  - Transport: -40…+85 °C
  - Long-term storage: -25…+70 °C
- Overvoltage category:
  - Classification of climatic conditions acc. to IEC 60721:
    - Stationary use (IEC 60721-3-3): 3K8 (except condensation and formation of ice)
    - Transport (IEC 60721-3-2): 2K3
    - Long-term storage (IEC 60721-3-1): 1K4
- Classification of mechanical conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3M4
  - Transport (IEC 60721-3-2): 2M2
  - Long-term storage (IEC 60721-3-1): 1M3
- Area of application: ≤ 3000 m NN

### Connection
- Connection type:
  - Pluggable screw-type terminal or push-wire terminal

### Screw-type terminal:
- Nominal current: ≤10 A
- Tightening torque: 0.5…0.6 Nm (5…7 lb-in)
- Conductor sizes:
  - AWG 24-12
  - Striping 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…1.5 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
  - Striping 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 terminals X1:
- Nominal current: ≤8 A
- Conductor sizes:
  - AWG 24-16
  - Striping 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
- Quick DIN rail mounting acc. to: IEC 60715

### Switching elements:
- Screw fixing:
  - 3 x M4 with mounting clip
- Enclosure material:
  - Polycarbonate
- Flammability class:
  - V-0
- Dimensions (W x H x D): 108 x 93 x 110 mm
- Documentation number: D00264
- Weight:
  - < 390 g

** = factory setting
* = indication limited outside the temperature range -25…+55 °C
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.
### Displays and controls

1. “A” button: up, increase value
2. “RESET” button: reset messages
   - “<” button: back, select parameter
3. “DATA” button: display data values
   - “V” button: down, decrease value
4. “MENU” button: start device menu
   - “ESC” button: abort, return to the previous menu level
5. “TEST” button: carry out self test
   - “>” button: forward, select parameter
6. “INFO” button: display information
   - “OK” button: OK, confirm
7. LED “ON”: Operation
8. LED indication “SERVICE, ALARM 1, ALARM 2”
9. LC display
1. Connection to a 3(N)AC system
2. Supply voltage $U_S$ (see nameplate) via 6 A fuse
3. Connection to the IT system to be monitored (L1/+ , L2, L3/-)
4. Separate connection of KE, E to PE
5. (K1) Alarm relay 1, available changeover contacts
6. (K2) Alarm relay 2, available changeover contacts
7. Switchable resistor R for RS-485 bus termination
8. Ethernet interface
9. Digital interface
10. 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 ≤ 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 otherwise the unit may be damaged. Only connect a nominal voltage of 24 V to the X1 interface.
**ISOMETER® 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**

- Insulation monitoring for unearthed systems AC, 3(N)AC 0…690 V, DC 0…1000 V
- Nominal system voltage can be expanded via coupling devices
- Two response values that can be set separately 1 kΩ…10 MΩ
- Combination of AMPplus and other profile-dependent measurement methods
- Continuous measurement of capacitance, voltage and system frequency
- Predefined measurement profiles to meet different requirements
- Automatic adaptation to system leakage capacitance
- INFO button to display device settings and system settings
- Self-monitoring with automatic alarm message
- Memory with real-time clock (3-day buffer) to store 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
- Permanent coupling monitoring of the measuring lines
- Freely programmable digital and analogue inputs and outputs
- Two separate alarm relays with potential-free contacts
- N/O or N/C operation selectable
- High-resolution graphic LC display
- IsoGraph function for time-related representation of the insulation resistance
- Remote setting of certain parameters via the Internet (option; COMTRAXX® Gateway)
- Worldwide remote diagnosis via Internet (made available by Bender-Service only)
- Modbus TCP and web server
- Multilingual

---

**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

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**Approvals**

UL in preparation
Lloyds Register in preparation

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**Standards**

The ISOMETER® isoRW685W-D series corresponds to the device standard: DIN EN 61557-8 (VDE 0413-8), DIN EN 50155

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**Further information**

For further information refer to our product range on www.bender.de.
**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)
- Measuring circuit (IC1)
- Protective separation (reinforced insulation) between: IC2/(IC3-5)
- Pollution degree for accessible parts on the outside of the device housing (UN)
- Nominal system voltage range
- Supply voltage

**Tolerance of:**
- Temperature dependence of: IC1/(IC2-5)
- Relative uncertainty (acc. to IEC 61557-8)
- Response values (alarm 1)
- Response values (alarm 2)
- Hysteresis

**Rated voltage:**
- Tolerance measurement of: IC2/(IC3-5)
- Permissible system leakage capacitance: C
- Measuring current: I
- Power consumption, typically 50 Hz (400 Hz)

**Rated impulse voltage:**
- Measuring ranges: IC3/(IC4-5)
- Measuring range: U
- Measuring current: I

**Rated insulation voltage:**
- Response values: IC1/(IC2-5)
- Response time: t
- Start-up delay: T

**Voltage test (routine test) according to IEC 61010-1:**
- Voltage range measurement of: IC4/IC5
- Measuring circuit:
- Display:
- Suitable measuring instruments on request!

**Ordering information**

<table>
<thead>
<tr>
<th>Nominal system voltage range UN</th>
<th>Supply voltage US</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>DC</td>
</tr>
<tr>
<td>0...690 V; 1...460 Hz</td>
<td>0...1000 V</td>
</tr>
<tr>
<td>isoRW685W-D</td>
<td>B 9106 7012W</td>
</tr>
</tbody>
</table>

**Accessories**

- A set of push-wire terminals
- Enclosure accessories (terminal cover, 2 mounting clips)
- A set of screw terminals
- A set of push-wire terminals

**Matching system components**

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupling devices</td>
<td>AGH150W-4</td>
<td>282</td>
</tr>
<tr>
<td></td>
<td>AGH204S-4</td>
<td>283</td>
</tr>
<tr>
<td></td>
<td>AGHS205</td>
<td>284</td>
</tr>
<tr>
<td></td>
<td>AGH676S-4</td>
<td>287</td>
</tr>
</tbody>
</table>

**Display**
- Indication:
- Display range measured value
- Suitable measuring instruments on request!

**LEDs**
- GN (operation LED)
- SERVICE
- ALARM 1
- ALARM 2

**Digital inputs**
- Number
- Operating mode, adjustable
- Functions

**Digital outputs**
- Number
- Operating mode, adjustable
- Functions

**Time response**
- Response time t at R0 = 0.5 x RWM (RWM = 10 kΩ) and C0 = 1 μF according to IEC 61557-8
- Response time t on offset at C0 = 1 μF
- Start-up delay T:

**I/O systems**
- Input current of: IC3/(IC4-5)
- Measuring range: X1
- Cable length X1
- Operating mode, adjustable
- Functions

**Frequency ranges**
- Frequency range of: UN
- Permissible extraneous DC voltage: U
- Permissible system leakage capacitance: C

**Matching system components**

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

*Insulation monitoring device ISOMETER® isoRW685W-D*
### Technical data (continued)

#### Analogue output

- **Number**
- **Operating mode**
  - linear, midscale point 28/120 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

**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
- **Network mask**
  - 255.255.255.0
- **IP address**
  - DHCP/manual* 192.168.0.5*
- **Connection**
- **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 (3)*

**Sensor bus:**
- **Interface/protocol**
  - RS-485
- **Data rate**
  - 9.6 kbaud/s
- **Cable length**
  - ≤ 100 m
- **Recommended cable**
  - twisted pair, one end of shield connected to PE

#### Switching elements

- **Number of switching elements**
  - 2 changeover contacts
- **Operating mode**
  - N/C operation*/*N/O operation
- **Contact 11-12-14**
  - off, Ins. alarm 1, Ins. alarm 2, 2 connection fault, DC+ alarm, DC- alarm, symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm
- **Contact 21-22-24**
  - off, Ins. alarm 1, Ins. alarm 2, 2 connection fault, DC+ alarm, DC- alarm, 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
- **Rated operational voltage**
- **Rated insulation current**
  - ≤ 2000 m NN
- **Rated insulation voltage**
  - 250 V
- **Rated insulation voltage**
  - 3000 m NN
- **Minimum contact rating**
  - 1 mA at AC/DC ≥ 10 V

#### Environment/EMC

- **EMC**
  - IEC 61326-2-4
  - **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)
      - 3K7
    - Transport (IEC 60721-3-2)
      - 2K3
    - Long-term storage (IEC 60721-3-1)
      - 1K4
  - **Classification of mechanical conditions acc. to IEC 60721:**
    - Stationary use (IEC 60721-3-3)
      - 3M7
    - Transport (IEC 60721-3-2)
      - 2M2
    - Long-term storage (IEC 60721-3-1)
      - 1M5
  - **Area of application**
    - ≤ 3000 m NN

#### 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
    - 3 mm
    - 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 24-16
  - Stripping length
    - 10 mm
    - 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
    - 0.2…2.5 mm²
    - Flexible with ferrule without plastic sleeve
      - 0.25…2.5 mm²
    - Flexible with TWIN ferrule with plastic sleeve
      - 0.25…2.5 mm²

#### 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**
  - D00178
- **Weight**
  - < 390 g

**Note:** 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.

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

**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.”**
**Displays and controls**

1. "▲" button: up, increase value
2. "RESET" button: reset messages
3. "▼" button: back, select parameter
4. "DATA" button: display data values
5. "V" button: down, decrease value
6. "MENU" button: start device menu
7. "ESC" button: abort, return to the previous menu level
8. "TEST" button: carry out self test
9. "INFO" button: display information
10. "OK" button: OK, confirm
11. LED "ON": Operation
12. LED indication "SERVICE, ALARM 1, ALARM 2"
13. LC display
**Insulation monitoring devices | Application-specific selection – Railway**

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

**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>Ground</td>
<td></td>
</tr>
</tbody>
</table>

**Digital outputs**

- Passive
- Active
- Low-Active

**Digital inputs**

- High-Active
- Current output
- Voltage output

**Example**

- Deactivate device
- Reset
- Test

---

**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, connection to Ethernet interface by Bender Service staff only
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!

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

---

**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.

---

**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.

---

**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.
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

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

Approvals
- UL in preparation
- Lloyd's Register in preparation

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage/frequency range $U_s$</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>B 9106 7904</td>
</tr>
<tr>
<td>24 V/–20…+25 %</td>
<td></td>
<td>FP200W</td>
<td>B 9106 7904W</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 IRDH575</td>
<td>B91067905</td>
</tr>
<tr>
<td>Front cover 144x96 transparent (for IP65)</td>
<td>B98060007</td>
</tr>
</tbody>
</table>
## Technical data

### Insulation coordination
- Rated insulation voltage (IEC 60664-1): 50 V
- Rated impulse voltage (IEC 60664-1): 500 V
- Overvoltage category: III
- Pollution degree: 3

### Supply voltage
- Supply voltage $U_S$: via iso685-S

### Display
- Graphic display: 127 x 127 pixels, 40 x 40 mm

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

### Interfaces
- Interface/protocol: Bender internal
- REMOTE cable: Patch cable min. CAT5e

### Environment/EMC
- **EMC:** IEC 61326-2-4; EN 50121-3-2; EN 50121-4
- **Ambient temperatures:**
  - Operation: -40...+70 °C
  - Transport: -40...+85 °C
  - Storage: -25...+70 °C
- **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
  - Long-term storage (IEC 60721-3-1): 1K4
- **Classification of mechanical conditions acc. to IEC 60721:**
  - Stationary use (IEC 60721-3-3): 3M4
  - Transport (IEC 60721-3-2): 2M2
  - Long-term storage (IEC 60721-3-1): 1M3
- **Area of application:** ≤3000 m NN

### Connection
- **Connection type:** plug connectors
- **Connection type:** continuous operation
- **Mounting:** 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 front cover (DIN EN 60529):** IP65
- **Panel cutout:** 138x66 mm
- **Permissible tolerance of panel cutout:** +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
- **Classification of climatic conditions acc. to IEC 60721:**
  - Stationary use (IEC 60721-3-3): 3K5 (condensation and formation of ice possible)
- **Classification of mechanical conditions acc. to IEC 60721:**
  - Stationary use (IEC 60721-3-3): 3M7

### Option “W”
- Devices with the suffix “W” feature increased shock and vibration resistance.
- Due to a special varnishing, the electronic parts are better protected against mechanical loads and humidity.
- When mounting the FP200W, it is necessary to secure the screws with thread-locking fluid since they could loosen when suffering high mechanical load.

### Dimension diagram (dimensions in mm)

---

**Dimension diagram (dimensions in mm):**

*Diagram showing the dimensions of the FP200 display and operator unit.*
Displays and controls

1. LED "ON" Operation
2. LED indication "SERVICE, ALARM 1, ALARM 2"
3. LC display

Connection to iso685
ISOMETER® IRDH275
Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems)

Device features
- Insulation monitoring for unearthed AC, AC/DC systems 0…793 V, DC 0…650 V
- Nominal voltage extendable via coupling device
- Two separately adjustable response values 1 kΩ…10 MΩ
- AMP® n measurement method
- Automatic adaptation to the system leakage capacitance
- Info button to display device settings and system leakage capacitance
- Self monitoring with automatic alarm
- Automatic self test, selectable
- Connection for external kΩ indication
- Test and reset button
- External test/reset button can be connected
- Two separate alarm relays with two potential-free changeover contacts
- N/O or N/C operation, selectable
- Backlit LC display
- RS-485 interface

Additional device features, version IRDH275B
- 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)

Typical applications
- AC, DC or AC/DC main circuits
- AC/DC main circuits with directly connected DC components, such as rectifiers, converters, and thyristor-controlled DC drives
- UPS systems, battery systems
- Heaters with phase control
- Installations including switch mode power supplies
- IT systems including high leakage capacitances
- Coupled IT systems

Approvals

Standards
The ISOMETER® of the IRDH257 series complies with the requirements of the device 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),

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

Ordering information

<table>
<thead>
<tr>
<th>RS-485 interface</th>
<th>Coupled IT systems</th>
<th>Output</th>
<th>Supply voltage $U_{ij}$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASCII-IsoData</td>
<td>not applicable</td>
<td>Current output 0…400 µA</td>
<td>88…264 V, 77…286 V</td>
<td>IRDH275-435</td>
<td>B 9106 5100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Current output 0…400 µA</td>
<td>–, 19.2…72 V</td>
<td>IRDH275-427</td>
<td>B 9106 5104</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Current output 0…400 µA</td>
<td>–, 10.2…36 V</td>
<td>IRDH275-425</td>
<td>B 9106 5108</td>
</tr>
<tr>
<td>BMS</td>
<td>applicable</td>
<td>Current output 0(4)…20 mA</td>
<td>88…264 V, 77…286 V</td>
<td>IRDH275B-435</td>
<td>B 9106 5101</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Current output 0(4)…20 mA</td>
<td>–, 19.2…72 V</td>
<td>IRDH275B-427</td>
<td>B 9106 5105</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Current output 0(4)…20 mA</td>
<td>–, 10.2…36 V</td>
<td>IRDH275B-425</td>
<td>B 9106 5109</td>
</tr>
</tbody>
</table>

$U_{ij}$ Absolute values
Device “Option-W” with increased shock and vibration resistance: Indicated by the letter “W” at the end of the order number.

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>External kΩ measuring instruments</td>
<td>7204-1421</td>
<td>328</td>
</tr>
<tr>
<td></td>
<td>9604-1421</td>
<td>328</td>
</tr>
<tr>
<td></td>
<td>9620-1421</td>
<td>328</td>
</tr>
<tr>
<td>Coupling devices</td>
<td>AGH150W-4</td>
<td>282</td>
</tr>
<tr>
<td></td>
<td>AGH2045-4</td>
<td>283</td>
</tr>
<tr>
<td></td>
<td>AGH5205</td>
<td>284</td>
</tr>
</tbody>
</table>
Technical data

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

- Rated supply voltage: AC 800 V
- Rated impulse voltage/pollution degree: 8 kV/3

**Voltage ranges**

- IRDH275..
  - Nominal system voltage $U_0$: AC, $1/3\text{N} / \text{U}, \ldots 793 \text{ V}^*$
  - Nominal frequency $f$: 50 ... 60 Hz
  - Nominal system voltage $U_0$: DC, $0 \ldots 650 \text{ V}^*$

**Device address, BMS bus**

- Permissible extraneous DC voltage
  - IRDH275..: $\leq 1 \text{ kV}$
  - IRDH275..-435:

**Nominal frequency $f$**

- Supply voltage $U$: AC 88 ... 264 V
- Frequency range: 42 ... 60 Hz
- Supply voltage $U$: DC 77 ... 286 V

**IRDH275..-427:**
- Supply voltage $U$: DC 19.2 ... 72 V

**IRDH275..**
- Power consumption: $\leq 14 \text{ VA}$

**Response values**

- Response value $R_{\text{m}}$(Alarm1): 1 kΩ ... 10 MΩ
- Response value $R_{\text{m}}$(Alarm2): 1 kΩ ... 10 MΩ
- Relative uncertainty (20 kΩ ... 1 MΩ) (acc. to IEC 61557-8): $\pm 15 \%$
- Relative uncertainty (1 ... 20 kΩ + 2 kΩ): $\pm 20 \%$
- Relative uncertainty: $\geq 10 \text{ MΩ}$
- Hysteresis (1 ... 10 kΩ): $\geq 2 \text{kΩ}$
- Hysteresis (10 ... 100 MΩ): $\geq 25 \%$

**Measuring circuit**

- Measuring voltage $U_{\text{m}}$: $\leq 50 \text{ V}$
- Measuring current $I_{\text{m}}$ (at $R_0 = 0 \text{ Ω}$): $\leq 280 \mu\text{A}$
- Internal DC resistance $R_0$: $\geq 180 \text{kΩ}$
- Impedance $Z$, at 50 Hz: $\geq 180 \text{kΩ}$
- Permissible extraneous DC voltage $U_{\text{m}}$: $\leq 120 \text{V DC}$
- Permissible system leakage capacitance: $\leq 500 \mu\text{F}$
- Factory setting: 150 µF

**Displays**

- Display: illuminated
- Display range measured value: 2 kΩ ... 10 MΩ
- Operating uncertainty (20 kΩ ... 1 MΩ) (nach IEC 61557-8): $\pm 15 \%$
- Operating uncertainty (1 ... 20 kΩ): $\geq 1 \text{kΩ}/21 \%$
- Operating uncertainty (1 ... 10 MΩ): $\geq 0.1 \text{MΩ}/21 \%$

**Outputs/Inputs**

- Test/reset button: internal/external
- Cable length test/reset button, external: $\leq 10 \text{ m}$
- Current output for measuring instrument SKMP (scale centre point = 120 kΩ):
  - IRDH275 (load): 400 µA ($\leq 12.5 \text{kΩ}$)
  - IRDH275 (load): 20 mA ($\leq 500 \text{kΩ}$)
- Current accuracy current output (1 kΩ ... 1 MΩ) related to the value indicated: $\pm 10 \%, \pm 1 \%$

**Serial interface**

- Interface/protocol IRDH275: RS-485/ASCII/IsoData
- Interface/protocol IRDH275B: RS-485/BMS
- Connection: terminals A/B
- Cable length: $\leq 1200 \text{ m}$
- Cable (twisted in pairs, one end of shield connected to PE): recommended: J-Y(S)TY min. 2×0.8
- Terminating resistor: 120 Ohm (0.5 W)
- Device address, BMS bus: 1 ... 30 (factory setting = 3)

**Switching elements**

- 2 changeover contacts: K1 (Alarm 1), K2 (Alarm 2, device error)
- 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, number of cycles: 12,000
- Contact class: IB (DIN IEC 60255-21)
- Rated contact voltage: AC 250 V, DC 300 V
- Making capacity: AC/DC 5 A
- Breaking capacity: 2 A, AC 230 V, cos phi = 0.4
- Current rating at DC 24 V: $\geq 2 \text{ mA}$ (50 mW)

**Environment/EMC**

- EMC: acc. to IEC 61326-2-4 Ed. 1.0
- 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 60668-2-6 (device in operation):
  - 1 g/10 ... 150 Hz
  - 2 g/10 ... 150 Hz
  - Ambient temperature (during operation): $-10 \ldots +55 ^\circ\text{C}$
  - Classification of climatic conditions acc. to IEC 60721-3-3: 3K5

**Connection**

- Connection: screw-terminal type
- Connection properties: rigid/flexible
- Connection materials: 0.2 ... 4 mm²/0.2 ... 2.5 mm²
- Connect with ferrules without/with plastic sleeve: 0.25 ... 2.5 mm²
- Tensioning torque: 0.3 Nm
- Conductor sizes (AWG): 24 ... 12

**Other**

- Operating mode: continuous operation
- Mounting: display-oriented
- Distance to adjacent devices: $\geq 30 \text{ mm}$
- 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
- Flammability class: UL94 V-0
- Documentation number: D00122
- Weight: $\leq 510 \text{ g}$

**Option “W”**

- Shock resistance IEC 60068-2-27 (device in operation): 30 g/11 ms
- Bumping IEC 60068-2-29 (Transport): 40 g/6 ms
- Vibration resistance IEC 60668-2-6: 1.6 mm/10 ... 25 Hz
- Ambient temperature (during operation): $-40 \ldots +70 ^\circ\text{C}$
- Storage temperature range: $-40 \ldots +85 ^\circ\text{C}$
- Screw mounting: 2 x M4

The data labelled with an * are absolute values
** = Under EMC test conditions in accordance with IEC 61326-2-4 the specified tolerances can double

---

**Dimension diagram (dimensions in mm)**

![Dimension diagram](image_url)
Displays and controls

1 “INFO” button: to query standard information
   ESC button: back to the menu function
2 “TEST” button: to call up the self test
   Arrow up button: Parameter changes, scroll
3 “RESET” button: to delete alarm and fault messages
   Arrow down button: Parameter change, scroll.
4 “MENU” button: to activate the menu system
   Enter button: to confirm parameter changes
5 Alarm LED “1” lights: insulation fault, 1st warning level reached
6 Alarm LED “2” lights: insulation fault, 2nd warning level reached
7 LED lights: system fault
8 LC display

Wiring diagram

1 Supply voltage \( U_S \) (see ordering information) 6 A fuse recommended; for UL and CSA applications, it is mandatory to use 5 A fuses.
2 Connection to the 3AC system being monitored:
   Connect the terminals L1, L2 to neutral conductor N or terminals L1, L2 to conductor L1, L1.
3 Connection of the AC system to be monitored:
   Connect terminals L1, L2 to conductor L1, L2.
4 Connection to the DC systems to be monitored:
   Connect terminal L1 to conductor L+ , terminal L2 to conductor L-.
5 Separate connection of the equipotential bonding conductor to PE and KE
6 External test button “T1/T2” (N/O contact)
7* External reset button “R1, R2” (N/C contact or wire jumper). When the terminals are open the fault messages will not be stored, provided that the fault memory has not been activated via the operating menu.
8* Standby by means of the function input “F1, F2”:
   with the contact in closed position no insulation measurement takes place (Isometer disconnection B version only/no disconnection when operated via AK).
9 IRDH275: Current output, electrically isolated: 0…400 µA
   IRDH275B: Current output, electrically isolated: 0…20 mA or 4…20 mA
10 RS-485 interface
11 Alarm relay: Alarm 1
12 Alarm relay: Alarm 2/system

* the terminal pairs 7, 8 and 9 have to be wired electrically isolated and do not have to be connected to earth!
Wiring diagrams

**ISOMETER® IRDH275 with coupling device AGH150W-4**

**ISOMETER® IRDH275 with coupling device AGH204S-4**

**ISOMETER® IRDH275 with coupling device AGH520S**

1. without rectifiers
   \( U_n = 3\, AC \, 0 \ldots 1650 \, V \) (DC max. 1000 V)

2. with rectifiers
   \( U_n = 3\, AC \, 0 \ldots 1300 \, V \) (peak voltage downstream of the rectifier or intermediate circuit voltage of max. 1840 V)
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
- {
  \textit{AMPplus} \ 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)…20 mA (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® of the IRDH275BM-7 series complies with the requirements of the device standards:

Further information

For further information refer to our product range on www.bender.de.
<table>
<thead>
<tr>
<th>Technical data IRDH275BM-7</th>
</tr>
</thead>
</table>

**Insulation coordination acc. to IEC 60664-1**
- **Rated voltage**: AC 800 V
- **Rated impulse voltage/pollution degree**: 8 kV/3

**Voltage ranges**
- Nominal voltage range Un via AGH675S-7...
- Supply voltage US (refer to nameplate for other values)
  - DC 19.2…72 V
- Power consumption: ≤14 VA

**Response values**
- Response value Ran1 (Alarm 1)
  - 100 kΩ…10 MΩ
- Relative percentage error 100…500 kΩ: ±100 kΩ
- 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 Zι, at 50 Hz
  - ≥ 2.4 MΩ
- Permissible extraneous DC voltage Ufg with AGH675S-7 ...
  - ≤ 100 V
- Permissible system leakage capacitance Ce
  - ≤ 5 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 IRDH275BM-7
  - RS-485/85
- 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
  - IR (IEC 60664-2-23)
- Rated contact voltage
  - AC 250 V/DC 300 V
- Making capacity
  - AC/DC 5 A
- Breaking capacity
  - 2 A, AC 230 V, cos phi = 0.4
  - 0.2 A, DC 220 V, L/R = 0.04 s
- Minimum contact current at DC 24 V
  - ≥ 2 mA (50 mW)

**Environment/EMC**
- EMC immunity
  - acc. to EN 61326
- EMC emission
  - acc. to EN 61326
- Shock resistance IEC 60668-2-27 (device in operation)
  - 15 g/11 ms
- Bumping IEC 60668-2-29 (during transport)
  - 40 g/6 ms
- Vibration resistance IEC 60668-2-6 (device in operation)
  - 1 g/10…150 Hz
- Vibration resistance IEC 60668-2-6 (during transport)
  - 2 g/10…150 Hz
- Ambient temperature (during operation)
  - -10 … +55 °C
- Storage temperature range
  - -40 … +70 °C
- Classification of climatic conditions acc. to IEC 60721-3-3
  - 3K5

**Connection**
- Connection
  - rigid, flexible
  - with connector sleeve, without/with plastic sleeve
  - 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 device ISOMETER® IRDH275BM-7 with coupling device AGH675-7 and AGH675-7MV15

**Technical data AGH675S-7…**

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

| AGH675S-7 |  
|---|---|
| Rated insulation voltage | AC 7.2 kV |

| AGH675S-7MV15 |  
|---|---|
| Rated insulation voltage | AC 15.5 kV |

### Voltage test acc. to DIN EN 61800-5-1

**Type test:**

- **AGH675S-7:**
  - Voltage impulse test (basic insulation): 40 kV
  - AC voltage test (basic insulation): 20 kV
  - Partial discharge test: 14 kV

- **AGH675S-7MV15:**
  - Voltage impulse test (basic insulation): 111 kV (attenuated)
  - AC voltage test (basic insulation): 70 kV
  - Partial discharge test: 29 kV

**Routine 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): 3K5 (no condensation, no formation of ice)
- Transport (IEC 60721-3-2): 2M2
- Long-term storage (IEC 60721-3-1): 1K4

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

- Stationary use (IEC 60721-3-3): 3M4 (3M7 Y shaft)
- Transport (IEC 60721-3-2): 2M2
- Long-term storage (IEC 60721-3-1): 1M3

### 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
- Connection:
  - rigid, flexible: 0.2…4 mm² / 0.2…2.5 mm²
  - flexible with connector sleeve: 0.25…2.5 mm²

### 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
- Screw mounting: M5
- Flammability class: UL94 V-0
- Documentation number: D0009S
- Weight approx.: ≤ 5100 g

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**Dimension diagrams (dimensions in mm)**

**IRDH275BM-7**

![Dimension diagram IRDH275BM-7](image1)

**AGH675S-7…**

![Dimension diagram AGH675S-7](image2)

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**BENDER** 2016/2017

Insulation monitoring devices | Application-specific selection – Variable-speed drives

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

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**Page 73**
Displays and controls

1. "INFO" button: to query standard information
2. ESC button: back to the menu function
3. "TEST" button: to call up the self test
4. Arrow up button: Parameter changes, scroll
5. "RESET" button: to delete installation and fault messages
6. Arrow down button: Parameter change, scroll.

Wiring diagrams

Connection AGH675S-7

1. Supply voltage Us (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 5: 200 V
4. Separate connection of and KE to PE
5. Separate connection of the terminals 3 and 4 of the AGH675S-7 or AGH675S-7MV15 to PE
6. External TEST button (NO contact)

Connection AGH675S-7MV15

1. External RESET button (NC contact or wire jumper), when the terminals are open, the fault message will not be stored
2. STANDBY by means of the function input F1, F2: When the contact is closed, insulation measurement does not take place.
3. Current output, galvanically separated: 0…20 mA or 4…20 mA
4. Serial interface RS-485 (termination 120 Ω resistor)
5. Alarm relay 1; changeover contacts provided
6. Alarm relay 2 (system fault relay); changeover contacts provided
7. 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.
   Connection of the two coupling devices AGH675S-7MV15 to the converter: connect the high voltage cable encapsulated on L+ and L-.
ISOMETER® IRDH375
Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems)

Device features
• Insulation monitoring for unearthed AC, AC/DC systems 0…793 V, DC 0…650 V
• Nominal voltage extendable via coupling device
• Two separately adjustable response values 1 kΩ…10 MΩ
• AMP® measurement method
• Automatic adaptation to the system leakage capacitance
• Info button to display device settings and the system leakage capacitance
• Continuous self monitoring, with automatic alarm message
• 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
• Alarm relay for system fault (N/C operation)
• Backlit LC display
• RS-485 interface
• Plug-in terminals

Additional device features, version IRDH375B
• 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

Typical applications
• AC, DC or AC/DC main circuits
• AC/DC main circuits with directly connected DC components, such as rectifiers, converters, and thyristor-controlled DC drives
• UPS systems, battery systems
• Heaters with phase control
• Installations including switch-mode power supplies
• IT systems including high leakage capacitances
• Coupled IT systems

Approvals

Standards
The ISOMETER® of the IRDH375 series complies with the requirements of the device 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),

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

Ordering information

<table>
<thead>
<tr>
<th>RS-485 interface</th>
<th>Coupled IT systems</th>
<th>Output</th>
<th>1 Supply voltage U1</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASCII</td>
<td>not applicable</td>
<td>external kΩ indication 0…400 µk</td>
<td>88…264 V 77…286 V</td>
<td>IRDH375-435</td>
<td>B 9106 5000</td>
</tr>
<tr>
<td>ASCII</td>
<td>not applicable</td>
<td>–</td>
<td>–</td>
<td>IRDH375-427</td>
<td>B 9106 5002</td>
</tr>
<tr>
<td>BMS</td>
<td>applicable</td>
<td>current output 0(4…20 mA)</td>
<td>88…264 V 77…286 V</td>
<td>IRDH375B-435</td>
<td>B 9106 5004</td>
</tr>
<tr>
<td>BMS</td>
<td>applicable</td>
<td>–</td>
<td>–</td>
<td>IRDH375B-427</td>
<td>B 9106 5006</td>
</tr>
</tbody>
</table>

1) Absolute values
Device "Option-W" with increased shock and vibration resistance: Indicated by the letter "W" at the end of the order number.

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>External kΩ measuring instruments</td>
<td>7204-1421</td>
<td>328</td>
</tr>
<tr>
<td></td>
<td>9604-1421</td>
<td>328</td>
</tr>
<tr>
<td></td>
<td>9620-1421</td>
<td>328</td>
</tr>
<tr>
<td>Coupling devices</td>
<td>AGH150W-4</td>
<td>282</td>
</tr>
<tr>
<td></td>
<td>AGH204S-4</td>
<td>283</td>
</tr>
<tr>
<td></td>
<td>AGH520S</td>
<td>284</td>
</tr>
<tr>
<td>Transparent front plate cover IP65</td>
<td>144x72</td>
<td>364</td>
</tr>
</tbody>
</table>
**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>AC 600 V</td>
</tr>
<tr>
<td>Rated impulse voltage/pollution degree</td>
<td>8 kV/3</td>
</tr>
</tbody>
</table>

**Voltage ranges**

<table>
<thead>
<tr>
<th>Model</th>
<th>Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IRDH375...</strong></td>
<td></td>
<td>Nominal system voltage $U_n$ (also see nameplate) AC $\ldots$ 650 V*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nominal system voltage $U_n$ (also see nameplate) DC $\ldots$ 650 V*</td>
</tr>
<tr>
<td><strong>IRDH375...-435: Supply voltage</strong></td>
<td></td>
<td>Supply voltage U$_S$ (also see nameplate) AC $\ldots$ 264 V*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Frequency range $U_f$ 42…$\ldots$ 460 Hz</td>
</tr>
<tr>
<td><strong>IRDH375...-427: Supply voltage</strong></td>
<td></td>
<td>Supply voltage U$_S$ (also see nameplate) DC $\ldots$ 72 V*</td>
</tr>
</tbody>
</table>

**Switching elements**

<table>
<thead>
<tr>
<th>Switching elements</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 changeover contacts</td>
<td></td>
</tr>
</tbody>
</table>

**K1 (Alarm 1), K2 (Alarm 2), K3 (device error)**

**Operating principle**

- K1 (Alarm 1)
- K2 (Alarm 2)
- K3 (device error)

**Factory setting**

- Alarm 1
- Alarm 2
- Device error

**Electrical endurance, number of cycles**

12,000

**Contact class**

IIb acc. to DIN IEC 60255 Part 0-20

**Rated contact voltage**

AC 250 V/DC 300 V

**Making capacity**

AC/DC 5 A

**Breaking capacity**

- 2 A, AC 230 V, cos phi = 0.4
- 0.2 A, DC 220 V, L/R = 0.04 s

**Contact rating at DC 24 V**

$\geq$ 2 mA (50 mW)

**Environment/EMC**

**EMC**

- according to IEC 61326-2-4 Ed. 1.0

**Shock resistance IEC 6068-2-27 (device in operation)**

- 15 g/11 ms

**Bumping IEC 6068-2-29 (transport)**

- 40 g/6 ms

**Vibration resistance IEC 6068-2-6 (device in operation)**

- 1 g/10…150 Hz

**Vibration resistance IEC 6068-2-6 (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 IEC 60721-3-3**

- SKS

**Other**

- Operational mode continuous operation

**Mounting**

- display-oriented

**Distance to adjacent devices**

- $\geq$ 30 mm

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

- IP30

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

- IP30

**Type of enclosure**

- X300, free from halogen

**DIN rail mounting acc. to**

- IEC 60715

**Flammability class**

- UL94 V-0

**Documentation number**

- D00124

**Weight**

- $\leq$ 510 g

**Option “W”**

**Shock resistance IEC 6068-2-27 (device in operation)**

- 30 g/11 ms

**Bumping IEC 6068-2-29 (transport)**

- 40 g/6 ms

**Vibration resistance IEC 6068-2-6**

- 1.6 mm/10…25 Hz
- 4 g/25…150 Hz

**Ambient temperature, during operation**

- $-$25…+70 °C

**Ambient temperature for storage**

- $-$40…+85 °C

**Screw mounting**

- 2 x M4

**The data labelled with an * are absolute values**

**= Under EMC test conditions in accordance with IEC 61326-2-4 the specified tolerances can double**

---

**Insulation monitoring device ISOMETER® IRDH375**

---

**Dimension diagram** (dimensions in mm)
# Displays and controls

**“INFO” button:** to query standard information
**ESC button:** back to the menu function

**“TEST” button:** to call up the self test
**Arrow up button:** Parameter changes, scroll

**“RESET” button:** to delete alarm and fault messages
**Arrow down button:** Parameter changes, scroll

**“MENU” button:** to activate the menu system
**Enter button:** to confirm parameter changes

**Alarm LED 1**, yellow, lights when the value falls below the set response value $R_{\text{ALARM1}}$

**Alarm LED 2**, yellow, lights when the value falls below the set response value $R_{\text{ALARM2}}$

**Alarm LED**, yellow, lights in case of fault in the connecting leads to the system or to earth, or in case of system fault

**Transparent front plate cover (accessory)**

---

### Wiring diagrams

1. 3AC system
2. 3NAC system
3. AC system
4. DC system
5. Supply voltage $U_S$ (see ordering information) 6 A fuse recommended.
   For UL and CSA applications, the use of 5 A fuses is mandatory.
6. Alarm relay $R_{\text{ALARM1}}$
7. Alarm relay $R_{\text{ALARM2}}$
8. Alarm relay system fault
9. External kΩ indication 0…400 µA or current output 0(4)…20 mA (option).
10. External reset button “R1, R2” (N/C contact or wire jumper). When the terminals are open the fault messages will not be stored, provided that the fault memory has not been activated via the operating menu.
11. External test button “T1/T2” (N/O contact)
12. Standby by means of the function input “F1, F2”:
   with the contact in closed position no insulation measurement takes place
13. DIP switch, S1 “ON”-RS-485 terminated (120 Ω on), S2 – unassigned

* The terminal pairs 10, 11 and 12 must be wired electrically isolated and may not be connected to earth!

---

1. Rear view IRDH375
2. Detachable terminal cover
Insulation monitoring devices | Main circuits

**Insulation monitoring device ISOMETER® IRDH375**

ISOMETER® IRDH375 with coupling device AGH150W-4

ISOMETER® IRDH375 with coupling device AGH204S-4

ISOMETER® IRDH375 with coupling device AGH520S

---

1. **without rectifier**
   
   \[ U_n = 3\text{AC }0...1650 \text{ V (DC max. 1000 V)} \]

2. **with rectifier**
   
   \[ U_n = 3\text{AC }0...1300 \text{ V (peak voltage downstream of the rectifier or intermediate circuit voltage of max. 1840 V)} \]
ISOMETER® IRDH575

Insulation monitoring device for unearthed AC, DC and AC/DC systems (IT systems) with control and display function for EDS insulation fault location systems

Device features

- Universal application in 3(N)AC, AC/DC and DC IT systems 20…575 V/340…760 V
- Response range 1 kΩ…10 MΩ
- Info button for the indication of various parameters and the system leakage capacitance
- Comprehensive self-monitoring function including system fault alarm relay
- Internal/external test and reset button
- Two separate alarm relays, N/C or N/O operation selectable
- Backlit plain text display 4 x 16 characters
- RS-485 interface
- Data memory, disconnection from supply and 0/4…20 mA current output
- Can be extended to an insulation fault location system for max. 1080 circuits
- Adjustable locating current for insulation fault location
- Appropriate for EDS4… insulation fault location systems
- AMP measurement method

Other functions

- History memory to store max. 99 alarm messages with date and time stamp
- Isometer disconnecting relays for the operation of several ISOMETER®s in coupled IT systems
- Built-in RS-485 interface (BMS bus) for communication with other Bender devices

Standards


Further information

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

Permissible extraneous DC voltage \(U_{fg}\) Nominal system voltage \(U_{n}\) Supply voltage \(U_{S}\) Type Art. No.

<table>
<thead>
<tr>
<th>DC</th>
<th>AC</th>
<th>DC</th>
<th>AC</th>
<th>DC</th>
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</thead>
<tbody>
<tr>
<td>(\leq 810) V</td>
<td>20…575 V</td>
<td>20…575 V</td>
<td>–</td>
<td>19.2…72 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>88…264 V</td>
<td>77…286 V</td>
</tr>
<tr>
<td></td>
<td>20…150 V</td>
<td>20…150 V</td>
<td>–</td>
<td>19.2…72 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>88…264 V</td>
<td>77…286 V</td>
</tr>
<tr>
<td>(\leq 1000) V</td>
<td>340…760 V</td>
<td>340…575 V</td>
<td>–</td>
<td>19.2…72 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>88…264 V</td>
<td>77…286 V</td>
</tr>
</tbody>
</table>

1) Measuring voltage \(U_{m}\) 10 V (version -4227) for usage in control circuits.
Device "Option-W" with increased resistance to shock and vibrations: Indicated by the letter "W" at the end of the order number.

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel seal for IP 42</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Transparent cover for IP 65</td>
<td>–</td>
<td>364</td>
</tr>
<tr>
<td>Adapter for DIN rail mounting</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Measuring instruments</td>
<td>9620-1421</td>
<td>328</td>
</tr>
<tr>
<td></td>
<td>96205-1421</td>
<td>328</td>
</tr>
</tbody>
</table>
1. Technical data

## Insulation coordination acc. to IEC 60664-1

- **Rated voltage:** AC 800 V
- **Rated impulse voltage/pollution degree:** 8 kV/3

### Voltage ranges

**IRDH575B1-4235:**
- **Nominal system voltage:** Uₐ = AC, 3(N)/AC 20...150 V
- **Nominal frequency:** 50...460 Hz
- **System leakage capacitance:** ≤ 150 μF
- **System leakage capacitance:** 50...460 Hz
- **System leakage capacitance:** DC 20...150 V

**IRDH575B1-4155:**
- **Nominal system voltage:** Uₐ = AC, 3(N)/AC 20...375 V
- **Nominal frequency:** 50...460 Hz
- **System leakage capacitance:** ≤ 150 μF
- **System leakage capacitance:** DC 20...375 V

**IRDH575B2-4155:**
- **Nominal system voltage:** Uₐ = AC, 3(N)/AC 340...700 V
- **Nominal frequency:** 50...460 Hz
- **System leakage capacitance:** ≤ 150 μF
- **System leakage capacitance:** DC 340...700 V

### Measuring circuit for insulation measurement

- **Measuring voltage:** Uₐ ≤ 40 V
- **Measuring current:** Iₐ ≤ 10 mA
- **Measuring current:** 1 KΩ to 10 MΩ
- **Response value:** ±15 %
- **Response value:** ±10 %
- **Response value:** ±5.5 %
- **Response value:** ±3 %
- **Response value:** ±1.5 %
- **Response value:** ±0.5 %

### Measuring circuit for insulation fault location (EDS)

- **Locating current:** Iₐ ≤ 1/2.5/10/25/50 mA
- **Test pulse/break:** 2/4 s

### Outputs/Inputs

- **Test/reset button:** internal/external
- **Current output:** IRDH575 (max. load): 0/4...20 mA (≤ 500 Ω)
- **Accuracy current output:** 1 KΩ...1 MΩ ±10 %, ±1 kΩ

### Serial interface

- **Interface/protocol:** RS-485/85
- **Max. cable length:** ≤ 1200 m
- **Recommended terminating resistor:** 120 Ω (0.5 W)

### Switching elements

- **Number of switching contacts:** K1 (Alarm1), K2 (Alarm2), K3 (device error, additionally selectable EDS alarm)
- **Operating principle:** N/O or N/C operation
- **Factory setting:** N/O operation
- **Switching principle:** N/C operation
- **Electrical endurance, number of cycles:** 12,000

### Environment/EMC

- **Contact class:** IIB (DIN IEC 60255-23)
- **Rated operating voltage:** AC 230 V/DC 300 V
- **Making capacity:** AC/DC 5 A
- **Breaking capacity:** 2 A, AC 230 V, cos ϕ = 0.4
- **Contact rating at DC 24 V:** ≥ 2 mA (50 mW)
- **Classification of climatic conditions:** acc. to DIN 46721-3-3

### Connection

- **Type of enclosure:** screw-type terminals
- **Connection properties:** rigid/flexible, flexible with ferrules without/with plastic sleeve
- **Conductor sizes (AWG):** 14…12

### Other

- **Operating mode:** continuous operation
- **Mounting:** display-oriented
- **Distance to adjacent devices:** ≥ 30 mm
- **Degree of protection, internal components:** DIN EN 60529
- **Degree of protection, terminals:** DIN EN 60529
- **Degree of protection, for door mounting:** DIN EN 60529
- **Degree of protection, for door mounting with panel sealing:** DIN EN 60529
- **Degree of protection, for mounting the transparent front plate cover:** DIN EN 60529
- **Type of enclosure:** suitable for panel mounting flat from halogen
- **Flammability class:** UL94 V-0
- **IP protection:** IP65
- **Electrical endurance, number of cycles:** ≥ 250
- **Ambient temperature (during storage):** ≤ 60 °C
- **Ambient temperature (during operation):** ≤ 55 °C
- **Ambient temperature (during storage):** ≤ 85 °C

### Option “W”

- **Shock resistance IEC 60668-2-27 (device in operation):** 15 g/13 ms
- **Bumping IEC 60668-2-29 (transport):** 40 g/6 ms
- **Vibration resistance IEC 60668-2-6 (during operation):** 1 g/10...150 Hz
- **Vibration resistance IEC 60668-2-6 (transport):** 2 g/10...150 Hz
- **Ambient temperature (during operation):** ≤ −25...+70 °C
- **Ambient temperature (during storage):** ≤ −40...+70 °C

The data labelled with an * are absolute values

---

**Notes:**
- Under EMC test conditions in accordance with IEC 61326-2-4 the specified tolerances can double
1. “INFO” button: to query standard information
   ESC button: back (menu function), confirms parameter changes
2. “TEST” button: to call up the self test (Isometer function only)
   Arrow up button: parameter change, to move up in the menu
3. “RESET” button: to delete insulation fault alarms
   (Isometer function only)
   Arrow down button: parameter change, to move down in the menu
4. “MENU” button: to call up the menu system.
   Enter button: to confirm parameter changes
5. EDS LED lights: Insulation fault location has been started
6. EDS alarm LED lights: Insulation fault localised
7. Alarm LED “1” lights: insulation fault, first warning level reached
9. LED lights: Device error

10. Indication of the insulation resistance in kΩ
11. Additional information about the insulation resistance: + = Fault at L+, - = Fault at L-, s = A new measuring process has been started.
12. Bus address of the testing EDS46...
   (indication in case of fault detection)
13. Channel being monitored by EDS4...
   (indication in case of fault detection)
14. Locating current in mA or µA (indication in case of fault detection)
15. EDS in AUTO mode and just running. Further modes are: on, off, pos: address and channel of the EDS can be predefined (in the Master mode only). 1 cycle: When all the channels have been checked once, the EDS will be deactivated.
16. Polarity of the locating current. Point = valid BMS traffic, H = a new entry is made in the history memory.
17. Plain text fault messages

Wiring diagram

1. For external indicating instrument
   Current output 0…20 mA or 4…20 mA
2. External test button “T1, T2” (N/O contact)
3* External reset button “R1, R2” (N/C contact or wire jumper), (with the terminals open and the ISO-SETUP setting Memory: off, insulation faults will not be stored)
4* STANDBY, when the contact is closed, no insulation measurement is carried out; disconnection from the IT system being monitored
5. S1 = ON: Termination of the serial RS-485 interface (A/B) with 120 Ω (S2 = not wired)
6. Serial RS-485 interface (BMS bus)
7. Alarm relay “K3” (device error and EDS alarm) (addr.: 1)
8. Alarm relay “K2” (insulation fault 2); available changeover contacts
9. Alarm relay “K1” (insulation fault 1); available changeover contacts
10. Supply voltage $U_S$ (see nameplate) via 6 A fuse; for UL and CSA applications, it is mandatory to use 5 A fuses.
11. Connection to the 3AC system to be monitored:
   Connect terminals L1, L2 L3 to conductor L1, L2, L3
12. Connection to the AC system to be monitored:
   Connect L1 to conductor L1 and terminals L2, L3 to conductor L2
13. Connection to the DC system to be monitored:
   Connect L1 to conductor L+ and terminals L2, L3 to conductor L-
14. Separate connection of $\overline{L}$ and KE to PE

* The terminal pairs 2, 3 and 4 have to be wired electrically isolated and must not be connected to PE!
Insulation monitoring devices | Main circuits

Insulation monitoring device ISOMETER® IRDH575

1. Rear view IRDH575
2. Detachable terminal cover

System configuration – Example

Wiring example EDS system with EDS460 and IRDH575

1. ISOMETER® IRDH575
2. RS-485/BMS protocol
3. EDS460/EDS461
4. EDS3090/EDS3091

Design of an insulation fault location system with EDS461

The example above shows an EDS461 system in a DC system for the supply of a programmable logic controller (PLC). Due to the fact that the inputs of PLC systems are very sensitive, the use of an EDS461 is recommended.

The locating current of the IRDH575 is to be set to max. 2.5 mA or as necessary to 1 mA, in order to avoid influences on the PLC system.

EDS system with IRDH575, EDS460 and measuring current transformers W... in a 3AC system

1. 3AC, 3NAC, DC 20...575 V bzw. 3AC, 3NAC, DC 340...760 V
2. $U_s$ see ordering information, 6 A fuse recommended.
3. Measuring current transformers W...
4. Outgoing circuits to the loads
5. ISOMETER® IRDH575
6. Insulation fault locator EDS460

AC 20...265V/DC 20 V...308 V

$U_s$ see ordering information, 6 A fuse recommended.

Note: Supply voltage $U_s$ in the IT system requires two fuses.

Measuring current transformers W.../8000

Outgoing circuits PLC: inputs and outputs

ISOMETER® IRDH575

Insulation fault locator EDS461

Note: Supply voltage $U_s$ in the IT system requires two fuses.
**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
  - LEDs: Alarm 1/Alarm 2
  - Fault memory behaviour, selectable
  - Connection monitoring system/earth
  - Test and reset button
  - Connection external test and reset button
  - Two separate alarm relays with one changeover contact each
  - N/O or N/C operation, selectable
  - Backlit LC display

- **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**

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

<table>
<thead>
<tr>
<th>Design</th>
<th>Supply voltage (V)</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AC: 16…72 V</td>
<td>DC: 10.2…84 V</td>
<td>IR1575-434</td>
</tr>
<tr>
<td>Increased shock and vibration resistance</td>
<td>AC: 88…264 V, 340…460 V</td>
<td>DC: 77…286 V</td>
<td>IR1575W-435</td>
</tr>
</tbody>
</table>

\(^{1)}\) Absolute values
## Insulation monitoring devices | Main circuits

### Insulation monitoring device ISOMETER® IR1575

#### Technical data

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

#### Voltage ranges

- **Nominal system voltage** $U_n$
  - AC, 3(N)/AC 0…480 V, DC 0…480 V
- **Nominal frequency** $f_n$
  - DC, 30…420 Hz
- **Supply voltage** $U_S$

#### Response values

- **Response value** $R_{an1}$ (Alarm 1): 2 kΩ…1 MΩ
- **Response value** $R_{an2}$ (Alarm 2): 2 kΩ…1 MΩ
- **Relative uncertainty**: 0…+20 %/min. +2 kΩ
- **Hysteresis**: 25%

#### Measuring circuit

- **Measuring voltage** $U_m$
  - ±20 V
- **Measuring current** $I_m$ (at $R_F = 0$ Ω)
  - ≤ 170 μA
- **Impedance $Z_i$ at 50 Hz**
  - ≥ 14 kΩ
- **Permissible extraneous DC voltage** $U_{fg}$
  - ≤ DC 680 V
- **Permissible system leakage capacitance**
  - ≤ 60 μF

#### Displays

- **Display**
  - Backlit LCD display
- **Characters (number of characters, height)**
  - 2 x 16 (4.5 mm)
- **Display range, measured value**
  - 1 kΩ…5 MΩ
- **Operating uncertainty (1…10 kΩ)**
  - ±120 Ω
- **Operating uncertainty (10 kΩ…5 MΩ)**
  - ±10 %

#### Outputs

- **Test and reset button**
  - Internal/external

#### Switching elements

- **Number of switching elements**: 2 x 1 changeover contact
- **Operating principle**: N/C operation/N/O operation
- **Factory setting**
  - N/O operation
- **Contact class**: IIB (IEC 60255-0-20)
- **Rated contact voltage**: AC 250 V/DC 500 V
- **Making capacity**: AC/DC 5 A
- **Breaking capacity**: 2 A, AC 230 V, cos phi 0.4
  - 0.2 A, DC 220 V, L/R = 0.04 s
- **Contact rating at DC 24 V**: ≥ 2 mA (50 mW)

#### 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
- **Classification of climatic conditions acc. to DIN IEC 60721-3-3**
  - 3K5

#### Connection

- **Connection**
  - Plug-in terminals
- **Connection properties**
  - Rigid/flexible
  - 0.2…/4/0.2…2.5 mm²
  - Flexible with ferrules without/with 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 position**
  - Display-oriented
- **Degree of protection, internal components (DIN EN 60529)**
  - IP30
- **Degree of protection, terminals (DIN EN 60529)**
  - IP20
- **Mounting**
  - Panel mounting
- **Flammability class**
  - UL94V-2
- **Documentation number**
  - D00116
- **Weight**
  - ≤ 400 g

---

### Dimension diagram (dimensions in mm)

![Dimension diagram](image-url)
### Wiring diagram – Operating elements

1. **“TEST” button:** to call up the self test  
   Arrow up button: Parameter changes, scroll
2. **“RESET” button:** to delete alarm and fault messages  
   Arrow down button: Parameter changes, scroll
3. **“MENU” button:** to call up the menu system  
   Enter button: to confirm parameter changes
4. LC display 2 x 16 characters
5. Alarm LED “1” lights: insulation fault, first warning level reached
7. External test button “T1/T2” (N/O contact)
8. External reset button “R1/R2” (N/C contact or wire jumper). When the terminals are open, the fault message will not be stored.
9. Alarm relay. Alarm 2
10. Alarm relay. Alarm 1

### Wiring diagram – System connection

1. Supply voltage $U_S$ (see nameplate), 6 A fuse protection recommended:  
   $A0$ – $A1 = AC 88…264 V$, $DC 77…286 V$  
   $A0$ – $A2 = AC 340…460 V$
2. Separate connection of E and KE to PE
3. Connection of the AC system to be monitored:  
   connect terminals L1, L2 to conductor L1, L2.
4. Connection to the DC systems to be monitored:  
   Connect terminal L1 to conductor L+, terminal L2 to conductor L-
5. Connection to the 3AC system being monitored:  
   Connect the terminals L1, L2 to neutral conductor N or terminals L1, L2 to conductor L1, L2.
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

Remote alarm indicator and test combination MK7
• Easy-to-clean front foil surface
• Label field
• Panel frame alpine white
• Alarm LEDs: Power On, insulation fault overload, overtemperature
• Test button, mute button
• Standard flush-mounting enclosure 66 mm

Standards
The ISOMETER® of the IR427 series complies with the requirements of the device standards: IEC 60364-7-710, IEC 61557-8 and 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 $U_o$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 70...264 V, 42...460 Hz</td>
<td>AC 70...264 V, 42...460 Hz</td>
<td>IR427-2</td>
<td>B 7207 5300</td>
</tr>
<tr>
<td>DC 18...28 V</td>
<td></td>
<td>MK7 Remote alarm indicator and test combination</td>
<td>B 9510 0201</td>
</tr>
</tbody>
</table>

Device version with screw terminals on request.

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>
<tr>
<td>MK-cavity-wall-box-60mm</td>
<td>B 95100203</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring current transformers</td>
<td>STW2</td>
<td>–</td>
</tr>
<tr>
<td>Temperature sensor (PTC)</td>
<td>ES0107</td>
<td>–</td>
</tr>
<tr>
<td>Mounting frame</td>
<td>XM420</td>
<td>363</td>
</tr>
</tbody>
</table>
Insulation monitoring device ISOMETER® IR427

**Technical data IR427**

- **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 (L1, L2, E, KE, 1, 2, 3, 4, ZK, L1 - (L1, L2, 14)) 2.2 kV
  - Voltage test acc. to IEC 60710-1 2.2 kV

**Supply voltage**
- Supply voltage $U_S$ = $U_0$
- Power consumption ≤ 4 VA

**IT system being monitored**
- Nominal system voltage $U_0$
  - Nominal frequency $f_0$
  - Nominal frequency $f_0$
  - 47…63 Hz

**Insulation monitoring**
- Response value $R_{RI}$
  - ≤ 50 mΩ
  - ≥ 200 kΩ
- Hysteresis: ≤ 25 %
- Permissible system leakage capacitance $C_L$ ≤ 5 μF

**Measuring circuit**
- Measuring voltage $U_M$
  - ≤ 12 V
- Measuring current $I_{RI}$ (at $R_0 = 0 Ω$) ≤ 50 μA
- Hysteresis: ≤ 25 %
- Measuring circuit: ≤ 5 μF
- Permissible system leakage capacitance $C_L$ ≤ 5 μF

**Load current monitoring**
- Response value, adjustable: 5…50 A (7 A)*
  - ≤ 5 %
- Hysteresis: ≤ 4 %
- Setting values load current measurement:
  - Transformer: 3150 VA
  - 14 A
  - 18 A
  - 22 A
  - 28 A
  - 35 A
  - 45 A
- PTC resistors acc. to DIN 44081 max. 6 m series

**Temperature monitoring:**
- Response value (fixed value): 4 kΩ
- Release value (fixed value): 1.6 kΩ
- PTC resistors acc. to DIN 44081 max. 6 m series

**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: J-Y(ST)Y min. 2x0.6

**Power supply (terminals 1 and 2):**
- $U_{IR}$
- DC 24 V
- $I_{max}$ (max. 4 MΩ): 80 mA

**Communication (terminal 3 and 4):**
- Interface/protocol: RS-485/proprietary, no BMS
- Terminating resistor: 120 (0.25 W), internal, switchable

---

**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)
  - 3K5 (except condensation and formation of ice)
  - Transport (IEC 60721-3-2)
  - 2K3 (except condensation and formation of ice)
- Classification of mechanical conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3)
  - 3K4
- Transport (IEC 60721-3-2)
  - 2M2
- Storage (IEC 60721-3-1)
  - 1M3

**Connection**
- Connection type: screw-type terminals
- Connection properties:
  - rigid/flexible
  - Flexible with ferrule
  - Flexible with ferrule
  - Flexible with ferrule
- Stripping length: 10 mm
- Operating force: 50 N
- Test opening, diameter: 2.1 mm

**Other**
- Operating mode: continuous operation
- Degree of protection, internal components (DIN EN 60529): IP20
- Degree of protection, terminals (DIN EN 60529): IP20
- Enclosure material: polycarbonate
- Flammability class: UL94V-0
- Screw mounting: 2 x M4
- Rail mounting acc. to: IEC 60715
- Documentation number: 000118
- Weight: ≤ 150 g

---

* (* = Factory setting)
### Alarm messages LEDs

<table>
<thead>
<tr>
<th></th>
<th>IR427</th>
<th>MK7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation</td>
<td>&quot;ON&quot;</td>
<td></td>
</tr>
<tr>
<td>System fault</td>
<td>flashing</td>
<td>flashing</td>
</tr>
<tr>
<td>Insulation fault</td>
<td>flashing</td>
<td>flashing</td>
</tr>
<tr>
<td>Overcurrent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overtemperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No communication btw. IR 427+MK7</td>
<td></td>
<td>flashing</td>
</tr>
</tbody>
</table>

1) Detailed alarm information on LCD

### Displays and controls

#### IR427

1. Power On LED “ON”  
2. Alarm LEDs “AL1”, “AL2”  
3. Test button “TEST” (>2 s): To call up the self test.  
   Arrow up button: parameter change to move up in the menu  
   Arrow down button: parameter change to move down in the menu  
4. “MENU” button (> 2 s): to call up the menu system. Enter button: to confirm parameter changes  
5. LC display

#### MK7

1. Power On LED “ON”  
2. LED to signal insulation faults  
3. LED to signal overload  
4. LED to signal overtemperature  
5. Mute button  
6. Test button “TEST”
1 Connection to the IT system to be monitored = supply voltage $U_S$ via fuse
2 Temperature sensor
3 Measuring current transformer for load current monitoring
4 Connection alarm indicator and test combination MK7 (max. 4 pieces)
5 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

PE = Protective earth
EB = Equipotential bonding
SEB = 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

Standards
The ISOMETER® of the isoMED427P series complies with the requirements of the device standards: IEC 60364-7-710, IEC 61557-8, IEC 61557-9 and DIN VDE 0100-710.

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

Supply voltage $U_S = U_n$1)

<table>
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<tr>
<th>Type</th>
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<tbody>
<tr>
<td>AC</td>
<td></td>
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<tr>
<td>70…264 V, 42…460 Hz</td>
<td>isoMED427P-2 B 7207 S301</td>
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1) Absolute values of the voltage range

Ordering information

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<tr>
<td>Three phase load monitor</td>
<td>CMS460-D4-2</td>
<td>–</td>
</tr>
<tr>
<td>Mounting frame</td>
<td>XM420</td>
<td>363</td>
</tr>
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</table>

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/pollution degree: 4 kV/3
- Protective separation (reinforced insulation) between (L1, L2, E, KE, T1, T2, A, B, Z, Z/k, L2, T1, T2, 14)
- Voltage test acc. to IEC 61010-1: 2.21 kV

**Voltage supply**

- Supply voltage $U_s = U_m$
- Power consumption: ≤ 6.5 VA

**IT system being monitored acc. to IEC 60364-7-710**

- Nominal system voltage $U_n$ = AC 70…264 V
- Nominal frequency $f_n$ = 47…63 Hz

**Insulation monitoring acc. to IEC 61557-8**

- Response value $R_n$: 50…500 kΩ (50 kΩ)\(^*\)
- Relative uncertainty: ±10 %
- Hysteresis: 25 %
- Response time $t_{n+}$ at $R = 0.5 \times R_n$ and $C = 0.5 \mu$F: ≤ 5 s
- Response time for PE connection monitoring: ≤ 1 s
- Permissible system leakage capacitance $C_s$: 5 μF

**Measuring circuit**

- Measuring voltage $U_m$: ±12 V
- Measuring current $I_m$ (at $R = 0$ μΩ): ≤ 50 μA
- Internal DC resistance $R_i$: ≥ 240 kΩ
- Impedance $Z_i$ at 50 Hz: ≥ 200 kΩ
- Permissible external DC voltage $U_{ih}$: ≤ DC 300 V

**Locating current injector acc. to IEC 61557-9**

- Locating current: ≤ 1 mA
- Test pulse/break: 2/4 s

**Load current monitoring**

- Response value, adjustable: 5…50 A (7 A)\(^*\)
- Relative uncertainty: ± 5 %
- Hysteresis: 4 %
- Nominal frequency $f_n$: 47…63 Hz
- Setting values load current measurement:
  - Transformer: 3150 VA, 4000 VA, 5000 VA, 6300 VA, 8000 VA, 10000 VA
  - Alarm 1 – 14 A, 18 A, 22 A, 28 A, 35 A, 45 A

**Temperature monitoring**

- Response value (fixed value): 4 kΩ
- Rated frequency $f_n$: 47…63 Hz
- Release value (fixed value): 1.6 kΩ
- PIC resistors acc. to DIN 44081: max. 6 in series
- Relative uncertainty: ± 10 %

**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 %…99 %
- Operating error: ± 5 %, ± 0.2 A
- Password: on, off/0…999 (off, 0)\(^*\)

**Interface**

- Interface/protocol: RS-485/BMS
- Baud rate: 9.6 kbit/s
- Cable length: 0…1200 m
- Cable (twisted in pairs, one end of shield connected to PE): recommended: 3-Y(S)YJ min. 2 x 0.8
- Terminating resistor: 120 (0.25 W), internal, switchable
- Device address, BMS bus: 2…90 (3)\(^*\)

**Interfaces for measuring current transformer STW2 and temperature sensor**

- Cable lengths:
  - single wire > 0.5 mm\(^2\): ≤ 1 m
  - single wire, twisted > 0.5 mm\(^2\): ≤ 10 m
  - twisted in pairs, shielded > 0.5 mm\(^2\): ≤ 40 m
- Cable (shield on one side connected to PE): recommended: 3-Y(S)YJ min. 2 x 0.6

**Switching elements**

- Number: 1 changeover contact
- Operating principle: N/C operation or 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, 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**

- Operating temperature: -25…+55 °C
- Classification of climatic conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3K5 (no condensation, no formation of ice)
  - Transport (IEC 60721-3-2): 2K3
  - Long-term storage (IEC 60721-3-1): 1K4
- Classification of mechanical conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3M4
  - Transport (IEC 60721-3-2): 2M2
  - Long-term storage (IEC 60721-3-1): 1M3

**Connection**

- Connection type: push-wire terminals
- Connection properties:
  - rigid: 0.2…2.5 mm\(^2\) (AWG 24…14)
  - flexible without ferrule: 0.75…2.5 mm\(^2\) (AWG 19…14)
  - flexible with ferrule: 0.2…1.5 mm\(^2\) (AWG 24…10)
- Stripping length: 10 mm
- Opening force: 50 N
- Test opening, diameter: 2.1 mm

**Other**

- Operating mode: continuous operation
- Position of normal use: any
- Degree of protection, 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 44081:
  - 2 x M4 with mounting clip
- Documentation number: D00045
- Weight: ≤ 150 g

\(^*\) = factory setting

---

**Alarm messages LEDs**

<table>
<thead>
<tr>
<th>isoMED427P</th>
<th>&quot;ON&quot;</th>
<th>&quot;AL1&quot;</th>
<th>&quot;AL2&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>System fault*</td>
<td>flashing</td>
<td>flashing</td>
<td>flashing</td>
</tr>
<tr>
<td>Insulation fault</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Overcurrent</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Overtemperature</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
</tbody>
</table>

* Detailed alarm information on LCD
**Displays and controls**

1. **Power On LED “ON”**
2. **Alarm LEDs “AL1”, “AL2”**
3. **“TEST” button (>2 s): to call up the self test.**
   **Arrow up button: parameter change, to move up in the menu**
4. **“MENU” button (>2 s): to call up the menu system.**
   **Enter button: confirms parameter changes**
5. **LC display**

**Wiring diagram**

1. **Connection to the IT system to be monitored = supply voltage $U_S$ via fuse**
2. **Temperatur sensor**
3. **Measuring current transformer for load current monitoring**
4. **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.**
5. **Serial interface BMS**

**Example of application**
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
- Insulation monitoring for unearthed systems AC, AC/DC 0…793 V, DC 0…1100 V
- Two separately adjustable response values 0.2…100 kΩ
- Various AMPPlus measurement methods selectable
- Automatic adaptation to the system leakage capacitance
- Info button to display device settings and the system leakage capacitance
- Self monitoring with automatic alarm
- Automatic self test, selectable
- Connection for external kΩ indication
- Test and reset button
- External test/reset button can be connected
- Two separate alarm relays with two potential-free changeover contacts
- N/O or N/C operation, selectable
- Backlit LC display
- RS-485 interface
- Presetting for PV systems via menu

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

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)

Standards
The ISOMETER® of the isoPV series complies with the requirements of the device standards:
DIN EN 61557-8 (VDE 0413-8), IEC 61557-8, IEC 61326-2-4 Ed. 1.0, DIN EN 60664-1 (VDE 0110-1), DIN EN 60664-3 (VDE 0110-3).

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>Set comprising</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 19.2…72 V</td>
<td>isoPV-327</td>
<td>B 9106 5130W</td>
</tr>
<tr>
<td>DC 77…286 V</td>
<td>AGH-PV</td>
<td>B 9803 9020W</td>
</tr>
<tr>
<td></td>
<td>isoPV-335</td>
<td>B 9106 5131W</td>
</tr>
<tr>
<td></td>
<td>AGH-PV</td>
<td>B 9803 9020W</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>B 990 056</td>
</tr>
</tbody>
</table>

Suitable system components
<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>External kΩ measuring instruments</td>
<td>9620-1421</td>
<td>328</td>
</tr>
</tbody>
</table>
Insulation monitoring devices | Application-specific selection – photovoltaic

Insulation monitoring device ISOMETER® isoPV with coupling device AGH-PV

**Technical data ISOMETER® isoPV**

### Insulation coordination acc. to IEC 60664-1

- Rated insulation voltage: AC 800 V
- Rated impulse withstand voltage/pollution degree: 8 kV/3

### Voltage ranges

- Nominal system voltage $U_n$: via AGH-PV
- ISOMETER® ISO PV: $88...264 V^*$
- Frequency range $f$: $42...460$ Hz
- Supply voltage $U_s$: $DC 77...286 V^*$
- ISOMETER® ISO PV-327: $DC 19.2...72 V^*$
- ISOMETER® ISO PV-...: Power consumption ≤ $8 VA$

### Response values

- Response value $R_{rel}$: $0.2...100 k\Omega$
- Factory setting $R_{set}$: $4 k\Omega$
- Response value $R_{beh}$: $0.2...100 k\Omega$
- Factory setting $R_{beh}$: $1 k\Omega$
- Relative uncertainty: $7...100 k\Omega$ (acc. to IEC 61557-8)
- Response time $t_{rel}$: $≤ 0.5 ms$ (full-scale response)

### Measuring circuit

- Measuring voltage $U_{mea}$ (peak value): $≤ 50 V$
- Measuring current $I_{mea}$ (at $R_i = 0 \Omega$): $≤ 1.5 \ mA$
- Internal DC resistance $R_i$: $≥ 35 k\Omega$
- Impedance $Z_i$ at $50 \ Hz$: $≥ 35 k\Omega$
- Permissible extraneous DC voltage $U_{ex}$: $≤ DC 1100 V$
- Permissible system leakage capacitance $C_Z$: $≤ 2000 \mu F$ (at $50 \ Hz$)

### Displays

- Display, illuminated: two-line display
- Characters (number/height): $2 \times 16/4 \ mm$
- Display range measured value: $0.2 \ k\Omega...1 \ M\Omega$
- Operating uncertainty: $± 15 \%$, $± 1 k\Omega$

### 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): $± 15 \%$, $± 1 k\Omega$

### Serial interface

- Interface/protocol: RS-485/BMS
- Connection: terminals A/B
- Cable (twisted pairs, shield connected to PE): $2...4 \ mm^2$, recommended: $1.5\ V/0.5 \ mm^2$
- 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
- Rated operational voltage: $230 \ V$, $220 \ V$, $24 \ V$, $170 \ V$, $220 \ V$
- 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:
  - EMI: 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): Class 3 (with condensation and formation of ice)
  - Transport (IEC 60721-3-2): K3 (with condensation and formation of ice)
  - Long-term storage (IEC 60721-3-1): K4 (with condensation and formation of ice)
- Classification of mechanical conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): Class 3 (with condensation and formation of ice)
  - Transport (IEC 60721-3-2): K2 (with condensation and formation of ice)
  - Long-term storage (IEC 60721-3-1): K3

### Connection

- Connection:
  - screw-type terminals
- Connection properties:
  - rigid/flexible: $0.2...4 \ mm^2/0.2...2.5 \ mm^2$
  - flexible with ferrules/without plastic sleeve: $0.2...2.5 \ mm^2$
- Tightening torque: $0.5 \ Nm$
- Conductor sizes (AWG): $24...12$
- Cable length between iso-PV and AGH-PV: $≤ 0.5 \ m$

### Other

- Operating mode:
  - continuous operation, 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
- Screw mounting:
  - $2 \times M4$ with mounting clip
- DIN rail mounting acc. to IEC 60715
- Flammability class:
  - UL 94 V-0
- Documentation number: D00024

**Data labelled with ** are absolute values

(*) = factory setting
### Technical data coupling device AGH-PV

#### 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 $U_{\text{max}}$ in the frequency range $f_n = 0.1…10 Hz$: $U_{\text{max}} = 110 V/Hz \times f_n$

#### Environment/EMC
- **EMC**: IEC 61326-2-1 Ed. 1.0
- **Operating temperature**: $-25…+70 ^\circ C$
- **Classification of climatic conditions acc. to IEC 60721**:
  - Stationary use (IEC 60721-3-3): 3K5 (with condensation and formation of ice)
  - Transport (IEC 60721-3-2): 2K3 (with condensation and formation of ice)
  - Long-term storage (IEC 60721-3-1): 1K4 (with condensation and formation of ice)
- **Classification of mechanical conditions acc. to IEC 60721**:
  - Stationary use (IEC 60721-3-3): 3M7
  - Transport (IEC 60721-3-2): 2M2
  - Long-time storage (IEC 60721-3-1): 1M3

#### Connection
- **Connection**: screw-type terminals
- **Rigor/flexible**: 0.2…4 mm²/0.2…2.5 mm²
- **Flexible with ferrules without/with plastic sleeve**: 0.25…2.5 mm²
- **Tightening torque**: 0.5 Nm
- **Conductor sizes (AWG)**: 24…12
- **Cable length between iso-PV and AGH-PV**: $\leq 0.5 m$
- **Distance to adjacent devices**: $\geq 30 mm$
- **Degree of protection, internal components (DIN EN 60529)**: IP30
- **Degree of protection, terminals (DIN EN 60529)**: IP20
- **Type of enclosure**: X200
- **Screw mounting**: 2 x M4
- **DIN rail mounting acc. to IEC 60715**:
- **Flammability class**: UL94V-0
- **Weight**: $\leq 230 g$

### Dimension diagrams (dimensions in mm)

<table>
<thead>
<tr>
<th>isoPV</th>
<th>AGH-PV</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Dimension diagram isoPV" /></td>
<td><img src="image" alt="Dimension diagram AGH-PV" /></td>
</tr>
</tbody>
</table>

### Operating elements isoPV

1. **“INFO” button**: to query standard information
2. **“ESC” button**: back (menu function), to confirm parameter change
3. **“TEST” button**: to call up the self test.
   - Arrow up button: parameter change, to move up in the menu
   - Arrow down button: parameter change, to move down in the menu
4. **“MENU” button**: to call up the menu system.
   - Enter button: to confirm parameter changes
5. **Alarm LED “1” lights**: insulation fault, first warning level reached
6. **Alarm LED “2” lights**: insulation fault, second warning level reached
7. **Device error LED lights**: isoPV faulty
8. **Two-line display for standard and menu mode**
Insulation monitoring devices | Application-specific selection – photovoltaic

ISOMETER® isoPV with coupling device AGH-PV

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 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. Separate connection of $\frac{1}{n}$ and KE to PE
6. External test button “T1, T2” (N/O contact)

Typical application

PV generator unearthed (IT system) with nominal voltage $\leq$ 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:
  - 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

Typical applications

- AC, DC or AC/DC main circuits
- Solar systems with directly connected inverters
- Solar systems with high system leakage capacitances
- Solar systems with high but slow voltage fluctuations
- Systems including switched mode power supplies

Standards

The ISOMETER® of the isoPV425 series complies with the requirements of the device standards: DIN EN 61557-8 (VDE 0413-8), IEC 61557-8, ASTM F 1669M-96 (2007).

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 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>0…690 V, 0…1000 V</td>
<td>≤ 500 μF</td>
<td>isoPV425-D4-2 with AGH420</td>
</tr>
</tbody>
</table>

Device version with screw terminals on request.

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>
Technical data isoPV425

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

- Rated voltage (A1, A2) - (11, 14, 24) = 300 V
- Rated impulse voltage = 4 kV
- Overvoltage category = III
- Pollution degree = 3
- Protective separation (reinforced insulation) between (A1, A2) - (AK1, GND, AK2, Up, KE, T/R, A, B) - (11, 14, 24)
- Voltage tests according to IEC 61010-1 = 2.2 kV

**Supply voltage**

- Supply voltage Uₜₙ: AC 100…240 V/DC 24…240 V
- Tolerance of Uₜₙ: ± 20…± 15 %
- Frequency range Uₜₙ: 47…63 Hz
- Power consumption = 3 W, ≤ 9 VA

**IT system being monitored**

- Nominal system voltage Uₜₙ with AGH420 = 3(U/N)/AC 0…690 V/DC 0…1000 V
- Tolerance of Uₜₙ = AC +15 %, DC +10 %
- Nominal voltage range Uₜₙ with AGH420 (UL508) = AC/DC 0…600 V
- Frequency range of Uₜₙ = DC, 15…460 Hz

**Measuring circuit**

- Permissible system leakage capacitance Cₛₜₙ at insulation value = 300 kΩ ≤ 500 μF
- Permissible system leakage capacitance Cₛₜₙ at insulation value = 300 kΩ ≤ 1000 μF
- Permissible extraneous DC voltage Uₜₙ = ≤ 1150 V

**Response values**

- Response value Rₛₜₙ: 2…500 kΩ (10 kΩ)*
- Response value Rₛₜₙ²: 1…490 kΩ (5 kΩ)*
- Relative uncertainty Rₛₜₙ: ± 15 %, at least ± 1 kΩ
- Hysteresis Rₛₜₙ: 25 %, at least 1 kΩ
- Undervoltage detection: 30…1.14 kV (off)*
- Overvoltage detection: 31…1.15 kV (off)*
- Relative uncertainty U: ± 5 %, at least ± 2 μF
- Relative uncertainty depending on the frequency ≥ 200 Hz = -0.03 %/Hz
- Hysteresis U: 5 %, at least 5 V

**Time response**

- Response time tₚₙ at Φₙ = 0.5 x Rₛₜₙ and Cₛₜₙ = 1 μF acc. to IEC 61557-8 = ≤ 10 s
- Start-up delay tₚₙ = 0…30 s (0 s)*
- Response delay tₚₙ = 0…99 s (0 s)*
- Delay on release tₚₙ = 0…99 s (0 s)*

**Displays, memories**

- Display: LC display, multifunctional, not illuminated
- Display range measured value insulation resistance (Rₛₜₙ): 1 kΩ…1 MΩ
- Operating uncertainty at Φₙ ≤ 1 MΩ: ± 15 %, at least ± 1 kΩ
- Display range measured value nominal system voltage (Uₜₙ): 30…1.15 kV rms
- Operating uncertainty: ± 5 %, at least ± 2 μF
- Relative uncertainty depending on the frequency ≥ 200 Hz = -0.03 %/Hz
- Display range measured value system leakage capacitance at Φₙ > 10 kΩ: 0…1000 μF
- Operating uncertainty: ± 15 %, at least ± 2 μF
- Password: (off)/0…999 (0, off)*
- Fault memory alarm messages: on/(off)*

**Interface/protocol**

- 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 pair, one end of shield connected to PE
  - recommended: min. 3-Y(yellow) 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 contact, common terminal T1
- Operating principle: N/C or N/O operation (N/C operation)*
- Electrical endurance in rated operating conditions: 10,000 cycles
- Contact data acc. to IEC 60947-5-1:
  - Stationary use (IEC 60721-3-3)
  - C₀-Rₚₙ ≤ 5 kΩ (except condensation and formation of ice)
  - C₀-Rₚₙ ≤ 2K4 (except condensation and formation of ice)
  - C₀-Rₚₙ ≤ 3K7 (except condensation and formation of ice)
- Long-term storage (IEC 60721-3-1): 1K5 (except condensation and formation of ice)
- Classification of mechanical conditions acc. to IEC 60721: 3M4
- Stationary use (IEC 60721-3-3): 2M2
- Long-term storage (IEC 60721-3-1): 1M3

**Connection**

- Connection type: push-wire terminal
- Nominal current: ≤ 10 A
- Conductor sizes: AWG 24-14
- Stripping length = 10 mm
- Connection properties:
  - Rigid/flexible: 0.2…2.5 mm²
  - Flexible with ferrule with/plastic sleeve: 0.25…2.5 mm²
  - Multi-conductor flexible with TWIN ferrules with plastic sleeve: 0.5…1.5 mm²
- Test opening, diameter = 50 H
- 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, 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
- Documentation number: D00026
- Weight: ≤ 150 g

(*) = Factory setting
Technical data AGH420

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage</td>
<td>1000 V</td>
</tr>
<tr>
<td>Rated impulse voltage</td>
<td>8 kV</td>
</tr>
<tr>
<td>Pollution degree</td>
<td>III</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>III</td>
</tr>
<tr>
<td>Protective separation (reinforced insulation) between (L1/+,-L2/-,-AK1,-GND,-AK2,-Up,-E)</td>
<td>4.3 kV</td>
</tr>
</tbody>
</table>

IT system being monitored

Nominal system voltage range $U_n$ AC/DC 0…1000 V

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 DC resistance $R_i$ ≥ 120 kΩ

Environment/EMC

EMC IEC 61326-2-4

Ambient temperatures:

Operation -40…+70 °C

Transport -40…+80 °C

Storage -40…+70 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3) 3K7 (except condensation and formation of ice)

Transport (IEC 60721-3-2) 2K4 (except condensation and formation of ice)

Long-term storage (IEC 60721-3-1) 1K5 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3) 3M4

Transport (IEC 60721-3-2) 2M2

Storage (IEC 60721-3-1) 1M3

Connection

Connection type push-wire terminal

Nominal current ≤ 10 A

Conductor sizes AWG 24-14

Stripping length 10 mm

Connection properties:

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

Opening force 50 N

Test opening, diameter 2.1 mm

Connection type terminals Up, AK1, GND, AK2

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

(*) = Factory setting

Dimension diagram (dimensions in mm)
Displays and controls

LED “ON” (operation LED) flashes in case of interruption of the connecting wires E/KE or L1/+ / L2/- or system fault.

Alarm LED “AL1” lights when the values fall below the set response value Alarm 1 and flashes in case of interruption of the connecting wires E/KE or L1/+ / L2/-, in the case of system faults as well as overvoltage (can be activated).

Alarm LED “AL2” lights when the values fall below the set response value Alarm 2 and flashes in case of interruption of the connecting wires E/KE or L1/+ / L2/-, in the case of system faults as well as undervoltage (can be activated).

Wiring diagram

1. 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. Connect each terminal separately to PE. The same wire cross section as for A1, A2 must be used.
3. Connect the terminals of the AGH420 to the corresponding terminals of the isoPV425
4. Connection to the 3(N)AC, AC or DC system to be monitored.
5. Connection for external combined test and reset button
6. Connection to alarm relay K1
7. Connection to alarm relay K2
8. Connection RS-485 with termination switch R (on/off)
   Example: Connection of a BMS Ethernet Gateway COM460IP

Example: Connection of a BMS Ethernet Gateway COM460IP
ISOMETER® isoPV1685/isoPV1685PFR

Insulation monitoring device with residual current monitoring (isoPV1685PFR only) for ungrounded DC systems for photovoltaic systems up to 1500 V

### Device features

- Only device version isoPV1685PFR provides a locating current injector and residual current measurement!
- 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 Ω…1 MΩ) for prewarning and alarm
- Automatic adaptation to high system leakage capacitances up to 2000 μF; selectable range
- Connection monitoring of L+, L- for reverse polarity
- Integrated locating current injector up to 50 mA (isoPV1685PFR only)
- Fast detection of insulation faults on the AC side by residual current monitoring (inverter, transformer) allowing fast disconnection (isoPV1685PFR only)
- Residual current response values $I_{Δn}$ for prewarning and alarm (1…5 A) (isoPV1685PFR only)
- CT connection monitoring (isoPV1685PFR only)
- Device self test with automatic fault message in the event of a fault
- Alarm relays separately adjustable for insulation faults, residual current faults and device errors (isoPV1685PFR only)
- Alarm relays separately adjustable for insulation fault 1, insulation fault 2 (isoPV1685 only)
- CAN interface to output measured values, statuses and alarms

### Typical applications

- Large photovoltaic systems up to 1500 V designed as IT systems

### Approvals

- UL Listed
- CE

### Standards

The isoPV1685… was developed according to the following standards:
DIN EN 61557-8 (VDE 0413-8), IEC 61557-8, IEC 61557-9, IEC 61326-2-4, DIN EN 60664-1 (VDE 0110-1).

### Ordering information

<table>
<thead>
<tr>
<th>Response value range</th>
<th>Supply voltage</th>
<th>Version</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC 200Ω…1MΩ</td>
<td>DC 18…30 V</td>
<td>without plug-in terminals</td>
<td>isoPV1685-425</td>
<td>B 9106 5602</td>
</tr>
<tr>
<td></td>
<td></td>
<td>with plug-in terminals</td>
<td>isoPV1685PFR-425</td>
<td>B 9106 5600</td>
</tr>
</tbody>
</table>

1) Absolute values
Technical Data

Insulation monitoring devices | Application-specific selection – photovoltaic

Insulation monitoring device ISOMETER® isoPV1685/isoPV1685PFR

Relative uncertainty (0.2 kΩ) (acc. to IEC 61557-8)

Rated residual operating current

Permissible system leakage capacitance C_L ≤ 2000 μF (500 μF)*

Response values for insulation monitoring

Response value R_m (Alarm 1) 200 Ω ... 1 MΩ (10 kΩ)^2

Relative uncertainty (10 kΩ ... 1 MΩ) acc. to IEC 61557-8)

Response value R_m (Alarm 2) 200 Ω ... 1 MΩ (1 kΩ)^2

Upper limit of the measuring range when set to C_L correlates = 2000 μF

Load

Number of turns of measurement winding 20

Number of turns of test winding 10

Response values for residual current measurement (AC instantaneous tripping)

Rated residual operating current I_m (1) 1...5 A (1 A)^2

Rated residual operating current I_m (2) alarm 1...5 A (5 A)^2

Relative uncertainty ±1 A

Response time t_m ≤ 1 s

Hysteresis 25 %

Cable lengths for measuring current transformers

Cable length ≤ 3 m

Test winding

Output voltage across kT/lT at max. 40 mA locating current 0.5 ... 0.8 V

Displays, memory

LEDs for alarms and operating states 2x green, 4x yellow

MicroSD card (spec. 2.0) for history memory and log files (ISO/IEC 1685PFR only) ≤ 32 GByte

Inputs

Digital inputs DigIn1/DigIn2:

High level 10...30 V

Low level 0...0.5 V

Serial interfaces

BMS:

Interface/protocol RS-485/BMS

Connection terminals A/B

Cable length ≤ 1200 m

Shielded cable (shield to functional earth on one end) 2-core, ≥ 0.6 mm², z. B. 3-FJ01X20.6

Shield terminal S

Terminating resistor, can be connected (term. RS-485) 120 Ω (0.5 W)

Device address, BMS bus 2 ... 33 (2^5)

CAN:

Protocol acc. to SIA/Bender specification V2.2

Frame format CAN 2.0A 11-bit identifier

Baud rate 500 kbit/s

Connection via 2 x RJ45 acc. to GA-303-1 connected in parallel Pin 1: CAN-H

Pin 2: CAN-L

Pin 3, 7: CAN-GND

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 Ω (0.5 W)

Potential of the socket housing functional earth-potential

Switching elements

Switching elements 3 changeover contacts: K1 (insulation fault), K2 (residual current fault), K3 (device error)

Operating principle K1, K2 N/C operation n.c. N/O operation n.o. N/C operation n.c.*

Operating principle K3 N/C operation n.c., cannot be changed

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 mAh 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 0.35

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

Connection flexible with connector sleeve, without/with plastic sleeve 0.25...2.5 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

Connection, flexible with ferrules, 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 acc. to IEC 61326-2-4 Ed. 1.0

Classification of climatic conditions acc. to IEC 60721:

Without solar radiation, precipitation, water, icing.

Condensation possible temporarily:

No solar radiation, precipitation, water, icing.

Stationary use (IEC 60721-3-3)

Condensation possible temporarily:

Without solar radiation, precipitation, water, icing.

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)

Deviation from the classification of climatic conditions:

Ambient temperature, during operation -40...+70 °C

Ambient temperature transport -40...+80 °C

Ambient temperature, during long-time storage -25...+80 °C

Relative humidity 10...100 %

Atmospheric pressure 700...1060 hPa (max. height 4000 m)
Technical data (continued)

Other
- Operating mode: continuous operation
- Position of normal use: vertical, system coupling on top
- PCB fixation: lens head screw DIN7985TX
- Tightening torque: 4.5 Nm
- Degree of protection, internal components: IP 10
- Degree of protection, terminals: IP 30
- Software version, isoPV1685: D409 V2.0x
- Software version, isoPV1685PFR: D366 V1.0x
- Documentation number: D00007
- Weight: 650 g

(*) = factory setting

Dimension diagrams (dimensions in mm)

Wiring diagrams

1. Currently has no function, digital input
2. Currently has no function, digital input
3. Connection to CAN bus, 2 x RJ-45, can be terminated using SS8102.
4. Connection to BMS bus, RS-485, S = shield (connect one end to PE), can be terminated with SS8100.
5. isoPV1685PFR only: Connection to measuring current transformer k, l = measurement winding/kT, IT = test winding
6. Alarm relay K3 for internal device errors
7. Description of relay assignment according to device type:
   isoPV1685 only:
   Alarm relay K2 for insulation faults
   isoPV1685PFR only:
   Alarm relay K2 for residual current faults
8. Alarm relay K1 for insulation faults
9. Separate connection of E and KE to PE
10. Connection to US = DC 24 V via fuses, 6 A each
11. Connection to L+ of the PV generator via 1 A fuse
12. Connection to L– of the PV generator via 1 A fuse
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 in 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

Approvals

Standards

The ISOMETER® of the isoLR275 series complies with the requirements of the device standards:
DIN EN 61557-8 (VDE 0413-8), IEC 61557-8, IEC 61326-2-4 Ed. 1.0, DIN EN 60664-1 (VDE 0110-1), DIN EN 60664-3 (VDE 0110-3)

Further information

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

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage Us</th>
<th>AC</th>
<th>DC</th>
<th>Set comprising</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>19.2…72 V</td>
<td>77…286 V</td>
<td>isoLR275-327</td>
<td>B 9106 5700W</td>
</tr>
<tr>
<td></td>
<td>B 9106 5702W</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>88…264 V</td>
<td>AGH-LR-3</td>
<td>B 9803 9022W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>77…286 V</td>
<td>isoLR275-335</td>
<td>B 9106 5701W</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B 9106 5703W</td>
<td></td>
<td></td>
<td></td>
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</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>B 990 056</td>
</tr>
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</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>External kΩ measuring instruments</td>
<td>9620-1421</td>
<td>328</td>
</tr>
</tbody>
</table>
### Technical data ISOMETER® isoLR275

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage for isoLR275-3</td>
<td>AC 250 V</td>
</tr>
<tr>
<td>Rated impulse voltage/pollution degree</td>
<td>6 kV/3</td>
</tr>
<tr>
<td>Protective separation (reinforced insulation) between (A1/+/A2/-) (11, 12, 14, 21, 22, 24)</td>
<td></td>
</tr>
<tr>
<td>Voltage test acc. to IEC 61010-1</td>
<td>3.536 kV</td>
</tr>
<tr>
<td>Rated insulation voltage</td>
<td>AC 250 V</td>
</tr>
<tr>
<td>Rated impulse voltage/pollution degree</td>
<td>4 kV/3</td>
</tr>
<tr>
<td>Basic insulation between: (11, 12, 14) (21, 22, 24)</td>
<td></td>
</tr>
<tr>
<td>Voltage test acc. to IEC 61010-1</td>
<td>2.21 kV</td>
</tr>
</tbody>
</table>

**Voltage ranges**

- Nominal system voltage $U_n$: via AGH-LR
- Supply voltage $U_s$ (also see nameplate): AC $88 \ldots 264$ V**
- Frequency range $f_s$: 42 $\ldots 460$ Hz
- Power consumption: $\leq 16$ VA
- Supply voltage $U_s$ (also see nameplate): DC $77 \ldots 286$ V**
- Power consumption: $\leq 8$ W

**Response values**

- Response value $R_{\text{R1}}$: $0.2 \ldots 100$ kΩ
- Factory setting $R_{\text{R1}}$ (Alarm 1): $4$ kΩ
- Response value $R_{\text{R2}}$: $0.2 \ldots 100$ kΩ
- Factory setting $R_{\text{R2}}$ (Alarm 2): $1$ kΩ
- Conformity to the rated insulation voltage for isoLR275-3: $3.536$ kV
- Permissible extraneous DC voltage $U_{\text{E}}$: $\leq 100$ kΩ
- Permissible system leakage capacitance $C_{\text{L}}$: $\leq 500$ μF ($150$ μF)*

**Displays**

- Display: illuminated
- Characters (number/height): $2 \times 16/4$ mm
- Display range measured value: $0.2$ kΩ $\ldots 1$ MΩ
- Operating uncertainty: $\pm 15\%$, $\pm 1$ kΩ

**Outputs/Inputs**

- Test/reset button: internal/external
- Cable length test/reset button, external: $\leq 10$ m
- Current output (Load): $0/4 \ldots 20$ mA ($\leq 500$ Ω)
- Accuracy current output, related to the value indicated ($1 \ldots 100$ kΩ): $\pm 15\%$, $\pm 1$ kΩ

**Serial interface**

- Interface/protocol: RS-485/BMS
- Connection: terminals A/B
- Cable length: $\leq 1200$ m
- Shielded cable (shield to PE on one end): $2\text{-core}$, $\geq 0.6$ mm², e.g. J-Y(St)Y
- Terminating resistor: $120$ Ω ($0.5$ W)
- Device address, BMS bus: $1 \ldots 30$ (3)*

**Switching elements**

- Switching elements: $2$ changeover contacts: K1 (Alarm 1), K2 (Alarm 2, device error)
- Operating mode K1, K2 (Alarm 1/Alarm 2): NC operation/N/O operation (N/O operation)*
- Contact data acc. to IEC 60947-5-1:
  - Utilization category: AC 13, AC 14
  - Rated operational voltage: $230$ V, $230$ V, $24$ V
  - Rated operational current: $5$ A, $3$ A, $1$ A
  - Minimum contact rating: $0.2$ A (at AC/DC $\geq 10$ V)

**Environment/EMC**

- not suitable for household and small companies: IEC 61132-2-4 Ed. 1.0
- Operating temperature: $-25 \ldots +70$ °C
- Classification of climatic conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3K5 (with condensation and formation of ice)
  - Transport (IEC 60721-3-2): 3K3 (with condensation and formation of ice)
  - Long-term storage (IEC 60721-3-1): 1K4 (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 899056
  - for DIN rail mounting: 3M4
  - Transport (IEC 60721-3-2): 2M2
  - Long-term storage (IEC 60721-3-1): 1M3

**Connection**

- Connection: screw-type terminals
- Connection properties: rigid/flexible
- Flexible with ferrules without/plastic sleeve
  - $0.2 \ldots 0.4$ mm²/$0.2 \ldots 0.25$ mm²
  - $2.5 \ldots 2.5$ mm²
- Tightening torque: $0.5$ Nm
- Conductor sizes (AWG): $24 \ldots 12$
- Cable length between isoLR275 and AGH-LR: $\leq 0.5$ m

**Other**

- Operating mode: continuous operation
- Mounting: display-oriented
- Distance to adjacent devices: $\geq 30$ 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: $2 \times M4$
  - DIN rail mounting acc. to IEC 60715: 2M2
  - Flammability class: UL94 V-0
  - Document number: D00127
  - Weight: $\leq 510$ g

* () = factory setting

**Data labelled with ** are absolute values

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### Technical data coupling device AGH-LR

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage</td>
<td>AC 800 V</td>
</tr>
<tr>
<td>Rated impulse voltage/pollution degree</td>
<td>8 kV/3</td>
</tr>
</tbody>
</table>

**Voltage ranges**

- Nominal system voltage $U_n$: AC $3(1)
- Nominal frequency $f_n$: DC $10 \ldots 460$ Hz
- Max. AC voltage $U$ – in the frequency range $f_n: 0.1 \ldots 10$ Hz
- $U$–max = $110$ V/Hz $\times f_n$

**Environment/EMC**

- EMC: IEC 61132-2-4 Ed. 1.0
- Operating temperature: $-25 \ldots +70$ °C
- Classification of climatic conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3K5 (with condensation and formation of ice)
  - Transport (IEC 60721-3-2): 3K3 (with condensation and formation of ice)
  - Long-term storage (IEC 60721-3-1): 1K4 (with condensation and formation of ice)
  - Classification of mechanical conditions acc. to IEC 60721:
    - Stationary use (IEC 60721-3-3): $3M7$
    - Transport (IEC 60721-3-2): $2M2$
    - Storage (IEC 60721-3-1): $1M3$

**Connection**

- Connection: screw-type terminals
- Connection properties: rigid/flexible
- Flexible with ferrules without/plastic sleeve
  - $0.2 \ldots 0.4$ mm²/$0.2 \ldots 0.25$ mm²
  - $0.25 \ldots 2.5$ mm²
- Tightening torque: $0.5$ Nm
- Conductor sizes (AWG): $24 \ldots 12$
- Cable length between isoLR275 and AGH-LR: $\leq 0.5$ m

**Other**

- Operating mode: continuous operation
- Mounting: cooling slots must be ventilated vertically!
- Distance to adjacent devices: $\geq 30$ 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
- Screw mounting with mounting clip: $2 \times M4$
- DIN rail mounting acc. to IEC 60715: 2M2
- Flammability class: UL94 V-0
- Weight: $\leq 238$ g

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

**Insulation monitoring device ISOMETER® isoLR275 with coupling device AGH-LR**

**ISO** 2016/2017
**Operating elements isoLR275**

1. **INFO** button: to query standard information/ “ESC” button: back (menu function), to confirm parameter change
2. **TEST** button: to call up the self test/arrow up button: parameter change, to move up in the menu
3. **RESET** button: to delete stored insulation fault alarms Arrow down button: parameter change, to move down in the menu

**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. Separate connection of $\frac{1}{5}$ and KE to PE
6. External test button (N/O contact)

**IsoLR275**

**AGH-LR**

- **Current output**, electrically isolated: 0…20 mA or 4…20 mA
- **Serial interface RS-485** (termination by means of a 120-Ω resistor)
- **Alarm relay “K1”**: available changeover contacts
- **Alarm relay “K2” (device error relay)**: available changeover contacts

* The terminal pairs 7, 8 and 9 have to be wired electrically isolated and do not have to be connected to earth!
**ISOMETER® IR470LY2-60…**

Insulation monitoring device for unearthed AC and 3(N)AC systems (IT systems) and de-energised loads

---

**Device features**

- Insulation monitoring for unearthed AC, 3(N)AC systems 0…793 V
- Off-line monitoring for TN, TT and IT systems 0…793 V
- Nominal voltage extendable via coupling device
- Operating mode selectable: Insulation monitoring/off-line monitoring
- Two separately adjustable response values 100 kΩ…1 MΩ/500 kΩ…5 MΩ
- Connection monitoring system/earth
- Power ON LED, Alarm LED for signalling AC, L+, L- insulation faults
- LED bar graph indicator for the indication of the insulation resistance
- Connection for external kΩ indication
- Combined test and reset button
- Two separate alarm relays with one potential-free changeover contact each
- N/O or N/C operation
- Fault memory behaviour, selectable

**Standards**

The ISOMETER® of the IR470LY2-60 series complies with the requirements of the device standards: DIN EN 61557-8 (VDE 0413-8), IEC 61557-8, ASTM F 1669M-96 (2007), ASTM F1134-94.

**Typical applications**

- AC, 3(N)AC main circuits (without directly connected rectifiers), such as motors, pumps, rolling mills without variable-speed drives, air cooling and air conditioning systems, lighting systems, heating systems, mobile generators, building services, domestic electrical installation practice, etc.
- De-energised loads, such as fire extinguisher pumps, slide-valve drives (gas, water, oil etc.), flue gas valves, cranes

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**Approvals**

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**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></td>
<td></td>
</tr>
<tr>
<td>230 V</td>
<td>IR470LY2-60</td>
<td>B 9104 8010</td>
</tr>
<tr>
<td>90…132 V$^{1)}$</td>
<td>IR470LY2-6013</td>
<td>B 9104 8013</td>
</tr>
<tr>
<td>400 V</td>
<td>IR470LY2-6015</td>
<td>B 9104 8009</td>
</tr>
<tr>
<td>–</td>
<td>IR470LY2-6021</td>
<td>B 9104 8014</td>
</tr>
</tbody>
</table>

$^{1)}$ Absolute values

Other supply voltages on request

---

**Suitable system components**

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>External kΩ measuring instruments</td>
<td>7204-1421</td>
<td>328</td>
</tr>
<tr>
<td></td>
<td>9604-1421</td>
<td>328</td>
</tr>
<tr>
<td>Coupling devices</td>
<td>AGH520S</td>
<td>284</td>
</tr>
</tbody>
</table>

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

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage
- AC 630 V

Rated impulse voltage/pollution degree
- 6 kV/3

Voltage ranges

<table>
<thead>
<tr>
<th>Nominal system voltage U_n</th>
<th>AC, 3(N)AC 0…793 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal frequency f_n</td>
<td>40...460 Hz</td>
</tr>
<tr>
<td>Supply voltage U_S</td>
<td>see ordering information</td>
</tr>
<tr>
<td>Operating range of U_S</td>
<td>0.8...1.15 x U_S</td>
</tr>
<tr>
<td>Frequency range U_r</td>
<td>50...460 Hz</td>
</tr>
</tbody>
</table>

Response values

| Response value R_an1 (Alarm 1) | 100 kΩ...1 MΩ |
| Response value R_an2 (Alarm 2) | 500 kΩ...5 MΩ |
| Response time t_an at R_an, t_ce = 1 μF | ≤ 4 s |

Measuring circuit

| Measuring voltage U_m | ≤ 40 V |
| Measuring current I_m | ≤ 33 μA |
| Internal RC resistance R_i | ≥ 1.2 MΩ |
| Impedance Z_i at 50 Hz | ≥ 1 MΩ |
| Permissible extraneous DC voltage U_fe | ≤ 800 V |
| Permissible system leakage capacitance C_e | ≤ 10 μF |

Outputs

| Test/reset button | internal/external |
| Current output for measuring instrument (scale centre point = 120 kΩ) | 0...400 μA |
| Load | ≤ 25 kΩ |

Switching elements

| Number of switching elements | 2 x 1 changeover contact |
| Operating principle | N/O operation/N/C operation |
| Factory setting | N/O operation |
| Electrical endurance, number of cycles | 12,000 |
| Contact class | 1B in accordance with DIN IEC 60355-20 |
| Rated contact voltage | AC 250 V/DC 300 V |
| Making capacity | AC/DC 5 A |
| Breaking capacity | 2 A, AC 230 V, cos phi = 0.4 |
| | 0.2 A, DC 220 V, L/R = 0.04 s |
| Contact rating at DC 24 V | ≥ 2 mA (50 mW) |

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 (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 °C |
| Ambient temperature (during storage) | 40...+70 °C |
| Classification of climatic conditions acc. to DIN IEC 60721-3-3 | 3K5 |

Connection

| Connection type | modular terminals |
| Connection properties rigid/flexible | 0.2...4 mm²/0.2...2.5 mm² |

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 | M4 |
| DIN rail mounting acc. to | IEC 60715 |
| Flammability class | UL94 V-0 |
| Documentation number | D00121 |
| Weight | ≤ 360 g |

Dimension diagram (dimensions in mm)
1. Combined test and reset button “TEST RESET”, short-time pressing (< 1 s) = RESET, long-time pressing (> 2 s) = TEST
2. Power On LED “ON”
3. Alarm LEDs “1 ALARM 2”, yellow, light when the value falls below the set response value and flash
4. In case of interruption of the connecting leads L1/KE or L1/L2
5. LED bar graph indicator
6. Operating principle of the alarm relays on-line/off-line
   - N/O operation
   - N/C operation
   - OFF-Line
   - ON-Line
7. Potentiometer to set the response value \( R_{an1} \) (Alarm 1)
8. Potentiometer to set the response value \( R_{an2} \) (Alarm 2)
9. Alarm relay 1: N/O operation (basic setting)
10. Alarm relay 1: N/C operation
11. Alarm relay 2: N/O operation (basic setting)
12. Alarm relay 2: N/C operation
13. External MΩ indicating instrument
14. \( U_S \) see ordering information, 6 A fuse recommended
15. External test button “PT”
16. External reset button “LT1, LT2” or bridge for fault memory

### Wiring diagram – front plate

#### 1. 3NAC system
#### 2. 3AC system

### Wiring diagram – system connection

#### 3. AC system
#### 4. AC > 690 V with coupling device
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® of the IR420 D6 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

<table>
<thead>
<tr>
<th>Supply voltage Uₗ</th>
<th>AC</th>
<th>DC</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>16...72 V, 42...460 Hz</td>
<td>9.6...94 V</td>
<td>IR420-D6-1</td>
<td>B 7101 6415</td>
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</tr>
<tr>
<td>70...300 V, 42...460 Hz</td>
<td>70...300 V</td>
<td>IR420-D6-2</td>
<td>B 7101 6407</td>
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<td></td>
<td></td>
<td>IR420-D64-2</td>
<td>B 7101 6408</td>
<td></td>
</tr>
</tbody>
</table>

Device version with screw terminals on request.

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>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupling device</td>
<td>AGH520S</td>
<td>284</td>
</tr>
<tr>
<td></td>
<td>AGH6765-4</td>
<td>287</td>
</tr>
</tbody>
</table>
Insulation monitoring devices | Application-specific selection – De-energised loads

Insulation monitoring device ISOMETER® IR420-D6

Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3
- Rated insulation voltage: 400 V
- Rated impulse voltage/pollution degree: 4 kV/3
- Protective separation (reinforced insulation) between (A1, A2) – (L1, AK, E, KE, T/R) – (11, 12, 14) – (21, 22, 24)
- Voltage test acc. to IEC 61010-1: 2.21 kV

Supply voltage
- Supply voltage U_S: see ordering information
- Power consumption: ≤ 4 VA

IT system being monitored
- Nominal system voltage U_n
- Without AGH: off-line
- With AGH: 0…7200 V, 50…400 Hz
- With AGH676S-4: AC 0…12 kV, 50…460 Hz

Response values
- Response value R_an1 (Alarm 1): 100 kΩ…10 MΩ
- Response value R_an2 (Alarm 2): 100 kΩ…10 MΩ
- Relative uncertainty: ±15 %
- Hysteresis: 25 %
- Time response: ≤ 4 s
- Start-up delay (start time): 0…10 s (0 s)*
- Measuring circuit: Measuring voltage U_m = 12 V
- Measuring current I_m (at R_F = 0 Ω): ≤ 10 µA
- Internal DC resistance R_i: ≥ 1.2 MΩ
- Impedance Z_e at 50 Hz: ≥ 1.3 MΩ
- Permissible extraneous DC voltage U_fg: ≤ DC 300 V
- Permissible system leakage capacitance C_e: ≤ 10 µF

Displays, memory
- Display range, measured value: 10 kΩ…20 MΩ
- Operating uncertainty: ± 15 %
- Password: off/0…999 (off)*
- Fault memory alarm relay: on/off (off)*

Switching elements
- Number of switching elements: 2 x 1 changeover contact
- Operating principle: NC or N/O (N/O) operation*
- Electrical service life, 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 > 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): K3 (except condensation and formation of ice)
- Transport (IEC 60721-3-2): K3 (except condensation and formation of ice)
- Long-time storage (IEC 60721-3-1): K4 (except condensation and formation of ice)

Classification of mechanical conditions IEC 60721
- Stationary use: AC-12, DC-12
- Transport: AC-12, DC-12
- Long-time storage: AC-12

Connection
- Connection type: push-wire terminal
- Connection properties:
  - rigid
  - flexible without ferrule
  - flexible with ferrule
- 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
- Documentation number: D00117
- Weight: ≤ 150 g

( )* = Factory setting

**Dimensions diagram (dimensions in mm)**
**Displays and controls**

1. Power On LED "ON", flashes in case of interruption of the connecting leads E/KE
2. Alarm LED "AL1", lights when the value falls below the set response value Alarm 1 and flashes in case of interruption of the connecting leads E/KE
3. Alarm LED "AL2", lights when the value falls below the set response value Alarm 2 and flashes in case of interruption of the connecting leads E/KE

**LC display**
- Test button "T": to call up the self test
- Arrow up button: parameter change, to move up in the menu
- Reset button "R": to delete stored insulation fault alarms parameter change, to move down in the menu
- "MENU" button: to call up the menu system
- Enter button: to confirm parameter changes

**Wiring diagrams**

1. Supply voltage $U_s$ (see ordering details) via fuse
2. Separate connection of E, KE to PE
3. Connection of the AC system to be monitored:
4. Alarm relay "K1": Alarm 1
5. Alarm relay "K2": Alarm 2

4. Combined test and reset button "TEST RESET" short-time pressing ($< 1.5$ s) = RESET long-time pressing ($> 1.5$ s) = TEST
5. 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.
6. K3 is also required and is not included in IR420-D6
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® of the IR423 series complies with the requirements of the device 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),

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 Rohrleitungsbauten 8/00" (Mobile auxiliary power generators on pipeline site") (DVGW)
- BGI 867 (German Berufsgenossenschafts Information) Auswahl und Betrieb von Ersatzstromerzeugern auf Bau-und Montagestellen (Selecting and operating standby generators on construction and installation sites)

Version Supply voltage ¹, ² DS ³ Type Art. No.

<table>
<thead>
<tr>
<th>Version</th>
<th>AC</th>
<th>DC</th>
<th>AC/DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>9.6…94 V</td>
<td>16…72 V, 30…460 Hz</td>
<td>–</td>
</tr>
<tr>
<td>High mechanical stress</td>
<td>9.6…94 V</td>
<td>16…72 V, 30…460 Hz</td>
<td>–</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>

For further information refer to our product range on www.bender.de.
ISOCHRON® 423

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 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 (A1, A2) and (L1, L2, E, KE, T/R)</td>
<td>(-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>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage Ue</td>
<td>see ordering information</td>
</tr>
<tr>
<td>Frequency range Ue</td>
<td>50…460 Hz</td>
</tr>
<tr>
<td>Power consumption</td>
<td>≤ 4 VA</td>
</tr>
</tbody>
</table>

IT system being monitored

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal system voltage Ue</td>
<td>AC 0…300 V</td>
</tr>
<tr>
<td>Nominal frequency Ue</td>
<td>50…60 Hz</td>
</tr>
</tbody>
</table>

Response values

<table>
<thead>
<tr>
<th>Response value</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response value Rs1 (Alarm 1)</td>
<td>1…200 kΩ (46 kΩ)*</td>
</tr>
<tr>
<td>Response value Rs2 (Alarm 2)</td>
<td>1…200 kΩ (23 kΩ)*</td>
</tr>
<tr>
<td>Relative uncertainty</td>
<td>±0.5 kΩ/±15 %</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>1…5 kΩ/5…200 kΩ</td>
</tr>
<tr>
<td>+1 kΩ/+25 %</td>
<td></td>
</tr>
</tbody>
</table>

Time response

<table>
<thead>
<tr>
<th>Time response</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response time tR at R = 0.5 x Rs, and C2 = 1 µF</td>
<td>≤ 1 s</td>
</tr>
<tr>
<td>Start-up delay (start time) t</td>
<td>0…10 s (0 s)*</td>
</tr>
<tr>
<td>Response delay tR1</td>
<td>0…99 s (0 s)*</td>
</tr>
</tbody>
</table>

Measuring circuit

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring voltage Um</td>
<td>±12 V</td>
</tr>
<tr>
<td>Measuring current Im (at R = 0 C2)</td>
<td>≤ 200 µA</td>
</tr>
<tr>
<td>Internal DC resistance R</td>
<td>≥ 62 kΩ</td>
</tr>
<tr>
<td>Impedance Z at 50 Hz</td>
<td>≥ 60 kΩ</td>
</tr>
<tr>
<td>Permissible extraneous DC voltage Ue2</td>
<td>≤ DC 300 V</td>
</tr>
<tr>
<td>Permissible system leakage capacitance</td>
<td>≤ 5 pF</td>
</tr>
</tbody>
</table>

Displays, memory

| Display | LC display, multi-functional, non-illuminated |
| Display range, measured value | 1 kΩ…1 MΩ |
| Operating uncertainty | ±0.5 kΩ/±15 % |
| Password | off/off 0…999 (off)* |
| Fault memory (alarm relay) | on/off |

Outputs

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable length test and reset button</td>
<td>≤ 10 m</td>
</tr>
</tbody>
</table>

Switching elements

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of switching elements</td>
<td>2 x 1 changeover contact</td>
</tr>
<tr>
<td>Operating principle</td>
<td>NC or N/O operation (N/O operation)*</td>
</tr>
<tr>
<td>Electrical endurance, number of cycles</td>
<td>10,000</td>
</tr>
<tr>
<td>Contact data acc. to IEC 60947-5-1</td>
<td></td>
</tr>
<tr>
<td>Utilisation category</td>
<td>AC-13 AC-14 DC-12 DC-12 DC-12</td>
</tr>
<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>

Dimensions (dimensions in mm)

![Dimension diagram](image-url)
Insulation monitoring devices | Application-specific selection – Mobile generators

**ISOMETER® IR423**

**Wiring Diagram**

- **1** Power On LED “ON”, flashes in case of interruption of the connecting leads E/KE or L1/L2
- **2** Alarm LED “AL1”, lights when the value falls below the set response value Alarm 1 and flashes in case of interruption of the connecting leads E/KE or L1/L2
- **3** Alarm LED “AL2”, lights when the value falls below the set response value Alarm 2 and flashes in case of interruption of the connecting leads E/KE or L1/L2
- **4** LC display
- **5** Test button “T”: to call up the self test.
- **6** Arrow up button: parameter change, to move up in the menu
- **7** Reset button “R”: to delete stored insulation fault alarms parameter change, to move down in the menu
- **8** “MENU” button: to call up the menu system.
- **9** Enter button: to confirm parameter changes

**Displays and controls**

- **Connect the leads E and KE separately to PE.**
- **Supply voltage** $U_s$ (see nameplate) via 6 A fuse
- **Alarm relay K1**
- **Alarm relay K2 (system fault relay)**
- **For combined external test/reset button**
- **U_s ≤ AC 230 V**: Terminals L1/L2 to L1/L2 of the generator
- **U_s ≤ 3AC 400 V**: Terminals L1/L2 to N of the generator

**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
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
- Cer tônal 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(1) )</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>B 9101 6308</td>
</tr>
</tbody>
</table>

* Absolute values
Technical data

Insulation coordination acc. to IEC 60664-1
Rated insulation voltage 250 V
Rated impulse voltage/pollution degree 2.5 kV/3
Protective separation (reinforced insulation) between: (A1/L1, A2/L2, E, KE, T/R, T, R, M+ KO-, OK-) -(11-12-14) -(21-22-24)
Voltage test acc. to IEC 60331-1 2.21 kV

Supply voltage
Supply voltage $U_S$ = $U_n$
Power consumption $\leq 3$ VA

IT system being monitored
Nominal system voltage $U_n$ AC 100…300 V
Nominal frequency $f_n$ 22…460 Hz

Response values
Response value $R_{an2}$ (Alarm 2) (46 kΩ)*
Response value $R_{an1}$ (Alarm 1) (23 kΩ)*
Second response range, adjustable via jumper JP1 80/40 kΩ
Relative percentage error $\pm 15\%$
Hysteresis $+25\%$

Time response
Response time $t_{an}$ at $R = 0.5 \times R_{an}$ and $C_e = 1\mu F$ $\leq 1\ s$

Measuring circuit
Measuring voltage $U_{m}$ $\leq 12$ V
Measuring current $I_{m}$ (at $R = 0\Omega$) $\leq 200\ \mu A$
Internal DC resistance $R_i$ $\geq 62$ kΩ
Impedance $Z_i$ at 50 Hz $\geq 60$ kΩ
Permissible extraneous DC voltage $U_{fg}$ $\leq DC 300$ V
Permissible system leakage capacitance $C_e$ $\leq 5\mu F$

Memory
Fault memory (alarm relay) on / off (on)*

Inputs
Reset button N/O contact
Test button N/O contact
Cable length external test/reset button 3 m

Switching elements
Number of switching elements 2 (changeover contacts K1, K2)
Operating principle K1/K2 N/C or N/O operation (N/O operation)*
Electrical endurance, number of cycles 10,000

Interfaces
Optocoupler, alarm $U_{CE} 24$ V, $I_c 10$ mA
Optocoupler, measured value $U_{CE} \leq DC 24$ V, $I_c \leq 10$ mA
PWM signal, duty cycle 0 % = $\infty$ kΩ
PWM signal, duty cycle 50 % = 120 kΩ
PWM signal, duty cycle 100 % = 0 kΩ

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

Environment/EMC

EMC acc. to IEC 61326-2-4
Operating temperature $-25\ldots+60$ °C

Climatic categories acc. to IEC 60721, valid for one encapsulated p.c.b.:
Stationary use (IEC 60721-3-3) 3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2) 2K3 (except condensation and formation of ice)
Storage (IEC 60721-3-1) 1K4 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721, valid for one encapsulated p.c.b.:
Stationary use (IEC 60721-3-3) 3M7
Transport (IEC 60721-3-2) 2M2
Storage (IEC 60721-3-1) 1M3

Connection connectors Universal MATE-N-LOK
3-pole TE Connectivity Nr. 350789-1
6-pole TE Connectivity Nr. 641831-1
8-pole TE Connectivity Nr. 641828-1

Other
Operating mode continuous operation
Mounting any position
Dimensions of the p.c.b., L x W x H, without connectors 107.5 x 76.5 x 20 mm, with connectors 107.5 x 76.5 x 35 mm
Enclosure without
Document control number D00113
Weight $\leq 150$ g

* = factory setting

Dimension diagrams (dimensions in mm)
1. Input for reset button “R” (N/O contact)
2. Input for test button “T” (N/O contact)
3. Common input for test and reset button “T/R”
4. Connect the leads E and KE separately to PE
5. Supply voltage $U_S = U_n$
   Connection to the IT system to be monitored
6. Digital output optocoupler “OK+”: Alarm 2;
   Connect to external operating voltage $U_B$: max. +24 V
7. Pulse-width-modulated output optocoupler “M+”: Measuring value;
   Connect to external operating voltage $U_B$: max. +24 V
8. Common reference point - $U_B$ “OK-, M-” for OK+ and M+
9. Alarm relay “K1”
10. Alarm relay “K2”

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® 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)

### 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) 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
- ISO 6469-3
- ISO 16750-1
- ISO 16750-2
- ISO 16750-4
- E1 (ECE regulation No. 10) acc. 72/245/EWG/EEC

**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 60 V. An additional central protection is necessary.

### Ordering information

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Response value ( R_{\text{min}} )</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>B 9106 8138V4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0 V (inactive)</td>
<td>High-side</td>
<td>IR155-3204</td>
<td>B 9106 8139V4</td>
</tr>
<tr>
<td>Customer-specific setting</td>
<td>100 kΩ…1 MΩ</td>
<td>10</td>
<td>0V...500V</td>
<td>Low-side</td>
<td>IR155-3203</td>
<td>B 9106 8138CV4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>High-side</td>
<td>IR155-3204</td>
<td>B 9106 8139CV4</td>
</tr>
</tbody>
</table>

### Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fastening set</td>
<td>B 9106 8500</td>
</tr>
<tr>
<td>Connector set IR155-32xx</td>
<td>B 9106 8501</td>
</tr>
</tbody>
</table>

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

#### Insulation coordination acc. to IEC 60664-1

Protective separation (reinforced insulation) between (L+/L–) – (KL 31, KL 15, E, NE, M6E, M6L, OKE, OKE)

<table>
<thead>
<tr>
<th>Voltage test</th>
<th>AC 3500 V/1 min</th>
</tr>
</thead>
</table>

#### Supply/IT system being monitored

<table>
<thead>
<tr>
<th>Supply voltage $U_{S}$</th>
<th>DC 10…36 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. operating current $I_{A}$</td>
<td>150 mA</td>
</tr>
<tr>
<td>Max. current $I_{A}$</td>
<td>2 A</td>
</tr>
</tbody>
</table>

#### HV voltage range (L+/L–) $U_{A}$

- AC 0…1000 V (peak value)
- $U_{A}$: 0…660 V r.m.s. (10 Hz…1 kHz)
- DC 0…1000 V

#### Power consumption

- $< 2 W$

#### Response values

| Response value hysteresis (DCP) | 25 % |
| Response value $R_{IMD}$ | 100 kΩ…1 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 $SST$ | $\pm 2.5 \%$ |
| Relative uncertainty DCP | $\pm 5 \%$ |
| (default setting 100 kΩ) | $\pm 2.5 \%$ |
| Relative uncertainty output M (fundamental frequency) | $\pm 5 \%$ at each frequency (10 Hz; 20 Hz; 30 Hz; 40 Hz; 50 Hz) |

#### Relative uncertainty

- undervoltage detection $U_{A} \geq 100 V \rightarrow \pm 10 \%$ at $U_{A} \geq 300 V \rightarrow \pm 5 \%$
- “Good condition” $\geq 2 \times R_{IMD}$
- “Bad condition” $\leq 0.5 \times R_{IMD}$

#### Response time

- Response time $t_{R}$ (OK/$SST$, SST)
- $t_{R} < 2 s$ (typ. $< 1 s$ at $U_{A} > 100 V$)
- Response time $t_{R}$ (OK/$SST$, DCP)
- (when changing over from $R_{1} = 10$ MΩ to $R_{2}/U_{2}$; at $C_{S} = 1 \mu F$; $U_{S} = DC 1000 V$
  - $t_{R} = 20 s$ (at $F_{PWM} = 10\%$)
  - $t_{R} = 17.5 s$ (at $F_{PWM} = 9\%$)
  - $t_{R} = 17.5 s$ (at $F_{PWM} = 8\%$)
  - $t_{R} = 15 s$ (at $F_{PWM} = 7\%$)
  - $t_{R} = 15 s$ (at $F_{PWM} = 6\%$)
  - $t_{R} = 12.5 s$ (at $F_{PWM} = 5\%$)
  - $t_{R} = 12.5 s$ (at $F_{PWM} = 4\%$)
  - $t_{R} = 10 s$ (at $F_{PWM} = 4\%$
  - $t_{R} = 7.5 s$ (at $F_{PWM} = 3\%$
  - $t_{R} = 7.5 s$ (at $F_{PWM} = 2\%$
  - $t_{R} = 5 s$ (at $F_{PWM} = 1\%$

- during the self test $t_{R} = 10 s$

#### Duration of the self test

- 10 s (every five minutes; should be added to $t_{R}$)

#### Measuring circuit

- System leakage capacitance $C_{S}$
  - $\leq 1 \mu F$
  - $> 1 \mu F$
  - (e.g. max. range 1 MΩ @ 3 µF, $t_{f} = 68 s$ when changing over from $R_{1} = 1 MΩ$ to $R_{2}/U_{2}$)

| Measuring voltage $U_{M}$ | $\pm 40 V$
| Measuring current $I_{M}$ at $R_{1} = 0$ | $\leq 33 \mu A$
| Impedance $Z_{M}$ at 50 Hz | $\geq 1.2 MΩ$
| Internal DC resistance $R_{i}$ | $\geq 1.2 MΩ$

#### Output

| Measurement output (M) | Measuring circuit $U_{M} = 2 V$ (3204)
|------------------------| (external pull-down resistor to KL 31 necessary 2.2 kΩ)
| $M_{LS}$ switches to KL 31 $+2 V$ (3203)
| (external pull-up resistor to KL 15 required 2.2 kΩ)

| Freq. | 0 Hz | $Hi$ | 10 Hz | $Normal$ \, condition
|-------|------|------|-------|---------------------|
| $U_{A}$ + (KL 15) | Low > IMD off or short circuit to KL 31
| $0 Hz$ | $Hi$ > short circuit to $U_{A}$ + (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 $\leq 17.5 s$ 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 $\leq 17.5 s$ Undervoltage detection $0…500 V$
| (Bender configurable)
| 30 Hz | Speed start measurement
| Insulation measurement (only good/bad evaluation) starts directly after power on $\geq 2 s$ 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 $47.5…52.5 \%$

* $F_{PWM} = 10$ is recommended for electric and hybrid vehicles
Technical data (continued)

Status output (OKES)
OKES switches to U5 – 2 V
(external pull-down resistor to Kl. 31 required 2.2 kΩ)

High No fault; \( R_f > \) response value
Low Insulation resistance ≤ 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)
  Duty cycle 5 % = > 50 kΩ (≈)
  Duty cycle 50 % = 1200 kΩ
  Duty cycle 95 % = 0 kΩ

\[
R_f = \frac{90 \% \times 1200 \text{ kΩ}}{d_{\text{meas}} \times 5\%} - 1200 \text{ kΩ}
\]

Onboard connectors
- Condition “SST” (30 Hz)
  Duty cycle 5…10 % (“good”)
  90…95 % (“bad”)

Grey → invalid

- Condition “Device error” and “Kl.31 fault” (40 Hz; 50 Hz)
  Duty cycle 47.5…52.5 %

Grey → invalid

Load current \( I_L \)
80 mA

Turn-on time \( t_{\text{on}} \) to 90 % \( V_{\text{out}} \)
max. 125 µs

Turn-off time \( t_{\text{off}} \) to 10 % \( V_{\text{out}} \)
max. 175 µs

Slew rate on \( 10\ldots30 \% V_{\text{out}} \)
max. 6 V/µs

Slew rate off \( 70\ldots40 \% V_{\text{out}} \)
max. 8 V/µs

Timing 3204 (inverse to 3203)

Load dump protection < 60 V
Measurement method Bender-BCP technology

Factor averaging
\( F_{\text{ave}} \) (output M)
1…10 (factory set: 10)

ESD protection
Contact discharge – directly to terminals
≤ 10 kV

Contact discharge – indirectly to environment
≤ 25 kV

Air discharge – handling of the PCB
≤ 6 kV

Connection

On-board connectors
TYCO-MICRO MATE-N-LOK
1 x 2-1445088-8
Kl. 31, Kl.15, E, KE, MHS, MLS, OKS
2 x 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!

Crimp contacts
TYCO-MICRO MATE-N-LOK Gold
14 x 2-794606-1

Conductor cross section: AWG 20…24

Enclosure for crimp contacts
TYCO-MICRO MATE-N-LOK receptor HSG single R -1445022-8
TYCO-MICRO MATE-N-LOK receptor HSG single R -1445022-2

General data

Necessary crimp tongs (TYCO)
91501-1

Operating mode/mounting
Continuous operation/any position

Temperature range
-40…+105 °C

Voltage failure
≤ 2 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 (KL31; 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

Enclosure for crimp contacts
TYCO-MICRO MATE-N-LOK receptor HSG single R -1445022-8
TYCO-MICRO MATE-N-LOK receptor HSG single R -1445022-2

General data

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Deflection
max. 1 % of the length or width of the PCB

Coating
thick-film lacquer

Documentation number
D00115

Weight
52 g ±2 g
### Dimension diagrams (dimensions in mm)

![Dimension Diagram](image)

### Wiring diagram

- **HV system DC 0V…1000V (-320x only)**
- **HV system DC 0V…800V (-3210 only)**

#### 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

![Application Diagram](image)
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® of the isoEV425 series complies with the requirements of the device 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.

Supply voltage 1) \( U_S \)

<table>
<thead>
<tr>
<th>AC</th>
<th>DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>100...240 V, 47...63 Hz</td>
<td>24...240 V</td>
</tr>
</tbody>
</table>

Type Art. No.

<table>
<thead>
<tr>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>isoEV425-D4-4 with AGH420</td>
<td>B 7103 6401</td>
</tr>
</tbody>
</table>

Device version with screw terminals on request.

1) Absolute values

Typical applications

- DC charging stations for electric vehicles according to IEC 61851-23

Approvals

- CE
- UL Listed

Further information

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

Ordering information

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting</td>
<td>B 9806 0008</td>
</tr>
</tbody>
</table>

1)  Absolute values
## Technical data ISOMETER® isoEV425

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

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Test voltage</th>
<th>Voltage category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>±(11, 14, 24)</td>
<td>III</td>
</tr>
<tr>
<td>Rated impulse voltage</td>
<td>4 kV</td>
<td></td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>I</td>
<td></td>
</tr>
</tbody>
</table>

### Pollution degree
- 3

### Protective separation (reinforced insulation) between
- (A1, A2) - (AK1, GND, AK2, Up, KE, T/R, A, B) - (11, 14, 24)

### Voltage tests according to IEC 61010-1
- 2.2 kV

### Operating uncertainty
- ±15 %, at least ±1 kΩ

### Measuring range
- Display range measured value system leakage capacitance at
- Display range measured value nominal system voltage (n)

### Response values
- Response value \( R_{an1} \):
  - 2…500 kΩ (500 kΩ)*
- Response value \( R_{an2} \):
  - 1…490 kΩ (100 kΩ)*
- Relative uncertainty \( R_{an} \):
  - ±15 %, at least ±1 kΩ
- Hysteresis \( R_{an} \):
  - 25 %, at least 1 kΩ
- Undervoltage detection:
  - 30 V…1.14 kV (off)*
- Overvoltage detection:
  - 31 V…1.15 kV (off)*
- Relative uncertainty \( U \):
  - ±5 %, at least ±5 V

### Time response
- Response time \( t_{res} \) at \( R_{an} \) = 0.5 x \( R_{an2} \) and \( C = 1 \mu F \) acc. to IEC 61557-8:
  - ≤ 10 s
- Start-up delay \( t_{on} \):
  - 0…10 s (0 s)*
- Response delay \( t_{off} \):
  - 0…99 s (0 s)*
- Delay on release \( t_{on} \):
  - 0…99 s (0 s)*

### Displays, memory
- LC display, multifunctional, not illuminated
- Operating uncertainty at \( R_{an} \) = 1 MΩ:
  - ±15 %, at least ±1 kΩ
- Display range measured value system leakage capacitance at \( R_{an} \):
  - 30 V…1.15 kV rms
- Operating uncertainty:
  - ±5 %, at least ±5 V

### Operating principle
- Overvoltage detection:
  - 1000 V…1.14 kV (off)*
- Undervoltage detection:
  - 30 V…1.15 kV rms
- Response delay:
  - ≤ 0.03 s

### Power consumption
- Frequency range of
  - Display range measured value insulation resistance (\( \Omega \)):
    - ±5 %, at least ±2 μF
- Power consumption:
  - 1…490 kHz

### Fault memory alarm messages
- on/off (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 pair, one end of shield connected to PE recommended: min. 3-Y(50) Y/2x0.6
- Termination resistor:
  - 120 Ω (0.25 W), internal, can be connected
- Device address, BMS bus, Modbus RTU:
  - 3…90 (3)*

### Switching elements
- Switching elements:
  - Operating principle
    - N/C or N/O operation (N/O operation)*
- Electrical endurance in rated operating conditions:
  - 10 000 cycles
- Contact data acc. to IEC 60947-5-1:
  - Utilization category:
    - AC-12
    - 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
- Ambient temperatures:
  - Operation:
    - -40…+70 °C
  - Transport:
    - -40…+80 °C
    - -40…+70 °C
- Classification of climatic conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3):
    - 3K7 (except condensation and formation of ice)
  - Transport (IEC 60721-3-2):
    - 2K4 (except condensation and formation of ice)
  - Long-term storage (IEC 60721-3-1):
    - 1K5 (except condensation and formation of ice)
- Classification of mechanical conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3):
    - 3MA
  - Transport (IEC 60721-3-2):
    - 2MK
  - Long-term storage (IEC 60721-3-1):
    - 1M3

### Connection
- Connection type:
  - push-wire terminal
- Nominal current:
  - ≤ 10 A
- Conductor sizes:
  - AWG 24…14
- Stripping length:
  - 10 mm
- Connection properties:
  - Rigid/flexible:
    - 0.2…2.5 mm²
  - Flexible with ferrule with/thout plastic sleeve:
    - 0.25…2.5 mm²
  - Multiple conductor flexible with TWIN ferrule with plastic sleeve:
    - 0.5…1.5 mm²
- Multiple conductor flexible with TWIN ferrule with plastic sleeve:
  - 0.5…1.5 mm²
- Multiple conductor flexible with TWIN ferrule with plastic sleeve:
  - 0.5…1.5 mm²
- Terminal resistor:
  - 120 Ω (0.25 W), internal, can be connected
- Degree of protection, internal components (IEC 60529):
  - IP 30
  - IP 20

### Other
- Degree of protection, internal components (IEC 60529):
  - IP 30
- Degree of protection, terminals (IEC 60529):
  - IP 20
- Mounting:
  - Screw mounting:
    - 2 x M4 with mounting clip
  - Mounting clip:
    - D00126
- Weight:
  - ≤ 150 g

### Protective separation (reinforced insulation) between
- (A1, A2) - (AK1, GND, AK2, Up, KE, T/R, A, B) - (11, 14, 24)

### Voltage tests according to IEC 61010-1
- 2.2 kV
### Technical data coupling device AGH420

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

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage</td>
<td>1000 V</td>
</tr>
<tr>
<td>Rated impulse voltage</td>
<td>8 kV</td>
</tr>
<tr>
<td>Pollution degree</td>
<td>3</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>III</td>
</tr>
<tr>
<td>Protective separation (reinforced insulation)</td>
<td>(L1/+, L2/-)</td>
</tr>
<tr>
<td>Voltage test, routine test (IEC 61010-1)</td>
<td>4.3 kV</td>
</tr>
</tbody>
</table>

#### IT system being monitored

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal system voltage range ( U_n )</td>
<td>AC/DC 0…1000 V</td>
</tr>
<tr>
<td>Tolerance of ( U_n )</td>
<td>AC/DC ±10 %</td>
</tr>
<tr>
<td>Nominal system voltage range ( U_n ) (UL508)</td>
<td>AC/DC 0…600 V</td>
</tr>
</tbody>
</table>

#### Measuring circuit

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring voltage ( U_m )</td>
<td>±45 V</td>
</tr>
<tr>
<td>Measuring current ( I_m ) at ( R_F )</td>
<td>≤ 400 μA</td>
</tr>
<tr>
<td>Internal DC resistance ( R_i )</td>
<td>≥ 120 kΩ</td>
</tr>
</tbody>
</table>

#### Environment/EMC

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC</td>
<td>IEC 61326-2-4</td>
</tr>
<tr>
<td>Ambient temperatures:</td>
<td></td>
</tr>
<tr>
<td>Operation</td>
<td>-40...+70 ºC</td>
</tr>
<tr>
<td>Transport</td>
<td>-40...+80 ºC</td>
</tr>
<tr>
<td>Storage</td>
<td>-40...+70 ºC</td>
</tr>
</tbody>
</table>

Classification of climatic conditions acc. to IEC 60721:

- Stationary use (IEC 60721-3-3): 3K7 (except condensation and formation of ice)
- Transport (IEC 60721-3-2): 2K4 (except condensation and formation of ice)
- Long-term storage (IEC 60721-3-1): 1K5 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721:

- Stationary use (IEC 60721-3-3): 3M4
- Transport (IEC 60721-3-2): 2M2
- Long-term storage (IEC 60721-3-1): 1M3

#### Connection

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection type</td>
<td>push-wire terminal</td>
</tr>
<tr>
<td>Nominal current</td>
<td>≤ 10 A</td>
</tr>
<tr>
<td>Conductor sizes</td>
<td>AWG 24…14</td>
</tr>
<tr>
<td>Stripping length</td>
<td>10 mm</td>
</tr>
<tr>
<td>Connection properties:</td>
<td></td>
</tr>
<tr>
<td>Rigid/flexible</td>
<td>0.2...2.5 mm²</td>
</tr>
<tr>
<td>Flexible with ferrule with/without plastic sleeve</td>
<td>0.25...2.5 mm²</td>
</tr>
<tr>
<td>Multiple conductor flexible with TWIN ferrule with plastic sleeve</td>
<td>0.5...1.5 mm²</td>
</tr>
<tr>
<td>Opening force</td>
<td>50 N</td>
</tr>
<tr>
<td>Test opening, diameter</td>
<td>2.1 mm</td>
</tr>
<tr>
<td>Connection type</td>
<td></td>
</tr>
<tr>
<td>terminals Up, AK1, GND, AK2</td>
<td></td>
</tr>
<tr>
<td>Single cables for terminals Up, AK1, GND, AK2</td>
<td>≤ 0.5 m</td>
</tr>
<tr>
<td>Connection properties:</td>
<td></td>
</tr>
<tr>
<td>≥ 0.75 mm²</td>
<td></td>
</tr>
</tbody>
</table>

#### 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 (IEC 60529): IP 30
- Degree of protection, terminals (IEC 60529): IP 20
- Enclosure material: polycarbonate
- DIN rail mounting acc. to IEC 60715
- Screw mounting: 2 x M4 with mounting clip
- Weight: ≤ 150 g

\( * = \) factory setting

---

**Dimension diagram** (dimensions in mm)
**Displays and controls**

1. LED “ON” (operation LED) flashes in case of interruption of the connecting wires E/KE or L1+/ L2/- or system fault.
2. Alarm LED “AL1”, lights when the values fall below the set response value Alarm 1 and flashes in case of interruption of the connecting wires E/KE or L1+/ L2/- or system faults as well as in the case of overvoltage (can be activated).
3. Alarm LED “AL2” lights when the values fall below the set response value Alarm 2 and flashes in case of interruption of the connecting wires E/KE or L1+/ L2/- or system faults as well as in the case of undervoltage (can be activated).

**Wiring diagram**

1. 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. Connect each terminal separately to PE. The same wire cross section as for A1, A2 must be used.
3. Connect the terminals of AGH420 to the corresponding terminals of the isoEV425.
4. Connection to the 3(N)AC, AC or DC system to be monitored.
5. Connection for the external combined test and reset button.
6. Connection to alarm relay K1.
7. Connection to alarm relay K2.
8. Connection RS-485 (BMS bus) with termination switch R (on/off).

Example: Connection of a BMS-Ethernet Gateway COM460IP.

**LEDs**

- LED “ON” (operation LED) flashes in case of interruption of the connecting wires E/KE or L1+/ L2/- or system fault.
- Alarm LED “AL1”, lights when the values fall below the set response value Alarm 1 and flashes in case of interruption of the connecting wires E/KE or L1+/ L2/- or system faults as well as in the case of overvoltage (can be activated).
- Alarm LED “AL2” lights when the values fall below the set response value Alarm 2 and flashes in case of interruption of the connecting wires E/KE or L1+/ L2/- or system faults as well as in the case of undervoltage (can be activated).

**Displays and controls**

1. LC display
2. Test button “T”: Call up the self-test
   Arrow up button: Parameter change, move upwards in the menu
3. Reset button “R”: Delete stored insulation fault alarms
   Arrow down button: Parameter change, move downwards in the menu
4. Menu button “MENU”: Call up the menu system.
   Enter button: Confirms parameter changes
Example of application
ISOMETER® iso165C
Insulation Monitoring Device (IMD) for unearthed DC drive systems (IT systems) in electric vehicles

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 earth faults and lost earth 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 separation of all signals from the HV side
  - HV coupled network
  - CAN bus interface
- Light weight: < 220 g (including housing and connection frame)

Typical applications
- Monitoring for unearthed DC drive systems (IT systems) in electric vehicles

Approvals

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

<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>Alarm1 (Error): 30 kΩ…1 MΩ (default 100 kΩ); Alarm2 (Warning): 40 kΩ…2 MΩ (default 200 kΩ)</td>
<td>0…600 V</td>
<td>12 V</td>
<td>iso165C</td>
<td>B 9106 8175</td>
</tr>
<tr>
<td>Alarm1 (Error): 30 kΩ…1 MΩ (customer setting xxx kΩ); Alarm2 (Warning): 40 kΩ…2 MΩ (customer setting xxx kΩ)</td>
<td>0…600 V</td>
<td>12 V</td>
<td>iso165C</td>
<td>B 9106 8175 C</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

#### Monitored IT system
- Rated voltage range $U_n$: DC 0…600 V
- Tolerance: ±15%
- Frequency range: 10 Hz…1 kHz
- System leakage capacity $C_e$: ≤ 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 $I_m$: at $R_F = 0$ ±33 μA
- Impedance $Z_i$ at 50 Hz (HV1): ≥ 1.2 MΩ (≥ 2.4 MΩ each line, high resistance in off state)
- Internal resistance $R_i$ (HV1): ≥ 1.2 MΩ (≥ 2.4 MΩ each line, high resistance in off state)
- Impedance $Z_i$ at 50 Hz (HV2): ≥ 10.5 MΩ (≥ 21 MΩ each line)
- Internal resistance $R_i$ (HV2): ≥ 10.5 MΩ (≥ 21 MΩ each line)

#### Measuring ranges
- Insulation resistance range: 8 Ω … 50 MΩ
- Insulation resistance duration/Pulse (normal operation): ~ 1.6 s (≤ 1 μF / 8 MΩ) ~ 6 s (≤ 1 μF / 10 MΩ)
- Relative error (DCP): 100 kΩ…5 MΩ, ±35 %
- Absolute error (DCP): 0 Ω … 100 kΩ, ±15 kΩ
- High-voltage range: 0…600 V
- High-voltage tolerance: 0…100 V, ±5 %

#### Response values
- Response Alarm 1 (Error): 30 kΩ…1 MΩ (default 100 kΩ)
- Response Alarm 2 (Warning): 40 kΩ…2 MΩ (default 200 kΩ)
- Response uncertainty (according to IEC 61557-4): ±15 %
- Hysteresis: 25 %
- Factor averaging $F_{ave}$: 1…10 (default:10)
- Response time tan (DCP) (Changeover $R_f$: 10 MΩ – $R_F$/2; at $C_e = 1$ μF; $U_n = 600$ V DC)
  - $t_{tan} ≤ 20$ s (at $F_{ave} = 10$)
  - $t_{tan} ≤ 3$ s (≤ 1 μF/150 kΩ)
- Measurement time after power on (and after HV relays are closed): ≤ 3 s
- Switch-off time tab (DCP) (changeover $R_f$:$R_F$/2 … 10 MΩ; at $C_e = 1$ μF; $U_n = DC$ 600 V)
  - $t_{tab} ≤ 40$ s (at $F_{ave} = 10$)
  - $t_{tab} ≤ 6$ s (≤ 1 μF/150 kΩ)

#### Interface
- Protocol: HS-CAN
- Data rate: 250 kbaud
- Terminating resistor: 124 Ω internally

#### Environment/EMC
- EMI immunity: IEC 61326-2-4
- Pollution degree: 2
- Overvoltage category: II
- Range of application: 5,000 m above sea level

#### Connectors (Tyco)
- Receptor enclosure type: 1719183-1, 1719183-2, 1719183-3 (black, white, blue)
- Receptor 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
- Documentation number: D00154

#### Mounting
- Recommended screws for mounting: 4 x M5 (not included).
- Max. tightening torque of 2.25 ±0.25 Nm for the screws.
  - $F_{ave} = 10$ is recommended for electric vehicles

---

**Note:**

The technical data provided is for the ISOMETER® iso165C insulation monitoring device, which is suitable for application-specific selection in the context of eMobility. It features a compact design with high reliability and robustness, making it ideal for monitoring insulation in electric vehicle systems. The device supports both continuous and pulse measurements, ensuring accurate and reliable data collection. With its wide range of operating parameters and compliance with various international standards, it is a reliable choice for ensuring safety and performance in electric mobility applications.
**Typical application**

![Typical application diagram](image)

---

**Connectivity**

- **Enclosure**: PBT GF30 black, UL Standard: UL94 V0
- **Cover**: PBT GF30 black, UL Standard: UL94 V0
- **Connector pin**: Cu-alloy, tin plated
- **Label**: White Polyester foil
- **Bracket**: PBT GF30 black, UL Standard: UL94 V0

<table>
<thead>
<tr>
<th>Connector</th>
<th>Type</th>
<th>Code</th>
<th>Colour</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>A</td>
<td>Black</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>B</td>
<td>White</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>C</td>
<td>Blue</td>
</tr>
</tbody>
</table>

1) Please refer to “Technical Data” for detailed connector information.

---

**Wiring diagram**

![Wiring diagram](image)

**Section view A-A**

Scale: 2:1

4 x M5 fastening torque: 2.25 ± 0.25 Nm

---

**Recommended screws (not included)**

4 x M5

---

**Enclosure**

**Cover**

**Connector pin**

**Label**

**Bracket**

---

**Electrical Chassis / Protective equipotential bonding**

---

**Inverter**

---

**RESS 1**

---

**RESS 2**

---

**IMD**

---

**PFC**

---

**EV Inlet**
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 400 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 1μF 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

Standards

The ISOMETER® isoRW425 complies with the requirements of the device standards:
DIN EN 61557-8 (VDE 0413-8), IEC 61557-8 and EN 50155

Further information

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

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 CE and UL marks indicate the conformity with the requirements of the applicable European standard:

- CE mark: EN 61557-8 (VDE 0413-8), IEC 61557-8 and EN 50155
- UL mark: UL 61557-8

Ordering information

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

<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>3(N)AC, AC/DC</td>
<td>DC</td>
<td>AC</td>
<td>DC</td>
<td>＜300 μF</td>
</tr>
<tr>
<td>0…400 V</td>
<td>15…460 Hz</td>
<td>100…240 V, 47…63 Hz</td>
<td>24…240 V</td>
<td></td>
</tr>
</tbody>
</table>

Device version with screw terminals on request. 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>
**Technical data**

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

- Rated voltage (A1, A2) - (11, 14, 24) 300 V
- Rated impulse withstand voltage 4 kV
- Rated voltage (L1/+, L2/-, E, KE, T/R, A, B) 400 V
- Rated impulse withstand voltage 6 kV
- Overvoltage category III
- Pollution degree 3
- Protective separation (reinforced insulation) between (A1, A2) - 0.1/+, L2/-, E, KE, T/R, A, B) - (11, 14, 24)
- Voltage tests according to IEC 61010-1 2.2 kV

**Supply voltage**

- Voltage tests according to U_S AC 100…240 V/DC 24…240 V
- Tolerance of U_S -30…+15 %
- Frequency range of U_S 47…63 Hz
- Power consumption \( \leq 3 \, \text{W} \), \( \leq 9 \, \text{kA} \)

**IT system being monitored**

- Nominal system voltage U_N 3(N)/AC, AC/DC 0…400 V
- Tolerance of U_N +25 %
- Frequency range of U_N DC, 15…460 Hz

**Measuring circuit**

- Measuring voltage U_m \( \pm 12 \, \text{V} \)
- Measuring current I_m at \( R_2 \), \( Z_2 = 0 \, \text{Ω} \) \( \leq 110 \, \mu\text{A} \)
- Internal resistance \( R_2 \), \( Z_2 \) \( \pm 115 \, \text{kΩ} \)
- Permissible system leakage capacitance \( C \) (off mode) \( \leq 300 \, \mu\text{F} \)
- Permissible system leakage capacitance \( C \) (2 mode) \( \leq 1 \, \text{pF} \)
- Permissible extraneous AC voltage U_S2 \( \leq 700 \, \text{V} \)

**Response values**

- Response value \( R_{\text{max}} \) 2…990 kΩ (40 kΩ)*
- Response value \( R_{\text{min}} \) 1…980 kΩ (10 kΩ)*
- Relative uncertainty \( R_{\text{rel}} \) (R mode or \( Z \) = \( R \)) \( \pm 1 \, \% \), at least \( \pm 1 \, \% \)
- Hysteresis \( R \) 25 %, at least 1 kΩ
- Response value \( Z_{\text{max}} \) 11…500 kΩ (off)*
- Response value \( Z_{\text{min}} \) 10…490 kΩ (off)*
- Relative uncertainty \( Z_{\text{rel}} \) \( \pm 1 \, \% \), at least \( \pm 1 \, \% \)
- Hysteresis \( Z \) 25 %, at least 1 kΩ
- Undervoltage detection 10…499 V (off)*
- Overvoltage detection 11…500 V (off)*
- Relative uncertainty \( U \) \( \pm 5 \, \% \), at least \( \pm 5 \, \% \)
- Relative uncertainty depending on the frequency \( \geq 400 \, \text{Hz} \) \( -0.015 \, \% / \text{kHz} \)
- Hysteresis \( U \) \( \pm 5 \, \% \), at least \( \pm 5 \, \% \)

**Time response**

- Response time \( t_{\text{max}} \) at \( R_0 = 0.5 \times R_{\text{min}} \) and \( C_{\text{rel}} = 1 \, \mu\text{F} \) acc. to IEC 61557-8 \( \leq 10 \, \text{s} \)
- Response time \( t_{\text{max}} \) at \( Z_0 = 0.5 \times Z_{\min} \) \( \leq 5 \, \text{s} \)
- Start-up delay \( t \) 0…10 s (0 s)*
- Response delay \( t_{\text{max}} \) 0…99 s (0 s)*
- Delay on release \( t_{\text{off}} \) 0…99 s (0 s)*

**Displays, memory**

- Display LC display, multifunctional, not illuminated
- Display range measured value insulation resistance \( (R) \) 1 kΩ…4 MΩ
- Display range measured value impedance \( (Z) \) with \( G_0 = 50…60 \, \text{Hz} \) 1 kΩ…2 MΩ
- Operating uncertainty \( (R) \) in R mode, \( Z \) in Z mode \( \pm 15 \, \% \), at least \( \pm 1 \, \% \)
- Display range measured value nominal system voltage \( U_0 \) 0…500 V RMS
- Operating uncertainty \( \pm 5 \, \% \), at least \( \pm 5 \, \% \)
- Display range measured value system leakage capacitance \( R \) > 10 kΩ 0…380 μF
- Display range measured value system leakage capacitance \( Z \) > 10 kΩ 1 nF…1 μF
- Operating uncertainty \( (Z) = X_0 \) \( \pm 15 \, \% \), at least \( \pm 2 \, \% \)
- 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 (can be set), isoData (115.2 kbit/s)
- Cable length (9.6 kbit/s) \( \leq 1200 \, \text{m} \)
- Cable (twisted pair, one end shielded connected to PE) : min. J-V(SIY 2x0.6) (recommended)
- 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 contact, common terminal 11
- Operating principle N/C operation or N/O operation (N/C operation)*
- Electrical endurance in rated operating conditions 10 000 cycles
- 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 0.5 A 2 A 1 A 0.2 A 0.1 A
  - Minimum contact rating 1 mA at AC/DC \( \leq 10 \, \text{V} \)

**Environment/EMC**

- EMC IEC 61326-2-4, DIN EN60121-3-2
- Ambient temperatures:
  - Operation -40…+70 °C
  - Transport -50…+80 °C
  - Storage -55…+80 °C
- Classification of climatic conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3) 3K7
  - Transport (IEC 60721-3-2) 2KX
  - Long-term storage (IEC 60721-3-1) 1K6
- Classification of mechanical conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3) 3M7
  - Transport (IEC 60721-3-2) 2M2
  - Long-term storage (IEC 60721-3-1) 1M3

**Connection**

- Connection type push-wire terminal
- Connection properties:
  - 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 cooling slots must be ventilated vertically
- 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
- Documentation number D00652
- Weight \( \leq 150 \, \text{g} \)

*1* = Factory setting

---

**Dimension diagram (dimensions in mm)**
### Displays and controls

1. LED power “ON”, flashes in case of interruption of the connecting leads E/KE, L1+/L2-/ or system fault.
2. Alarm LED “AL1”, lights when the value falls below the set response value Alarm 1 and flashes in case of interruption of the connecting leads E/KE or L1+/L2-/ or system fault and in case of overvoltage (can be activated).
3. Alarm LED “AL2”, lights when the value falls below the set response value Alarm 2 and flashes in case of interruption of the connecting leads E/KE or L1+/L2-/ or system fault and in case of undervoltage (can be activated).

### Wiring diagram

1. Supply voltage \( U_S \) (see ordering information) via fuse
2. Separate connection of E, KE to PE
3. Connection to the IT system to be monitored:
   - AC: Connect terminals L1/+, L2/- to conductor L1, L2.
   - DC: Connect terminal L1/+ to L1 and L2/- to L2.
4. Alarm relay K1, K2 with single pole
5. Serial interface RS-485 (termination with a 120 Ω resistor, can be enabled in the device) Bender protocol BMS
6. Combined test and reset button “T/R” short-time pressing (< 1.5 s) = RESET long-time pressing (> 1.5 s) = TEST
7. 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.
Insulation monitoring devices
ISOMETER®

Equipment for insulation fault location
ISOSCAN®

Power Quality and Energy Measurement
LINETRAXX®

Measuring and monitoring relays
LINETRAXX®

Residual current monitoring systems
LINETRAXX®

System components
Coupling devices
Measuring current transformers
Transformers
Measuring transducers
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
Standards and guidelines applied
Alphabetical list of devices
Technical terms
Service
### Device overview Equipment for insulation fault location ISOSCAN®

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<td>Application</td>
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<td><strong>Circuits</strong></td>
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<td>Main circuits</td>
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<tr>
<td><strong>Voltage system</strong></td>
<td>300VAC</td>
<td>AC</td>
<td>AC/DC</td>
<td>DC</td>
<td></td>
</tr>
<tr>
<td><strong>Nominal voltage Uₘₙ max</strong></td>
<td>AC 20…276 V, DC 20…308 V</td>
<td>AC 20…276 V, DC 20…308 V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>System leakage capacitance $C_p \mu F$</td>
<td>acc. to characteristic curve</td>
<td>acc. to characteristic curve</td>
<td>acc. to characteristic curve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response value $R_{an \ k\Omega}$</td>
<td>acc. to characteristic curve</td>
<td>acc. to characteristic curve</td>
<td>acc. to characteristic curve</td>
<td>acc. to characteristic curve</td>
<td>acc. to characteristic curve</td>
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<tr>
<td><strong>Installation</strong></td>
<td>DIN rail</td>
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<tr>
<td>Screw mounting</td>
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<tr>
<td><strong>Interfaces</strong></td>
<td>BB</td>
<td>EDS440-S</td>
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<td>BS</td>
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<td>CMS</td>
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### Suitable system components

<table>
<thead>
<tr>
<th>Type</th>
<th>P.</th>
<th>Suitable system components</th>
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<tbody>
<tr>
<td>ISO685-D-P</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>IRDH575</td>
<td>79</td>
<td></td>
</tr>
<tr>
<td>isoMED427P</td>
<td>90</td>
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<td>isoPV1685P</td>
<td>101</td>
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<td>iso1685DP</td>
<td>–</td>
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<tr>
<td>W…</td>
<td>291</td>
<td></td>
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<tr>
<td>W…-8000</td>
<td>291</td>
<td></td>
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<tr>
<td>IR…50P</td>
<td>297</td>
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<td>WR…</td>
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<td>WS…</td>
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<tr>
<td>WS…-8000</td>
<td>299</td>
<td></td>
</tr>
<tr>
<td>W…A</td>
<td>294</td>
<td></td>
</tr>
<tr>
<td>Power supply unit</td>
<td>AN410</td>
<td>322</td>
</tr>
<tr>
<td>AN450</td>
<td>326</td>
<td></td>
</tr>
<tr>
<td>AN450-133</td>
<td>326</td>
<td></td>
</tr>
</tbody>
</table>
### ISOSCAN®

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Application</th>
<th>Circuits</th>
<th>Voltage System</th>
<th>Nominal Voltage</th>
<th>System Leakage Capacitance</th>
<th>Response Value</th>
<th>Installation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISOSCAN® EDS440</td>
<td></td>
<td>Medical locations</td>
<td>Stationary</td>
<td>AC</td>
<td>20…276 V</td>
<td>acc. to characteristic curve</td>
<td>acc. to characteristic curve</td>
<td>DIN rail</td>
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<tr>
<td>ISOSCAN® EDS441</td>
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<td>Stationary</td>
<td>AC</td>
<td>20…276 V</td>
<td>acc. to characteristic curve</td>
<td>acc. to characteristic curve</td>
<td>Screw mounting</td>
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<tr>
<td>ISOSCAN® EDS441-L</td>
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<td></td>
<td>Portable</td>
<td>AC/DC</td>
<td>20…308 V</td>
<td>acc. to characteristic curve</td>
<td>acc. to characteristic curve</td>
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</tr>
<tr>
<td>ISOSCAN® EDS460/490</td>
<td></td>
<td></td>
<td>Stationary</td>
<td>DC</td>
<td>20…308 V</td>
<td>acc. to characteristic curve</td>
<td>acc. to characteristic curve</td>
<td></td>
</tr>
<tr>
<td>ISOSCAN® EDS461/491</td>
<td></td>
<td></td>
<td>Portable</td>
<td>DC</td>
<td>20…308 V</td>
<td>acc. to characteristic curve</td>
<td>acc. to characteristic curve</td>
<td></td>
</tr>
</tbody>
</table>

**Suitable System Components**

- Suitable ISOMETER®s with integrated PGH
  - iso685-D-P
  - IRDH575
  - isoMED427P
  - isoPV1685P
  - iso1685DP
- Measuring current transformers
  - W…291
  - W…-8000
  - WR…S(P)
  - WS…299
  - WS…-8000
  - W…AB

**Power Supply Unit**

- AN410
- AN450
- AN450-133
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 W…, WR…, WS…, W…AB
- Fault memory behaviour selectable
- Configuration possibilities enable individual adjustments
- Up to 21 EDS insulation fault locators in the system, 252 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 button via digital inputs
- Indication via iso685-D-P or LEDs
- Central indication of faulty outgoing circuits
- Serial interface RS-485, BS bus address range 2…90
- 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 EDS… series meets the device standards:
- DIN VDE 0100-410 (VDE 0100-410):2007-06, Erection of low voltage electrical installations Part 4-41: Protective measures – Protection against electric shock (IEC 60364-4-41:2005, modified); German adoption HD 60364-4-41:2007

Further information

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

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage AC/DC</th>
<th>Response value</th>
<th>Type</th>
<th>Art. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>24…240 V AC/DC</td>
<td>2…10mA</td>
<td>EDS440-S-1</td>
<td>B 9108 0201</td>
</tr>
<tr>
<td></td>
<td>0.2…1mA</td>
<td>EDS440-L-4</td>
<td>B 9108 0202</td>
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<td></td>
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<td>EDS441-S</td>
<td>B 9108 0203</td>
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<td>EDS441-L-4</td>
<td>B 9108 0204</td>
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<tr>
<td></td>
<td></td>
<td>EDS441-LAB-4</td>
<td>B 9108 0205</td>
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</table>

1) Absolute values

Accessibility

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plug kit, screw terminals²</td>
<td>B 9108 0901</td>
</tr>
<tr>
<td>Plug kit, push-wire terminals</td>
<td>B 9108 0902</td>
</tr>
<tr>
<td>Mechanical accessories (terminal cover, 2 mounting clips)²</td>
<td>B 9108 0903</td>
</tr>
</tbody>
</table>

² included in the scope of delivery
### Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Design</th>
<th>Type of construction</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-485 repeater</td>
<td>Bus repeater</td>
<td>–</td>
<td>DI-1DL</td>
<td>329</td>
</tr>
<tr>
<td></td>
<td>Supplied by the USB port</td>
<td>–</td>
<td>DI-2USB</td>
<td>331</td>
</tr>
<tr>
<td></td>
<td>Power supply unit for DI-1 or DI-2</td>
<td>–</td>
<td>AK471</td>
<td>–</td>
</tr>
<tr>
<td>Measuring current transformers</td>
<td>pulsed DC sensitive</td>
<td>circular</td>
<td>W…</td>
<td>291</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W…AB</td>
<td>294</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>rectangular</td>
<td>WR…S(P)</td>
<td>297</td>
</tr>
<tr>
<td></td>
<td></td>
<td>split-core</td>
<td>WS…</td>
<td>299</td>
</tr>
</tbody>
</table>

### Technische Daten

#### Insulation coordination
- Rated impulse voltage (IEC 60664-1): AC 250 V
- Rated impulse voltage (IEC 60664-1): 4 kV
- Overvoltage category: III
- Pollution degree: 2
- Protective separation (reinforced insulation): between (A1,A2)-(13,14)-(23,24)-(31,32,33)
- Voltage test acc. to IEC 60710-1: 2.2 kV

#### Supply voltage
- Supply voltage range: AC/DC 24…240 V
- Tolerance of U:n: ±20…±15%
- Frequency range of U:n: 42…60 Hz
- Power consumption, typically 50 Hz (400 Hz) EDS44…: ≤4 W/7 VA (≤4 W, 28 VA)
- Power consumption, typically (DC via BB-Bus) EDS44…-S: ≤1 W

#### Response values
- Response value: 2…10 mA
- Response value (IEC 60664-1): 0.2…1 mA
- Relative uncertainty (IEC 60664-1): ±30 %, ±2 mA
- Response value residual current measurement (IEC 60664-1): 100 mA…10 A
- Relative uncertainty (IEC 60664-1): ±30 %, ±2 mA
- Response value residual current measurement (IEC 60664-1): 100 mA…1 A
- Relative uncertainty (IEC 60664-1): ±30 %, ±2 mA
- Hysteresis: 20 %

#### Time response
- Scanning time for all channels insulation fault location (IEC 60664-1): profile-dependent, min. 6 s
- Response time residual current measurement (IEC 60664-1): ≤400 ms
- Response time for measuring current transformer monitoring: max. 18 min

#### Measuring circuit
- Nominal system voltage (IEC 60664-1): refer to locating current injector (e.g. ISOMET® iso685-D-P)
- Nominal system voltage (IEC 60664-1): AC 20…276 V, DC 20…308 V
- Measuring current transformer external for EDS444 type: W…S
- Measuring current transformer external for EDS444 type: W…/8000, W…/8000
- Measuring current transformer external for EDS444 type: W…/8000, W…/8000
- Load EDS440: 47 Ω
- Load EDS441: 1.5 Ω
- Rated insulation voltage (measuring current transformer): 800 V

#### Connection EDS measuring current transformer
- Single wire ≥ 0.75 mm²: 0…1 m
- Single wire, twisted ≥ 0.75 mm²: 1…10 m
- Shielded cable ≥ 0.5 mm²: 10…40 m
- Recommended cable (shielded, shield connected to PE on one side): J-Y (St) Y min. 2x0.8

#### Measuring ranges
- Rated frequency range: DC, 42…1000 Hz
- Measuring range insulation fault location (IEC 60664-1): 1.5…25 mA (50 mA in DC systems only)
- Measuring range insulation fault location (IEC 60664-1): 0.15…5 mA
- Measuring range residual current measurement (IEC 60664-1): 100 mA…20 A
- Measuring range residual current measurement (IEC 60664-1): 1000 mA…2 A

#### LEDs
- UN (operation LED): green
- COM: yellow
- SERVICE: yellow
- I:n ALARM: yellow
- I:n ALARM: yellow
- 1…12 channel indication: yellow

### Digital inputs
- Number: 2
- Operating mode: adjustable
- Function: active high, active low
- Voltage level: Low DC: 5…5 V, High DC 11…32 V

#### Digital current output
- Number: 1
- Function: none, I:n alarm, I:n alarm, device fault, transformer connection fault, common alarm
- Current: 0 mA DC inactive, 20 mA DC active
- Tolerance: ±10 %

#### Buzzers
- Number: 1
- Function: none, I:n alarm, I:n alarm, device fault, transformer connection fault, insulation fault location active, common alarm

#### Interfaces
- Interface/protocol: RS-485/BS
- Data rate: 9600 baud/s
- Cable length: ≤1200 m
- Cable: twisted pair, one end of shield connected to PE recommended: J-Y (St) Y min. 2x0.8
- Connection: X1, X1.8
- Terminating resistor: 120 Ω, can be connected internally
- Device address, BS bus: 2…90

#### Switching elements
- Number: 2 N/O contacts
- Operating mode: N/C operation/N/O operation
- Function contact 11,14: none, I:n alarm, I:n alarm, device fault, transformer connection fault, common alarm
- Function contact 23,24: none, I:n alarm, I:n alarm, device fault, transformer connection fault, common alarm
- Electrical endurance under rated operating conditions: 30000
- Rated operational voltage: 250 VAC
- Rated operational current: 7 A
- Rated insulation voltage: 4 kV
- Max. switching capacity: 300 W/2770 VA
- Max. switching capacity: 30 VDC/2777 VAC

#### Environment/EMC
- EMC: IEC 61326-2-4
- Ambient temperatures:
  - Operating temperature: −40…+70 °C
  - Transport: −40…+85 °C
  - Storage: −25…+70 °C
- Classification of climatic conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3K5 (no condensation, no formation of ice)
  - Transport (IEC 60721-3-2): 2K3
  - Long-term storage (IEC 60721-3-1): 1K4
- Classification of mechanical conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3M4
  - Transport (IEC 60721-3-2): 2M2
  - Long-term storage (IEC 60721-3-1): 1M3
- Range of use: ≤2000 m above sea level
### Technical data (continued)

#### Connection

<table>
<thead>
<tr>
<th>Connection type</th>
<th>pluggable screw-type terminal or push-wire terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Screw-type terminal:</strong></td>
<td></td>
</tr>
<tr>
<td>Tightening torque</td>
<td>0.5…0.6 Nm (5…7 lb-in)</td>
</tr>
<tr>
<td>Conductor sizes</td>
<td>AWG 24-12</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 ferrule, with/plastic sleeve</td>
<td>0.25…2.5 mm²</td>
</tr>
<tr>
<td>Multiple conductor, rigid</td>
<td>0.2…1.1 mm²</td>
</tr>
<tr>
<td>Multiple conductor, flexible</td>
<td>0.2…1.5 mm²</td>
</tr>
<tr>
<td>Multiple conductor, flexible with ferrule, without/plastic sleeve</td>
<td>0.25…1.1 mm²</td>
</tr>
<tr>
<td>Multiple conductor, flexible with/TWIN ferrule with plastic sleeve</td>
<td>0.5…1.5 mm²</td>
</tr>
<tr>
<td><strong>Push-wire terminals:</strong></td>
<td></td>
</tr>
<tr>
<td>Conductor sizes</td>
<td>AWG 24-12</td>
</tr>
<tr>
<td>Stripping length</td>
<td>10 mm</td>
</tr>
<tr>
<td>rigid/flexible</td>
<td>0.2…2.5 mm²</td>
</tr>
<tr>
<td>flexible with ferrule, without/plastic sleeve</td>
<td>0.25…2.5 mm²</td>
</tr>
<tr>
<td>Multiple conductor, flexible with/TWIN ferrule with plastic sleeve</td>
<td>0.5…1.5 mm²</td>
</tr>
<tr>
<td><strong>Push-wire terminals X1, X2:</strong></td>
<td></td>
</tr>
<tr>
<td>Conductor sizes</td>
<td>AWG 24-16</td>
</tr>
<tr>
<td>Stripping length</td>
<td>10 mm</td>
</tr>
<tr>
<td>rigid/flexible</td>
<td>0.2…1.5 mm²</td>
</tr>
<tr>
<td>flexible with ferrule, without/plastic sleeve</td>
<td>0.25…1.5 mm²</td>
</tr>
<tr>
<td>flexible with TWIN ferrule with plastic sleeve</td>
<td>0.25…0.75 mm²</td>
</tr>
</tbody>
</table>

#### Other

| Operating mode                   | continuous operation                                |
| Mounting                         | at an ambient temperature >55 °C, vertical mounting required |
| 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)                            |

### Dimension diagram (dimensions in mm)

![Dimension diagram](image)

---

1) At a frequency >200 Hz, connection of X1 and k1-12/l1-12 must be insulated. Only permanently installed devices which at least have overvoltage category CAT2 (300V) may be connected.

2) Only 50/60 Hz are permitted for UL applications.

3) Effect of a residual current >100 mA results in a greater relative uncertainty.

4) The $I_{Δn}$ function of the EDS441… is only suitable for 50/60 Hz.
1. The LED "ON" is lit when the device is switched on and flashes during power up until the device is ready for operation.
2. The LED "COM" is lit when the fault location is active and the RS-485 interface communicates.
3. The LED "SERVICE" lights either when there is a device fault, a connection fault of the measuring current transformers or an error message e.g. due to low-frequency residual currents, external magnetic fields, etc.
4. The LED "ALARM IΔL" is the main alarm. The LED lights when an insulation fault is detected (EDS function) on one of the measuring channels.
5. The LED "ALARM IΔn" lights if the set response value is exceeded. The factory setting for the response value is 10 A. This is the alarm LED for residual currents.
6. TEST button: Initiate self test.
7. The channel LEDs "1...12" light up if an insulation fault has been detected on the respective measuring channel. They flash if the measuring current transformer circuit is interrupted or short-circuited.
8. RESET button: resets the fault memory. The fault memory can only be reset if it is activated and the fault has disappeared.
9. SLAVE ADDRESS: Device address setting.
10. MUTE button: Deactivates the buzzer.

Connection to the X1 interface

- **I1** Input 1
- **I2** Input 2
- **A** RS-485 A (input)
- **B** RS-485 B (input)
- **B** RS-485 B (output)
- **A** RS-485 A (output)
- **M+** dig. output

Connection to the k1-12/l1-12 interface
For insulation fault location, the measuring current transformers of the W… (closed), WR… (rectangular) and WS… (split-core) series are used.

Connecting measuring current transformers of the W…AB series to EDS441-LAB

To use the EDS441-LAB with the maximum locating current of ≤ 1.8 mA, the closed measuring current transformers of the W…AB series are required. For every 6 measuring current transformers of the W…AB series, one power supply unit AN420 or AN110 is required.
Wiring diagram to 3(N)AC system with iso685

Wiring diagram to DC system with iso685
Wiring diagram to AC system with iso685

Connection example: iso685, EDS440-S and EDS440-L
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 W, 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
The ISOSCAN® EDS46… 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 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</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDS-Funktion</td>
<td>RCM-Funktion</td>
<td></td>
<td>AC/DC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2…10 mA</td>
<td>100 mA…10 A</td>
<td>2 x 1 changeover contact</td>
<td>–</td>
<td>16…72 V, 42…460 Hz, 16…94 V</td>
<td>EDS460-D-1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>42…460 Hz</td>
<td>–</td>
<td>70…276 V</td>
</tr>
<tr>
<td>0.2…1 mA</td>
<td>10 mA…1 A</td>
<td>2 x 1 changeover contact</td>
<td>–</td>
<td>16…72 V, 42…460 Hz, 16…94 V</td>
<td>EDS461-D-1</td>
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<tr>
<td></td>
<td></td>
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<td>–</td>
<td>70…276 V</td>
</tr>
<tr>
<td>2…10 mA</td>
<td>100 mA…10 A</td>
<td>2 x 1 changeover contact</td>
<td>12 x 1 N/O contact</td>
<td>16…72 V, 42…460 Hz, 16…94 V</td>
<td>EDS490-D-1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>42…460 Hz</td>
<td>–</td>
<td>70…276 V</td>
</tr>
<tr>
<td>0.2…1 mA</td>
<td>10 mA…1 A</td>
<td>2 x 1 changeover contact</td>
<td>12 x 1 N/O contact</td>
<td>16…72 V, 42…460 Hz, 16…94 V</td>
<td>EDS491-D-1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>42…460 Hz</td>
<td>–</td>
<td>70…276 V</td>
</tr>
</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</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDS-Funktion</td>
<td>RCM-Funktion</td>
<td></td>
<td>AC/DC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2…10 mA</td>
<td>100 mA…10 A</td>
<td>2 x 1 changeover contact</td>
<td>–</td>
<td>16…72 V, 42…460 Hz, 16…94 V</td>
<td>EDS460-L-1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>42…460 Hz</td>
<td>–</td>
<td>70…276 V</td>
</tr>
<tr>
<td>0.2…1 mA</td>
<td>10 mA…1 A</td>
<td>2 x 1 changeover contact</td>
<td>–</td>
<td>16…72 V, 42…460 Hz, 16…94 V</td>
<td>EDS461-L-1</td>
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<tr>
<td></td>
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</tr>
<tr>
<td>2…10 mA</td>
<td>100 mA…10 A</td>
<td>2 x 1 changeover contact</td>
<td>12 x 1 N/O contact</td>
<td>16…72 V, 42…460 Hz, 16…94 V</td>
<td>EDS490-L-1</td>
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<td></td>
<td></td>
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<td>0.2…1 mA</td>
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<td>12 x 1 N/O contact</td>
<td>16…72 V, 42…460 Hz, 16…94 V</td>
<td>EDS491-L-1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>42…460 Hz</td>
<td>–</td>
<td>70…276 V</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

<table>
<thead>
<tr>
<th>Description</th>
<th>Design</th>
<th>Type of construction</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage</td>
<td>AC 250 V</td>
<td>–</td>
<td>DI-1DL</td>
<td>329</td>
</tr>
<tr>
<td>Rated impulse voltage/pollution degree</td>
<td>6 kV</td>
<td>–</td>
<td>DI-2USB</td>
<td>331</td>
</tr>
<tr>
<td>Protective separation (reinforced insulation) between</td>
<td>(A1, A2) - (k1, l) - (k1, l2, R, T, A, B) - (C1, C12, C14), (C21, C22, C24), (C11, C14), (21, 24), (31, 34), (41, 44), (51, 54), (61, 64), (71, 74), (81, 84), (91, 94), (101, 104), (111, 114), (121, 124)</td>
<td>–</td>
<td>AN471</td>
<td>–</td>
</tr>
<tr>
<td>Rated insulation voltage/pollution degree</td>
<td>6 kV</td>
<td>–</td>
<td>COM460IP</td>
<td>335</td>
</tr>
<tr>
<td>Protective separation (reinforced insulation) between</td>
<td>(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)</td>
<td>–</td>
<td>COM462RTU</td>
<td>341</td>
</tr>
<tr>
<td>Voltage test acc. to IEC 61010-1</td>
<td>3.536 kV</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Rated insulation voltage</td>
<td>AC 250 V</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Rated impulse voltage/pollution degree</td>
<td>6 kV</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Basic insulation between:</td>
<td>(k1, l1...l2, R, T, A, B) - (C11, C12, C14), (C21, C22, C24)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Basic insulation between:</td>
<td>(11, 14) - (21, 24) - (31, 34) - (41, 44) - (51, 54) - (61, 64)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Voltage test acc. to IEC 61010-1</td>
<td>2.21 kV</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

#### 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

<table>
<thead>
<tr>
<th>Description</th>
<th>Design</th>
<th>Type of construction</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage</td>
<td>AC 100 V</td>
<td>–</td>
<td>DI-1DL</td>
<td>329</td>
</tr>
<tr>
<td>Rated impulse voltage/pollution degree</td>
<td>2.5 kV</td>
<td>–</td>
<td>DI-2USB</td>
<td>331</td>
</tr>
<tr>
<td>Protective separation (reinforced insulation) between</td>
<td>(A1, A2) - (k1, l1...l2, 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)</td>
<td>–</td>
<td>AN471</td>
<td>–</td>
</tr>
<tr>
<td>Rated insulation voltage/pollution degree</td>
<td>6 kV</td>
<td>–</td>
<td>COM460IP</td>
<td>335</td>
</tr>
<tr>
<td>Basic insulation between:</td>
<td>(11, 14) - (21, 24) - (31, 34) - (41, 44) - (51, 54) - (61, 64)</td>
<td>–</td>
<td>COM462RTU</td>
<td>341</td>
</tr>
<tr>
<td>Voltage test acc. to IEC 61010-1</td>
<td>2.21 kV</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Rated insulation voltage</td>
<td>AC 250 V</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Rated impulse voltage/pollution degree</td>
<td>6 kV</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Protective separation (reinforced insulation) between</td>
<td>(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)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Voltage test acc. to IEC 61010-1</td>
<td>2.21 kV</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

### Time response

<table>
<thead>
<tr>
<th>Description</th>
<th>Design</th>
<th>Type of construction</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response delay tau</td>
<td>0...24 s</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Delay on release tau</td>
<td>0...24 s</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Scanning time for all channels</td>
<td>approx. 6...24 s (EDS460 490/1)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Displays, memory</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>LEDs</td>
<td>ON/ALARM (EDS4...-0)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>LC display</td>
<td>ON/ALARM/measuring channel 1...12 (EDS4...-4)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>7-segment display</td>
<td>backlit graphical display (EDS4...-8)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>History memory</td>
<td>300 data records (EDS4...-0)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Password</td>
<td>off/0...999 (off)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Language</td>
<td>D, GB, F (GB)*</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Fault memory alarm relay</td>
<td>on/off (off)*</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

### Inputs/outputs

<table>
<thead>
<tr>
<th>Description</th>
<th>Design</th>
<th>Type of construction</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test/reset button</td>
<td>internal/external</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Cable length for external test/reset button</td>
<td>0...10 m</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Interface/protocol</td>
<td>RS-485/BMS</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Baud rate</td>
<td>9.6 kbit/s</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Cable length</td>
<td>0...1200 m</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Terminating resistor</td>
<td>120 Ω (0.25 W) connectable via DIP switch</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Device address, BMS bus</td>
<td>1...90 (2)*</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

### Connection: EDS – measuring current transformer

- Single wire ≥ 0.75 mm²
  - 0...1 m
- Single wire, twisted ≥ 0.75 mm²
  - 1...10 m
- Shielded cable ≥ 0.5 mm²
  - 10...40 m
- Shielded cable (shielded on one side connected to L-conductor, not connected to earth)
  - 1...50 m

### Switching elements

<table>
<thead>
<tr>
<th>Description</th>
<th>Design</th>
<th>Type of construction</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum contact rating</td>
<td>1 mA at AC/DC ≥ 10 V</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

### Environment/EMC

<table>
<thead>
<tr>
<th>Description</th>
<th>Design</th>
<th>Type of construction</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>10,20</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Classification of climatic conditions acc. to IEC 60721</td>
<td>0...100</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Stationary use (IEC 60721-3-3)</td>
<td>2K3</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Stationary use (IEC 60721-3-1)</td>
<td>3K5</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Stationary use (IEC 60721-3-2)</td>
<td>3K6</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Stationary use (IEC 60721-3-2)</td>
<td>3M4</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Stationary use (IEC 60721-3-2)</td>
<td>3M3</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>
Technical data (continued)

### Connection

<table>
<thead>
<tr>
<th>Connection</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>rigid/flexible</td>
<td>0.2…4/0.2…2.5 mm² (AWG 24…12)</td>
</tr>
<tr>
<td>Multi-conductor connection (2 conductors with the same cross section):</td>
<td></td>
</tr>
<tr>
<td>rigid/flexible</td>
<td>0.2…1.5/0.2…1.5 mm²</td>
</tr>
<tr>
<td>Stripping length</td>
<td>8…9 mm</td>
</tr>
<tr>
<td>Tightening torque</td>
<td>0.5…0.6 Nm</td>
</tr>
</tbody>
</table>

### Other

<table>
<thead>
<tr>
<th>Operating mode</th>
<th>continuous operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position of normal use</td>
<td>any</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>Flammability class</td>
<td>UL94V-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</td>
</tr>
<tr>
<td>Weight</td>
<td>≤ 360 g (EDS460)</td>
</tr>
<tr>
<td></td>
<td>≤ 330 g (EDS490)</td>
</tr>
</tbody>
</table>

*factory setting*

---

### Dimension diagrams (dimensions in mm)

**EDS46…-D/-L**

![Dimension diagram of EDS46…-D/-L](image1)

**EDS49…-D/-L**

![Dimension diagram of EDS49…-D/-L](image2)

---

### 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></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EDS461: 0.2…1 mA</td>
<td>EDS491: 0.2…1 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual current indication</td>
<td>EDS460: 100 mA...10 A</td>
<td>EDS490: 100 mA...10 A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EDS461: 10 mA...1 A</td>
<td></td>
<td></td>
<td></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…90</td>
<td>1…90</td>
<td>1…90</td>
<td>1…90</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>2 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>

---

*( ) factory setting*
**Displays and controls**

1. **LED “ALARM 1”** lights up in case of the following system faults:
   - when the residual current exceeds > 10 A (EDS460/490) or > 1 A (EDS461/EDS491) (RCM function)
   - when there is a loss of power or short circuit in a measuring current transformer circuit (this function can be deactivated)

2. **LED “Alarm 2”** lights up when an insulation fault is detected on a channel (EDS function)

3. **Power On LED “ON”**

4. **LC graphical display**

5. **“INFO” button:** to query standard information (does not apply to EDS…L).
   - **ESC button:** back to menu function.

6. **“TEST” button:** to call up the self test
   - **Arrow up button:** Parameter changes, scroll
   - **“RESET” button:** to acknowledge insulation and fault messages
   - **Arrow down button:** Parameter changes, scroll
   - **“MENU” button:** EDS…-D: to toggle between the standard display, menu and alarm indication EDS…-L: to set the BMS address
   - **Enter button:** to confirm parameter changes

7. **Alarm LEDs “1…12”, light up if an insulation fault has been detected in the relevant channel**

**Wiring diagrams**

1. **Supply voltage** $U_S$ (see ordering information), 6 A fuse recommended; two-pole fuses are required on IT systems

2. **Connection measuring current transformers k1…k12**

3. **Serial interface RS-485**

4. **External reset button “R” (N/O contact)*

5. **External test button “T” (N/O contact)*

6. **Alarm relay 1**

7. **Alarm relay 2**

8. **Alarm relay: one N/O contact per channel (EDS490/491 only)**

9. **Rear: Termination of the serial RS-485 interface (A/B) with 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
- Cyclic self test

### 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.

### 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)

### Approvals

### Ordering information

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>Response value</th>
<th>Supply voltage</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDS function</td>
<td>RC 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></td>
<td></td>
</tr>
<tr>
<td>0.5...2.5 mA</td>
<td>0.5 mA</td>
<td>1 A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Absolute values

### Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Voltage supply</th>
<th>Output voltage</th>
<th>Explanation</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply unit</td>
<td>AC 90...264V/DC 120...370V/47...63 Hz</td>
<td>DC 24V, 420 mA</td>
<td>For the supply of max. 6 EDS15...</td>
<td>AN410</td>
<td>322</td>
</tr>
<tr>
<td></td>
<td>AC 85...280V/47...63 Hz</td>
<td>DC 24V, 1300 mA</td>
<td>For the supply of max. 20 EDS15...</td>
<td>AN430</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>AC 230V/50...60 Hz</td>
<td>AC 20 V, 500 mA</td>
<td>For the supply of max. 6 EDS15...</td>
<td>AN450</td>
<td>326</td>
</tr>
<tr>
<td></td>
<td>AC 127V/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>326</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/k

**Voltage ranges**

**IT system being monitored:**
- Nominal system voltage $U_n$: see IRDH575, PSH (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**
- Power consumption AC: ≤ 3 VA
- Power consumption DC: ≤ 1.5 VA

**Measuring circuit**

<table>
<thead>
<tr>
<th>Dimension diagrams (dimensions in mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Diagram 1" /></td>
</tr>
</tbody>
</table>

**EDS function:**
- Response value: EDS150: 5 mA
- EDS151: 0.5 mA
- 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
- Scanning time for all channels: approx. 72 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 mm²
  - ≤ 1200 m
- Terminating resistor: 120 Ω (0.25 W)
- Device address, BMS bus: 3…90 (3)*

**Environment/EMC**
- Rated frequency: 42…460 Hz
- Measuring range EDS function: rigid:
  - 0.2…1.5 mm² (AWG 24…16)
- Multi-conductor connection (2 conductors of 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: 2 x M6
- Tightening torque: 1.5 Nm
- Documentation number: D00106 (EDS150)
  - D00107 (EDS151)
- Weight: ≤ 340 g

* (3)* = factory setting
ISOSCAN® EDS150/EDS151

Displays and controls

1. Opening for screw mounting
2. Alarm LEDs measuring channels “K1…K6”
3. Cable lead-through of the measuring current transformers for the measuring channels K1…K6
4. “ON/COM” LED: Power On LED and bus activity
5. Set the ones position of the BMS address
6. Set the tens position of the BMS address
7. Connection to the supply voltage
8. Connection RS-485, BMS bus

Wiring diagrams

1. Transformer for the IT system to be monitored
2. Circuit breakers for the circuits
3. AN430 resp. AN410 for DC 24 V supply voltage
4. Alarm indicator and test combination MK2430/MK800 for indication of alarm messages from the EDS150/151 (BMS master)
5. IRDH575 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 Ue, 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 EDS195P
- 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:
DIN EN 61557-8 (VDE 0413-8), EN 61557-8, 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.

<table>
<thead>
<tr>
<th>Main circuits</th>
<th>Control circuits</th>
<th>Nominal voltage $U_n$</th>
<th>Supply voltage $U_S$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>with EDS</td>
<td>without EDS</td>
<td>AC DC</td>
<td>AC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EDS460/490</td>
<td>–</td>
<td>– –</td>
<td>20…575 V 42…460 Hz</td>
<td>20…304 V</td>
<td>EDS3090</td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>– –</td>
<td>20…575 V 42…460 Hz</td>
<td>20…304 V</td>
<td>EDS3090PG</td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>– –</td>
<td>20…575 V 42…460 Hz</td>
<td>20…304 V</td>
<td>EDS3090PG-13</td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>– –</td>
<td>0…575 V 42…460 Hz</td>
<td>0…304 V</td>
<td>EDS3096PG</td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>– –</td>
<td>0…575 V 42…460 Hz</td>
<td>0…304 V</td>
<td>EDS3096PG-13</td>
</tr>
<tr>
<td>–</td>
<td>EDS461/491</td>
<td>– –</td>
<td>20…265 V 42…460 Hz</td>
<td>20…308 V</td>
<td>EDS3091</td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>– –</td>
<td>20…265 V 42…460 Hz</td>
<td>20…308 V</td>
<td>EDS3091PG</td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>– –</td>
<td>20…265 V 42…460 Hz</td>
<td>20…308 V</td>
<td>EDS3091PG-13</td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>– –</td>
<td>20…265 V 42…460 Hz</td>
<td>20…308 V</td>
<td>EDS3092PG</td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>– –</td>
<td>20…265 V 42…460 Hz</td>
<td>20…308 V</td>
<td>EDS3092PG-13</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Designation</th>
<th>Nominal voltage $U_n$</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>–</td>
<td>– AC DC</td>
<td>PSA3165</td>
<td>–</td>
</tr>
<tr>
<td>Coupling-device to extend the voltage range of the PGH185/186</td>
<td>500…790 V/42…460 Hz</td>
<td>AGE185</td>
<td>160</td>
</tr>
<tr>
<td>Accessories for fault location in diode-decoupled systems</td>
<td>–</td>
<td>EDS165-SET</td>
<td>–</td>
</tr>
</tbody>
</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>EDS195P</td>
<td>–</td>
<td>PSA3020</td>
<td>PSA3052</td>
<td>EDS3090</td>
</tr>
<tr>
<td>EDS195P</td>
<td>PGH185</td>
<td>PSA3020</td>
<td>PSA3052</td>
<td>EDS3090PG</td>
</tr>
<tr>
<td>EDS195P</td>
<td>PGH185-13</td>
<td>PSA3020</td>
<td>PSA3052</td>
<td>EDS3090PG-13</td>
</tr>
<tr>
<td>EDS195P</td>
<td>PGH186</td>
<td>PSA3020</td>
<td>PSA3052</td>
<td>EDS3096PG</td>
</tr>
<tr>
<td>EDS195P</td>
<td>PGH186-13</td>
<td>PSA3020</td>
<td>PSA3052</td>
<td>EDS3096PG-13</td>
</tr>
<tr>
<td>EDS195P</td>
<td>–</td>
<td>PSA3320</td>
<td>PSA3352</td>
<td>EDS3091</td>
</tr>
<tr>
<td>EDS195P</td>
<td>PGH183</td>
<td>PSA3320</td>
<td>PSA3352</td>
<td>EDS3091PG</td>
</tr>
<tr>
<td>EDS195P</td>
<td>PGH183-13</td>
<td>PSA3320</td>
<td>PSA3352</td>
<td>EDS3091PG-13</td>
</tr>
<tr>
<td>EDS195P</td>
<td>PGH185</td>
<td>PSA3320</td>
<td>PSA3352</td>
<td>EDS3092PG</td>
</tr>
<tr>
<td>EDS195P</td>
<td>PGH185-13</td>
<td>PSA3320</td>
<td>PSA3352</td>
<td>EDS3092PG-13</td>
</tr>
<tr>
<td>EDS195P</td>
<td>–</td>
<td>2 x PSA3052</td>
<td>–</td>
<td>EDS3096PV</td>
</tr>
</tbody>
</table>
Technical data EDS309…system

The technical data listed in this chapter apply to the components:
PGH18…, EDS195P, AGH185.

Environment/EMC

Table: Environment/EMC

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC</td>
<td>IEC 61326-2-4</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-10…+55 °C</td>
</tr>
<tr>
<td>Classification of climatic cond. acc. to IEC 60721</td>
<td></td>
</tr>
<tr>
<td>Stationary use (IEC 60721-3-3)</td>
<td>3K5 (except condensation and formation of ice)</td>
</tr>
<tr>
<td>Transport (IEC 60721-3-2)</td>
<td>2K3 (except condensation and formation of ice)</td>
</tr>
<tr>
<td>Storage (IEC 60721-3-1)</td>
<td>1K4 (except condensation and formation of ice)</td>
</tr>
</tbody>
</table>

Classification of mechanical conditions acc. to IEC 60721

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stationary use (IEC 60721-3-3)</td>
<td>3M4</td>
</tr>
<tr>
<td>Transport (IEC 60721-3-2)</td>
<td>2M2</td>
</tr>
<tr>
<td>Long-time storage (IEC 60721-3-1)</td>
<td>1M3</td>
</tr>
</tbody>
</table>

Other

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating mode</td>
<td>continuous operation</td>
</tr>
<tr>
<td>Position of normal use</td>
<td>any</td>
</tr>
<tr>
<td>Weight EDS309…</td>
<td>≤ 7000 g</td>
</tr>
<tr>
<td>Weight EDS309… with PSA3165</td>
<td>≤ 8500 g</td>
</tr>
<tr>
<td>Weight EDS3092</td>
<td>≤ 9000 g</td>
</tr>
<tr>
<td>Dimensions WxHxD</td>
<td>430 x 340 x 155 mm</td>
</tr>
<tr>
<td>Documentation number</td>
<td>D00012</td>
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Technical data PGH18…

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 insulation voltage</td>
<td>AC 500 V</td>
</tr>
<tr>
<td>Rated impulse withstand voltage/pollution degree</td>
<td>4 kV/3</td>
</tr>
</tbody>
</table>

Table: Nominal system voltage $U_n$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGH183</td>
<td>AC 20…265 V/42…460 Hz, DC 20…308 V</td>
</tr>
<tr>
<td>PGH185</td>
<td>3AC/AC 20…575 V/42…460 Hz, DC 20…504 V</td>
</tr>
<tr>
<td>PGH186</td>
<td>3AC/AC 0…575 V/42…460 Hz, DC 0…504 V</td>
</tr>
</tbody>
</table>

Voltage supply

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage $U_s$</td>
<td>AC 230 V/50…60 Hz</td>
</tr>
<tr>
<td>Operating range of $U_s$</td>
<td>0.85…1.15 x $U_s$</td>
</tr>
<tr>
<td>Supply voltage $U_s$ version -13</td>
<td>AC 90…132 V/50…60 Hz</td>
</tr>
</tbody>
</table>

Table: Voltage supply

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGH183, PGH185: Power consumption</td>
<td>≤ 3 VA</td>
</tr>
<tr>
<td>PGH186: Power consumption</td>
<td>≤ 6 VA</td>
</tr>
</tbody>
</table>

Locating current

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test current, selectable, max.</td>
<td>1/2.5 mA</td>
</tr>
<tr>
<td>PGH185/186: Locating current $I_L$, selectable, max.</td>
<td>10/25 mA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clock pulse</td>
<td>2 s</td>
</tr>
<tr>
<td>Idle time</td>
<td>4 s</td>
</tr>
</tbody>
</table>

Measuring voltage $U_m$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGH186</td>
<td>DC 50 V</td>
</tr>
</tbody>
</table>

Other

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of protection, internal components DIN 60529 (VDE 0470-1)</td>
<td>IP40</td>
</tr>
<tr>
<td>Enclosure material</td>
<td>ABS plastic</td>
</tr>
<tr>
<td>Flammability class</td>
<td>UL94 V-0</td>
</tr>
<tr>
<td>Weight</td>
<td>≤ 700 g</td>
</tr>
<tr>
<td>Dimensions WxHxD</td>
<td>160 x 148 x 81 mm</td>
</tr>
</tbody>
</table>

Technical data EDS195P

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 insulation voltage</td>
<td>50 V</td>
</tr>
<tr>
<td>Rated impulse withstand voltage/pollution degree</td>
<td>0.8 kV/3</td>
</tr>
</tbody>
</table>

Voltage supply

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage $U_s$ accumulators, batteries or USB power supply unit</td>
<td>3 x NiMH ≥ 2000 mAh</td>
</tr>
<tr>
<td>Hours of operation (without display illumination)</td>
<td>≥ 150 h</td>
</tr>
<tr>
<td>Charging time</td>
<td>≤ 5 h</td>
</tr>
<tr>
<td>Size Batteries</td>
<td>AA 6 B</td>
</tr>
<tr>
<td>Batteries 3 x LR6 AA ~ 1.5 V</td>
<td>USB power supply unit:</td>
</tr>
<tr>
<td>Supply voltage $U_s$</td>
<td>DC 5 V, ±10 %</td>
</tr>
<tr>
<td>Power consumption</td>
<td>≤ 0.5 W</td>
</tr>
</tbody>
</table>

Measuring circuit insulation fault location

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal system voltage conductors uninsulated, including measuring clamp up to 600 V</td>
<td></td>
</tr>
<tr>
<td>Rated frequency</td>
<td>DC, 42…2000 Hz</td>
</tr>
</tbody>
</table>

Main circuit (I_{max} = 50 mA)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>2 mA…50 mA</td>
</tr>
<tr>
<td>Measuring current $I_m$, adjustable</td>
<td>2mA…10mA (5 mA)*</td>
</tr>
<tr>
<td>Relative uncertainty</td>
<td>±30 %/±2 mA of the reference value</td>
</tr>
</tbody>
</table>

Control circuit (I_{max} = 5 mA)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>0.2 mA…5 mA</td>
</tr>
<tr>
<td>Measuring current $I_m$, adjustable</td>
<td>0.2 mA…1.0 mA (0.5 mA)*</td>
</tr>
<tr>
<td>Relative uncertainty</td>
<td>±30 %/±0.2 mA of the reference value</td>
</tr>
<tr>
<td>Relative uncertainty 1…5 mA</td>
<td>±30 %/±2 mA of the reference value</td>
</tr>
</tbody>
</table>

Measuring circuit residual current

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>with measuring clamps</td>
<td>PSA3020, PSA3052, PSA3165</td>
</tr>
<tr>
<td>Measuring range</td>
<td>5 mA…10 A (crest factor up to 3)</td>
</tr>
<tr>
<td>Response value $I_m$, adjustable</td>
<td>10 mA…10 A (100 mA)*</td>
</tr>
<tr>
<td>with measuring clamps</td>
<td>PSA3320, PSA3352</td>
</tr>
<tr>
<td>Measuring range</td>
<td>2 mA…2 A (crest factor up to 3)</td>
</tr>
<tr>
<td>Response value $I_m$, adjustable</td>
<td>5 mA…1 A (100 mA)*</td>
</tr>
<tr>
<td>Frequency range</td>
<td>42…1000 Hz</td>
</tr>
<tr>
<td>Relative uncertainty</td>
<td>±5 %</td>
</tr>
<tr>
<td>Frequency range</td>
<td>42…1000 Hz</td>
</tr>
<tr>
<td>Relative uncertainty 42…60 Hz</td>
<td>±20 %</td>
</tr>
<tr>
<td>Harmonics, adjustable</td>
<td>1st to 8th harmonic component</td>
</tr>
</tbody>
</table>

Connection

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of connection measuring clamp</td>
<td>BNC plug</td>
</tr>
<tr>
<td>Power supply unit (DC 5 V)</td>
<td>μUSB plug</td>
</tr>
</tbody>
</table>

Indicator

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCD</td>
<td>3 x 16 characters, selectable illumination</td>
</tr>
<tr>
<td>Alarm</td>
<td></td>
</tr>
</tbody>
</table>

Other

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of protection, internal components DIN 60529 (VDE 0470-1)</td>
<td>IP40</td>
</tr>
<tr>
<td>Protection class acc. to IEC 60947-1, DIN EN 60947-1 (VDE 0666-100)</td>
<td>Class III</td>
</tr>
<tr>
<td>Enclosure material</td>
<td>ABS plastic</td>
</tr>
<tr>
<td>Flammability class</td>
<td>UL94 V-0</td>
</tr>
<tr>
<td>Dimensions WxHxD</td>
<td>84 x 197 x 30 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>≤ 350 g</td>
</tr>
</tbody>
</table>

\( \ast = \text{Factory settings} \)
ISOSCAN® EDS30...

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
- **PSA33**: 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 PSA3020/3320: 20 mm
- Permissible cable diameter PSA3165: 115 mm
- Weight PSA3052/3352: ≤ 700 g
- PSA3020/3320: ≤ 100 g
- 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 Uₚ**: 3AC, AC 300…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
- Test port: BNC plug
- 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)**

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Equipment for insulation fault location Portable equipment for insulation fault location ISOSCAN® EDS30...
ISOSCAN® EDS30...

**Operating elements PGH18...**

1. **On/Off switch “ON”,** activates the test current
2. **Selector switch for the maximum locating current** 25/10 mA or 2.5/1 mA
3. **Not visible: Magnetic adhesive strip at the back of the enclosure for fixing to metal parts (e.g. switchboard cabinet)**
4. **3 sockets for system coupling**
5. **Socket for PE connection**

**Operating elements EDS195P**

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:**
   - $I_{\Delta S} =$ insulation fault location in IT systems (EDS mode)
   - $I_{\Delta n} =$ residual current measurement in TN-S systems (RCM mode)
6. **Button for transformer selection**
7. **Microfuse 100 mA**
8. **Panel plug for supply voltage**

**LED indicators:**
- “ON” Power On LED
- Indication of the positive clock pulse of the locating current
- Indication of the negative clock pulse of the locating current

---

**Parameter changes, scroll**
- **Arrow up button:** Parameter changes, scroll
- **Arrow down button:** Parameter changes, scroll

**Illumination button:** To switch on the display lighting

---

**INFO** button: – device type – software version – current response values $I_{\Delta S}$ and $I_{\Delta n}$ – setup status

**ESC button:** to exit the menu function without changing parameters

**“MENU” button:** to toggle between the standard display and the menu selection

**“HOLD” button:** to store the currently indicated measured value

**“RESET” button:** fault memory acknowledgement

---

**Operating elements PGH18...**

1. **On/Off switch “ON”,** activates the test current
2. **Selector switch for the maximum locating current 25/10 mA or 2.5/1 mA
3. **Not visible: Magnetic adhesive strip at the back of the enclosure for fixing to metal parts (e.g. switchboard cabinet)**
4. **3 sockets for system coupling**
5. **Socket for PE connection**

**Operating elements EDS195P**

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**
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**LED indicators:**
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- Indication of the positive clock pulse of the locating current
- Indication of the negative clock pulse of the locating current

---

**Parameter changes, scroll**
- **Arrow up button:** Parameter changes, scroll
- **Arrow down button:** Parameter changes, scroll

**Illumination button:** To switch on the display lighting
Equipment for insulation fault location EDS3096PG in de-energised systems (IT systems) (Note: TN-S system with all poles disconnected)

Residual current measurement with EDS309… in earthed systems (TN-S systems)

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

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>
<thead>
<tr>
<th>Type of distribution system</th>
<th>AC, DC, AC/DC (mixed systems)</th>
<th>AC, DC, AC/DC (mixed systems)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application range</td>
<td>Main circuits</td>
<td>Control circuits</td>
</tr>
</tbody>
</table>

#### Insulation monitoring device ISOMETER® / Locating current injector PGH

<table>
<thead>
<tr>
<th></th>
<th>AC, AC 20…575 V, DC 20…504 V</th>
<th>AC, AC 20…150 V, DC 20…150 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal system voltage $U_{n}$ (B1)</td>
<td>3AC, AC 340…760 V, DC 340…575 V</td>
<td>IRDH575B1-4227</td>
</tr>
<tr>
<td>Nominal system voltage $U_{n}$ (B2)</td>
<td>3AC, AC 19.2…72 V</td>
<td>IRDH575B1-415</td>
</tr>
<tr>
<td>Locating current $I_L$</td>
<td>10/25/50 mA</td>
<td>1/2.5 mA</td>
</tr>
<tr>
<td>Response values</td>
<td>1 kΩ…10 MC²</td>
<td>1 kΩ…10 MC²</td>
</tr>
<tr>
<td>LC display</td>
<td>4 x 20 characters</td>
<td>4 x 20 characters</td>
</tr>
<tr>
<td>Alarm relay</td>
<td>3 changeover contacts</td>
<td>3 changeover contacts</td>
</tr>
<tr>
<td>Interface/protocol</td>
<td>RS-485 (BMS)</td>
<td>RS-485 (BMS)</td>
</tr>
<tr>
<td>Address range</td>
<td>1…30</td>
<td>1…30</td>
</tr>
</tbody>
</table>

#### Insulation fault locator

<table>
<thead>
<tr>
<th></th>
<th>EDS195P</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC display</td>
<td>3 x 16 characters</td>
</tr>
<tr>
<td>Evaluating current $I_{DL}$</td>
<td>0.2…50 mA</td>
</tr>
<tr>
<td>Response value</td>
<td>0.2…1/2…10 mA selectable</td>
</tr>
</tbody>
</table>

#### Measuring clamps

<table>
<thead>
<tr>
<th>Type</th>
<th>PSA3020</th>
<th>PSA3052</th>
<th>PSA3165 (optional)</th>
<th>PSA3320</th>
<th>PSA3352</th>
</tr>
</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>
<td>✔</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

#### Complete systems

<table>
<thead>
<tr>
<th>Type</th>
<th>EDS3090</th>
<th>EDS3091</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprising</td>
<td>Aluminium case, EDS195P, PSA3020, PSA3052, power supply unit</td>
<td>Aluminium case, EDS195P, PSA3020, PSA3052, power supply unit</td>
</tr>
</tbody>
</table>
Device selection for IT systems without a permanently installed equipment for insulation fault location

<table>
<thead>
<tr>
<th>Application</th>
<th>Main circuit</th>
<th>Control circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>energised</td>
<td>offline</td>
</tr>
<tr>
<td></td>
<td></td>
<td>energised</td>
</tr>
</tbody>
</table>

Locating current injector PGH

<table>
<thead>
<tr>
<th>Nominal system voltage $U_n$</th>
<th>3AC, AC 20…575 V DC 20…504 V</th>
<th>3AC, AC 0…575 V DC 0…504 V</th>
<th>AC 20…265 V, DC 20…308 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>$U_n$ AC 230 V</td>
<td>PGH185</td>
<td>PGH186</td>
<td>PGH183</td>
</tr>
<tr>
<td>$U_n$ AC 90…132 V</td>
<td>PGH185-13</td>
<td>PGH186-13</td>
<td>PGH183-13</td>
</tr>
<tr>
<td>Locating current $I_L$ max.</td>
<td>10/25 mA</td>
<td>10/25 mA</td>
<td>1/2.5 mA</td>
</tr>
</tbody>
</table>

Insulation fault locator

<table>
<thead>
<tr>
<th>Type</th>
<th>EDS195P</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC display</td>
<td>3 x 16 characters</td>
</tr>
<tr>
<td>Evaluating current $I_L$</td>
<td>0.2…50 mA</td>
</tr>
<tr>
<td>Response value</td>
<td>0.2…1/2…10 mA selectable</td>
</tr>
</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, 3N(1AC)</td>
<td>DC</td>
<td></td>
</tr>
<tr>
<td>500…790 V</td>
<td>400…960 V</td>
<td>AGE185</td>
</tr>
</tbody>
</table>

Wiring diagram

Locating current injector PGH185 and coupling device AGE185
### Device overview Universal Devices for Power Quality and Energy Measurement PEM

<table>
<thead>
<tr>
<th>Parameters</th>
<th>LINETRAXX PEM330</th>
<th>LINETRAXX PEM333</th>
<th>LINETRAXX PEM533</th>
<th>LINETRAXX PEM555</th>
<th>LINETRAXX PEM575</th>
<th>LINETRAXX PEM735</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase voltages/line voltages</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Phase currents</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Neutral current Iₐ</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Neutral current Iₐ (calculated)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Frequency/phase angle</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Reactive and active power import/reactive and active power export</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Voltage unbalance/current unbalance</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Power</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Displacement factor cos(φ)/power factor λ</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Total harmonic distortion (THDᵰ/THDI)</td>
<td>up to the 15ᵗʰ</td>
<td>up to the 15ᵗʰ</td>
<td>up to the 3₁ᵗʰ</td>
<td>up to the 3₁ᵗʰ</td>
<td>up to the 6₃ʳᵈ</td>
<td>up to the 6₃ʳᵈ</td>
</tr>
<tr>
<td>Harmonic components voltage</td>
<td>up to the 3₁ᵗʰ</td>
<td>up to the 3₁ᵗʰ</td>
<td>up to the 6₃ʳᵈ</td>
<td>up to the 6₃ʳᵈ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harmonic components current</td>
<td>up to the 3₁ᵗʰ</td>
<td>up to the 3₁ᵗʰ</td>
<td>up to the 6₃ʳᵈ</td>
<td>up to the 6₃ʳᵈ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transient detection</td>
<td>longer than 80 µs</td>
<td>longer than 80 µs</td>
<td>longer than 40 µs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overvoltage (swell)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undervoltage (sag)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flicker severity Pₛₚ</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital inputs</td>
<td>2</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Digital outputs</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Relay outputs (RO)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Voltage supply</td>
<td>95 … 260 V AC (47 … 440 Hz)/DC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sampling rate</td>
<td>1.6 kHz</td>
<td>1.6 kHz</td>
<td>3.2 kHz</td>
<td>6.4 kHz</td>
<td>12.8 kHz</td>
<td>25.6 kHz</td>
</tr>
<tr>
<td>Temperature</td>
<td>-25 … +55 °C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td>Modbus RTU</td>
<td>Modbus RTU</td>
<td>Modbus RTU &amp; TCP</td>
<td>Modbus RTU &amp; TCP</td>
<td>Modbus RTU &amp; TCP</td>
<td></td>
</tr>
</tbody>
</table>

All PEM measuring devices can be operated with standard measuring current transformers (1 A or 5 A). It should be ensured that the measuring device and the measuring transformers used at least comply with accuracy class 0.5 S or higher. Bender provides a selection of measuring current transformers, from the manufacturer MBS AG (catalogue pages 190 to 193), that are suitable for the operation of Power Quality and Energy Measurement devices.
Example of system design

NSHV = Low-voltage main distribution board
Power Quality and Energy Measurement PEM330/PEM333

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 °
  – 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 (φ)
  – Power factor λ
  – 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 $I$
  – Demands of energy and current for particular time frames
  – Peak demands with timestamps

Version PEM333

• Programmable setpoint monitoring
• 2 digital outputs

Version PEM333-P

• Modbus RTU communication via RS-485
• 2 pulse outputs (kWh/kvarh)

Standards

The universal measuring device for Power Quality and Energy Measurement PEM330/PEM333 was developed in accordance with the following standards: DIN EN 62053-22 (VDE 0418 Part 3-22), DIN EN 61557-12 (VDE 0413-12)

Further information

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

Ordering information

<table>
<thead>
<tr>
<th>Interface</th>
<th>Digital inputs/outputs</th>
<th>Current input</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>–</td>
<td>–</td>
<td>5 A</td>
<td>PEM330</td>
<td>B 9310 0330</td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>1 A</td>
<td>PEM330-251</td>
<td>B 9310 0331</td>
</tr>
<tr>
<td>RS-485</td>
<td>2/2</td>
<td>5 A</td>
<td>PEM333</td>
<td>B 9310 0333</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 A</td>
<td>PEM333-251</td>
<td>B 9310 0334</td>
</tr>
<tr>
<td></td>
<td>2 pulse (kWh/kvarh)</td>
<td>5 A</td>
<td>PEM333-255P</td>
<td>B 9310 0335</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 A</td>
<td>PEM333-251P</td>
<td>B 9310 0336</td>
</tr>
</tbody>
</table>
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 $U_s$: 95...250 V
- Frequency range of $U_s$: DC, 44...440 Hz
- Power consumption: $\leq 3$ VA

Measuring current inputs
- Measuring voltage inputs: $U_{L1-N}, U_{L2-N}, U_{L3-N}$: 230 V
  $U_{L1-L2}, U_{L2-L3}, U_{L3-L1}$: 400 V
- Measuring range: 10...120 % $U_n$
- Rated frequency: 45...65 Hz
- Internal resistance (L-N): $> 500$ kΩ

Measuring current transformer ratio:
- PEM330/PEM333: 1...6000
- PEM333...P: 1...30000

Accuracy class according to 5 A measuring current transformer:
- PEM330/PEM333: 0.5
- PEM333...P: 0.5

Accuracy class according to 1 A measuring current transformer:
- PEM330-251/PEM333-251/PEM333-251P: 1

Accuracy (of measured value/of full scale value)
- Phase voltage $U_{L1-N}, U_{L2-N}, U_{L3-N}$: $\pm 0.2$ % of measured value
- Current: $\pm 0.2$ % of measured value +0.05 % of full scale value
- Neutral current $I_n$: 1 % of full scale value
- Frequency: $\leq 0.02$ Hz
- Phase position: $\pm 1^\circ$

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
- PEM333...

Interface/protocol: RS-485/Modbus RTU
- Cable length: 0...1200 m

Shielded cable (shield connected to terminal SH on one side) recommended: J-Y(St)Y min. 2x0.8

Switching elements

Outputs
- 2 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
- 6 A

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

Inputs
- 2 electrically separated digital inputs
- $I_{min}$: 2.4 mA
- $I_{max}$: DC 24 V

Environment/EMC

DIN EN 61326-1
- Operating temperature: -25...+55 °C
- Classification of climatic conditions acc. to DIN EN 60721
  - Stationary use: 3K5
- Classification of mechanical conditions acc. to DIN EN 60721
  - Stationary use: 3K4
- Height to 4000 m

Connection

Connection screw-type terminals

Other

Degree of protection, installation: IP20

Degree of protection, front: IP52

Documentation number: D00004

Weight: $\leq 550$ g

Warning!

This is a class A Product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.
Displays and controls

1 Pulse LED: kWh
2 Pulse LED: kvarh
3 Display
4 “SYSTEM” button: Selection (in the menu)
5 “PHASE” button: Up (in the menu)
6 “ENERGY” button: Down (in the menu)
7 “SETUP” button: OK (in the menu)

Press the “SETUP” button > 1.5 s to enter/leave the Setup menu.

Wiring diagram PEM330

1 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.
2 Measuring voltage inputs: The measuring leads should be protected by appropriate fuses.
3 Connection to the system to be monitored
1 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.

2 Measuring voltage inputs: The measuring leads should be protected by appropriate fuses.

3 Connection to the system to be monitored

4 Connection RS-485 bus

5 Digital inputs

6 Digital outputs (N/O contacts)

---

1 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.

2 Measuring voltage inputs: The measuring leads should be protected by appropriate fuses.

3 Connection to the system to be monitored

4 Connection RS-485 bus

5 Digital inputs

6 Pulse outputs for kWh and kvarh
Connection diagram voltage inputs

Three-phase 4-wire system (TN, TT, IT systems)
The PEM can be used in three-phase 4-wire systems, independent of the type of distribution system (TN, TT, IT system).

Three-phase 3-wire system
The PEM can be used in three-phase 3-wire systems. The line-to-line voltage must not exceed AC 400 V.

Connection via voltage transformers
The coupling via measuring voltage transformers allows the use of a measuring device in medium and high voltage systems. The transformation ratio in PEM330/PEM333 can be adjusted (1…2200).
### One-phase 2-wire system
The PEM can be used in one-phase 2-wire systems. The line-to-line voltage must not exceed AC 230 V.

### Connection diagram voltage inputs

- **L1**
- **L2**
- **N**
- **PEM**
- **AC 230 V**

### One-phase 3-wire system
The PEM can be used in one-phase 3-wire systems.
Power Quality and Energy Measurement PEM533

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-to-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 °
  - Power per phase conductor $S$ 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 %
  - Total harmonic distortion (THD) for $U$ and $I$
  - k-Factor for $I$
- Programmable setpoint monitoring
- LED pulse outputs for active and reactive energy
- Modbus RTU communication via RS-485
- 2 digital outputs
- Demands of energy and current for particular time frames
- Peak demands with timestamps
- Individual current/voltage harmonics up to the 31st harmonic
- Minimum and maximum values

Standards

The universal measuring device for Power Quality and Energy Measurement PEM533 was developed in accordance with the following standards: DIN EN 62053-22 (VDE 0418 Part 3-22), DIN EN 61557-12 (VDE 0413-12)

Further information

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

Typical applications

- As a compact device for front panel mounting, the PEM533 is a replacement for analogue indicating instruments
- Typical application in low and medium-voltage networks (via measuring voltage transformer)
- Power quality monitoring
- Collection of relevant data for energy management systems
- Cost allocation of energy consumption

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Interface</th>
<th>Nominal system voltage</th>
<th>Current input</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-485</td>
<td>230/400 V</td>
<td>5 A</td>
<td>PEM533</td>
<td>B 9310 0533</td>
</tr>
<tr>
<td></td>
<td>1 A</td>
<td>PEM533-251</td>
<td>B 9310 0534</td>
<td></td>
</tr>
<tr>
<td></td>
<td>400/600 V</td>
<td>5 A</td>
<td>PEM533-455</td>
<td>B 9310 0535</td>
</tr>
<tr>
<td></td>
<td>1 A</td>
<td>PEM533-451</td>
<td>B 9310 0536</td>
<td></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: 300 V
- Overvoltage category: II
- Pollution degree: 2

### Measuring circuit

#### Measuring voltage inputs

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>U_{L1-N,L2-N,L3-N}</td>
<td>230 V, 400 V (only -451, -455), 690 V (only -451, -455)</td>
</tr>
<tr>
<td>U_{L1-L2,L2-L3,L3-L1}</td>
<td>400 V, 690 V (only -451, -455)</td>
</tr>
</tbody>
</table>

#### Measuring current inputs

- **External measuring current transformer**
  - Should at least comply with accuracy class 0.5 S

### Measuring range

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power consumption</td>
<td>≤ 5 VA</td>
</tr>
<tr>
<td>Measuring range</td>
<td>10...120 % U_n</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>45...65 Hz</td>
</tr>
<tr>
<td>Internal resistance (L-N)</td>
<td>&gt; 500 kΩ</td>
</tr>
</tbody>
</table>

### Measuring accuracies (of measured value/of full scale value)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase voltage</td>
<td>±0.2 % of measured value</td>
</tr>
<tr>
<td>Current</td>
<td>±0.2 % of measured value +0.05 % of full scale value</td>
</tr>
<tr>
<td>Neutral current</td>
<td>1 % of full scale value</td>
</tr>
<tr>
<td>Frequency</td>
<td>±0.02 Hz</td>
</tr>
<tr>
<td>Phase position</td>
<td>±1 °</td>
</tr>
</tbody>
</table>

### 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: J-Y[55]Y min. 2x0.8

### Switching elements

<table>
<thead>
<tr>
<th>Outputs</th>
<th>2 N/O contacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating principle</td>
<td>N/O operation</td>
</tr>
<tr>
<td>Rated operational voltage</td>
<td>AC 230 V, DC 24 V, AC 240 V, DC 12 V</td>
</tr>
<tr>
<td>Rated operational current</td>
<td>5 A, 5 A, 6 A, 5 A</td>
</tr>
<tr>
<td>Minimum contact rating</td>
<td>1 mA at AC/DC ≥ 10 V</td>
</tr>
</tbody>
</table>

### Environment/EMC

- **EMC**
  - DIN EN 61326-1
- **Operating temperature**
  - -25...+55 °C
- **Classification of climatic conditions acc. to DIN EN 60721**
  - 3K5
- **Classification of mechanical conditions acc. to DIN EN 60721**
  - 3M4
- **Stationary use**
  - to 4000 m

### Connection

- **Connection**
  - Screw-type terminals

### Other

- **Degree of protection, installation**
  - IP20
- **Degree of protection, front**
  - IP52
- **Documentation number**
  - D00013
- **Weight**
  - ≤ 1100 g

---

**Dimension diagram** (dimensions in mm)

**Panel cut-out** (dimensions in mm)
Displays and controls

1. Pulse LED: kWh
2. Pulse LED: kvarh
3. Display
4. “V/I” button: Selection (in the menu)
5. “POWER” button: Up (in the menu)
6. “HARMONICS” button: Down (in the menu)
7. “ENERGY” button: OK (in the menu)

Press the “ENERGY” button > 1.5 s to enter/leave the Setup menu.

Wiring diagram

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
Three-phase 4-wire system (TN, TT, IT systems)
The PEM can be used in three-phase 4-wire systems, independent of the type of distribution system (TN, TT, IT system).

Three-phase 3-wire system
The PEM can be used in three-phase 3-wire systems.

Connection via voltage transformers
The coupling via measuring voltage transformers allows the use of a measuring device in medium and high voltage systems. The transformation ratio in PEM533 can be adjusted (1...2200).
Power Quality and Energy Measurement PEM555

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 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 ($\phi$)
  - 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 31st harmonic
- Minimum and maximum values
- Waveform recording (6.4 kHz)
- Data recorder
- High-resolution waveform recording
- Detection of transient events

Standards

The universal measuring device for Power Quality and Energy Measurement PEM555 was developed in accordance with the following standards: DIN EN 62053-22 (VDE 0418 Part 3-22), DIN EN 61557-12 (VDE 0413-12)

Further information

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

<table>
<thead>
<tr>
<th>Interface</th>
<th>Nominal system voltage</th>
<th>Current input</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3(N)AC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS-485/Ethernet</td>
<td>230/400 V</td>
<td>5 A</td>
<td>PEM555</td>
<td>B 9310 0555</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 A</td>
<td>PEM555-251</td>
<td>B 9310 0556</td>
</tr>
<tr>
<td></td>
<td>400/690 V</td>
<td>5 A</td>
<td>PEM555-455</td>
<td>B 9310 0557</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 A</td>
<td>PEM555-451</td>
<td>B 9310 0558</td>
</tr>
<tr>
<td></td>
<td>69/120 V</td>
<td>1 A</td>
<td>PEM555-151</td>
<td>B 9310 0559</td>
</tr>
</tbody>
</table>

Typical applications

- As a compact device for front panel mounting, the PEM575 is a replacement for analogue indicating instruments
- Typical application in low and medium-voltage networks (via measuring voltage transformer)
- Power quality monitoring
- Collection of relevant data for energy management
- Cost allocation of energy consumption
- High-resolution waveform recording allows analysis of power quality phenomena

Approvals

For further information refer to our product range on www.bender.de.
### 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: Uₜ
- Frequency range of Uₜ: DC, 44…440 Hz
- Power consumption: ≤ 11 VA
- Measuring inputs
  - Measuring voltage inputs: Uₘ₃, Uₘ₄, Uₘ₅, Uₘ₆
  - Measuring range: 230 V, 400 V (only -451, -455)
  - Overvoltage category: III
- Measuring range
  - Uₘ₃, Uₘ₄: 10…120 % Uₜ
  - Uₘ₅, Uₘ₆: > 500 kΩ
- Measuring current inputs
  - Measuring range: 0.1…120 % Iₜ
  - Measuring current transformer ratio: 1…6000
- Accuracy class according with 5 A measuring current transformer: 0.5
- Accuracy class according with 1 A measuring current transformer: 1

#### 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 5H on one side) recommended: J-Y(S)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
- Rated operational current: 5 A, 6 A, 5 A
- Minimum contact rating: 1 mA at AC/DC ≥ 10 V
- Inputs: 6 electrically separated digital inputs
-謇: 2.4 mA

#### Environment/EMC
- EMC: DIN EN 61326-1
- Operating temperature: -25…+55 °C
- Classification of climatic conditions acc. to DIN EN 60721
  - Stationary use: 3K5
- Classification of mechanical conditions acc. to DIN EN 60721
  - Stationary use: 3M4
- Height: to 4000 m

#### Connection
- Connection: screw-type terminals

#### Other
- Degree of protection, installation: IP20
- Degree of protection, front: IP52
- Documentation number: D00016
- Weight: ≤ 1100 g

#### 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 5H on one side) recommended: J-Y(S)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
- Rated operational current: 5 A, 6 A, 5 A
- Minimum contact rating: 1 mA at AC/DC ≥ 10 V
- Inputs: 6 electrically separated digital inputs
-謇: 2.4 mA

#### Environment/EMC
- EMC: DIN EN 61326-1
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- Classification of mechanical conditions acc. to DIN EN 60721
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- Height: to 4000 m

#### Connection
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#### Other
- Degree of protection, installation: IP20
- Degree of protection, front: IP52
- Documentation number: D00016
- Weight: ≤ 1100 g

### Dimension diagram (dimensions in mm)

![Dimension diagram](image)

### Panel cut-out (dimensions in mm)

![Panel cut-out](image)
**Displays and controls**

1. Pulse LED: kWh
2. Pulse LED: kvarh
3. Display
4. “V/I” button: Selection (in the menu)
5. “POWER” button: Up (in the menu)
6. “HARMONICS” button: Down (in the menu)
7. “ENERGY” button: OK (in the menu)

Press the “ENERGY” button > 1.5 s to enter/leave the Setup menu.

**Wiring diagram**

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
Three-phase 4-wire system (TN, TT, IT systems)
The PEM can be used in three-phase 4-wire systems, independent of the type of distribution system (TN, TT, IT system).

Three-phase 3-wire system
The PEM can be used in three-phase 3-wire systems.

Connection via voltage transformers
The coupling via measuring voltage transformers allows the use of a measuring device in medium and high voltage systems. The transformation ratio in PEM555 can be adjusted (1…10000).
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) $I_o$ 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 (φ)
  – Power factor λ
  – 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

Typical applications

• As a compact device for front panel mounting, the PEM575 is a replacement for analogue indicating instruments
• Typical application in low and medium-voltage networks (via measuring voltage transformer)
• Power quality monitoring
• Collection of relevant data for energy management
• Cost allocation of energy consumption
• High-resolution waveform recording allows analysis of power quality phenomena

Approvals

Standards

The universal measuring device for Power Quality and Energy Measurement PEM575 was developed in accordance with the following standards: DIN EN 62053-22 (VDE 0418 Part 3-22), DIN EN 61557-12 (VDE 0413-12)

Further information

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

Ordering information

<table>
<thead>
<tr>
<th>Interface</th>
<th>Nominal system voltage</th>
<th>Current input</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-485/Ethernet</td>
<td>400/230 V</td>
<td>5 A</td>
<td>PEM575</td>
<td>B 9310 0575</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 A</td>
<td>PEM575-251</td>
<td>B 9310 0576</td>
</tr>
<tr>
<td></td>
<td>690/400 V</td>
<td>5 A</td>
<td>PEM575-455</td>
<td>B 9310 0577</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 A</td>
<td>PEM575-451</td>
<td>B 9310 0578</td>
</tr>
<tr>
<td></td>
<td>69/120 V</td>
<td>5 A</td>
<td>PEM575-155</td>
<td>B 9310 0579</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 A</td>
<td>PEM575-151</td>
<td>B 9310 0580</td>
</tr>
</tbody>
</table>
### Technical data

#### Insulation coordination

<table>
<thead>
<tr>
<th>Circuit</th>
<th>Rated insulation voltage</th>
<th>Overvoltage category</th>
<th>Pollution degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring circuit</td>
<td>300 V</td>
<td>III</td>
<td>2</td>
</tr>
<tr>
<td>Supply circuit</td>
<td>300 V</td>
<td>II</td>
<td>2</td>
</tr>
</tbody>
</table>

#### Supply voltage

<table>
<thead>
<tr>
<th>Voltage level</th>
<th>Measuring circuit</th>
<th>Supply circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 95–415 V</td>
<td>230 V</td>
<td>300 V</td>
</tr>
</tbody>
</table>

#### Measuring circuit

<table>
<thead>
<tr>
<th>Input Voltage</th>
<th>Measuring voltage inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>U_L1-N</td>
<td>230 V</td>
</tr>
<tr>
<td>U_L1-L2</td>
<td>400 V (only -451, -455)</td>
</tr>
<tr>
<td>U_L2-L3</td>
<td>690 V (only -451, -455)</td>
</tr>
<tr>
<td>U_L3-N</td>
<td>120 V (only -451, -455)</td>
</tr>
</tbody>
</table>

#### Environment/EMC

<table>
<thead>
<tr>
<th>Standard</th>
<th>Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC</td>
<td>DIN EN 61326-1</td>
</tr>
</tbody>
</table>

#### Connection

<table>
<thead>
<tr>
<th>Input/Output</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface/protocol</td>
<td>RS-485, Modbus RTU</td>
</tr>
<tr>
<td>Baud rate</td>
<td>1.2...19.2 kbits/s</td>
</tr>
<tr>
<td>Cable length</td>
<td>0...1200 m</td>
</tr>
<tr>
<td>Shielded cable</td>
<td>recommended: J-Y(St)Y min. 2x0.8</td>
</tr>
<tr>
<td>Interface/protocol</td>
<td>Ethernet, Modbus TCP</td>
</tr>
<tr>
<td>Baud rate</td>
<td>100 Mb/s</td>
</tr>
</tbody>
</table>

#### Switching elements

<table>
<thead>
<tr>
<th>Output</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 N/O contacts</td>
<td>N/O operation</td>
</tr>
<tr>
<td>Rated operational voltage</td>
<td>AC 230 V, DC 24 V</td>
</tr>
<tr>
<td>Rated operational current</td>
<td>5 A, 6 A, 5 A</td>
</tr>
<tr>
<td>Minimum contact rating</td>
<td>1 mA at AC/DC ≥ 10 V</td>
</tr>
<tr>
<td>Inputs</td>
<td>6 electrically separated digital inputs</td>
</tr>
</tbody>
</table>

#### Interface

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#### Switching elements

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<th>Description</th>
</tr>
</thead>
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<td>3 N/O contacts</td>
<td>N/O operation</td>
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<td>Rated operational voltage</td>
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<tr>
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<tr>
<td>Inputs</td>
<td>6 electrically separated digital inputs</td>
</tr>
</tbody>
</table>

#### Technical data

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring voltage</td>
<td>230 V</td>
</tr>
<tr>
<td>Measuring current</td>
<td>5 A</td>
</tr>
<tr>
<td>Accuracy class according with 5 A measuring current transformer</td>
<td>0.2</td>
</tr>
<tr>
<td>Accuracy class according with 1 A measuring current transformer</td>
<td>0.5</td>
</tr>
<tr>
<td>Measuring range</td>
<td>0.1...120%</td>
</tr>
<tr>
<td>Measuring current transformer ratio</td>
<td>1...6000</td>
</tr>
<tr>
<td>Accuracy class according with 1 A measuring current transformer</td>
<td>0.2</td>
</tr>
<tr>
<td>准确 (of measured value/full scale value)</td>
<td>±0.2 % of measured value, ±0.05 % of full scale value</td>
</tr>
<tr>
<td>Neutral current I4</td>
<td>0.5 % of full scale value</td>
</tr>
<tr>
<td>Frequency</td>
<td>±0.01 Hz</td>
</tr>
<tr>
<td>Phase position</td>
<td>±1 °</td>
</tr>
</tbody>
</table>

#### Interface

<table>
<thead>
<tr>
<th>Input/Output</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface/protocol</td>
<td>RS-485, Modbus RTU</td>
</tr>
<tr>
<td>Baud rate</td>
<td>1.2...19.2 kbits/s</td>
</tr>
<tr>
<td>Cable length</td>
<td>0...1200 m</td>
</tr>
<tr>
<td>Shielded cable</td>
<td>recommended: J-Y(St)Y min. 2x0.8</td>
</tr>
<tr>
<td>Interface/protocol</td>
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</tr>
<tr>
<td>Baud rate</td>
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#### Switching elements

<table>
<thead>
<tr>
<th>Output</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 N/O contacts</td>
<td>N/O operation</td>
</tr>
<tr>
<td>Rated operational voltage</td>
<td>AC 230 V, DC 24 V</td>
</tr>
<tr>
<td>Rated operational current</td>
<td>5 A, 6 A, 5 A</td>
</tr>
<tr>
<td>Minimum contact rating</td>
<td>1 mA at AC/DC ≥ 10 V</td>
</tr>
<tr>
<td>Inputs</td>
<td>6 electrically separated digital inputs</td>
</tr>
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</table>

#### Interface

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#### Technical data

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring voltage</td>
<td>230 V</td>
</tr>
<tr>
<td>Measuring current</td>
<td>5 A</td>
</tr>
<tr>
<td>Accuracy class according with 5 A measuring current transformer</td>
<td>0.2</td>
</tr>
<tr>
<td>Accuracy class according with 1 A measuring current transformer</td>
<td>0.5</td>
</tr>
<tr>
<td>Measuring range</td>
<td>0.1...120%</td>
</tr>
<tr>
<td>Measuring current transformer ratio</td>
<td>1...6000</td>
</tr>
<tr>
<td>Accuracy class according with 1 A measuring current transformer</td>
<td>0.2</td>
</tr>
<tr>
<td>准确 (of measured value/full scale value)</td>
<td>±0.2 % of measured value, ±0.05 % of full scale value</td>
</tr>
<tr>
<td>Neutral current I4</td>
<td>0.5 % of full scale value</td>
</tr>
<tr>
<td>Frequency</td>
<td>±0.01 Hz</td>
</tr>
<tr>
<td>Phase position</td>
<td>±1 °</td>
</tr>
</tbody>
</table>

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<td>Ethernet, Modbus TCP</td>
</tr>
<tr>
<td>Baud rate</td>
<td>100 Mb/s</td>
</tr>
</tbody>
</table>
### Displays and controls

1. Pulse LED: kWh
2. Pulse LED: kvarh
3. Display
4. “V/I” button: Selection (in the menu)
5. “POWER” button: Up (in the menu)
6. “HARMONICS” button: Down (in the menu)
7. “ENERGY” button: OK (in the menu)

Press the “ENERGY” button > 1.5 s to enter/leave the Setup menu.

### Wiring diagram

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
Three-phase 4-wire system (TN, TT, IT systems)
The PEM can be used in three-phase 4-wire systems, independent of the type of distribution system (TN, TT, IT system).

Three-phase 3-wire system
The PEM can be used in three-phase 3-wire systems.

Connection via voltage transformers
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).
Device features

- Power analyser of Class A, certified according to DIN EN 61000-4-30
- Monitoring the voltage quality in accordance with DIN EN 50160
- Accuracy class in accordance with IEC 62053-22: 0.2 S
- TFT colour display (640x480) 5.7”
- Modbus RTU and Modbus TCP
- 4 current inputs
- 5 voltage inputs
- 1 GB internal memory
- Panel mounting 144x144
- Integrated web server
- Data export via FTP: comtrade, PQDIF
- Flicker measurement
- Detection and recording of transients (40 us)
- Sampling rate: 512 samples/cycle
- Freely configurable recorders for waveform, consumption and long-term recording

Typical applications

- Continuous monitoring of the voltage quality in accordance with DIN EN 50160
- Collection of relevant data for energy management systems
- High-resolution waveform recording allow analysis of power quality phenomena

Standards

The universal measuring device for Power Quality and Energy Measurement/PEM735 was developed in accordance with the following standards: IEC 62053-22(VDE 0418 Part 3-22), DIN EN 61557-12 (VDE 0413-12), DIN EN 50160, DIN EN 61000-4-30 (VDE 0847-4-30), DIN EN 61000-4-7 (VDE 0847-4-7), DIN EN 61000-4-15 (VDE 0847-4-15)

Further information

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

Ordering information

<table>
<thead>
<tr>
<th>Nominal system voltage</th>
<th>Current input</th>
<th>Type</th>
<th>Art. No.</th>
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</thead>
<tbody>
<tr>
<td>3(N)AC 100…690 V</td>
<td>5 A</td>
<td>PEM735</td>
<td>B 9310 0735</td>
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</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring current transformers</td>
<td>CTB41</td>
<td>190</td>
</tr>
<tr>
<td></td>
<td>CTB51</td>
<td>191</td>
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<tr>
<td></td>
<td>KBR18</td>
<td>192</td>
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<tr>
<td></td>
<td>KBR32</td>
<td>193</td>
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</table>
### Technical data

#### Insulation coordination

<table>
<thead>
<tr>
<th>Measurement circuit</th>
<th>Voltage</th>
<th>Overvoltage category</th>
<th>Pollution degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage</td>
<td>600 V</td>
<td>III</td>
<td>2</td>
</tr>
<tr>
<td>Supply circuit</td>
<td>Voltage</td>
<td>Overvoltage category</td>
<td>Pollution degree</td>
</tr>
<tr>
<td>Rated insulation voltage</td>
<td>300 V</td>
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<td>2</td>
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</table>

#### Supply voltage

<table>
<thead>
<tr>
<th>Supply circuit</th>
<th>Voltage</th>
<th>Overvoltage category</th>
<th>Pollution degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated supply voltage U_M</td>
<td>95…250 V</td>
<td>II</td>
<td>2</td>
</tr>
<tr>
<td>Frequency range of U_M</td>
<td>DC, 44…440 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>≤ 14 VA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Measuring circuit

<table>
<thead>
<tr>
<th>Measuring circuit</th>
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<th>Overvoltage category</th>
<th>Pollution degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage</td>
<td>400 V</td>
<td>III</td>
<td>2</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>690 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measuring range</td>
<td>10…120 % U_M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CT transformation ratio</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>1…1,000,000 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary</td>
<td>100…690 V U_L (1…3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal resistance (I-L-N)</td>
<td>&gt; 6 MΩ</td>
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</tbody>
</table>

#### Measuring voltage inputs

<table>
<thead>
<tr>
<th>CT1, CT2, CT3, CT4, CT5</th>
<th>U_L1-N, U_L2-N, U_L3-N</th>
<th>400 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT1, CT2, CT3, CT4, CT5, CT6</td>
<td>U_L1-L2, U_L2-L3, U_L3-L1</td>
<td>690 V</td>
</tr>
</tbody>
</table>

#### Measuring current inputs

<table>
<thead>
<tr>
<th>Measuring current transformer</th>
<th>Measuring range</th>
<th>CT transformation ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>External measuring current transformer</td>
<td>0.1…120 % I_N</td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>1…5 A</td>
<td></td>
</tr>
<tr>
<td>Secondary</td>
<td>1…30000 A</td>
<td></td>
</tr>
</tbody>
</table>

#### Measuring range

| Phase voltage | 10…120 % U_M |
| Neutral current | 0.5 % v. s. |
| Frequency | ±0.005 Hz |
| Phase position | ±1° |

#### Accuracies (of measured value/full scale value)

| Active energy measurement acc. to DIN EN 62053-22 (VDE 0418 Part 3-22) |
| RMS voltage measurements acc. to DIN EN 61557-12 (VDE 0413-12), chapter 4.7.6 |
| RMS, phase current measurements acc. to DIN EN 61557-12 (VDE 0413-12), chapter 4.7.5 |
| Frequency measurements acc. to DIN EN 61557-12 (VDE 0413-12), chapter 4.7.4 |
| Measurement of the harmonics acc. to DIN EN 61000-4-7 class A |

#### Interface

| Interface/protocol | 2 x RS-485, Modbus RTU |
| Baud rate | 1.2…19.2 kbits/s |
| Cable length | 0…1200 m |
| Shielded cable | recommended: J-Y(St)Y min. 2x0.8 |
| Interface | Ethernet |
| Protocol | Modbus TCP |
| Baud rate | 100 MBits/s |

#### Switching elements

| Outputs (DO) |
| Inputs |
| Rated operational voltage |
| DC 12 V |
| AC 230 V |
| AC 110 V |
| Rated operational current |
| 5 A |
| 5 A |
| 6 A |
| Minimum contact rating | 1 mA at AC/DC ≥ 10 V |

| Operating temperature |
| Classification of climatic conditions acc. to DIN EN 60721 |
| Stationary use |
| Classification of mechanical conditions acc. to IEC 60721 |
| Stationary use |
| Height |
| to 4000 m |

#### Environment/EMC

| EMC |
| Operating temperature |
| -25…+55 °C |
| Classification of climatic conditions acc. to DIN EN 60721 |
| Stationary use |
| Classification of mechanical conditions acc. to IEC 60721 |
| Stationary use |
| Height |
| to 4000 m |

#### Connection

| Connection |
| Screw-type terminals |

#### Other

| Degree of protection, installation |
| Degree of protection, front |
| Degree of protection, installation |
| Degree of protection, front |
| Document number |
| D00084 |
| Weight |
| ≤ 2000 g |

### Dimension diagram (dimensions in mm)

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<thead>
<tr>
<th>Dimension diagram</th>
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<tbody>
<tr>
<td>144</td>
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<tr>
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</tr>
<tr>
<td>138</td>
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### Panel cut-out (dimensions in mm)

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**Displays and controls**

1. Pulse LED: kWh
2. Pulse LED: kvarh
3. Display
4. "<" button: Selection (in the menu)
5. "A" button: Up (in the menu)
6. "\^" button: Down (in the menu)
7. ">" button: Selection (in the menu)
8. "ENTER" button: OK
9. "ESC" button:

**Wiring diagram**

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 Ethernet
8. Relay output
Three-phase 4-wire system (TN, TT, IT systems)
The PEM can be used in three-phase 4-wire systems, independent of the type of distribution system (TN, TT, IT system).

Three-phase 3-wire system
The PEM can be used in three-phase 3-wire systems.

Connection via voltage transformers
The coupling via measuring current transformers allows the use of the measuring device in medium and high voltage systems. The transformation ratio can be adjusted in the PEM735.
Power Quality and Energy Measurement
PEM735 measuring case

Device features
• Class A power analyser certified acc. to DIN EN 61000-4-30
• Voltage quality monitoring acc. to DIN EN 50160
• Accuracy class acc. to IEC 62053-22: 0.2 S
• TFT colour display (640x480) 5.7”
• Modbus TCP
• 4 current inputs
• 5 voltage inputs (3L/N/PE)
• 1 GB internal memory
• An integrated web server
• Flicker measurement
• Transient detection and recording (40 µs)
• Sampling rate: 512 samples/cycle
• Individually configurable recorder for waveforms, consumption, long-term recordings

Typical applications
• Continuous monitoring of the voltage quality in accordance with DIN EN 50160
• Collection of relevant data for energy management systems
• High-resolution waveform recording allow analysis of power quality phenomena

Standards
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<td>PEM735 measuring case</td>
<td>B 9830 0014</td>
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Scope of delivery
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<td>4 flexible current transformers for measurements up to 4000 A</td>
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<tr>
<td>1 current measuring clamp 1000 A, 5 kHz</td>
</tr>
<tr>
<td>1 current measuring clamp 350/500/1000 A, 1 kHz</td>
</tr>
<tr>
<td>incl. integrated WLAN router, a trolley, various safety test probes</td>
</tr>
</tbody>
</table>
### Technical data PEM735

#### Insulation coordination

<table>
<thead>
<tr>
<th>Measuring circuit</th>
<th>Rated insulation voltage</th>
<th>600 V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overvoltage category</td>
<td>III</td>
</tr>
<tr>
<td></td>
<td>Pollution degree</td>
<td>2</td>
</tr>
</tbody>
</table>

#### Supply circuit

<table>
<thead>
<tr>
<th>Rated insulation voltage</th>
<th>300 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overvoltage category</td>
<td>II</td>
</tr>
<tr>
<td>Pollution degree</td>
<td>2</td>
</tr>
</tbody>
</table>

#### Supply voltage

| Rated supply voltage     | 100 … 240 V |
| Frequency range of \(U_f\) | 47 … 63 Hz |

#### Measuring circuit

<table>
<thead>
<tr>
<th>Measuring voltage inputs</th>
<th>(U_{L1-N}, U_{L2-N}, U_{L3-N})</th>
<th>400 V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(U_{L1-L2}, U_{L2-L3}, U_{L3-L1})</td>
<td>690 V</td>
</tr>
<tr>
<td>Measuring range</td>
<td>10 … 120 % (U_n)</td>
<td></td>
</tr>
<tr>
<td>Measuring frequency</td>
<td>45 … 65 Hz</td>
<td></td>
</tr>
<tr>
<td>Internal resistance (L-N)</td>
<td>&gt; 6 MΩ</td>
<td></td>
</tr>
</tbody>
</table>

#### Measuring current inputs

| External measuring current transformers | should at least comply with accuracy class 0.2 S |
| Burden n.A., internal current transformers |                  |
| Measuring range                      | 0.1 … 120 \% \(I_n\)         |
| Measuring current transformer conversion ratio, secondary | 1 … 5 A |
| Measuring current transformer conversion ratio, primary | 1 … 30000 A |

#### Accuracies (\(mv = \) of measured value/\(fs = \) of full scale value)

| Phase voltage | \(U_{L1-N}, U_{L2-N}, U_{L3-N}\) | ±0.1 % \(mv\) |
| Current       | \(\pm 0.1 \% \text{ } mv + 0.05 \% \text{ } fs\) |
| Frequency     | ±0.005 Hz                        |
| Phasing       | ± 1 °                           |

#### Measurement of the active energy

acc. to DIN EN 62053-22 (VDE 0411 part 3-22)

#### Measurement of the voltage r.m.s. values

acc. to DIN EN 61557-12 (VDE 0413-12), chapter 4.7.6

#### Measurement of the phase current r.m.s. values

acc. to DIN EN 61557-12 (VDE 0413-12), chapter 4.7.4

#### Frequency measurement

acc. to DIN EN 61557-12 (VDE 0413-12), chapter 4.7.4

#### Measurement of the harmonics

acc. to DIN EN 61000-4-7 class A

#### Interface

| Interface/protocol | RJ-45, Modbus TCP |

#### Switching elements

| Outputs (RO) | 2 x 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 | 2 electrically separated digital inputs |
| Terminals | 2.4 mA |
| Alt | DC 24 V |

#### Environment/EMC

| Operating temperature | -0 … +40 °C |
| Classification of climatic conditions | acc. to DIN EN 60721 |
| Height | up to 4000 m |

#### Other

| Degree of protection | IP20 |
| Dimensions | approx. 556 x 416 x 295 mm |
| Documentation number | D00240 |
| Weight | ≤ 16 kg |
3.1 Wiring diagram of the front plate

1. Overview of the DIP switch settings for the transducers of the Rogowski coils
2. Transducers for the Rogowski coils
3. Jumper wire slots to configure the measuring current transformers in use
4. Slots for replacement jumper wires
5. Universal measuring device PEM735

3.1 Wiring panel side

1. On/off switch of the measuring case
2. Measuring voltage inputs
3. Power supply socket for measuring case
4. Ethernet connection socket
5. Measuring current transformer inputs
6. Digital inputs and relay outputs
7. Connection Rogowski coils
CTB41
Window-type current transformer

Device features
- Window-type current transformer
- Screwless-type connection technique
- Maintenance-free, gas-tight connection
- Max. operating voltage up to 1.2 kV
- Can also be used in 690 V systems
- Unbreakable plastic enclosure, self-extinguishing, UL94-V0, flame-resistant

Standards
The window-type current transformer CTB41 was designed in accordance with the following standards:
IEC 61869-1, IEC 61869-2 and IEC 61010-1.

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

Ordering information

<table>
<thead>
<tr>
<th>Primary current</th>
<th>Secondary current</th>
<th>Accuracy</th>
<th>Type</th>
<th>Design</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>S</td>
<td>1</td>
<td>WL605 KL.1</td>
<td>CTB41</td>
<td>B 9808 6001</td>
</tr>
<tr>
<td>60</td>
<td>1</td>
<td>1</td>
<td>WL60-1 KL.1</td>
<td>CTB41</td>
<td>B 9808 6002</td>
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<tr>
<td>75</td>
<td>S</td>
<td>1</td>
<td>WL755 KL.1</td>
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<td>B 9808 6003</td>
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<tr>
<td>75</td>
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<td>1</td>
<td>WL75-1 KL.1</td>
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<tr>
<td>125</td>
<td>S</td>
<td>0.5</td>
<td>WL1255 KL.0,5</td>
<td>CTB41</td>
<td>B 9808 6005</td>
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<tr>
<td>125</td>
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<td>0.5</td>
<td>WL125-1 KL.0,5</td>
<td>CTB41</td>
<td>B 9808 6006</td>
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<tr>
<td>150</td>
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<td>WL1505 KL.0,5</td>
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<tr>
<td>150</td>
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<td>B 9808 6008</td>
</tr>
<tr>
<td>150</td>
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<td>B 9808 6009</td>
</tr>
<tr>
<td>200</td>
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<tr>
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<tr>
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<td>1</td>
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<tr>
<td>250</td>
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<tr>
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<tr>
<td>250</td>
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<tr>
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<tr>
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<tr>
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<tr>
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<td>B 9808 6019</td>
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<tr>
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<td>1</td>
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<tr>
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<tr>
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<td>0.5</td>
<td>WL500-1 KL.0,5</td>
<td>CTB41</td>
<td>B 9808 6023</td>
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<tr>
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<td>B 9808 6024</td>
</tr>
<tr>
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<td>B 9808 6025</td>
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<tr>
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<td>1</td>
<td>WL500-1 KL.1</td>
<td>CTB41</td>
<td>B 9808 6026</td>
</tr>
</tbody>
</table>

Technical data
- Rated continuous thermal current \( I_{ck} \) 1.2 x \( I_N \)
- Rated short-time thermal current \( I_{th} \) 60 x \( I_N \), 1 s
- Max. operating voltage \( U_{op} \) 1.2 x \( U_{eff} \)
- Insulation test voltage 6 kV, \( U_{eff} \), 50 Hz, 1 min
- Nominal frequency 50/60 Hz
- Insulation class E
- Operating temperature -5…50 °C
- Documentation number D00231

Dimension diagram (dimensions in mm)

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
<th>Busbar 1</th>
<th>Busbar 2</th>
<th>Circular conductor</th>
<th>Overall width</th>
<th>Installation height</th>
<th>Overall depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Busbar 1</td>
<td>40 x 10</td>
<td></td>
<td></td>
<td>70</td>
<td>91</td>
<td>52</td>
</tr>
<tr>
<td>Busbar 2</td>
<td>30 x 15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Circular conductor</td>
<td>32</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall width</td>
<td></td>
<td></td>
<td></td>
<td>70</td>
<td>91</td>
<td>52</td>
</tr>
<tr>
<td>Installation height</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall depth</td>
<td></td>
<td></td>
<td></td>
<td>70</td>
<td>91</td>
<td>52</td>
</tr>
</tbody>
</table>
CTB51
Window-type current transformer

Device features
- Window-type current transformer
- Screwless-type connection technique
- Maintenance-free, gas-tight connection
- Max. operating voltage up to 1.2 kV
- Can also be used in 690 V systems
- Unbreakable plastic enclosure, self-extinguishing, UL94-V0, flame-resistant

Standards
The window-type current transformer CTB51 was designed in accordance with the following standards:
IEC 61869-1, IEC 61869-2 and IEC 61010-1.

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

Ordering information

<table>
<thead>
<tr>
<th>Primary current</th>
<th>Secondary current</th>
<th>Accuracy</th>
<th>Type</th>
<th>Design</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>600</td>
<td>5</td>
<td>1</td>
<td>WL600-5 KL.1</td>
<td>CTB51</td>
<td>B 9808 6034</td>
</tr>
<tr>
<td>600</td>
<td>5</td>
<td>0.5</td>
<td>WL600-5 KL.0,5</td>
<td>CTB51</td>
<td>B 9808 6035</td>
</tr>
<tr>
<td>600</td>
<td>1</td>
<td>1</td>
<td>WL600-1 KL.1</td>
<td>CTB51</td>
<td>B 9808 6036</td>
</tr>
<tr>
<td>600</td>
<td>0.5</td>
<td>1</td>
<td>WL600-1 KL.0,5</td>
<td>CTB51</td>
<td>B 9808 6037</td>
</tr>
<tr>
<td>800</td>
<td>5</td>
<td>1</td>
<td>WL800-5 KL.1</td>
<td>CTB51</td>
<td>B 9808 6038</td>
</tr>
<tr>
<td>800</td>
<td>5</td>
<td>0.5</td>
<td>WL800-5 KL.0,5</td>
<td>CTB51</td>
<td>B 9808 6039</td>
</tr>
<tr>
<td>800</td>
<td>1</td>
<td>1</td>
<td>WL800-1 KL.1</td>
<td>CTB51</td>
<td>B 9808 6040</td>
</tr>
<tr>
<td>800</td>
<td>0.5</td>
<td>1</td>
<td>WL800-1 KL.0,5</td>
<td>CTB51</td>
<td>B 9808 6041</td>
</tr>
<tr>
<td>1000</td>
<td>5</td>
<td>1</td>
<td>WL1000-5 KL.1</td>
<td>CTB51</td>
<td>B 9808 6042</td>
</tr>
<tr>
<td>1000</td>
<td>5</td>
<td>0.5</td>
<td>WL1000-5 KL.0,5</td>
<td>CTB51</td>
<td>B 9808 6043</td>
</tr>
<tr>
<td>1000</td>
<td>1</td>
<td>1</td>
<td>WL1000-1 KL.1</td>
<td>CTB51</td>
<td>B 9808 6044</td>
</tr>
<tr>
<td>1000</td>
<td>0.5</td>
<td>1</td>
<td>WL1000-1 KL.0,5</td>
<td>CTB51</td>
<td>B 9808 6045</td>
</tr>
</tbody>
</table>

Technical data
- Rated continuous thermal current \(I_{\text{cth}}\)
  \(1.2 \times \) \(I_N\)
- Rated short-time thermal current \(I_{\text{th}}\)
  \(60 \times \) \(I_N\), 1 s
- Max. operating voltage \(U_{\text{th}}\)
  \(1.2 \text{ kV, } U_{\text{eff}}\)
- Insulation test voltage
  \(6 \text{ kV, } U_{\text{eff}}, 50 \text{ Hz, 1 min}\)
- Nominal frequency
  \(50/60 \text{ Hz}\)
- Insulation class
  \(E\)
- Operating temperature
  \(-5 \ldots 50 \text{ °C}\)
- Documentation number
  \(D00231\)

Dimension diagram (dimensions in mm)

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Busbar 1</td>
</tr>
<tr>
<td>Busbar 2</td>
</tr>
<tr>
<td>Circular conductor</td>
</tr>
<tr>
<td>Overall width</td>
</tr>
<tr>
<td>Installation height</td>
</tr>
<tr>
<td>Overall depth</td>
</tr>
</tbody>
</table>

Approvals
KBR18
Split-core type current transformer

Device features
- Split-core type current transformer (mounting without disconnecting the primary conductor)
- Incl. connecting cable (2.5 m)
- Max. operating voltage up to 0.72 kV

Standards
The split-core type current transformer KBR18 was designed in accordance with the following standards:
IEC 61869-1, IEC 61869-2 and IEC 61010-1.

Approvals

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

Ordering information

<table>
<thead>
<tr>
<th>Primary current</th>
<th>Secondary current</th>
<th>Accuracy</th>
<th>Type</th>
<th>Design</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>1</td>
<td>3FSS</td>
<td>WLS501 KL.3FSS</td>
<td>KBR18</td>
<td>B 9808 6046</td>
</tr>
<tr>
<td>100</td>
<td>1</td>
<td>3FSS</td>
<td>WLS1001 KL.3FSS</td>
<td>KBR18</td>
<td>B 9808 6047</td>
</tr>
<tr>
<td>150</td>
<td>1</td>
<td>3FSS</td>
<td>WLS1501 KL.3FSS</td>
<td>KBR18</td>
<td>B 9808 6048</td>
</tr>
</tbody>
</table>

Technical data

- Rated continuous thermal current \(i_{\text{eth}}\) \(1.2 \times i_N\)
- Rated short-time thermal current \(i_{\text{eth}}\) \(60 \times i_N, 1 \text{ s}\)
- Max. operating voltage \(U_{\text{eth}}\) 0.72 kV, \(U_{\text{eff}}\)
- Insulation test voltage 3 kV, \(U_{\text{eff}, 50 \text{ Hz}, 1 \text{ min}}\)
- Nominal frequency 50 Hz
- Insulation class E
- Operating temperature \(-5...50^\circ\text{C}\)
- Documentation number D00231

Dimensions (mm)

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circular conductor</td>
</tr>
<tr>
<td>Overall width</td>
</tr>
<tr>
<td>Installation height</td>
</tr>
<tr>
<td>Overall depth incl. fixing clips</td>
</tr>
</tbody>
</table>
KBR32
Split-core type current transformer

### Device features
- Split-core type current transformer (mounting without disconnecting the primary conductor)
- Incl. connecting cable (2.5 m)
- Max. operating voltage up to 0.72 kV

### Standards
The split-core type current transformer KBR32 was designed in accordance with the following standards:
IEC 61869-1, IEC 61869-2 and IEC 61010-1.

### Approvals

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

### Ordering information

<table>
<thead>
<tr>
<th>Primary current</th>
<th>Secondary current</th>
<th>Accuracy</th>
<th>Type</th>
<th>Design</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
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<td>WL52501 KL.3FSS</td>
<td>KBR32</td>
<td>B 9808 6049</td>
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<tr>
<td>500</td>
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<td>3FSS</td>
<td>WL55001 KL.1FSS</td>
<td>KBR32</td>
<td>B 9808 6050</td>
</tr>
</tbody>
</table>

### Technical data
- Rated continuous thermal current $I_{th}$: $1.2 \times I_N$
- Rated short-time thermal current $I_{th}$: $60 \times I_N$, 3 s
- Max. operating voltage $U_m$: 0.72 kV, $U_{eff}$
- Insulation test voltage: 3 kV, $U_{eff}$, 50 Hz, 1 min
- Nominal frequency: 50 Hz
- Insulation class: E
- Operating temperature: -5...50 °C
- Documentation number: D00231

### Dimension diagram (dimensions in mm)

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circular conductor</td>
</tr>
<tr>
<td>Overall width</td>
</tr>
<tr>
<td>Installation height</td>
</tr>
<tr>
<td>Overall depth incl. fixing clips</td>
</tr>
</tbody>
</table>
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>
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</thead>
<tbody>
<tr>
<td>Energy meter 1Ph/32 A MID Modbus RTU</td>
<td>ALD1</td>
<td>B 9310 1005</td>
</tr>
<tr>
<td>Energy meter 3Ph/65 A MID Modbus RTU</td>
<td>ALE3</td>
<td>B 9310 1006</td>
</tr>
<tr>
<td>Energy meter 3Ph/6 A MID Modbus RTU</td>
<td>AWD3</td>
<td>B 9310 1007</td>
</tr>
<tr>
<td>50 pulse counter (four-fold) with Modbus RTU</td>
<td>PCD7</td>
<td>B 9310 1008</td>
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Accessories

<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>B 9310 1009</td>
</tr>
<tr>
<td>Sealable cover for ALE3/AWD3 (four per counter)</td>
<td>–</td>
<td>B 9310 1010</td>
</tr>
</tbody>
</table>

Technical data ALD1

<table>
<thead>
<tr>
<th>Parameter Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy class</td>
<td>B acc. to EN 50470-3, 1 acc. to IEC 62053-21</td>
</tr>
<tr>
<td>Operating voltage</td>
<td>AC 230 V, 50 Hz</td>
</tr>
<tr>
<td>Tolerance</td>
<td>-20 %/+15 %</td>
</tr>
<tr>
<td>Reference current/maximum current</td>
<td>Iref = 5 A, Imax = 32 A</td>
</tr>
<tr>
<td>Starting current/minimum current</td>
<td>Imin = 20 mA, Iref = 0.25 A</td>
</tr>
<tr>
<td>Power consumption</td>
<td>active power 0.4 W</td>
</tr>
<tr>
<td>Counting range</td>
<td>00’000.00…99 999.99</td>
</tr>
<tr>
<td>LC display</td>
<td>2000 imp/kWh</td>
</tr>
</tbody>
</table>

Technical data ALE3

<table>
<thead>
<tr>
<th>Parameter Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy class</td>
<td>B acc. to EN 50470-3, 1 acc. to IEC 62053-21</td>
</tr>
<tr>
<td>Operating voltage</td>
<td>3 x AC 230/400 V, 50 Hz</td>
</tr>
<tr>
<td>Tolerance</td>
<td>-20 %/+15 %</td>
</tr>
<tr>
<td>Reference current/maximum current</td>
<td>Iref = 10 A, Imax = 65 A</td>
</tr>
<tr>
<td>Starting current/minimum current</td>
<td>Imin = 40 mA, Iref = 0.5 A</td>
</tr>
<tr>
<td>Power consumption</td>
<td>active 0.4 W per phase</td>
</tr>
<tr>
<td>Counting range</td>
<td>00’000.00…99 999.99</td>
</tr>
<tr>
<td>LC display</td>
<td>1000 imp/kWh</td>
</tr>
</tbody>
</table>

Technical data AWD3

<table>
<thead>
<tr>
<th>Parameter Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy class</td>
<td>B acc. to EN 50470-3, 1 acc. to IEC 62053-21</td>
</tr>
<tr>
<td>Operating voltage</td>
<td>3 x AC 230/400 V, 50 Hz</td>
</tr>
<tr>
<td>Tolerance</td>
<td>-20 %/+15 %</td>
</tr>
<tr>
<td>Power consumption</td>
<td>active 0.4 W per phase</td>
</tr>
<tr>
<td>Counter range</td>
<td>000’000.0…999‘9999</td>
</tr>
<tr>
<td>LC display</td>
<td>1000 imp/kWh</td>
</tr>
</tbody>
</table>

Documentation number: D00231
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>Special applications</th>
<th>Power plant</th>
<th>Energy backup for device series VMD258</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AC</strong></td>
<td>&lt;(U, &gt;U)</td>
<td>( &lt;U, &gt;U)</td>
</tr>
<tr>
<td><strong>3AC</strong></td>
<td>( &lt;U, &gt;U)</td>
<td>( &lt;U, &gt;U)</td>
</tr>
<tr>
<td><strong>3(N)AC</strong></td>
<td>( &lt;U, &gt;U)</td>
<td>( &lt;U, &gt;U)</td>
</tr>
<tr>
<td><strong>DC</strong></td>
<td>( &lt;U, &gt;U)</td>
<td>( &lt;U, &gt;U)</td>
</tr>
<tr>
<td><strong>Measuring range/ nominal system voltage (U)</strong></td>
<td>( AC/DC ) systems 0 … 300 V</td>
<td>( 3AC ) 690/500/480/440/400/230/110/100 V</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>( &lt;f, &gt;f)</td>
<td>( &lt;f, &gt;f)</td>
</tr>
<tr>
<td><strong>Asymmetry/phase failure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Phase sequence</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Current monitoring</strong></td>
<td>1 AC with (I)</td>
<td>3 AC with (I)</td>
</tr>
<tr>
<td><strong>Special function</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Installation</strong></td>
<td>DIN rail</td>
<td></td>
</tr>
<tr>
<td><strong>Screw mounting</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Special applications

- **Power plant Energy backup for device series VMD258**

### Interface Protection System/Decoupling protection relay

- Loop monitoring
- Loop monitoring
- Fault voltage relay
- Interface Protection System/Decoupling protection relay
- Interface Protection System/Decoupling protection relay
- Loop monitoring
- Loop monitoring
- Fault voltage relay

### Measuring range/nominal system voltage

<table>
<thead>
<tr>
<th>AC/DC systems</th>
<th>AC/DC systems</th>
<th>AC/DC systems</th>
<th>AC/DC systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>0…300 V</td>
<td>9.6…150 V</td>
<td>70…300 V</td>
<td>3AC 690/500/480/440/400/230/110/100 V</td>
</tr>
<tr>
<td>(L-N) 0…288 V</td>
<td>(L-L) 0…500 V</td>
<td>(L-N) 0…288 V</td>
<td>(L-N) 0…300 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Frequency</th>
<th>Frequency</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;f, &gt;f</td>
<td>&lt;f, &gt;f</td>
<td>&lt;f, &gt;f</td>
<td>&lt;f, &gt;f</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Asymmetry/phase failure</th>
<th>Asymmetry/phase failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase sequence</td>
<td>Phase sequence</td>
</tr>
</tbody>
</table>

### Current monitoring

- 1 AC with Us < I, > I
- 3 AC with Us < I, > I

### Special function

- RS-485 interface, Islanding detection:
  - ROCOF (di/dt)
  - Vector shift

### Installation

- DIN rail
- Screw mounting
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 < U₁, > U₁, < 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) Uₛ</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AC</td>
<td></td>
</tr>
<tr>
<td>16…72 V, 15…460 Hz</td>
<td></td>
<td>VME420-D-1</td>
</tr>
<tr>
<td>70…300 V, 15…460 Hz</td>
<td></td>
<td>VME420-D-2</td>
</tr>
<tr>
<td></td>
<td>DC</td>
<td></td>
</tr>
<tr>
<td>9.6…94 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70…300 V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹) Absolute values

Device version with screw terminals 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>B 9806 0008</td>
</tr>
</tbody>
</table>
### Technical data

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

<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>4 kV/3</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>III</td>
</tr>
</tbody>
</table>

Protective separation (reinforced insulation) between:

- (A1, A2) - (U1+/U2-)
- (U11-12-14) - (U21-22-24)

#### Supply voltage

**VME420-D-1**

- Supply voltage $U_\text{s}$: AC 16…72 V/DC 9.6…94 V
- Frequency range $f_\text{s}$: 15…460 Hz

**VME420-D-2**

- Supply voltage $U_\text{s}$: AC/DC 70…300 V
- Frequency range $f_\text{s}$: 15…460 Hz
- Power consumption: $\leq 4$ VA

### Measuring circuit

#### Measuring range (r.m.s. value)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC, 15…460 Hz:</td>
<td>≤ 130 ms, AC 42…460 Hz: ≤ 70 ms</td>
</tr>
</tbody>
</table>

#### Resolution of setting

- DC: 100…500 Hz; ±0.2 %, ±1 digit
- AC: 10…500 Hz; ±3 %, ±2 digits

#### Response values

- $U_{\text{rel}} < U$ (Alarm 2): AC/DC 6…300 V
- $U_{\text{rel}} > U$ (Alarm 1): AC/DC 6…300 V
- Resolution of setting $U$: 0.1 V
- Resolution of setting $f$: 1 V

#### Preset function:

- Undervoltage $U$: $U_\text{s}$ = 0.85 $U_\text{n}$,*
- Overvoltage $U$: $U_\text{s}$ = 1.1 $U_\text{n}$,*
- Relative uncertainty voltage at 50/60 Hz: $\pm 1.5 %$, $\pm 2$ digits
- Relative uncertainty, voltage in the range of 15…460 Hz: $\pm 3 %$, $\pm 2$ digit
- Hysteresis $U$: $\pm 10 %$ ($5 %$)*
- Underfrequency $f$: $100 … 500 Hz$**
- Overfrequency $f$: $100 … 500 Hz$**
- Resolution of setting $f$: 0.1…40 % ($5 %$)*

#### Operating uncertainty at 50/60 Hz

- ±0.2 %, ±1 digit

#### Time response

- Start-up delay $t_{\text{on1/2}}$: 0…300 s ($0.1 s$)*
- Delay on release $t_{\text{off1/2}}$: 0…300 s ($0.1 s$)*
- $t_{\text{on1/2}}$: 0.1 s
- $t_{\text{off1/2}}$: 1 s
- $t_{\text{on1/2}}$: 10 s
- Operating time frequency $f_{\text{on}}$: DC/AC 16.7 Hz: $\leq 130$ ms, AC 42…460 Hz: $\leq 70$ ms
- Operating time frequency $f_{\text{off}}$: AC 15…460 Hz: $\leq 310$ ms
- $t_{\text{on}} = t_{\text{on1/2}} + t_{\text{off1/2}}$
- Recovery time $t_{\text{on}}$: $\leq 300$ ms

### Displays, memory

- Display: LC display, multifunctional, not illuminated
- Display range measured value: 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, frequency in the range of 15…460 Hz: $\pm 0.2 %$, $\pm 1$ digit
- History memory (NS) for the first alarm value: data record measured values

#### Switching elements

- Number: 2 x 1 changeover contacts (K1, K2)

#### Operating principle

- N/C operation N/O operation

- Classification of mechanical conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3K5 (no condensation, no formation of ice)
  - Long-term storage (IEC 60721-3-1): 1K4

#### Connection

- Push terminals

#### Environment/EMC

- EMC: IEC 61326-1
- Operating temperature: $-25…+55 ^\circ$C
- Classification of climatic conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3K5 (no condensation, no formation of ice)
  - Long-term storage (IEC 60721-3-1): 1K4

#### Other

- Operating mode: continuous operation
- 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 DIN 43880: IEC 60715
- Flammability class: UL94 V0

#### Weight

- $\leq 150$ g

* = factory setting

** = The technical data applies to the operating range of the rated frequency 15…460 Hz only

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

#### Utilisation category

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated operational voltage</td>
<td>230 V</td>
</tr>
<tr>
<td>Rated operational current</td>
<td>5 A</td>
</tr>
</tbody>
</table>

#### Minimum contact rating

- $1$ mA at AC/DC $\geq 10$ V

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

- Stationary use (IEC 60721-3-3): 1K4
- Long-term storage (IEC 60721-3-1): 1M3

#### Operating mode

- Continuous operation

- 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 DIN 43880: IEC 60715
- Flammability class: UL94 V0

#### Documentation number

- D00026

#### Weight

- $\leq 150$ g

---

**LINETRAXX®** VME420

2016/2017
### LINETRAXX® VME420

#### Monitoring relay for undervoltage, overvoltage and frequency

- **LINETRAXX® VME420**

#### Displays and controls

1. **Power On LED “ON” (green):** lights when supply voltage is applied and flashes in the event of system fault alarm
2. **Alarm LED “AL1” (yellow),** lights when the set response value $U/\text{f} > f$ is exceeded and flashes in the event of system fault alarm
3. **Alarm LED “AL2” (yellow),** lights when the value falls below the set response value $U/\text{f} < f$ and flashes in the event of system fault alarm
4. **Multi-functional LC display**
5. **Test button “T”:**
   - Arrow up button: To change the measured value display, move upwards in the menu or to change parameters.
   - To call up the self test: press the button $> 1.5$ s
6. **Reset button “R”:**
   - Arrow down button: to change the measured value indication, move downwards in the menu or to change parameters.
   - To delete stored alarms: press the button “T” $> 1.5$ s
7. **“MENU” button:**
   - Enter button: to confirm the measured value indication or to confirm changed parameters.
   - To call up the menu system, press the button “T” $> 1.5$ s
   - Press the ESC button $> 1.5$ s to abort an action or to return to the previous menu level.
   - When the menu item LED is activated, the alarm LED “AL1” indicates that K1 is in the alarm state. When “AL2” lights up, K2 is in the alarm position.

#### Wiring diagram

1. **Connection to the system/load being monitored**
2. **Supply voltage $U_s$ (see ordering information)**
3. **Alarm relay “K1”:** Configurable for $U/\text{f} > f/\text{f} > \text{ERROR}$
4. **Alarm relay “K2”:** Configurable for $U/\text{f} > U/\text{f} > \text{ERROR}$
5. **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® 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
- 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>Nominal system voltage (^{1)}) (U_n)</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 9.6…150 V, 15…460 Hz</td>
<td>VME421H-D-1</td>
<td>B 7301 0003</td>
</tr>
<tr>
<td>AC 70…300 V, 15…460 Hz</td>
<td>VME421H-D-2</td>
<td>B 7301 0004</td>
</tr>
</tbody>
</table>

Device version with screw terminals on request.
\(^{1)}\) 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>
Technical data

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

- Rated insulation voltage: 250 V
- Rated impulse voltage/pollution degree: 4 kV / III
- 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: \( \leq 6 \text{ VA} \)

**Measuring circuit**

- Measuring range (r.m.s. value) (VME421H-D-1): AC/DC 0…150 V
- Measuring range (r.m.s. value) (VME421H-D-2): AC/DC 0…300 V
- Rated frequency \( f_0 \): DC, 15…460 Hz
- Frequency display range: \( 10…500 \) Hz

**Response values**

**VME421H-D-1:**
- Undervoltage \( < \) (Alarm 2): AC/DC 9.6…150 V
- Overvoltage \( > \) (Alarm 1): AC/DC 9.6…150 V

**VME421H-D-2:**
- Undervoltage \( < \) (Alarm 2): AC/DC 70…300 V
- Overvoltage \( > \) (Alarm 1): AC/DC 70…300 V

- Resolution of setting: 0.1…2 Hz
- Minimum trip time: 0.1 s
- Minimum delay time: 0.1 s
- Resolution of setting \( f \): 0.1 Hz
- Minimum alarm delay \( t_{min} \): 0.1 s

**Relative uncertainty, frequency in the range 15…460 Hz:**
- Relative uncertainty \( \pm 0.2 \% \text{, } \pm 1 \text{ digit} \)

**Time response**

- Start-up delay \( t_{on} \): 0…300 s (0 s)*
- Response delay \( t_{on} \): 0…300 s (0 s)*
- Delay \( t_{off} \): 0…300 s (0.5 s)*

**Discharges, 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

**Switching elements**

- Operating principle:
  - Type: N/C operation
- Classification of climatic conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3K5 (no condensation, no formation of ice)
  - Transport (IEC 60721-3-2): 2K3
  - Long-term storage (IEC 60721-3-1): 1K4
  - Stationary use (IEC 60721-3-3): 3M4
  - Transport (IEC 60721-3-2): 2M2
  - Long-term storage (IEC 60721-3-1): 1M3

**Electrical characteristics**

- Contact data acc. to IEC 60947-5-1:
  - Utilisation category: AC-13
  - Rated operational current: 230 V
  - Rated operational voltage: 230 V
  - Rated operational current: 1 A
  - Rated operational voltage: 230 V

**Connection**

- Connection type: push-wire terminals

**Other**

- Degree of protection, internal components (DIN EN 60529): IP30
- Degree of protection, terminals (DIN EN 60529): IP20
- Enclosure material: polycarbonate
- Screws: 2 x M4 with mounting clip
- DIN rail mounting acc. to IEC 60715
- Flammability class: UL 94V-0
- Documentation number: D00141
- Weight: \( \leq 240 \text{ g} \)

\(* = \) factory setting

**--** The technical data applies to the operating range of the rated frequency 15…460 Hz only.
3.2 Measuring and monitoring relays | voltage relays

Monitoring relay for undervoltage, overvoltage and frequency LINETRAXX® VME421H

**Linetraxx® VME421H**

- **Connection to the system/load being monitored**
- **Alarm relay “K1”**: Configurable for \(<U>/U_{f}f>/ERROR
- **Alarm relay “K2”**: Configurable for \(<U>/U_{f}f>/ERROR
- **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.

**Displays and controls**

1. Power On LED “ON” (green); lights when supply voltage is applied and flashes in the event of system fault alarm
2. Alarm LED “AL1” (yellow), lights when the set response value \(<U>/U_{f}f>/ERROR is exceeded and flashes in the event of system fault alarm
3. Alarm LED “AL2” (yellow), lights when the value falls below the set response value \(<U>/U_{f}f>/ERROR and flashes in the event of system fault alarm
4. Multi-functional LC display
5. Test button “T”:
   - Arrow up button: To change the measured value display, move upwards in the menu or to change parameters.
   - To call up the self test: press the button “T” >1.5 s
6. Reset button “R”:
   - Arrow down button: To change the measured value indication, move downwards in the menu or to change parameters.
   - To delete stored alarms: press the button “T” >1.5 s
7. “MENU” button:
   - Enter button: To confirm the measured value indication or to confirm changed parameters.
   - To call up the menu system, press the button “T” >1.5 s
   - Press the ESC button >1.5 s to abort an action or to return to the previous menu level

**Wiring diagram**

1. Connection to the system/load being monitored
2. Alarm relay “K1”:
3. Alarm relay “K2”:
4. 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® VMD258
Undervoltage/overvoltage relay for monitoring three-phase AC systems (window function)

Device features
- 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 Un/1.05…1.3 x Un
- 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 und 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>
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<tbody>
<tr>
<td>3AC, 100 V</td>
<td>VMD258 3AC 100 V</td>
<td>B 9301 0060</td>
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<tr>
<td>3AC, 110 V</td>
<td>VMD258 3AC 110 V</td>
<td>B 9301 0061</td>
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<tr>
<td>3AC, 230 V</td>
<td>VMD258 3AC 230 V</td>
<td>B 9301 0062</td>
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<tr>
<td>3AC, 400 V</td>
<td>VMD258 3AC 400 V</td>
<td>B 9301 0063</td>
</tr>
<tr>
<td>3AC, 440 V</td>
<td>VMD258 3AC 440 V</td>
<td>B 9301 0064</td>
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<tr>
<td>3AC, 480 V</td>
<td>VMD258 3AC 480 V</td>
<td>B 9301 0065</td>
</tr>
<tr>
<td>3AC, 500 V</td>
<td>VMD258 3AC 500 V</td>
<td>B 9301 0066</td>
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<tr>
<td>3AC, 690 V</td>
<td>VMD258 3AC 690 V</td>
<td>B 9301 0067</td>
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Accessories

<table>
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<tr>
<th>Description</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Additional mounting clips (screw mounting)</td>
<td>B 9806 0008</td>
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</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy backup</td>
<td>ES258</td>
<td>209</td>
</tr>
</tbody>
</table>
Insulation coordination acc. to DIN EN 60255-27

Supply voltage $U_s$ AC (V) 690 480/500 400/440 230 100/110
Rated voltage AC (V) 1000 1000 600 300 150
Rated impulse voltage (kV) 12 12 8 6 4
Pollution degree 3
Overvoltage category III

Voltage ranges
Frequency range of $U_s$ AC 45…66 Hz
Operating range 0.5…1.5 x $U_s$
Nominal supply voltage $U_s$ AC 690 500 480 440 400 230 110 100
Power consumption at 50 Hz 1.3 x $U_s$ (VA) 19 15 12 14 9 16 15 10
Power consumption at 60 Hz 1.3 x $U_s$ (VA) 11 9 8 8 6 9 9 7

Measuring circuit
Nominal system voltage $U_n$ 3AC 690/500/480/440/400/230/110/100 V
Setting range 0.7…1.3 x $U_n$
Frequency range $f_n$ 45…66 Hz
Max. permissible measuring voltage 1.5 x $U_n$
Response value $U_n$ adjustable $>$ $U_n$, $<$ $U_n$

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 $t_{au}$ 500 ms ±20 %
Response delay $t_{sw}$ 0…5 s ±10 %
Delay on release $t_{off}$ 100 ms ±20 %
Operating time $t_{op}$ at overvoltage 60 ms ±20 %
Operating time $t_{op}$ at undervoltage 100 ms ±20 %
Response time $t_{RS}$ $t_{op} = t_{op} + t_{sw}$
Long-term influence $-$10 %
Overshoot time tov $<$ 60 ms

Connection for external energy storage device
$U_{dc}$ DC 24 V
$U_{dc}$ DC 68 V
$U_{dc}$ at 1.0 x $U_n$ 42…47 V ±15 %
Short circuit proof (Z+, Z−) short time yes

Environmental/EMC
EMC immunity acc. to IEC 60950-1
EMC emission acc. to IEC 60950-1
Operating temperature -20…+70 °C
Class of climatic conditions acc. to DIN IEC 60721-1-3
Stationary use 3K5
Transport 2K3
Long-term storage 1K4
Classification of mechanical conditions acc. to IEC 60721
Stationary use 3M4
Transport 2M2
Long-term storage 1M3
Requirements acc. to IEC 60255
Class 2

Connection
Connection properties screw terminals
Connection
rigid/flexible
flexible with connector sleeve
without/with plastic sleeve
Conductor sizes (AWG)
24…13

Lighting torque 0.5…0.6Nm
Current through L1/L1, L2/L2, L3/L3 each max. 3 A

Other
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 UL94 V-0
DIN rail mounting acc. to IEC 60715
Screw mounting 4 x M4
Documentation number D00668
Weight 825 g

Operating time $t_{op}$ overvoltage
Increase from 100 % to 130 %, switching threshold at 105 %

Operating time $t_{op}$ undervoltage
Decrease from 100 % to 0 %, switching threshold at 95 %
### Displays and controls

1. Power On LED "ON" (green)
2. Alarm LED ">U" (yellow); lights in the event of overvoltage
3. Alarm LED "<U" (yellow); lights in the event of undervoltage
4. Setting potentiometer for overvoltage ">U"
5. Setting potentiometer of the response value for undervoltage "ton"
6. Setting potentiometer of the response value for overvoltage "ton"

### Wiring diagram

1. Z+ and Z-: Connection ES258 for a backup time of > 5 s

### Dependent time characteristic

\[ U_{\text{calc}} = \frac{U_m}{T(1-(U_m/U_s))} \]

- \( U_{\text{calc}} \): value calculated according to the following formula
- \( U_m \): measured value of voltage
- \( U_s \): switching threshold
- \( T \): dependent time characteristic

Three-phase voltage and frequency monitoring relay LINETRAXX® VMD258
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.

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES258</td>
<td>B 9301 0068</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

Wiring diagram

Dimension diagram (dimensions in mm)
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
• 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
• 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

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

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage (^{1)}) Us</th>
<th>Type</th>
<th>Art. No.</th>
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</thead>
<tbody>
<tr>
<td>AC</td>
<td>DC</td>
<td>AC/DC</td>
</tr>
<tr>
<td>16…72 V</td>
<td>9.6…94 V, 15…460 Hz</td>
<td>–</td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>70…300 V, 15…460 Hz</td>
</tr>
</tbody>
</table>

Device version with screw terminals on request.

| 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>
<tr>
<td>Technical data</td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td></td>
</tr>
<tr>
<td><strong>Insulation coordination acc. to IEC 60664-1/IEC 60664-3</strong></td>
<td></td>
</tr>
<tr>
<td>Rated insulation voltage</td>
<td>400 V</td>
</tr>
<tr>
<td>Rated impulse voltage/pollution degree</td>
<td>4 kV/3 kV</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>
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<tr>
<td>Voltage test acc. to IEC 61010-1:</td>
<td></td>
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<tr>
<td>(N, L1, L2, L3) - (A1, A2), (11, 12, 14)</td>
<td>3.32 kV</td>
</tr>
<tr>
<td>(N, L1, L2, L3) - (21, 22, 24)</td>
<td>2.21 kV</td>
</tr>
<tr>
<td>(A1, A2) - (11, 12, 14) - (21, 22, 24)</td>
<td>2.21 kV</td>
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<tr>
<td><strong>Supply voltage</strong></td>
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</tr>
<tr>
<td>VMD420-D-1: Supply voltage</td>
<td>AC 16…72 V/DC 9.6…94 V</td>
</tr>
<tr>
<td>Frequency range U5</td>
<td>15…460 Hz</td>
</tr>
<tr>
<td>VMD420-D-2: Supply voltage</td>
<td>AC/DC 70…300 V</td>
</tr>
<tr>
<td>Frequency range U5</td>
<td>15…460 Hz</td>
</tr>
<tr>
<td>Power consumption</td>
<td>≤ 4 VA</td>
</tr>
<tr>
<td><strong>Measuring circuit</strong></td>
<td></td>
</tr>
<tr>
<td>Measuring range (r.m.s. value) (L-N)</td>
<td>AC 0…288 V</td>
</tr>
<tr>
<td>Rated frequency f5</td>
<td>1…50 Hz</td>
</tr>
<tr>
<td>Frequency range display</td>
<td>10…500 Hz</td>
</tr>
<tr>
<td><strong>Response values</strong></td>
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</tr>
<tr>
<td>Type of distribution system</td>
<td>3+N/AC/3AC (3AC)*</td>
</tr>
<tr>
<td>Undervoltage &lt; U (Alarm 2) (measurement method: 3Ph/3n)</td>
<td>AC 6…500/6…288 V</td>
</tr>
<tr>
<td>Overvoltage &gt; U (Alarm 1) (measurement method: 3Ph/3n)</td>
<td>AC 6…500/6…288 V</td>
</tr>
<tr>
<td>Resolution of setting U</td>
<td>1 V</td>
</tr>
<tr>
<td><strong>Preset function for 3AC measurement:</strong></td>
<td></td>
</tr>
<tr>
<td>Undervoltage &lt; U (0.85 Un)* for Un = 400/208 V</td>
<td>340/177 V</td>
</tr>
<tr>
<td>Overvoltage &gt; U (1.1 Un)* for Un = 400/208 V</td>
<td>440/229 V</td>
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<tr>
<td><strong>Preset function for 3/NAC measurement:</strong></td>
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<tr>
<td>Undervoltage &lt; U (0.85 Un)* for Un = 230/120 V</td>
<td>196/102 V</td>
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<tr>
<td>Overvoltage &gt; U (1.1 Un)* for Un = 230/120 V</td>
<td>253/132 V</td>
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<tr>
<td>Asymmetry</td>
<td>5…30 % (30 %)*</td>
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<tr>
<td>Phase failure</td>
<td>by setting the asymmetry</td>
</tr>
<tr>
<td>Phase sequence</td>
<td>clockwise/anticlockwise rotation (off)*</td>
</tr>
<tr>
<td>Relative uncertainty, voltage at 50/60 Hz</td>
<td>±1.5 %, ±2 digits</td>
</tr>
<tr>
<td>Relative uncertainty, voltage in the range 15…460 Hz</td>
<td>±3 %, ±2 digits</td>
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<tr>
<td>Hysteresis U</td>
<td>1…40 % (5 %)*</td>
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<tr>
<td>Underfrequency &lt; Hz</td>
<td>10…500 Hz**</td>
</tr>
<tr>
<td>Overfrequency &gt; Hz</td>
<td>10…500 Hz**</td>
</tr>
<tr>
<td>Resolution of setting f (10.0…99.9 Hz)</td>
<td>0.1 Hz</td>
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<tr>
<td>Resolution of setting f (100…500 Hz)</td>
<td>1 Hz</td>
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<tr>
<td><strong>Preset function:</strong></td>
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<tr>
<td>Underfrequency for fn = 400/60/50/16.7 Hz</td>
<td>399/59/49/15.7 Hz</td>
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<tr>
<td>Overfrequency for fn = 400/60/50/16.7 Hz</td>
<td>401/61/51/17.7 Hz</td>
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<tr>
<td>Hysteresis, frequency Hz</td>
<td>0.1…2 Hz (0.2 Hz)*</td>
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<tr>
<td>Relative uncertainty, frequency range 15…460 Hz</td>
<td>±0.2 %, ±1 digit</td>
</tr>
<tr>
<td><strong>Time response</strong></td>
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</tr>
<tr>
<td>Start-up delay t</td>
<td>0…300 s (0 u)</td>
</tr>
<tr>
<td>Response delay t</td>
<td>0…300 s (0 u)</td>
</tr>
<tr>
<td>Delay on release t</td>
<td>0…300 s (0.5 u)</td>
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<tr>
<td>Resolution of setting t, t +0.1s, 0.1 s</td>
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<tr>
<td>Resolution of setting t, t +0.1s, 1 s</td>
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<tr>
<td>Resolution of setting t, t +0.1s, 10 s</td>
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<td>Operating time, voltage</td>
<td>≤ 140 ms</td>
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<tr>
<td>Operating time, frequency</td>
<td>≤ 315 ms</td>
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<tr>
<td>Response time to</td>
<td>≤ 300 ms</td>
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<tr>
<td>Recovery time t</td>
<td>300 ms</td>
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<td><strong>Displays, memory</strong></td>
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<tr>
<td>Display</td>
<td>LC display, multifunctional, not illuminated</td>
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<tr>
<td>Display range measured value</td>
<td>AC/DC 0…500 V</td>
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<tr>
<td>Operating uncertainty, voltage at 50 Hz/60 Hz</td>
<td>±0.5 %, ±2 digits</td>
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<tr>
<td>Operating uncertainty voltage in the range of 15…460 Hz</td>
<td>±0.2 %, ±1 digit</td>
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<tr>
<td>History memory (HiS) for the first alarm value</td>
<td>data record measured values</td>
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<tr>
<td><strong>Password</strong></td>
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<tr>
<td>Fault memory (M) alarm relay</td>
<td>on/off/con (on)*</td>
</tr>
<tr>
<td><strong>Switching elements</strong></td>
<td></td>
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<tr>
<td>Number</td>
<td>2 x 1 changeover contacts (K1, K2)</td>
</tr>
<tr>
<td>Operating principle</td>
<td>N/C operation n. or N/O operation n.o.</td>
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<tr>
<td>Operating temperature</td>
<td>-25…+55 °C</td>
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<tr>
<td>Classification of climatic conditions acc. to IEC 60721:</td>
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<tr>
<td>Stationary use (IEC 60721-3-3)</td>
<td>3K3 (no condensation, no formation of ice)</td>
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<tr>
<td>Transport (IEC 60721-2-2)</td>
<td>2K3</td>
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<tr>
<td>Long-term storage (IEC 60721-3-1)</td>
<td>1K4</td>
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<td>Classification of mechanical conditions acc. to IEC 60721:</td>
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<tr>
<td>Stationary use (IEC 60721-3-3)</td>
<td>3M4</td>
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<tr>
<td>Transport (IEC 60721-2-2)</td>
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<tr>
<td>Long-term storage (IEC 60721-3-1)</td>
<td>1M3</td>
</tr>
<tr>
<td><strong>Environment/EMC</strong></td>
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<tr>
<td>EMC</td>
<td>IEC 61326-1</td>
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<tr>
<td>Operating temperature</td>
<td>-25…+55 °C</td>
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<td>Classification of mechanical conditions acc. to IEC 60721:</td>
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<tr>
<td>Stationary use (IEC 60721-3-3)</td>
<td>3M4</td>
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<tr>
<td>Transport (IEC 60721-2-2)</td>
<td>2M2</td>
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<td>Long-term storage (IEC 60721-3-1)</td>
<td>1M3</td>
</tr>
<tr>
<td><strong>Connection</strong></td>
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</tr>
<tr>
<td>Connection type</td>
<td>push-wire terminals</td>
</tr>
<tr>
<td>Connection properties</td>
<td>rigid</td>
</tr>
<tr>
<td>Flexible without ferrule</td>
<td>0.2…2.5 mm² (AWG 24…14)</td>
</tr>
<tr>
<td>Flexible with ferrule</td>
<td>0.2…1.5 mm² (AWG 24…16)</td>
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<tr>
<td>Stripping length</td>
<td>10 mm</td>
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<tr>
<td>Opening force</td>
<td>50 N</td>
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<tr>
<td>Test opening, diameter</td>
<td>2.1 mm</td>
</tr>
<tr>
<td><strong>Other</strong></td>
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</tr>
<tr>
<td>Operating mode</td>
<td>continuous operation</td>
</tr>
<tr>
<td>Degree of protection, internal components (DIN EN 60529)</td>
<td>IP30</td>
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<td>Degree of protection, terminals (DIN EN 60529)</td>
<td>IP20</td>
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<td>Enclosure material</td>
<td>polycarbonate</td>
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<tr>
<td>Screw mounting</td>
<td>2 x M4 with mounting clip</td>
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<tr>
<td>DIN rail mounting acc. to</td>
<td>IEC 60715</td>
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<tr>
<td>Flammability class</td>
<td>UL94 V-0</td>
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<td>Document number</td>
<td>D00137</td>
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<tr>
<td>Weight</td>
<td>≤ 150 g</td>
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</tbody>
</table>

(*) = factory setting

(**) = The technical data can only be ensured in the operating range of the nominal frequency 15…460 Hz.
Displays and controls

1. Power On LED “ON” (green); lights when supply voltage is applied and flashes in the event of system fault alarm
2. Alarm LED “AL1” (yellow), lights when the set response value \( U/\langle f\rangle < f/\text{Asy/PHS} \) is exceeded and flashes in the event of system fault alarm
3. Alarm LED “AL2” (yellow), lights when the set response value \( U/\langle f\rangle < f/\text{Asy/PHS} \) is exceeded and flashes in the event of system fault alarm
4. Multi-functional LC display
5. Test button “T”:
   - Arrow up button: to change the measured value display, move upwards in the menu or to change parameters
   - To call up the self test: press the button “T” > 1.5 s
6. Reset button “R”:
   - Arrow down button: to change the measured value display, move downwards in the menu or to change parameters
   - To delete stored alarms: press the button “T” > 1.5 s
7. “MENU” button:
   - Enter button: to confirm the measured value indication or to confirm changed parameters
   - To call up the menu system, press the button “T” > 1.5 s
   - Press the ESC button > 1.5 s to abort an action or to return to the previous menu level
   - When the menu item LED is activated, the alarm LED “AL1” indicates that K1 is in the alarm state. When “AL2” lights up, K2 is in the alarm position.

Wiring diagram

1. Connection to the system/load to be monitored
2. Supply voltage \( U_S \) (see ordering information)
3. Alarm relay “K1”:
   - Configurable for \( U/\langle f\rangle > f/\text{Asy/PHS/ERROR} \)
4. Alarm relay “K2”:
   - Configurable for \( U/\langle f\rangle > f/\text{Asy/PHS/ERROR} \)
5. 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® VMD421H
Multi-functional voltage relay for 3(3)AC systems, frequency/overvoltage/undervoltage, phase, phase failure, asymmetry

Device features
- Undervoltage, overvoltage and frequency monitoring in 3(3)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>, >U, <f>, >f
- Start-up delay, response delay, 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
- 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 and IEC 60255-6.

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

Ordering information
<table>
<thead>
<tr>
<th>Nominal system voltage 1) U_n</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3(3)AC</td>
<td>VMD421H-D-3</td>
<td>B 7301 0007</td>
</tr>
</tbody>
</table>

Device version with screw terminals on request. 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>
### Insulation coordination acc. to IEC 60664-1/IEC 60664-3

**Rated insulation voltage**
- 400 V

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

**Overvoltage category**
- III

**Protective separation (reinforced insulation) between**
- (N L1 L2 L3) – (10.12 14) – (21 22 24)

**Voltage test acc. to IEC 60101-1:**
- (N L1 L2 L3) – (11 12 14) – (21 22 24)

**Supply voltage**
- Supply voltage Uₜ:
  - none (internally supplied by Uₜ)

**Power consumption**
- ≤ 6 VA

### Measuring circuit

**Measuring range (c.m.s. value) (L-N):**
- AC 0…288 V

**Measuring range (c.m.s. value) (L-L):**
- AC 0…500 V

**Rated frequency fₜ:**
- 15…460 Hz

**Frequency display range:**
- 10…500 Hz

### Response values

**Type of distribution system:**
- TN Type A/C/3AC (3AC)*

**Undervoltage < U (Alarm 2) (measurement method: 3Ph/3n):**
- AC 70…500/72…288 V

**Overvoltage > U (Alarm 1) (measurement method: 3Ph/3n):**
- AC 70…500/278…288 V

**Resolution of setting U:**
- 1 V

**Preset function for 3AC measurement:**
- Undervoltage < U (0.85 Uₜ)* for Uₜ = 400/208 V
  - 340/177 V

**Overvoltage > U (1.1 Uₜ)* for Uₜ = 400/208 V:**
- 440/229 V

**Preset function for 3NAC measurement:**
- Undervoltage < U (0.85 Uₜ)* for Uₜ = 230/120 V
  - 196/102 V

**Overvoltage > U (1.1 Uₜ)* for Uₜ = 230/120 V:**
- 253/132 V

**Asymmetry:**
- 5…30 % (50 %)*

**Phase failure by setting the asymmetry:**
- clockwise/anticlockwise rotation (off)*

**Relative uncertainty, voltage at 50/60 Hz:**
- ±1.5 %, ±2 digits

**Relative uncertainty voltage in the range 15…460 Hz:**
- ±1 %, ±2 digits

**Hysteresis U:**
- 1…40 % (5 %)*

**Underfrequency < Hz:**
- 10…500 Hz

**Overfrequency > Hz:**
- 10…500 Hz

**Resolution of setting f**
- 100…99.9 Hz

**Resolution of setting f**
- 100…300 Hz

**By preset function:**
- 1 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

### Switching elements

**Number:**
- 2 x 1 changeover contacts (R1, K2)

**Operating principle:**
- N/C operation n.c. or N/O operation n.o.

**K2: En < U, > U, Asy, < Hz, > Hz, PHS:**
- (undervoltage < U, asymmetry Asy, N/O operation n.o.)*

**K1: En < U, > U, Asy, < Hz, > Hz, PHS:**
- (overvoltage > U, asymmetry Asy, N/O operation n.o.)*

**Technical data**

**Voltage test acc. to IEC 60947-5-1:**
- Utilisation category:
  - AC-13
  - AC-14

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

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

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

### Environment/EMC

**Classification of climatic conditions acc. to IEC 60721:**
- 3K5 (no condensation, no formation of ice)

**Stationary use:**
- Transport (IEC 60721-3-2)
- 2K3

**Long-term storage:**
- Stationary use acc. to IEC 60721;
  - DIN rail mounting acc. to IEC 60721-3-3

**Classification of mechanical conditions acc. to IEC 60721:**
- 3M4

**Transport (IEC 60721-3-2):**
- 2M2

**Long-term storage (IEC 60721-3-1):**
- 1M3

### Connection

**Connection type:**
- push-wire terminals

**Connection properties:**
- rigid
  - 0.2…2.5 mm² (AWG 24…14)
  - 0.75…2.5 mm² (AWG 19…14)
  - 2.5…15 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:**
- IEC 60715

**Flammability class:**
- UL94 V-0

**Documentation number:**
- D005138

**Weight:**
- ≤ 240 g

(*) = factory setting

---

**LINETRAX® VMD421H**

**Measuring and monitoring relays | voltage relays**

**Monitoring relay for undervoltage, overvoltage and frequency LINETRAX® VMD421H**

**U °**

**Overvoltage > U**

**Relative uncertainty, voltage in the range of 15…460 Hz**

**Response time tₜ:**

- 0…300 s (0 s)*

**Response delay tₚ₁/tₜ₂**

- 0…300 s (0 s)*

**Delay on release tₜ₂:**

- 0…300 s (0.5 s)*

**Operating time, voltage tₑv**

- ≤ 140 ms

**Operating time, frequency tₑₑ**

- ≤ 335 ms

**Response time tₑₑ**

- tₑₑ = tₑᵥ + tₑₑ/t₂

**Discharging time energy backup on power failure**

- 2.5 s

**Charging time energy storage**

- 60 s

**Recovery time tᵣ:**

- ≤ 300 ms

**Data record measured values**

**Password**

Off/…999 (OFF)*

**Fault memory (M) alarm relay**

on/off/on (on)*

**Switching elements**

**Number**

2 x 1 changeover contacts (R1, K2)

**Operating principle**

N/C operation n.c. or N/O operation n.o.

**K2: En < U, > U, Asy, < Hz, > Hz, PHS:**

(undervoltage < U, asymmetry Asy, N/O operation n.o.)*

**K1: En < U, > U, Asy, < Hz, > Hz, PHS:**

(overvoltage > U, asymmetry Asy, N/O operation n.o.)*

**Technical data**

**Voltage test 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 24 V 110 V 220 V

**Rated operational current**

- 5 A 3 A 1 A 0.2 A

**Minimum contact rating**

- 1 mA at AC/DC ≥ 10 V

**Environment/EMC**

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

Stationary use (IEC 60721-3-3)

- 3K5 (no condensation, no formation of ice)

**Stationary use (IEC 60721-3-2):**

- Transport (IEC 60721-3-2)

**Long-term storage (IEC 60721-3-1):**

- 3M4

**Transport (IEC 60721-3-2):**

- 2M2

**Long-term storage (IEC 60721-3-1):**

- 1M3

**Connection**

**Connection type**

- push-wire terminals

**Connection properties**

- rigid
  - 0.2…2.5 mm² (AWG 24…14)
  - 0.75…2.5 mm² (AWG 19…14)
  - 2.5…15 mm² (AWG 24…16)

**Stripping length**

- 10 mm

**Opening force**

- 50 N

**Test opening, diameter**

- 2.1 mm

**Other**

**Operating mode**

- continuous operation
### Displays and controls

1. **Power On LED “ON” (green)**, lights when the supply voltage is applied or flashes in the event of system fault alarm
2. **Alarm LED “AL1” (yellow)**, lights when the set response value \( U_{<}/f_{>}/f_{<}/f_{>}/f_{<}/f_{>}/f_{<} \) is exceeded and flashes in the event of system fault alarm
3. **Alarm LED “AL2” (yellow)**, lights when value falls below the set response value \( U_{<}/f_{>}/f_{<}/f_{>}/f_{<}/f_{>}/f_{<} \) and flashes in the event of system fault alarm
4. **Multi-functional LC display**
5. **Test button “T”**: Arrow up button: To change the measured value display, move upwards in the menu or to change parameters. To call up the self test: press the button >1.5 s
6. **Reset button “R”**: Arrow down button: to change the measured value indication, move downwards in the menu or to change parameters. To delete stored alarms: press the button “T” >1.5 s
7. **“MENU” button**: Enter button: to confirm the measured value indication or to confirm changed parameters press the button “T” >1.5 s. Press the ESC button >1.5 s to abort an action or to return to the previous menu level

### Wiring diagram

1. **Connection to the system/load to be monitored**
2. **Alarm relay “K1”**: Configurable for \( U_{<}/f_{>}/f_{<}/f_{>}/f_{<}/f_{>}/f_{<} \)
3. **Alarm relay “K2”**: Configurable for \( U_{<}/f_{>}/f_{<}/f_{>}/f_{<}/f_{>}/f_{<} \)
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
- r.m.s. 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
- Universally applicable for photovoltaic systems, CHPs (Combined Heat and Power plants), wind power and hydro power plants

Approvals
- Certificates of non-objection
  - DIN V VDE V 0126-1-1:2006-02 (France, Switzerland)
  - DIN V VDE V 0126-1-1:2006-02 and EN 50438:2007 (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</th>
<th>Response value</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 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>AC 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>U4</td>
<td>U4</td>
<td>70…500 V</td>
<td>VMD423H-D-3</td>
</tr>
</tbody>
</table>

Device version with screw terminals 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>B 9806 0008</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/3
- **Overvoltage category** II
- **Protective separation (reinforced insulation) between**
  - (A1, A2) - (N, L1, L2, L3) - (11, 12, 14) - (21, 22, 24)
  - (A1, A2, A3) - (11, 12, 14) - (21, 22, 24)

**Voltage test according to IEC 61010-1:**
- **VMD423 and VMD423H:**
  - (N, L1, L2, L3) - (A1, A2, A3) - (11, 12, 14) - (21, 22, 24)
  - 3.2 kV
- **VMD423:**
  - (A1, A2, A3) - (11, 12, 14) - (21, 22, 24)
  - 2.21 kV

### Supply voltage

#### VMD423-D-1:
- **Rating voltage** U_{c}
- **Supply voltage** AC 16...72 V/DC 9.6...94 V
- **Rated frequency** f_{c}
- **Frequency range** U_{c}
- **Power consumption** ≤ 0.4 VA

#### VMD423-D-2:
- **Rating voltage** U_{c}
- **Supply voltage** AC/DC 70...300 V
- **Rated frequency** f_{c}
- **Frequency range** U_{c}
- **Power consumption** ≤ 0.4 VA

#### VMD423H-D-3:
- **Rating voltage** U_{c}
- **Supply voltage** AC/DC 70...300 V
- **Rated frequency** f_{c}
- **Frequency range** U_{c}
- **Power consumption** ≤ 0.4 VA

### Measuring circuit

- **Measuring range (r.m.s. value) (L-N)**
  - **VMD423:** (AC/3AC (3(N)AC)*
  - **VMD423H-D-3:** (AC/DC ≥ 10 V
- **Measuring range (rms. value) (L-L)**
  - **VMD423:** (AC/3AC (3(N)AC)*
  - **VMD423H-D-3:** (AC/DC ≥ 10 V
- **Rated frequency** f_{c}
- **Frequency display range** 25...100 Hz

### Response values

- **Response time t**
  - **VMD423-D-1/VMD423-D-2**
  - **VMD423H-D-3**

### Displays, Memory

- **Display** LC display, multifunctional, not illuminated
- **Display range measured value** AC/DC...±500 V
- **Operating uncertainty, voltage at 50/60 Hz** ±1.5 %, ±2 digits
- **Operating uncertainty, frequency in the range of 40...65 Hz** ±0.1 %, ±1 digit
- **History memory (HIS) for the first alarm value** data record measured values
- **Password** off/on/off/0...999 (on/126)"a
- **Fault memory** on/off/on/off (off)"a

### Switching Elements

- **Number** 2 x 1 changeover contacts (K1, K2)
- **Operating principle K1/K2**
  - N/O operation n.o./N/C operation n.c
- **Operating temperature** -25...+55 °C
- **Classification of climatic conditions acc. to IEC 60721**:
  - **Stationary use** (IEC 60721-3-1)
    - 3KS (no condensation, no formation of ice)
    - 2K3
    - 1K4
  - **Transit** (IEC 60721-3-3)
    - 3M4
  - **Transport** (IEC 60721-3-2)
    - 2M2
  - **Long-term storage** (IEC 60721-3-1)
    - 1M3

### Connection

- **Connection type** push-wire terminals
- **Connection properties**
  - rigid 0.2...2.5 mm² (AWG 24...14)
  - flexible with ferrule 0.1...4 mm² (AWG 26...16)
  - flexible without ferrule 0.1...4 mm² (AWG 26...16)
- **Stripping length** 10 mm
- **Test opening, diameter** 0.75...2.5 mm²
- **DIN rail mounting**
  - UL94 0.2...1.5 mm² (AWG 24...16)
  - UL94 V-0 0.2...2.5 mm² (AWG 24...16)
- **Connection properties**
  - flexible with ferrule 0.1...4 mm² (AWG 26...16)
  - flexible without ferrule 0.1...4 mm² (AWG 26...16)

### Other

- **Operating mode** continuous operation
- **Mounting** any position
- **Degree of protection, internal components (IEC 60529)**
  - IP 30
- **Degree of protection, terminals (IEC 60529)**
  - IP 30
- **Enclosure material** polycarbonate
- **Screw mounting**
  - 2 x M4 with mounting clip
- **DIN rail mounting**
  - IEC 60715
- **Flammability class**
  - UL94 V-0
- **Documentation number**
  - D00140 (VMD423H)
  - D00139 (VMD423)
- **Weight**
  - ≤ 230 g (VMD423)
  - ≤ 240 g (VMD423H)

*(*) = Factory setting
### Displays and controls

1. Power On LED "ON" (green): Lights up when voltage is available and when the device is in operation or flashes in case of system fault alarm.
2. Alarm LED "AL1" (yellow): Lights up in case of the following fault messages: >U1/U2 (10 minute average determination)
3. Alarm LED "AL2" (yellow): Lights up in case of the following fault message: <U
   Both the alarm LEDs "AL1" and "AL2" light up in case of the following fault messages: <f/>/Asy/PHS, the alarm LEDs flash in case of system fault alarm.
4. Display: Displays operating information.
5. Test button "T": UPWARDS (<1.5 s)/TEST (>1.5 s):
   The arrow up button is used to increase input values or to navigate through the menu.
   The test button is used to start a manual self test.
6. Reset button "R": Down (<1.5 s)/Reset (>1.5 s):
   The arrow down button is used to decrease input values or to navigate through the menu.
   The reset button "R" is used to activate a manual reset.
7. ENTER (<1.5 s)/MENU (>1.5 s) button:
   The Enter button is used to save input data and changed data.
   Press the "MENU" button to call up the menu system.
   Press the "MENU" (ESC) button >1.5 s in the menu mode to abort an action or to return to the previous menu level. (ESC)
   When the menu item LED is activated, the alarm LED "AL1" indicates that K1 is in the alarm state. When "AL2" lights up, K2 is in the alarm position.
### Wiring diagram – VMD423

1. Connection to the system to be monitored and to supply voltage
2. Alarm relay "K1": Configurable for \( \frac{U}{U_1} > \frac{U_2}{f} \)
3. Alarm relay "K2": Configurable for \( \frac{U}{U_1} > \frac{U_2}{f} \)
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.

### Wiring diagram

1. Connection to the system to be monitored and to supply voltage
2. Alarm relay "K1": Configurable for \( \frac{U}{U_1} > \frac{U_2}{f} \)
3. Alarm relay "K2": Configurable for \( \frac{U}{U_1} > \frac{U_2}{f} \)
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
- Straightforward commissioning due to pre-set basic programs for national standards and regulations
- Single-fault tolerance
- Monitoring of the connected coupling switch (configurable: NC/NO/off)
- Islanding detection df/dt (ROCOF)
- Vector shift
- Interface RS-485 (data exchange, parameter setting, software update)
- Test function for the determination of the disconnection time
- Test button for the trigger circuit
- The last 300 distribution network faults can be recalled with time stamp/real-time clock
- Continuous monitoring of the phase and line-to-line voltage
- Separate switching conditions after a threshold infringement
- Language selection (German, English, Italian)
- Backlight graphics LC display
- Remote shutdown via ripple control signal receiver
- Password protection for device setting
- Sealable enclosure

Certificates of non-objection/certificate of conformity
- CEI O-21
- VDE-AR-N 4105
- BDEW guideline
- C10/11
- G59/2
- G59/3
- G83/2
- DIN V VDE V 0126-1-1/A1

Typical applications
- Central NS protection
- Automatic switching point between a power generation system operated in parallel with the network and the public grid
- Application in accordance with CEI 0-21, VDE-AR-N 4105, BDEW guideline, C10/11, G59/2, G59/3, G83/2, DIN V VDE V 0126-1-1/A1
- Universally applicable for safe mains decoupling of power generation systems

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 100...240 V</td>
<td>VMD460-NA-D-2</td>
<td>B 9301 0045</td>
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</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>B 9806 0008</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>6 kV/2</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>III</td>
</tr>
<tr>
<td>Safe separation (reinforced insulation) between</td>
<td>(A1, A2), (L1, L2, L3, N), (11, 12, 14, 21, 22, 24)</td>
</tr>
<tr>
<td>Voltage test acc. to IEC 61010-1:</td>
<td>(N, L1, L2, L3) - (A1, A2), (11, 12, 14, 21, 22, 24)</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>50 Hz</td>
</tr>
<tr>
<td>Rated insulation voltage</td>
<td>3.2 kV</td>
</tr>
<tr>
<td>Rated impulse voltage</td>
<td>400 kV</td>
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</tbody>
</table>

Supply voltage

<table>
<thead>
<tr>
<th>Nominal supply voltage</th>
<th>U_n</th>
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</thead>
<tbody>
<tr>
<td>AC/DC 100...240 V</td>
<td>DC/50/60 Hz</td>
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Operating range U_i

<table>
<thead>
<tr>
<th>Operating range</th>
<th>U_i</th>
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<tbody>
<tr>
<td>AC/DC 75...300 V</td>
<td>DC/40...70 Hz</td>
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</table>

Power consumption at AC 230 V

<table>
<thead>
<tr>
<th>Power consumption</th>
<th>&lt; 7.5 VA</th>
<th>&lt; 3.5 W</th>
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</thead>
<tbody>
<tr>
<td>9 VA/3.5 W</td>
<td>max.</td>
<td></td>
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Measuring circuit

<table>
<thead>
<tr>
<th>Type of distribution system</th>
<th>1AC, 230 V, 50 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>3(N)AC</td>
<td>400/230 V, 50 Hz</td>
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</tbody>
</table>

Relative uncertainty, voltage

<table>
<thead>
<tr>
<th>Relative uncertainty</th>
<th>U</th>
<th>280 V</th>
<th>± 1 %</th>
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</thead>
<tbody>
<tr>
<td>U</td>
<td>&gt; 280 V</td>
<td>± 3 %</td>
<td></td>
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</table>

Resolution of setting, voltage

<table>
<thead>
<tr>
<th>Resolution</th>
<th>1%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated frequency</td>
<td>45...65 Hz</td>
</tr>
</tbody>
</table>

Response values

<table>
<thead>
<tr>
<th>Relative uncertainty, frequency</th>
<th>≤ ±0.1 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated uncertainty, frequency</td>
<td>0.05 Hz</td>
</tr>
</tbody>
</table>

Recording of measurement values, condition for connection

<table>
<thead>
<tr>
<th>L-N, L-L</th>
<th>0...3.3 U</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; f, &lt; f</td>
<td>45...60 Hz</td>
</tr>
<tr>
<td>&gt; f, &gt; f</td>
<td>50...65 Hz</td>
</tr>
</tbody>
</table>

Recording of measurement values, condition for disconnection

<table>
<thead>
<tr>
<th>L-N, L-L</th>
<th>0...3.3 U</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; f, &lt; f</td>
<td>45...60 Hz</td>
</tr>
<tr>
<td>&gt; f, &gt; f</td>
<td>50...65 Hz</td>
</tr>
</tbody>
</table>

df/dt

<table>
<thead>
<tr>
<th>df/dt</th>
<th>0.05...9.9 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vector shift</td>
<td>1...25°</td>
</tr>
<tr>
<td>Asymmetry</td>
<td>1...50 %</td>
</tr>
<tr>
<td>Neutral-Voltage-Displacement 59 (N)</td>
<td></td>
</tr>
</tbody>
</table>

Time response

<table>
<thead>
<tr>
<th>Delay time for connection t_{on}</th>
<th>40 ms...30 s (1...3600 s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution of setting t_{on}</td>
<td>&lt; 5 ms: 5 ms</td>
</tr>
<tr>
<td></td>
<td>50...200 ms: 10 ms</td>
</tr>
<tr>
<td></td>
<td>200 ms...5 s: 50 ms</td>
</tr>
<tr>
<td></td>
<td>5...10 s: 0.1 s</td>
</tr>
<tr>
<td></td>
<td>10 s...60 s: 1 s</td>
</tr>
<tr>
<td></td>
<td>60...300 s: 10 s</td>
</tr>
<tr>
<td></td>
<td>300 s...&lt; 60 min: 1 min</td>
</tr>
</tbody>
</table>

Operating time voltage t_{ov}

<table>
<thead>
<tr>
<th>Operating time frequency t_{fr}</th>
<th>≤ 40 ms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recovery time t_r</td>
<td>≤ 300 ms</td>
</tr>
</tbody>
</table>

Digital inputs

Monitoring of potential-free contacts or voltage inputs:

<table>
<thead>
<tr>
<th>Number</th>
<th>closed = low; 0...4 V, I_k = &lt; -5 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>open = high; &gt; 6...≤ 30 V</td>
</tr>
</tbody>
</table>

Display

<table>
<thead>
<tr>
<th>Display</th>
<th>LC display, multi-functional, illuminated</th>
</tr>
</thead>
</table>

Display range measured value

<table>
<thead>
<tr>
<th>Operating uncertainty, voltage</th>
<th>U</th>
<th>≤ ±0.1 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating uncertainty, frequency</td>
<td>U</td>
<td>≤ ±0.1 %</td>
</tr>
</tbody>
</table>

History memory for the last 300 messages | per data record measured values |

Password | on/off/0...999 (def) |

Switching elements

<table>
<thead>
<tr>
<th>Number</th>
<th>2 x 1 changeover contacts (R1, K2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact data acc. to IEC 60947-5-1:</td>
<td>3(N) operation n.c.</td>
</tr>
<tr>
<td>2(N) operation n.o.</td>
<td></td>
</tr>
<tr>
<td>Electrical endurance, number of cycles</td>
<td>10,000</td>
</tr>
</tbody>
</table>

Environment/EMC

<table>
<thead>
<tr>
<th>EMC</th>
<th>DIN EN 60255-26-CEI 0-21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</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)</td>
</tr>
<tr>
<td>3K5 (except condensation and formation of ice)</td>
<td></td>
</tr>
<tr>
<td>Storage (IEC 60721-3-1)</td>
<td></td>
</tr>
<tr>
<td>1K4 (except condensation and formation of ice)</td>
<td></td>
</tr>
<tr>
<td>Classification of mechanical conditions acc. to IEC 60721:</td>
<td>Stationary use (IEC 60721-3-3)</td>
</tr>
<tr>
<td>Transport (IEC 60721-3-2)</td>
<td></td>
</tr>
<tr>
<td>Storage (IEC 60721-3-1)</td>
<td></td>
</tr>
</tbody>
</table>

Connection

<table>
<thead>
<tr>
<th>Connection type</th>
<th>screw terminals or push-wire terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection properties:</td>
<td>rigid</td>
</tr>
<tr>
<td></td>
<td>0.2...4 mm² (AWG 24...12)</td>
</tr>
<tr>
<td>Flexible</td>
<td>0.2...2.5 mm² (AWG 24...14)</td>
</tr>
<tr>
<td>Stripping length</td>
<td>8...3 mm</td>
</tr>
<tr>
<td>Lightening torque</td>
<td>0.5...0.6 N-m</td>
</tr>
</tbody>
</table>

Other

<table>
<thead>
<tr>
<th>Operating mode</th>
<th>continuous operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting</td>
<td>any position</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>Enclosure material</td>
<td>polycarbonate</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>D00001</td>
</tr>
<tr>
<td>Weight</td>
<td>≤ 360 g</td>
</tr>
</tbody>
</table>

( *) = factory setting
Displays and controls

1. Both alarm LEDs "AL1" and "AL2": light when voltage and frequency values are outside the thresholds.
2. LED "ON" (green): lights up when voltage is available and when the device is in operation or flashes in case of system fault alarm (external watchdog).
3. Backlit LC display
4. "INFO" button
5. The test button "TEST" is used to start a manual self test that triggers both alarm relays (trigger test to check the coupling switches). In addition, a fault is simulated to determine the disconnection time.
6. Arrow up button: parameter change, scroll
7. "RESE T" button: to acknowledge alarm and fault messages
8. Arrow down button: parameter change, scroll
9. "MENU" button: to toggle between the standard display, menu and alarm display

Wiring diagram VMD460 (VDE-AR-N-4105)

1. Supply voltage $U_S$ (see ordering information)
2. Coupling to the grid
3. Relay connections
4. Contact monitoring coupling switch (feedback signal contacts, optional NC/NO/off)
   - NO (in non-operating state open)
   - NC (in non-operating state closed)
   - off (contact monitoring switched off)
5. Remote trip input (NC/NO)
6. RS-485 interface
7. Activate or deactivate the BMS bus terminating resistor (120 Ω)
**Intended use**

The principle of an installation according to CEI 0-21; VDE-AR-N 4105 (30 kW and higher), C10/11, BDEW guideline, DIN V VDE V 0126-1-1/A1, G59/2, G59/3, G83/2

1. Supply voltage $U_S$ (see ordering information)
2. Coupling to the grid
3. Contact monitoring coupling switch (feedback signal contacts, optional NC/NO/off)
   - **NO** (in non-operating state open)
   - **NC** (in non-operating state closed)
   - **off** (contact monitoring switched off)
4. Relay connections
5. GND, digital inputs (external monitoring)
6. Remote trip input (NC/NO)
7. RS-485 interface
8. Activate or deactivate the BMS bus terminating resistor (120 Ω)
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
- Seable 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

Standards
The LINETRAXX® CME420 series complies with the requirements of the device standards: IEC 60255-6.

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

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage (U)</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 16…72 V, 42…460 Hz</td>
<td>CME420-D-1</td>
<td>B 7306 0001</td>
</tr>
<tr>
<td>DC 9.6…94 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC 70…300 V, 42…460 Hz</td>
<td>CME420-D-2</td>
<td>B 7306 0002</td>
</tr>
<tr>
<td>DC 70…300 V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Device version with screw terminals on request.

Ordering information

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>
### Technical data

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

<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/overvoltage category</td>
<td>4 kV/III</td>
</tr>
<tr>
<td>Pollution degree</td>
<td>3</td>
</tr>
<tr>
<td>Protective separation (reinforced insulation)</td>
<td>(A1, A2) - (k, l) -(11, 12, 14) -(21, 22, 24)</td>
</tr>
<tr>
<td>Maximum nominal voltage of the system being monitored</td>
<td>when the conductor being monitored is directly connected: With protective separation</td>
</tr>
<tr>
<td></td>
<td>Without protective separation</td>
</tr>
</tbody>
</table>

#### Supply voltage

**CME420-D-1:**
- Supply voltage $U_s$: AC 16...22 V/DC 9.6...20 V
- Frequency range $f_s$: 42...660 Hz

**CME420-D-2:**
- Supply voltage $U_s$: AC/DC 70...300 V
- Frequency range $f_s$: 42...660 Hz
- Power consumption: ≤ 4 W

#### Overcurrent

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range (r.m.s. value, screw-type terminal)</td>
<td>AC 0.05...16 A</td>
</tr>
<tr>
<td>Measuring range (r.m.s. value, push-wire terminal)</td>
<td>AC 0.05...12 A</td>
</tr>
<tr>
<td>Overload capability $I_o$</td>
<td>40 A</td>
</tr>
<tr>
<td>Rated frequency $f_o$</td>
<td>42...2000 Hz</td>
</tr>
</tbody>
</table>

#### Response values

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Push-wire terminal</td>
<td>AC 0.1...12 A (1 A)*</td>
</tr>
<tr>
<td>Screw-type terminal</td>
<td>AC 0.1...16 A (1 A)*</td>
</tr>
<tr>
<td>or external current transformer</td>
<td>AC 0.1...16 A (1 A)*</td>
</tr>
<tr>
<td>Rated frequency $f_o$</td>
<td>40 A</td>
</tr>
</tbody>
</table>

#### Undercurrent

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Push-wire terminal</td>
<td>AC 0.1...12 A (1 A)*</td>
</tr>
<tr>
<td>Screw-type terminal</td>
<td>AC 0.1...12 A (1 A)*</td>
</tr>
<tr>
<td>or external current transformer</td>
<td>AC 0.1...12 A (1 A)*</td>
</tr>
<tr>
<td>Rated frequency $f_o$</td>
<td>42...2000 Hz</td>
</tr>
</tbody>
</table>

#### Overcurrent

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Push-wire terminal</td>
<td>AC 0.1...12 A (1 A)*</td>
</tr>
<tr>
<td>Screw-type terminal</td>
<td>AC 0.1...12 A (1 A)*</td>
</tr>
<tr>
<td>or external current transformer</td>
<td>AC 0.1...12 A (1 A)*</td>
</tr>
<tr>
<td>Rated frequency $f_o$</td>
<td>10...100 % (50 %)*</td>
</tr>
</tbody>
</table>

#### Others

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>External current transformer</td>
<td>$x/1 A, x/5 A, x/10 A</td>
</tr>
<tr>
<td>Transformation ratio factor $n$</td>
<td>1...2000 (1)*</td>
</tr>
<tr>
<td>Relative percentage error at 50/60 Hz</td>
<td>±3 %, ±2 digits</td>
</tr>
<tr>
<td>Relative percentage error in the range of 42...2000 Hz</td>
<td>±5 %, ±2 digits</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>10...40 % (15 %)*</td>
</tr>
</tbody>
</table>

#### Specified time

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starting delay</td>
<td>0...300 s (0.5 s)*</td>
</tr>
<tr>
<td>Response delay $t_{on1}$</td>
<td>0...300 s (1 s)*</td>
</tr>
<tr>
<td>Response delay $t_{on2}$</td>
<td>0...300 s (0 s)*</td>
</tr>
<tr>
<td>Delay on release $t_{on}$</td>
<td>0...300 s (1 s)*</td>
</tr>
<tr>
<td>Operating time $t_{op}$</td>
<td>≤ 70 ms</td>
</tr>
<tr>
<td>Response time $t_{on}$</td>
<td>$t_{on} = t_{on1} + t_{on2}/2$</td>
</tr>
<tr>
<td>Recovery time $t_{re}$</td>
<td>≤ 300 ms</td>
</tr>
</tbody>
</table>

#### Displays, memory

<table>
<thead>
<tr>
<th>Display</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>LC display, multi-functional, not illuminated</td>
</tr>
<tr>
<td>Measuring range measured value x transformation ratio factor</td>
<td>AC 0.01...16 A x n</td>
</tr>
<tr>
<td>Operating error at 50/60 Hz</td>
<td>±3 %, ±2 digits</td>
</tr>
<tr>
<td>Operating error in the range of 42...2000 Hz</td>
<td>±5 %, ±2 digits</td>
</tr>
<tr>
<td>Measured-value memory (HIS) for the first alarm value</td>
<td>data record measured values</td>
</tr>
<tr>
<td>Password</td>
<td>Off/0...999 (OFF)*</td>
</tr>
<tr>
<td>Fault memory (M) alarm relay</td>
<td>on/off (on)*</td>
</tr>
</tbody>
</table>

#### Switching elements

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>2 relays, with one changeover contact each (K1, K2)</td>
</tr>
<tr>
<td>Operating principle</td>
<td>N/C operation n.c./N/O operation n.o. (N/C operation n.c.)*</td>
</tr>
<tr>
<td>Electrical service life under rated operating conditions</td>
<td>10,000 switching operations</td>
</tr>
</tbody>
</table>

#### Environment/EMC

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>-25...+55 °C</td>
</tr>
<tr>
<td>Classification of climatic conditions acc. to IEC 60721:</td>
<td>3K5 (except condensation and formation of ice)</td>
</tr>
<tr>
<td>Transportation (IEC 60721-3-2)</td>
<td>2K3 (except condensation and formation of ice)</td>
</tr>
<tr>
<td>Storage (IEC 60721-3-1)</td>
<td>1K4 (except condensation and formation of ice)</td>
</tr>
<tr>
<td>Classification of mechanical conditions acc. to IEC 60721:</td>
<td>3M4</td>
</tr>
<tr>
<td>Transportation (IEC 60721-3-3)</td>
<td>2M2</td>
</tr>
<tr>
<td>Storage (IEC 60721-3-3)</td>
<td>1M3</td>
</tr>
</tbody>
</table>

#### Connection

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection</td>
<td>push-wire terminals</td>
</tr>
<tr>
<td>Connection properties:</td>
<td>rigid</td>
</tr>
<tr>
<td>flexible without ferrule</td>
<td>0.2...2.5 mm² (AWG 24...14)</td>
</tr>
<tr>
<td>flexible with ferrule</td>
<td>0.75...2.5 mm² (AWG 19...14)</td>
</tr>
<tr>
<td>Stripping length</td>
<td>10 mm</td>
</tr>
<tr>
<td>Opening force</td>
<td>50 N</td>
</tr>
<tr>
<td>Test opening, diameter</td>
<td>2.1 mm</td>
</tr>
</tbody>
</table>

#### Other

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating mode</td>
<td>continuous operation</td>
</tr>
<tr>
<td>Degree of protection DIN EN 60529, internal components</td>
<td>IP30</td>
</tr>
<tr>
<td>Degree of protection DIN EN 60529, terminals</td>
<td>IP20</td>
</tr>
<tr>
<td>Enclosure material</td>
<td>polycarbonate</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>D00034</td>
</tr>
<tr>
<td>Weight</td>
<td>≤ 160 g</td>
</tr>
<tr>
<td>( )* = factory setting</td>
<td></td>
</tr>
</tbody>
</table>

---

#### Dimension diagram (dimensions in mm)
### Displays and controls

1. **Power On LED “ON”** (green): lights when supply voltage is applied and flashes in the event of system fault alarm
2. **Alarm LED “AL1”** (yellow): lights when the set response value is exceeded or flashes in the event of system fault alarm
3. **Alarm LED “AL2”** (yellow): lights when the value falls below the set response value or flashes in the event of system fault alarm.
4. **Multi-functional LC display**
5. **Test button “T”**: Arrow up button: to change the measured value display, move upwards in the menu or to change parameters. To call up the self test: press the button “T” > 1.5 s

### Wiring diagram

1. **Connection to the system/load being monitored**
2. **Supply voltage Us (see ordering information)**
3. **Alarm relay “K1”:** configurable for <I, >I or <I/>I/ERROR/TEST
4. **Alarm relay “K2”:** configurable for <I, >I or <I/>I/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® 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
- r.m.s. 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
- Cyclical 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</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>x/1A</td>
<td>0.1…1 A x n</td>
<td>16…72 V, 15…460 Hz, 9.6…94 V</td>
<td>CMD420-D-1</td>
<td>B 7306 0006</td>
</tr>
<tr>
<td>x/5A</td>
<td>0.5…5 A x n</td>
<td>16…72 V, 15…460 Hz, 9.6…94 V</td>
<td>CMD421-D-1</td>
<td>B 7306 0008</td>
</tr>
</tbody>
</table>

Device version with screw terminals 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>B 9806 0008</td>
</tr>
</tbody>
</table>
### Technical data

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage</td>
<td>AC 250 V</td>
</tr>
<tr>
<td>Rated impulse voltage/pollution degree</td>
<td>6 kV/l</td>
</tr>
</tbody>
</table>

#### Protective separation

- Reinforced insulation: (k1, k2, l1, l2, k3, l3) - (11, 12, 14) - (21, 22, 24)
- Non-reinforced insulation: (k1, k2, l1, l2, k3, l3) - (11, 12, 14) - (21, 22, 24)

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

- CMD420-D-1 | 5.55 kV |
- CMD421-D-1 | 5.55 kV |
- CMD420-D-2 | 4 kV/l |
- CMD421-D-2 | 4 kV/l |

#### Basic insulation

- (k1, k2, l1, l2, k3, l3) - (11, 12, 14) - (21, 22, 24)

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

- Voltage test | 2.21 kV |

### Supply voltage

#### CMD420-D-1, CMD421-D-1:

- Supply voltage | U<sub>se</sub> |
- Frequency range | 15...460 Hz |

#### CMD420-D-2, CMD421-D-2:

- Supply voltage | U<sub>se</sub> |
- Frequency range | 15...460 Hz |

#### Power consumption

- ≤ 4 VA

### Measuring circuit CMD420

#### Nominal measuring range (r.m.s. value) n = 1

- AC 0...1 A

#### Overload capability, continuous

- 2 A

#### Overload capability < 5 s

- 5 A

#### Load per measuring input

- 50 mV

#### Rated frequency f<sub>n</sub>

- 42...2000 Hz

#### Response values CMD420

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undercurrent = I&lt;sub&gt;1&lt;/sub&gt; (Alarm 2) n = 1</td>
<td>AC 0.1...1 A (0.3 A)*</td>
</tr>
<tr>
<td>Overcurrent &gt; I&lt;sub&gt;1&lt;/sub&gt; (Alarm 2) n = 1</td>
<td>100...200 % (150 %)*</td>
</tr>
</tbody>
</table>

#### Overcurrent Hi > I<sub>1</sub> (Alarm 2) n = 1

- AC 0.5...5 A (5 A)* |

#### Window i<sub>1</sub> > i<sub>1</sub> (Alarm 2) n = 1

- AC 0.3 A |

#### Overcurrent Hi > I<sub>1</sub> (Alarm 2) n = 1

- 50...100 % (50 %)* |

#### Window i<sub>1</sub> > i<sub>1</sub> (Alarm 2) n = 1

- 50...100 % (50 %)* |

#### External current transformer

- x = 1 A

#### Transformation ratio n

- 1...2000 (1)* |

#### Relative uncertainty in the range of 42...460 Hz

- ±2 %, ±2 digits

#### Hysteresis

- 3...40 % (15 %)* |

### Measuring circuit CMD421

#### Nominal measuring range (r.m.s. value)

- AC 0...5 A

#### Overload capability, continuous

- 7.5 A

#### Overload capability < 5 s

- with screw-type terminal connection: 20 A

- with push-wire terminals: 12 A

#### Load per measuring input

- 3 mV

#### Rated frequency f<sub>n</sub>

- 42...460 Hz

#### Response values CMD421

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undercurrent = I&lt;sub&gt;1&lt;/sub&gt; (Alarm 2) n = 1</td>
<td>AC 0.5...5 A (5 A)*</td>
</tr>
<tr>
<td>Overcurrent &gt; I&lt;sub&gt;1&lt;/sub&gt; (Alarm 2) n = 1</td>
<td>100...200 % (150 %)*</td>
</tr>
</tbody>
</table>

#### Overcurrent Hi > I<sub>1</sub> (Alarm 2) n = 1

- AC 0.5...5 A (5 A)* |

#### Window i<sub>1</sub> > i<sub>1</sub> (Alarm 2) n = 1

- AC 0.3 A |

#### Overcurrent Hi > I<sub>1</sub> (Alarm 2) n = 1

- 50...100 % (50 %)* |

#### Window i<sub>1</sub> > i<sub>1</sub> (Alarm 2) n = 1

- 50...100 % (50 %)* |

#### External current transformer

- x = 1 A

#### Transformation ratio n

- 1...2000 (1)* |

#### Relative uncertainty in the range of 42...460 Hz

- ±2 %, ±2 digits

#### Hysteresis

- 3...40 % (15 %)* |

### Displays, memory

- Display: LC display, multifunctional, not illuminated

- Display range, measured value (r.m.s. value) x transformation ratio n

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMD420: AC 0...1 A x n</td>
<td></td>
</tr>
<tr>
<td>CMD421: AC 0...5 A x n</td>
<td></td>
</tr>
</tbody>
</table>

#### Operating uncertainty in the range of 42...460 Hz

- ±5 %, ±2 digits

#### Measured-value memory (HiS) for the first alarm value

- Data record of measured values

#### Password

- on/off (off)*

#### Fault memory (M) alarm relay

- on/off (on)*

### Switching elements

#### Number

- 2 x 1 changeover contacts (K1, K2)

#### Operating principle

- N/C operation

#### Utilisation category

- K1: Overcurrent alarm > I1, test button tES (device error Err, overcurrent prewarning > I1, test button tES)*

- K2: Overcurrent alarm > I1, test button tES (device error Err, overcurrent alarm > I1, test button tES)*

### Electrical endurance, number of cycles

- 10,000

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

#### Utilisation category

- AC-13 |
- 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 61326-1

#### Operating temperature

- -25...+55 °C

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

- Stationary use (IEC 60721-3-3)

#### Transport (IEC 60721-3-2)

- 3K (except condensation and formation of ice)

#### Storage (IEC 60721-3-3)

- 1K4 (except condensation and formation of ice)

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

- Stationary use (IEC 60721-3-3)

#### Transport (IEC 60721-3-2)

- 2M2

#### Storage (IEC 60721-3-1)

- 1M3

### Connection

#### Connection type

- push-wire terminals

#### Connection properties

- rigid

#### Flexible without ferrule

- 0.2...2.5 mm² (AWG 24...14)

#### Flexible with ferrule

- 0.75...2.5 mm² (AWG 19...14)

#### Stripping length

- 10 mm

#### Test opening, diameter

- 2.1 mm

### Other

- Operating mode

#### continuous operation

- any position

#### Degree of protection, internal components (IEC 60529)

- Degree of protection, terminals (IEC 60529)

#### IP20

#### Enclosure material

- polycarbonate

#### Flammability class

- UL94 V-0

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

- 2 x M4 with mounting clip

#### Document number

- D00101

#### Weight

- ≤ 150 g

(*) = factory setting
**Multi-functional current relay LINETRAXX® CMD420/CMD421**

**Dimension diagram (dimensions in mm)**

**Displays and controls**

1. Power On LED “ON” (green): lights when supply voltage is applied and flashes in the event of system fault alarm
2. Alarm LED “AL1” (yellow): lights when the value exceeds or falls below the set response values and flashes in the event of system fault alarm
3. Alarm LED “AL2” (yellow): lights when the value exceeds or falls below the set response values and flashes in the event of system fault alarm
4. Multi-functional LC display
5. Test button “T”:
   - Arrow up button: To change the measured value display, move upwards in the menu or to change parameters.
   - To call up the self test: press the button “T” > 1.5 s
6. Reset button “R”:
   - Arrow down button: to change the measured value indication, move downwards in the menu or to change parameters
   - To delete stored alarms: press the button “T” > 1.5 s
7. “MENU” button:
   - Enter button: to confirm the measured value indication or to confirm changed parameters
   - To call up the menu system, press the button “T” > 1.5 s
   - Press the ESC button > 1.5 s to abort an action or to return to the previous menu level

**Wiring diagram**

1. Connection to the conductors to be monitored; using current transformers
2. Supply voltage $U_S$ (see ordering information)
3. Alarm relay “K1”:
   - configurable for $<I$, $>I$ or $<I>/I$ ERROR/TEST
4. Alarm relay “K2”:
   - configurable for alarm $<I$, $>I$ or $<I>/I$ 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
- r.m.s. 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 W…, 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.
### Measuring and monitoring relays | current relays

<table>
<thead>
<tr>
<th>Frequency range of</th>
<th>Rated operating current</th>
<th>Measuring range</th>
<th>Cut-off frequency</th>
<th>Operating characteristics acc. to IEC 60755</th>
<th>Rated insulation voltage (measuring current transformer)</th>
<th>Load</th>
<th>External measuring current transformer</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>I</td>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>W...</td>
</tr>
<tr>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WR...S(P)</td>
</tr>
<tr>
<td>S</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WS...</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td></td>
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<td></td>
<td>flexible</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WX...</td>
</tr>
<tr>
<td>Protocol converters</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>BMS bus – TCP IP via Ethernet</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>BMS bus – Modbus RTU</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Alarm indicator and test combination</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>RS-485 repeater</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Power supply unit for DI-1</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
</tbody>
</table>

#### Technical data

<table>
<thead>
<tr>
<th>Insulation coordination acc. to IEC 60664-1/IEC 60664-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage: 250V</td>
</tr>
<tr>
<td>Rated impulse voltage/pollution degree: 6 kV/3</td>
</tr>
<tr>
<td>Protective separation (reinforced insulation):</td>
</tr>
<tr>
<td>(A1, A2) – (k1, l1, …, k12, R, T/R, T, A, B), (C11, C12, C14), (C21, C22, C24)</td>
</tr>
<tr>
<td>Protective separation (reinforced insulation):</td>
</tr>
<tr>
<td>(C11, C12, C14) – (C22, C22, C24)</td>
</tr>
<tr>
<td>Voltage test acc. to IEC 60100-1: 3.536 kV</td>
</tr>
<tr>
<td>Rated insulation voltage: 250V</td>
</tr>
<tr>
<td>Rated impulse voltage/pollution degree: 4 kV/3</td>
</tr>
<tr>
<td>Basic insulation between:</td>
</tr>
<tr>
<td>(k1, l1, …, k12, R, T/R, T, A, B) – (C11, C12, C14), (C21, C22, C24)</td>
</tr>
<tr>
<td>Voltage test acc. to IEC 60100-1: 2.21 kV</td>
</tr>
</tbody>
</table>

#### Supply voltage

<table>
<thead>
<tr>
<th>DC voltage: 16…94 V, AC voltage: 16…72 V, 42…460 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load: 1 Ω</td>
</tr>
<tr>
<td>Rated insulation voltage (measuring current transformer): 800 V</td>
</tr>
<tr>
<td>Operating characteristics acc. to IEC 60755</td>
</tr>
<tr>
<td>Type A, depending on the type of current transformer (Type A)*</td>
</tr>
<tr>
<td>Rated frequency: 42…2000 Hz (Type A)</td>
</tr>
<tr>
<td>Cut-off frequency: none, IEC, 50 Hz, 60 Hz (none)**</td>
</tr>
<tr>
<td>Measuring range: 100 mA…125 A (measuring current transformer Type A)</td>
</tr>
<tr>
<td>100 mA…30 A (measuring current transformer Type A)*</td>
</tr>
<tr>
<td>Crest factor up to 10 A = 4, up to 125 A = 2</td>
</tr>
<tr>
<td>Rated operating current I&lt;sub&gt;A&lt;/sub&gt; (alarm): 100 mA…125 A (16 A overcurrent)*</td>
</tr>
<tr>
<td>Rated operating current I&lt;sub&gt;A&lt;/sub&gt; (prewarning): 10…100 % x I&lt;sub&gt;A&lt;/sub&gt;*</td>
</tr>
<tr>
<td>Preset for alarm: offset: 0…20 A (1 A)* and 1 x factor 1...99 (3)</td>
</tr>
<tr>
<td>Relative uncertainty: +10…20 %</td>
</tr>
<tr>
<td>Hysteresis: 2…40% (20 %)*</td>
</tr>
<tr>
<td>Factor for additional CT: 2…10; x 1…10 (x 1)*</td>
</tr>
<tr>
<td>Number of measuring channels (per device/system): 12/1080</td>
</tr>
</tbody>
</table>

#### Time response

<table>
<thead>
<tr>
<th>Time response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start-up delay t (start-up) per device: 0…99 s (0 ms)*</td>
</tr>
<tr>
<td>Response delay t&lt;sub&gt;RE&lt;/sub&gt; per channel: 0…999 s (200 ms)*</td>
</tr>
<tr>
<td>Delay on release t&lt;sub&gt;REL&lt;/sub&gt; per channel: 0…999 s (200 ms)*</td>
</tr>
<tr>
<td>Operating time t&lt;sub&gt;OP&lt;/sub&gt; at t&lt;sub&gt;0&lt;/sub&gt; = 1 x in 1/2: ≤ 180 ms</td>
</tr>
<tr>
<td>Operating time t&lt;sub&gt;OP&lt;/sub&gt; at t&lt;sub&gt;0&lt;/sub&gt; = 5 x in 1/2: ≤ 30 ms</td>
</tr>
<tr>
<td>Response time t&lt;sub&gt;R&lt;/sub&gt; for current measurement: t&lt;sub&gt;R&lt;/sub&gt; = t&lt;sub&gt;OP&lt;/sub&gt; + Fast/2</td>
</tr>
<tr>
<td>Scanning time for all measuring channels (current measurement): ≤ 180 ms</td>
</tr>
<tr>
<td>Recovery time t&lt;sub&gt;R&lt;/sub&gt;: 500…600 ms</td>
</tr>
</tbody>
</table>

#### Displays, memory

<table>
<thead>
<tr>
<th>Displays, memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display range measured value: &lt; 10 mA…125 A (measuring current transformer Type A)</td>
</tr>
<tr>
<td>&lt; 10 mA…30 A (measuring current transformer Flex)</td>
</tr>
<tr>
<td>Operating uncertainty: ±10 %</td>
</tr>
<tr>
<td>LEDS: ON/ALARM</td>
</tr>
<tr>
<td>LC display: backlit graphical display</td>
</tr>
<tr>
<td>History memory: 300 data records</td>
</tr>
<tr>
<td>Data logger: 300 data records per measuring channel</td>
</tr>
<tr>
<td>Password: off/0…999 (off)*</td>
</tr>
<tr>
<td>Language: 0, 0B, 0F (GB)*</td>
</tr>
<tr>
<td>Fault memory alarm relay: on/off (off)*</td>
</tr>
</tbody>
</table>

#### Inputs/outputs

<table>
<thead>
<tr>
<th>Inputs/outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test/reset button: internal/external</td>
</tr>
<tr>
<td>Cable length for external test/reset button: 0…10 m</td>
</tr>
</tbody>
</table>

#### Interface

<table>
<thead>
<tr>
<th>Interface/protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-485/BMS</td>
</tr>
<tr>
<td>Baud rate: 9.6 kbit/s</td>
</tr>
<tr>
<td>Cable length: 0…1200 m</td>
</tr>
<tr>
<td>Cable (twisted in pairs, one end of shield connected to PE): recommended: J-Y(ST)Y min. 2x0.8</td>
</tr>
<tr>
<td>Terminating resistor: 120 Ω (0.25 W) connectable via DIP switch</td>
</tr>
<tr>
<td>Device address, BMS bus: 1…90 (2)*</td>
</tr>
</tbody>
</table>

#### Cable lengths for W... WR... S(P), WS... WF... series measuring current transformers

<table>
<thead>
<tr>
<th>Cable lengths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single wire: 0.75 mm²: 0…1 m</td>
</tr>
<tr>
<td>Single wire, twisted: 0.75 mm²: 0…10 m</td>
</tr>
<tr>
<td>Shielded cable: 0.5 mm²: 0…40 m</td>
</tr>
<tr>
<td>Shielded cable (shield connected to terminal l at one end, not connected to earth): recommended: J-Y(ST)Y min. 2x0.8</td>
</tr>
</tbody>
</table>
### Technical data (continued)

#### Switching elements
- **Number**: 2 x 1 changeover contact
- **Operating principle**: NC/N/O operation (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
- **Rated operational voltage**: 230 V, 230 V, 24 V, 110 V, 220 V
- **Rated operational current (common alarm relays)**: 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 ... +55 °C
- **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 (except condensation and formation of ice)
- **Classification of mechanical conditions acc. to IEC 60721**
  - **Stationary use (IEC 60721-3-3)**: 3M4
  - **Transport (IEC 60721-3-2)**: 2M2
  - **Long-time storage (IEC 60721-3-1)**: 1M3

#### Connection
- **Connection**: screw-type terminals
- **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)**: 0.2 ... 1.5/0.2 ... 1.5 mm²
- **Shrouding 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 mounting**: 2 x M4
- **DIN rail mounting acc. to IEC 60715**: 1D0045
- **Documentation number**: 2016/2017
- **Weight**: ≤ 360 g

*( )* factory setting

#### Displays and controls

1. **LED “ALARM 2”** lights up if the measured value falls below or exceeds the “Alarm” response value in a measuring channel.
2. **LED “ALARM 1”** lights up if the measured value falls below or exceeds the “Alarm” response value in a measuring channel.
   In the event of a device error, the LED lights up.
3. The **LED “ON”** lights up when the device is switched on and flashes during power on until the device is ready for operation.
4. **Backlit graphics LC display**
5. **“INFO” button**: to call up standard information
   **ESC** button: to exit the menu function without changing parameters
6. **“TEST” button**: to call up the automatic self test
   **Arrow up button**: Parameter changes, scroll
7. **“RESET” button**: to delete alarm and fault messages
   **Arrow down button**: Parameter changes, scroll
8. **“MENU” button**: to toggle between the standard display, MENU and alarm display
   **Enter button**: to confirm parameter changes

---

**Dimension diagrams** (dimensions in mm)

![Dimension Diagram](image_url)

**Connection**
- **Connection**: screw-type terminals
- **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)**: 0.2 ... 1.5/0.2 ... 1.5 mm²
- **Shrouding 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 mounting**: 2 x M4
- **DIN rail mounting acc. to IEC 60715**: 1D0045
- **Documentation number**: 2016/2017
- **Weight**: ≤ 360 g

*( )* factory setting

**Displays and controls**

1. **LED “ALARM 2”** lights up if the measured value falls below or exceeds the “Alarm” response value in a measuring channel.
2. **LED “ALARM 1”** lights up if the measured value falls below or exceeds the “Alarm” response value in a measuring channel.
   In the event of a device error, the LED lights up.
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   **Arrow up button**: Parameter changes, scroll
7. **“RESET” button**: to delete alarm and fault messages
   **Arrow down button**: Parameter changes, scroll
8. **“MENU” button**: to toggle between the standard display, MENU and alarm display
   **Enter button**: to confirm parameter changes
1. Connection of supply voltage $U_S$ (see ordering information), 6 A fuse recommended.
2. Connection of measuring current transformers CT1…CT12
3. RS-485 interface with BMS protocol
4. External reset button "R" (N/O contact)*
5. External test button "T" (N/O contact). The external "T/R" buttons of several devices must not be connected to one another.

6. Alarm relay "K1": Alarm 1, common alarm for alarm, prewarning, device error, ext. alarm (adjustable)
7. Alarm relay "K2": Alarm 2, common alarm for alarm, prewarning, device error, ext. alarm (adjustable)
8. $R_{\text{on/off}}$: Activate or deactivate the BMS bus terminating resistor (120 Ω)

---

Connection W…, 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 U₅</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 16…72 V; 15…460 Hz 9.6…94 V</td>
<td>GM420-D-1</td>
<td>B 7308 2001</td>
</tr>
<tr>
<td>DC 70…300 V; 15…460 Hz 70…300 V</td>
<td>GM420-D-2</td>
<td>B 7308 2002</td>
</tr>
</tbody>
</table>

Device version with screw terminals on request.

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>
### Technical data

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage</td>
<td>400 V</td>
</tr>
<tr>
<td>Rated impulse voltage/pollution degree</td>
<td>4 kV/3</td>
</tr>
<tr>
<td>Protective separation (reinforced insulation)</td>
<td>(A1, A2) - (E, KE) - (11-12-14) - (21-22-24)</td>
</tr>
</tbody>
</table>

#### Voltage test acc. to IEC 61010-1:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 0…50 V</td>
<td></td>
</tr>
<tr>
<td>DC 0…50 V</td>
<td></td>
</tr>
</tbody>
</table>

### Measuring circuit

#### Loop resistance $R_m$:

<table>
<thead>
<tr>
<th>Measuring range $R_m$</th>
<th>0…100 Ω</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring voltage $U_m$</td>
<td>≤ DC 24 V</td>
</tr>
</tbody>
</table>

#### Extraneous voltage $U_e$:

<table>
<thead>
<tr>
<th>Measuring range $U_e$</th>
<th>AC 0…50 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated frequency $f_r$</td>
<td>42…460 Hz</td>
</tr>
<tr>
<td>Disconnection of the measuring loop at $U_e$</td>
<td>≥ 12 V</td>
</tr>
<tr>
<td>Reconnection of the measuring loop</td>
<td>≤ 10 V</td>
</tr>
<tr>
<td>Permissible extraneous voltage $U_e$</td>
<td>≤ 440 V</td>
</tr>
<tr>
<td>Permissible extraneous DC voltage, without influence on the measurement</td>
<td>DC 0 V</td>
</tr>
</tbody>
</table>

#### Response values

| Loop resistance $R$ (Alarm 1) | 0.1…100 Ω |
| Resolution of setting $R$ | 0.1 Ω |
| Resolution of setting $R$ | 1 Ω |

#### Preset function:

| Loop resistance $R$ (> $R$) | $(R_m + 0.5 \times 0.2) \times 1.5$* |
| Relative uncertainty 0…1 Ω | ±20 %, ±1 digit |
| Relative uncertainty 100 Ω | ±5 %, ±1 digit |
| Hysteresis $R$ | 1…40 % (5 %)* |
| Extraneous voltage $U$ (Alarm 2) | 1…50 V (25 V)* |
| Resolution of setting $U$ | 0.5 V |
| Relative uncertainty $U$ (> $U$) in the range of 50/60 Hz | ±2 %, ±1 digit |
| Relative uncertainty $U$ (> $U$) in the range of 42…460 Hz | ±10 %, ±1 digit |
| Hysteresis $U$ | 1…40 % (5 %)* |

#### Time response

| Start-up delay $t_1$ | 0…99 s (0 s)* |
| Response delay $t_{del}$ | 0…99 s (0 s)* |
| Delay on release $t_{rel}$ | 0…99 s (0.5 s)* |

#### Operating time

| In the case of loop interruption ($R > 50$ kΩ) $t_{IR}$ | ≤ 40 ms |
| In the case of closed loop ($R > R$) $t_{IR}$ | ≤ 500 ms |
| In the case of extraneous voltage ($> U$) and overload (UL) $t_{IR}$ | ≤ 100 ms |
| Response time $t_{R}$ | $t_{R} = t_{IR} + t_{on/2}$ |
| Recovery time $t_0$ | ≤ 300 ms |
| Recovery time $t_{on}$ after safety shutdown | ≤ 1 s |

### Displays, memory

<table>
<thead>
<tr>
<th>Display</th>
<th>LC display, multifunctional, not illuminated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display range, measuring value $R_m$</td>
<td>0…100 Ω</td>
</tr>
<tr>
<td>Display range, measuring value $U_e$</td>
<td>AC 0…50 V</td>
</tr>
<tr>
<td>Operating uncertainty, loop resistance $0…1$ Ω</td>
<td>±10 %, ±1 digit</td>
</tr>
<tr>
<td>Operating uncertainty loop resistance $1…100$ Ω</td>
<td>±5 %, ±1 digit</td>
</tr>
<tr>
<td>Operating uncertainty voltage in the range of 50/60 Hz</td>
<td>±2 %, ±1 digit</td>
</tr>
<tr>
<td>Operating uncertainty voltage in the range of 42…460 Hz</td>
<td>±10 %, ±1 digit</td>
</tr>
</tbody>
</table>

#### History memory (HiS) for the first alarm value

<table>
<thead>
<tr>
<th>Password</th>
<th>on/off (on)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault memory (M) alarm relay</td>
<td>on/off (on)*</td>
</tr>
</tbody>
</table>

### Switching elements

#### Number

| 2 x 1 changeover contacts (K1, K2) |

#### Operating principle

<table>
<thead>
<tr>
<th>N/C operation or N/O operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>K1: Err, &gt; R, OL, &gt; U, IES (device error, loop resistance, measuring current disconnection: N/O operation n.o.)*</td>
</tr>
<tr>
<td>K2: Err, &gt; R, OL, &gt; U, IES (overvoltage: N/O operation n.o.)*</td>
</tr>
</tbody>
</table>

#### Electrical endurability, number of cycles

| 10,000 |

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

<table>
<thead>
<tr>
<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>230 V</td>
<td>230 V</td>
<td>24 V</td>
<td>110 V</td>
<td>220 V</td>
</tr>
</tbody>
</table>

#### Rated operational voltage

| 5 A | 3 A | 1 A | 0.2 A | 0.1 A |

#### Minimum contact rating

| 1 mA at AC/DC 10 V |

### Environment/EMC

#### EMCC

| IEC 61326 |

#### Operating temperature

| -25…+55 °C |

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

| Stationary use (IEC 60721-3-3) |
| JKS (except condensation and formation of ice) |
| Transport (IEC 60721-3-2) |
| KS (except condensation and formation of ice) |
| Long time storage (IEC 60721-3-1) |
| HK (except condensation and formation of ice) |

#### Classification of mechanical conditions acc. to IEC 60721

| Stationary use (IEC 60721-3-3) |
| 3M4 |
| Transport (IEC 60721-3-2) |
| 2M2 |
| Long-time storage (IEC 60721-3-1) |
| 1M3 |

### Connection

#### Connection type

| push-wire terminals |

#### Connection properties

| 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 (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 IEC 60715

| IEC 60715 |

#### Flammability class

| UL94 V-O |

#### Document Number

| D00112 |

#### Weight

| ≤ 150 g |

| (*) = factory setting |
3.2

Loop monitor LINETRAXX® GM420

 Displays and controls

1. Power On LED “ON” (green); lights when supply voltage is applied and flashes in the event of system fault alarm
2. Alarm LED “AL1” (yellow), lights when the set response value $> R$, OL, $> U_f$, ERROR, TEST is exceeded and flashes in the event of system fault alarm
3. Alarm LED “AL2” (yellow), lights when the value falls below the set response value $> R$, OL, $> U_f$, ERROR, TEST and flashes in the event of system fault alarm
4. Multi-functional LC display
5. Test button “T”:
   - Arrow up button: To change the measured value display, move upwards in the menu or to change parameters.
   - To call up the self test: press the button > 1.5 s

 Wiring diagram

1. Supply voltage $U_f$ (see ordering details) via fuse
2. Connection of E to the PE conductor
3. Connection of KE to the loads or the monitoring conductor
4. Alarm relay “K1”: Alarm 1 configurable for $> R$, OL, $> U_f$, ERROR, TEST
5. Alarm relay “K2”: Alarm 2 configurable for $> R$, OL, $> U_f$, ERROR, TEST

6. Test button “T”:
   - To delete stored alarms: press the button “T” > 1.5 s

7. “MENU” button:
   - Enter button: to confirm the measured value indication or to confirm changed parameters
   - To call up the menu system, press the button “T” > 1.5 s
   - Press the ESC button > 1.5 s to abort an action or to return to the previous menu level

When the menu item LED is activated, the alarm LED “AL1” indicates that K1 is in the alarm state. When “AL2” lights up, K2 is in the alarm position.

8. Reset button “R”:
   - Arrow down button: to change the measured value indication, move downwards in the menu or to change parameters
   - To delete stored alarms: press the button “T” > 1.5 s

9. 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.
3.2 Measuring and monitoring relays | Application-specific selection – Loop resistance

Loop monitor RM475/RM475LY

Device features

• RM475: permanently set response value: series resistance 200 Ω, cross resistance 1000 Ω
• RM475LY: series resistance, adjustable 50…500 Ω, cross resistance 1000 Ω
• Adjustable response delay 1…10 s (RM475LY)
• N/O or N/C operation, selectable
• Fault memory behaviour selectable
• Internal/external test/reset button
• LEDs: Power On, alarm, extraneous voltage
• LED bar graph for series resistance
• 2 potential-free changeover contacts
• Modular DIN rail enclosure

Typical applications

• Monitoring conductor for monitoring cables and conductors
• Monitoring of PE loops

Approvals

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

Ordering information

<table>
<thead>
<tr>
<th>Series resistance</th>
<th>Response delay</th>
<th>Supply voltage U/S</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 Ω</td>
<td>&lt; 1 s</td>
<td>AC 230 V, 50…60 Hz</td>
<td>RM475</td>
<td>B 9702 2001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DC</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>90…132 V, 50…60 Hz</td>
<td>RM475-13</td>
<td>B 9702 2002</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9.8…84 V</td>
<td>RM475-21</td>
<td>B 9702 2005</td>
<td></td>
</tr>
<tr>
<td></td>
<td>77…286 V</td>
<td>RM475-23</td>
<td>B 9702 2006</td>
<td></td>
</tr>
<tr>
<td>adjustable 50…500 Ω</td>
<td>adjustable 1…10 s</td>
<td>AC 230 V, 50…60 Hz</td>
<td>RM475LY</td>
<td>B 9702 2007</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DC</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>90…132 V, 50…60 Hz</td>
<td>RM475LY-13</td>
<td>B 9702 2008</td>
<td></td>
</tr>
<tr>
<td></td>
<td>400 V, 50…60 Hz</td>
<td>RM475LY-15</td>
<td>B 9702 2009</td>
<td></td>
</tr>
<tr>
<td></td>
<td>500 V, 50…60 Hz</td>
<td>RM475LY-16</td>
<td>B 9702 2010</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9.8…84 V</td>
<td>RM475LY-21</td>
<td>B 9702 2011</td>
<td></td>
</tr>
<tr>
<td></td>
<td>77…286 V</td>
<td>RM475LY-23</td>
<td>B 9702 2012</td>
<td></td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminating resistor</td>
<td>EV22S</td>
<td>B 984 800</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/3

Supply voltage
Supply voltage $U_s$ see ordering information
Operating range $U_s$ 0.85…1.1 $U_s$
Power consumption $\leq \, 3 \, \text{VA}$

Measuring circuit
RM475
Response value, series resistance 200 $\Omega$
Response value, cross resistance 1000 $\Omega$
Response time $t_{an} < \, 1 \, \text{s}$
RM475LY
Response value, series resistance 50…500 $\Omega$ (200 $\Omega$)*
Response value, cross resistance 1000 $\Omega$
Response time $t_{V} 1…10 \, \text{s}$
Max. extraneous voltage measuring circuit $\leq \, 30 \, \text{V}$
Terminating resistor conductor loop EV22S AC 500 V 1 s

Switching elements
Number of changeover contacts 1 x 2 Operating principle N/C operation/N/O operation (N/C operation)* Fault memory behaviour selectable ON/OFF Electrical endurance, number of cycles 12,000 Contact class IEC 60255-0-20 IB Rated contact voltage AC 230 V/DC 300 V Making capacity AC/DC 5 A Breaking capacity 2 A, AC 230 V, cos phi 0.4 0.2 A, DC 220 V, L/R = 0.04 s

Environment/EMC
EMC immunity acc. to IEC 61000-6-2
EMC emission acc. to IEC 61000-6-4
 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 (device not in operation) 2 g/10…150 Hz
Ambient temperature, during operation $-10…+55 \, ^\circ \text{C}$
Ambient temperature for storage $-40…+70 \, ^\circ \text{C}$
Classification of climatic conditions acc. to IEC 60721-3-3 3K5 (except condensation and formation of ice)

Connection
Connection type modular terminals
Connection properties single wire 0.2…4 mm² flexible 0.25…2.5 mm²

Other
Operating mode continuous operation
Mounting any position
Degree of protection, internal components (IEC 60529) IP30
Degree of protection, terminals (IEC 60529) IP30
Screw mounting 2 x M4 DIN rail mounting acc. to IEC 60715
Flammability class UL94V-2
Documentation number D00133
Weight $\leq \, 400 \, \text{g}$

(* ) factory setting

Dimension diagram (dimensions in mm)

Wiring diagram

1. Line
2. Series resistance
3. Cross resistance
4. Test and reset button “TEST, RESET”
5. Power On LED “ON”
6. Alarm LEDs, light in the case of cross resistance and series resistance faults, flash in the case of extraneous voltage
7. DIP switch for setting the
   – operating principle -N/C or N/O operation
   – Fault memory on/off (on)*
8. Adjustable response value “R”, cross resistance 50…500 $\Omega$
   (RM475LY only)
9. Adjustable time delay “t/s” 1…10 s (RM475LY only)
10. Terminating resistor
11. External test and reset button
12. Alarm relay:
   – N/C operation
   – - - N/O operation
13. Short circuit protection supply voltage 6 A fuse is recommended
SB146
Fault voltage monitor

### Device features
- Voltage monitoring of 6 secondary circuits of welding transformers
- Alarm LEDs for fault voltage per channel, PE/KE interruption, interruption of the measuring line
- Connection monitoring of measuring line and earth connection
- Fault memory
- Reset button
- 1 potential-free changeover contact
- 45 mm enclosure

### Typical applications
- Monitoring of welding equipment according to DIN VDE 0545 (VDE 0545-1)

### Standards
The SB146 series complies with the requirements of the device standard: DIN VDE 0545-1.

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

### Ordering information

<table>
<thead>
<tr>
<th>Supply voltage Uₚ</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 10…65 V</td>
<td>SB146-34</td>
<td>B 9308 3017</td>
</tr>
<tr>
<td>DC 10…90 V</td>
<td>SB146-35</td>
<td>B 9308 3018</td>
</tr>
</tbody>
</table>

### Technical data

#### Insulation coordination acc. to IEC 60664-1
- Rated insulation voltage: AC 800 V
- Rated impulse voltage/pollution degree: 6 kV/3

#### Supply voltage
- Supply voltage Uₚ: see ordering information
- Power consumption: ≤ 3 VA

#### Measuring circuit
- Nominal system voltage Uₚ: 600 V
- Nominal voltage range: 0…1.15 x Uₚ
- Response value
  - Uᵢ for sinusoidal voltages: AC 21.6…24 V, 50…1000 Hz
  - Uᵢ for DC voltages: DC 19…24 V
- Response time tᵢ at 1.1 x Uᵢ max: ≤ 100 ms
- Response time for coupling monitoring: ≤ 3 s
- Recovery time Uᵢ: ≤ 500 ms

#### Switching elements
- Number of changeover contacts: 1 x 1
- Operating principle: N/C operation

#### Fault memory behaviour
- Electrical endurance, number of cycles: 12,000
- Contact class IEC 60255-0-20: IIb
- Rated contact voltage: AC 250 V/DC 300 V
- Making capacity: AC/DC 5 A
- Breaking capacity: 2 A, AC 230 V, cos phi 0.4
  - 0.2 A, DC 220 V, L/R = 0.04 s

#### Environment/EMC
- EMC immunity: acc. to IEC 61000-6-2
- EMC emission: acc. to IEC 61000-6-4
- Shock resistance IEC 60668-2-27 (device in operation): 15 g/11 ms
- Bumping IEC 60668-2-29 (transport): 40 g/6 ms
- Vibration resistance IEC 60668-2-6 (device in operation): 1 g/10…150 Hz
- Vibration resistance IEC 60668-2-6 (device not in operation): 2 g/10…150 Hz
- Ambient temperature, during operation: -10…+55 °C
- Ambient temperature for storage: ≤ -45…+70 °C

#### Classification of climatic conditions acc. to IEC 60721-3-3: 3K5 (except condensation and formation of ice)

#### Connection
- Connection type: modular terminals
- Connection properties: single wire/flexible
  - 0.14…2.5 mm²

#### Other
- Operating mode: continuous operation
- Mounting: any position
- Degree of protection, internal components (IEC 60529): IP30
- Degree of protection, terminals (IEC 60529): IP00
- Screw mounting: no
- DIN rail mounting acc. to: IEC 60715
- Flammability class: UL94V-0
- Documentation number: D00134
- Weight: ≤ 210 g
### Alarm messages

<table>
<thead>
<tr>
<th>Condition</th>
<th>Messages</th>
</tr>
</thead>
<tbody>
<tr>
<td>$U_s$</td>
<td>$U_k&gt;$</td>
</tr>
<tr>
<td>on</td>
<td>–</td>
</tr>
<tr>
<td>on</td>
<td>–</td>
</tr>
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<td>on</td>
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<tr>
<td>on</td>
<td>–</td>
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<tr>
<td>off</td>
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</tr>
</tbody>
</table>

### Wiring diagram

1. Power On LED "ON":
   - lights during operating mode
   - flashes in case of interruption of the connection PE/KE
2. Test button "TEST"
3. Reset button "RESET"
4. Alarm LEDs
   - light in the case of fault voltage
   - flash in case of a fault in the connection monitoring
5. Welding transformers monitored
6. Alarm relay in N/C operation (marked by dotted lines: without fault voltage)
7. 6 A fuse recommended.
8. Unassigned inputs have to be bridged individually
Insulation monitoring devices

ISOMETER®

Equipment for insulation fault location

ISOSCAN®

Power Quality and Energy Measurement

LINETRAXX®

Measuring and monitoring relays

LINETRAXX®

Residual current monitoring systems

LINETRAXX®

System components

Coupling devices
Measuring current transformers
Transformers
Measuring transducers

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

Standards and guidelines applied
Alphabetical list of devices

Technical terms
Service
Device overview residual current monitors LINETRAXX®

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<td>Monitoring of final circuits,</td>
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<td>of electric vehicle AC</td>
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<td>charging stations</td>
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<td>Charge controller with</td>
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<td>AC charging stations</td>
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<th>TN/TT</th>
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<tr>
<td><strong>Residual current monitors</strong></td>
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<tr>
<td>LINETRAXX®</td>
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<tr>
<td>RCM420</td>
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<td>RCMA423</td>
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<td>RCMB35-30-02</td>
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<td>RCMB42…EC CC612</td>
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<table>
<thead>
<tr>
<th><strong>Rated frequency range</strong></th>
<th>42…2000 Hz</th>
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<tbody>
<tr>
<td><strong>Number of measuring channels</strong></td>
<td>1</td>
<td>1</td>
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<td>12 (per device) 1080 (per system)</td>
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<tr>
<td><strong>Response value</strong></td>
<td></td>
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<tr>
<td>(I_{\text{a1}})</td>
<td>50…100 (%) (I_{\text{a2}})</td>
<td>50…100 (%) (I_{\text{a2}})</td>
<td>50…100 (%) (I_{\text{a2}})</td>
<td>10…100 (%) (I_{\text{a2}}) min. 5 mA</td>
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<td>(I_{\text{a2}})</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>
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<td><strong>Response delay</strong> (t_{\text{a0}})</td>
<td>0…10 s</td>
<td>0…10 s</td>
<td>0…10 s</td>
<td>0…99 s</td>
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<tr>
<td><strong>Start-up delay</strong> (t_{\text{a0}})</td>
<td>0…10 s</td>
<td>0…10 s</td>
<td>0…10 s</td>
<td>0…99 s</td>
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<tr>
<td><strong>Delay on release</strong> (t_{\text{a0}})</td>
<td>0…300 s</td>
<td>0…99 s</td>
<td>0…99 s</td>
<td>0…999 s</td>
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| **Operating principle, alarm relays** | N/C operation or N/O operation | N/C operation or N/O operation | N/C operation or N/O operation | N/C operation or N/O operation |

| **Installation** | DIN rail | Screw mounting |  |  |

<table>
<thead>
<tr>
<th><strong>Measuring current transformers</strong></th>
<th>W…</th>
<th>291</th>
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<tr>
<td>WR…5(P)</td>
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<tr>
<td>WS…</td>
<td>299</td>
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<td>WF…</td>
<td>303</td>
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<td>W…AB(P)</td>
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<tr>
<td><strong>Connection cable measuring current transformer</strong></td>
<td>WX…</td>
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<td>WXS…</td>
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<tr>
<td><strong>RS-485 repeater</strong></td>
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<tr>
<td><strong>Power supply units</strong></td>
<td>AN420-1</td>
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<td>AN420-2</td>
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<td>Monitoring of final circuits, DGUV Regulation 3 (German Social Accident Insurance)</td>
<td>Fault current monitoring in installations containing frequency converters</td>
<td>MRCD application</td>
<td>MRCD application</td>
<td>Fault current monitoring of electric vehicle AC charging stations</td>
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<tr>
<td>0…1000 Hz</td>
<td>0…100 Hz</td>
<td>0…1000 Hz</td>
<td>0…10000 Hz</td>
<td>0…2000 Hz</td>
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<tr>
<td>6 virtual 12</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1 (RCMB422EC) or 2 (RCMB420EC)</td>
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<tr>
<td>50…100 % x I (\Delta n_2)</td>
<td>DC 6 mA</td>
<td>DC 6 mA</td>
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<tr>
<td>3…300 mA (Type B)</td>
<td>30 mA</td>
<td>30 mA</td>
<td>RMS 30 mA</td>
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<td>0…600 s</td>
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<td>0,5…600 s</td>
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<tr>
<td>0…600 s (after reset)</td>
<td>2 s</td>
<td>2 s</td>
<td>2 s</td>
<td>(after reset)</td>
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<tr>
<td>Suitable system components</td>
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</table>

**Suitable system components**
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
- 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

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>Type</th>
<th>Art. No.</th>
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</thead>
<tbody>
<tr>
<td>AC 16…72 V, 40…460 Hz</td>
<td>RCM420-D-1</td>
<td>B 7401 4001</td>
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<tr>
<td>DC 9.6…94 V</td>
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<tr>
<td>AC 70…300 V, 40…460 Hz</td>
<td>RCM420-D-2</td>
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<td>DC 70…300 V</td>
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Device version with screw terminals on request.
1) Absolute values

Accessories

<table>
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<tr>
<th>Description</th>
<th>Art. No.</th>
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<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B 9806 0008</td>
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Table of suitable system components

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<th>Suitable system components</th>
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<tbody>
<tr>
<td>Description</td>
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<tr>
<td>Measuring current transformers</td>
</tr>
<tr>
<td>circular</td>
</tr>
<tr>
<td>rectangular</td>
</tr>
<tr>
<td>split-core</td>
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<tr>
<td>flexible</td>
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</table>
Residual current monitoring systems | 1-channel, AC/DC pulsed sensitive residual current monitoring RCM

RCM420-D-1
Rated insulation voltage 100 V
Rated impulse voltage/pollution degree 2.5 kV/3
Overvoltage category III

RCM420-D-2
Rated insulation voltage 250 V
Rated impulse voltage/pollution degree 4 kV/3
Overvoltage category III

Supply voltage
RCM420-D-1
Supply voltage range $U_s$ AC 24...60 V/DC 24...78 V
Operating range $U_s$ AC 16...72 V/DC 9.6...14 V
Frequency range $f_s$ DC 42...460 Hz

RCM420-D-2
Supply voltage range $U_s$ AC/DC 100...250 V
Operating range $U_s$ AC/DC 70...300 V
Frequency range $f_s$ 42...460 Hz

Technical data
Insulation coordination acc. to IEC 60664-1/IEC 60664-3
Rated operational voltage UL 200 V
Rated operational voltage AC 230 V
Rated operational voltage DC 24 V
Rated operational current 10 mA
Rated insulation voltage (measuring current transformer) 1K4
Rated operational current AL1 50 mA
Rated operational current AL2 10 A
Rated residual operating current (prewarning, AL1) 50...100 mA x $n_{AL1}$, (50 %)*
Rated residual operating current (Alarm, AL2) 10 mA...10 A (30 mA)*
Hysteresis 10...25 % (15%)*

Response values
Starting delay $t_{ON1}$ 0...10 s (0.5 s)*
Response delay $t_{ON2}$ (Alarm) 0...10 s (0 s)*
Response delay $t_{OFF1,2}$ (prewarning) 0...10 s (s)*
Delay on release $t_{OFF1}$ 0...300 s (s)*
Operating time $t_{ON1}$ at $I_{ON1} = 3 \times I_{ON1/2}$ ≤ 180 ms
Operating time $t_{ON2}$ at $I_{ON2} = 5 \times I_{ON2/2}$ ≤ 50 ms
Response time $t_{OFF1}$ $t_{OFF1} = t_{OFF1} + 2 \times t_{ON1/2}$
Recovery time $t_{OFF2}$ ≤ 300 ms
Number of reload cycles 0...100 (0)*

Cable lengths for measuring current transformers
Single wire ≥ 0.75 mm² 0...1 m
Single wire, twisted ≥ 0.75 mm² 0...10 m
Shielded cable ≥ 0.75 mm² 0...40 m
Recommended cable (shielded, shield on one side connected to terminal 1 of the RCM420, not connected to earth) J-HSOY min. 2x0.8
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

Swiching 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 10,000 switching operations

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 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 ≥ 10 V

Environment/EMC
EMC IEC 60620
Operating temperature -25...+55 °C

Classification of climatic conditions IEC 60721
Stationary use (IEC 60721-3-3) 3K5 (except condensation and formation of ice)
Transportation (IEC 60721-3-1) 2K3 (except condensation and formation of ice)
Storage (IEC 60721-3-1) 1M (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) 3M4
Transportation (IEC 60721-3-2) 2M2
Storage (IEC 60721-3-1) 1M3

Connection
For UL application
use 60/70°C copper conductors only
Connection type push-wire terminals
Connecting method continuous operation
Connection properties:
Rigid 0.2...2.5 mm² (AWG 19...14)
Flexible without ferrules 0.75...2.5 mm² (AWG 19...14)
Flexible with ferrules 0.2...1.5 mm² (AWG 24...16)

Cable lengths for external test/reset button
0...10 m

Testing
AC 24...60 V/DC 24...78 V
AC 16...72 V/DC 9.6...14 V
DC 42...460 Hz

Dimensions:
70.5 x 67.5 x 36 mm

Recommended cable (shielded, shield on one side connected to terminal 1 of the RCM420, not connected to earth)
J-HSOY min. 2x0.8
Connection screw terminals

Technical data
External measuring current transformer type W... WR... 5(P), WR... 7(P)
Load 68 Ω
Rated insulation voltage (measuring current transformer) 800 V
Operating characteristic acc. to IEC 62020 type A
Frequency range 42...200 kHz
Measuring range 3 mA...16 A
Relative uncertainty 0...-20 %
Operating uncertainty 0...+30 %

Response values
Rated residual operating current $I_{ON1}$ (prewarning, AL1) 50...100 % x $I_{OFF1}$, (50 %)*
Rated residual operating current $I_{ON2}$ (Alarm, AL2) 10 mA...10 A (30 mA)*
Hysteresis 10...25 % (15%)*

Specific time
Starting delay $t_{ON1}$ 0...10 s (0.5 s)*
Response delay $t_{ON2}$ (Alarm) 0...10 s (0 s)*
Response delay $t_{OFF1,2}$ (prewarning) 0...10 s (s)*
Delay on release $t_{OFF1}$ 0...300 s (s)*
Operating time $t_{ON1}$ at $I_{ON1} = 3 \times I_{ON1/2}$ ≤ 180 ms
Operating time $t_{ON2}$ at $I_{ON2} = 5 \times I_{ON2/2}$ ≤ 50 ms
Response time $t_{OFF1}$ $t_{OFF1} = t_{OFF1} + 2 \times t_{ON1/2}$
Recovery time $t_{OFF2}$ ≤ 300 ms
Number of reload cycles 0...100 (0)*

Cable lengths for measuring current transformers
Single wire ≥ 0.75 mm² 0...1 m
Single wire, twisted ≥ 0.75 mm² 0...10 m
Shielded cable ≥ 0.75 mm² 0...40 m
Recommended cable (shielded, shield on one side connected to terminal 1 of the RCM420, not connected to earth)
J-HSOY min. 2x0.8
Connection screw terminals

Dimension diagram (dimensions in mm)
Displays and controls

1. Power On LED “ON” (green); lights when supply voltage is applied and flashes in the event of system fault alarm respectively in the event of CT malfunction.

2. Alarm LED “AL1” (yellow), prewarning; lights when the set response value $I_{Δn1}$ is exceeded or flashes in the event of system fault alarm respectively in the event of CT malfunction

3. Alarm LED “AL2” (yellow), alarm; lights when the set response value $I_{Δn2}$ is exceeded or flashes in the event of system fault alarm respectively in the event of CT malfunction

4. Multi-functional LC display

5. Test button “T”: to call up the self test.

6. Arrow up button: parameter change, to move up in the menu

7. Reset button “R”: to delete saved alarms.

8. Arrow down button: parameter change, to move down in the menu

9. “MENU” button: to call up the menu system.

10. Enter button: to confirm parameter change.

11. “ESC” button: press the button “T” > 1.5 s

Wiring diagram

1. Supply voltage $U_S$ see ordering information, 6 A fuse recommended

2. Connection of the external measuring current transformer

3. Alarm relay “K1”: configurable for alarm $I_{Δn1}/I_{Δn2}/TEST/ERROR$

4. Alarm relay “K2”: configurable for alarm $I_{Δn1}/I_{Δn2}/TEST/ERROR$

5. Combined test and reset button “T/R” short-time pressing (< 1.5 s) = RESET

6. Long-time pressing (> 1.5 s) = TEST

7. 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
• Push-wire terminal (two terminals per connection)

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)

Approvals

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

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage Uₜ</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 16…72 V, 42…460 Hz</td>
<td>RCMA420-D-1</td>
<td>B 7404 3001</td>
</tr>
<tr>
<td>DC 9.6…94 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC 70…300 V, 42…460 Hz</td>
<td>RCMA420-D-2</td>
<td>B 7404 3002</td>
</tr>
<tr>
<td>DC 70…300 V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Device version with screw terminals on request.

Supplied current transformers

<table>
<thead>
<tr>
<th>Description</th>
<th>Type of construction</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring current transformers</td>
<td>circular</td>
<td>W…AB(P)</td>
<td>294</td>
</tr>
<tr>
<td>Connection cable measuring current transformer</td>
<td>–</td>
<td>WX…</td>
<td>294</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>B 9806 0008</td>
</tr>
</tbody>
</table>

Suitable system components

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>RCM420-D-1:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage</td>
<td>100 V</td>
</tr>
<tr>
<td>Rated impulse voltage/pollution degree</td>
<td>2.5 kV/3</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>III</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RCM420-D-2:</th>
<th></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>Overvoltage category</td>
<td>III</td>
</tr>
</tbody>
</table>

**Supply voltage**

<table>
<thead>
<tr>
<th>RCM420-D-1:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage range $U_S$</td>
<td>AC 24…60 V/DC 24…78 V</td>
</tr>
<tr>
<td>Operating range $U_S$</td>
<td>AC 16…72 V/DC 9.6…94 V</td>
</tr>
<tr>
<td>Frequency range $f_S$</td>
<td>DC, 42…460 Hz</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RCM420-D-2:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage range $U_S$</td>
<td>AC/DC 100…250 V</td>
</tr>
<tr>
<td>Operating range $U_S$</td>
<td>AC/DC 70…300 V</td>
</tr>
<tr>
<td>Frequency range $f_S$</td>
<td>42…460 Hz</td>
</tr>
</tbody>
</table>

**Protective separation (reinforced insulation) between**

(A1, A2) - (k/L) TR - (11, 12, 14) - (21, 22, 24)

**Voltage test according to IEC 61010-1**

2.21 kV

**Power consumption**

$\leq 6.5$ VA

**Measuring circuit**

External measuring current transformer

W20AB, W35AB(P), W60AB(P) series

Rated insulation voltage (measuring current transformer) | 800 V |

Operating characteristic acc. to IEC 62020 and IEC/TR 60755

Type B

Frequency range

$0…2000$ Hz

Measuring range AC

$0…1.5$ A

Measuring range DC

$0…600$ mA

Relative uncertainty for $f \geq 2$ Hz or $\geq 16$ Hz

$0…15$ %

Relative uncertainty for $f > 2…<16$ Hz

$-35…+100$ %

Operating uncertainty

$0…35$ %

**Response values**

Rated residual operating current $I_{\text{res1}}$ (prewarning, AL1) | $0…100$ % $\times I_{\text{max2}}$, (50 %)* |

Rated residual operating current $I_{\text{res2}}$ (Alarm, AL2) | $10…500$ mA (30 mA)* |

Hysteresis

$0…25$ % (13%)*

**Specified times**

Starting delay $t_1$

$0…10$ s (0.5 s)*

Response delay $t_2$ (alarm)

$0…10$ s (0.5 s)*

Response delay $t_3$ (prewarning)

$0…10$ s (1 s)*

Delay on release $t_{\text{on}}$

$0…99$ s (5 s)*

Operating time $t_{\text{ov}}$ at $I_{\text{max}} = 1 \times I_{\text{max}}/2$

$\leq 180$ ms

Operating time $t_{\text{ov}}$ at $I_{\text{max}} = 5 \times I_{\text{max}}/2$

$\leq 38$ ms

Response time $t_{\text{off}}$

$t_{\text{on}} = f_{\text{on}} + f_{\text{on}}/2$

Recovery time $t_{\text{b}}$

$\leq 300$ ms

**Displays, memory**

Display range, measured value AC

$0…1.5$ A

Display range, measured value DC

$0…600$ mA

Error of indication

$\pm 17.5$ %/$\pm 2$ 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 WX...

$1$ m/2.5 m/5 m/10 m or alternatively: single wire $6 \times 0.75$ mm²

$0…10$ m

**Switching elements**

Number of switching elements

$2 \times 1$ changeover contact

Operating principle

N/C operation/N/O operation (N/C operation)*

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 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 $\geq 10$ V

**Environment/EMC**

EMC

IEC 62020

Operating temperature

$-25…+55$ °C

Stationary use (IEC 60721-3-3)

3K5 (except condensation and formation of ice)

Transportation (IEC 60721-3-2)

2K3 (except condensation and formation of ice)

Storage (IEC 60721-3-1)

1K4 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)

3M4

Transportation (IEC 60721-3-2)

2M2

Storage (IEC 60721-3-1)

1M3

**Connection**

For UL applications:

use 60/70°C copper conductors only

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)

Shimming 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 60652) | IP30

Degree of protection, terminals (IEC 60652) | IP20

Enclosure material

polycarbonate

Flammability class

UL94V-0

DIN rail mounting acc. to

IEC 60715

Screw fixing

$2 \times M4$ with mounting clip

Documentation number

D00059

Weight

$\leq 150$ g

(* = factory setting)

**Dimension diagram** (dimensions in mm)
Displays and controls

1. Power On LED "ON" (green); lights when supply voltage is applied and flashes in the event of system fault alarm respectively in the event of CT malfunction.
2. Alarm LED "AL1" (yellow), prewarning; lights when the set response value $I_{\Delta n1}$ is exceeded or flashes in the event of system fault alarm respectively in the event of CT malfunction.
3. Alarm LED "AL2" (yellow), alarm; lights when the set response value $I_{\Delta n2}$ is exceeded or flashes in the event of system fault alarm respectively in the event of CT malfunction.
4. Multi-functional LC display
5. Test button "T": to call up the self test.
   Arrow up button: parameter change, to move up in the menu
6. Reset button "R": to delete saved alarms.
   Arrow down button: parameter change, to move down in the menu
7. "MENU" button: to call up the menu system.
   Enter button: to confirm parameter change.
   "ESC" button: press the button > 1.5 seconds.

Connection of measuring current transformers

1. Supply voltage $U_S$ see ordering information, 6 A fuse recommended
2. Connector for the external W20AB...W60AB series measuring current transformer
3. Alarm relay "K1": $I_{\Delta n1}$ (prewarning)
4. Alarm relay "K2": alarm $I_{\Delta n2}$ (alarm)
5. Combined test and reset button "T/R" short-time pressing (≤ 1.5 s) = RESET long-time pressing (> 1.5 s) = TEST
   Do not route the PE conductor through the measuring current transformer!

Wiring diagram

1. Power On LED "ON" (green); lights when supply voltage is applied and flashes in the event of system fault alarm respectively in the event of CT malfunction.
2. Alarm LED "AL1" (yellow), prewarning; lights when the set response value $I_{\Delta n1}$ is exceeded or flashes in the event of system fault alarm respectively in the event of CT malfunction.
3. Alarm LED "AL2" (yellow), alarm; lights when the set response value $I_{\Delta n2}$ is exceeded or flashes in the event of system fault alarm respectively in the event of CT malfunction.

Connection to the RCMA423 residual current monitor using the WX... connecting cable.
Colour coding for WX...: 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
- Sealed transparent cover
- Push-wire terminal (two terminals per connection)
- Two-module enclosure (36 mm)

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

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)

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage U_s</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 16…72 V, 42…460 Hz</td>
<td>RCMA423-D-1</td>
<td>B 7404 3023</td>
</tr>
<tr>
<td>DC 9.6…94 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC 70…300 V, 42…460 Hz</td>
<td>RCMA423-D-2</td>
<td>B 7404 3025</td>
</tr>
<tr>
<td>DC 70…300 V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Device version with screw terminals on request.

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>Type of construction</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring current transformers</td>
<td>circular</td>
<td>W…AB(P)</td>
<td>294</td>
</tr>
<tr>
<td>Connection cable measuring current transformer</td>
<td>–</td>
<td>WX…</td>
<td>294</td>
</tr>
</tbody>
</table>
Technical data

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

RCMA423-D-1:
- Rated insulation voltage: 100 V
- Rated impulse voltage/pollution degree: 2.5 kV/3
- Overvoltage category: III

RCMA423-D-2:
- Rated insulation voltage: 250 V
- Rated impulse voltage/pollution degree: 4 kV/3
- Overvoltage category: III

Supply voltage
RCMA423-D-1:
- Supply voltage range $U_1$: AC 24…60 V/DC 24…78 V
- Operating range $U_1$: AC 16…72 V/DC 9.6…94 V
- Frequency range $f_1$: DC 42…460 Hz

RCMA423-D-2:
- Supply voltage range $U_1$: AC/DC 100…250 V
- Operating range $U_1$: AC/DC 70…300 V
- Frequency range $f_1$: 42…460 Hz

Proper separation (reinforced insulation) between (A1, A2) - (k1, L/R) - (11, 12, 14) - (21, 22, 24)
Voltage test according to IEC 61010-1: 2.21 kV
Power consumption: ≤ 6.5 VA

Measuring circuit
External measuring current transformer: W20AB, W35AB(P), W60AB(P), W120AB, W210AB series
Rated insulation voltage (measuring current transformer): 800 V
Operating characteristic acc. to IEC 62020 and IEC/TR 60755: Type B
Rated frequency: 0…2000 Hz
Relative uncertainty for $f ≤ 2$ Hz or $≥ 16$ Hz: 0…-35 %
Relative uncertainty for $f > 2$ Hz…<16 Hz: -35 %…+100 %
Operating uncertainty: 0…35 %

Response values
Rated residual operating current $I_{n1}$ (prewarning, AL1): 50…100 % of $I_{n2}$ (50 %)*
Rated residual operating current $I_{n2}$ (alarm, AL2): 30 mA…3 A (30 mA)*
Hysteresis: 10…25 % (15%)*

Specified time
Start-up delay $t$: 0…10 s (0.5 s)*
Response delay $t_{r1}$ (prewarning): 0…10 s (1 s)*
Response delay $t_{r2}$ (alarm): 0…10 s (0 s)*
Delay on release $t_{o}$: 0…99 s (1 s)*
Operating time $t_{w}$ bei $I_{n1} = I_1$: ≤ 100 ms
Operating time $t_{w2}$ bei $I_{n2} = 5 \times I_1$: ≤ 10 s
Response time $t_{h1}$: $t_{h1} = t_{o} + t_{r1}/2$
Recovery time $t_{h2}$: ≤ 300 ms

Displays, memory
Display range, measured value AC/DC: 0…6 A
Error of indication: ±17.5 %/±2 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: 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 endurance, number of cycles: 10,000
- Contact data acc. to IEC 60947-5-1: Type B
- 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 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 mKA at AC/DC ≥ 10 V

Environment/EMC
- Operating temperature: -25…+55 °C
- EMC: IEC 62020
- Classification of climatic conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): JKS (no condensation, no formation of ice)
  - Transport (IEC 60721-3-2): 2K3
  - Long-term storage (IEC 60721-3-1): 1K4
- Classification of mechanical conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3M4
  - Transport (IEC 60721-3-2): 2M2
  - Long-term storage (IEC 60721-3-1): 1M3

Connection
- For UL application: use 60/70°C copper conductors only
  - 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

Other
- Operating mode: continuous operation
  - Position of normal use: display-oriented
  - Degree of protection, internal components (IEC 60529): IP20
  - Degree of protection, terminals (IEC 60529): IP20
  - Enclosure material: polycarbonate
  - Flammability class: UL94V-0
  - DIN rail mounting acc. to: IEC 60715
  - Screw mounting: 2 x M4 with mounting clip
  - Documentation number: D00053
  - Weight: ≤ 150 g

( )* = factory setting
Displays and controls

1. Power On LED “ON” (green); lights when supply voltage is applied and flashes in the event of system fault alarm respectively in the event of CT malfunction.
2. Alarm LED “AL1” (yellow), prewarning: lights when the set response value $I_{\Delta n1}$ is exceeded or flashes in the event of system fault alarm respectively in the event of CT malfunction.
3. Alarm LED “AL2” (yellow), alarm; lights when the set response value $I_{\Delta n2}$ is exceeded or flashes in the event of system fault alarm respectively in the event of CT malfunction.

Wiring diagram

1. Supply voltage $U_S$ see ordering information, 6 A fuse recommended.
2. Connector for the external W20AB...W210AB series measuring current transformer.
3. Alarm relay “K1”: $I_{\Delta n1}$ (prerwarning).
5. Combined test and reset button “T/R”: short-time pressing (< 1.5 s) = RESET, long-time pressing (> 1.5 s) = TEST.

Connection of measuring current transformers

Connection to the RCMA423 residual current monitor using the WX… connecting cable.
Colour coding for WX…: 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 and alarm LEDs
- Data exchange via BMS bus
- Password protection for device setting
- Continuous CT connection monitoring
- RoHS compliant

Typical applications
- Measuring and evaluating residual, fault and rated currents of loads and installations in the frequency range of 0...2000 Hz (W, WR, WS, WF series measuring current transformers), 42...2000 Hz (W, 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

Standards
The LINETRAXX® RCMS460/490 series complies with the requirements of the device standards: DIN EN 62020 (VDE 0663) and IEC 62020.

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

<table>
<thead>
<tr>
<th>Description</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>6 mA…20 A</td>
<td>10 mA…10 A</td>
<td>2 x 1 changeover contact</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>16…72 V, 42…460 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>70…276 V, 42…460 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>100 mA…125 A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>16…72 V, 42…460 Hz</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>70…276 V, 42…460 Hz</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Absolute values

### Ordering information RCMS460/490-D

<table>
<thead>
<tr>
<th>Order information</th>
<th>RCMS460/490-D</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 channels for load current measurement</td>
<td>4 channels for current measurement</td>
</tr>
<tr>
<td>Supply voltage $U_s$</td>
<td>Type</td>
</tr>
<tr>
<td>AC</td>
<td>DC</td>
</tr>
<tr>
<td>16…72 V, 42…460 Hz</td>
<td>RCMS460-D-1</td>
</tr>
<tr>
<td>70…276 V, 42…460 Hz</td>
<td>RCMS460-D-2</td>
</tr>
<tr>
<td>16…72 V, 42…460 Hz</td>
<td>RCMS460-D4-1</td>
</tr>
<tr>
<td>70…276 V, 42…460 Hz</td>
<td>RCMS460-D4-2</td>
</tr>
<tr>
<td>16…72 V, 42…460 Hz</td>
<td>RCMS490-D-1</td>
</tr>
<tr>
<td>70…276 V, 42…460 Hz</td>
<td>RCMS490-D-2</td>
</tr>
<tr>
<td>16…72 V, 42…460 Hz</td>
<td>RCMS490-D4-1</td>
</tr>
<tr>
<td>70…276 V, 42…460 Hz</td>
<td>RCMS490-D4-2</td>
</tr>
</tbody>
</table>

1) Absolute values

### Ordering information RCMS460/490-L

<table>
<thead>
<tr>
<th>Order information</th>
<th>RCMS460/490-L</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 channels for load current measurement</td>
<td>4 channels for load current measurement</td>
</tr>
<tr>
<td>Supply voltage $U_s$</td>
<td>Type</td>
</tr>
<tr>
<td>AC</td>
<td>DC</td>
</tr>
<tr>
<td>16…72 V, 42…460 Hz</td>
<td>RCMS460-L-1</td>
</tr>
<tr>
<td>70…276 V, 42…460 Hz</td>
<td>RCMS460-L-2</td>
</tr>
<tr>
<td>16…72 V, 42…460 Hz</td>
<td>RCMS490-L-1</td>
</tr>
<tr>
<td>70…276 V, 42…460 Hz</td>
<td>RCMS490-L-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>B 990 995</td>
</tr>
</tbody>
</table>

### Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Version</th>
<th>Type of construction</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring current transformers</td>
<td>pulsed DC sensitive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connecting cable measuring current transformers $W…AB(P)$</td>
<td></td>
<td></td>
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<tr>
<td>Protocol converters</td>
<td>BMS-Ethernet-Gateway</td>
<td>COM460IP</td>
<td></td>
<td>335</td>
</tr>
<tr>
<td>BMS bus – Modbus RTU</td>
<td></td>
<td>COM462RTU</td>
<td></td>
<td>341</td>
</tr>
<tr>
<td>RS-485 repeater</td>
<td></td>
<td></td>
<td>DI-1DL</td>
<td>329</td>
</tr>
<tr>
<td>Power supply unit</td>
<td>for supplying up to six $W…AB(P)$ series measuring current transformers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>for DI-1</td>
<td>AN420-1</td>
<td>324</td>
</tr>
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<td>AN420-2</td>
<td>324</td>
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<td>AN110-1</td>
<td>320</td>
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<td>AN110-2</td>
<td>320</td>
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<td>AN471</td>
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</table>
### Overview of device types

<table>
<thead>
<tr>
<th>Device features/distinguishing features</th>
<th>RCMS460-D/-L</th>
<th>RCMS460-L</th>
<th>RCMS490-D/-L</th>
<th>RCMS490-L</th>
<th>...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement circuit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measuring channels per device</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>W, WR, W5(P), W6, W8, W9, AB(P), W...</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Measuring current transformer</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>CT monitoring</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>AC/DC sensitive 0...2000 Hz (Type B)</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>
<td></td>
</tr>
<tr>
<td>Pulsed DC sensitive 42...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 (Alarm)</td>
<td>100 mA...125 A</td>
<td>100 mA...125 A</td>
<td>100 mA...125 A</td>
<td>100 mA...125 A</td>
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<tr>
<td>Measuring circuit</td>
<td></td>
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<tr>
<td>Parameter setting function</td>
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<td></td>
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<tr>
<td>Master/Slave</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Address range</td>
<td>1...90</td>
<td>1...90</td>
<td>1...90</td>
<td>1...90</td>
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</tr>
<tr>
<td>Measuring circuit</td>
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<tr>
<td>Rated residual operating current</td>
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<tr>
<td>Rated residual operating current</td>
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<tr>
<td>Hysteresis</td>
<td>2...40 %</td>
<td>2...40 %</td>
<td>2...40 %</td>
<td>2...40 %</td>
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<tr>
<td>Preset function for I∆n2 and I/O</td>
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<tr>
<td>Switching elements</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>
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</tr>
<tr>
<td>Start-up delay 0...99 s</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Response delay tv, adjustable 0...999 s</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Operating time at</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Analysis of the harmonics (I, DC, THF)</td>
<td></td>
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<tr>
<td>History memory 300 data records</td>
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<tr>
<td>Data logger for 300 data records/channel</td>
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<tr>
<td>Internal clock</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Password</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Language English, German, French, Swedish</td>
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<tr>
<td>Backlight graphics LC display</td>
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<tr>
<td>7-segment display and LED line</td>
<td></td>
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</tr>
</tbody>
</table>

* only in conjunction with RCMS4xx-D, MK2430 or COM460IP
Insulation coordination acc. to IEC 60664-1/IEC 60664-3 for the versions:

a) RCMS4x0-D-01
Supply voltage Uₜ: AC 24…60 V/DC 24…75 V (AC/DC ±20 %)
Supply voltage frequency: DC, 50/60 Hz
Rated insulation voltage: 100 V
Rated impulse voltage/pollution degree: 2.5 kV/V3
Overvoltage category: III
Protective separation (reinforced insulation) between: (A1, A2) - (K1, L1, 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/V3
Overvoltage category: III
Basic insulation between: (A1, A2) - (K1, L1, R, T, A, B) - (C1, C2, C4) - (C2, C2, C4) - (11,14) - (21, 24) - (31, 34) - (41, 44) - (51, 54) - (61, 64)
Voltage test acc. to IEC 61010-1: 2.21 kV
Rated insulation voltage: 250 V
Rated impulse voltage/pollution degree: 6 kV/V3
Overvoltage category: III
Basic insulation between: (C1, C2) - (C2, C2) - (11,14) - (21, 24) - (31, 34) - (41, 44) - (51, 54) - (61, 64)
Voltage test acc. to IEC 61010-1: 3.536 kV

b) RCMS4x0-D-02
Supply voltage Uₜ: 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/V3
Overvoltage category: III
Basic insulation between: (K1, L1…R, T, A, B) - (C1, C2, C4) - (C2, C2, C4) - (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: 2.21 kV
Rated insulation voltage: 250 V
Rated impulse voltage/pollution degree: 6 kV/V3
Overvoltage category: III
Basic insulation between: (11, 14) - (21, 24) - (31, 34) - (41, 44) - (51, 54) - (61, 64)
Voltage test acc. to IEC 61010-1: 3.536 kV

Measuring circuit
External measuring current transformers
W…, WR…, WS…, WF… series (Type A), W…, WA… series (Type A)
CT monitoring
on/off (on)*
Rated burden RCMS…-D/-L: 68 Ω
Rated burden RCMS…-D4/-L4 (channels 9…12 only): 1 Ω
Rated insulation voltage (measuring current transformer): 800 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 1B) / 42…2000 Hz (Type 1B)
Cut-off frequency nonlinearity, IEC 50, 60 Hz (nonlinear)*
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
Rated residual operating current Iₜ₂₉ (alarm): 10 mA…10 A (Type B)
6 mA…20 A (Type A)
100 mA overcurrent*)
Rated residual operating current Iₜ₂₉ (alarm) for RCMS…-D4/-L4 (channels 9…12 only): 100 mA…125 A (16 A overcurrent*)
Rated residual operating current Iₜ₂₉ (warning): min. 5 mA (50 %)*
Digital input
T: ≤ 100 Ω
0: ≥ 250 Ω
Digital input
n factor: 0...1...99...100 (3)*
Offset 0...20 (30 mA)*
Relative uncertainty RCMS…-D/-L: 0...20 %*
Relative uncertainty RCMS…-D4/-L4 (channels 9…12 only): +10...-20 %*
Hysteresis: 2...40 % (20 %)*
Factor for additional CT
1/1...10 x 1...250 x (1)*
Number of measuring channels (per device/system): 12/1080
## Displays and controls

1. LED ALARM "2" lights up when the measured value falls below or exceeds the response value in a measuring channel or an error is indicated by the digital input.
2. LED "ALARM 1" lights up if the measured value exceeds or falls below the "Prewarning" response value in a channel or in the event of device error.
3. Power On LED "ON" lights up when the device is switched on or flashes until the device is ready for operation during switching on.
4. Illuminated graphic LCD
5. "INFO" button: to query standard information (does not apply to RCMS4...-L)
   ESC button: to exit the menu function without changing parameters

6. Test button "TEST": to call up the self test
7. Arrow up button: Parameter changes, scroll
8. Reset button "RESET": to delete alarm and fault messages
9. Arrow down button: Parameter changes, scroll
10. "MENU" button: RCMS460-D/490-D: to toggle between the standard display, menu and alarm display
    "SET" button: RCMS460-D/490-D: to set the BMS address
11. Enter button: to confirm parameter changes
12. Alarm LEDs "1...12" light up when a fault has been detected in the relevant measuring channel or flash if there is a fault with the measuring current transformer
13. Digital display for device address and error codes.
Residual current monitoring systems | Multichannel residual current monitoring RCMS
Residual current monitors LINETRAXX® RCMS460-D/-L – RCMS490-D/-L

1. Connection of supply voltage $U_S$ (see ordering information), 6 A fuse recommended.
2. Connection of measuring current transformers CT1…CT12. Either Type A or Type B measuring current transformers can be selected for each measuring channel. Six W…AB(P) series measuring current transformers require one AN420 or AN110 power supply unit. The channels k9…k12 of the device versions RCMS460-D4/-L4 require the connection of Type A measuring current transformers.
3. RS-485 interface with BMS protocol
4. External reset button “R” (N/O contact)*
5. External test button “T” (N/O contact) The external “T/R” buttons of several devices must not be connected to one another.
6. Alarm relay “K1”: Alarm 1, common alarm for alarm, prewarning, device error, ext. alarm (adjustable)
7. Alarm relay “K2”: Alarm 2, common alarm for alarm, prewarning, device error, ext. alarm (adjustable)
8. $\text{Ron/off}$ : Activate or deactivate the BMS bus terminating resistor (120)
9. Alarm relay: N/O contact per channel

---

**Wiring diagrams**

1. Connection of supply voltage $U_S$ (see ordering information), 6 A fuse recommended.
2. Connection of measuring current transformers CT1…CT12. Either Type A or Type B measuring current transformers can be selected for each measuring channel. Six W…AB(P) series measuring current transformers require one AN420 or AN110 power supply unit. The channels k9…k12 of the device versions RCMS460-D4/-L4 require the connection of Type A measuring current transformers.
3. RS-485 interface with BMS protocol
4. External reset button “R” (N/O contact)*
5. External test button “T” (N/O contact) The external “T/R” buttons of several devices must not be connected to one another.
6. Alarm relay “K1”: Alarm 1, common alarm for alarm, prewarning, device error, ext. alarm (adjustable)
7. Alarm relay “K2”: Alarm 2, common alarm for alarm, prewarning, device error, ext. alarm (adjustable)
8. $\text{Ron/off}$ : Activate or deactivate the BMS bus terminating resistor (120)
9. Alarm relay: N/O contact per channel

---

**Digital input**

1. Potential-free contact
   - $\Omega$ Resistance between $k$ and $l > 250 \, \Omega$
   - $\Delta$ Resistance between $k$ and $l < 100 \, \Omega$
2. Measuring current transformers
Residual current monitoring systems | Multichannel residual current monitoring RCMS

Residual current monitors LINETRAXX® RCMS460-D/-L – RCMS490-D/-L

Analogue output
Connection W..., WR..., W... series measuring current transformers (pulsed current sensitive)

Connection W...AB(P) series measuring current transformer (AC/DC current sensitive)

Connection WF... series measuring current transformers
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 AC/DC sensitive measuring current transformers of the W…AB(P) series are used, an AN420 or AN110* is required that supplies up to six measuring current transformers of this type.
2. The DI-1DL repeater only is required when the length of the cable exceeds 1200 m or when more than 32 devices are connected to the bus.

When the supply voltage of AN110-1 is < 30 V, the output power decreases, so that only 5 measuring current transformers can be connected.
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 RMS, 1 x DC)
- Compatible with RCMS460/490 in a system setup
- Ideal for applications with space limitations
- Easy DIN rail or screw mounting to standard distribution panels
- 2 separately adjustable response values (DC or 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 COM460IP, COM465IP, CP700
- Up to 534 measuring channels in the monitored system that can be combined via BMS bus
- RS-485 interface with BMS bus (Modbus RTU on request)
- BMS address range 2…90

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 U₅</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC 24V</td>
<td>RCMS150</td>
<td>B 9405 3025</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>B 9108 0110</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>COM465IP</td>
<td></td>
</tr>
<tr>
<td>Condition Monitor</td>
<td>CP700</td>
<td></td>
</tr>
<tr>
<td>RS-485 repeater</td>
<td>DI-1DL</td>
<td></td>
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<tr>
<td>Power supply</td>
<td>AN410</td>
<td></td>
</tr>
<tr>
<td>Residual current monitor</td>
<td>RCMS460-D-1</td>
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<tr>
<td>RCMS460-D-2</td>
<td></td>
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<tr>
<td>RCMS490-D-1</td>
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<tr>
<td>RCMS490-D-2</td>
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</tr>
</tbody>
</table>

1) from function module C
2) suitable for measured value and alarm indication only, not suitable for parameter setting
The data are valid for the monitored primary circuit to the output circuit:

- **Output circuit**
- **Rated insulation voltage**: 300 V
- **Overvoltage category**: III
- **Rated impulse withstand voltage monitored circuit/output circuit**: 4 kV
- **Range of use**: ≤ 2000 m AMSL
- **Rated insulation voltage**: 250 V
- **Pollution degree**: 3

**Insulation**

- **BI**: Overvoltage category III
- **DI**: Overvoltage category II

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

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

- **AC 2.2 kV**

**Power supply**

- **Nominal supply voltage**: 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**
  - \( I_{\Delta N2}\text{RMS}/I_{\Delta N2}\text{DC} \)
  - DC 10…500 Hz: 0.2…100 %
  - 500 Hz…1 kHz: -20…+100 %

- **Hysteresis**
  - 10…25 % (15 %)

**Time response**

- **Start-up delay** \( t_{\text{start-up}} \)
  - 0.5…600 s (0.5 s)*

- **Response delay** \( t_{\text{on1 RMS/DC}} \)
  - 0…600 s (0 s)*

- **Delay on release** \( t_{\text{off1 DC}} \)
  - 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
  - \( I_{\Delta} > I_{\Delta N2} \)
  - yellow (flashing): measured value range exceeded

**Interface**

- **Interface/protocol**: RS-485/BMS
- **Connection**: terminals A/B

**Environment/EMC**

- **EMC immunity**: IEC 61000-6-2
- **emission**: IEC 61000-6-3

- **Classifications of climatic conditions acc. to IEC 60721**:
  - **Stationary use** (IEC 60721-3-3): 3K5
  - **Transport** (IEC 60721-3-2): 2K3
  - **Long-term storage** (IEC 60721-3-1): 1K4

**Connection**

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

<table>
<thead>
<tr>
<th>Multi-conductor connection (2 conductors with the same cross section):</th>
</tr>
</thead>
<tbody>
<tr>
<td>rigid</td>
</tr>
<tr>
<td>0.2…1.5 mm²/AWG</td>
</tr>
</tbody>
</table>

**Other**

- **Operating mode**: continuous operation

**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

\( (*) = \text{factory settings} \)
### Display and operating controls

1. Slot for screw mounting
2. Alarm LEDs for the measuring channels K1…K6
3. Line feed-through of the measuring current transformers for the measuring channels K1…K6
4. ON LED: Power On LED
5. Determination of ones’ position of the BMS address
6. Determination of tens’ position of the BMS address
7. Connection to the supply voltage
8. Connection RS-485, BMS bus

### Wiring diagram

1. Residual current monitor RCMS150
2. Supply voltage US 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® RCMB20-500-01/RCMB35-500-01
AC/DC sensitive residual current monitoring module with frequency converters

Device features

- AC/DC sensitive measured value acquisition
- Frequency range 0…500 Hz
- Measuring current transformer, inside diameter 20 mm/35 mm
- Measuring range 500 mA
- Measuring time ≤ 180 ms
- Supply voltage DC 24 V
- Analogue output current DC 4…20 mA
- Insensitive to load currents ensured by a full magnetic shielding
- Connection monitoring measuring current transformers using cyclical test current
- Multicolour LEDs for operation and fault indication

Approvals

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

Further information

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

<table>
<thead>
<tr>
<th>Supply voltage DC</th>
<th>Inside diameter</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.4…28.8 V</td>
<td>ø 20 mm</td>
<td>RCMB20-500-01</td>
<td>B 9404 2103</td>
</tr>
<tr>
<td></td>
<td>ø 35 mm</td>
<td>RCMB35-500-01</td>
<td>B 9404 2104</td>
</tr>
</tbody>
</table>

1) Absolute values

Ordering information

For type Accessories Dimen-
insions Units

<table>
<thead>
<tr>
<th>For type</th>
<th>Accessories</th>
<th>Dimensions</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCMB20-500-01</td>
<td>Single conductor with integrally moulded ferrule (black, white, red, blue)</td>
<td>45 cm</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>PVC insulating tube</td>
<td>45 cm</td>
<td>1</td>
</tr>
<tr>
<td>RCMB35-500-01</td>
<td>Single conductor with integrally moulded ferrule (black, white, red, blue)</td>
<td>80 cm</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>PVC insulating tube</td>
<td>80 cm</td>
<td>1</td>
</tr>
<tr>
<td>RCMB20-500-01</td>
<td>Push-wire plug, four-pole, encoded</td>
<td>–</td>
<td>2</td>
</tr>
<tr>
<td>RCMB35-500-01</td>
<td>Mounting brackets for measuring current transformers</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Ferrule (mm² x mm)</td>
<td>0.5 x 6</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Cable ties (mm x mm)</td>
<td>100 x 2.5</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Lens head screw</td>
<td>M6 x 12</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Spring washer</td>
<td>M6</td>
<td>2</td>
</tr>
</tbody>
</table>

Scope of delivery

The connection set supplied consists of the following individual parts:
**Technical data**

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**
- Rated insulation voltage: AC 800 V
- Rated impulse voltage/pollution degree: 12 kV/2
- Overvoltage category: CAT III
- Protective separation (reinforced insulation) between primary conductor and measurement electronics
- Voltage tests according to IEC 61010-1: 6.88 kV

**Supply voltage**
- Supply voltage $U_s$: DC 24 V
- Ripple $U_s$: ≤ 1 %
- Power consumption: ≤ 2.5 VA

**Measuring circuit**
- Measuring current transformer RCMB20/RCMB35, inside diameter: 20/35 mm
- Rated insulation voltage (measuring current transformer): 800 V
- Characteristics according to IEC 62020 and IEC/TR 60755:
  - AC/DC sensitive, Type B
  - Frequency range: 0…500 Hz
  - Measuring range $I_{Δn}$: AC/DC 0…500 mA
  - Nominal current at 3NAC (RCMB20/RCMB35): 32 A/80 A
  - Relative uncertainty: ± 4 %
  - Relative uncertainty at 10…30 Hz: + 3 %…-15 %
  - Relative uncertainty at 30…400 Hz: ± 3 %
  - Relative uncertainty at 400…500 Hz: ± 10 %
  - Resolution measuring circuit: 2 mA
- Test winding: yes

**Measurement**
- Response delay $t_{on}$: 0 s
- Delay on release $t_{off}$ (if outside the measuring range): ≤ 1 s
- Operating time $t_{on}$ at $I_q$: ≤ 180 ms
- Response time $t_{on}$: $= t_{on} + t_{off}$
- Recovery time $t_{off}$: ≤ 1 s

**Displays**
- LED lights constantly green = operation indicator
- Flashes red = fault (output current > 20 mA)

**Outputs**
- Current output, proportional to the residual current: DC 4…20 mA
- Current output, resolution $I_{Δn} = 31.25 \times$ (analogue output current - 4 mA)
- Load: ≤ 100 Ω

**Environment/EMC**
- EMC: IEC 60947-2 Annex M
- Operating temperature: -25…70 °C
- For UL application:
  - Maximum ambient temperature: 70 °C
  - Stationary use (IEC 60721-3-3): 1K5 (except condensation and formation of ice)
  - Transport (IEC 60721-3-2): 2K3 (except condensation and formation of ice)
  - Long-time storage (IEC 60721-3-1): 1K4 (except condensation and formation of ice)
  - Classification of climatic conditions acc. to IEC 60721:
    - Stationary use (IEC 60721-3-3): 3M4
    - Transport (IEC 60721-3-2): 2M3
    - Long-time storage (IEC 60721-3-1): 1M3
- Chemical stresses acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3C4
  - For UL application:
    - Use at least 60/75 °C copper lines!
    - Connection types: plugable push-wire terminals, 2 x four-pole

**General data**
- Degree of protection, internal components (DIN EN 60529): IP40
- Degree of protection, terminals (DIN EN 60529): IP20
- Enclosure material: polycarbonate
- Flammability class: UL94V-0
- Screw mounting: M5 with mounting brackets
- DIN rail mounting acc. to IEC 60715
- Documentation number: D00131
- Weight: 200 g (RCMB20-500-01)
  - 250 g (RCMB35-500-01)

**Dimensions (mm)**

**Dimensions diagram**

**Screw mounting**

---

**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>
</tr>
</thead>
<tbody>
<tr>
<td>RCMB20</td>
<td>30</td>
<td>56.3</td>
<td>50</td>
<td>76.4</td>
<td>48.5</td>
<td>ø 20</td>
<td>29.8</td>
<td>16.4</td>
</tr>
<tr>
<td>RCMB35</td>
<td>30</td>
<td>79.2</td>
<td>62</td>
<td>99.5</td>
<td>55</td>
<td>ø 35</td>
<td>41.7</td>
<td>20</td>
</tr>
</tbody>
</table>

* of full scale value of the measuring range
Wiring diagram

Connect the residual current monitoring module according to the wiring diagram. The output current in proportion to the residual current \( I_a \) must be made available to the frequency converter.

Connections

Position of the terminals, connection and disconnection of the conductors

Wiring of the plug-in terminal XK1

<table>
<thead>
<tr>
<th>Coding socket</th>
<th>Pluggable push-wire terminal</th>
<th>Terminal</th>
<th>Colour</th>
<th>RCMB20/RCMB35</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a</td>
<td>A</td>
<td>black</td>
<td>GND (05)</td>
</tr>
<tr>
<td></td>
<td>b</td>
<td>B</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>c</td>
<td>C</td>
<td>white</td>
<td>DC 4...20 mA</td>
</tr>
<tr>
<td></td>
<td>d</td>
<td>D</td>
<td>blue</td>
<td>GND (DC 4...20 mA)</td>
</tr>
<tr>
<td></td>
<td>e</td>
<td>E</td>
<td>red</td>
<td>+24V (U6)</td>
</tr>
<tr>
<td></td>
<td>f</td>
<td>F</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>g</td>
<td>G</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>h</td>
<td>H</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

Installation examples
LINETRAXX® RCMB35-30-01/RCMB35-30-02
AC/DC sensitive residual current monitoring module
for residual current monitoring in earthed systems (TN and TT systems)

Device features
- Realisation of a protective device in accordance with DIN EN 60947-2 Annex M in combination with circuit breakers providing isolating properties
- Integral switching output for controlling an undervoltage release with two changeover contacts
- Combined test and reset button
- Monitoring of the connection to the measuring current transformer with cyclical test current
- Insensitive to load currents due to magnetic screen
- Multicolour LED indicating operation, response value exceeded and fault detected
- AC/DC sensitive measured value acquisition
- Response value $I_{\Delta n} \leq 30 \text{ mA}$
- Rated frequency range
  - RCMB35-30-01: 0…1 kHz
  - RCMB35-30-02: 0…10 kHz
- Supply voltage DC 24 V
- Measuring current transformer, inside diameter 35 mm

Approvals
- CE
- UL Listed

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>Inside diameter</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td>ø 35 mm</td>
<td>RCMB35-30-01</td>
<td>B 9404 2100</td>
</tr>
<tr>
<td>20.4…28.8 V</td>
<td></td>
<td>RCMB35-30-02</td>
<td>B 9404 2106</td>
</tr>
</tbody>
</table>

$^1$ Absolute values
Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3
Rated insulation voltage AC 800 V
Rated impulse withstand voltage/pollution degree 12 kV/2
Overvoltage category III
Protective separation (reinforced insulation) between primary conductor and the measurement electronics Voltage tests according to IEC 61010-1 6.88 kV

Supply voltage
Supply voltage Uₚ DC 24 V
Operating range of Uₚ AC 20.4...28.8 V
 Ripple Uₚ ≤ 1 %
Power consumption ≤ 2.5 VA
Making current 5 A, 1 ms

Measuring circuit
Measuring current transformer, inside diameter 35 mm
Rated insulation voltage (measuring current transformer) 800 V

Response value Iₚmin 30 mA
Nominal current 160 A
Relative uncertainty of the response value 0...-35 %
Test winding yes

Time response
Response delay tₚmin 0 s
Delay on release tₚoff 2 s after reset
Operating time tₚ at 1 x Iₚmin ≤ 180 ms
Operating time tₚ at 2 x Iₚmin ≤ 130 ms
Operating time tₚ at 5 x Iₚmin ≤ 20 ms
Response time tₚ = tₚmin + tₚoff
Recovery time tₐ ≤ 1 s

Displays
Multicolour LED lights constantly green operation indicator
Lights green (quickly) self test
Lights constantly red response value exceeded/self test: no faults detected
Flashes red (quickly) Reset
Flashes red (slowly) fault/during a self test: fault occurred

Outputs
Number 2 change-over contacts
Operating principle N/C operation
Switching outputs a2/a3, a3/a4, b2/b3, b3/b4 AC 24 V/DC 48 V; 200 mA
Electrical service life, number of cycles 100,000

Environment/EMC
EMC IEC 60947-2 Annex M
Operating temperature -25...70 °C

For UL application:
Max. surrounding air temperature 70 °C

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 (except condensation and formation of ice)
Long-term storage (IEC 60721-3-1) 1K4 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721
Stationary use (IEC 60721-3-3) 3M4
Transport (IEC 60721-3-2) 2M3
Storage (IEC 60721-3-1) 1M3

Chemical stresses acc. to IEC 60721
Stationary use (IEC 60721-3-3) 3C4

Connection
Primary conductor ≤ 4 x 35 mm² or 3 x 50 mm²
Connector XK1: Connection type pluggable push-wire terminals, 2 x four-pole

For UL application:
Use min. 60 °C/75 °C copper conductors only!

Connection properties:
Rigid 0.2...2.5 mm² (AWG 24...14)
Flexible without ferrules 0.2...2.5 mm² (AWG 24...14)
Flexible with ferrules 0.2...1.5 mm² (AWG 24...16)
Stripping length 10 mm
Opening force 50 N

Other
Operating mode continuous operation
Position any position
Degree of protection, internal components (DIN EN 60529) IP40
Degree of protection, terminals (DIN EN 60529) IP20
Enclosure material polycarbonate
Flammability class UL94 V-0
Screw mounting M5 with mounting brackets
DIN rail mounting acc. to IEC 60715
Documentation number D00079
Weight ≤ 250 g

Dimension diagram

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>
</tr>
</thead>
<tbody>
<tr>
<td>RCBM35-30-…</td>
<td>30</td>
<td>79.2</td>
<td>62</td>
<td>99.5</td>
<td>55</td>
<td>ø 35</td>
<td>41.7</td>
<td>20</td>
</tr>
</tbody>
</table>

Screw mounting

Dimensions (mm)

<table>
<thead>
<tr>
<th>Type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCBM35-30-… (mounting with 2 angles diagonal)</td>
<td>47</td>
<td>48.5</td>
<td>63</td>
<td>12.85</td>
</tr>
</tbody>
</table>
Residual current monitoring systems | single-channel, AC/DC sensitive residual current monitoring RCMB

**AC/DC sensitive residual current monitoring module LINETRAXX® RCMB35-30-01/RCMB35-30-02**

---

**Wiring diagram**

1. Circuit breaker with undervoltage release in accordance with DIN EN 60947-2; \( t_{ab} \leq 20 \text{ ms} \)
2. RCMB35-30-01/RCMB35-30-02
3. Loads, e.g. welding inverter
4. K2: internal electronic switch (redundancy)
5. K1: changeover contact in N/C operation for controlling the undervoltage release and an alarm LED
6. Supply voltage for RCMB35-30-01/RCMB35-30-02
7. Fuse F: 100 mA, time-lag

---

**Connections**

Position of the terminals

connecting of the conductors

disconnecting of the conductors

---

**Wiring of the plug-in terminal XK1**

<table>
<thead>
<tr>
<th>Coding socket</th>
<th>Pluggable push-wire terminal</th>
<th>Terminal</th>
<th>RCMB35-30-01/RCMB35-30-02</th>
</tr>
</thead>
<tbody>
<tr>
<td>a1</td>
<td>GND ((U_S))</td>
<td>a1</td>
<td></td>
</tr>
<tr>
<td>a2</td>
<td>K1, contact 12</td>
<td>a2</td>
<td></td>
</tr>
<tr>
<td>a3</td>
<td>K1, contact 11</td>
<td>a3</td>
<td></td>
</tr>
<tr>
<td>a4</td>
<td>K1, contact 14</td>
<td>a4</td>
<td></td>
</tr>
<tr>
<td>b1</td>
<td>+24 V ((U_S))</td>
<td>b1</td>
<td></td>
</tr>
<tr>
<td>b2</td>
<td>K1, contact 22</td>
<td>b2</td>
<td></td>
</tr>
<tr>
<td>b3</td>
<td>K1, contact 21</td>
<td>b3</td>
<td></td>
</tr>
<tr>
<td>b4</td>
<td>K1, contact 24</td>
<td>b4</td>
<td></td>
</tr>
</tbody>
</table>
LINETRAXX® RCMB42...EC
AC/DC sensitive residual current monitor

Device features
• AC/DC sensitive residual current monitoring module Type B in accordance with IEC 60364-7-722 (VDE 0100-722)
• Response value 2 – AC/DC 30 mA: r.m.s. 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
• Shielded residual current transformer to prevent the effects of external disturbances
• Connection by means of push-wire terminals
• Variants: Single and two-channel residual current measurement

Typical applications
• Residual current monitoring of AC charging stations for electric vehicles

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>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC 0…6 mA</td>
<td>0…30 mA (rms)</td>
<td>2</td>
<td>2 x residual current</td>
<td>RCMB420EC-2</td>
<td>B 7404 2500</td>
</tr>
<tr>
<td></td>
<td>0…2000 Hz</td>
<td>1</td>
<td>1 x residual current</td>
<td>RCMB422EC-2</td>
<td>B 7404 2502</td>
</tr>
</tbody>
</table>

Delivery incl. measuring current transformers.
Measuring current transformer available with shorter cable on request (minimum order quantity 250 pcs).
### 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 insulation voltage</td>
<td>AC 250 V</td>
</tr>
<tr>
<td>Overvoltage category/pollution degree</td>
<td>III/3</td>
</tr>
<tr>
<td>Rated impulse voltage</td>
<td>4 kV</td>
</tr>
</tbody>
</table>

#### Degree of Contamination

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protective separation</td>
<td>between (A1, A2) - (D1, D2, Err, Test, GND) - (13, 14, 23, 24)</td>
</tr>
<tr>
<td>Basic insulation</td>
<td>between (13, 14) - (23, 24)</td>
</tr>
<tr>
<td>Range of use</td>
<td>≤ 2000 m above NN</td>
</tr>
</tbody>
</table>

#### Power supply

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal supply voltage Uₚ</td>
<td>AC 110…240 V, 50/60 Hz</td>
</tr>
<tr>
<td>DC 150…220 V</td>
<td></td>
</tr>
<tr>
<td>Operating range of the supply voltage Uₚ</td>
<td>AC 0.85…1.1 x Uₚ, DC 0.8…1.2 x Uₚ</td>
</tr>
<tr>
<td>Power consumption</td>
<td>&lt; 5 VA</td>
</tr>
</tbody>
</table>

#### Measuring range residual current

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated frequency</td>
<td>0…2000 Hz</td>
</tr>
<tr>
<td>Measuring range</td>
<td>±300 mA</td>
</tr>
</tbody>
</table>

#### Response values

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residual current Δn₂</td>
<td>6 mA</td>
</tr>
<tr>
<td>Response tolerance Δn₂</td>
<td>0…–50 %</td>
</tr>
<tr>
<td>Residual current Δn₁</td>
<td>30 mA</td>
</tr>
<tr>
<td>Response tolerance Δn₁</td>
<td>0…–20 %</td>
</tr>
<tr>
<td>Restart sequence value</td>
<td>&lt; 3 mA</td>
</tr>
<tr>
<td>AC/DC 30 mA (rms) for f ≤ 1 kHz</td>
<td>&lt; 12 mA</td>
</tr>
<tr>
<td>AC/DC 30 mA (rms) for f &gt; 1 kHz</td>
<td>&lt; 22 mA</td>
</tr>
<tr>
<td>Operating time tₐ for</td>
<td></td>
</tr>
<tr>
<td>1 x ΔRₜ</td>
<td>&lt; 180 ms</td>
</tr>
<tr>
<td>2 x ΔRₜ</td>
<td>&lt; 70 ms</td>
</tr>
<tr>
<td>5 x ΔRₜ</td>
<td>&lt; 20 ms</td>
</tr>
</tbody>
</table>

#### Inputs and operation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test button</td>
<td>on front side</td>
</tr>
<tr>
<td>Test</td>
<td>internal/external</td>
</tr>
<tr>
<td>Cable length Test/Err, GND</td>
<td>0…10 m</td>
</tr>
<tr>
<td>Transformer connection</td>
<td>external</td>
</tr>
<tr>
<td>LED device function</td>
<td>green</td>
</tr>
<tr>
<td>LED alarm channel 1</td>
<td>yellow</td>
</tr>
<tr>
<td>LED alarm channel 2</td>
<td>yellow</td>
</tr>
</tbody>
</table>

### Switching elements

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm relay K₁, K₂</td>
<td></td>
</tr>
<tr>
<td>Iₛₚ, DC &gt; 6 mA; Iₛₚ AC/DC &gt; 30 mA (rms)</td>
<td></td>
</tr>
<tr>
<td>Contact elements</td>
<td>2 x 1 N/O contacts</td>
</tr>
<tr>
<td>Operating principle</td>
<td></td>
</tr>
<tr>
<td>Electrical service life</td>
<td>10,000 switching cycles</td>
</tr>
<tr>
<td>Contact data to IEC 60947-5-1</td>
<td></td>
</tr>
<tr>
<td>Utilisation category</td>
<td>AC-14/DC-13</td>
</tr>
<tr>
<td>Rated operational voltage</td>
<td>250 V</td>
</tr>
<tr>
<td>Rated operational current</td>
<td>5 A</td>
</tr>
<tr>
<td>Minimum contact rating</td>
<td>1 mA at AC/DC ≥ 10 V</td>
</tr>
</tbody>
</table>

#### Environment/EMC

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>-25…+75 °C</td>
</tr>
</tbody>
</table>

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

- Stationary use (IEC 60271-3-3): 3K5
- Transport (IEC 60721-3-2): 2K5
- Long-time storage (IEC 60721-3-1): 1K4

#### Classification of mechanical conditions IEC 60271

- Stationary use (IEC 60721-3-3): 3M4 (except condensation and formation of ice)
- Transport (IEC 60721-3-2): 2M3
- Long-time storage (IEC 60721-3-1): 1M3

### Connection

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection type</td>
<td>push-wire terminal</td>
</tr>
<tr>
<td>Connection properties</td>
<td></td>
</tr>
<tr>
<td>rigid</td>
<td>0.2…2.5 mm² (AWG 24…14)</td>
</tr>
<tr>
<td>flexible without ferrule</td>
<td>0.75…2.5 mm² (AWG 19…14)</td>
</tr>
<tr>
<td>flexible with ferrule</td>
<td>0.2…1.5 mm² (AWG 24…16)</td>
</tr>
<tr>
<td>Stripping length</td>
<td>10 mm</td>
</tr>
<tr>
<td>Opening force</td>
<td>50 N</td>
</tr>
<tr>
<td>Test opening, diameter</td>
<td>2.1 mm</td>
</tr>
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### Other

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating mode</td>
<td>continuous operation</td>
</tr>
</tbody>
</table>

#### Degree of protection

- IP 30
- IP 20

#### Degree of protection terminals

DIN rail mounting: IEC 60715
Screw mounting: 2 x M4 with mounting clip

#### Measuring current transformers

| Diameter cable gland residual current transformer | 15 mm |
| Cable length                                      | 1.5 m |
| Mounting with cable ties                         |       |
| Connection type connector                        |       |
| Connection to the main device connector with 6 poles |       |
| Max. load current                                | 3 x 32 A (4 x 6 mm²) |

### Dimension diagram

![Dimension diagram](image-url)
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.


RCD Typ A
L = Ladekontrollregler/Charge controller

RCMB420EC with 2 channels with \( I_{\Delta} = DC \geq 6 \text{ mA} \) and \( I_{\Delta} = AC/DC \geq 30 \text{ mA} \) (rms)

RCMB422EC with 1 channel with \( I_{\Delta} = DC \geq 6 \text{ mA} \) and \( I_{\Delta} = AC/DC \geq 30 \text{ mA} \) (rms)
Insulation monitoring devices
ISOMETER®

Equipment for insulation fault location
ISOSCAN®

Power Quality and Energy Measurement
LINETRAXX®

Measuring and monitoring relays
LINETRAXX®

Residual current monitoring systems
LINETRAXX®

System components
Coupling devices
Measuring current transformers
Transformers
Measuring transducers
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
Standards and guidelines applied
Alphabetical list of devices
Technical terms
Service
## Device overview coupling devices

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<td><strong>Application</strong></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>Extension of the nominal voltage range for ISOMETER®s</td>
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<tr>
<td><strong>Nominal system voltage U&lt;sub&gt;n&lt;/sub&gt;</strong></td>
<td>AC 0...1500 V, DC 0...1700 V</td>
<td>AC 0...1300 V / AC 0...1600 V</td>
<td>AC 3(N)/AC 0...7200 V</td>
<td>AC 3(N)/AC 0...7.2 kV</td>
<td>AC 3(N)/AC 0...12 kV</td>
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<tr>
<td><strong>Device family</strong></td>
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<td>IRDH275BM</td>
<td>IR420-D64</td>
<td>iso685-D</td>
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<td></td>
<td></td>
<td></td>
<td>iso685-S</td>
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## Device overview measuring current transformers

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<td>W0/600</td>
<td>W0/5</td>
<td>W1/35</td>
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<td><strong>Dimensions (mm)</strong></td>
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<td></td>
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<tr>
<td>Inside diameter</td>
<td>10</td>
<td>20</td>
<td>35</td>
</tr>
<tr>
<td>Width x height</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strip length</td>
<td></td>
<td></td>
<td></td>
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<td><strong>Device family</strong></td>
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<td>EDS441</td>
<td>EDS441-LAB</td>
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System components | Device overview
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<td>WS...</td>
<td>WF...</td>
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<td>WR1(S/16-05/P)</td>
<td>WS...</td>
<td>WS...</td>
<td>WF...</td>
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<td>WR2(S/06-05/P)</td>
<td>WS...</td>
<td>WS...</td>
<td>WF...</td>
</tr>
<tr>
<td>WR3(S/06-06/P)</td>
<td>WS...</td>
<td>WS...</td>
<td>WF...</td>
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<tr>
<td>WS0/30</td>
<td>WS0/80</td>
<td>WS0/10</td>
<td>WS0/15</td>
</tr>
<tr>
<td>WS0/20</td>
<td>WS0/35</td>
<td>WS0/60</td>
<td>WS0/120</td>
</tr>
<tr>
<td>WS0/20-800</td>
<td>WS0/35-800</td>
<td>WS0/60-800</td>
<td>WS0/120-800</td>
</tr>
<tr>
<td>WS0/20AB</td>
<td>WS0/35AB(P)</td>
<td>WS0/60AB(P)</td>
<td>WS0/120AB</td>
</tr>
<tr>
<td>WR70x175S(P)</td>
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<tr>
<td>WS20x30-8000</td>
<td>WS50x80-8000</td>
<td>WS80x120S</td>
<td>WS80x160S</td>
</tr>
<tr>
<td>WS80x120S</td>
<td>WS80x160S</td>
<td>WF170</td>
<td>WF250</td>
</tr>
<tr>
<td>WS80x120S</td>
<td>WS80x160S</td>
<td>WF500</td>
<td>WF800</td>
</tr>
<tr>
<td>WS80x120S</td>
<td>WS80x160S</td>
<td>WF1200</td>
<td>WF1800</td>
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<table>
<thead>
<tr>
<th>Characteristics</th>
<th>split-core</th>
<th>split-core</th>
<th>flexible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inside diameter</td>
<td>10 20 35 70 105 140 210</td>
<td>20 35 60 120 210</td>
<td>20 35 60 20 35 60 120 210</td>
</tr>
<tr>
<td>Width x height</td>
<td>70 x 175 115 x 305 150 x 350 200 x 500</td>
<td>20 x 30 50 x 80 80 x 120 20 x 30 50 x 80 50 x 80 80 x 80 80 x 120 80 x 160</td>
<td>170 250 500 800 1200 1800</td>
</tr>
<tr>
<td>Strip length</td>
<td>170 250 500 800 1200 1800</td>
<td>170 250 500 800 1200 1800</td>
<td></td>
</tr>
</tbody>
</table>
| Device family   | EDS440  EDS441  EDS441-LAB  EDS460/490  EDS461/491  RCM420  RCMA420  RCMA423  RCM460/490

System components | Device overview
Device overview isolating transformers, transformers for operating theatre lights

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<tbody>
<tr>
<td>Application</td>
<td>Design of medical IT systems</td>
<td>Supply of three-phase loads in group 0, 1 or 2 medical locations</td>
<td>Supply of operating theatre luminaires</td>
</tr>
<tr>
<td>Type of distribution system</td>
<td>single-phase</td>
<td>three-phase</td>
<td>single-phase</td>
</tr>
<tr>
<td>Input</td>
<td>AC 230 V</td>
<td>3AC 400 V</td>
<td>AC 230 V (±5 %, ±10 %)</td>
</tr>
<tr>
<td>Output</td>
<td>AC 230 V</td>
<td>3NAC 230 V</td>
<td>AC 23…28 V</td>
</tr>
<tr>
<td>Frequency range</td>
<td>50…60 Hz</td>
<td>50…60 Hz</td>
<td>50…60 Hz</td>
</tr>
<tr>
<td>Power</td>
<td>3150 VA</td>
<td>2000 VA</td>
<td>120 VA</td>
</tr>
<tr>
<td></td>
<td>4000 VA</td>
<td>3150 VA</td>
<td>160 VA</td>
</tr>
<tr>
<td></td>
<td>5000 VA</td>
<td>4000 VA</td>
<td>280 VA</td>
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<tr>
<td></td>
<td>6300 VA</td>
<td>5000 VA</td>
<td>400 VA</td>
</tr>
<tr>
<td></td>
<td>8000 VA</td>
<td>6300 VA</td>
<td>630 VA</td>
</tr>
<tr>
<td></td>
<td>10000 VA</td>
<td>8000 VA</td>
<td>1000 VA</td>
</tr>
<tr>
<td>Design type</td>
<td>vertical</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>horizontal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>encapsulated (protection class B)</td>
<td></td>
<td></td>
</tr>
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Device overview measuring transducer

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<tr>
<td>Application</td>
<td>Conversion of DC currents</td>
</tr>
<tr>
<td>Input Current</td>
<td>DC 0…400 µA</td>
</tr>
<tr>
<td>Output Current</td>
<td>0/4…20 mA</td>
</tr>
<tr>
<td>Voltage</td>
<td>DC 0…10 V</td>
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### Device overview power supply units

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<th>AN410</th>
<th>AN420</th>
<th>AN450</th>
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<tr>
<td><strong>Application</strong></td>
<td>for measuring current transformers</td>
<td>for DC 24 V power supply</td>
<td>for measuring current transformers</td>
<td>for voltage supply</td>
</tr>
<tr>
<td><strong>Output voltage</strong></td>
<td>±12 V</td>
<td>DC 24 V</td>
<td>DC ±12 V</td>
<td>AC 20 V, 50…60 Hz</td>
</tr>
<tr>
<td><strong>Supply voltage U_s</strong></td>
<td>AC 20…60 V; DC 18…72 V</td>
<td>AC 90…264 V</td>
<td>AC 16…72; DC 9.6…94 V</td>
<td>AC 230 V, 50…60 Hz</td>
</tr>
</tbody>
</table>

### Device overview measuring instruments

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<th>7220</th>
<th>9604</th>
<th>9620</th>
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<tbody>
<tr>
<td><strong>Input current</strong></td>
<td>0…400 μA</td>
<td>0…20 mA</td>
<td>0…400 μA</td>
<td>0…20 mA</td>
</tr>
<tr>
<td><strong>Dimensions (mm)</strong></td>
<td>72 x 72</td>
<td>72 x 72</td>
<td>96 x 96</td>
<td>96 x 96</td>
</tr>
<tr>
<td><strong>Device family</strong></td>
<td>IR470LY…</td>
<td>IR470LY2-6…</td>
<td>IRDH275/375</td>
<td>IRDH275B/375B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>IRDH575</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>iso685…</td>
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Device overview interface converters and repeaters

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<th>DI-2USB</th>
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<td><strong>Application</strong></td>
<td>Interface repeater BMS bus</td>
<td>Interface converter BMS/USB</td>
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<td><strong>Input</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td>RS-485</td>
<td>RS-485</td>
</tr>
<tr>
<td><strong>Connection</strong></td>
<td>screw-type terminal</td>
<td>screw-type terminal</td>
</tr>
<tr>
<td><strong>Cable length</strong></td>
<td>≤ 1200 m</td>
<td>≤ 1200 m</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td></td>
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</tr>
<tr>
<td><strong>Output</strong></td>
<td>RS-485</td>
<td>USB</td>
</tr>
<tr>
<td><strong>Connection</strong></td>
<td>screw-type terminal</td>
<td>USB Type B</td>
</tr>
<tr>
<td><strong>Cable length</strong></td>
<td>≤ 1200 m</td>
<td>≤ 5 m</td>
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<tr>
<td><strong>Expansion of bus devices</strong></td>
<td></td>
<td>≤ 30</td>
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<tr>
<td><strong>Supply voltage U_s</strong></td>
<td>AC 85…260 V, 50…60 Hz</td>
<td>via USB</td>
</tr>
<tr>
<td><strong>Particular features</strong></td>
<td></td>
<td>Driver CD</td>
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Device overview Charge Controller

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<td><strong>Application</strong></td>
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<td><strong>DC 6 mA sensor</strong></td>
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<td><strong>Supply voltage U_s</strong></td>
<td>DC 12 V</td>
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<td><strong>Interface</strong></td>
<td></td>
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<td>Modbus</td>
<td></td>
</tr>
<tr>
<td>eHZ meter</td>
<td></td>
</tr>
<tr>
<td>Modem</td>
<td>3G modem (optional)</td>
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## Device overview gateways

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**Application**
- BMS-Ethernet-Gateway
- BMS-Ethernet-Gateway
- BMS-Modbus RTU-Gateway
- Condition Monitor/PROFIBUS-Gateway
- Condition Monitor/Gateway

**Protocol input**
- BMS
- BMS
- BMS
- BMS/Modbus RTU/TCP
- BMS/Modbus RTU/TCP

**Protocol output**
- Ethernet/Modbus TCP
- Ethernet/Modbus TCP
- Modbus RTU
- Ethernet/Modbus TCP
- Ethernet/Modbus TCP

**Display**
- LCD/LED
- LED
- LCD/LED
- LED
- LED
- 7”-colour LCD

**Alarm messages**
- 1, 2)
- 1, 2)
- 1, 2)
- 1, 2, 3)
- 1, 2, 3)

**Measured values**
- 1, 2)
- 1, 2)
- 1, 2)
- 1, 2)
- 1, 2)

**Device parameter setting**
- 1)
- 2)
- 1)
- 2)
- 1)

**Alarm list**
- 1)
- 2)
- 1)
- 2)
- 1)

**History memory**
- 1)
- 2)
- 1)
- 2)
- 1)

**Diagrams**
- 1)
- 2)
- 1)
- 2)
- 1)

**Visualisation**
- 1)
- 2)
- 1)
- 2)
- 1)

**E-mail notification**
- 1, 4)
- 1, 4)
- 1, 4)
- 1, 4)
- 1, 4)

**Device tests**
- 1, 2)
- 1, 2)
- 1, 2)
- 1, 2)
- 1, 2)

**SNMP**
- 1)
- 2)
- 1)
- 2)
- 1)

**Data logger**
- 1)
- 2)
- 1)
- 2)
- 1)

**Connection**
- BMS
- screw-type terminal
- screw-type terminal
- screw-type terminal
- pluggable screw terminals
- pluggable screw terminals
- pluggable screw terminals

**Output**
- RJ 45
- RJ 45
- screw-type terminal
- RJ 45
- RJ 45
- 9-pole
- RJ 45

**Supply voltage**
- AC/DC 76…276 V
- AC 16…72 V, DC 16…94 V
- AC/DC 76…276 V
- AC/DC 24…240 V, DC 24 V
- AC/DC 24…240 V, DC 24 V
- DC 24 V

**Browser**
- Internet Explorer, Chrome, Firefox etc.
- Internet Explorer, Chrome, Firefox etc.
- Internet Explorer, Chrome, Firefox etc.
- Internet Explorer, Chrome, Firefox etc.
- Internet Explorer, Chrome, Firefox etc.

---

*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
### Device overview alarm indicator and test combinations

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<td>RCMS Residual current monitoring system</td>
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<td>EDS insulation fault locator</td>
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<tr>
<td><strong>Installation type</strong></td>
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<td>Flush mounting</td>
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<td>Cavity wall mounting</td>
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<td>Cable duct mounting</td>
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<td>Surface mounting</td>
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<td><strong>Input/outputs</strong></td>
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<tr>
<td>Digital inputs (potential free)</td>
<td>0/16</td>
<td>0/12</td>
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</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>
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<td>Languages selectable</td>
<td>21</td>
<td>20</td>
<td>programmable</td>
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<tr>
<td>Standard display</td>
<td>4 x 20 characters</td>
<td>4 x 20 characters</td>
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</tr>
<tr>
<td>Additional text display</td>
<td>3 x 20 characters</td>
<td>3 x 20 characters</td>
<td></td>
</tr>
<tr>
<td>Standard texts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freely configurable text messages</td>
<td>1000</td>
<td>200</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>TMK-Set V 4.xx (USB, BMS)</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>Interfaces</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS-485 (BMS protocol)</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMS address range</td>
<td>internal: 1…150, external: 1…99</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><strong>Supply voltage</strong></td>
<td>AC/DC 24 V</td>
<td>AC/DC 24 V</td>
<td></td>
</tr>
<tr>
<td>Stored energy time in the event of power failure</td>
<td>≤ 2 s</td>
<td>≤ 15 s</td>
<td></td>
</tr>
</tbody>
</table>
**AGH150W-4**

**Coupling device**

**Typical applications**
- Extension of the nominal voltage range for the ISOMETER®'s iso685… series and IRDH… series to AC 0…1150 V, DC 0…1760 V

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

**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>AC 0…1150 V, DC 0…1760 V</td>
<td>AGH150W-4</td>
<td>B 9801 8006</td>
</tr>
</tbody>
</table>

**Technical data**

- **Insulation coordination acc. to DIN EN 61800-5-1 (VDE 0160-105-1)**
  - Rated insulation voltage: AC 1600 V

- **Voltage test acc. to DIN EN 61800-5-1 (VDE 0160-105-1)**
  - Voltage impulse test (basic insulation) $\geq$ AC 11 kV
  - AC voltage test (basic insulation) $\geq$ AC 6.6 kV

- **Voltage ranges**
  - Nominal system voltage $U_n$: AC 0…1150 V, DC 0…1760 V
  - Overvoltage category/rated impulse voltage: CAT III $\geq$ 11 kV
  - Internal DC resistance $R_i$: $\geq$ 160 kΩ

- **Environment**
  - Shock resistance IEC 60606-2-27 (device in operation): 15 g/11 ms
  - Bumping IEC 60606-2-29 (transport): 40 g/6 ms
  - Vibration resistance IEC 60606-2-6 (device in operation): 1 g/10…150 Hz
  - Vibration resistance IEC 60606-2-6 (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: 3K5

- **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
  - Documentation number: D00093
  - Weight: $\leq$ 900 g

**Dimension diagram (dimensions in mm)**

- Terminal cover: 104 x 5 x 62 mm
- Dimensions: 71 mm

**Wiring diagram**

- **AC system** $U_s$: AC 0…1150 V
- **DC system** $U_s$: DC 0…1760 V
- Connections: L1, L2, L3, L4, L5
- Isolator: ISO685
- Coupling device: AGH150W-4
AGH204S-4
Coupling device

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 and IRDH275-4…/IRDH375-4…/IR470LY-40/IRDH1065B-4

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>B 914 013</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/\(\geq 10.4 kV\)

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 60686-2-6 (device in operation) 1 g/10…150 Hz
Vibration resistance IEC 60686-2-6 (transport) 2 g/10…150 Hz
Ambient temperature (during operation) -10…+55 °C
Ambient temperature (during storage) -40…+78 °C
Classification of climatic conditions acc. to DIN IEC 60721-3-3 3K5

Connection
Connection screw-type terminals
Connections properties rigid/flexible 0.2…4 mm²/0.2…2.5 mm²
Tightening torque 0.5 Nm
Conductor sizes (AWG) 24…12

Other
Operating mode continuous operation
Mounting any position
Degree of protection, internal components (DIN EN 60529) IP20
Degree of protection, terminals (DIN EN 60529) IP20
Type of enclosure X112, free from halogen
DIN rail mounting 2 x M4
Flammability class UL94 V-0
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 and IRDH275-4…/IRDH375-4…/IR470LY-40/IR420-D6/IRDH1065B-4

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>3/(N)/AC</td>
<td>AGH520S</td>
<td>B 913 033</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 $U_n$, for UL applications: AC, 3(N)AC 0…6 kV
- Nominal frequency $f_n$: 50…400 Hz
- Nominal voltage $U_n$: 3(N)AC 0…7.2 kV
- Impedance $Z_i$: AC 17.5 kV
- Partial discharge test: 12 kV
- Voltage test: AC 6.3 kV
- Overvoltage category/impulse voltage test: III/AC 35 kV

Environmental conditions
- Classification of mechanical conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3M4
  - Transport (IEC 60721-3-2): 2M2
  - Storage (IEC 60721-3-1): 1M3
- Ambient temperature (during operation): -10…+55 °C
- Ambient temperature (during storage): -20…+70 °C
- Classification of climatic conditions acc. to IEC 60721-3-3: 3K5

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

Other
- 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 V-HB
- Documentation number: D00073
- Weight: ≤ 4500 g

Dimension diagram (dimensions in mm)

Wiring diagram

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

#### 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>
<td></td>
<td></td>
</tr>
<tr>
<td>0…7.2 kV, 0…460 Hz</td>
<td>500 mm</td>
<td>AGH675S-7-500</td>
<td>B 913 060</td>
</tr>
<tr>
<td></td>
<td>2000 mm</td>
<td>AGH675S-7-2000</td>
<td>B 913 061</td>
</tr>
<tr>
<td>0…15.5 kV, 0…460 Hz</td>
<td>500 mm</td>
<td>AGH675S-7-MV15-500</td>
<td>B 913 058</td>
</tr>
</tbody>
</table>

#### Technical data

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

- **AGH675S-7**
  - Rated insulation voltage: AC 7.2 kV
- **AGH675S-7MV15**
  - Rated insulation voltage: AC 15.5 kV

**Voltage test acc. to DIN EN 61800-5-1**

- **Type test:**
  - **AGH675S-7**
    - Voltage impulse test (basic insulation): 40 kV
    - AC voltage test (basic insulation): 20 kV
    - Partial discharge test: 29 kV
  - **AGH675S-7MV15**
    - Voltage impulse 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**
  - 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): 3K5 (no condensation, no formation of ice)
  - Transport (IEC 60721-3-2): 2K3
  - Long-term storage (IEC 60721-3-1): 1K4
- Classification of mechanical conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3M4 (3M7 Y shaft)
  - Transport (IEC 60721-3-2): 2M2
  - Long-term storage (IEC 60721-3-1): 1M3

**Connection**

- Connection (medium voltage): high-voltage cable (encapsulated on the device side)
- Connection, flexible with ring terminal: M4
- Connection 3, 4, 5: screw-type terminals
- Connection rigid, flexible: 0.2…4 mm²/0.2…2.5 mm²
- Connection flexible with connector sleeve: 0.25…2.5 mm²

**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
- Screw mounting: MS
- Flammability class: UL94 V-0
- Documentation number: D00095
- Weight approx.: ≤ 5100 g

**Further information**

For further information refer to our product range on www.bender.de.
Both AKs (one from each coupling device) are bridged and coupled with the AK from the IRDH275BM-7.
AGH676S-4
Coupling device

**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 IRDH275-4xx/IRDH375-4xx/IR420-D64

**Further information**

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

**Ordering information**

<table>
<thead>
<tr>
<th>Nominal system voltage Us</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></td>
<td>AGH676S-4</td>
<td>B 913 055</td>
</tr>
</tbody>
</table>

| Voltage test acc. to IEC 61800-5-1 |

**Technical data**

- **Insulation coordination acc. to IEC 61800-5-1**
  - Rated insulation voltage: AC 12 kV
- **Voltage test acc. to IEC 61800-5-1**
  - Voltage impulse test: ≥ AC 75 kV
  - AC voltage test: ≥ AC 45 kV
  - Partial discharge test: ≥ 16.5 kVeff
- **Routine test**
  - AC voltage test, rate of increase < 2 kV/s: AC 25 kV

**Voltage ranges**

- **Nominal system voltage Un**
  - AC / 3(N)AC 0…12 kV
- **Nominal frequency fn**
  - 50…460 Hz
- **Internal DC resistance Ri**
  - ≥ 160 kΩ
- **Impedance Z at 12 kV and 50 Hz**
  - ≥ 12 MΩ

**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 °C
- **Storage temperature range**
  - -40…+70 °C
- **Classification of climatic conditions acc. to IEC 60721-3-3**
  - 3K5

**Connection**

- **Connection medium voltage**
  - high-voltage cable (encapsulated on the device side)
- **Connection, flexible with ring terminal**
  - M8 screw terminals
- **Connection properties**
  - rigid/flexible
  - 0.2…4 mm²/0.2…2.5 mm²

**Other**

- **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 fixing**
  - M5
- **Flammability class**
  - UL94 V-0
- **Documentation number**
  - D00096
- **Weight**
  - ≤ 8400 g
### 5.1 System components | Individual components and accessories | Coupling devices for ISOMETER® and RCM

#### Coupling device AGH676S-4

- **2016/2017**
- **System components | Individual components and accessories | Coupling devices for ISOMETER® and RCM**

#### Dimension diagram (dimensions in mm)

- **Dimensions shown:**
  - Width: 220 mm
  - Height: 320 mm
  - Depth: 170 mm

#### Wiring diagram offline (IR420-D64)

- **$U_n = 3\text{AC} 12\text{kV}$**
- **Connections:**
  - L1, L2, L3
  - AK, E, KE
  - PE

#### Wiring diagram online (iso685/IRDH275-4xx/IRDH375-4xx)

- **$U_n = 3\text{AC} 12\text{kV}$**
- **Connections:**
  - L1, L2, L3
  - AK, KE
  - PE
  - ISO685
  - IRDH275-4xx / IRDH375-4xx
W0-S20…W5-S210, W10/600
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
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>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 mm</td>
<td>W10/600</td>
<td>B 911 761</td>
</tr>
<tr>
<td>20 mm</td>
<td>W0-S20</td>
<td>B 911 787</td>
</tr>
<tr>
<td>35 mm</td>
<td>W1-S35</td>
<td>B 911 731</td>
</tr>
<tr>
<td>70 mm</td>
<td>W2-S70</td>
<td>B 911 732</td>
</tr>
<tr>
<td>105 mm</td>
<td>W3-S105</td>
<td>B 911 733</td>
</tr>
<tr>
<td>140 mm</td>
<td>W4-S140</td>
<td>B 911 734</td>
</tr>
<tr>
<td>210 mm</td>
<td>W5-S210</td>
<td>B 911 735</td>
</tr>
</tbody>
</table>

Approvals

<table>
<thead>
<tr>
<th>Type</th>
<th>UL</th>
<th>GL</th>
<th>EAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>W10/600</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>W0-S20</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>W1-S35</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>W2-S70</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>W3-S105</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>W4-S140</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>W5-S210</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 $U_{in}$: AC 720 V
- Rated impulse withstand voltage $U_{imp}$: 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: $50 \, W$
- Rated frequency: $15...400 \, Hz$
- 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**
- Standard: IEC 60044-1
- Shock resistance IEC 60068-2-27 (device in operation): $15 \, g/11 \, ms$
- Bumping IEC 60068-2-29 (transport): $40 \, g/8 \, ms$
- Vibration resistance IEC 60068-2-6 (device in operation): W1-S35...W3-S105 $1 \, g/10...150 \, Hz$
- W4-S140, WS-S210 $1 \, g/10...150 \, Hz/0.075 \, mm$
- Vibration resistance IEC 60068-2-6 (device not in operation): W1-S35...W5-S210 $2 \, g/10...150 \, Hz$
- Ambient temperature (during operation/during storage): $-10...+50 \, ^\circ\mathrm{C}/-40...+70 \, ^\circ\mathrm{C}$
- Classification of climatic conditions acc. to DIN IEC 60721-3-3: 3K5

**Connection**
- Connection: screw-type terminals
- Connections: rigid/flexible $0.2.../0.2...2.5 \, mm^2$
- Flexible with ferrules with/without plastic sleeve $0.25...2.5 \, mm^2$
- Conductor sizes (AWG): 24...12
- Connection to the evaluator:
  - single wire: $\geq 0.75 \, mm^2$
  - single wire, twisted: $\geq 0.75 \, mm^2$
  - shielded cable: $\geq 0.6 \, mm^2$
  - shielded cable (shield connected to PE on one side): recommended cable J-Y(St)Y min. 2x0.6

**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 W10/600](image)

#### Type W0-S20

![Type W0-S20](image)

#### Type W1-S35...W5-S210

![Type W1-S35...W5-S210](image)

<table>
<thead>
<tr>
<th>Dimensions (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>W10/600</td>
<td></td>
<td>ø 37</td>
<td>ø 10</td>
<td>18</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>85 g</td>
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<tr>
<td>W0-S20</td>
<td></td>
<td>32.4</td>
<td>ø 46</td>
<td>23.2</td>
<td>ø 20</td>
<td>–</td>
<td>–</td>
<td>70 g</td>
</tr>
<tr>
<td>W1-S35</td>
<td></td>
<td>100</td>
<td>79</td>
<td>26</td>
<td>48.5</td>
<td>33</td>
<td>46</td>
<td>ø 35</td>
</tr>
<tr>
<td>W2-S70</td>
<td></td>
<td>130</td>
<td>110</td>
<td>32</td>
<td>66</td>
<td>33</td>
<td>46</td>
<td>ø 70</td>
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<tr>
<td>W3-S105</td>
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<td>170</td>
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<td>33</td>
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<td>ø 105</td>
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<tr>
<td>W4-S140</td>
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<td>220</td>
<td>196</td>
<td>48.5</td>
<td>123</td>
<td>33</td>
<td>46</td>
<td>ø 140</td>
</tr>
<tr>
<td>W5-S210</td>
<td></td>
<td>299</td>
<td>284</td>
<td>69</td>
<td>161</td>
<td>33</td>
<td>46</td>
<td>ø 210</td>
</tr>
</tbody>
</table>
W.../W...-8000 series
Measuring current transformers

Typical applications

Measuring current transformers W...
- For RCM5460/490 residual current monitoring systems
- For RCM420 residual current monitors
- For EDS470, EDS460/490 and EDS440 insulation fault locators in AC and DC systems

W...-8000 measuring current transformers
- For 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>Inside diameter</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting brackets, DIN rail</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 mm</td>
<td>W20</td>
<td>B 9808 0003</td>
<td></td>
</tr>
<tr>
<td></td>
<td>W20-8000</td>
<td>B 9808 0009</td>
<td></td>
</tr>
<tr>
<td>35 mm</td>
<td>W35</td>
<td>B 9808 0010</td>
<td></td>
</tr>
<tr>
<td></td>
<td>W35-8000</td>
<td>B 9808 0017</td>
<td></td>
</tr>
<tr>
<td>60 mm</td>
<td>W60</td>
<td>B 9808 0018</td>
<td></td>
</tr>
<tr>
<td></td>
<td>W60-8000</td>
<td>B 9808 0027</td>
<td></td>
</tr>
<tr>
<td>Mounting brackets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>120 mm</td>
<td>W120</td>
<td>B 9808 0028</td>
<td></td>
</tr>
<tr>
<td></td>
<td>W210</td>
<td>B 9808 0034</td>
<td></td>
</tr>
</tbody>
</table>

1) For EDS461/491 and EDS473/474 insulation fault locators

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Width</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snap-on mounting for W20-W35, W20-W35-8000</td>
<td>43.5 mm</td>
<td>B 9808 0501</td>
</tr>
<tr>
<td>Snap-on mounting for W60, W60-8000</td>
<td>50 mm</td>
<td>B 9808 0502</td>
</tr>
</tbody>
</table>

Selection list

<table>
<thead>
<tr>
<th>Type</th>
<th>RCM420</th>
<th>RCM5460</th>
<th>EDS460</th>
<th>EDS461</th>
<th>EDS440</th>
<th>EDS441</th>
<th>EDS441-LAB</th>
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</thead>
<tbody>
<tr>
<td>W20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>W35</td>
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</tr>
<tr>
<td>W60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W120</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W210</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W20-8000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W35-8000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>W60-8000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Technical data

Insulation coordination acc. to IEC 60664-1
Rated insulation voltage: 800 V
Rated impulse voltage/pollution degree 8 kV/3

CT circuit W…-8000 series measuring current transformers
Rated primary residual current: 10 A
Rated secondary residual current: 0.0167 A
Rated transformation ratio $K_n$: 10/0.0167 A
Rated burden: max. 180 Q*
Nominal power: 0.05 VA
Frequency range: 42 Hz...3 kHz
Rated continuous thermal current $I_{ct}$: 40 A
Rated short-time thermal current $I_{th}$: 60 $I_{ct} = 2.4$ kA/1 s
Rated dynamic current $I_{dyn}$: 2.5 $I_{th} = 6.0$ kA/40 ms

CT circuit W…-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 $I_{ct}$: 6 A
Rated short-time thermal current $I_{th}$: 60 $I_{ct} = 0.36$ kA/1 s
Rated dynamic current $I_{dyn}$: 2.5 $I_{th} = 0.9$ kA/40 ms

Environment
Operating temperature: -25...+70 °C
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) 2K5 (except condensation and formation of ice)
Long-time storage (IEC 60721-3-1) 1K5 (except condensation and formation of ice)
Classification of mechanical conditions IEC 60721
Stationary use (IEC 60721-3-3) 3M4
Transport (IEC 60721-3-2) 2M2
Long-time storage (IEC 60721-3-1) 1M3

Connection
Connection
rigid/flexible/conductor sizes 0.08...2.5/0.08...2.5 mm² (AWG 28...12)
Stripping length 8...9 mm

Connection EDS, RCM(S) measuring current transformers
Single wire ≥ 0.75 mm² 0...1 m
Single wire, twisted ≥ 0.75 mm² 0...10 m
Shielded cable ≥ 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 (IEC 60529) IP20
Screw mounting MS with mounting bracket
Flammability class UL94 V-0
Documentation number D00078
Approvals and certifications UL under development

* The rated burden may vary depending on the respective device data sheet.

---

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>A</td>
</tr>
<tr>
<td>W20</td>
<td>76.4</td>
</tr>
<tr>
<td>W35</td>
<td>99.5</td>
</tr>
<tr>
<td>W60</td>
<td>135</td>
</tr>
<tr>
<td>W120</td>
<td>210</td>
</tr>
<tr>
<td>W210</td>
<td>323</td>
</tr>
<tr>
<td>W20-8000*</td>
<td>76.4</td>
</tr>
<tr>
<td>W35-8000*</td>
<td>99.5</td>
</tr>
<tr>
<td>W60-8000*</td>
<td>135</td>
</tr>
</tbody>
</table>

Tolerance: ±0.5 mm
* For EDS461/491 insulation fault locators
Screw mounting

Screw mounting with mounting brackets for:
W20, W35, W60 and W20-8000, W35-8000, W60-8000

W.../W...-8000 series measuring current transformers

Dimensions (mm)

<table>
<thead>
<tr>
<th>Type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>W20/W20-8000</td>
<td>49</td>
<td>31.4</td>
<td>65</td>
<td>18.6</td>
</tr>
<tr>
<td>(fixing with two mounting brackets, diagonally)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W35/W35-8000</td>
<td>49</td>
<td>49.8</td>
<td>65</td>
<td>12.1</td>
</tr>
<tr>
<td>(fixing with two mounting brackets, diagonally)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W60/W60-8000</td>
<td>56</td>
<td>66</td>
<td>72</td>
<td>17.7</td>
</tr>
<tr>
<td>(fixing with four mounting brackets)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W120 (screw mounting)</td>
<td>51</td>
<td>103</td>
<td>60.6</td>
<td>65</td>
</tr>
<tr>
<td>W210 (screw mounting)</td>
<td>59</td>
<td>180</td>
<td>68.6</td>
<td>83</td>
</tr>
</tbody>
</table>

Tolerance for screw mounting with mounting brackets: ±1.5 mm

Snap-on mounting

Snap-on mounting on DIN rail: for vertical or horizontal mounting:
W20, W35, W60 und W20-8000, W35-8000, W60-8000

Dimensions (mm)

<table>
<thead>
<tr>
<th>Type</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>W20/W20-8000</td>
<td>43.5</td>
<td>32</td>
</tr>
<tr>
<td>W35/W35-8000</td>
<td>43.5</td>
<td>32</td>
</tr>
<tr>
<td>W60/W60-8000</td>
<td>50</td>
<td>39</td>
</tr>
</tbody>
</table>

Measuring current transformers W...

Connection to the respective residual current monitoring system RCMS, residual current monitors RCM or to insulation fault location systems EDS

W...-8000 measuring current transformers

Connection to the respective EDS461 and EDS491 insulation fault locator

Wiring diagram

Connection to the respective device

1.2 = K = 51
3.4 = I = 52

To the loads

PE L1 L2 L3 N
W…AB(P) series
Measuring current transformers

- **Typical applications**
  - W20AB…W60AB for AC/DC sensitive RCMA420 residual current monitors
  - W20AB…W210AB for RCMS460/490 residual current monitoring systems or for RCMA423 residual current monitors
  - W35ABP and W60ABP for RCMS460/490 and for RCMA420/423 residual current monitors. For use in systems where short-term load currents are likely to occur.

- **Standards**
  - W…AB(P) series 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 brackets, DIN rail</th>
<th>Inside diameter</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20 mm</td>
<td>W20AB</td>
<td>B 9808 0008</td>
</tr>
<tr>
<td></td>
<td>35 mm</td>
<td>W35AB</td>
<td>B 9808 0016</td>
</tr>
<tr>
<td></td>
<td>60 mm</td>
<td>W60AB</td>
<td>B 9808 0026</td>
</tr>
</tbody>
</table>

| Mounting brackets           | 120 mm          | W120AB| B 9808 0041 |
|                            | 210 mm          | W210AB| B 9808 0040 |

### Connecting wires

<table>
<thead>
<tr>
<th>For device</th>
<th>Length</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCMA420/423</td>
<td>1 m</td>
<td>WX-100</td>
<td>B 9808 0503</td>
</tr>
<tr>
<td></td>
<td>2.5 m</td>
<td>WX-250</td>
<td>B 9808 0504</td>
</tr>
<tr>
<td></td>
<td>5 m</td>
<td>WX-500</td>
<td>B 9808 0505</td>
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<td></td>
<td>10 m</td>
<td>WX-1000</td>
<td>B 9808 0511</td>
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<tr>
<td>RCMS460/490</td>
<td>1 m</td>
<td>WXS-100</td>
<td>B 9808 0506</td>
</tr>
<tr>
<td></td>
<td>2.5 m</td>
<td>WXS-250</td>
<td>B 9808 0507</td>
</tr>
<tr>
<td></td>
<td>5 m</td>
<td>WXS-300</td>
<td>B 9808 0508</td>
</tr>
<tr>
<td></td>
<td>10 m</td>
<td>WXS-1000</td>
<td>B 9808 0509</td>
</tr>
</tbody>
</table>

Control cable LiYY flexible, 6 x AWG 20 (6 x 0.56 mm²), approved by UL 2464

### Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>For device</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snap-on mounting</td>
<td>W20AB, W35AB(P)</td>
<td>B 9808 0501</td>
</tr>
<tr>
<td></td>
<td>W60AB(P)</td>
<td>B 9808 0502</td>
</tr>
</tbody>
</table>

### Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply units</td>
<td>AN420-1</td>
<td>324</td>
</tr>
<tr>
<td></td>
<td>AN420-2</td>
<td>324</td>
</tr>
<tr>
<td></td>
<td>AN110-1</td>
<td>320</td>
</tr>
<tr>
<td></td>
<td>AN110-2</td>
<td>320</td>
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</table>

### Selection list

<table>
<thead>
<tr>
<th>Type</th>
<th>RCMA420</th>
<th>RCMA423</th>
<th>RCMS460/490</th>
<th>EDS441-LAB</th>
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</thead>
<tbody>
<tr>
<td>W20AB</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>W35AB(P)</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>W60AB(P)</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>W120AB</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>W210AB</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
</tbody>
</table>
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

Supply voltage
Supply voltage $U_s$ DC ±12 V
Operating range of $U_s$ 0.95 ... 1.05 x $U_s$
Power consumption ≤ 2.5 VA

CT circuit
Rated primary residual current W20AB 10 ... 500 mA
Rated primary residual current W35AB(P) ... W120AB 10 mA ... 10 A
Rated primary residual current W210AB 300 mA ... 10 A
Rated continuous thermal current $I_{ct}$ 40 A
Rated short-time thermal current $I_{th}$ 2.4 kA/1 s
Rated dynamic current $I_{dyn}$ 6.0 kA/40 ms

Environment/EMC
EMC IEC 62020
Ambient temperature, operation -10 ... +55 °C
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) 2M2
Long-time storage (IEC 60721-3-1) 1M3

Connection
Type of connection plug-in connectors
Connection RCMA/RCMS measuring current transformers see table “connecting cables”

Other
Degree of protection, internal components (IEC 60529) IP40
Degree of protection, terminals (IEC 60529) IP20
Screw mounting lens head screw M5 acc. to DIN 7985
DIN rail mounting (W20AB ... W60AB(P) only) with snap-on mounting
Flammability class UL94 V-HB
Documentation number D00074

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>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>W20AB</td>
<td>30</td>
<td>56.3</td>
<td>50</td>
<td>76.4</td>
<td>48.5</td>
<td>ø 20</td>
<td>29.8</td>
<td>16.4</td>
<td>180 g</td>
</tr>
<tr>
<td>W35AB(P)</td>
<td>30</td>
<td>79.2</td>
<td>62</td>
<td>99.5</td>
<td>55</td>
<td>ø 35</td>
<td>41.7</td>
<td>20</td>
<td>350 g</td>
</tr>
<tr>
<td>W60AB(P)</td>
<td>37</td>
<td>116.4</td>
<td>79</td>
<td>135</td>
<td>67</td>
<td>ø 60</td>
<td>60.4</td>
<td>24</td>
<td>570 g</td>
</tr>
<tr>
<td>W120AB</td>
<td>37</td>
<td>191.5</td>
<td>116.5</td>
<td>210</td>
<td>67</td>
<td>ø 120</td>
<td>98</td>
<td>33.5</td>
<td>1920 g</td>
</tr>
<tr>
<td>W210AB</td>
<td>45</td>
<td>304.5</td>
<td>173</td>
<td>323</td>
<td>80</td>
<td>ø 210</td>
<td>154.5</td>
<td>45</td>
<td>5800 g</td>
</tr>
</tbody>
</table>

Tolerance: ±0.5 mm

Screw mounting
Screw mounting with mounting brackets for W20AB, W35AB(P), W60AB(P)

Screw mounting: W120AB, W210AB

Dimensions (mm)

<table>
<thead>
<tr>
<th>Type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>W35 (mounting with 2 mounting brackets diagonal)</td>
<td>49</td>
<td>31.4</td>
<td>65</td>
<td>18.6</td>
</tr>
<tr>
<td>W35AB(P) (mounting with 2 mounting brackets diagonal)</td>
<td>49</td>
<td>49.8</td>
<td>65</td>
<td>12.1</td>
</tr>
<tr>
<td>W60AB(P) (mounting with 3 mounting brackets diagonal)</td>
<td>56</td>
<td>66</td>
<td>72</td>
<td>17.7</td>
</tr>
<tr>
<td>W120AB (screw mounting)</td>
<td>81</td>
<td>103</td>
<td>90.6</td>
<td>65</td>
</tr>
<tr>
<td>W210AB (screw mounting)</td>
<td>98</td>
<td>180</td>
<td>117.1</td>
<td>83</td>
</tr>
</tbody>
</table>

Dimensions in mm
Tolerance for screw mounting with mounting brackets: ±1.5 mm

Snap-on mounting
Snap-on mounting on DIN rail for vertical or horizontal mounting, for W20AB, W35AB(P), W60AB(P)

Dimensions (mm)

<table>
<thead>
<tr>
<th>Type</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>W20AB</td>
<td>43.5</td>
<td>32</td>
</tr>
<tr>
<td>W35AB(P)</td>
<td>43.5</td>
<td>32</td>
</tr>
<tr>
<td>W60AB(P)</td>
<td>50</td>
<td>39</td>
</tr>
</tbody>
</table>
Connection to the RCMS460/490 residual current monitoring system using the WXS-… connecting cable.

Connection to the RCMA420/423 residual current monitor using the WX-… connecting cable.

Colour coding for WXS… and WX…: k = yellow, l = green, -12 V = black, GND = brown, +12 V = red, test (T) = orange
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>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>without screening</td>
<td>70 x 175 mm</td>
<td>WR70x175S</td>
<td>B 911 738</td>
</tr>
<tr>
<td></td>
<td>115 x 305 mm</td>
<td>WR115x305S</td>
<td>B 911 739</td>
</tr>
<tr>
<td></td>
<td>150 x 350 mm</td>
<td>WR150x350S</td>
<td>B 911 740</td>
</tr>
<tr>
<td></td>
<td>200 x 500 mm</td>
<td>WR200x500S</td>
<td>B 911 763</td>
</tr>
<tr>
<td>Screening integrated</td>
<td>70 x 175 mm</td>
<td>WR70x175SP</td>
<td>B 911 790</td>
</tr>
<tr>
<td></td>
<td>115 x 305 mm</td>
<td>WR115x305SP</td>
<td>B 911 791</td>
</tr>
<tr>
<td></td>
<td>150 x 350 mm</td>
<td>WR150x350SP</td>
<td>B 911 792</td>
</tr>
<tr>
<td></td>
<td>200 x 500 mm</td>
<td>WR200x500SP</td>
<td>B 911 793</td>
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Approvals

<table>
<thead>
<tr>
<th>Type</th>
<th>UL</th>
<th>GL</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR70x175S(P)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WR115x305S(P)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WR150x350S(P)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WR200x500S(P)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Technical data**

### Insulation coordination acc. to IEC 61869-2
- Highest system voltage for electrical equipment $U_{\text{m}}$: AC 720 V
- Rated impulse withstand voltage $U_{\text{imp}}$: 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 P6KE6V8CP
- 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 60644-1
- Shock resistance IEC 60668-2-27: 15 g/11 ms
- Bumping IEC 60668-2-29 (transport): 40 g/6 s
- Vibration resistance IEC 60668-2-6: 1 g/10…150 Hz
- Vibration resistance IEC 60668-2-6 (transport): 2 g/10…150 Hz
- Ambient temperature (during operation): $-10$…+50 °C
- Ambient temperature (during storage): $-40$…+70 °C
- Classification of climatic conditions acc. to DIN IEC 60721-3-3: 3K5

### 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 ≥ 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(S)Y min. 2x0.6

### 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
- Documentation number: D00144
- Flammability class: UL94 V-0

### Dimensions (mm) and 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>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR70x175S(P)</td>
<td>70</td>
<td>175</td>
<td>225</td>
<td>85</td>
<td>22</td>
<td>46</td>
<td>261</td>
<td>176</td>
<td>7.5</td>
<td>2900 g</td>
</tr>
<tr>
<td>WR115x305S(P)</td>
<td>115</td>
<td>305</td>
<td>360</td>
<td>116</td>
<td>25</td>
<td>55</td>
<td>397</td>
<td>240</td>
<td>8</td>
<td>6300 g</td>
</tr>
<tr>
<td>WR150x350S(P)</td>
<td>150</td>
<td>350</td>
<td>415</td>
<td>140</td>
<td>28</td>
<td>55</td>
<td>460</td>
<td>285</td>
<td>8</td>
<td>8250 g</td>
</tr>
<tr>
<td>WR200x500S(P)</td>
<td>500</td>
<td>200</td>
<td>585</td>
<td>568.5</td>
<td>268.5</td>
<td>285</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>9000 g</td>
</tr>
</tbody>
</table>

### Wiring diagram

- PE L1 L2 L3 N
- S1 (k)
- S2 (l)
- RCM, RCMS, EDS
- to the loads
**WS…/WS…-8000 series**

Split-core type measuring current transformers

<table>
<thead>
<tr>
<th>Typical applications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WS… measuring current transformers</strong></td>
</tr>
<tr>
<td>• For RCMS460/490 residual current monitoring systems</td>
</tr>
<tr>
<td>• For RCM420/RCM460 residual current monitors</td>
</tr>
<tr>
<td>• For EDS470, EDS460/490 and EDS440 insulation fault locators in AC and DC systems</td>
</tr>
</tbody>
</table>

| **WS…-8000 measuring current transformer** |
| • For EDS473(E)-12, EDS474(E)-12, EDS461 and EDS491 insulation fault locators |

<table>
<thead>
<tr>
<th>Approvals</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS… and WS…-8000 measuring current transformers comply with the device standard: IEC 61869-1.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Further information</th>
</tr>
</thead>
<tbody>
<tr>
<td>For further information refer to our product range on <a href="http://www.bender.de">www.bender.de</a>.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ordering information</th>
</tr>
</thead>
</table>

<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>B 9808 0601</td>
</tr>
<tr>
<td></td>
<td>20 x 30 mm-8000</td>
<td>WS20x30-8000</td>
<td>B 9808 0602</td>
</tr>
<tr>
<td></td>
<td>50 x 80 mm</td>
<td>WS50x80</td>
<td>B 9808 0603</td>
</tr>
<tr>
<td></td>
<td>50 x 80 mm-8000</td>
<td>WS50x80-8000</td>
<td>B 9808 0604</td>
</tr>
<tr>
<td></td>
<td>80 x 120 mm</td>
<td>WS80x120</td>
<td>B 9808 0606</td>
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</table>

1) For EDS461/491 and EDS473/474 insulation fault locators

<table>
<thead>
<tr>
<th>Selection list</th>
</tr>
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<table>
<thead>
<tr>
<th>Type</th>
<th>RCM420</th>
<th>RCMS460</th>
<th>RCMS490</th>
<th>EDS460</th>
<th>EDS490</th>
<th>EDS461</th>
<th>EDS491</th>
<th>EDS440</th>
<th>EDS441</th>
<th>EDS441-LAB</th>
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</thead>
<tbody>
<tr>
<td>WS20x30</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS50x80</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS80x120</td>
<td>✔</td>
<td>✔</td>
<td></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>
<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>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

WS.../WS...-8000 series measuring current transformers
### 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 burden: max. 0.05 Ω
- Frequency range: 42 Hz...3 kHz
- Rated continuous thermal current: 40 A
- Rated short-time thermal current: 2.4 kA/1 s
- Rated dynamic current: 6.0 kA/40 ms

**CT circuit WS…-8000**
- Rated primary residual current: 1 A
- Rated secondary residual current: 0.125 mA
- Rated burden: 1 A/0.125 mA
- Frequency range: 42 Hz...3 kHz
- Rated continuous thermal current: 6 A
- Rated short-time thermal current: 0.36 kA/1 s
- Rated dynamic current: 0.9 kA/40 ms

### Environmental conditions

**Operating temperature**
- -25...+70 °C

**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): 2K5 (except condensation and formation of ice)
- Long-time storage (IEC 60721-3-1): 1K3

**Classification of mechanical conditions IEC 60721**
- Stationary use (IEC 60721-3-3): 3M4
- Transport (IEC 60721-3-2): 2M2
- Long-time storage (IEC 60721-3-1): 1M3

### Connection

- Connection: screw-type terminals
- rigidity/flexibility/conductor sizes: 0.08...2.5 mm² (AWG 28...12)
- Stripping length: 8...9 mm

**Connection EDS, RCM(S) measuring current transformers**
- Single wire ≥ 0.75 mm²: 0...1 m
- Single wire, twisted ≥ 0.75 mm²: 0...10 m
- Shielded cable ≥ 0.5 mm²: 0...40 m
- Shielded cable (shield on one side connected to L-conductor, not connected to earth): recommended: J-Y(S)TY 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
- Approvals and certifications: UL under development

### Dimensions and Weight

<table>
<thead>
<tr>
<th>Type</th>
<th>Dimensions (mm)</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>WS20x30</td>
<td>93</td>
<td>106.15</td>
</tr>
<tr>
<td>WS50x80</td>
<td>125</td>
<td>158.15</td>
</tr>
<tr>
<td>WS80x120</td>
<td>155</td>
<td>198.15</td>
</tr>
<tr>
<td>WS20x30-8000</td>
<td>93</td>
<td>106.15</td>
</tr>
<tr>
<td>WS50x80-8000</td>
<td>125</td>
<td>158.15</td>
</tr>
</tbody>
</table>

### Dimension diagram

![Dimension diagram](image1)

### Wiring diagram

![Wiring diagram](image2)

**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>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 x 80 mm</td>
<td>WS50x80S</td>
<td>B 911 741</td>
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<tr>
<td>80 x 80 mm</td>
<td>WS80x80S</td>
<td>B 911 742</td>
</tr>
<tr>
<td>80 x 120 mm</td>
<td>WS80x120S</td>
<td>B 911 743</td>
</tr>
<tr>
<td>80 x 160 mm</td>
<td>WS80x160S</td>
<td>B 911 755</td>
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</table>

### Approvals

<table>
<thead>
<tr>
<th>Type</th>
<th>UL</th>
<th>GL</th>
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<tbody>
<tr>
<td>WS50x80S</td>
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<td></td>
</tr>
<tr>
<td>WS80x80S</td>
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<td></td>
</tr>
<tr>
<td>WS80x120S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS80x160S</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Technical data

**Insulation coordination acc. to IEC 60044-1**

- Highest system voltage for electrical equipment $U_{\text{m}}$: AC 720 V
- Rated impulse withstand voltage $U_{\text{imp}}$: 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 mA
- Rated frequency: $50 \ldots 400$ Hz
- Internal resistance: $5 \ldots 8$ Ω

**Secondary overvoltage protection**

- with suppressor diode P0KE6V8CP
- 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/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): $-10 \ldots +50 ^\circ$ C
- Storage temperature range: $-40 \ldots +70 ^\circ$ C
- Classification of climatic conditions acc. to DIN IEC 60721-3-3: 3K5

**Connection**

- Connection: screw-type terminals
- rigid/flexible: $0.2 \ldots 4/0.2 \ldots 2.5$ mm²
- flexible with ferrules with/without plastic sleeve: $0.25 \ldots 2.5$ mm²
- Conductor sizes (AWG): 24...12

**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

**Dimensions diagrams**

**WS50x80S…WS80x160S series**

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td><strong>A</strong></td>
</tr>
<tr>
<td>WS50x80S</td>
<td>50</td>
</tr>
<tr>
<td>WS80x80S</td>
<td>80</td>
</tr>
<tr>
<td>WS80x120S</td>
<td>80</td>
</tr>
<tr>
<td>WS80x160S</td>
<td>80</td>
</tr>
</tbody>
</table>
LINETRAXX® Series WF...
Consisting of an RCC420 signal converter and a WF…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.

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Length A measuring current transformer</th>
<th>Supply voltage U1(1)</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DC</td>
<td></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>B 9806 0008</td>
</tr>
</tbody>
</table>
### Technical data

#### Electrical safety
- Standard: RCC420
- Pollution degree: 3
- Rated insulation voltage: 250 V
- Standard: WF...
- IEC 61010-1 and IEC 61010-2-032 CAT III
- Pollution degree: 2
- Rated insulation voltage (CAT III): 1000 Vrms or DC

#### Supply voltage
- Supply voltage $U_S$
- see ordering information
- Power consumption: ≤ 3 VA

#### Measuring circuit
- Measuring range: 100 mA...20 A
- Rated transformation ratio $K_n (U - I): 100 \text{ mV/A}$, $K_n (k - l): 1.67 \text{ mA/A}$
- Rated burden (signal output $k$, $I$): 68 Ω
- Rated frequency: 42...2000 Hz
- Rated short-time thermal current $I_{th}$: 1 kA
- Rated dynamic current $I_{dyn}$: 150 kA/40 ms

#### Environment/EMC
- EMC:
- IEC 62020
- Operating temperature:
- -25...+55 °C
- 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 (except condensation and formation of ice)
- Long-time storage (IEC 60721-3-1): 1K4 (except condensation and formation of ice)
- Classification of mechanical conditions acc. to IEC 60721
- Stationary use (IEC 60721-3-3): 3M4
- Transport (IEC 60721-3-2): 2M2
- Long-time storage (IEC 60721-3-1): 1M3

#### Connection RCC420
- Connection type: push-wire terminal
- Connection properties:
- rigid
- flexible without ferrule
- Shiedled cable ≥ 0.5 mm²
- Shielded cable (shield to terminal, not connected to earth) recommended: J-Y(St)Y min. 2x0.8

#### Operating mode
- continuous operation
- Mounting:
- any position
- Degree of protection, internal components (IEC 60529): IP30
- Degree of protection, terminals (IEC 60529): IP30
- 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
- WF1800 ≤ 430g

#### Other
- Weight:
- RCC 420 ≤ 160 g
- WF170 ≤ 160 g
- WF250 ≤ 180 g
- WF500 ≤ 200 g
- WF1200 ≤ 310 g
- WF1800 ≤ 430g

#### Note:
The measuring current transformer is adapted to the associated signal converter RCC420.

### Dimension diagrams (dimensions in mm)

**XM420 (RCC420)**

![Dimension diagram XM420](https://example.com/diagram)

**WF... measuring current transformers**

A = For details about the length of the measuring current transformer refer to ordering information.

**WF170...WF250**

![Dimension diagram WF170...WF250](https://example.com/diagram)

**Note:** The measuring current transformer is adapted to the associated signal converter RCC420.

**Locking connector measuring current transformer WF500...WF1800**

Keep the locking connector clean

**Locking connector WF170...WF250**

Keep the locking connector clean
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...

* 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".
# Measuring current transformer selection list

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<th>Suitable system components</th>
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## Cables and wires

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Suitable system components
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: IiO
- Inrush current \( I_E \) GL version < 8 \( x I_n \)

Typical applications
- For IT systems in medical locations

Approvals

Standards
ES710 isolating transformers comply with the device standards and the regulations for installation:

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

#### Power/voltages/currents

<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>
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<td>5000 VA</td>
<td>6300 VA</td>
<td>8000 VA</td>
<td>10000 VA</td>
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<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>AC 230 V</td>
<td>AC 230 V</td>
<td>AC 230 V</td>
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<td>≤ 35 dB(A)</td>
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<td>≤ 35 dB(A)</td>
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#### Environmental conditions

- **Ambient temperature**: ≤ 40 °C
- **No-load temperature rise**: ≤ 22 °C
- **Full-load temperature rise**: ≤ 35 °C
- **Noise level (under no-load conditions and nominal load)**: ≤ 35 dB(A)

#### Other

- **Insulation classification**: t=40/B
- **Degree of protection**: IP00
- **Protection class**: U/I* IP00
- **Core UI**: 180/93
- **Core UI GL version**: 180/93
- **Recommended use when used in accordance with DIN VDE 0100-710**: 25 A gl/gl 25 A gl/gl 50 A gl/gl 50 A gl/gl 63 A gl/gl 63 A gl/gl 80 A gl/gl
- **Recommended use when used in accordance with DIN VDE 0100-710 GL version**: 25 A gl/gl 25 A gl/gl 35 A gl/gl 35 A gl/gl 50 A gl/gl 50 A gl/gl 50 A gl/gl 63 A gl/gl 63 A gl/gl
- **Inductance**: 0.66 H
- **Primary**: 0.125 H
- **Secondary**: 0.125 H
- **Efficiency**: 95 %
- **Documentation 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)**: < 95 W
- **Cu loss (copper loss) GL version**: < 95 W

#### Heat dissipation loss at 40 °C ambient temperature and 100 % continuous load

- **Heat dissipation loss**: 175 W
- **Heat dissipation loss GL version**: < 135 W

**Green Line transformer (energy efficient version) – High degree of energy saving over the life time (16 years AfA)**

- **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
- **Standard version**: GL version (Green Line)
- **Higher purchase price of approx. 15-20%**: ROI (Return on Investment) after about 1-3 years
**Isolating transformer ES710**

<table>
<thead>
<tr>
<th>Dimension diagrams</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard</strong> – Dimension B: depth incl. terminals</td>
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![Diagram of Standard transformer](image1)

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<tr>
<th><strong>SK2 series</strong></th>
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![Diagram of SK2 series transformer](image2)

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<th><strong>S series</strong> – Dimension E: width incl. terminals</th>
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![Diagram of S series transformer](image3)

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<th><strong>K series</strong></th>
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![Diagram of K series transformer](image4)

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<th><strong>LG series</strong></th>
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![Diagram of LG series transformer](image5)

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<th><strong>Transformer enclosure</strong></th>
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![Diagram of Transformer enclosure](image6)

All other dimensions correspond to the standard dimensions.
### Ordering information

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<th>Weight (lg)</th>
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### Ordering information enclosure

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5.1 Isolating transformer ES710

### 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)

### Wiring diagram

[Image of wiring diagram]

- **S**: input terminal
- **115 V**: secondary voltage
- **230 V**: primary voltage

### Terminal diagram

#### Standard
- **K series**
- **LG series**
- **S 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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<td>4/6 mm²</td>
<td>2.5/4 mm²</td>
<td>35/35 mm²</td>
</tr>
</tbody>
</table>
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

Typical applications
- For IT systems in medical locations

Approvals
DS0107 isolating transformers comply with the device standards and the regulations for installation:

Note:
- According to DIN VDE 0100-710 (VDE 0100-710), 2002-11, para. 710.512.1.6.2, 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

Type | DS0107/2000 | DS0107/3150 | DS0107/4000 | DS0107/5000 | DS0107/6300 | DS0107/8000 | DS0107/10000
---|---|---|---|---|---|---|---
Insulation classification | ta 40/B | ta 40/B | ta 40/B | ta 40/B | ta 40/B | ta 40/B | ta 40/B
Degree of protection | IP00 | IP00 | IP00 | IP00 | IP00 | IP00 | IP00
Protection class | I/II* | I/II* | I/II* | I/II* | I/II* | I/II* | I/II*

Power/voltages/currents

<table>
<thead>
<tr>
<th>Rated power</th>
<th>2000 VA</th>
<th>3150 VA</th>
<th>4000 VA</th>
<th>5000 VA</th>
<th>6300 VA</th>
<th>8000 VA</th>
<th>10000 VA</th>
</tr>
</thead>
<tbody>
<tr>
<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>
<td>50 – 60 Hz</td>
<td>50 – 60 Hz</td>
</tr>
<tr>
<td>Rated input voltage</td>
<td>3AC 400 V</td>
<td>3AC 400 V</td>
<td>3AC 400 V</td>
<td>3AC 400 V</td>
<td>3AC 400 V</td>
<td>3AC 400 V</td>
<td>3AC 400 V</td>
</tr>
<tr>
<td>Rated input current</td>
<td>3 A</td>
<td>4.9 A</td>
<td>6.1 A</td>
<td>7.7 A</td>
<td>9.8 A</td>
<td>12.2 A</td>
<td>15.6 A</td>
</tr>
<tr>
<td>Rated output voltage</td>
<td>3NA 230 V</td>
<td>3NA 230 V</td>
<td>3NA 230 V</td>
<td>3NA 230 V</td>
<td>3NA 230 V</td>
<td>3NA 230 V</td>
<td>3NA 230 V</td>
</tr>
<tr>
<td>Rated output current</td>
<td>5 A</td>
<td>7.9 A</td>
<td>10 A</td>
<td>12.6 A</td>
<td>15.8 A</td>
<td>20.1 A</td>
<td>25.2 A</td>
</tr>
<tr>
<td>Inrush current i_k</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>
<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>
<td>≤ 0.5 mA</td>
<td>≤ 0.5 mA</td>
<td>≤ 0.5 mA</td>
</tr>
<tr>
<td>No-load input current i_0</td>
<td>≤ 3.0 %</td>
<td>≤ 3.0 %</td>
<td>≤ 3.0 %</td>
<td>≤ 3.0 %</td>
<td>≤ 3.0 %</td>
<td>≤ 3.0 %</td>
<td>≤ 3.0 %</td>
</tr>
<tr>
<td>No-load output voltage u_0</td>
<td>&lt; 232 V</td>
<td>&lt; 235 V</td>
<td>&lt; 234 V</td>
<td>&lt; 236 V</td>
<td>&lt; 236 V</td>
<td>&lt; 235 V</td>
<td>&lt; 235 V</td>
</tr>
<tr>
<td>Short-circuit voltage u_s</td>
<td>≤ 2.9 %</td>
<td>≤ 2.9 %</td>
<td>≤ 2.8 %</td>
<td>≤ 2.8 %</td>
<td>≤ 2.7 %</td>
<td>≤ 2.8 %</td>
<td>≤ 2.5 %</td>
</tr>
</tbody>
</table>

Environmental conditions

| Ambient temperature | ≤ 40 °C | ≤ 40 °C | ≤ 40 °C | ≤ 40 °C | ≤ 40 °C | ≤ 40 °C | ≤ 40 °C |
| No-load temperature rise | ≤ 25 °C | ≤ 21 °C | ≤ 24 °C | ≤ 28 °C | ≤ 24 °C | ≤ 27 °C | ≤ 32 °C |
| Full-load temperature rise | ≤ 50 °C | ≤ 50 °C | ≤ 53 °C | ≤ 67 °C | ≤ 60 °C | ≤ 72 °C | ≤ 75 °C |
| Noise level (no load and full load) | ≤ 35 dB(A) | ≤ 35 dB(A) | ≤ 35 dB(A) | ≤ 35 dB(A) | ≤ 35 dB(A) | ≤ 35 dB(A) | ≤ 35 dB(A) |

Other

<table>
<thead>
<tr>
<th>Recommended fuse when used in accordance with DIN VDE 0100-710</th>
<th>10 A gl/gG</th>
<th>16 A gl/gG</th>
<th>20 A gl/gG</th>
<th>20 A gl/gG</th>
<th>25 A gl/gG</th>
<th>35 A gl/gG</th>
<th>35 A gl/gG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Induction</td>
<td>1.0 T</td>
<td>0.8 T</td>
<td>0.86 T</td>
<td>0.8 T</td>
<td>0.8 T</td>
<td>0.8 T</td>
<td>0.8 T</td>
</tr>
<tr>
<td>Ψ-primary</td>
<td>1.12 Ω</td>
<td>0.7 Ω</td>
<td>0.42 Ω</td>
<td>0.38 Ω</td>
<td>0.33 Ω</td>
<td>0.26 Ω</td>
<td>0.13 Ω</td>
</tr>
<tr>
<td>Ψ-secondary</td>
<td>0.27 Ω</td>
<td>0.17 Ω</td>
<td>0.13 Ω</td>
<td>0.12 Ω</td>
<td>0.07 Ω</td>
<td>0.055 Ω</td>
<td>0.05 Ω</td>
</tr>
<tr>
<td>FE loss (iron loss)</td>
<td>45 W</td>
<td>51 W</td>
<td>70 W</td>
<td>75 W</td>
<td>80 W</td>
<td>96 W</td>
<td>120 W</td>
</tr>
<tr>
<td>Cu loss (copper loss)</td>
<td>60 W</td>
<td>105 W</td>
<td>115 W</td>
<td>170 W</td>
<td>200 W</td>
<td>255 W</td>
<td>270 W</td>
</tr>
<tr>
<td>Efficiency</td>
<td>95 %</td>
<td>96 %</td>
<td>95 %</td>
<td>95 %</td>
<td>96 %</td>
<td>96 %</td>
<td>96 %</td>
</tr>
</tbody>
</table>

Documentation number: D00105

* Option: completely encapsulated version
### Ordering information

#### Dimensions (mm) Suitable for the following device types

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
<th>Suitable for the following device types</th>
<th>Weight (kg)</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>430</td>
<td>380</td>
<td>490</td>
<td>385</td>
<td>420</td>
</tr>
<tr>
<td>600</td>
<td>420</td>
<td>490</td>
<td>555</td>
<td>460</td>
</tr>
</tbody>
</table>
Isolating transformer DS0107

**Nameplate**

- **ES**: single-phase isolating transformer
- **DS**: three-phase isolating transformer
- **P**: rated power (VA)

**Type series**
- **without**: standard
- **K**: terminals on top
- **LG**: horizontal position
- **SK2**: encapsulation according to protection class II
- **S**: terminals on top side end

**Wiring diagram**

![Wiring diagram](image)

**Terminal diagram**

**Standard, K series, LG series**

**SK2 series,**

**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>
</tr>
<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>
</tr>
<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>
</tr>
<tr>
<td>DS0107/5000</td>
<td>10/16 mm²</td>
<td>10/16 mm²</td>
<td>2.5/4 mm²</td>
<td>10/16 mm²</td>
</tr>
<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>
</tr>
<tr>
<td>DS0107/8000</td>
<td>10/16 mm²</td>
<td>10/16 mm²</td>
<td>2.5/4 mm²</td>
<td>16/25 mm²</td>
</tr>
<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>
</tr>
</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 and DIN EN 61558-2-6 (VDE 0570-2-6), IEC 61558-2-6.

Typical applications
- For the supply of operating theatre lights in group 2 medical locations

Approvals

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

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>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation classification</td>
<td>G1 40/E</td>
<td>G1 40/E</td>
<td>G1 40/E</td>
<td>G1 40/E</td>
<td>G1 40/E</td>
<td>G1 40/E</td>
</tr>
<tr>
<td>Degree of protection/protection class</td>
<td>IP00/I</td>
<td>IP00/I</td>
<td>IP00/I</td>
<td>IP00/I</td>
<td>IP00/I</td>
<td>IP00/I</td>
</tr>
<tr>
<td>Power/voltages/currents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<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>
<td>1000 VA</td>
</tr>
<tr>
<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>
<td>50...60 Hz</td>
</tr>
<tr>
<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>
</tr>
<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>
</tr>
<tr>
<td>Rated output voltage</td>
<td>23...28 V</td>
<td>23...28 V</td>
<td>23...28 V</td>
<td>23...28 V</td>
<td>23...28 V</td>
<td>23...28 V</td>
</tr>
<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>
</tr>
<tr>
<td>Insrush current</td>
<td>&lt; 15 x I0</td>
<td>&lt; 15 x I0</td>
<td>&lt; 15 x I0</td>
<td>&lt; 15 x I0</td>
<td>&lt; 15 x I0</td>
<td>&lt; 15 x I0</td>
</tr>
<tr>
<td>Leakage current</td>
<td>≤ 5 µA</td>
<td>≤ 5 µA</td>
<td>≤ 5 µA</td>
<td>≤ 5 µA</td>
<td>≤ 5 µA</td>
<td>≤ 5 µA</td>
</tr>
<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>
</tr>
<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>
</tr>
<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>
</tr>
</tbody>
</table>

Environmetal conditions

| Ambient temperature | 40 °C | 40 °C | 40 °C | 40 °C | 40 °C | 40 °C |
| No-load temperature rise | ≤ 17 °C | ≤ 20 °C | ≤ 18 °C | ≤ 26 °C | ≤ 23 °C | ≤ 26 °C |
| No-load temperature rise | ≤ 66 °C | ≤ 64 °C | ≤ 71 °C | ≤ 62 °C | ≤ 64 °C | ≤ 65 °C |
| Noise level (no load and full load) | ≤ 35 dB(A) | ≤ 35 dB(A) | ≤ 35 dB(A) | ≤ 35 dB(A) | ≤ 35 dB(A) | ≤ 35 dB(A) |

Other

Recommended fuse when used in accordance with DIN VDE 0100-710

<table>
<thead>
<tr>
<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>
</tr>
</thead>
<tbody>
<tr>
<td>Induction</td>
<td>1.23 T</td>
<td>1.19 T</td>
<td>1.14 T</td>
<td>1.14 T</td>
<td>1.06 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>
</tr>
<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>
</tr>
<tr>
<td>FE loss (iron loss)</td>
<td>5.5 W</td>
<td>6.3 W</td>
<td>9 W</td>
<td>15 W</td>
<td>18 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>
</tr>
<tr>
<td>Efficiency</td>
<td>85 %</td>
<td>88 %</td>
<td>89 %</td>
<td>91 %</td>
<td>92 %</td>
</tr>
</tbody>
</table>

Documentation number: D00110
**Isolating transformer**

**ESL0107 transformers for operating theatre lights**

**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>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>96</td>
<td>96</td>
<td>105</td>
<td>84</td>
<td>82</td>
</tr>
<tr>
<td>96</td>
<td>106</td>
<td>105</td>
<td>84</td>
<td>92</td>
</tr>
<tr>
<td>120</td>
<td>102</td>
<td>125</td>
<td>90</td>
<td>92</td>
</tr>
<tr>
<td>120</td>
<td>134</td>
<td>125</td>
<td>90</td>
<td>128</td>
</tr>
<tr>
<td>150</td>
<td>135</td>
<td>150</td>
<td>122</td>
<td>130</td>
</tr>
<tr>
<td>174</td>
<td>145</td>
<td>175</td>
<td>135</td>
<td>150</td>
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</tbody>
</table>

**Ordering information enclosure**

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
<th>Weight (kg)</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>240</td>
<td>280</td>
<td>220</td>
<td>300</td>
</tr>
</tbody>
</table>

**Terminal diagram**

- **Primary**
  - 23 V
  - 24 V
  - 25 V
  - 26 V
  - 28 V
- **Secondary**
  - 4/6 mm²
  - 4/6 mm²
  - 4/6 mm²

**Connection properties**

<table>
<thead>
<tr>
<th>Type</th>
<th>Input terminals flexible/rigid</th>
<th>Screen winding flexible/rigid</th>
<th>Output terminals flexible/rigid</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESL0107/120</td>
<td>4/6 mm²</td>
<td>4/6 mm²</td>
<td>4/6 mm²</td>
</tr>
<tr>
<td>ESL0107/160</td>
<td>4/6 mm²</td>
<td>4/6 mm²</td>
<td>4/6 mm²</td>
</tr>
<tr>
<td>ESL0107/280</td>
<td>4/6 mm²</td>
<td>4/6 mm²</td>
<td>4/6 mm²</td>
</tr>
<tr>
<td>ESL0107/400</td>
<td>4/6 mm²</td>
<td>4/6 mm²</td>
<td>4/6 mm²</td>
</tr>
<tr>
<td>ESL0107/630</td>
<td>10/16 mm²</td>
<td>4/6 mm²</td>
<td>10/16 mm²</td>
</tr>
<tr>
<td>ESL0107/1000</td>
<td>10/16 mm²</td>
<td>4/6 mm²</td>
<td>10/16 mm²</td>
</tr>
</tbody>
</table>

**Wiring diagram**
RK170
Measuring converter

Device features
- Plastic enclosure for DIN rail mounting
- Zero setting 0 or 4 mA
- Electrical separation between the input and output signal

Typical applications
- Conversion of DC 0...400 µA current signals into 0(4)...20 mA or 0...10 V signals
- For ISOMETER®s and RCM and RCMA residual current monitors with measurement instrument output DC 0...400 µA

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

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage U_S</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC 19...264 V</td>
<td>RK170</td>
<td>B 9804 1500</td>
</tr>
<tr>
<td>DC 20...297 V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Absolute values

Technical data

<table>
<thead>
<tr>
<th>Voltage ranges</th>
<th>Supply voltage U_S</th>
<th>Frequency range U_S</th>
<th>Power consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DC 19...264 V</td>
<td>50...120 Hz</td>
<td>≤ 3 VA</td>
</tr>
</tbody>
</table>

Inputs
- Current input DC 0...400 µA
- Max. permissible current DC 4 mA
- Rated input resistance approx. 2.5 kΩ

Outputs
- Two outputs with common ground
- Voltage output DC 0...10 V
- Max. no load voltage DC 12 V
- Rated burden 1 kΩ
- Current output DC 0/4...20 mA
- Short-circuit current ≤ DC 50 mA short-circuit proof
- Rated burden 500 Ω

Environment
- Shock resistance IEC 60068-2-27 (device in operation) 5 g/11 ms
- Vibration resistance IEC 6066-2-6 (device in operation) 1 g/10...150 Hz
- Vibration resistance IEC 6066-2-6 (transport) 2 g/10...150 Hz
- Ambient temperature (during operation) 0...+50 °C
- Ambient temperature (during storage) -20...+70 °C
- Classification of climatic conditions acc. to IEC 60721-3-3 3K3

Connection
- Connection type modular terminals
- Connection properties rigid/flexible 0.5...2.5 mm²/0.14...1.5 mm²

Other
- Operating mode continuous operation
- Mounting any position
- Degree of protection, internal components (IEC 60529) IP40
- Degree of protection, external components (IEC 60529) IP20
- Dimensions 75 x 22.5 x 110 mm
- DIN rail mounting acc. to IEC 60715
- Flammability class UL94 V-2
- Documentation number D00132
- Weight ≤ 200 g
5.1 Measuring transducer RK170

### Dimension diagram (dimensions in mm)

![Dimension diagram]

- **1**: Zero: zero setting
- **2**: Scale: full-scale value calibration
- **3**: Device of the RCM series
- **4**: $U_S$ see nameplate, 2 A slow-blow fuse recommended

### Wiring diagram

![Wiring diagram]
AN110
Power supply unit for measuring current transformers

Typical applications
- Power supply for W...AB(P) series measuring current transformers

Approvals

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

Ordering information

<table>
<thead>
<tr>
<th>Output voltage</th>
<th>Supply voltage Us</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AC</td>
<td>DC</td>
<td></td>
</tr>
<tr>
<td>±12 V</td>
<td>20...60 V</td>
<td>18...72 V</td>
<td>AN110-1</td>
</tr>
<tr>
<td></td>
<td>90...264 V</td>
<td>100...553 V</td>
<td>AN110-2</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring current transformers</td>
<td>W...AB(P)</td>
<td>294</td>
</tr>
<tr>
<td>Connecting cables for measuring current transformers of the W...AB(P) series</td>
<td>WXS-100</td>
<td>294</td>
</tr>
<tr>
<td></td>
<td>WXS-250</td>
<td>294</td>
</tr>
<tr>
<td></td>
<td>WXS-500</td>
<td>294</td>
</tr>
<tr>
<td></td>
<td>WXS-1000</td>
<td>294</td>
</tr>
</tbody>
</table>

Technical data

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

AN110-1:
- Rated insulation voltage: AC 100 V
- Rated impulse voltage/pollution degree: 2.5 kV/3
- Protective separation (reinforced insulation) between (A1, A2) -(+12 V, GND, -12 V)
- Voltage test acc. to IEC 61010-1: 3.3 kV

AN110-2:
- Rated insulation voltage: AC 250 V
- Rated impulse voltage/pollution degree: 4 kV/3
- Voltage test acc. to IEC 61010-1: 3.3 kV

Supply voltage

AN110-1: Supply voltage Us
- AC 20...60 V; DC 18...72 V
- Frequency range Us: DC, AC 50...60 Hz
- Power consumption: ≤ 30 VA

AN110-2: Supply voltage Us
- AC 90...264 V; DC 100...353 V
- Frequency range Us: DC, AC 50...60 Hz
- Power consumption: ≤ 30 VA

Output power supply unit

Output voltage Us\text{out}
- DC ±12 V, short-circuit proof
- Operating range: 11.5...12.5 V
- Rated output: 12 W

Cable length
- Recommended cable: WXS100...WXS1000 (see suitable system components)

Environment/EMC
- EMC: DIN EN 61000-6-3/DIN EN 61000-6-2
- Operating temperature AN110-1: -25...+65 °C
- Humidity: 5 %/K
- Operating temperature AN110-2: -25...+65 °C
- 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 (except condensation and formation of ice)
  - Long-time storage (IEC 60721-3-1): 1K4 (except condensation and formation of ice)
- Classification of mechanical conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3M4
  - Transport (IEC 60721-3-2): 2M2
  - Long-term storage (IEC 60721-3-1): 1M3

Connection
- Connection: screw-type terminals
- Connection: rigid/flexible/conductor sizes: 0.2...4/0.2...2.5 mm² (AWG 24...12)
- Multi-conductor connection (2 conductors of the same cross section): rigid/flexible: 0.2...1.5 mm²
- Stripping length: 8...9 mm
- Tightening torque: 0.5...0.6 Nm

Other
- Operating mode: continuous operation
- Mounting: see dimension diagram
- Degree of protection, internal components (DIN EN 60529): IP65
- Degree of protection, terminals (DIN EN 60529): IP20
- Enclosure material: Polybutylenterephthalat (PBT)
- Screw mounting: 4 x M4
- DIN rail mounting acc. to IEC 60715
- Flammability class: UL94 V-0
- Document number: D00097
- Weight: ≤ 200 g

* When the supply voltage is smaller than 30 V, the output power is reduced, so that only five measuring current transformers can be connected.
Dimension diagram (dimensions in mm)

![Dimension diagram]

Wiring diagram

![Wiring diagram]

1 Supply voltage $U_S$
2 Short circuit protection for $U_S$, recommended fuses:
   - AN110-1: 2 A time-lag fuse recommended
   - AN110-2: 1A time-lag fuse recommended
3 Symmetrical output voltage

Colour coding for the conductors of the WXS… connecting cable
- $k1$ = yellow, $l$ = green, $-12\,\text{V}$ = black, $\text{GND}$ = brown, $+12\,\text{V}$ = red
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/max. 2 MK800 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.

Typical applications
- To supply Bender devices with DC 24 V and maximum 10 VA power consumption

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

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 120…370 V</td>
<td>CP-D 24/0.42/A0. No. 1SVR 427 041 R0000</td>
<td>AN410</td>
<td>B 924 209</td>
</tr>
<tr>
<td>−</td>
<td>DC 9…35 V</td>
<td>CP-D RU/A0. No. 1SVR 427 049 R0000</td>
<td>AN420-R</td>
<td>B 9510 0250</td>
</tr>
</tbody>
</table>

Technical data

Insulation coordination acc. to IEC 60664-1
- Rated impulse voltage/pollution degree $3 \text{kV}$/2
- Rated insulation voltage $U_i$ input circuit/output circuit $3 \text{kV}$

Inputs
- Rated input voltage $U_{IN}$ see ordering information
- Power consumption $\leq 3 \text{W}$
- Inrush current $\leq 30 \text{A}$, $\leq 3 \text{ms}$
- Stored energy time in the event of power system failure $\geq 30 \text{ms}$
- Typical current/power consumption:
  - at AC 110 V $184 \text{mA}$/11.62 W
  - at AC 230 V $120.6 \text{mA}$/12 W
- Primary fuse (internal device protection, not accessible) $1 \text{A}$ time-lag/AC 250 V

Output circuit
- Rated output voltage DC 24 V ($\leq 1 \text{VA}$)
- Rated output current $420 \text{mA}$
- Derating of the output current $60 \degree C < T_0 \leq 70 \degree C$ $2.5 \%$/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) $-25 \ldots +70 \degree C/-25 \ldots +85 \degree C$
- Classification of mechanical conditions acc. to IEC/EN 60668-2

Connection
- Connection screw-type terminals
- Connection rigid, flexible (with or without ferrule)/conductor sizes $0.2 \ldots 2 \text{mm}^2$ (AWG 24 \ldots 14)
- Stripping length $6 \text{ mm}$ (0.24 inches)
- Tightening torque $0.36 \ldots 0.56 \text{ Nm}$

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 6090, CAN/CSA C22.2 No. 60950 *)
- CCC *)

Mark
- CE
- CCC

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 III
- Minimum distance to adjacent devices vertically/horizontally 25/25 mm
- Enclosure dimensions (W x H x 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 D00099
- Weight $\leq 70 \text{g}$

*) Approval relating to the rated input voltage $U_{IN}$

<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 120…370 V</td>
<td>CP-D 24/0.42/A0. No. 1SVR 427 041 R0000</td>
<td>AN410</td>
<td>B 924 209</td>
</tr>
<tr>
<td>−</td>
<td>DC 9…35 V</td>
<td>CP-D RU/A0. No. 1SVR 427 049 R0000</td>
<td>AN420-R</td>
<td>B 9510 0250</td>
</tr>
</tbody>
</table>
**Displays and controls**

Power On LED "DC ON" lights up green signalling that voltage is available at the output of the power supply unit. LED "DC LOW" lights red signalling that the output voltage is too low.

---

**Wiring diagram**

L, N: input voltage  
+ , -: output voltage

---

**Option for redundant power supply**

input voltage 1  
input voltage 2
AN420
Power supply unit for measuring current transformers

### Typical applications
- Power supply for W…AB(P) series measuring current transformers

### Approvals

![CE][EAC][UL Listed]

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

### Ordering information

<table>
<thead>
<tr>
<th>Supply voltage</th>
<th>Output voltage</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC 16…72 V, 42…66 Hz/9.6…94 V</td>
<td>DC ±12 V/400 mA</td>
<td>AN420-1</td>
<td>B 7405 3099</td>
</tr>
<tr>
<td>70…276 V, 42…460 Hz</td>
<td>DC ±12 V/400 mA</td>
<td>AN420-2</td>
<td>B 7405 3100</td>
</tr>
</tbody>
</table>

Device version with screw terminals on request.

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>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring current transformers</td>
<td>W…AB(P)</td>
<td>294</td>
</tr>
<tr>
<td>Connecting cables for measuring current transformers of the W…AB(P) series</td>
<td>WX5-100</td>
<td>294</td>
</tr>
<tr>
<td>WX5-250</td>
<td>294</td>
<td></td>
</tr>
<tr>
<td>WX5-500</td>
<td>294</td>
<td></td>
</tr>
<tr>
<td>WX5-1000</td>
<td>294</td>
<td></td>
</tr>
</tbody>
</table>

### Technical data

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

**AN420-1**:
- Rated insulation voltage: AC 250 V
- Rated impulse voltage/pollution degree: 2.5 kV/3
- Protective separation (reinforced insulation) between (A1, A2) -(+12 V, GND, -12 V)
- Voltage test acc. to IEC 60101-1: 2.21 kV

**Supply voltage**
- Supply voltage U_s: AC 16…72 V/DC 9.6…94 V
- Frequency range f_s: DC, AC 42…66 Hz
- Power consumption: ≤ 30 VA

**AN420-2**:
- Rated insulation voltage: AC 250 V
- Rated impulse voltage/pollution degree: 4 kV/3
- Protective separation (reinforced insulation) between (A1, A2) -(+12 V, GND, -12 V)
- Voltage test acc. to IEC 60101-1: 2.21 kV

**Supply voltage**
- Supply voltage U_s: AC/DC 70…276 V
- Frequency range f_s: DC, AC 42…460 Hz
- Power consumption: ≤ 30 VA

#### Output power supply unit
- Output voltage U_out: DC ±12 V, short-circuit proof
- Operating range: 11.9…12.1 V
- Rated output: 9 W

#### Cable length
- Recommended cable: WX5100…WX51000 (see ordering information)

### Environment/EMC

- **EMC**
  - IEC 61204-3
- **Operating temperature**
  - -25…+55 °C
- **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 (except condensation and formation of ice)
  - Long-time storage (IEC 60721-3-1): 1K4 (except condensation and formation of ice)
- **Classification of mechanical conditions IEC 60721**
  - Stationary use (IEC 60721-3-3): 3M4
  - Transport (IEC 60721-3-2): 2M2
  - Long-time storage (IEC 60721-3-1): 1M3

### Connection

- **Connection type**
  - screwless-type terminals
- **Connection properties**
  - 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 (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 IEC 60715**
  - DIN rail mounting
- **Flammability class**
  - UL94 V-0
- **Documentation number**
  - D00081
- **Weight**
  - ≤ 140 g

---

5.1

System components | Individual components and accessories | Power supply units

Power supply unit AN420
1. Supply voltage $U_S$
2. Short circuit protection for $U_S$, 6 A fuse recommended
3. Symmetrical output voltage

**Colour coding for the conductors of the WX5... connecting cable**

- $k_1 =$ yellow
- $l =$ green
- $-12 V =$ black
- GND =$ brown
- $+12 V =$ red
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 MK2430/1 MK800 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) and IEC 61558-1.

Typical applications
- Supply of Bender devices with AC 20 V and a power consumption of maximum 9 VA

Approvals

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

Ordering information

<table>
<thead>
<tr>
<th>Output voltage</th>
<th>Supply voltage $U_v$</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 20 V, 50…60 Hz</td>
<td>230 V, 50…60 Hz</td>
<td>AN450</td>
<td>B 924 201</td>
</tr>
<tr>
<td></td>
<td>127 V, 50…60 Hz</td>
<td>AN450-133</td>
<td>B 924 203</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/3

Supply voltage
- Supply voltage $U_v$: see ordering information
- Frequency range $f_v$: see ordering information
- Operating range $U_\text{op}$: 0.85...1.1 x $U_v$
- Power consumption: $\leq 9$ VA
- Output voltage: AC 20 V, 50…60 Hz
- Rated output: $\leq 9$ VA
- Secondary protection: PTC resistors

Environment/EMC
- EMC immunity: IEC 61000-6-2
- EMC emission: IEC 61000-6-3
- Classification of climatic conditions acc. to IEC 60721
  - Stationary use: 3K5
  - Transport: 2K3
  - Long-time storage: 1K4
- Ambient temperature, operation: -10…+55 °C
- Classification of mechanical conditions acc. to IEC 60721
  - Stationary use/transport/long-time storage: 3M4/2M2/1M3

Connection
- Connection: screw-type terminals
- Connection properties
  - rigid/flexible/conductor sizes: 0.2...4/0.2...2.5 mm² (AWG 22...12)
  - flexible with ferrule, without/with plastic sleeve: 0.25...2 mm²
- Stripping length: 8 mm
- Tightening torque: 0.9 Nm

Other
- Operating mode: continuous operation
- Mounting: any position
- Degree of protection, internal components DIN EN 60529 (VDE 0470-1): IP50
- Degree of protection, terminals (DIN EN 60529 (VDE 0470-1)): IP20
- Type of enclosure: X400
- Screw mounting: 2 x M4
- DIN rail mounting acc. to IEC 60715
- Flammability class: UL94V-0
- Documentation number: D00100
- Weight: $\leq 400$ g
**Displays and controls**

![Dimension diagram](image)

**Operation LED (green) "ON" lights, when the device is in operating state.**

**Wiring diagram**

![Wiring diagram](image)

1. A1, A2 = supply voltage $U_S$, F = short circuit protection
2. Power supply unit AN450
3. U2, V2 = output voltage
4. Alarm indicator and test combination
### 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.

### Typical applications

- The analogue measuring instruments of the 96…/72… series for indication of measured values from Bender devices utilising an appropriate output

### Approvals

![CE EAC]

### 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>IRD04LX-4…, IRD04H275/375, is0685…</td>
<td>0…400 µA</td>
<td>72 x 72 mm</td>
<td>120 kΩ</td>
<td>7204-1421</td>
<td>B 986 763</td>
</tr>
<tr>
<td></td>
<td></td>
<td>96 x 96 mm</td>
<td>120 kΩ</td>
<td>9604-1421</td>
<td>B 986 764</td>
</tr>
<tr>
<td>IRD0275B/375B/575, is0685…</td>
<td>0…20 mA</td>
<td>96 x 96 mm</td>
<td>120 kΩ</td>
<td>9620-1421</td>
<td>B 986 841</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1,2 MΩ</td>
<td>9620S-1421</td>
<td>B 986 842</td>
</tr>
<tr>
<td>IRD042B-6…, is0685…</td>
<td>0…400 µA</td>
<td>72 x 72 mm</td>
<td>120 kΩ</td>
<td>7200-1421</td>
<td>B 986 782</td>
</tr>
<tr>
<td>IRD025B/375B/575, is0685…</td>
<td>0…20 mA</td>
<td>96 x 96 mm</td>
<td>1,2 MΩ</td>
<td>9604-1621</td>
<td>B 986 844</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>120 kΩ</td>
<td>7220-1421</td>
<td>B 986 848</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

- Enclosure: IP53
- Terminals: IP00
- Terminals with contact protection
- Documentation number: D00002

### Dimension diagram (dimensions in mm)

#### 7204/7220

- Cut-out dimensions: 68 x 68 mm
- Min. installation depth: 62.6

#### 9604/9620

- Cut-out dimensions: 92 x 92 mm
- Min. installation depth: 62.6
**DI-1DL**  
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

### Typical applications
- Extension of the maximum possible bus length by 1200 m in BMS systems (EDS, RCMS, MEDICS® systems)  
- Extension of the maximum possible bus nodes by 31*  
- Protection against spikes by galvanic separation between the input and output circuit and the power supply  
- Implementation of resonant stubs (refer also to BSM instruction leaflet)

### 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 85…260 V, 50…60 Hz</td>
<td>DI-1DL</td>
<td>B 9501 2047</td>
</tr>
</tbody>
</table>

### Technical data

#### Supply voltage
- Supply voltage $U_s$  
- Power consumption 0.1 A/7 W

#### Interfaces
- **BMS**  
  - Interface/protocol: 2 x RS-485/BMS  
  - Baud rate: dynamic  
  - Cable length: ≤ 1200 m  
  - Cable (twisted in pairs, one end of shield connected to PE): recommended: J-YT5/Y min. 2x0.8  
  - Data direction switchover: automatically  
  - Cascading option: yes  
  - Number of bus devices: 31 additional bus devices per repeater, cascading allows a virtually unrestricted number of connections  
  - Integrated terminating resistor adjustable by a switch or externally  
  - Device address, BMS bus

#### Environment
- Operating temperature: 0…+70 °C

#### Connection
- Connection: push-wire/plug-in terminals

#### Other
- Operating mode: continuous operation  
- Mounting: any position  
- Enclosure: for standard DIN rail 32 mm (approx. 110 x 75 x 55)  
- Operating manual: DiaLog RS-485 repeater type CH-2-1  
- Documentation number: D00125  
- Weight: approx. 90 g

#### Dimension diagram (dimensions in mm)

* depending on used transceivers

---

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

<table>
<thead>
<tr>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) 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.</td>
</tr>
<tr>
<td>b) 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.</td>
</tr>
</tbody>
</table>

The termination is carried out as shown in the following example of a BMS bus system:

<table>
<thead>
<tr>
<th>Termination/bias voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Master</td>
</tr>
<tr>
<td>B Slave</td>
</tr>
<tr>
<td>C RS-485 interface repeater DI-1DL</td>
</tr>
<tr>
<td>D RS-485 interface repeater DI-1DL</td>
</tr>
<tr>
<td>E Slave</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
- Electrical 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 (MK800, MK2430) with RS-485 interface, by means of software via PC with USB interface

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>supplied by USB port, no additional power supply required</td>
<td>DI-2USB</td>
<td>B 9501 2045</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 information
- Power consumption 95 mVA

Interfaces

BMS
- Interface/protocol 1 x RS-485/–
- Baud rate 9.6...115.2 kbit/s
- Cable length $\leq$ 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 resistor, selectable via jumper, factory setting terminating resistor included
- Device address, BMS bus -
- 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
- Classification of climatic conditions acc. to IEC 60721
- Stationary use 3K5
- Transport 2K3
- Long-time storage 1K4
- Ambient temperature, operation $-10...+55 ^\circ C$
- Classification of mechanical conditions acc. to IEC 60721
- Stationary use 3M4
- Transport 2M2
- Long-time storage 1M3

Connection
- Connection screw-type terminals/USB plug Type B
- Connection rigid/flexible/conductor sizes 0.5...2.5 mm² (AWG 22…12)

Other
- Operating mode continuous operation
- Mounting any position
- DIN rail mounting acc. to IEC 60715
- Operating manual manual of third-party manufacturer
- Documentation number D00103
- Weight $\leq$ 25 g

Dimensions (dimensions in mm)

Wiring diagram

DI-2USB to connect a personal computer utilising a USB interface to a BMS network.

Note:
Consider BMS bus termination
Charge Controller CC612

Device features
• Charge controller acc. to IEC 61851-22 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 compliant) and is compatible with all electric vehicles on the market
• Supports 2.5G Edge and 3G UMTS mobile networks and an integrated modem is optional
• Two USB interfaces - one for local configuration (CONFIG) and the other as an extension port for peripheral USB devices (Ethernet/WiFi home applications)

Typical applications
• Electric vehicle (EV) charging stations, wall boxes or street light charging points

Approvals

Ordering information
<table>
<thead>
<tr>
<th>Supply voltage Uₜₜ</th>
<th>6 mA sensor</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC 12 V</td>
<td></td>
<td>CC612-1M3PR</td>
<td>B 9406 0001</td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFID110-L1 (RJ45 cable length 500mm)</td>
<td>B 9406 0110</td>
</tr>
<tr>
<td>Current transformer W15BS (cable length 1500mm)</td>
<td>B 9808 0065</td>
</tr>
<tr>
<td>Current transformer W15BS-02 (cable length 180mm)</td>
<td>B 9808 0067</td>
</tr>
</tbody>
</table>

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

Please refer to the manual to check in which countries devices with an integrated 3G modem may be operated.
### 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 NN

### Supply voltage

**Nominal supply voltage \(U_s\)**
12 V

**Operating range of the supply voltage**
DC 11.4...12.6

**Nominal current**
1 A

### Measuring range DC sensor

**Measuring range**
100 mA

**Response values:**
- Residual current \(\Delta I_n\)
  - DC 6 mA
- Response tolerance \(\pm \Delta I_n\)
  - -50...0 %

**Restart sequence value:**
- DC 6 mA
  - < 3 mA

### Wireless parameters

**Frequency bands**
GPRS: UL 85.6 kBit/s; DL 85.6 kBit/s
EDGE: UL 236.8 kBit/s; DL 236.8 kBit/s
WCDMA PS: UL 384 kBit/s; DL 384 kBit/s
HSPA: UL 5.76 Mbit/s; DL 14.4 Mbit/s

**Antenna gain**
≤ 2.5 dBi

**Impedance**
50 Ω

**Data rate**
- GPRS: UL 85.6 kBit/s; DL 85.6 kBit/s
- EDGE: UL 236.8 kBit/s; DL 236.8 kBit/s
- WCDMA PS: UL 384 kBit/s; DL 384 kBit/s
- HSPA: UL 5.76 Mbit/s; DL 14.4 Mbit/s

**Specified antenna**
Phoenix Contact model PSI-GSM /UMTS-QB-ANT-2313371

### Inputs/outputs and operation

**LED ALARM**
Yellow

**LED READY**
Green

**USB Extension interface (Ethernet, WiFi®, ...)**
USB socket type A

**CONFIG (Configuration interface)**
Micro socket type AB

**SIM card**
micro SIM

### Terminal A:

A1
- Actuator IN

A2
- Actuator +

A3
- Actuator pull-up output

A4
- Actuator -

### Terminal B:

B1
- +12 V IN

B2
- 0 V

B3
- Relay 1 NO

B4
- Relay 1 NO

### Terminal C:

C1
- Proximity PP

C2
- Control Pilot (optional Powerline Communication PLC acc. to ISO/IEC 15118)

C3
- Relay 2 IN

C4
- Relay 2 IN

C5
- Input 1-

C6
- Input 1+

C7
- Input 2-

C8
- Input 2+

**CT**
Current transformer

### Input 1 and 2:

**Input voltage**
DC 11.4...25.2 V

**Input current**
1.72...3.81 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 \(U_{op}\)**
30 V

**Rated operational current \(I_{op}\)**
1 A

**Minimum contact rating**
1 mA at: 10 V

**Rated voltage \(U_i\)**
32 V

### Environment/EMC

**EMC**
IEC 61851-1, IEC 61851-22, ETSI EN 301 489-1, ETSI EN 301 489-7

**Operating temperature**
-30...+70°C

**Climatic conditions acc. to IEC 60721:**
Stationary use (IEC 60721-3-3)
- 3K5 (except condensation, water and formation of ice)

Transport (IEC 60721-3-2)
- 2K3
- 1K4

Storage (IEC 60721-3-1)
- 1M4
- 1M3

### Connection

**Connection type (terminal block C)**
push-in terminal

**Connection properties:**
- 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 ... 20)

**Stripping length**
10 mm

**Opening force**
0.5 - 0.6 N (4 - 5 lb-in)

**Connection type (terminal blocks A and B)**
screw terminal

**Connection properties:**
- rigid/flexible 0.2...2.5 mm² (AWG 24 ... 14)
- flexible with ferrule without plastic sleeve 0.25...2.5 mm² (AWG 24 ... 14)
- 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**
IP 20

**DIN rail mounting**
IEC 60715

**Documentation number**
D00254

**Weight**
160 g
5.2

System components  |  Communication systems  |  Charge Controller

Charge Controller CC612

**  Each type 2 socket can also be used in conjunction with lock release modules from Mennekes and Phoenix Contact. Please refer to wiring diagrams in the CC612 operating manual for connection details.

** Sockets from different manufacturers are supported (see table)

<table>
<thead>
<tr>
<th>Type 2 sockets**</th>
<th>A4</th>
<th>A3</th>
<th>A2</th>
<th>A1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mennekes (31086, 31087, 31089-31098)</td>
<td>Wire 3</td>
<td>Wire 1</td>
<td>Wire 2</td>
<td></td>
</tr>
<tr>
<td>Bals (839300, 839301, 839302)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walther-Werke (974300, 974301)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harting (1405213, 1405214, 1405215, 1405216)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phoenix Contact (1405213, 1405214, 1405215, 1405216, 1405217, 1405218)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Brown wire  | Green wire  | Red wire  | Yellow wire |

The relay in the CC612 used to control the contactor is rated for 30V/1A. An intermediate relay may be required if this rating is inadequate. The illustration shows the wiring when an intermediate relay is used.

The relay in the CC612 used to control the contactor is rated for 30V/1A. An intermediate relay may be required if this rating is inadequate. The illustration shows the wiring when an intermediate relay is used.

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The relay in the CC612 used to control the contactor is rated for 30V/1A. An intermediate relay may be required if this rating is inadequate. The illustration shows the wiring when an intermediate relay is used.
COMTRAXX® COM460IP
BMS Ethernet gateway

Device features
- Modular, expandable gateway between BMS bus and TCP/IP
- Gateway between BMS bus and Ethernet
- Range of functions customisable through function packages
- Remote access via LAN, WAN or Internet

Device versions

Basic device
- Representation of BMS data using a standard web browser with Silverlight™ plug in
- Representation of current measured values, operational and alarm messages
- Time synchronisation for all BMS bus devices
- Integrated Ethernet switch: 2 x RJ45, 10/100 Mbit/s
- LCD for simple address setting
- Operation possible via the internal BMS bus
- Modbus TCP data access to BMS addresses 1…10 of the first internal BMS bus
- Password-protected device menu
- History memory for 1000 entries
- 12 data loggers, freely configurable with 1000 entries each.

Function package A – Individual messages
- Assignment of individual texts for devices and measuring points (channels).
- E-mail notification to various user groups in the event of alarms and system faults.
- The e-mail address of the sender being displayed can be entered.
- Device failure monitoring
- Report function saves measured values and settings. Saved settings can be compared with the current settings made on the COM460IP.

Function package B – Modbus TCP expansion
- Up to 150 BMS devices can be monitored on the internal bus
- From an external application (e.g. visualisation software) commands can be sent to BMS devices.

Function package C – Parameter setting
- Fast, simple parameter setting of BMS devices using the web browser
- BMS devices, other than COM460IP, can only be parameterised when the gateway is operated on the internal BMS bus
- Report function saves measured values and settings when the gateway is operated on the internal BMS bus. Saved settings can be compared with the current settings made on the COM460IP. The saved settings can be reloaded into the COM460IP.

Function package D – Visualisation
- Fast and simple visualisation without any programming. For example, measured values or alarms can be arranged on a floor plan and visualised.
- Displaying an overview the contents of which takes up more than one page. Jump to another view page and back to the overview page.
- A graphical representation with the scaling of the time axis for the data logger of COM460IP and compatible Bender devices.
- System visualisation: Displaying several gateways (COM460IP, CP700) on one website. Displaying common alarms of the devices. Clicking on a device being displayed will open its web user interface.

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

<table>
<thead>
<tr>
<th>Application</th>
<th>Function package (software license)</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual texts for devices/channels, e-mail in the event of an alarm</td>
<td>Function package A</td>
<td>B 7506 1011</td>
</tr>
<tr>
<td>Modbus TCP server with max. 14700 BMS nodes</td>
<td>Function package B</td>
<td>B 7506 1012</td>
</tr>
<tr>
<td>Parameter setting for BMS devices</td>
<td>Function package C</td>
<td>B 7506 1013</td>
</tr>
<tr>
<td>Visualisation of BMS devices</td>
<td>Function package D</td>
<td>B 7506 1014</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

#### Supply voltage
- Supply voltage and frequency for UL applications:
  - AC/DC: 76…276 V, 42…460 Hz
  - AC: 6…94 V
  - DC: 5…35 mA
- Power consumption: ≤ 4 VA

#### Environment/EMC
- Classification of climatic conditions acc. to IEC 60721:
  - Stationary use: 3K5 (no condensation, no formation of ice)
  - Transport: 2K3
  - Long-term storage: 1K4
- Operating temperature: -10…+55 °C
- Classification of mechanical conditions acc. to IEC 60721:
  - Stationary use: 3M4
  - Transport: 2M2
  - Long-term storage: 1M3

#### Connection
- Screw terminals: M4
- DIN rail mounting: according to IEC 60715
- Flammability class: UL94V-0
- Documentation number: D00023
- Weight: ≤ 310 g

#### Other
- Type of enclosure: X460
- Weight: ≤ 310 g

#### Interfaces
- BMS bus (internal):
  - Interface/protocol: RS-485/BMS internal
  - Operating mode: master/slave
  - Baud rate (normal): 9.6 kbit/s
  - Cable length: ≤ 1200 m
  - Cable (twisted in pairs, one end of shield connected to PE): J-Y(St)Y
  - Terminating resistor: 120 Ω (0.25 W)
  - Device address, BMS bus internal: 1…99 (2)*

#### Ethernet:
- Connection: 2 x RJ45
- Data rate: 10/100 Mbit/s, autodetect
- DHCP: on/off (on)*
- DNS (DHCP): 5…60 s (30 s)*
- IP address: nnn.nnn.nnn.nnn (192.168.0.254)*
- Netmask: nnn.nnn.nnn.nnn (255.255.0.0)*

#### Protocols (depending on the function package selected):
- TCP/IP, Modbus TCP, DHCP, SMTP, NTP

### Function package

#### Application | Function package | Art. No.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual texts for devices/channels, e-mail in the event of an alarm</td>
<td>Function package A</td>
<td>B 7506 1011</td>
</tr>
<tr>
<td>Modbus TCP server with max. 14700 BMS nodes</td>
<td>Function package B</td>
<td>B 7506 1012</td>
</tr>
<tr>
<td>Parameter setting for BMS devices</td>
<td>Function package C</td>
<td>B 7506 1013</td>
</tr>
<tr>
<td>Visualisation of BMS devices</td>
<td>Function package D</td>
<td>B 7506 1014</td>
</tr>
</tbody>
</table>

* = factory setting

---

5.2
## Displays and controls

1. “ON” LED lights when supply voltage is applied
2. “COM” LED lights when the gateway is responding to BMS requests
3. “ALARM” LED lights when an internal device error occurs
4. LED “ETH1 act/link” flashes when data is being transmitted
5. LED “ETH2 act/link” flashes when data is being transmitted
6. “INFO” button to query the COM460IP for device-specific information
7. “\(^{1}\)” button: to move up in the menu, to increase the parameter value
8. Micro-SD card
9. “\(^{1}\)” button: to move down in the menu, to decrease values
10. “MENU” button for starting and exiting the menu
11. “\(^{1}\)” button to confirm parameter change
12. LC display for standard and menu mode
13. no function (reserve)
14. no function (reserve)

## Wiring diagram

1. Connection to the supply voltage, 6 A fuse recommended, IT systems require two fuses,
   For UL and CSA applications, it is mandatory to use 5 A fuses
2. Currently has no function (digital inputs)
3. Currently has no function (alarm relay K1)
4. Currently has no function (digital inputs)
5. Currently has no function
6. Currently has no function
7. Two connections to: a personal computer or to the local network (hub, switch, router); Connection with a CAT5 cable; internal Layer 2 switch with cable autodetect
8. Connection BMS bus (internal) with shielded cable (e.g. J-Y(St)Y 2x0.8)
9. Switch for BMS bus termination. When the device is installed at the end of the bus, set the terminating switch to “on”
COMTRAXX® COM461MT
BMS Ethernet gateway

Device features

- Setting of the IP address, BMS address and time/date using a standard web browser
- Time synchronisation for all BMS bus devices
- Integrated Ethernet switch: 2 x RJ45, 10/100 Mbit/s
- Can be operated on the internal BMS bus
- Modbus TCP data access to the internal BMS bus, max. 150 BMS devices
- Commands can be sent from an external application (e.g. visualisation software) to BMS devices and measured values read.

Typical applications

- The use of professional visualisation programs by converting the BMS data to the Modbus TCP protocol
- Observing and analysing Bender products that support communication, such as RCMS, EDS and MEDICS® systems

Further information

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

Approvals

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage/ frequency range U5</th>
<th>Supply voltage/ frequency range U5 for UL application</th>
<th>Power consumption</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC 76…276 V 1), 42…460 Hz</td>
<td>AC 76…250 V, 25…60 mA, 42…460 Hz DC 76…250 V, 6…21 mA</td>
<td>≤ 6.5 VA</td>
<td>COM461MT</td>
<td>B 9506 1021</td>
</tr>
</tbody>
</table>

1) Absolute values
## Technical Data

### Insulation coordination acc. to IEC 60664-1

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage</td>
<td>AC 250 V</td>
</tr>
<tr>
<td>Rated impulse voltage/pollution degree</td>
<td>4 kV/3</td>
</tr>
</tbody>
</table>

### Supply voltage

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage Uₜ</td>
<td>see ordering information</td>
</tr>
<tr>
<td>Frequency range Uₜ</td>
<td>see ordering information</td>
</tr>
<tr>
<td>Power consumption</td>
<td>see ordering information</td>
</tr>
</tbody>
</table>

### LED indicators

- 2 x Ethernet ETH1, ETH2 act/link
- lights when connected to the network, flashes during data transmission
- ON operation indicator

### Interfaces

**BMS bus internal:**
- Interface/protocol: RS-485/BMS bus internal
- Operating mode: master/slave (slave)*
- Baud rate BMS internal: 9.6 kbit/s
- Cable length: ≤ 1200 m
- Cable (twisted pair, shielded, shield connected to PE on one side): recommended: J-Y(St)Y 2x0.8
- Connection, BMS internal: terminals A, B
- Terminating resistor: 120 Ω (0.25 W)
- Device address, BMS bus internal: 1…99 (2)*

**Ethernet:**
- Connection: 2 x RJ45
- Data rate: 10/100 Mbit/s, autodetect
- IP address: nnn.nnn.nnn.nnn (192.168.0.254)*
- Netmask: nnn.nnn.nnn.nnn (255.255.0.0)*
- Protocols: TCP/IP, Modbus TCP, NTP

### Environment/EMC

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC</td>
<td>EN 61326-1</td>
</tr>
<tr>
<td>Classification of climatic conditions acc. to IEC 60721:</td>
<td></td>
</tr>
<tr>
<td>Stationary use</td>
<td>3K5</td>
</tr>
<tr>
<td>Transport</td>
<td>2K3</td>
</tr>
<tr>
<td>Long-term storage</td>
<td>1K4</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-18...+55 °C</td>
</tr>
<tr>
<td>Classification of mechanical conditions acc. to IEC 60721:</td>
<td></td>
</tr>
<tr>
<td>Stationary use</td>
<td>3M4</td>
</tr>
<tr>
<td>Transport</td>
<td>2M2</td>
</tr>
<tr>
<td>Long-term storage</td>
<td>1M3</td>
</tr>
<tr>
<td>RoHS</td>
<td>EN 61326-1</td>
</tr>
</tbody>
</table>

### Connection

- Connection: screw-type terminals
- Connection properties: rigid/flexible: 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
- Display oriented
- Degree of protection, internal components (IEC 60529): IP30
- Degree of protection, terminals (IEC 60529): IP20
- Type of enclosure: X460
- Screw mounting: 2 x M4
- DIN rail mounting acc. to IEC 60715
- Flammability class: UL94V-0
- Documentation number: D00011
- Weight: ≤ 310 g

( )* = factory setting

---

### Dimension diagram (dimensions in mm)

![Dimension diagram](image-url)
### Operating elements

1. **“ON” LED lights when supply voltage is applied**
2. **Run/off** (beside terminals A, B)
   - Switch for terminating the BMS bus. When the device is installed at the end of the bus, set the terminating switch to “on”.

### Wiring diagram

1. **Connection to the supply voltage, 6 A fuse recommended,**
2. **Two connections for connection to a personal computer or connection to the local network (hub, switch, router):**
3. **Connection using a CAT5 cable; internal Layer 2 switch with cable autodetect.**
4. **Switch for BMS bus termination. When the device is installed at the end of the bus, set the terminating switch to “on”.

---

#### 1
- **U_1**: Connection to the supply voltage, 6 A fuse recommended,
- **Fuses**: two-pole fuses should be used on IT systems. For UL and CSA applications, it is mandatory to use 5 A fuses.

#### 2
- **A1, A2**: Two connections for connection to a personal computer or connection to the local network (hub, switch, router).
- **Cat 5 cable**: Connection using a CAT5 cable; internal Layer 2 switch with cable autodetect.

#### 3
- **A, B**: Switch for BMS bus termination. When the device is installed at the end of the bus, set the terminating switch to “on”.

#### 4
- **BMS bus**: Connection to the internal BMS bus with shielded cable (e.g. J-Y(St)Y 2x0.8)
COMTRAXX® COM462RTU
BMS Modbus RTU gateway

[Image of COMTRAXX® COM462RTU]

### Device features
- Setting of address data for the BMS bus and Modbus RTU and date and time setting using the internal operating menu.
- Time synchronisation for all BMS bus devices
- Can be operated on the internal BMS bus
- Modbus RTU data access to the internal BMS bus, max. 150 BMS devices
- Commands can be sent from an external application (e.g. visualisation software) to BMS devices and measured values read.

### Typical applications
- Usage of professional visualisation programs by converting BMS data to Modbus RTU protocols.
- Observing and analysing Bender products that support communication, such as RCMS, EDS and MEDICS® systems.

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

### Approvals

![CE, UL, Lloyds Register](image)

### Ordering information

<table>
<thead>
<tr>
<th>Supply voltage/ frequency range $U_S$</th>
<th>Supply voltage/ frequency range $U_S$ for UL applications</th>
<th>Power consumption</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC</td>
<td>AC/DC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>76…276 V, 42…460 Hz</td>
<td>76…250 V, 40…150 mA, 42…460 Hz</td>
<td>3.5…40 VA, 2.4 W</td>
<td>COM462RTU</td>
<td>B 9506 1022</td>
</tr>
</tbody>
</table>

1) Absolute values
Technical data

Insulation coordination acc. to IEC 60664-1

- Rated insulation voltage: AC 250 V
- Rated impulse voltage/pollution degree: 4 kV/3

Supply voltage

- Supply voltage $U_s$ see ordering information
- Frequency range $f_s$ see ordering information
- Power consumption see ordering information

LED indicators

- ALARM: internal device error
- COM: data traffic BMS bus
- ON: operation indicator

Interfaces

BMS bus, internal:

- Interface/protocol: RS-485/BMS bus, internal
- Operating mode: master/slave (slave)*
- Baud rate BMS internal: 9.6 kbit/s
- Cable length: $\leq 1200$ m
- Cable (twisted pair, shielded, shield connected to PE on one side): recommended: J-Y(St)Y 2x0.8
- Connection, BMS internal: terminals A, B
- Terminating resistor: 120 $\Omega$ (0.25 W)
- Device address, BMS bus internal: 1…99 (2)*

Modbus RTU:

- Interface/protocol: RS-485/Modbus RTU
- Operating mode: slave
- Baud rate Modbus RTU: 9.6…57.6 kbit/s
- Cable length: $\leq 1200$ m
- Cable (twisted pair, shielded, shield connected to PE on one side): recommended: J-Y(St)Y 2x0.8
- Connection, Modbus RTU: terminals D+, D
- Terminating resistor: 120 $\Omega$ (0.25 W)
- Device address, Modbus RTU: 2…247 (2)*

Environment/EMC

- EMC: EN 61326-1
- Classification of climatic conditions acc. to IEC 60721:
  - Stationary use: 3K5
  - Transport: 2K3
  - Long-term storage: 1K4
  - Operating temperature: -10…+55 °C
- Classification of mechanical conditions acc. to IEC 60721:
  - Stationary use: 3M4
  - Transport: 2M2
  - Long-term storage: 1M3

Connection

- Connection: screw-type terminals
- Connection properties:
  - rigid/flexible: 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
- Shaping length:
  - $\leq 9$ 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
- Type of enclosure: X460
- Screw mounting: 2 x M4
- DIN rail mounting acc. to IEC 60715
- Flammability class: UL94V-0
- Documentation number: D00010
- Weight: $\leq 310$ g

(*) = factory setting

Dimension diagram (dimensions in mm)
Operating elements

1. “ON” LED, lights when supply voltage is applied
2. “COM” LED, lights when the gateway is responding to BMS requests
3. “ALARM” LED, lights when an internal device error occurs
4. “INFO” button, to query the COM462RTU for device-specific information
5. “A” button: to move up in the menu, to increase values
6. “▼” button: to move down in the menu, to decrease values
7. “MENU” button for starting and exiting the menu
8. “ESC” button to confirm parameter change
9. LC display for standard and menu mode

Wiring diagram

1. Connection to the supply voltage. 6 A fuse recommended, two-pole fuses should be used on IT systems. For UL and CSA applications, it is mandatory to use 5 A fuses.
2. Connection to the BMS bus (internal) with shielded cable (e.g. J-Y(St)Y 2x0.8)
3. Connection Modbus RTU with shielded cable (e.g. J-Y(St)2x0.8)
4. Switch for BMS bus termination. When the device is installed at the end of the bus, set the terminating switch to “on”.
5. Switch for Modbus RTU termination. When the device is installed at the end of the bus, set the terminating switch to “on”.
**COMTRAXX® COM465IP**

Condition Monitor with integrated gateway for the connection of Bender devices to Ethernet TCP/IP networks

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### 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
- Support of devices connected to the internal or external BMS bus via BCOM, Modbus RTU or Modbus TCP

### Typical applications

- Optimum indication and visualisation of device and system statuses via web browser
- Observation and analysis of compatible Bender products (ISOMETER®, ATICS®, RCMS, EDS, Linetraxx® and MEDICS® systems, universal measuring devices and energy meters)
- 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 protocol
- Parameter setting for devices, saving, documenting and restoring of parameters in a clear and practice-oriented manner
- Commissioning and diagnosis of Bender systems
- Remote diagnosis, remote maintenance

### Approvals

- CE
- EAC
- UL
- Listed

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### Range of functions

#### Basic device (without function modules)

- Condition Monitor with web interface for use with Bender BMS and BCOM as well as universal measuring devices.
- Supports devices that are connected
  - to the internal (max. 139 devices) or the external* BMS bus (max. 98 * 139 devices),
  - via BCOM interface (refer to BCOM manual)
  - via Modbus RTU or via Modbus TCP (max. 247 devices).
- Remote indication of current measured values, operation/alarm messages and parameters*.
- Gateway to Modbus TCP: Reading-out of current measured values, operation/alarm messages of addresses 1...10 of the own subsystem 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 associated devices
- History memory (1,000 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.

*) Indicating the parameters of BMS bus devices is only possible when the gateway is connected to the internal BMS bus.

**) Parameters can be set via web application and externally (via BMS/ICOM/BCOM), but not via Modbus. The parameters of associated devices can only be read; Function module C is necessary for modification of settings!

No reports can be generated – also not for your own device.

#### Function module A

- Assignment of individual texts for devices, channels (measuring points) and alarms.
- Device failure monitoring.
- E-mail notifications to various users in the event of alarms and system faults.
- Configuration of e-mail notifications.
- Report function* saves measured values and settings of associated devices. Saved settings can be compared to the current settings of the device. The report function is available for the gateway and for each associated Bender device.
- Generating reports of BMS bus devices is only possible when the gateway is connected to the internal BMS bus.

#### Function module B

- Supports external applications (such as visualisation programs or PLCs) via the Modbus TCP protocol
- Reading-out of current measured values, operation/alarm messages of associated devices. Uniform access to all associated devices via Modbus TCP over integrated server.
- Control commands: Commands can be sent to devices by an external application (e.g. visualisation software or PLC) via Modbus TCP.
- Access via SNMP protocol (V1, V2c or V3) to alarms and measured values.

#### Function module C

- Fast and easy parameter setting of all devices* associated to the gateway via web browser.
- Report function** for documenting and saving settings and measured values. Saved settings can be compared to the current settings of the device. The saved settings can be reloaded into the device.***
- The report function is available for the gateway and for each associated Bender device.
- Parameter setting of BMS bus devices is only possible when the gateway is connected to the internal BMS bus.

*) Generating reports of BMS bus devices and loading settings from reports to BMS bus devices is only possible when the gateway is connected to the internal BMS bus.

**) Currently, the Silverlight web interface is still necessary for this function.
Function module D*
Fast and simple visualisation without any programming. Device conditions, alarms or measured values can be arranged and displayed on a background image (e.g. a room plan).
- Displaying an overview the content of which takes up more than one page. Click to jump to another view. Return to the overview page.
- Graphical presentation with the scaling of the time axis.
- System visualisation: Several gateways (COM460IP, COM465IP, COM465DP, CP700) are displayed on one website. Indication of common alarms of the devices. Clicking on a device that is being displayed will open its web user interface.

*) 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 RTU or Modbus TCP) can be integrated into the system.

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage/frequency range</th>
<th>Power consumption</th>
<th>Application</th>
<th>Type</th>
<th>Art. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC 24…240 V, 50…60 Hz</td>
<td>≤ 6.5 VA/≤ 4 W</td>
<td>Condition Monitor with integrated gateway: Bender system/Ethernet</td>
<td>COM465IP-230 V</td>
<td>B95061065</td>
</tr>
<tr>
<td>DC</td>
<td></td>
<td></td>
<td>COM465IP-24 V</td>
<td>B95061066</td>
</tr>
<tr>
<td>24 V</td>
<td>≤ 3 W</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

(For 230 V variants B95061060)

- **Rated insulation voltage:** AC 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), (X1, X4)]

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

(For 24 V variants B95061061)

- **Rated insulation voltage:** AC 50 V
- **Rated impulse voltage/Overvoltage category:** 0.5 kV/III
- **Pollution degree:** 3

### Supply voltage

- **Supply voltage U₅:** see ordering information
- **Frequency range f₅:** see ordering information
- **Power consumption:** see ordering information

### Indications

- **LEDs:**
  - ON
  - ETHERTIP
  - MODBUS RTU
  - DATA TRAFFIC ETHERNET
  - BMS
  - DATA TRAFFIC BMS
  - Ethernet terminal X2

### E-mail configuration (function module A only) and device failure monitoring

- **Max. 250 entries**
- **Individual texts (function module A only):** unlimited number of texts with 100 characters each
- **Number of data points for "third-party devices" on Modbus TCP and Modbus RTU:** 50

### Quantity

- **Data loggers:** 10
- **Number of data points per data logger:** 10,000
- **Number of history memory entries:** 1,000

### Visualisation

- **Number of pages:** 20
- **Size of the background image:** 50 KByte (scaled down if larger)
- **Data points (per page):** 50 devices or channels, 150 text elements

### Interfaces

<table>
<thead>
<tr>
<th>Ethernet Port</th>
<th>Data rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1 (AMB, BMB)</td>
<td>24.5 KBit/s</td>
</tr>
<tr>
<td>X2, X3, X4</td>
<td>10/100 MBit/s</td>
</tr>
</tbody>
</table>

**SNMP**

- **Versions:** 1, 2c, 3
- **Supported devices:** Querying all devices (channels) possible (no trap functionality)

### BMS bus (internal/external)

- **Interface/protocol:** RS-485/BMS internal or BMS external (BMS internal)*
- **Operating mode:** master/slave (master)*
- **Baud rate BMS:** internal 9.6 kBit/s (external 9.6 kBit/s, 19.2, 38.4, 57.6 kBit/s)
- **Cable length:** ≤ 1,200 m
- **Cable:** twisted pair, shielded, one end of shield connected to PE recommended: J-Y(St)Y min. 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, BMS bus external/inter- nal:** 1...99 (2)*

**BCOM**

- **Interface/protocol:** Ethernet/BCOM
- **BCOM subsystem address:** 1...99 (1)*
- **BCOM device address:** 1...99 (2)*

**Modbus TCP**

- **Interface/protocol:** Ethernet/Modbus TCP
- **Operating mode:** client for associated PEM and "third-party devices"
- **Operating mode:** server for access to the process image and for Modbus control commands

### Modbus RTU

- **Interface/protocol:** RS-485/Modbus RTU
- **Operating mode:** master
- **Baud rate:** 9.6...57.6 kBit/s
- **Cable length:** ≤ 1,200 m
- **Connection:** X1 (AMB, BMB)
- **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

### Environment/EMC

- **EMC:** EN 61326-1
- **Ambient temperatures:**
  - Operation: -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)
    - 3M4
  - Transport (IEC 60721-3-2)
    - 2M2
  - Long-term storage (IEC 60721-3-1)
    - 1M3
- **Option "W" data different from the standard version**
  - Classification of climatic conditions acc. to IEC 60721:
    - Stationary use (IEC 60721-3-3)
    - 3M7
- **Modbus RTU slave addresses**: unlimited number of texts with 100 characters each

### Push-wire terminals

- **Conductor sizes:** AWG 24-12
- **Stripping length:** 10 mm
- **Baud rate:** rigid/flexible 0.2...2.5 mm²
  - flexible with ferrule, with/without plastic sleeve 0.25...2.5 mm²
  - Multiple conductor, flexible with TW IN ferrule with plastic sleeve 0.5...1.5 mm²
  - flexible with ferrule without plastic sleeve 0.25...1.5 mm²
  - flexible with TW IN ferrule with plastic sleeve 0.25...0.75 mm²

### Push-wire terminal X1

- **Conductor sizes:** AWG 24-16
- **Stripping length:** 10 mm
- **Baud rate:** rigid/flexible 0.2...1.5 mm²
  - flexible with ferrule without plastic sleeve 0.25...1.5 mm²
  - flexible with TW IN 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
- **Degree of protection, terminals (IEC 60529):** IP20
- **Enclosure type:** 3G60
- **Enclosure material:** polycarbonate
- **Flammability class:** UL94-V-0
- **Dimensions (W x H x D):** 107.5 x 93 x 62.9 mm
- **Documentati on number:** D00216
- **Weight:** ≤ 240 g

* = factory setting
### Operating controls and connections

1. **LED “ON”:** Flashes during start-up. The LED lights permanently as soon as the device is ready for operation.
2. **LEDs show activities on the different interfaces**
3. **Supply voltage: see nameplate and ordering information**
4. **Interface Modbus RTU (plug X1)**
5. **BMS bus (Bender measuring device interface) (plug X1)**
6. **Ethernet port (RJ45) for connection to the PC network as well as BCOM (plug X2)**
7. **Terminating resistor Modbus RTU switch**
8. **Terminating resistor BMS bus switch**
9. **Micro USB interface (currently without function) (plug X3)**
10. **Mini HDMI interface (currently without function) (plug X4)**

For UL applications, the following must be observed:
- Maximum ambient temperature: 55 °C
- Only 60/75 °C copper wires must be used
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 the Internet
- Range of functions adjustable through function modules
- Ethernet (10/100 Mbit/s) for remote access via LAN, WAN or the Internet
- Support of devices connected to the internal or external BMS bus via BCOM, Modbus RTU or Modbus TCP
- Integrated gateway between Bender system and PROFIBUS DP

Typical applications

- Optimum indication and visualisation of device and system statuses via web browser
- Observation and analysis of compatible Bender products (ISOMETER®, ATICS®, RCMS, EDS, Linetraxx® and MEDICS® systems, universal measuring devices and energy meters)
- 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 protocol or PROFIBUS DP
- Parameter setting for devices, saving, documenting and restoring of parameters in a clear and practice-oriented manner
- Commissioning and diagnosis of Bender systems
- Remote diagnosis, remote maintenance

Range of functions

Basic device (without function modules)

- Condition Monitor with web interface for use with Bender BMS and BCOM as well as universal measuring devices.
- Supports devices that are connected
  - to the internal (max. 139 devices) or the external* BMS bus (max. 98 * 139 devices),
  - via BCOM interface (refer to BCOM manual)
  - via Modbus RTU or via Modbus TCP (max. 247 devices).
- Remote indication of current measured values, operation/alarms messages and parameters*.
- Gateway for coupling of associated devices with the PROFIBUS DP.
- Gateway to Modbus TCP: Reading-out of current measured values, operation/alarms messages of addresses 1...10 of the own subsystem 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 associated devices
- History memory (1,000 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.
- Supports external applications (such as visualisation programs or PLCs) via the PROFIBUS DP protocol
- Reading-out of current measured values, operation/alarms messages of associated devices. Uniform access to all associated devices via PROFIBUS DP over an integrated server.
- Control commands: Commands can be sent to devices by an external application (e.g. visualisation software or PLC) via PROFIBUS DP.

Range of functions adjustable through function modules

- Generating reports of BMS bus devices is only possible when the gateway is connected to the internal BMS bus.
- Parameters can be set via web application and externally (via BMS/ICOM/BCOM), but not via Modbus or PROFIBUS. The parameters of associated devices can only be read; Function module C is necessary for modification of settings!

No reports can be generated – also not for your own device.

Function module A

- Assignment of individual texts for devices, channels (measuring points) and alarms.
- Device failure monitoring.
- E-mail notifications to various users in the event of alarms and system faults.
- Configuration of e-mail notifications.
- Report function* saves measured values and settings of associated devices. Saved settings can be compared to the current settings of the device. The report function is available for the gateway and for each associated Bender device.

*) Generating reports of BMS bus devices is only possible when the gateway is connected to the internal BMS bus.

Function module B

- Supports external applications (such as visualisation programs or PLCs) via the Modbus TCP protocol
- Reading-out of current measured values, operation/alarms messages of associated devices. Uniform access to all associated devices via Modbus TCP over integrated server.
- Control commands: Commands can be sent to devices by an external application (e.g. visualisation software or PLC) via Modbus TCP.
- Access via SNMP protocol (V1, V2c or V3) to alarms and measured values.
Ordering information

<table>
<thead>
<tr>
<th>Supply voltage/frequency range U₅</th>
<th>Power consumption</th>
<th>Application</th>
<th>Type</th>
<th>Art. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC/DC</td>
<td>DC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24…240 V, 50…60 Hz</td>
<td>≤ 6.5 VA/≤ 4 W</td>
<td>Condition Monitor with integrated gateway: Bender system/PROFIBUS DP/Ethernet</td>
<td>COM465DP-230 V</td>
<td>B95061060</td>
</tr>
<tr>
<td>–</td>
<td>≤ 3 W</td>
<td></td>
<td>COM465DP-24 V</td>
<td>B95061061</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 text messages for all devices/ channels, device failure monitoring, e-mail in the event of an alarm</td>
<td>Function module A</td>
<td>B 7506 1011</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>B 7506 1012</td>
</tr>
<tr>
<td>Parameter setting of BMS devices as well as BCOM and universal measuring devices</td>
<td>Function module C</td>
<td>B 7506 1013</td>
</tr>
<tr>
<td>Visualisation of Bender systems, System visualisation</td>
<td>Function module D</td>
<td>B 7506 1014</td>
</tr>
<tr>
<td>Virtual devices</td>
<td>Function module E</td>
<td>B 7506 1015</td>
</tr>
<tr>
<td>Integration of third-party devices</td>
<td>Function module F</td>
<td>B 7506 1016</td>
</tr>
</tbody>
</table>

Function module C
- Fast and easy parameter setting of all devices* associated to the gateway via web browser.
- Report function** for documenting and saving settings and measured values. Saved settings can be compared to the current settings of the device. The saved settings can be reloaded into the device.***
- The report function is available for the gateway and for each associated Bender device.

*) Parameter setting of BMS bus devices is only possible when the gateway is connected to the internal BMS bus.
***) Generating reports of BMS bus devices and loading settings from reports to BMS bus devices is only possible when the gateway is connected to the internal BMS bus.

Function module B
Fast and simple visualisation without any programming. Device conditions, alarms or measured values can be arranged and displayed on a background image (e.g. a room plan).
- Displaying an overview of the content of which takes up more than one page. Click to jump to another view. Return to the overview page.
- Graphical presentation with the scaling of the time axis.
- System visualisation: Several gateways (COM460IP, COM465IP, COM465DP, CP700) are displayed on one website. Indication of common alarms of the devices. Clicking on a device that is being displayed will open its web user interface.

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
(For 230 V variants B95061060)
Rated insulation voltage
Rated impulse voltage/Overvoltage category
Pollution degree
Protective separation (reinforced insulation) between
(4/1, 4/2) [IM, MBM, (AM), (BM), (X2), (X3), (X4), (PROFIBUS DP)]

Insulation coordination acc. to IEC 60664-1/IEC 60664-3
(For 24 V variants B95061061)
Rated insulation voltage
Rated impulse voltage/Overvoltage category
Pollution degree

Supply voltage
Supply voltage $U_S$
Frequency range $U_f$
Power consumption

Indications
LEDs:
ON operation indicator
PROFIBUS data traffic PROFIBUS DP
ETHERNET data traffic Ethernet
MODBUS RTU data traffic Modbus
BMS data traffic BMS
Ethernet (terminal X2) lights during network connection, flashes during data transfer

Memory
E-mail configuration (function module A only) and device failure monitoring max. 250 entries
Individual texts (function module A only) unlimited number of texts with 100 characters each
Number of data points for “third-party devices” on Modbus TCP and Modbus RTU

Quantity
Data loggers
Number of data points per data logger
Number of history memory entries

Visualisation
Number of pages
Size of the background image
Data points (per page) 50 devices or channels, 150 text elements

Interfaces
Ethernet
Port
Data rate
DHCP
IP address
Netmask
Protocol (depending on the function module selected)
TCP/IP, Modbus TCP, Modbus RTU, DHCP, SMTP, NTP

SNMP
Versions
Supported devices Querying all devices (channels) possible (no trap-functionality)

BMS bus (internal/external)
Interface/protocol RS-485/BMS internal or BMS external (BMS internal)*
Operating mode master/slave (master)*
Baud rate BMS internal 9.6 kBit/s external 19,2; 38,4; 57,6 kBit/s
Cable length $\leq 1,200$ m
Cable: twisted pair, shielded, one end of shield connected to PE recommended: J-Y(St)Y min. 2x0.8
Connection X1 (BMS, BMSS)
Connection type refer to connection “push-wire terminal X1”
Terminating resistor $120 \Omega (0.25 W)$, can be connected internally
Device address, BMS bus external/internal

BCOM
Interface/protocol Ethernet/BCOM
BCOM subsystem address 1…99 (1)*
BCOM device address 1…99 (2)*

Modbus TCP
Interface/protocol Ethernet/Modbus TCP
Operating mode client for associated PEM and “third-party devices”
Operating mode server for access to the process image and for Modbus control commands

Modbus RTU
Interface/protocol RS-485/Modbus RTU
Operating mode master
Baud rate 9.6…57.6 kBit/s
Cable length $\leq 1,200$ m
Connection X1 (AMB, BMSS)
Connection type refer to connection "push-wire terminal X1"
Terminating resistor $120 \Omega (0.25 W)$, can be connected internally
Supported Modbus RTU slave addresses

PROFIBUS DP
Interface/protocol RS-485 gallerically separated/PROFIBUS DP
Operating mode slave
Baud rate automatic baud rate detection: 9.6 kBit/s…1.5 MBit/s
Connection 9-pole sub D
Device address, PROFIBUS DP

Environment/EMC
EMC
Ambient temperatures:
Operation -25…+55 °C
Transport -40…+85 °C
Transport (storage) -25…+70 °C
Classification of climatic conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) 3K5 (except condensation and formation of ice)
Stationary use (IEC 60721-3-1) 1K4
Classification of mechanical conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) 3M4
Transport (IEC 60721-3-2) 2M2
Long-term storage (IEC 60721-3-1) 1M3

Option “W” data different from the standard version
Classification of climatic conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) 3K5 (condensation and formation of ice possible)
Classification of mechanical conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) 3M7

Connection
Connection type pluggable push-wire terminals

Push-wire terminals
Conductor sizes
Stripping length
flexible with ferrule, with/without plastic sleeve
flexible with TWI ferrule with plastic sleeve
Other

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
DIN rail mounting acc. to DIN 43651
Screw fixing 2 x M4
Enclosure type J460
Enclosure material polycarbonate
Flammability class UL94-V0
Dimensions W x H x D 107.5 x 93 x 62.9 mm
Document number 006216
Weight $\leq 240$ g

(1)* = factory setting

5.2
Operating controls and connections

1. LED "ON": Flashes during start-up. The LED lights permanently as soon as the device is ready for operation.
2. LEDs show activities on the different interfaces
3. Supply voltage: see nameplate and ordering information
4. Connection PROFIBUS DP
5. Interface Modbus RTU (plug X1)
6. BMS bus (Bender measuring device interface) (plug X1)
7. Ethernet port (RJ45) for connection to the PC network as well as BCOM (plug X2)
8. Terminating resistor Modbus RTU switch
9. Terminating resistor BMS bus switch
10. Micro USB interface (currently without function) (plug X3)
11. Mini HDMI interface (currently without function) (plug X4)

For UL applications, the following must be observed:
- Maximum ambient temperature: 55 °C
- Only 60/75 °C copper wires must be used
**COMTRAXX® CP700**
Condition Monitor for Bender BMS devices and universal measuring devices

### Device features
- Condition Monitor for Bender BMS devices and universal measuring devices
- 7" TFT WVGA Color Display
- Analogue resistive touch screen
- Small mounting depth
- Fanless operation
- Integrated gateway to Ethernet (TCP/IP), 10/100/1000 Mbit/s
- Remote access via LAN, WAN or Internet
- Support for devices connected to the internal BMS bus via Modbus RTU or Modbus TCP.

### Device characteristics

#### Range of functions
- Display of currently measured values, operating and alarm messages from Bender BMS devices and Bender universal measuring devices on the touch screen
- Remote indication of data from Bender BMS devices and Bender universal measuring devices using a standard web browser with Silverlight plug-in
- Time synchronisation for all BMS bus devices and Bender universal measuring devices
- Easy address setting via touch screen
- Fast, simple parameter setting of BMS devices using the PC's web browser.
- Report function saves measured values and settings. Saved settings can be compared with the current settings and can be reloaded.
- Password-protected device menu
- Assignment of individual texts for devices and measuring points (channels) and alarms
- E-mail notifications to different user groups according to a time controlled schedule in the event of alarms and system faults
- Monitoring for device failure

#### 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.

#### Access via Modbus TCP
- Uniform access to all Bender devices assigned to the CP700 via the integrated Modbus TCP server (max. 247 devices)
- Bender BMS devices can be controlled by an external application (e.g. visualisation or SPS) via Modbus TCP
- Support of professional visualisation programs by the Modbus TCP protocol

#### Visualisation
- Fast and easy visualisation on a personal computer without previous knowledge of computer programming. Measured values or alarms can be arranged in front of a graphic (system diagram, room plan) and displayed
- Multipage documents supported

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

### Ordering information

<table>
<thead>
<tr>
<th>Supply voltage/frequency range U₅</th>
<th>Power consumption</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td>24 W</td>
<td>CP700</td>
<td>B 9506 1030</td>
</tr>
</tbody>
</table>

Device version with Gost certification available.

### Function modules

<table>
<thead>
<tr>
<th>Application</th>
<th>Function module (software licence)</th>
<th>Art. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virtual devices</td>
<td>Function module E</td>
<td>B 7506 1015</td>
</tr>
<tr>
<td>Integration of third-party devices</td>
<td>Function module F</td>
<td>B 7506 1016</td>
</tr>
</tbody>
</table>
5.2

### Recommended power supply units

<table>
<thead>
<tr>
<th>Material number/type</th>
<th>Manufacturer</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0PS1025.2</td>
<td>B&amp;R</td>
<td>DC 24 V power supply unit, 2.5 A, input AC 100…240 V, DIN-rail mounting/wall mounting WxHxD: 72 x 90 x 61 mm</td>
</tr>
<tr>
<td>0PS1020.0</td>
<td>B&amp;R</td>
<td>DC 24 V power supply unit, 2 A, input AC 100…240 V, DIN rail mounting WxHxD: 45 x 99 x 107 mm</td>
</tr>
<tr>
<td>1SVR427044R0200/CP-D 24/2.5 EAN: 4016779661188</td>
<td>ABB</td>
<td>Power supply unit In: AC 100…240 V Out: DC 24 V/2.5 A, DIN-rail mounting WxHxD: 71 x 91 x 57.5 mm</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

**Supply voltage**
- Supply voltage U_S
- Frequency range U_S
- Power consumption
- see ordering information

**Displays, memory**
- Display: 7" TFT WVGA Color
- LEDs: Power, CF, Link, Run, Master/Slave
- Button: Power, Reset
- Buzzer: no
- Memory card for special device functions (CF card): 4 GB
- E-mail configuration and device failure monitoring: max. 250 entries
- Individual texts: max. 1200 texts with 100 characters each
- Devices that can be displayed: max. 247

**Interfaces**
- **BMS bus:**
  - Interface/protocol: RS-485/BMS internal
  - Operating mode (max. one CP700 per bus): master/slave (slave)*
  - Device address, BMS bus: 1…99 (2)*
  - Baud rate BMS: 9.6 kbit/s
- **Modbus RTU:**
  - Interface/protocol: RS-485/Modbus RTU
  - Operating mode: master
  - Baud rate Modbus RTU: 1.2 kbit/s…57.6 kbit/s
- **Cable length**: ≤ 1200 m
- **Connection, BMS**: terminals A, B
- **Connection, Modbus RTU**: terminals D+, D-
- **Terminating resistor**: 120 Ω (0.25 W)

**Ethernet:**
- **Connection**: RJ45
- **Data rate**: 10/100/1000 Mbit/s, autodetect
- **DHCP**: on/off (on)*
- **IP address**: 192.168.0.100* (optional)
- **Netmask**: 255.255.255.0* (optional)
- **Protocols**: TCP/IP, Modbus TCP, DHCP, SMTP, NTP
- **Additional interface protocols**: connection to SCADA systems and/or PLC via OPC, BACnet or other protocols on request

**Environment/EMC**
- **Classification of climatic conditions acc. to IEC 60721:**
  - Stationary use: 3K5
  - Transport: 2K3
  - Long-term storage: 1K4
  - Operating temperature: 0…+55 °C
  - Fanless
- **Classification of mechanical conditions acc. to IEC 60721:**
  - Stationary use: 3M4
  - Transport: 2M2
  - Long-term storage: 1M3

**Connection**
- **Plug connectors**

**General data**
- **Operating mode**: continuous operation
- **Mounting**: display oriented
- **Degree of protection, on the front (IEC 60529)**: IP66
- **Degree of protection, on the rear (IEC 60529)**: IP20
- **Type of enclosure**: panel mounting
- **Control panel cut-out**: 199x143 mm
- **Screw mounting**: with mounting brackets
- **Flammability class**: UL94V-0
- **Documentation number**: D00005
- **Weight**: ≤ 1200 g

(*) = factory setting

---

**Dimension diagram (dimensions in mm)**

**Control panel cut-out (dimensions in mm)**
## Operating elements and Wiring diagram

### Interfaces

<table>
<thead>
<tr>
<th>1</th>
<th>Interface Modbus RTU</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Switch and LED master/slave for interface Modbus RTU</td>
</tr>
<tr>
<td>3</td>
<td>BMS bus (Bender measuring device interface)</td>
</tr>
<tr>
<td>4</td>
<td>Switch and LED master/slave for BMS bus</td>
</tr>
<tr>
<td>5</td>
<td>USB interface, without function</td>
</tr>
<tr>
<td>6</td>
<td>Connection of supply voltage, DC 24 V</td>
</tr>
</tbody>
</table>

### Rear cover

<table>
<thead>
<tr>
<th>1</th>
<th>Mode/node switch x16</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Mode/node switch x1</td>
</tr>
<tr>
<td>3</td>
<td>Buttons: Power, Reset</td>
</tr>
<tr>
<td>4</td>
<td>LEDs: Power, CF, Link, Run</td>
</tr>
</tbody>
</table>

### Notes

1. LC display with touch screen for standard and menu mode
2. Connection to supply voltage, DC 24 V
3. RJ45 connection for connection to personal computer resp. to the local network
4. Connection BMS bus (cable included in the scope of delivery)
5. Connection Modbus RTU (cable included in the scope of delivery)
COMTRAXX® MK800 (DI400)
Alarm indicator and test combination with LCD

### Device features
- Display of operating status, warning and alarm messages from Bender monitoring systems
- Backlit clear LC text display (4 x 20 characters, 8 mm)
- Additional text to be displayed, if required.
- A set of LEDs, red, yellow and green, allowing warning and alarm messages to be indicated in an order of priority
- Predefined standard texts in 21 languages
- 1000 freely programmable message texts
- Easy parameter setting with PC (USB interface) or menu
- Memory with real-time clock to store 1000 warning and alarm messages with date and time stamp
- 16 digital inputs (option)
- One programmable relay (option)
- Five large function buttons
- Versions available for flush and surface mounting as well as for mounting into cavity walls or for door mounting
- Non-reflecting, multicoloured foil
- Smooth surfaces without openings to meet the hygiene requirements for medical locations

### Standards
The MK800 alarm indicator and test combination meets the requirements for installation: DIN VDE 0100-710 (VDE 0100 Part 710) and IEC 60364-7-710.

### Ordering information

<table>
<thead>
<tr>
<th>Enclosure</th>
<th>Indication</th>
<th>Digital inputs/relay outputs</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flush-mounting enclosure</td>
<td>LCD</td>
<td>16/1</td>
<td>MK800-11</td>
<td>B 9510 0100</td>
</tr>
<tr>
<td></td>
<td>3 LEDs</td>
<td>–</td>
<td>MK800-12</td>
<td>B 9510 0101</td>
</tr>
<tr>
<td>Surface mounting</td>
<td>LCD</td>
<td>16/1</td>
<td>MK800A-11</td>
<td>B 9510 0102</td>
</tr>
<tr>
<td></td>
<td>3 LEDs</td>
<td>–</td>
<td>MK800A-12</td>
<td>B 9510 0103</td>
</tr>
<tr>
<td>Surface mounting, front door</td>
<td>LCD</td>
<td>16/1</td>
<td>MK800AF-11</td>
<td>B 9510 0104</td>
</tr>
<tr>
<td></td>
<td>3 LEDs</td>
<td>–</td>
<td>MK800AF-12</td>
<td>B 9510 0105</td>
</tr>
<tr>
<td>Built-in type without enclosure</td>
<td>LCD</td>
<td>16/1</td>
<td>MK800E-11</td>
<td>B 9510 0106</td>
</tr>
<tr>
<td></td>
<td>3 LEDs</td>
<td>–</td>
<td>MK800E-12</td>
<td>B 9510 0107</td>
</tr>
<tr>
<td>Surface mounting</td>
<td>LCD</td>
<td>16/1</td>
<td>DI400-11</td>
<td>B 9510 0113</td>
</tr>
<tr>
<td></td>
<td>3 LEDs</td>
<td>–</td>
<td>DI400-12</td>
<td>B 9510 0114</td>
</tr>
</tbody>
</table>

### Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameterisation software</td>
<td>TMK-SET V3.xx as Internet download</td>
<td></td>
</tr>
<tr>
<td>Flush-mounting enclosure for MK800</td>
<td>UP800</td>
<td>B 9510 0110</td>
</tr>
<tr>
<td>Bezel frame silver for MK800</td>
<td>BR800-1</td>
<td>B 9510 0111</td>
</tr>
<tr>
<td>Bezel frame white for MK800</td>
<td>BR800-2</td>
<td>B 9510 0112</td>
</tr>
</tbody>
</table>

### Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply unit</td>
<td>AN410</td>
<td>322</td>
</tr>
</tbody>
</table>
### Technical data

**Insulation coordination according to IEC 60664-1**
- Rated insulation voltage: AC 250 V
- Rated impulse withstand voltage/pollution degree: 4 kV/3

**Supply voltage**
- Supply voltage $U_s$: AC/DC 24 V
- Frequency range $f_s$: 40…60 Hz/DC
- Operating range $U_s$: AC 18…28/DC 18…30 V
- Power consumption: $\leq 5$ VA

**Stored energy time in the event of power system failure**
- Time, date: $> 5$ days (MK800 only)
- Restart in the event of voltage failure for at least: 1.5 s

**Displays and LEDs**
- Displays: four lines, 4 x 20 characters
- Standard message texts in 21 national languages
- Alarm addresses, programmable: 250
- Text messages, programmable: 1000
- Permissible number of operating messages on the internal BMS bus: 176
- History memory (messages): 1000
- Standard text message: 3 x 20 characters
- Additional text message (press button to access): 3 x 20 characters
- Alarm LEDs (a set of LEDs): NORMAL (green), WARNING (yellow), ALARM (red)

**Menu texts**
- German/English
- Buttons: 5 (test of assigned devices, buzzer mute, additional text, scroll, menu)

**Buzzer**
- Buzzer message: can be acknowledged, adoption of characteristics of new value
- Buzzer interval: configurable
- Buzzer frequency: configurable
- Buzzer repetition configurable: configurable

**Inputs (MK800…/DI400-11 only)**
- Digital inputs: 16 (INT1…INT16)
- Galvanic separation: yes
- Control of digital inputs: via potential-free contacts/extraneous voltage
- Operation mode: N/O, N/C operation, off, selectable for each input
- Factory setting: Off
- Voltage range (high): AC/DC 10…30 V
- Voltage range (low): AC/DC 0…2 V

**Interface internal/external**
- Interface/protocol: 2 x RS-485/BMS
- Baud rate internal/external (default setting): 9.6 kbit/s/57.6 kbit/s
- Cable length: $\leq 1200$ m
- Cable: twisted pair, shield connected to PE on one side
- Terminating resistor: 120 $\Omega$ (0.25 W) can be connected via DIP switch
- Factory setting: both on, off, position
- Device address, BMS bus external/internal: 1…150/1…99
- Factory setting device address internal/external: 1 (master)/1 (master)

**Programming**
- Interfaces: RS-485 or USB (V2.0/V1.1), USB cable: Type A plug on Type B plug
- TMK-SET V 4.0 and higher
- Software: TMK-SET V 4.0 and higher
- Factory setting password query: activated

**Cable length when the power supply for the MK800 is taken from AN450**
- 0.28 mm²: 50 m
- 0.5 mm²: 90 m
- 0.75 mm²: 150 m
- 1.5 mm²: 250 m
- 2.5 mm²: 400 m

**Cable length when the power supply for the MK800 is taken from AN410**
- 0.28 mm²: 150 m
- 0.5 mm²: 300 m
- 0.75 mm²: 500 m
- 1.5 mm²: 1000 m
- 2.5 mm²: 1600 m

**Colours**
- MK800: Front foil RAL 7015 (light grey) / RAL 7040 (basalt grey)
- DI400: Front foil RAL 5005 (signal blue)

**Switching elements (MK800-11/DI400-11 only)**
- Number: 1 changeover contact
- Function: programmable
- Operation mode: N/C or N/O operation (programmable)
- Electrical service life under rated operating conditions: 10,000 switching operations
- Contact data acc. to IEC 60947-5-1:
  - Utilisation category: AC-13
  - Rated operational voltage: 24 V
  - Rated operational current: 5 A
  - Minimum contact rating: 1 mA at AC/DC $> 10$ V

**Environment/EMC**
- EMC immunity: acc. to EN 61000-6-2
- EMC emission: acc. to EN 61000-6-3

**Ambient temperatures:**
- Operating temperature: -5…+55 °C
- Transport: -25…+70 °C
- Long-term storage: -25…+55 °C

**Classification of climatic conditions acc. to IEC 60721:**
- Stationary use (IEC 60721-3-3): 3K5 (no condensation, no formation of ice)
- Transport (IEC 60721-3-2): 2K4
- Long-term storage (IEC 60721-3-1): 1K4
- Classification of mechanical conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3M4
  - Transport (IEC 60721-3-2): 2M2
  - Long-term storage (IEC 60721-3-1): 1M3

**Option „W“ data different from the standard version**
- Classification of climatic conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3K5 (condensation and formation of ice is possible)
- Classification of mechanical conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3M7

**Connection**
- Connection: pluggable screw terminals
- Connection properties (supply voltage, BMS bus):
  - Rigidity/flexible/connector sizes: 0.2…2.5/0.2…2.5 mm²/AWG 24-12
  - Flexible with ferrules, without/with plastic sleeve: 0.25…2.5/0.25…2.5 mm²
- Connection properties (inputs):
  - Rigidity/flexible/connector sizes: 0.08…1.5/0.08…1.5 mm²/AWG 28-16
  - Flexible with ferrules, without/with plastic sleeve: 0.25…1.5/0.25…0.5 mm²
- Stripping length: 7 mm
- Tightening torque: 0.5…0.6 Nm (4.5…5.3 lb-in)

**Other**
- Operation mode: continuous operation
- Mounting: display-oriented
- Degree of protection, built-in components (DIN EN 60529): IP50
- Degree of protection, terminals (DIN EN 60529): IP20
- Flammability class: UL94 V-0
- Document number: D00053 (MK800)
- Weight: 2016/2017
- Surface-mounting (MK800AF/DI400):
  - ≤ 950 g
- Surface-mounting (MK800AF):
  - ≤ 880 g
  - ≤ 1150 g

**Technical data**

**System components | Communication systems | Alarm indicator and test combinations**

Remote alarm indicator and test combination COMTRAXX® MK800
Remote alarm indicator and test combination COMTRAXX® MK800

COMTRAXX® MK800 (DI400)

2016/2017 System components | Communication systems | Alarm indicator and test combinations

Remote alarm indicator and test combination COMTRAXX® MK800

COMTRAXX® MK800

Dimension diagram (dimensions in mm)

MK800A-11/MK800A-12/DI400-11/DI400-12, surface-mounting

MK800AF-11/MK800AF-12, surface-mounting with door

Flush-mounting enclosure UP800

MK800-11/MK800-12 with bezel frame BR800 and flush-mounting enclosure UP800, example: cavity wall mounting

MK800-11/MK800-12, example: door mounting

COMTRAXX® MK800 (DI400)
Displays and controls

1. LCD: Display of operating status, warning and alarm messages as well as menu functions
2. LED “NORMAL”: Power On indicator, green (only lights up if no warnings or alarms are pending)
3. LED “WARNING”: warning messages, yellow
4. LED “ALARM”: alarm messages, red
5. Test button “TEST”: to activate the test for connected and assigned insulation monitoring devices
6. “Mute” button: in operating mode: to mute the buzzer.
   In menu mode: ESC function
7. “Scroll” button: In operating mode: to scroll messages.
   In menu mode: up
8. “Add. text” button: In operating mode: additional text.
   In menu mode: down
9. “MENU” button: In operating mode: to call up the menu mode.
   In menu mode: enter function

Wiring diagram

1. Supply voltage $U_S$
2. Looped through connection for supply voltage (e.g. for control voltage relay contacts)
3. Switch S1 to terminate the external BMS bus. If two or more devices are connected to each other via the BMS bus, the bus line must be terminated at both ends with a resistor ($R = 120 \, \Omega$).
4. External BMS bus connection. The external BMS bus is primarily used for the connection of several MK800 or TM800. SMI472-12 signal converters can also be connected.
5. Internal BMS bus connection. Various Bender devices with a BMS bus interface can be connected to the BMS bus. These may include: insulation monitoring devices 107TD47, control devices PRC487, residual current monitors RCMS470 and many more.
6. Switch S2 to terminate the internal BMS bus. If two or more devices are connected to each other via the BMS bus, the bus line must be terminated at both ends with a resistor ($R = 120 \, \Omega$).
7. USB Interface. For PC connection. The TMK-SET PC software is used to program the MK800. You can use the PC software TMK-HISTORY to read out the MK800 history memory.
8. MK800-11 only: Digital inputs. The digital inputs can be controlled by an internal or external voltage and potential-free contacts. If the inputs are controlled via an external voltage, the common 0(-) is applied to terminal “0 V” and the 1(+) signal to the corresponding input IN1…IN16.
9. MK800-11 only: Relay output. Programmable contact for device errors, test of assigned devices, device failure, common alarm message, buzzer.
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
  - 200 freely programmable message texts

- **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) and IEC 60364-7-710.

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

### Ordering information

<table>
<thead>
<tr>
<th>Enclosure</th>
<th>Digital inputs/relay output</th>
<th>BMS bus</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flush-mounting</td>
<td>12/1</td>
<td>✓</td>
<td>MK2430-11</td>
<td>B 9510 0001</td>
</tr>
<tr>
<td></td>
<td>–</td>
<td></td>
<td>MK2430-12</td>
<td>B 9510 0002</td>
</tr>
<tr>
<td>Surface mounting</td>
<td>12/1</td>
<td>✓</td>
<td>MK240A-11</td>
<td>B 9510 0005</td>
</tr>
<tr>
<td></td>
<td>–</td>
<td></td>
<td>MK240A-12</td>
<td>B 9510 0006</td>
</tr>
</tbody>
</table>

### Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameterisation software</td>
<td>TMK-SET as Internet download</td>
<td></td>
</tr>
<tr>
<td>MK2430 mounting kit, complete</td>
<td>B 9510 1000</td>
<td></td>
</tr>
</tbody>
</table>

### Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply unit</td>
<td>AN410</td>
<td>322</td>
</tr>
<tr>
<td></td>
<td>AN450</td>
<td>326</td>
</tr>
</tbody>
</table>
### 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>AC 250 V</td>
</tr>
<tr>
<td>Rated impulse withstand voltage/pollution degree</td>
<td>4 kV/V</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>AC/DC 24 V</td>
</tr>
<tr>
<td>Frequency range $f_s$</td>
<td>0/40...60 Hz</td>
</tr>
<tr>
<td>Operating range $U_s$</td>
<td>AC 18...28/DC 18...30 V</td>
</tr>
<tr>
<td>Power consumption</td>
<td>≤ 3 VA</td>
</tr>
<tr>
<td>Voltage failure without reset</td>
<td>≤ 15 s</td>
</tr>
</tbody>
</table>

#### Displays and LEDs

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display, characters</td>
<td>four lines, 4 x 20 characters</td>
</tr>
<tr>
<td>Standard message texts in</td>
<td>20 languages</td>
</tr>
<tr>
<td>Alarm addresses configurable</td>
<td>150</td>
</tr>
<tr>
<td>Programmable text messages</td>
<td>200</td>
</tr>
<tr>
<td>History memory (messages)</td>
<td>250</td>
</tr>
<tr>
<td>Standard text message</td>
<td>3 x 20 characters</td>
</tr>
<tr>
<td>Additional text message (press button to access)</td>
<td>3 x 20 characters</td>
</tr>
<tr>
<td>Alarm LEDs (three different colours)</td>
<td>NORMAL (green), WARNING (yellow), ALARM (red)</td>
</tr>
<tr>
<td>Menu texts</td>
<td>German/English</td>
</tr>
<tr>
<td>Buttons</td>
<td>5 (isometer test, buzzer mute, additional text, scroll, menu)</td>
</tr>
</tbody>
</table>

#### Buzzer

Buzzer message can be acknowledged, with new value operation

Buzzer interval configurable

Buzzer frequency configurable

Buzzer repetition configurable

#### Inputs (MK2430…-11 only)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital inputs</td>
<td>12 (INT1...INT12)</td>
</tr>
<tr>
<td>Galvanic separation</td>
<td>yes</td>
</tr>
<tr>
<td>Activation of the digital inputs</td>
<td>via potential-free contacts/extraneous voltage</td>
</tr>
<tr>
<td>Operating principle</td>
<td>N/O or N/C operation individually selectable for each input</td>
</tr>
<tr>
<td>Factory setting</td>
<td>N/O operation</td>
</tr>
<tr>
<td>Voltage range (high)</td>
<td>AC/DC 10...30 V</td>
</tr>
<tr>
<td>Voltage range (low)</td>
<td>AC/DC 0...2 V</td>
</tr>
<tr>
<td>Cable recommended</td>
<td>J-Y(St)Y min. n x 0.8</td>
</tr>
<tr>
<td>Cable length</td>
<td>≤ 500 m</td>
</tr>
<tr>
<td>Interfaces</td>
<td>RS-485 and USB (V2.0/V1.1)</td>
</tr>
</tbody>
</table>

#### Technical data for the RS-485 interface:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocol</td>
<td>BMS</td>
</tr>
<tr>
<td>Baud rate</td>
<td>9.6 kbit/s</td>
</tr>
<tr>
<td>Cable length</td>
<td>≤ 1200 m</td>
</tr>
<tr>
<td>Cable recommended</td>
<td>J-Y(St)Y min. 2x0.8</td>
</tr>
<tr>
<td>Terminating resistor</td>
<td>120 Ω (0.25 W) connectable via DIP switch</td>
</tr>
<tr>
<td>Device address, BMS bus</td>
<td>DIP switch 1...150</td>
</tr>
<tr>
<td>Factory setting address</td>
<td>1 (master)</td>
</tr>
</tbody>
</table>

#### Programming

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interfaces</td>
<td>RS-485 or USB (V2.0/V1.1), USB cable: Type A plug on type B plug</td>
</tr>
<tr>
<td>Software</td>
<td>TMK-SET, V 4.0 or higher</td>
</tr>
<tr>
<td>Factory setting password</td>
<td>activated</td>
</tr>
</tbody>
</table>

#### Max. cable length in case of power supply of 1/2/3 MK24… from one AN450

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.28 mm² (e.g. J-Y(St)Y n x 0.6)</td>
<td>160/40...m</td>
</tr>
<tr>
<td>0.5 mm² (e.g. J-Y(St)Y n x 0.8)</td>
<td>250/70...m</td>
</tr>
<tr>
<td>0.75 mm²</td>
<td>400/100...m</td>
</tr>
<tr>
<td>1.5 mm²</td>
<td>800/210/10 m</td>
</tr>
<tr>
<td>2.5 mm²</td>
<td>1300/360/20 m</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. cable length in case of power supply of 1/2/3 MK24… from one AN410</td>
<td>300/150/100 m</td>
</tr>
<tr>
<td>0.5 mm² (e.g. J-Y(St)Y n x 0.6)</td>
<td>500 /250/150 m</td>
</tr>
<tr>
<td>0.75 mm²</td>
<td>750/375/250 m</td>
</tr>
<tr>
<td>1.5 mm²</td>
<td>1500/750/500 m</td>
</tr>
<tr>
<td>2.5 mm²</td>
<td>2500/1200/750 m</td>
</tr>
</tbody>
</table>

#### Colours

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front foil</td>
<td>RAL 7035 (light grey): RAL 7040 (basalt grey)</td>
</tr>
<tr>
<td>Marking</td>
<td>RAL 5005 (ultramarine blue)</td>
</tr>
<tr>
<td>Front plate</td>
<td>RAL 7015 (light grey)</td>
</tr>
</tbody>
</table>

#### Switching elements (MK2430…-11 only)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>1 changeover contact</td>
</tr>
<tr>
<td>Function</td>
<td>programmable</td>
</tr>
<tr>
<td>Operating principle</td>
<td>N/C or N/O operation (programmable)</td>
</tr>
<tr>
<td>Electrical endurance, number of cycles</td>
<td>10,000</td>
</tr>
<tr>
<td>Contact data acc. to IEC 60947-5-1</td>
<td></td>
</tr>
<tr>
<td>Utilisation category</td>
<td>AC-13</td>
</tr>
<tr>
<td>Operating voltage</td>
<td>24 V</td>
</tr>
<tr>
<td>Rated operational current</td>
<td>5 A</td>
</tr>
<tr>
<td>Rated operational current</td>
<td>1 A</td>
</tr>
<tr>
<td>Minimum contact rating</td>
<td>1 mA at AC/DC &gt; 10 V</td>
</tr>
</tbody>
</table>

#### Environment/EMC

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC immunity</td>
<td>EN 61000-6-2</td>
</tr>
<tr>
<td>EMC emission</td>
<td>EN 61000-6-3</td>
</tr>
<tr>
<td>Classification of climatic conditions acc. to IEC 60721:</td>
<td></td>
</tr>
<tr>
<td>Stationary use</td>
<td>3kS</td>
</tr>
<tr>
<td>Transport</td>
<td>2kS</td>
</tr>
<tr>
<td>Long-term storage</td>
<td>1kA</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-5...+55 °C</td>
</tr>
<tr>
<td>Classification of mechanical conditions acc. to IEC 60721:</td>
<td></td>
</tr>
<tr>
<td>Stationary use</td>
<td>3M4</td>
</tr>
<tr>
<td>Transport</td>
<td>2M2</td>
</tr>
<tr>
<td>Long-term storage</td>
<td>1M3</td>
</tr>
</tbody>
</table>

#### Connection

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection</td>
<td>pluggable screw terminals</td>
</tr>
</tbody>
</table>

#### Connection properties (supply voltage, BMS bus):

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection of single conductors</td>
<td></td>
</tr>
<tr>
<td>rigid/flexible/conductor sizes</td>
<td>0.2...2.5 mm² (AWG 24...12)</td>
</tr>
<tr>
<td>flexible with ferrule/without with plastic sleeve</td>
<td>0.25...2.5 mm²</td>
</tr>
<tr>
<td>Multi-conductor connection (2 conductors of the same cross section)</td>
<td></td>
</tr>
<tr>
<td>rigid/flexible/conductor sizes</td>
<td>0.2...1/0.2...1.5 mm²</td>
</tr>
<tr>
<td>flexible with ferrule/without plastic sleeve</td>
<td>0.25...1.5 mm²</td>
</tr>
<tr>
<td>flexible with TWIN ferrules with plastic sleeve</td>
<td>0.5...1.5 mm²</td>
</tr>
</tbody>
</table>

#### Connection properties (inputs):

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection of single conductors</td>
<td></td>
</tr>
<tr>
<td>rigid/flexible/conductor sizes</td>
<td>0.08...1.5 mm² (AWG 28...16)</td>
</tr>
<tr>
<td>flexible with ferrule/without with plastic sleeve</td>
<td>0.25...1/0.25...0.5 mm²</td>
</tr>
<tr>
<td>Multi-conductor connection (2 conductors with the same cross section):</td>
<td></td>
</tr>
<tr>
<td>rigid/flexible/conductor sizes</td>
<td>0.08...0.5 mm²</td>
</tr>
<tr>
<td>flexible with ferrules/without plastic sleeve</td>
<td>0.25...0.34 mm²</td>
</tr>
<tr>
<td>flexible with TWIN ferrule with plastic sleeve</td>
<td>0.5 mm²</td>
</tr>
</tbody>
</table>

#### Environment/EMC

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stripping length</td>
<td>7 mm</td>
</tr>
<tr>
<td>Tightening torque</td>
<td>0.5...0.6 Nm</td>
</tr>
</tbody>
</table>

#### Other

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating mode</td>
<td>continuous operation</td>
</tr>
<tr>
<td>Mounting</td>
<td>display-oriented</td>
</tr>
<tr>
<td>Degree of protection, internal components (DIN EN 60529)</td>
<td>IP50 (surface-mounting type: IP54)</td>
</tr>
<tr>
<td>Degree of protection, terminals (IEC 60529)</td>
<td>IP20</td>
</tr>
<tr>
<td>Flammability class</td>
<td>UL94V-0</td>
</tr>
<tr>
<td>Documentation number</td>
<td>D00129</td>
</tr>
<tr>
<td>Weight</td>
<td>flush mounting ≤ 210 g, surface mounting ≤ 400 g</td>
</tr>
</tbody>
</table>
**Displays and controls**

1. LED "NORMAL": operating mode display
2. LED "WARNING": Warning messages
3. LED "ALARM": Alarm messages
4. LCD: Display of operating and alarm messages
5. Mute button
   - In operating mode: to mute the buzzer
   - In menu mode: ESC function
6. “TEST” button: to activate the test for connected and assigned insulation monitoring devices.
7. “MENU” button
   - In operating mode: to call up the menu mode.
   - In menu mode: Enter function
8. Additional text button
   - In operating mode: additional text
   - In menu mode: Down button
9. Scroll button
   - In operating mode: to scroll messages
   - In menu mode: Up button

**Wiring diagram**

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 COM460IP 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

Typical applications

- Visualisation of Bender systems

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.
Enclosure mounting

Mounting frame for installing enclosures into control panels with standard cutout

For mounting X470/XM460 enclosures into panels with 144 x 72 mm cutout, made of silver anodised aluminium. Suitable for the 470 and 460 series, e.g. IR470, EDS470, RCMS470, RCMS460 and EDS460 devices.

For mounting XM490 enclosures into panel cutouts of 198 x 72 mm. Suitable for 490 series devices, e.g. RCMS490, EDS490/491. Dimensions are given in mm.

Fixing set for enclosure mounting into panels with 45 mm cutout

For mounting X440, X460, X470 enclosures into 45 mm panel cutouts, made of stainless steel.

Suitable for all 470 series devices, e.g. RCM470, RCMA470. Dimensions are given in mm.

XM420 mounting frame for mounting enclosures into panels

For mounting XM420 enclosures into panels. Suitable for all XM420 series devices, e.g. RCM420, RCMA420, RCMA423.
Front plate cover
for protection class IP65

Typical applications
Transparent front plate cover for use in harsh environmental conditions and for increasing the degree of protection (IP65), suitable for devices of the IRDH375/575 series.

Ordering information

<table>
<thead>
<tr>
<th>Suitable for</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRDH375, FP200</td>
<td>Front plate cover 144 x 72 mm</td>
<td>B 9806 0005</td>
</tr>
<tr>
<td>IRDH575</td>
<td>Front plate cover 144 x 96 mm</td>
<td>B 9806 0007</td>
</tr>
</tbody>
</table>
Insulation monitoring devices
ISOMETER®

Equipment for insulation fault location
ISOSCAN®

Power Quality and Energy Measurement
LINETRAXX®

Measuring and monitoring relays
LINETRAXX®

Residual current monitoring systems
LINETRAXX®

System components
Coupling devices
Measuring current transformers
Transformers
Measuring transducers
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
Standards and guidelines applied
Alphabetical list of devices
Technical terms
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>Safe</th>
<th>Easy-to-use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional safety SIL2 according to IEC 61508 guarantees protection against malfunction hazards</td>
<td>Easy to operate and perfect overview due to clear menu structure and user guidance</td>
</tr>
<tr>
<td>Continuous self monitoring of electronic system and circuit paths with automatic notification</td>
<td>Correct information at the correct time due to clear messages via an illuminated graphic display and via bus</td>
</tr>
<tr>
<td>Preventive safety by automatic reminders for prescribed tests</td>
<td>Safe manual changeover during service due to integrated manual/automatic mode with mechanical restart interlock</td>
</tr>
<tr>
<td><strong>Maximum reliability during changeover</strong></td>
<td><strong>Complete documentation of events</strong></td>
</tr>
<tr>
<td>■ Patented changeover system with mechanical and electrical interlock</td>
<td>■ Changeover procedures</td>
</tr>
<tr>
<td>■ Weld-free switching contacts with circuit breaker mechanism</td>
<td>■ Testing</td>
</tr>
<tr>
<td>■ Insensitive to voltage fluctuations or shocks, for example, due to stable operating position and constant contact pressure</td>
<td>■ Parameter changes</td>
</tr>
<tr>
<td>■ Monitoring for short circuits</td>
<td><strong>External functional test or replacement without service interruption</strong> by optional bypass switch</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Compact</th>
<th>Efficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compact design of electronic system and switching elements in one enclosure</td>
<td>Small space required</td>
</tr>
<tr>
<td>Changeover, IT system monitoring and locating current injector in one device</td>
<td>Tests according to the regulations without interruption of the power supply</td>
</tr>
<tr>
<td>Simple wiring due to integrated design</td>
<td>Easy integration into existing installations</td>
</tr>
<tr>
<td>Completely pluggable</td>
<td></td>
</tr>
</tbody>
</table>
Device overview ATICS® switchover and monitoring devices

<table>
<thead>
<tr>
<th></th>
<th>ATICS®…-ISO</th>
<th>ATICS®…-DIO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Page</strong></td>
<td>368</td>
<td>371</td>
</tr>
<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_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>10 kΩ…1 MΩ</td>
</tr>
<tr>
<td><strong>Insulation monitoring Response value R_{set}</strong></td>
<td>50…500 kΩ</td>
<td>50…500 kΩ</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>Generation Pluggable screw terminals</strong></td>
<td>(up to 125 A)</td>
<td>(up to 125 A)</td>
</tr>
<tr>
<td><strong>Connection Screw terminals</strong></td>
<td>(160 A)</td>
<td>(160 A)</td>
</tr>
<tr>
<td><strong>Installation 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>
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 designing safety power supplies with functional safety more easily, in accordance with DIN VDE 61508 (SIL 2) e.g. for Group 2 medical locations in compliance with IEC 60364-7-710:2002/DIN VDE 0100-710 (VDE 0100-710)
• The integration of both the switching elements and the IT system monitoring electronics in one compact
device provides increased safety and availability
• All-in-one: Integration of switch disconnector, control and monitoring electronics for unearthed safety power
supplies
• Solutions for any application

Typical applications
• Design of safety power supplies in group 2 medical locations, e.g.
  – intensive care unit
  – operating theatres
• Retrofit

Approvals

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 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 ATICS-…-ISO series complies with the requirements of the device standards:
DIN VDE 0100-710 (VDE 0100-710)/IEC 60364-7-710, functional safety in accordance with EN 61508 (SIL 2),
DIN EN 60947-6-1; VDE 0660-114/IEC 60947-6-1

Further information

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

Ordering information

<table>
<thead>
<tr>
<th>Rated operational voltage ( U_s )</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>230 V</td>
<td>63 A</td>
<td>ATICS-2-63A-ISO</td>
<td>B 9205 7202</td>
</tr>
<tr>
<td></td>
<td></td>
<td>80 A</td>
<td>ATICS-2-80A-ISO</td>
<td>B 9205 7203</td>
</tr>
<tr>
<td></td>
<td>400 V</td>
<td>63 A</td>
<td>ATICS-2-63A-ISO-400</td>
<td>B 9205 7204</td>
</tr>
<tr>
<td></td>
<td></td>
<td>80 A</td>
<td>ATICS-2-80A-ISO-400</td>
<td>B 9205 7205</td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Rated operational current ( I_e )</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bypass switch kit</td>
<td>63 A</td>
<td>ATICS-BP-63A-SET</td>
<td>B 9205 7252</td>
</tr>
<tr>
<td></td>
<td>80 A</td>
<td>ATICS-BP-80A-SET</td>
<td>B 9205 7253</td>
</tr>
</tbody>
</table>

Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation fault locator</td>
<td>EDS151</td>
<td>149</td>
</tr>
</tbody>
</table>
**Technical data**

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**
- Overvoltage category: III
- Rated insulation voltage: 250 V
- Supply voltage $U_1$: see ordering information

**Power section/switching elements**
- Nominal system voltage $U_0$: see ordering information
- Frequency range $f_0$: 48…62 Hz

**IT system monitoring**

**Insulation monitoring**
- Measuring range: $10\,\text{k}\Omega \ldots 1\,\text{M}\Omega$
- Response value $R_{\text{res}}$ (ALARM 1): $50 \ldots 500\,\text{k}\Omega$

**Load current monitoring (IT system transformer)**
- Measuring range (TRMS): $10 \ldots 110\%$ of the response value
- Response value adjustable: $S \ldots (50)\,100\,\text{A}$ (1 A steps)

**Temperature monitoring (IT system transformer)**
- PTC resistors acc. to DIN 44081: max. 6 in series

**Displays and data memory**
- Display (languages DE, EN, FR): graphic display
- History memory: 500 data records
- Data logger: 500 data records/channel
- Config. logger: 300 data records
- Test logger: 100 data records
- Service logger: 100 data records

**Input**
- Digital inputs: 1
  - Function selectable: switching back interlocking function, manual/automatic mode, bypass operation, functional test, changeover for the preferred supply, alarm input for operating theatre lights, alarm input for other electrical equipment

**Output**
- Switching element: 1 potential-free changeover contact
- Operating principle adjustable: N/O or N/C operation
- Function selectable: alarm or operating message/common alarm message/generator start-up

**BMS interface**
- Interface/protocol: RS-485/BMS

**Environment/EMC**
- EMC: IEC 61326-1/IEC 61326-2-4
- Operating temperature: $-25 \ldots +55\,^\circ\text{C}$
- Degree of protection: IP20

**Terminals**

**Power section**
- Connection: pluggable screw terminals
- Rigid max.: 35 mm²
- Flexible max.: 25 mm²

**Other**
- Operating mode: continuous operation
- DIN rail mounting: according to IEC 60715
- Screw mounting: 4 x M5
- Documentation number: D00046
- Weight: approx. 4500 g
- Scope of delivery: ATICS® incl. STW2 and STW3 measuring current transformers, bridge, connector and terminal cover

---

**Dimension diagram (dimensions in mm)**
Example intensive care unit
- ATICS-2-63A-ISO: Automatic changeover between the preferred and the redundant line while monitoring the medical IT system with transformer load and temperature monitoring
- EDS151: Insulation fault locator for fast insulation fault location (recommended)
- ATICS-BP: Bypass switch for uninterrupted test/maintenance (recommended)
- MK2430/MK800/TM800: Alarm at at least two points for functional safety

Example application operating theatre
- ATICS-2-63A-ISO: Automatic changeover between the preferred and the redundant line while monitoring the medical IT system with transformer load and temperature monitoring
- IR426-D47: Monitoring the operating theatre light IT system (optional)
- MK2430/MK800/TM800: Alarm at at least two points for functional safety
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 data 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

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 ATICS—DIO series complies with the requirements of the device standards:
DIN VDE 0100-710 (VDE 0100-710)/IEC 60364-7-710, functional safety in accordance with EN 61508 (SIL 2), DIN EN 60947-6-1; VDE 0660-114/IEC 60947-6-1

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 $I_e$</th>
<th>Scope of delivery</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-pole</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC</td>
<td>63 A</td>
<td>1 x STW3, bridge, connectors, terminal cover</td>
<td>ATICS-2-63A-DIO</td>
<td>B 9205 7212</td>
</tr>
<tr>
<td></td>
<td>80 A</td>
<td>1 x STW3, bridge, connectors, terminal cover</td>
<td>ATICS-2-80A-DIO</td>
<td>B 9205 7213</td>
</tr>
<tr>
<td>Bypass switch set</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC</td>
<td>63 A</td>
<td>Bridge, terminal cover, auxiliary contacts, LEDs green/red</td>
<td>ATICS-BP-3-63A-SET</td>
<td>B 9205 7252</td>
</tr>
<tr>
<td></td>
<td>80 A</td>
<td>Bridge, terminal cover, auxiliary contacts, LEDs green/red</td>
<td>ATICS-BP-3-80A-SET</td>
<td>B 9205 7253</td>
</tr>
</tbody>
</table>

Ordering information ATICS®—DIO 4-pole

<table>
<thead>
<tr>
<th>Version</th>
<th>Rated operational current $I_e$</th>
<th>Scope of delivery</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-pole</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC</td>
<td>80 A</td>
<td>4 x STW4, bridge, connectors, terminal cover</td>
<td>ATICS-4-80A-DIO</td>
<td>B 9205 7222</td>
</tr>
<tr>
<td></td>
<td>125 A</td>
<td>4 x STW4, bridge, connectors, terminal cover</td>
<td>ATICS-4-125A-DIO</td>
<td>B 9205 7223</td>
</tr>
<tr>
<td></td>
<td>160 A</td>
<td>4 x STW4, bridge, terminal cover</td>
<td>ATICS-4-160A-DIO</td>
<td>B 9205 7224</td>
</tr>
</tbody>
</table>
Technical data

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

<table>
<thead>
<tr>
<th>Overvoltage category</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated operational voltage $U_e$ (operating range)</td>
<td>230 V (AC 160…276 V)</td>
</tr>
<tr>
<td>Rated insulation voltage ATICS®-2-DIO/ATICS®-4-DIO</td>
<td>250/400 V</td>
</tr>
<tr>
<td>Supply voltage $U_s$ from the system being monitored</td>
<td></td>
</tr>
</tbody>
</table>

Power sectionswitching elements

<table>
<thead>
<tr>
<th>Nominal system voltage $U_{n}$</th>
<th>2-pole AC 230 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-pole</td>
<td>380/415/440 V</td>
</tr>
</tbody>
</table>

| Frequency range $f_n$ | 48…62 Hz |

Displays and data memory

<table>
<thead>
<tr>
<th>Display (languages DE, EN, FR)</th>
<th>graphic display</th>
</tr>
</thead>
<tbody>
<tr>
<td>History memory</td>
<td>500 data records</td>
</tr>
<tr>
<td>Data logger</td>
<td>500 data records</td>
</tr>
<tr>
<td>Config. logger</td>
<td>300 data records</td>
</tr>
<tr>
<td>Test logger</td>
<td>100 data records</td>
</tr>
<tr>
<td>Service logger</td>
<td>100 data records</td>
</tr>
</tbody>
</table>

Input

<table>
<thead>
<tr>
<th>Digital inputs</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function selectable</td>
<td>switching back interlocking function, manual/automatic mode, bypass mode, functional test, changeover to the preferred line, alarm input for operating theatre lights, alarm input for other technical equipment</td>
</tr>
</tbody>
</table>

Output

<table>
<thead>
<tr>
<th>Switching elements</th>
<th>1 potential-free changeover contact/3 potential-free N/O contacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating principle adjustable</td>
<td>N/O or N/C operation</td>
</tr>
<tr>
<td>Function selectable</td>
<td>alarm or operating message/common alarm message/generator start-up</td>
</tr>
</tbody>
</table>

BMS interface

| Interface/protocol | RS-485/BMS |

Environment/EMC

<table>
<thead>
<tr>
<th>Operating temperature</th>
<th>-25…+55 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC</td>
<td>IEC 61326-1</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IP20</td>
</tr>
</tbody>
</table>

Terminals

<table>
<thead>
<tr>
<th>Power unit</th>
<th>up to 125 A</th>
<th>160 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection</td>
<td>pluggable screw terminals</td>
<td>screw-type terminals</td>
</tr>
<tr>
<td>rigid max.</td>
<td>35 mm²</td>
<td>70 mm²</td>
</tr>
<tr>
<td>flexible max.</td>
<td>25 mm²</td>
<td>50 mm²</td>
</tr>
</tbody>
</table>

Other

<table>
<thead>
<tr>
<th>Operating mode</th>
<th>continuous operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIN rail mounting</td>
<td>according to IEC 60715</td>
</tr>
<tr>
<td>Screw mounting</td>
<td>4 x M5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weight</th>
<th>2-pole</th>
<th>approx. 4500 g</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4-pole</td>
<td>approx. 5700 g</td>
</tr>
<tr>
<td>Scope of delivery</td>
<td>see ordering information</td>
<td></td>
</tr>
<tr>
<td>Documentation number</td>
<td>D00080</td>
<td></td>
</tr>
</tbody>
</table>

Dimension diagrams (dimensions in mm)

2-pole

4-pole

* Version 80 A/125 A. Version 160 A without connectors.
Example application data centre
- ATICS®-…-DIO: Changeover between the preferred and the redundant line
- MK2430/MK800/TM800: Alarm at least two points for functional safety
**Safety Analyser**

For over 25 years, the “Bender Tester” has been a well-known 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>Page</th>
<th>UNIMET® 300ST</th>
<th>UNIMET® 400ST</th>
<th>UNIMET® 810ST</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Application</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric hospital and care beds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical electrical equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Voltages</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply voltage $U_S$</td>
<td>AC 230 V</td>
<td>AC 230 V</td>
<td>AC 100…120 V, AC 220…240 V</td>
</tr>
<tr>
<td>Voltage measurement</td>
<td>AC 90…264 V</td>
<td>AC 90…264 V</td>
<td>AC 90…264 V</td>
</tr>
<tr>
<td>Load current measurement</td>
<td>0.01…16 A</td>
<td>0.01…16 A</td>
<td>0.01…16 A</td>
</tr>
<tr>
<td><strong>Test sequence</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>manual</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>semi-automatic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>automatic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Data exchange</strong></td>
<td>UNIData300</td>
<td>UNIData300/400</td>
<td>UNIMET® 800ST Control Center</td>
</tr>
</tbody>
</table>

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

Die 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, OVE E8701-1

Further information

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

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage Uₜ</th>
<th>Version</th>
<th>Type</th>
<th>Art. No</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 230 V</td>
<td>Standard</td>
<td>UNIMET® 300ST</td>
<td>B 9602 3000</td>
</tr>
<tr>
<td></td>
<td>CH</td>
<td>UNIMET® 300ST</td>
<td>B 9602 3001</td>
</tr>
</tbody>
</table>

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>German Schuko</td>
<td>VK701-6</td>
<td>B 9602 0067</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Non-heating appliances</td>
<td>VK701-7</td>
<td>B 9602 0066</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Adapter kit 16 A for DS32A</td>
<td>VK701-8</td>
<td>B 9602 0097</td>
<td>–</td>
</tr>
<tr>
<td>Test probe</td>
<td>–</td>
<td>Test probe</td>
<td>B 920 748</td>
<td>–</td>
</tr>
<tr>
<td>Test terminal</td>
<td>–</td>
<td>Test terminal</td>
<td>B 920 741</td>
<td>–</td>
</tr>
<tr>
<td>Barcode scanner</td>
<td>–</td>
<td>PS/2</td>
<td>B 9602 0082</td>
<td>–</td>
</tr>
<tr>
<td>Converter</td>
<td>–</td>
<td>USB 1.1 RS-232 converter</td>
<td>B 9602 0086</td>
<td>–</td>
</tr>
<tr>
<td>Flex keyboard</td>
<td>–</td>
<td>Flex keyboard</td>
<td>B 9602 0093</td>
<td>–</td>
</tr>
<tr>
<td>Three-phase adapter</td>
<td>–</td>
<td>DS32A</td>
<td>B 9602 0098</td>
<td>388</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DS32DCT</td>
<td>B 9602 0100</td>
<td>–</td>
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</tbody>
</table>
## Technical data

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>AC 230 V ± 10 %</td>
</tr>
<tr>
<td>Frequency range</td>
<td>45…65 Hz</td>
</tr>
<tr>
<td>Power consumption</td>
<td>max. 50 VA</td>
</tr>
<tr>
<td>Maximum load current</td>
<td>16 A</td>
</tr>
<tr>
<td>Max. connectable load at 230 V</td>
<td>3700 VA</td>
</tr>
<tr>
<td>Protection class</td>
<td>II</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>0…50 °C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-10…+70 °C</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IP20</td>
</tr>
</tbody>
</table>

### Testing of PE resistance

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test voltage</td>
<td>approx. 5 V, system frequency</td>
</tr>
<tr>
<td>Short-circuit current</td>
<td>&gt; 2 A</td>
</tr>
<tr>
<td>Measuring range</td>
<td>0.001…29.999 Ω</td>
</tr>
<tr>
<td>Measuring accuracy</td>
<td>±2.5 % of MV ±2 digits</td>
</tr>
<tr>
<td>Leakage current, differential measurement method</td>
<td>0.001…1.0 Ω; ±5 % of MV ±5 digits</td>
</tr>
<tr>
<td>Leakage current, direct measurement</td>
<td>0.001…19.999 mA</td>
</tr>
<tr>
<td>Measuring range</td>
<td>±5 % of MV ±5 digits</td>
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</tbody>
</table>

### Equipment leakage current - Alternative method

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>0.001…19.999 mA</td>
</tr>
<tr>
<td>Measuring accuracy</td>
<td>±5 % of MV ±5 digits</td>
</tr>
</tbody>
</table>

### Insulation resistance

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test voltage</td>
<td>approx. DC 500 V</td>
</tr>
<tr>
<td>Max. test current</td>
<td>2.5 mA</td>
</tr>
<tr>
<td>Measuring range</td>
<td>0.01…199.99 MC2</td>
</tr>
<tr>
<td>Measuring accuracy</td>
<td>±5 % of MV ±2 digits</td>
</tr>
<tr>
<td>Load current measurement</td>
<td>0.01 A to 16 A</td>
</tr>
<tr>
<td>Measuring accuracy</td>
<td>±2.5 % of MV ±3 digits</td>
</tr>
</tbody>
</table>

### Voltage measurement

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>90…264 V</td>
</tr>
<tr>
<td>Measuring accuracy</td>
<td>±2.5 % of MV ±2 digits</td>
</tr>
</tbody>
</table>

### Apparent power

<table>
<thead>
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<th>Specification</th>
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<tbody>
<tr>
<td>Measuring range</td>
<td>5…3700 VA</td>
</tr>
<tr>
<td>Measuring accuracy</td>
<td>±5 % of MV ±5 digits</td>
</tr>
</tbody>
</table>

### Other

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (without bag)</td>
<td>ca. 168 x 272 x 124 mm (W x D x H)</td>
</tr>
<tr>
<td>Weight (without accessories or bag)</td>
<td>approx. 2.2 kg</td>
</tr>
<tr>
<td>Calibration interval</td>
<td>36 months</td>
</tr>
<tr>
<td>Documentation number</td>
<td>D00135</td>
</tr>
</tbody>
</table>

### Load current measurement

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>0.001…9,999 mA</td>
</tr>
<tr>
<td>Measuring accuracy</td>
<td>±5 % of MV ±2 digits</td>
</tr>
<tr>
<td>Measuring range</td>
<td>10,000…19,999 mA</td>
</tr>
<tr>
<td>Measuring accuracy</td>
<td>±7 % of MV ±2 digits</td>
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### Test voltage (Equipment leakage current measurement – alternative method)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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<tbody>
<tr>
<td>Max. test current</td>
<td>2.5 mA</td>
</tr>
<tr>
<td>Measuring range</td>
<td>0.001…9,999 mA</td>
</tr>
<tr>
<td>Measuring accuracy</td>
<td>±5 % of MV ±2 digits</td>
</tr>
<tr>
<td>Test voltage</td>
<td>approx. system voltage, system frequency</td>
</tr>
<tr>
<td>Test current</td>
<td>max. 3.5 mA</td>
</tr>
</tbody>
</table>

### Load current measurement

<table>
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<tr>
<th>Specification</th>
<th>Value</th>
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<tbody>
<tr>
<td>Measuring range</td>
<td>0.01 A to 16 A</td>
</tr>
<tr>
<td>Measuring accuracy</td>
<td>±2.5 % of MV ±3 digits</td>
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### Voltage measurement

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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<tbody>
<tr>
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### Apparent power

<table>
<thead>
<tr>
<th>Specification</th>
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<tr>
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### Test voltage (Equipment leakage current measurement – alternative method)

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<tr>
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<td>approx. system voltage, system frequency</td>
</tr>
<tr>
<td>Test current</td>
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### Load current measurement

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<tr>
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<td>Calibration interval</td>
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</tr>
<tr>
<td>Documentation number</td>
<td>D00135</td>
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### Test voltage (Equipment leakage current measurement – alternative method)

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</tr>
<tr>
<td>Test voltage</td>
<td>approx. system voltage, system frequency</td>
</tr>
<tr>
<td>Test current</td>
<td>max. 3.5 mA</td>
</tr>
</tbody>
</table>
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
   - 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

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

- 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

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

Ordering information

<table>
<thead>
<tr>
<th>Supply voltage Uₜ</th>
<th>Version</th>
<th>Type</th>
<th>Art. No.</th>
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<tbody>
<tr>
<td>AC 230V</td>
<td>Standard</td>
<td>UNIMET® 400ST</td>
<td>B 9602 4000</td>
</tr>
<tr>
<td>CH</td>
<td>UNIMET® 400ST</td>
<td>B 9602 4001</td>
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</tr>
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</table>

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>PatBox</td>
<td>–</td>
<td>PatBox</td>
<td>B 9602 0096</td>
<td></td>
</tr>
<tr>
<td>Adapter</td>
<td>German Schuko</td>
<td>VK701-6</td>
<td>B 9602 0067</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Non-heating appliances</td>
<td>VK701-7</td>
<td>B 9602 0066</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Adapter kit 16 A for DS32A</td>
<td>VK701-8</td>
<td>B 9602 0097</td>
<td>-</td>
</tr>
<tr>
<td>Interface cable</td>
<td>–</td>
<td>RS-232/RS-232</td>
<td>B 9601 2012</td>
<td>-</td>
</tr>
<tr>
<td>Test probe</td>
<td>–</td>
<td>Test probe</td>
<td>B 928 748</td>
<td>-</td>
</tr>
<tr>
<td>Test terminal</td>
<td>–</td>
<td>Test terminal</td>
<td>B 928 741</td>
<td>-</td>
</tr>
<tr>
<td>Barcode scanner</td>
<td>–</td>
<td>PS/2</td>
<td>B 9602 0082</td>
<td>-</td>
</tr>
<tr>
<td>Converter</td>
<td>–</td>
<td>USB1.1 RS-232 converter</td>
<td>B 9602 0086</td>
<td>-</td>
</tr>
<tr>
<td>Flex keyboard</td>
<td>–</td>
<td>Flex keyboard</td>
<td>B 9602 0093</td>
<td>-</td>
</tr>
<tr>
<td>Three-phase adapter</td>
<td>–</td>
<td>DS32A</td>
<td>B 96020998</td>
<td>388</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DS32DCT</td>
<td>B 9602 0100</td>
<td>-</td>
</tr>
</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
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

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
Testing of extension cables
- Connection of connecting and extension cords

Connection of medical electrical equipment with plug-in connector
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

Typical applications
- Tests of medical electrical equipment in accordance with DIN EN 60601-1 3rd edition
- Recurrent tests of medical electrical equipment in accordance with DIN EN 62353 (VDE 0751-1).
- Electrical equipment “Prüfung nach Instandsetzung, Änderung elektrischer Geräte (Recurrent test and test after repair and modification of electrical equipment)” in accordance with DIN VDE 0701-0702 (VDE 0701-0702).

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

<table>
<thead>
<tr>
<th>Nominal voltage range</th>
<th>Maximum load current</th>
<th>Version</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
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<tbody>
<tr>
<td>AC</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>100...120 V and 220...240 V</td>
<td>16 A</td>
<td>Standard (DE/DE)</td>
<td>UNIMET® 810ST</td>
<td>B 9602 8020</td>
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<td>13 A</td>
<td>GB/GB</td>
<td>UNIMET® 810ST</td>
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<td>B 9602 8027</td>
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<td>UNIMET® 810ST</td>
<td>B 9602 8028</td>
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<td>10 A</td>
<td>CH</td>
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Suitable system components

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<td>VK701-6</td>
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<td>VK701-7</td>
<td>B 9602 0066</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Adapter kit 16 A for DS32A</td>
<td>VK701-8</td>
<td>B 9602 0097</td>
<td>390</td>
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</tr>
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<td>Cable</td>
<td>for connecting the test system with a PC, 9-pole, female-female (Null modem cable)</td>
<td>RS-232/RS-232 interface cable</td>
<td>B 9601 2012</td>
<td>–</td>
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<tr>
<td>Measuring lead, 150 cm, 4 mm connector</td>
<td>Cable 150 cm</td>
<td>B 928 703</td>
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<td>Test probe active (with switch)</td>
<td>TP800</td>
<td>B 9602 0080</td>
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</tr>
<tr>
<td>3 m measuring lead with black test probe</td>
<td>–</td>
<td>B 928 748</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Test terminal black</td>
<td>–</td>
<td>B 928 741</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Touchscreen pen</td>
<td>–</td>
<td>B 928 749</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Barcode scanner</td>
<td>–</td>
<td>B 928 0082</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Flex keyboard</td>
<td>for the UNIMET® 810ST (PS/2 connection)</td>
<td>–</td>
<td>B 928 0093</td>
<td>–</td>
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<tr>
<td>Test kit</td>
<td>for the UNIMET® 810ST (USB connection)</td>
<td>–</td>
<td>B 928 0093</td>
<td>–</td>
</tr>
<tr>
<td>Test box</td>
<td>for testing test systems</td>
<td>PK3</td>
<td>B 9602 0004</td>
<td>–</td>
</tr>
<tr>
<td>Three-phase adapter</td>
<td>for testing three-phase devices during operation</td>
<td>DS32A</td>
<td>B 9602 0098</td>
<td>388</td>
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<tr>
<td>External power source 25 A</td>
<td>for standard-compliant protective earth resistance measurements (only in conjunction with UNIMET® 810ST)</td>
<td>EPS800</td>
<td>B 9602 8050</td>
<td>386</td>
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</table>

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

6.2
**Technical data**

Nominal voltage range  100...120 V/±10 %, AC 220...240 V/±10 %
Frequency range  48...62 Hz
Power consumption  max. 100 VA
Maximum output current  see ordering information
Protection class  SKII

**Testing of PE resistance**

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>0.001...29.999 Ω</th>
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<tr>
<td>Measuring current</td>
<td>max. AC 6 A</td>
</tr>
<tr>
<td>Measuring voltage</td>
<td>max. AC 8 V</td>
</tr>
<tr>
<td>Intrinsic uncertainty</td>
<td>±2.5 % v. M. ±5 digits</td>
</tr>
<tr>
<td>Operating uncertainty</td>
<td>±5 % v. M. ±10 digits</td>
</tr>
</tbody>
</table>

**Insulation resistance**

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>0.01...199.99 MΩ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring voltage</td>
<td>max. DC 550 V</td>
</tr>
<tr>
<td>Measuring current</td>
<td>max. 2.5 mA</td>
</tr>
<tr>
<td>Intrinsic uncertainty</td>
<td>±2.5 % v. M. ±2 digits</td>
</tr>
<tr>
<td>Operating uncertainty</td>
<td>±7.5 % v. M. ±4 digits</td>
</tr>
</tbody>
</table>

**Equipment leakage current - alternative method**

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>0.001...19.999 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring voltage</td>
<td>max. AC 250 V</td>
</tr>
<tr>
<td>Measuring current</td>
<td>max. 3 mA</td>
</tr>
<tr>
<td>Intrinsic uncertainty</td>
<td>±2.5 % v. M. ±5 digits</td>
</tr>
<tr>
<td>Operating uncertainty</td>
<td>±7.5 % v. M. ±10 digits</td>
</tr>
</tbody>
</table>

**Leakage current, differential measurement method**

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>0.02...19.999 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrinsic uncertainty</td>
<td>±2.5 % v. M. ±2 digits</td>
</tr>
<tr>
<td>Operating uncertainty</td>
<td>±7.5 % v. M. ±4 digits</td>
</tr>
<tr>
<td>Frequency response</td>
<td>40...100 kHz ±3 dB</td>
</tr>
</tbody>
</table>

**Leakage current, direct measurement**

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>0.001...19.999 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrinsic uncertainty</td>
<td>±5 % v. M. ±2 digits</td>
</tr>
<tr>
<td>Operating uncertainty</td>
<td>±7.5 % v. M. ±4 digits</td>
</tr>
<tr>
<td>Frequency response</td>
<td>up to 100 kHz ±3 dB</td>
</tr>
</tbody>
</table>

**Voltage measurement**

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>AC 90...264 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency range</td>
<td>48...62 Hz</td>
</tr>
<tr>
<td>Intrinsic uncertainty</td>
<td>±2.5 % v. M. ±3 digits</td>
</tr>
</tbody>
</table>

**Load current measurement**

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>0.005...16 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency range</td>
<td>48...62 Hz</td>
</tr>
<tr>
<td>Intrinsic uncertainty</td>
<td>±2.5 % v. M. ±3 digits</td>
</tr>
</tbody>
</table>

**Apparent power**

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>5...3600 VA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency range</td>
<td>48...62 Hz</td>
</tr>
<tr>
<td>Intrinsic uncertainty</td>
<td>±5 % v. M. ±3 digits</td>
</tr>
</tbody>
</table>

**Environment/EMC**

<table>
<thead>
<tr>
<th>EMC</th>
<th>EN 61326-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature</td>
<td>0...+40 °C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-10...+70 °C</td>
</tr>
<tr>
<td>Relative humidity (up to 31 °C)</td>
<td>max. 80 %</td>
</tr>
<tr>
<td>Relative humidity (&gt; 31...40 °C)</td>
<td>decreasing linearly, max. 50 %</td>
</tr>
<tr>
<td>Height above sea level</td>
<td>max. 2000 m</td>
</tr>
</tbody>
</table>

**Other**

Degree of protection, enclosure: IP40, connections: IP20

- Dimensions (without bag): approx. 380x277x126 mm (W x D x H)
- Weight (without accessories or bag): approx. 3.5 kg
- Calibration interval: 36 months

- Dimensions diagram (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.
8 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)

### Wiring diagram

- **Test object**
- **L, N, PE, AP**
- **Connection**
- **Testing system**
EPS800
External power source 25 A for UNIMET®810ST

Device features

• To be used in conjunction with the appropriate UNIMET® 810ST

Standards

The EPS800 series carries out tests in compliance with the device standard: IEC 60601-1

Typical applications

• External 25 A power source for standard-compliant protective earth resistance measurement

Approvals

Ordering information

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard (German)</td>
<td>B 9602 8020</td>
<td>EPS800</td>
<td>B 9602 8050</td>
</tr>
<tr>
<td>GB</td>
<td>B 9602 8024</td>
<td>EPS800</td>
<td>B 9602 8054</td>
</tr>
<tr>
<td>CH</td>
<td>B 9602 8026</td>
<td>EPS800</td>
<td>B 9602 8056</td>
</tr>
<tr>
<td>B</td>
<td>B 9602 8027</td>
<td>EPS800</td>
<td>B 9602 8057</td>
</tr>
<tr>
<td>US</td>
<td>B 9602 8028</td>
<td>EPS800</td>
<td>B 9602 8058</td>
</tr>
</tbody>
</table>

Technical data

<table>
<thead>
<tr>
<th>Nominal voltage</th>
<th>AC 207…253 V, 48 … 62 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power consumption</td>
<td>400 VA</td>
</tr>
<tr>
<td>Measuring current</td>
<td>AC 25 A ±10 % (0 … 0.3 Ω)</td>
</tr>
<tr>
<td>Output power</td>
<td>230 VA</td>
</tr>
<tr>
<td>Operating mode</td>
<td>continuous operation</td>
</tr>
<tr>
<td>Protection class</td>
<td>II</td>
</tr>
<tr>
<td>Micro-fuse</td>
<td>5 x 20 mm, fast 5 A/250 V</td>
</tr>
</tbody>
</table>

Other

| 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 % |
| Weight | ≤ 4 kg |

Dimension diagram (dimensions in mm)

| 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 |

For further information refer to our product range on www.bender.de.
1. Insert the control cable of the EPS800 into the "EPS800" connector socket on the rear of the UNIMET® 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® 810ST to the power socket.
4. Switch on the power switch of the UNIMET® 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

Approvals

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>89602 0098</td>
</tr>
</tbody>
</table>

Technical data

Electrical safety
- Protection class: 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)
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)
**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.

**Typical applications**
- For the measurement of 16-A-three-phase devices in conjunction with the three-phase adapter DS32A

**Approvals**

**Ordering information**

<table>
<thead>
<tr>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>VK701-8</td>
<td>B 9602 0097</td>
</tr>
</tbody>
</table>

**Technical data**

- **Nominal voltage**
  - Nominal voltage: 3AC 400 V
  - Max. current: 16 A
  - Documentation number: D00172

**Wiring diagram**

- System connection CEE 16A
- VK701-8
- DS32A Three-phase adapter
- Connection to the test socket UNIMET®
- Power supply UNIMET®
- Device under test 3AC (max. 16A)
- Test probe
TB3
Test box

Device features
- Test box for UNIMET® 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>B 9602 0025</td>
</tr>
<tr>
<td>CH</td>
<td>TB3 test box</td>
<td>B 9602 0055</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 /f /: 100…240 V
- Rated frequency /f R: 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): 1000 Ø
  - R - PE: 0.233 Ø
  - R3: 25 000 Ø
  - R4: 1 000 000 Ø
  - R5: 1 500 000 Ø
  - R6: 100 000 000 Ø
  - R7: 1 000 000 Ø
  - R8: 100 000 Ø
  - R9: 130 000 Ø

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)
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>1</th>
<th>2</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buchsen seitlich</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8 Jumpers allow simulation of different test situations

---

1 Jumpers. Insert the jumpers in such a way that the following sockets are connected:

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>μP601</td>
<td>UNIMET® 810ST</td>
</tr>
<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
   - at μP-Sicherheitstester, insert supply cable from below
   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® 810ST test system
6 μP601 safety tester
## Applied product standards and guidelines

<table>
<thead>
<tr>
<th>Device families</th>
<th>International (IEC)</th>
<th>Europe (EN)</th>
<th>National standards (DIN VDE/DIN EN)</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insulation monitoring devices and coupling devices</strong> (ISOMETER® and AKGs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ASTM F 1669 M:2012-01 (for AC, AC/DC, DC)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ASTM F 1134:2015-01 (for offline monitor)</td>
</tr>
<tr>
<td></td>
<td>E</td>
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</tr>
<tr>
<td><strong>Power supply units, energy backup, communication modules (FTCs) and the like, alarm indicator and test combinations (MK), operator and indicator panels</strong></td>
<td>IEC 61010-1:2010-06 +Cor.:2011</td>
<td></td>
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</tr>
</tbody>
</table>

The edition of the standards listed above corresponds to the catalogue's latest date of issue.
<table>
<thead>
<tr>
<th>Technical terms</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alarm state</strong></td>
<td>Alarm state indicates that the residual current in the installation monitored has exceeded the preset level of the RCM.</td>
</tr>
<tr>
<td><strong>Direct contact</strong></td>
<td>Electric contact of persons or animals with live parts.</td>
</tr>
<tr>
<td><strong>Earth</strong></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><strong>Earth electrode</strong></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><strong>Earth fault</strong></td>
<td>Occurrence of an accidental conductive path between a live conductor and the Earth.</td>
</tr>
<tr>
<td><strong>Earth fault current</strong></td>
<td>Current flowing to earth due to an insulation fault.</td>
</tr>
<tr>
<td><strong>Earth leakage current</strong></td>
<td>Current flowing from the live parts of the installation to earth in the absence of an insulation fault.</td>
</tr>
<tr>
<td><strong>Effect of the supply voltage</strong></td>
<td>Effect influencing the functioning of measuring equipment and, consequently, the measured value produced by it.</td>
</tr>
<tr>
<td><strong>Effects of the distribution system voltage</strong></td>
<td>Effect influencing the operation and, consequently, the measured value produced by it.</td>
</tr>
<tr>
<td><strong>Electric shock</strong></td>
<td>Physiological effect resulting from an electric current through a human or animal body.</td>
</tr>
<tr>
<td><strong>Equipment for insulation fault location</strong></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><strong>Equipotential bonding</strong></td>
<td>Provision of electrical connections between conductive parts, intended to achieve equipotentiality.</td>
</tr>
<tr>
<td><strong>Exposed-conductive part</strong></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><strong>Extraneous conductive part</strong></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><strong>Extraneous DC voltage U_{fg}</strong></td>
<td>DC voltage occurring in AC systems between the AC conductors and earth (derived from DC parts).</td>
</tr>
<tr>
<td><strong>Extraneous voltage</strong></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><strong>Fault current I_{Δ}</strong></td>
<td>Current which flows across a given point of fault resulting from an insulation fault.</td>
</tr>
<tr>
<td><strong>Fault voltage (U_{f})</strong></td>
<td>Voltage appearing under fault conditions between exposed conductive and/or extraneous conductive parts and earth.</td>
</tr>
<tr>
<td><strong>Fiducial value</strong></td>
<td>A clearly specified value to which reference is made in order to define the fiducial error.</td>
</tr>
<tr>
<td><strong>Indirect contact</strong></td>
<td>Electric contact of persons or animals with exposed-conductive parts which have become live under fault conditions.</td>
</tr>
<tr>
<td><strong>Influence quantity</strong></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><strong>Insulation fault</strong></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><strong>Insulation fault locator</strong></td>
<td>Device or part of device for the location of the insulation fault.</td>
</tr>
<tr>
<td><strong>Insulation monitoring device</strong></td>
<td>Equipment which permanently monitors and indicate 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><strong>Insulation resistance R_{F}</strong></td>
<td>Resistance in the system being monitored, including the resistance of all the connected appliances to earth.</td>
</tr>
<tr>
<td><strong>Internal DC resistance ( R_i )</strong></td>
<td>Resistance of the insulation monitoring device between the terminals to the system being monitored and earth.</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Internal impedance ( Z_i )</strong></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><strong>ISOMETER®</strong></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><strong>Leakage current</strong></td>
<td>Electric current in an unwanted conductive path under normal operating conditions.</td>
</tr>
<tr>
<td><strong>Live part</strong></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><strong>Locating current ( I_L )</strong></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><strong>Locating voltage ( U_{L} )</strong></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><strong>Measuring current ( I_m )</strong></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><strong>Measuring voltage ( U_m )</strong></td>
<td>Voltage present at the measuring terminals during the measurement.</td>
</tr>
<tr>
<td><strong>Nominal current ( I_n )</strong></td>
<td>Current of the measuring equipment under nominal conditions.</td>
</tr>
<tr>
<td><strong>Nominal frequency ( f_n )</strong></td>
<td>Frequency for which the measuring equipment is intended to be used and designed.</td>
</tr>
<tr>
<td><strong>Nominal voltage of the distribution system ( U_n )</strong></td>
<td>Voltage by which a distribution system or equipment is designated and to which certain operating characteristics are referred.</td>
</tr>
<tr>
<td><strong>Nominal voltage of the measuring equipment ( U_{me} )</strong></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><strong>Nominal voltage range</strong></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><strong>Open-circuit voltage ( U_q )</strong></td>
<td>Voltage present across unloaded terminals on the measuring equipment.</td>
</tr>
<tr>
<td><strong>Operating voltage in a system</strong></td>
<td>The value of the voltage under normal conditions at a given, specific point of the system.</td>
</tr>
<tr>
<td><strong>Origin (of the electrical installation)</strong></td>
<td>Point at which electric energy is delivered to the electrical installation.</td>
</tr>
<tr>
<td><strong>Output voltage ( U_a )</strong></td>
<td>Voltage across the measuring equipment terminals where this equipment does or can output electric power.</td>
</tr>
<tr>
<td><strong>Performance characteristic</strong></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><strong>Protective conductor PE</strong></td>
<td>Conductor provided for purposes of safety for example protection against electric shock.</td>
</tr>
<tr>
<td><strong>Pulsating direct current</strong></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><strong>Rated contact voltage</strong></td>
<td>Voltage for which a relay contact is rated to open and close under specified conditions.</td>
</tr>
<tr>
<td><strong>Rated operating conditions</strong></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><strong>Rated residual operating current ( I_{\Delta n} )</strong></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><strong>RCM directionally discriminating</strong></td>
<td>RCM used in IT systems, capable of directionally discriminating between supply side and load side residual currents.</td>
</tr>
<tr>
<td><strong>RCM type A</strong></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>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>
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<tr>
<td><strong>Residual current ( I_\Delta )</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_a )</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_L )</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>
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<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>
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<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>
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| **Voltage against earth \( U_0 \)** | 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. |
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<td>MRCD</td>
<td>Gerät oder Anordnung von Geräten, das/die eine Strommessung und eine Auswertung 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 evaluate the residual current and to control the opening of the contacts of a current breaking device</td>
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<tr>
<td>PRCD</td>
<td>ortveränderliche FI-bzw. DI-Schutzeinrichtung (auch OVS)</td>
<td>portable residual current protective device</td>
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<tr>
<td>PRCD-S</td>
<td>OVS mit erweitertem Schutzumfang und Sicherstellung der bestimmspezifischen Nutzungsfähigkeit des Schutzleiters</td>
<td>portable residual current protective device-safety</td>
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<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>
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<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 for household and similar uses</td>
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<tr>
<td>SRCD</td>
<td>ortsfeste FI-bzw-DI-Schutzvorrichtung in Steckdosenauflösung</td>
<td>fixed socket-outlets residual current protective device</td>
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Support at all stages
All-round 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 know-how and our expertise is at your disposal in all project phases.

Furthermore, our first-class service ensures you the maximum safety for your electrical installations.

The service we offer range from telephone support through repairs to on-site service – with state-of-the-art measuring devices and professional employees.

Many service activities, fault clearance, but also analysis and inspections, can be carried out by remote maintenance – no technician needs to be on-site, saving you time and money.

Convincing benefits:

- High availability of your installation by responding faster to fault messages
- Automatic control, analysis, correction, readjustments/updates are possible
- Competent assistance on changing settings and with updates
- Regular checking of your installations/power quality/monitoring devices
- Significant cost reduction by reduced downtimes and shorter service times